Community Based Dengue Control Interventions for Behavior change and Sustainability (An overview of the available Evidence)

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Abstract

Background:

Dengue is a viral disease which is transmitted by Aedes aegypti mosquitoes. Every year an estimated 50 to 100 million cases of dengue are reported worldwide. The aim of this overview was to investigate community based dengue prevention interventions for behavior change by available evidence of literature. We reviewed studies which were explicitly linked with community based behavior change and sustainability in dengue control interventions from available published evidence.

Method:

A literature search was performed between February, 2014 to May, 2014 by using Web of Science, Google search engine and Pub Med .We did scoping review (made list of key word). Identified the main key words The term 'dengue' and DF/DHF/DSS was combined with the terms community, 'control, intervention, 'prevention strategies, behavior, 'behavior change', 'sustainable behavior', 'socio demographic determinants' and socio demographic factors in different combinations to identify potential articles and references. PRISMA checklist was used for guidance during developing the paper.

Results:

Overall, 18 studies were analyzed. Among them 13studies used both qualitative and quantitative approaches, 4 studies used quantitative strategies and 1 study used qualitative approach for data collection. The result shows that community based dengue control intervention by using integrated vector management tools (IVM) are effective for dengue control. Vertical top down dengue prevention techniques by using any tool is not sustainable. Community ownership and strategies embedded in daily routine activities are comparatively more sustainable. No study promises behavior change and sustainability. However, for sustainability, developing a tool to measure the parameters of behavior change could be useful for planning and implementation of dengue control interventions.

Keywords:

Dengue fever, community based, behavior change, sustainable behavior, socio demographic determinants, analysis

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Introduction

Dengue fever (DF) is the most reemerging disease in today's word. Approximately, 40% of the world's population (2.5 billion people) now lives in areas where transmission occurs. In the absence of effective vaccine, prevention is the only strategy to counter with DF. A range of ecological, biological and social factors are contributing to promote the disease transmission. Many multi-disciplinary studies(Quintero et al., 2014; Sommerfeld & Kroeger, 2012) across countries have been conducted to look at these factors by using integrated strategies. Despite using ecological biological and chemical dengue control strategies, reemergence of dengue has become global threat to public health. There is dire need of revisit the vector control activities, which would result as sustainable change in human behavior regarding dengue prevention (Elder & Lloyd, 2006; Gubler, 2002; Guzman et al., 2010). This paper will present an overview of studies used community based strategies for behavior change for dengue control.

Aim

The aim of this overview was to investigate community based dengue prevention interventions for behavior change by available evidence of literature to find the gap of scientific knowledge to support further research efforts.

Objectives

- To conduct desktop review to identify issues related to behavior change and dengue control
- To critically evaluate different community based dengue control interventions for behavior change
- To identify and critique socio demographic determinant of behavior change dengue control
- To identify gaps in knowledge to support further research efforts.
- To propose key objectives for multidisciplinary study on bases of results

Methodology of the Review

A literature search was performed between February, 2014 to May, 2014 by using Web of Science, Google search engine and Pub Med. The term 'dengue' and DF/DHF/DSS was combined with the terms community, control, intervention, prevention strategies, behavior, 'behavior change', 'sustainable behavior', 'socio demographic determinants' and socio demographic factors were used in different combinations to identify potential articles and references.

Additionally, the bibliographies of all identified publications were checked to identify further relevant studies. Searches were restricted to assess full text articles, papers written in English. Publications that presented original data from trials evaluating the effect of community-based dengue control interventions were included. Besides that papers which have explicitly link with community based behavior dengue control intervention were also reviewed to capture scientific knowledge. A community-based dengue

control intervention or strategy was defined as any intervention in which at least one component targeted the community (e.g. educational meetings, involvement of local people, environmental management) and whose aim was to reduce the incidence of dengue disease or infestation of the community with Aedes mosquitoes (as measured by any entomological index). Publications which are reporting no community based behavior change dengue control programs, conference papers, grey literature and clinical observations were excluded.

Information transferred from the reviewed articles into evidence tables included authors, geographical setting (when and where), study design and sample, major outcome measures (dengue incidence, entomological indices), and results.

Data Bases Used

The following databases from 2000 to 2014 were accessed: Pub Med, Web of Knowledge, Google search engine. To identify potential articles, key references from extracted papers were also further searched.

INCLUSION AND EXCLUSION CRITERIA

For extraction into summary tables, inclusion criteria were; studies where an explicit link is made between DF, behavior change, community, socio demographic factors. The studies which used community based interventions for dengue control, all countries/contexts, and studies published in January 2000 to until May 2014, based on individual database capabilities and were considered for inclusion in this review. By including data from 2000, we hoped to capture any information on community based dengue control programs for behavior change and identify knowledge gap. So that may have contributed to development of formal programs in dengue fever control.

