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Challenges and opportunities for implementing an intersectoral approach in malaria control in Tanzania

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Abstract

Background: Malaria is a complex health problem related to socio-economic and environmental factors that cut across a number of sectors. Establishing intersectoral linkages is important to facilitate joint efforts to address the problem at all levels. The objectives of this study were to explore key sectoral engagements in malaria control policy formulation and implementation, and to determine decision and policy makers' opinions about different sectoral activities that contribute to malaria transmission and control in Tanzania.

Methods: This study included documentary review, self-administered interviews and group discussion. Interviews and group discussions involved key informants at district and national levels. The sectors involved were health, agriculture, environment, livestock, fisheries, education, works, irrigation, water resources, land development, forestry, and community development.

Results: Institutions and organizations that were involved in the development of the previous and current National Malaria Strategic Plan (2007-2013 and 2013-2020) were the Ministries of Health and Social Welfare, Prime Minister's Office of Regional Administration and Local Government, Public universities and non-governmental organizations. All the individuals involved in the development of the plans were either medical or health professionals. According to key informants, sectoral activities identified to contribute to malaria transmission included farming systems, deforestation, fishing, nomadic pastoralism, household water storage, water resource development projects, road and house construction and mining. The lack of intersectoral approaches in malaria control programme included the facts that the Health Sector does not involve other sectors during planning and development of policy guidelines, differences in sectoral mandates and management culture, lack of a national coordinating framework and lack of budget for intersectoral activities.

Conclusion: The current strategies for malaria control in Tanzania need to address socio-economic and development activities across sectors and emphasise the need for intersectoral collaboration. It is recommended that the future of malaria control strategies should, therefore, be broad based and intersectoral in planning and implementation.

Keywords: malaria, control, intersectoral, collaboration, policy makers, Tanzania

Introduction

Malaria is one of the most important public health problems in Tanzania. In recent years, there have been increased efforts to combat malaria in the country through the use of insecticide treated mosquito nets (ITNs), indoor residual spraying, early diagnosis and prompt treatment. However, the disease is still responsible for more than one-third of deaths among <5 years and one-fifth of deaths among pregnant women (Mboera *et al*., 2013; MoHSW/WHO/IHI/NIMR, 2013). Malaria has remained number one public health problem because of weak health systems, antimalarial drug and insecticide resistance, environmental changes that favour vector

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population increase, demographic factors such as land use change patterns, climate change, and significant human migration (Mboera *et al*., 2013; Cotter *et al*., 2013).

Malaria is a complex health problem related to socio-economic and environmental factors that cut across a number of sectors. It has already been recognised that socio-economic and environmental factors affect health, exposure to illness, risk for illness-producing behaviours, and the household response to the respective health problem. Malaria tends to become increasingly geographically and demographically focused in population groups that share social, occupational, behavioural and geographical characteristics (MoHSW/WHO/IHI/NIMR, 2013). Some livelihood activities; such as irrigation farming, fishing and nomadic pastoralism; expose people more to malaria than others (Mboera *et al.,* 2013). Some occupational, social and behavioural factors that require people to stay outside the home at night put these groups in contact with malaria mosquitoes (Worrall *et al.*, 2002; Himeidan & Kweka, 2012; Kweka *et al*., 2013; Thomas *et al.*, 2012; Burki, 2013).

The fact that there are linkages between environment, livelihoods and malaria poses an opportunity for the various sectors to work together to help solve each other's problems. However, in Sub-Saharan Africa most often, government ministries, departments and agencies are organized strictly along sectoral lines, usually restricted in addressing specific sectoral mandates; hence rarely collaborate (Mboera *et al*., 2013). Establishing intersectoral collaboration could be important to facilitate joint efforts to holistically address the problem at the national, district and community levels.

According to the World Health Organization, an intersectoral collaboration is defined as a "recognized relationship between part or parts of different sectors of society which have been formed to take action on an issue to achieve health outcomes in a way which is more effective, efficient or sustainable than might be achieved by the health sector working alone (WHO, 1997). Intersectoral collaboration in addressing health issues is based on the Alma Ata Declaration of 1978 and the World Health Organization concept of intersectoral action for health (WHO, 1978, 1997). The intersectoral action for health is a relationship between parts of the health sector and parts of another sector which has been formed to take action on an issue to achieve health outcomes in a manner that is more effective, efficient or sustainable than could be achieved by the health sector acting alone (WHO, 1978, 1997). Usually, intersectoral collaboration is beyond the scenario where organizations are merely working together, but rather it involves partnership with commitment to mutual relationships and goals (Mattessich *et al*., 2001).). Cross-sectoral approach in disease control has been described to ensure better preparedness and contingency planning, cost-sharing between sectors, increased health equity and improved sharing of costs for service provision (Wendt *et al.,* 2014; Braks *et al.* 2014). Available statistics indicate that inter-sectoral approaches for health actions have been employed at global, regional, national and community levels (PHAC, 2007; WHO & PHAC, 2008). Despite such knowledge, there is dearth of information on inter-sectoral collaboration in malaria control in Tanzania. The objectives of this study were to explore key sectoral engagements in malaria control policy formulation and implementation, and to determine decision and policy makers' opinions about different sectoral activities that contribute to malaria transmission and control in Tanzania.

