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Community Assessment on Understanding, Involvement, and Action in The Prevention of Dengue Fever: A Case Study of Mvita Sub-County, Mombasa County, Kenya

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Abstract

Dengue fever is a mosquito-borne viral disease transmitted by the female Aedes Aegypti species. There has been a dramatic increase in Dengue cases globally, many cases being asymptomatic or mild. WHO reports an 8-fold increase in cases over the last two decades, 5.2 million cases in 2019, compared to 2.4 million in 2010 and 505,430 cases in 2000, with a noted increase in fatality cases from 960 to 4032 between years 2000 and 2015. Cases have increased over the last years, with approximately 2.5 billion people at risk (WHO 2019). An estimated 50 million cases occur worldwide annually, with an estimated 500,000 people with DHF requiring hospitalization, the majority being children of less than five years, of whom 2.5% of those affected die. The first Dengue fever outbreak in Kenya was in 1982 in the coastal region, with outbreaks from April-June 2013 and March-June 2014 coinciding with long rains that provide a conducive breeding ground. Mombasa County has environmental conditions favoring mosquito proliferation and interaction with humans, such as a warm climate, high rainfall, and overcrowding. This study realized a major misconception about how Dengue fever is spread when 48% of the respondents recommended sleeping under a mosquito net as the key preventive measure. This study recommends community engagement and sensitization to update on the correct Dengue Fever information, possibly via health promotion activities such as community dialogues, radio talk shows, commercials, and community action days to clear the environment of all items listed and identified as possible Aedes mosquito breeding sites.

Keywords: *Aedes Aegypti, Dengue fever, Mosquito.*

Introduction

Dengue fever is one of the viral diseases that is mosquito-borne that has rapidly spread in all regions in the recent years that is transmitted by the female mosquitoes, mainly of the Aedes Aegypti species and the Aedes Albopictus to a lesser extent[1] These being the same mosquitoes that are vectors of chikungunya, yellow fever and Zika viruses [2]. Dengue fever disease is caused by the Flaviviridae family virus, and there are four distinct strains that are close in similarity [3]. The serotypes of the virus that consecutively lead to Dengue fever are DENV-1, DENV-2, DENV-3, and DENV-4 [4]. Fever experienced by Dengue fever infected patients ranges from subclinical disease (people may not even know they are even infected) to severe flu-like symptoms [5]. Some dengue patients can develop case severity, although less common, and can experience severe bleeding that might result in organ impairment and/or plasma leakage [6]. Severe Dengue, first realized in the 1950s during suspected Dengue disease epidemics in the Philippines and Thailand, resulted in higher

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risk of death when not managed in the required manner [7]. Countries mostly affected currently by this disease in severity are the Asian and Latin American countries [8], making Dengue fever the leading cause of hospitalization and fatality amongst children and adults within the region [9]. There has been a dramatic increase in Dengue cases around the globe recently, with a majority of the cases being asymptomatic, mild or self-managed, masking the actual of Dengue fever cases around the world, with most of the cases being misdiagnosed and recorded as other febrile illnesses.

The most prevalent public health issue in tropical and subtropical countries is Dengue currently, with the number of dengue cases reported by WHO increasing by 8-fold over the last two decades, numbers being 5.2 million in 2019, compared to 2.4 million in 2010 and 505,430 cases in the year 2000 [10]. There has been a noted increase in fatality cases from 960 to 4032 between the years 2000 and 2015. Dengue cases have increased drastically over the last years, with approximately 50% of the global population (2.5 billion people) at risk of infection [11], subjecting the vast population of the world population within tropical and subtropical countries to the risk of Dengue fever exposure. An estimated 50 million dengue infections occur worldwide annually, with an estimated 500 000 people with DHF requiring hospitalization each year, with the majority of them are children aged less than five years, of whom 2.5% of those affected die [12].

Dengue and DHF diseases are endemic to not less than 100 countries in the WHO regions of Africa, the Americas, the Eastern Mediterranean, South-East Asia, and the Western Pacific as well, with South-East Asia and Western Pacific regions being the most seriously affected, epidemics increasing by the day[13]. During epidemics, 40% to 50% of those not previously exposed to the disease can attain exposure of up to 80% to 90%, resulting in an alarming incline of cases recorded and reported to the Ministries of Health and to the WHO.