Studies that did not focus explicitly on the behavior change of dengue fever, studies not published in English and all papers that did not fulfilling including criteria were excluded.

Data Synthesis

Data extracted on the bases of key words like dengue fever, community based, behavior change, socio demographic factors were synthesized in a narrative summary.

Definition of Key Terms

Dengue fever:

Dengue fever is also known as break bone fever, is a mosquito-borne tropical disease caused by the dengue virus. Symptoms include fever, headache, muscle and joint pains, and a characteristic skin rash. Infection by any of the four dengue serotypes may be lead to classic dengue fever (DF) or more severe forms of the disease, haemorrhagic fever (DHF) and dengue shock syndrome (DSS) (Whitehorn, et al 2011).

Socio Demographic Determinants

Socio-demographic factors refer to a set of variables such as a given population's age, education, gender, water and sanitation, ethnicity, or SES (socioeconomic status) whether they reside in an urban or rural area.

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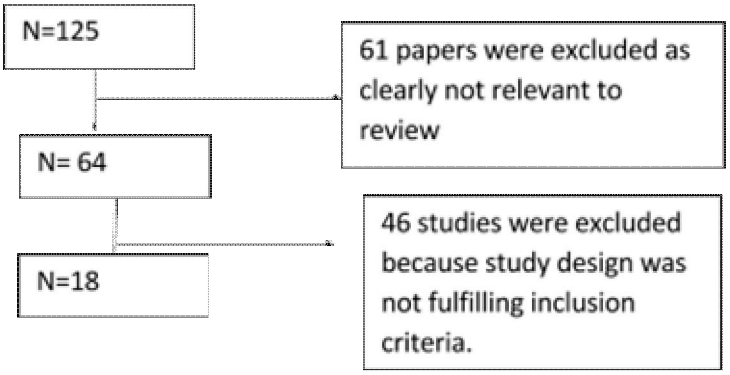
Integrated Vector Management (IVM)

In IVM, a range of interventions are selected on the basis of diseases of vectors, their habitats, the diseases they transmit, and the factors that contribute to their presence and transmission of the disease (WHO, 2012).



Potentially relevant papers identified by literature search

Abstracts retrieved for examination

Papers retrieved for detailed overview

Figure 1: Flowchart of number of citations identified, retrieved, included and excluded.

Review Results/Findings

Overall, 125 studies were identified as suitable for this review. 61 papers were excluded as clearly not relevant to review. After abstract reading 64 full text articles were retrieved for detailed study. 46 studies were excluded because study design was not fulfilling inclusion criteria. 18 studies were selected based on key word "dengue" "community based behavior changed" and socio "demographic factors for behavior change" for overview. These studies were fulfilling the review criteria. Among them, 13 studies used mixed (qualitative and quantitative) approaches 4 studies used quantitative methods, and 1 study used qualitative method. Qualitative data collection techniques included one -on-one interviewing, questionnaires, key informant selection, focus groups, participant observation, participatory action research, and community mobilization techniques. Quantitative studies encompassed mainly descriptive studies and cross sectional surveys and controlled trial.

Community based behavior change and sustainability intervention for dengue control

Overall a large number of studies from different countries suggest that community based integrated vector management (IVM) programs are most effective for behavior change.(Espino et al., 2012; Sommerfeld & Kroeger, 2012; Tana et al., 2012; M.E. Toledo et al., 2007).These strategies vary with respect to target groups and intervention procedures. (Tapia-Conyer, Méndez-Galván, & Burciaga-Zúñiga, 2012). For measurement outcome, three widely employed entomological parameters: House index (HI): percentage of houses infested with larvae and/or pupae, Container index (CI): percentage of water-holding containers infested with larvae or pupae, Breteau index (BI): number of positive containers per 100 houses inspected were used.

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Environmental, biological and socio demographic factors have played a significant role in increasing the severity of dengue in recent decades. Looking into these factors critically would be beneficial in designing dengue control activates (Nazareth et al, 2014; Castro et al 2013; Koyaden et al, 2012). The large scale IVM programs are already being carried out in a range of countries. These studies (Kittayapong et al., 2012; Rozhan, Jamsiah, Rahimah, & Ang, 2006; Sommerfeld & Kroeger, 2012; M.E. Toledo et al., 2007; Maria E. Toledo et al., 2008, 2011; Vanlerberghe et al., 2009a) used chemicals, biological, educational and communication approaches. COMBI tools were claimed to be most effective in IVM strategies(Rozhan et al., 2006).

In IVM, environmental management was the central approach(Vanlerberghe et al., 2009b), combined with biological control measures (Battrick & ISAIRAS (8, 2005; Toledo Romani et al., 2007) or chemical interventions(Maria E. Toledo et al., 2011).