Materials and Methods

Documentary review

The review included government policy documents, reports and publications to explore and document malaria control policy development process and to identify stakeholders' and non-health sectors' involvements. The role and operationalization of the key actors was documented and analysed to identify intersectoral collaboration in malaria control. In the process, the focus was placed on key actors in health delivery systems in the country using malaria as a tracer

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disease. The review on malaria profile and policy was carried out using current health sector policy framework, specific sector policies and health sector strategic plans covering the period of 2008 to 2020.

Data collection

This study involved key informants at district and national levels. District level participants were heads of department and senior officials of the Kilosa District Council (5°55' -7°53' S; 36°30' - 37°30 E). The district has a total surface area of about 14,400 km^2 and a population of 438,175 people (NBS, 2013). The district has a semi-humid tropical savannah climate. The rainfall regime is closely related to elevation and has a characteristic monomodal pattern; the rains begin in October with a peak in April and continue till May. The annual average rainfall is 800mm while the mean annual temperature is 25°C. Kilosa is malaria a holoendemic area (Wort *et al*., 2006). This was part of a larger study on malaria, ecosystems and livelihoods, and the district was selected for the study due to the nature of the livelihoods of its community which include crop farming, nomadic pastoralism, mixed farming, large sisal estates, petty business, and civil services (Mboera *et al*., 2013).

At the district level, data were collected through a participatory workshop held in October 2012. The workshop was attended by heads of departments responsible for health, agriculture, environment, livestock, fisheries, education, works, irrigation, water, land development, forestry, and community development as well as representatives from agricultural and health research institutions. During the workshop, the participants were requested to fill a self- administered structured questionnaire to get their views on sectoral activities that contribute to malaria transmission and control as well as opportunities and challenges of intersectoral approach in malaria control in the district. Thereafter, using systematic sampling method, participants were divided into three groups for discussion: (i) Production Sector- composed of participants from departments of Agriculture, Livestock, Forestry, Irrigation, and Fisheries; (ii) Construction Sector - with participants from departments of Works, Land Development and Water Development; and (ii) Social Sector - composed of participants from departments of Education and Community Development. Participants from the department of health were allocated to all the three groups. Participants were given time to discuss on the following key issues: (i) Sectoral activities that are likely to impact health, paying specific attention to malaria in Kilosa District; (ii) Inter-sectoral collaborations in malaria control in the district; and (iii) Efforts, challenges and opportunities for intersectoral collaborations in malaria control at the district level. Group discussions were followed up with a plenary session in which all groups presented their findings and a general consensus was reached.

At the national level, a workshop of senior officials from government ministries, research institutions, and non-governmental organizations was held in November 2012. The participants' opinions were elicited using an open-ended self-administered questionnaire. The questionnaire sought information on the contribution of each sector in the transmission and control of malaria and possible future inter-sectoral approaches in malaria control in Tanzania. Other questions were on the probable reasons for lack of intersectoral approach in the current malaria control programme and whether establishing intersectoral strategies would improve malaria control in Tanzania. This exercise was followed by a plenary discussion and consensus was reached.

Data analysis

The individual questionnaires responses were typed in an excel template which was organized based on the structure of the questionnaire. Two sociologists read and re-read all responses separately, identified consistencies and differences on the ideas and concepts that emerged from the responses, and categorized the responses into groups while focusing on the theme of the

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broad objective and sub-theme on the specific objectives. Later the two discussed the harmonized outputs to achieve a common understanding.

Ethical Consideration

The study obtained ethical approval from the Medical Research Coordinating Committee of the National Institute for Medical Research. Each respondent was informed about the objectives of the study.

Results

National policy formulation and key actors in malaria control

Institutions and organizations involved in the development of the National Malaria Medium Term Strategic Plans of 2007-2013 and 2013-2020 were the Ministry of Health and Social Welfare, Prime Minister's Office for Regional Administration and Local Government (PMORALG), and One Public University and Non-governmental Organizations. All the individuals involved in the development of the plans were either medical or health professionals.