A high threat of an impending dengue outbreak now exists in Europe, with local transmission being reported for the first time in France and Croatia since 2010 and imported cases being detected in 3 other European countries. An outbreak of Dengue on the Madeira Islands of Portugal in the year 2012 resulted in more than 2000 cases being detected in the Portugal mainland and in 10 other countries within Europe. Autochthonous cases are currently being observed on an annual basis in many of the European countries [14]. Travelers returning from low- and middle-income countries are more susceptible to dengue fever as the second most diagnosed cause of fever after malaria [14].

Dengue fever affected several countries in 2020, depicting an increased number of cases in Brazil, Bangladesh, Ecuador, Cook Islands, Indonesia, India, Maldives, Mauritania, Mayotte (Fr), Singapore, Nepal, Sri Lanka, Sudan, Thailand, Timor-Leste, and Yemen to mention a few [15]. Dengue continued to affect Brazil, the Cook Islands, Colombia, Fiji, Kenya, Paraguay, Peru, and Reunion Island in the last year [8]. DHF was first confirmed as an epidemic in the Philippines in 1953–1954 and in Thailand in 1958. Member countries of the WHO South-East Asia (SEA) and Western Pacific (WP) regions have since then often reported major dengue outbreaks.

The Guidelines for Comprehensive Prevention and Control of Dengue and Dengue Haemorrhagic Fever confirmed DHF outbreak occurred in India in 1963. Indonesia, Maldives, Myanmar, and Sri Lanka have since also reported major DHF outbreaks. These outbreaks prompted bi-regional meetings on the disease in 1974 in Manila, the Philippines, where technical guidelines for the diagnosis, treatment, prevention, and control of Dengue and DHF were developed. This document was later revised at a summit meeting in Bangkok in the year 1980 [14].

In 1993, the Forty-sixth World Health Assembly (*46th WHA, 1993*) which occurred in the month of May, adopted a resolution on dengue prevention and control that urged the strengthening of national and local programs for the prevention and control of dengue fever disease (DF), DHF and DSS being among the foremost health priorities of those W.H.O Member States where the disease was consented as endemic. The resolution urged Member States to (a) develop strategies that contain the spread and the increase of Dengue in a sustainable manner; (b) improvement of community health education; (c) encouragement of health promotion; (d) bolster research; (e) expansion of dengue surveillance; (f) provide guidance on vector control; and (g) prioritization of the mobilization of external resources for disease prevention., A global strategy for the operationalization of vector control was developed in response to the World Health Assembly resolution, termed as the Salient features of Global strategy for the control of DF/DHF vectors comprising of five major components, which are;

1. Selective integrated mosquito control with community and intersectoral participation.
2. Active disease surveillance is based on strong health information systems (HIS).
3. Emergency preparedness.
4. Capacity-building and training.
5. Intensive research on vector control.

The Global Burden of Disease reported dengue fever case incidence has multiplied by six-fold from 1990 to 2013, with the Southeast Asia region contributing to the burden by 52% of the disease. World Health Organization (*WHO*) projects 50 million to 100 million cases of Dengue fever to occur annually, being endemic in more than 100 countries, with South-East Asia being the most affected region. There is no specific treatment for the management of dengue fever. Pain killers can be used to control muscle aches and pains symptoms and fever, with the best options to treat these symptoms being acetaminophen or paracetamol. NSAIDs (non-steroidal anti-inflammatory drugs), such as aspirin and ibuprofen, are contraindicated.

For severe dengue cases, specialised care by physicians and nurses experienced with the effects and progression of the disease can save lives – declining mortality rates from higher than 20% to less than 1%. Upholding of a patient's body fluid volume is critical in severe dengue care. Patients with Dengue should seek medical advice upon the appearance of the warning signs. If one knows they have or suspect to have Dengue, they should avoid getting further mosquito bites during the first week of illness. The virus may be circulating in the blood during this time and therefore result in the transmission of the virus to new uninfected mosquitoes, who may result infect other people [5]. The proximity of mosquito breeding sites to human habitation is a major risk factor for the spread of Dengue as well as for other infectious diseases that the Aedes mosquito transmits. At present, the main method of control or prevention of the transmission of the dengue virus is by eliminating the mosquito vectors. This can be achieved through the prevention of mosquito breeding, prevention of mosquitoes from accessing egg-laying habitats through environmental management and modification, disposing of solid waste properly, and removal of man-made habitats that can hold water by Covering, emptying and cleaning domestic water storage containers on a frequent basis, applying the right insecticide to water storage containers, effect personal protection from mosquito bites, use of personal household protection measures such as repellents, window screens, coils, vaporizers, and insecticide-treated materials. These measures must be observed round the clock, both inside and outside of houses and institutions (e.g., at work/school). Wearing clothing that minimizes skin exposure to mosquitoes is advised because the primary mosquito vectors bite throughout the day [5]. Community engagement, educating