A study using cluster randomized trial was carried out in Cuba. In which routine Aedes control program like entomological surveillance, source reduction were used in 16 controlled clusters. Whereas, intervention comprising the routine Aedes control combine with environmental management approach. The result shows 50% lower BI and HI. 73 % pupae per inhabitant.

In Santiago de Cuba, a community-based program used the removal or covering of defective water containers and water treatment with larvicides (M.E. Toledo et al., 2007). The results of studies shows that at household level, uncovered water storage containers decreased from 49.3% to 2.6% between 2000 and 2002, and removing larvicides from them dropped from 45.5% to 1%. There was a reduction of 75% in the absolute number of positive containers and a significant decrease from 1.23% to 0.35% in the house index. The study concluded that local task forces, in which the interests of householders as well as vector control workers are directly represented, can lead to effective government–community partnerships that resolve problems of mutual concern.

The overview also explore the biological interventions, implemented by professional staff was most effective. Biological control of dengue vectors is based on the concept of introducing organisms that reduce the density of vectors. For vector control, certain species of fish and predatory copepods have proven effective (Kay et al., 2000; Nam et al.,2004; Seng et al., 2008).

For example Viet Nam has experimented with the use of the copepod as a community-based biological control strategy(Nam et al., 2004). The study showed significant results, and within three years, less than 1.5% of houses were positive for dengue vectors in the study areas. In Cambodia, a successful intervention of the effectiveness of introducing larvivorous guppy fish into water storage containers was made. The households receiving the intervention exhibiting a 79.0% reduction in *Aedes* container index compared with control houses (Seng et al., 2008).This study used community volunteers to distribute guppies and showed a clear impact on entomological indices in

the 14-village trial area. Hence, biological control interventions should consider cultural practices relating to water storage and the social adoptability of keeping living organisms in storage containers of drinking water (Elder & Lloyd, 2006). These interventions should be conducted parallel to community-based educational programs that aim to train householders to use water containers appropriately to maintain populations of larvivorous organisms(Heintze, Garrido, & Kroeger, 2007; Kay et al., 2000; Nam et al., 2004). There is critical need of collaboration in trained staff and local communities at basic level by using integrated vector management. Identifying the relationship between direct and indirect determinant of dengue related practices can contribute in understanding the sustainability of behavior change in dengue prevention.

On the contrary, integrated dengue vector control approaches implemented in Mexico (Espinoza-Gómez, Moises Hernández-Suárez, & Coll-Cárdenas, 2002) and Trinidad and Tobago (Chadee, Williams, & Kitron, 2005) resulted in only modest reductions of entomological parameters. IVM can reduce vector densities significantly (McCall & Kittayapong, 2006) in short term however it is rarely sustainable. The results of interventions are often transient (Maria E. Toledo et al., 2008).

It can be inferred that once spraying activities were completed, vector populations re-emerged. In cases where the performance was measured shortly after spraying activities, effectiveness was usually high. Chemical control, for example space spraying, has limited acceptability, as it is perceived negative impacts on the environment and human health (Curtis & Lines, 2000).

In recent years, concerns about environmental contamination and the emergence of vector resistance to insecticides have resulted in a shift in policy environmental friendly interventions. One of the possible example could be a study(Sommerfeld & Kroeger, 2012) conducted 5-year multi country research between 2006 and 2011 six countries of South Asia by using multi method approach. They propose framework for systematic vector control. The study reports that eco socio bio IVM strategies would be more sustainable. For this the investigators must be multi-disciplinary. The study investigated a community-driven approach that included education and an environmental approach of avoiding pesticides. Developing new non-insecticidal intervention tools (such as rectangular water container covers in India, sweeping nets or dragon fly nymphs in Myanmar, and copepods and screen covers for earthen jars in Thailand) can be environmental friendly. Such strategies would be cost effective and sustainable for urban and rural settings. All these efforts are investigated by trained staff with help of community volunteers. As the enthusiasm dies at point of time, there is need of developing tool to measure behavior change by identifying set of parameters to measure behavior change in dengue control efforts. The tool would be used to explore the time period of specific behavior change. Dengue control program personals and policy

makers can use this tool to implement and re implement in particular population at specific period of time.

WHO has suggested an approach known as COMBI (Communication for-Behavioral-Impact) in the design and implementation of behaviorally-focused social mobilization and communication program (*Planning social mobilization and communication for dengue fever prevention and control*, 2004). The studies (Rozhan et al., 2006; Suhaili et al., 2004) using COMBI planning tool found successful in getting desired result in short term. The study claimed reduction in breeding incidence at the culmination of the 16 week period was approximately 80%(Rozhan et al., 2006). Expansion of COMBI as a community-based intervention in dengue control is proven to be effective for short-term but the sustainability of behavior by COMBI in long- term remained challenging (Azmawati & Aniza, 2013). For sustainability, the message of the COMBI Program would have to redeliver to these particular groups at scheduled intervals(Rozhan et al., 2006), in order to sensitize community.