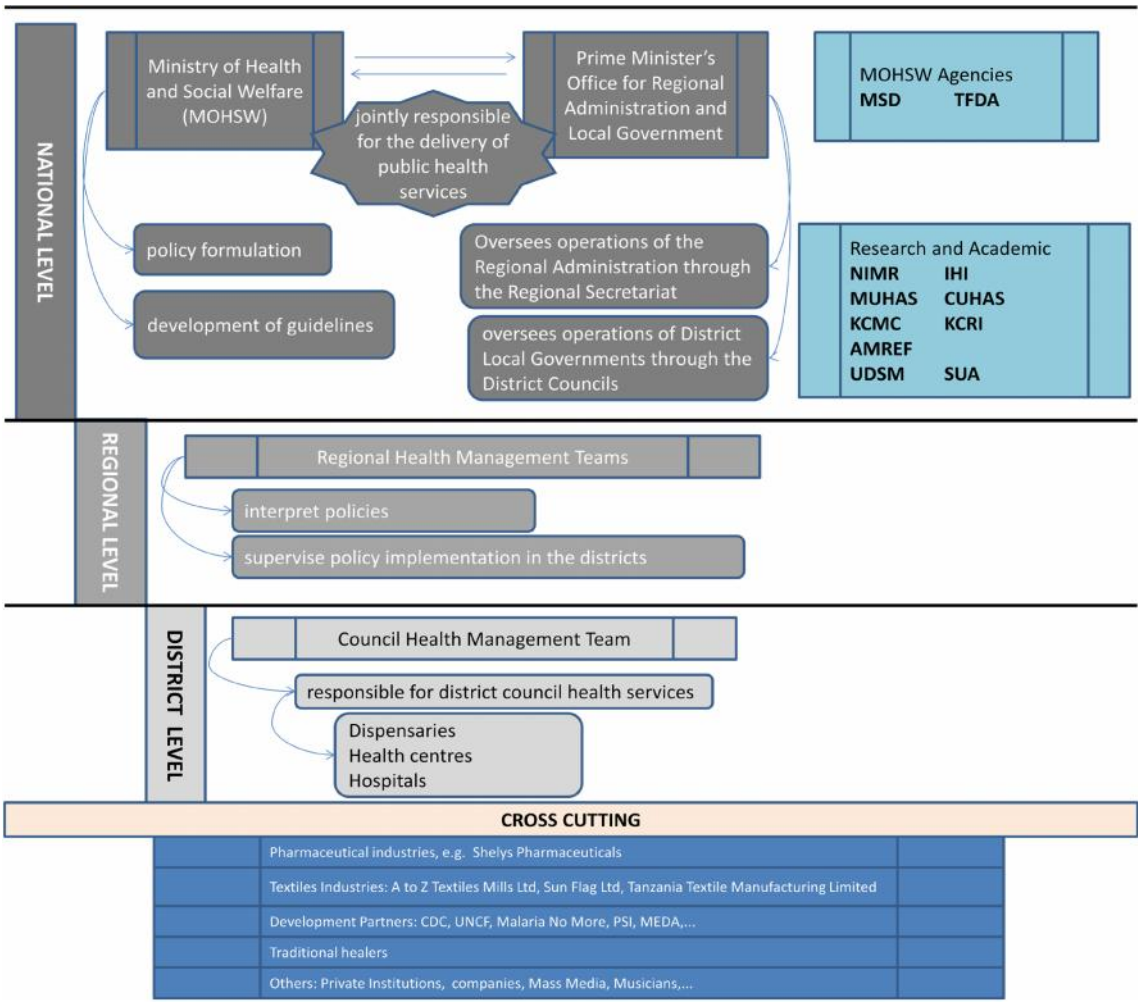

Figure 1: Key actors in malaria control in Tanzania

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In terms of key actors in malaria control in Tanzania, the Ministry of Health and Social Welfare (MoHSW) and PMORALG are the ministries jointly responsible for the delivery of public health services in Tanzania. MoHSW is responsible for policy formulation and the development of guidelines. The PMORALG oversees the operations of the Regional Administration and District Local Governments through the Regional Secretariat and District Councils. At the regional level, the Regional Health Management Teams (RHMTs) interpret the policies and supervise their implementation in the districts. The Council Health Management Team (CHMT) is responsible for district health service delivery through dispensaries, health centres and district hospitals (Figure 1).

The Ministry of Health and Social Welfare Agencies were also identified as other key actors in the delivery of malaria services. These include Medical Stores Department (MSD) and Tanzania Food and Drug Authority (TFDA). MSD is the sole provider of medicines and medical supplies to the public health care system. On the other hand, TFDA is responsible for controlling the quality, safety and effectiveness of medicines and medical devices. Both public and private health research and academic institutions were among the key actors in malaria control programme especially in generating evidence for decision making and policy formulation in Tanzania. The National Institute for Medical Research (NIMR) and Ifakara Health Institute (IHI) are two major health institutions carrying out malaria research in the country. Malaria researches are also carried out by Muhimbili University of Health and Allied Sciences (MUHAS), Catholic University of Health and Allied Sciences-Bugando (CUHAS), Kilimanjaro Christian Medical University College (KCMC), Kilimanjaro Clinical Research Institute (KCRI), African Medical Research Foundation (AMREF), University of Dar es Salaam (UDSM) and Sokoine University of Agriculture (SUA) (NIMR, 2013).

Pharmaceutical and Textiles industries were identified to have an important role in malaria control in Tanzania. Tanzania has three large mosquito net manufacturing firms: the A to Z Textiles Mills Limited, Sun Flag Limited and Tanzania Textile Manufacturing Limited. These local net manufacturing firms have made substantial progress in expanding the distribution of mosquito nets. A number of development partners were identified to play roles in malaria control. These include the United States Centers for Disease Control through the President's Malaria Initiative. Since 2005, this initiative has improved access to malaria prevention and treatment interventions in Tanzania. Others included the World Health Organization, United Nations Children Fund, Malaria No More, Population Services International, John's Hopkins University Center for Communication Programs, Tanzania Red Cross, United Against Malaria, Mennonite Economic Development Associate, World Vision and Clinton Health Access Initiative. Faith-based Organizations including Christian Social Services Commission and the National Muslim Council were identified to have joined malaria control campaigns by engaging faith leaders and their congregations in the effort to combat malaria nationwide. There were numerous large-scale private sector companies with large workforce that have a strong incentive to prevent malaria. Sugarcane, Telecommunications and Mining companies have joined the programme in recent years to form public-private partnership to develop and implement sustainable, cost-effective integrated malaria control programmes in some districts. Mass media and musicians were also identified to play a significant role in malaria control in Tanzania.