the community on the risks of mosquito-borne diseases, engaging with the community to improve participation and mobilization for sustained vector control, and emergency vector control measures such as space spraying during outbreaks may be used by health authorities, active mosquito and virus surveillance, active surveillance of vector abundance and species composition should be carried out to determine the effectiveness of control interventions, prospectively monitor the prevalence of the virus in the mosquito population, with an active screening of sentinel mosquito collections[16]. The life cycle of a mosquito consists of four separate stages: egg, larva, pupa, and adult (Figure 4.0), the first three stages requiring an aqueous environment [17]. The duration of the developmental stages being dependent on the environment's temperature, water, and availability of food at the larval stage. For *Ae. aegypti*, it takes 8-10 days at room temperature [18]. Adult male mosquito feed on flower nectar and juices of fruits for flight energy. The female requires a blood meal for egg development. Human blood is preferred, and the ankle area is a favored feeding site [19]. Once a mosquito has fed on a viremic human, the virus replicates in the arthropod mid-gut and disseminates to the salivary glands within 8-12 days. Following dissemination to the salivary glands, female *Aedes* mosquitoes are able to transmit DENV to new hosts. However, for the virus infection to be sustained in the vector mosquito, the virus titer in the human host should exceed $10^5 – 10^7$ virus particles per ml [20]. The vector itself is thought to function as an important biological filter for maintaining the virus titers at high level [20]. In periods of low virus transmission, the DENV may survive through transovarial transmission from parent to progeny and possibly also between mosquitoes sexually [21].

There is ongoing research amongst international collaborators in search of novel tools and innovative strategies that will contribute to the global efforts on the interruption of the transmission of dengue fever, as well as other mosquito-borne diseases. WHO encourages the integration of vector management approaches to achieve sustainable, locally effective, and adapted vector control interventions [21].

Problem statement: The first Dengue fever outbreak in Kenya was reported in 1982 in the coastal region. Outbreaks were reported from April to June 2013 and March to June 2014, coinciding with the long rain seasons that provide a conducive breeding ground for the dengue mosquitoes. A dengue outbreak was confirmed in Mandera County and another in Mombasa in 2013 through 2014. Dengue fever is mostly an urban disease driven by human behaviors of storing water in open containers inside or around homes. These are excellent breeding grounds and the close proximity to human beings increases the risk of getting the disease. Mombasa county, in Kenya, besides being surrounded by the Indian ocean, experiences an acute shortage of fresh drinking and cooking water resulting in the communities' need to store water in drums and containers for use. In periods of warm and wet weather, for example, during El Nino, the mosquito population increases rapidly, and the virus in the mosquito also develops very quickly. Infection with more than one type of dengue virus can cause dengue hemorrhagic fever. The International Association for Medical Assistance for Travelers currently has a travel advisory against Kenya on Dengue fever, citing is as endemic, with risk presenting round the year, with peak transmission during the rainy season, i.e., April to October.

The endemic cases of Dengue fever have the Kenyan government planning to provide dengue test kits to Mvita Sub County, Mombasa, and other counties where the disease is endemic to facilitate treatment and provision of data that will be utilized to establish the country's disease burden and distribution, with this move being expected to inform the implementation of vector control activities as

well as other preventive interventions. In 2016, the Ministry with support from various partners, conducted a dengue survey in Mombasa County and found that the disease is present in the County with a high zero-positivity rate, indicating a longstanding continued presence. The survey has been conducted in 10 community health units in Mvita sub-county, Mombasa County Referral Hospital, Tudor sub-County Hospital and Ganjoni Health Centre. The above study was done by the Kenyan government with an aim to use the information to plan for a bigger disease burden assessment to be able to respond to other areas suspected to have Dengue, which will help in designing interventions that could be rolled out in conjunction with County governments and give clear policy direction. This study was focused on one of the six sub-counties within Mombasa County, Kenya, namely the Mvita sub-county, to understand the community understanding of Dengue fever, involvement in the prevention of Dengue fever and the community preventive measure in place for the prevention of Dengue fever. Mvita sub-county has with 61,784 households and a total population of 157 610 people, of whom 44,601 are below 15 years. There was an increased number of Dengue fever cases were reported in the financial year 2020/2021, with 57 confirmed cases of children below 5 years, and 907 confirmed cases of people above 5 years, as can be shown in Table 1.