It can be conjecture that for sustainability continues motivation of health personnel and community is needed. The motivation lost with passage of time Therefore, sensitization of community is important. However, at what time of intervals, this activity would be carried out is a question which is need to be answered. To solve this issue, finding a set of parameters for measuring sustainable behavior is very important. By developing a tool to measure the parameters of sustainable behavior would be helpful for health personnel and policy makers to identify at which level people in a community relapse to previous practices. These parameters would be helpful for reinforcement of dengue prevention at specific period of time.

For behavior change, exploring socio demographic factors are also important. Based on decisions like what socio demographic factors are contributing in dengue expansion in a community, and why community has/ has not a specific behavior which are contributing in dengue are the critical questions which are need to answered before designing community based dengue control activities. Socio demographic predictors will significantly help us to understand the processes of dengue transmission dynamics and to implement dengue prevention and control programs effectively and efficiently. The studies(Castro et al., 2013; Espino et al., 2012; Koyadun, Butraporn, & Kittayapong, 2012; Nazareth et al., 2014; Quintero et al., 2014; Sommerfeld & Kroeger, 2012; Tana et al., 2012; Wong & AbuBakar, 2013) reported significant associations between dengue and demographic factors like gender, education, income, age, ethnicity, water and sanitation. There is reasonably consistent evidence that there is positive association between dengue and people lack of knowledge, rainfall, densely populated areas, water supply. (Sommerfeld & Kroeger, 2012). Education level and dengue has also association (Castro et al., 2013). For example a study carried out in Cuba, reported that high education leads to increase knowledge about dengue which results as better practices regarding dengue prevention. The study also asserts the

direct association of economic status with knowledge on dengue. One of the possible explanations could be the people who have sound financial back ground have better opportunities of education which create more ways to avail knowledge that leads to better practices. However, (Koyadun et al., 2012) found that higher degrees of education had higher risk because higher moment due to job. A study (Nazareth et al , 2014) was carried out in Madeira, Portugal to explore residents perceptions regarding most critical community behavior found that demographic and societal changes and lack of awareness of prevention practices have contributed to increase dengue out brake activity. That is why; there is need of behavior change activity for sustainability. A set of environmental and socio demographic parameters can be useful. Investigation into such socio demographic, environmental perspectives to measure can provide in depth understanding of dengue control efforts. It can contribute to effective management solutions at policy level in an ever-changing environment.

Moreover, the overview of available evidence shows that some studies used regression models to examine the direct relationships(Castro et al., 2013; Toledo Romani et al., 2007; Vanlerberghe et al., 2009b) of human behavior and vector control. However, the challenge is to assess the behavioral sustainability and to understand the direct and indirect effects of the determinants on sustainable behavior. Latent variable structural equation modeling provides a tool to address this challenge and allows for the quantification and testing of hypothesized relationships among latent and observed variables (MacCallum & Austin, 2000).

There is need to develop an indicator to measure the parameters of sustainable behavior to assess the sustainable behavior by using latent variable structural education. This indicator will help to measure whether or not the behavior has taken place(Elder & Lloyd, 2006) and to what extent it has been carried out. Unfortunately, we do not t have an indicator by which we can measure dengue behavioral sustainability risk(Elder & Lloyd, 2006) . The indicator would be beneficial to measure, how long will it takes to people to relapse. This type of information would be vital in the decision making for the control of dengue prevention programs at policy level.

Conclusions:

The results of this review have demonstrated that researchers are putting great efforts to find out ways to prevention of dengue fever. They are challenging themselves by identifying links to bring permanent changes in human behavior. For this purpose they are taking precautions for dengue fever in absence of its vaccinations by community participation in dengue control programs. Community based control interventions together with biological and chemical vector control tools are successful in dengue control in short term. Besides that Studies which used dengue prevention techniques embedded in daily routine activities were more sustainable as compare to studies which were implemented by program organizers. Most dengue control

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programs are inadequate to develop and manage sustained community participation. Sustainability in behavior regarding dengue prevention, interventions relying mostly on insecticides, difficulties in engaging communities, little capacity building was limitations. For measuring outcome HI, BI and CI were used in most of the cases. However, for behavior change, observation method was used which is not a standard tool or method. Therefore, developing indicator of parameter to measure behavior change is the dire of time. Findings of this paper are recommended to be used as future study in order to more effectively impact on the communities behavior and sustainability.

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