Malaria burden

At the district level, a total of 25 individuals from different sectors attended the workshop and filled the self-administered questionnaire. The sectors represented in the workshop were Social (health, education, community development, and water resources); Production (agriculture, livestock, and fisheries); Economic (works) and Cross-cutting sector (environment, works, land development). At the national level, a total of 36 participants attended the workshop and filled the questionnaire. The participants were drawn from four main sectors, namely: Production

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sector (agriculture, fisheries, livestock, mining, and industries); Economic sector (works/construction, transport, and energy); Social sector (education, health, water, social welfare); and Cross-cutting sector (environment, employment, finance, private sector). Other participants were from the Prime Ministers' Office, Municipalities of Kinondoni and Ilala in Dar es Salaam region, the National Environmental Management Council, Private institutions, World Health Organization, and Research and Academic Institutions (Table 1).

All informants, regardless of their sectors, considered malaria as an important public health problem in their districts and the whole country in general. Malaria was described to have an impact on development due to reduction in manpower and financial resources spent on taking care of the patients. One of the district informants confirmed by saying *"most of the reported cases of illnesses at health facilities are due to malaria, and the disease ranks number one among the top ten causes of illness and death in our district" (*Informant, Department of Health).

At the district level, factors contributing to malaria burden in Kilosa district were identified to include: (i) the presence of large water bodies such as swamps, ponds and irrigation schemes, (ii) poor community knowledge about malaria disease and its control, (iii) location of houses in relation to potential mosquito breeding sites, (iv) healthcare seeking behaviour, (v) poverty; (vi) misuse of mosquito nets, (vi) night social and livelihood activities, (vii) agricultural practices, (viii) environmental management, (ix) climate change, (x) antimalarial drug resistance, (xi) poor governance, (xii) culture; and (xiii) weakness of the health delivery system.

Table 1: Number of participants and their respective sectors and ministries/institutions

Sector	Number of participants	Ministry/Institution
Production	4	Agriculture, Food Security and Cooperative
		Livestock and Fisheries Development
		Mining (Energy and Minerals)
		Industries (Trade and Industries)
Economic	6	Works
		Transport
		Energy (Energy and Minerals)
Social	8	Education and Vocational Training
		Health (Health and Social Welfare)
		Water
		Social Welfare (Health and Social Welfare)
		Communication, Science and Technology
		Community Development, Gender and Children
Cross cutting	8	Environment (Vice President's Office)
		Labour (Labour and Employment)
		Finance
		Planning Commission
Others	10	Muvek Development Solutions
		National Institute for Medical Research
		Sokoine University of Agriculture
		Muhimbili University of Health and Allied Sciences
		World Health Organization
Total	36	

In addition, to the department of health, the majority of respondents mentioned a wide range of stakeholders including other government departments, faith-based organizations, non-governmental organizations, politicians, community leaders and community members as key stakeholders in malaria control. Some went further to say that malaria control is the responsibility of everybody, both men and women. Specifically, the following comments were made: *"Everybody in the district should take responsibilities to control malaria through*

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environmental management and use of mosquito nets" (District key informant, Department of Fisheries); "*Stakeholders in malaria control include health and non-health departments. In fact, the Kilosa District Council and the community are key stakeholders in malaria control*" (District Informant, Department of Water).

Sectoral activities that contribute to malaria transmission

According to the district key informants, major sectoral activities that contribute to malaria transmission include agricultural production systems, construction works and water resource development projects. Others include night social and livelihood activities such as farming, travelling, pastoralism, socio-cultural gatherings and fishing activities. Key informants agreed that irrigation schemes and deforestation tend to increase mosquito productivity through creation of open spaces and water bodies. Irrigation activities, uncontrolled clearing of forests for farming and charcoal production, uncontrolled animal grazing and nomadic lifestyle are some of activities that in one way or another contribute to increase in mosquito breeding sites. Fishing activities were also described to play part in malaria transmission since most fishing activities are done at night, and fishermen put on inadequate clothing that did not cover all parts of the body, and hence exposed the individual to mosquito bites.

Other sectoral activities described to have impacts on malaria transmission included use of temporary water storage tanks during construction, brick making, poorly planned water drainage systems and poorly constructed shallow wells. Other activities that create mosquito breeding sites included leaking water pipes, poorly constructed water aprons, and unprotected traditional wells. Storm water channels constructed alongside roads that are left unattended and blocked by solid waste materials lead to stagnant water, hence provide grounds for mosquito breeding. Borrow pits that are left behind by quarry activities and brick making as well as discarded containers, were also described as potential mosquito breeding sites. Poor town planning, allocation of plots close to swampy areas were cited as risk factors in acquiring malaria.

Similarly, at the national level, about half of the participants mentioned that some of their sectoral activities contribute to malaria transmission. These included construction, agriculture, irrigation and mining activities. One participant from the agricultural sector had these to say: "*Construction of irrigation channels, disposal of empty containers and farming practices, all contribute to mosquito productivity and malaria transmission*" Another participants from the Ministry of Community Development added: "*Water dams constructed in different parts of the country by my ministry somehow contribute to malaria transmission*". A participant from the Ministry of Works said: "*The poorly designed drainage structures, borrow pits, and pot holes are good mosquito breeding sites".* Finally, another participant from the Ministry responsible for Environment added that: "*There is haphazard disposal of water containers that contribute to breeding of malaria mosquitoes*"

Intersectoral collaboration

Over half of the district key informants indicated to have their respective departments involved in implementing intersectoral activities. The health sector was mentioned to have jointly worked with other departments such as planning, water, irrigation, education, culture and sports and community development in executing its functions. On the other hand, the Department of Community Development was described as a cross-cutting sector and had been involved in public health education and promotion in malaria control. In general, it was pointed out that there were stronger but informal collaborations between the departments of water, community development and health than with other sectors in the district. There were also some collaborative activities between departments of livestock and health in zoonotic diseases control campaigns. The departments of Irrigation and health have worked together in the design of irrigation schemes to avoid creating conditions for water-borne diseases. The department of

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environment had collaborated with health on environmental sanitation activities. The department of water had collaborated with almost all other departments in infrastructural development projects.

Fishing and community development sectors had been working together in initiating development projects. Health and works departments worked together in approving permits for house construction. Health and fisheries sectors had collaborated in educating community on illegal fishing using poisonous chemicals. Land Development and Works departments had collaborated in land surveying, designing, supervision of infrastructure and construction. Community Development department had facilitated the formation of malaria education clubs in primary schools. Usually, the district holds routine meetings between heads of departments to discuss cross-cutting issues.

Over two-thirds of the respondents from the national level agreed that malaria was an indirect agenda in their organization activities. "*Application of insecticide for the control of malaria whether through residual house spray or larviciding may affect the ecosystem if the insecticides are not carefully selected and applied appropriately*" (Participant, National Environmental Management Commission). A representative of the Vice President's Office responsible for Environment noted that: "*Mitigation measures for malaria is our concern in all development projects implement by my Ministry. Management plans for health impacts are required in every environmental impact assessment report".* Another participant added: "*In the mining sector malaria is an agenda. We ask companies to fill borrow pits resulting from quarry activities because we know they are good breeding sites for malaria mosquitoes*" (Participants, Ministry of Energy and Minerals). In addition, one participant had these to say: "*Public health pesticides that are used indoors are registered by the Tropical Pesticide Research Institute under the Ministry of Agriculture and Food Security. We understand, some of the pesticides used for malaria vector control have impacts on agricultural sector and the vice versa. We need to collaborate to avoid misuse and development of insecticide resistance*" (Participant, Ministry of Agriculture and Food Security)

Less than half of the respondents mentioned that their organizations had been involved either directly or indirectly in malaria control activities in Tanzania, including policy formulation, training, advocacy and implementation of control measures. Participants from different sectors admitted to be informally involved in advocacy and awareness campaigns on malaria control, cleaning up of surroundings and areas that indirectly contribute to mosquito breeding grounds. Some respondents added that their organizations had contributed resources including funds to malaria control campaigns. Specifically, one participant from the Ministry of Finance said that: "*In collaboration with telecommunication companies, we have participated in malaria prevention advocacy and awareness campaigns through donation of mobile phone sets".* "*My Ministry is responsible for approving budgets for health and other sectors. My ministry has participated in the negotiations with development partners and in signing of grants for malaria control.....Yet we are never invited to their planning sessions*" Still another participant from the Ministry responsible for Environment commented that: "My *institution was involved in the preparation of guidelines for indoor residual spraying in Tanzania".*

About half of the participants mentioned that they envisaged that there would be some contributions that their ministries/organizations could make in malaria and other disease control programmes in Tanzania. The contributions included participation in research, management of water resources, community awareness creation, planning, policy formulation, and environmental management. Generally, participants envisaged their involvement in research and development as having contributed substantially to improving socio-economic status of Tanzanian population. One participant from the Ministry of Works commented that: "W*e have a leading role in the campaigns aimed at controlling malaria in Tanzania. The city and town authorities are instructed to ensure that all standing water on streets is drained and solid waste removed from the drainages to allow water to flow smoothly all the time".* In addition, about two-thirds of the

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respondents mentioned that there were initiatives in their ministries or organizations that indicate that there is political will and high level of commitment towards intersectoral collaboration.

Challenges and Opportunities for Inter-Sectoral Collaboration

Lack of adequate funds and commitment, irresponsibility, poor infrastructure and lack of skilled staff were identified as some of the challenges in intersectoral collaborative initiatives (Figure 2). Most sectors are under-funded and do not have budget items for inter-sectoral activities. It was described that most often it was difficult to harmonize resources for cross-cutting activities due to conflict of interest. All key informants agreed that there are opportunities to strengthen intersectoral collaboration within the district because already some informal collaboration does exist. Half of the key informants mentioned the following: (i) availability of funds for implementation of inter-sectoral activities; (ii) inadequate human resources with capacity in ecohealth approaches; (ii) perceptions that malaria control is the responsibility of health sector alone; and (iv) lack of a district framework on inter-sectoral collaboration. One informant had these to say: *"It is difficult to implement intersectoral collaboration due to poor communication between departments and lack of funds. Usually, each sector strives to fulfil its own goals"* (Informant, Department of Fisheries).

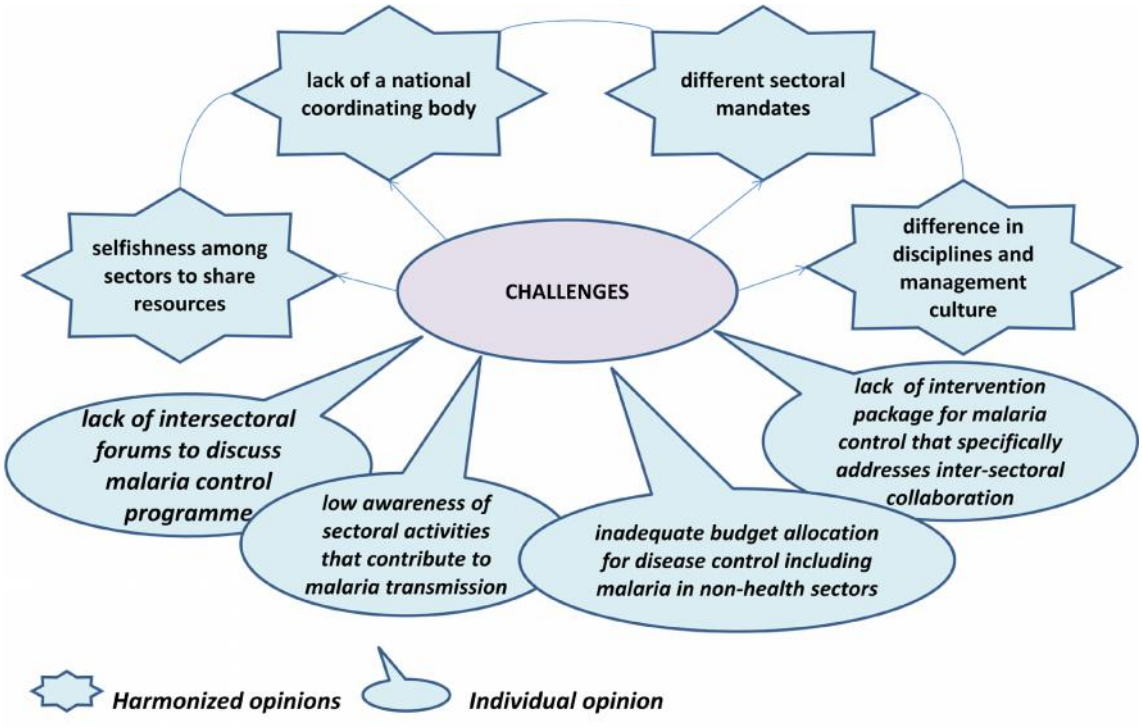

Figure 2: Challenges in intersectoral approaches in malaria control

With the national level participants, the probable reasons for the lack of intersectoral approaches in disease control programmes in Tanzania include the fact that the Ministry of Health and Social Welfare does not involve other sectors during planning and development of strategic plans and policy guidelines; different sectoral mandates, difference in disciplines and management culture, lack of a national coordinating body, and selfishness among sectors to share resources. In

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addition, there were different opinions from some of the respondents. One respondent from the Ministry of Health said: "*There is no intervention package for malaria control that specifically addresses inter-sectoral collaboration*". On the other hand, a respondent from the Ministry responsible for Environment commented that: "*There is lack of intersectoral forums to discuss malaria control programmes. There is low awareness of sectoral activities that contribute to malaria transmission and inadequate budget allocation for disease control including malaria in non-health sectors*".

To improve inter-sectoral collaboration, some participants were of the opinion that, the district needs to have a specific district framework and budget for inter-sectoral activities. It was also proposed to the government to formulate a policy that guides districts on issues of inter-sectoral collaboration. Some participants suggested the need for the district authority to introduce quarterly meetings to review departmental activities, and identify those that could be implemented in an inter-sectoral approach. The participants had the following reasons to support the initiative: (i) Malaria cuts across a number of sectors and with the current environmental changes there is likelihood of malaria burden to increase; (ii) Intersectoral collaboration will help different sectors to be involved in joint planning and budgeting for malaria control; (iii) It will facilitate sectors to share and learn from each other and contribute to malaria control efficiently; and (iv) It will facilitate easy implementation of the other inter-sectoral activities. One had these to say: "*Since malaria is associated with human activities, by engaging different sectors it will be easier to reach many people through different activities*" (Informant, Department of Health). It was highly recommended that the government should set aside specific budget items for inter-sectoral activities. The fund should be controlled by the District Executive Director. To formalize intersectoral collaboration, it was recommended to establish a district steering committee to oversee and coordinate the initial intersectoral collaboration in malaria control.

Half of the respondents from the national level were of the opinion that inter-sectoral policy on malaria control and joint activities between sectors are likely to minimize malaria burden. However, it was argued that sectors should avail resources for joint malaria control activities. One participant from the Ministry of Works said: "*Each sector should mobilise resources to address issues that contribute to malaria transmission and control that are within its sectoral mandates. If every sector embarked on controlling malaria, there would be greater impact on the reduction of overall morbidity and mortality, and this would reduce the burden that is shouldered by the Ministry of Health alone.*" Further, another respondent commented that: "*There should be harmonization of multi-sectoral policies putting emphasis on malaria control as one sector cannot do it alone.*" "*Inter-sectoral collaborations would allow the sharing of information that is necessary for planning and policy formulation and hence enhance better utilization of limited resources*" (Respondent, Ministry of Agriculture and Food Security).

About half of the national level respondents agreed that there are opportunities for intersectoral collaboration in malaria and other disease control in Tanzania. The opportunities included the willingness of some sectors to collaborate. This is testified by one of participants' statement that: "*Yes, opportunities are there and we need to exploit them to support the current national malaria control initiatives. As it is for the HIV/AIDS campaign; malaria control should be among the top agenda in all sectoral activities in this country. For example, the country has now embarked on Kilimo Kwanza (*Agriculture is of high priority*) strategy, and large irrigation projects are going to be implemented. This is the right time for the government to bring in other sectors including Health, Environment, Education, and Community Development to make sure that the programme will not increase the burden of water-borne diseases*". To enhance intersectoral collaboration, a respondent from the Ministry of Community Development suggested that: "*We need seminars on inter-sectoral collaboration to strengthen our capacity in addressing cross-cutting issues, including malaria control.*" In addition, a participant from the Ministry of Works had these to say: "*There is potential for intersectoral collaboration in malaria control as various sectors are*

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engaged in activities which in one way or another contribute to the burden of the disease. What is needed is to identify who should take a leading role in this new approach."

The respondents gave their opinions on areas that should be addressed to improve intersectoral collaboration in malaria and other disease control programmes. These include creation of awareness and advocacy for political support, provision of human and financial resources, sharing of expertise, formulation and coordination of policies. There is need to raise community awareness on livelihood activities that contribute to malaria transmission and the community should play a role in the malaria control programme. At community level, the government should make malaria control as a permanent agenda in all village meetings. On the other hand, at district level, the council should develop guidelines that detail the inter-sectoral approach for malaria and other disease control programmes. Similarly, at the national level, a policy document that details each sector's role in the inter-sectoral approach for malaria control measures needs to be developed. It was also proposed that research institutions should carry out studies and analysis to map key livelihoods and ecological determinants of malaria in Tanzania and identify common issues of interests for different sectors to contribute towards malaria control.

Discussion

Although a number of actors are involved in provision of malaria control services, the linkages are strong between institutions within the health sector and between the health sector and the private sector. The recent emphasis to involve private sectors in disease control followed realization by the international community that, in tackling the health problems of low income countries, there is a need for better coordination of the traditional public and private sector roles to harness the synergistic combination of the strengths, resources and expertise of the different sectors (Buse & Walt, 2000; Widdus, 2001). The involvement of private sector in malaria control in Tanzania has been described in detail (Njau *et al*., 2009; WHO, 2011). Recently, the government of Tanzania recognised and awarded 35 corporate companies and parastatal organizations following their response to fighting malaria (http://allafrica.com/stories/201312090357.html). The multi-sectoral actions described in this study are necessary but not sufficient to constitute inter-sectoral collaboration (Adeleye & Ofili, 2010).

The findings of this study indicate a major disconnect among sectoral ministries. Except for the Prime Minister's Office for Regional Administration and Local government, no clear linkages between the health sector and other sectoral ministries were identified. In both National Malaria Strategic Plans of 2007-2013 and 2014-2020, there was no involvement of experts from other sectoral ministries. Bringing health initiatives to scale often requires massive collaboration within government as well as coordinated efforts among government, international agencies, manufacturing firms, corporate companies, civil societies, non-governmental organizations, and communities. In Tanzania, such systems are exceedingly fragile, with the infrastructure for collaboration and coordination between sectors being often weak. However, in this study, it was realised that a number of actors were involved in malaria control from different angles though all of them had a health service component as one of their functions. It is now increasingly recognized that a much broader, coordinated approach, range of knowledge and skills, and resource base are required to tackle the malaria problem in Africa. An ecohealth approach has been shown to be more robust in malaria control than the traditional medical approach (Okello-Onen *et al.*, 2011). Moreover, because of the fact that various sectoral activities contribute to malaria transmission, and because of the complexity and scope of malaria interventions, specialists need to be drawn from a variety of relevant disciplines to work together in a trans-disciplinary and intersectoral approach (Mboera *et al*., 2013). Within such scenario, there is need to establish planning for malaria control in development efforts in non-health sectors.

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Several sectoral activities were identified to contribute to malaria transmission. These included agricultural practices and production systems, infrastructural development programmes, demographic changes including population movements as a result of livelihoods activities. Such sectoral activities and development projects are likely to influence the transmission and control of malaria. It has already been established in many parts of Africa that water resource development projects have in many cases caused increase in the incidence of vector-borne diseases (Oomen *et al.*, 1988; Mutero *et al.*, 2006; Mboera *et al.*, 2007; Asenso-Okyere *et al.*, 2009). It is therefore clear that, if not anticipated and corrected in the initial plans, most sectoral activities and development projects will result in an increase in malaria transmission.

Despite the call by Alma Ata Declaration that all governments should formulate national policies, strategies and plans of action to launch, and sustain primary health care as part of a comprehensive national health system and in coordination with other sectors, to this end, this has not been operationalized in Tanzania and other developing countries (Adeleye & Ofili, 2010). While intersectoral collaboration is described in the Health Sector Strategic Plan III, active collaborative projects between the health and non-health sectors are not common. In Tanzania, a number of shortcomings in the implementation of intersectoral primary health care (PHC) have been identified (Kamuzora, 1996). These include misconception by the Ministry of Health that PHC is a vertical programme, weakening the national level coordinating mechanism by lack of political legitimacy it deserves, and inadequate legal mechanisms proposed in the 1983 PHC guidelines.

Departments of education, agriculture, water resources, works, community development and land development, for example, should all consider malaria as being directly relevant to their respective missions, encouraging cross-sectoral cooperation at the national, district, and community levels. For instance, fostering collaboration between a village health worker and an agricultural extension officer for community outreach, education, and training programmes, and for regulation of insecticide use is crucial at the community level as evidenced in this study. Already, in Sudan, the Health Education and Community Participation Unit utilizes agricultural extension officers who promote health education messages by linking up with farmers (http:.//www.aaas/international/Africa/malaria91/rec1.html). Strengthening community-level collaboration in the maintenance of local water resources and small irrigation projects is crucial to avoid creating mosquito breeding sites.

Similar to the recommendations made by national stakeholders in this study, about two decades ago, Kamuzora (1996) proposed that intersectoral coordination processes at national level should guide similar processes at sub-national levels. To-date, such a framework has not been established. To enhance malaria prevention and control, the intersectoral integration of ministries involved in specific development efforts must be established and strengthened. The health sector must play a leading role in planning, implementing, and monitoring development efforts that may have an adverse impact on malaria. The health sector should therefore take the initiative in developing national and district plans and to coordinate anti-malaria activities, effectively involving other relevant sectors, non-governmental organizations, civil societies, and communities. Such health sector-coordinated groups would be responsible for increasing awareness of malaria as a problem among non-health sectors.

The need for collaboration arises from the diverse nature of the malaria problem. Malaria problem has multiple determinants, affects many people and sectors, and requires action by different sectors. Lack of skills on inter-sectoral collaboration at the district and national levels was identified as one of the major challenges. It is important that district and national malaria programme managers be trained cross-sectorally – for example to have knowledge on agriculture, water, environment and economics so as to prepare them for inter-sectoral collaboration. Training should expose students to other perspectives, encourage exploratory

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ideas and provide experience working in an inter-sectoral team in order to prepare students for cross-cutting work. As observed in this study, financial resource is among the major limiting factors in strengthening intersectoral collaboration at the district and national levels in Tanzania. Intersectoral cooperation requires financial support as well as evaluation to determine how they can best be strengthened. It is also clear that to be sustainable and effective, intersectoral programmes must have their own funding and clear authority (USAID/AD, 1991). The lack of sustainable institutionalisation of intersectoral partnership has been described to be attributed to a number of factors such as attitude of the medical and non-medical experts, unavailability of adequate resources, lack of clarify of mandates and lack of institutional framework (Mazet *et al.*, 2009; El Sayed & Sleem, 2011; Kayunze *et al.*, 2013).

Like in the current strategic plan, in the proposed National Malaria Strategic Plan 2014-2020, the Ministry of Health and Social Welfare, through the National Malaria Control Programme, envisages establishing a Malaria Steering Committee to be responsible for strategic decisions with respect of malaria control (MoHSW, 2013). The composition of the Steering Committee will include senior representatives from Ministries responsible for Finance and Local Governments, Development Partner Group, Tanzania National Coordinating Mechanism Secretariat, World Bank and the World Health Organisation. In addition, a Malaria Vector Control Sub-Committee will include, among others, a representative from research institutions in health and agriculture, National Environmental Management Council, Division of Environment of the Vice President Office and the Ministry of Agriculture. Such institutional linkage is expected to stimulate system changes by enabling an intersectoral health leadership team to develop and implement innovative malaria control and prevention programmes. The linkages between the relevant sectors will provide a new approach to problem solving by breaking down traditional boundaries between sectoral ministries to create hybrid solutions that draw on the best each domain has to offer. This is a commendable move, though it has limited the number of sectors to be involved in the future of malaria control in Tanzania.

In conclusion, current strategies for malaria control in Tanzania need to be sustainably maintained. However, without considering the impact of development activities including livelihoods, they are unlikely to result into sustained control of malaria. The interventions need to address issues of livelihoods and ecosystems and emphasise the need for intersectoral collaboration. It is recommended that all development projects take into account the potential for an adverse impact on malaria and other health problems. Project plans must thus include provisions for reducing the potential for transmission. Development of such plans and mechanisms for monitoring impact can best be achieved through an intersectoral approach. Intersectoral cooperation needs to be encouraged at all levels. Coordination with the national or district government that take into consideration the participation of all key sectors is necessary in order to obtain the support critical to the success of malaria control programme. The future of malaria control strategy should be broad based, and inter-sectoral in planning and operation.

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Author contributions

MRSM, LEGM, SFR contributed equally to the development of the concept and design of the approach. TM, EHS, VMB, RCM, BKM, KOM participated in the organization and coordination of the workshops and questionnaire administration. SFR and LEGM managed and analyzed data. MRSM, LEGM, SFR wrote the manuscript. All authors reviewed, contributed to, and approved the final version of the manuscript.

Competing interest

The authors declare that they have no competing interests.

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