Table 1. Dengue fever data, Mombasa County, Kenya Health Information System (DHIS2)

Period	**MOH 505 Rev 2020_IDSR Dengue <5 yrs, Cases**	**MOH 505 Rev 2020_IDSR Dengue >5 yrs, Cases**
July 2020	5	78
August 2020	4	57
September 2020	11	131
October 2020	2	306
November 2020	1	90
December 2020	2	41
January 2021	2	8
February 2021	3	42
March 2021	16	50
April 2021	2	32
May 2021	8	45
June 2021	1	27
Total	57	907

Source: Kenya Health Information System (DHIS2)

The study main objective is to determine the community understanding, involvement, and action in the prevention of Dengue fever in Mvita sub-county, Mombasa County, Kenya. Specific objective for the study is to determine the community's understanding on Dengue fever. It also determine the community involvement and preventive measure in place in the prevention of Dengue fever.

Methodology

Study Design

This study was conducted within the 5 locational wards of the Mvita sub-county. This is a descriptive study where convenience sampling was applied. Questionnaires were used, where five research assistants were recruited, trained on the questionnaire, and tasked to go out to the 5 locational wards to

engage the community. Participation was on a voluntary basis, the households being randomly selected, and informed consent was obtained from participants after an explanation of the study objectives. Informed consent was first explained to the respondents, and the questionnaire was then administered once consent had been sought. For the purpose of ownership and transparency with this research, it was agreed with the Mvita sub-county health management team that the sub-county health management team's email address be listed on the informed consent request form for any communication.

Ethical Considerations

Authorization was sought from the department of health, Mvita sub-county to conduct this study.

Assurance was given to respondents that they would not be identifiable in the questionnaire and the information that they provided will be treated as confidential will be utilized to strengthen and improve on the management of Dengue fever in Mvita sub-county and Mombasa County in general.

Limitation of the study

1. Convenience sampling was used. These results could be prone to bias as those who volunteered to take part might not be the ones informed on the subject matter, and the sample may not be representative of other characteristics, such as age or sex.
2. The study was limited to the study objectives. The study collected data from the 50 respondents picked within the Mvita sub-county, 10 being picked from each of the 5 wards within the sub-county.
3. Further, this study only focused on the community understanding on Dengue fever, involvement in the prevention of Dengue fever and the community preventive measure in place for the prevention of Dengue fever thus we cannot generalize the findings to overall health in other settings. Lastly, the study is only focused in the Mvita sub-county, Mombasa County, thus it cannot be generalized to the whole of Kenya.

Results and Findings

An equal number of ten houses were assessed in each of the five wards within the Mvita sub-county.

The occupation inquiry for the fifty houses assessed noted a higher number of the respondent being employed, followed by housewives, then partially employed, as in the table below.

Table 2. Respondent's Occupation Data

Occupation	Tudor	Ganjoni	Old town	Majengo	Tononoka
Full time employment	3	8	7	5	-
Housewife	4	1	2	3	3
Student	1	-	1	1	-
Part time employment	2	1	-	1	5
Unemployed	1	-	-	-	2

The average number of occupants per household assessed realizes that Tudor and Old Town wards had the highest and a general equal number of occupants, followed by Tononoka ward, and finally Ganjoni ward, with Majengo ward having the least. Majengo ward had the highest number of children per household, as highlighted in the table below.

Table 3. Aggregate Population per Household Data

Wards	Average population	Children in the house (average)
Tudor	5.2	3
Ganjoni	4.8	2.1
Old town	5.2	2.4
Majengo	4.3	3.6
Tononoka	5.1	2.6

On exposure to and contacting Dengue fever within the last three months, the study noted a higher number of reported cases in Tudor ward, four, followed by Tononoka ward with three cases and 1 case in Majengo ward. No cases were reported in Ganjoni and Old Town wards.

Table 4. Confirmed Dengue Fever in Last 3 Months' Data

Wards	Dengue cases
Tudor	4
Ganjoni	0
Old town	0
Majengo	1
Tononoka	3

On the inquiry on how Dengue fever is transmitted to a person, the majority of the respondent acknowledged mosquito bites being the main cause of Dengue fever infection. Two of the respondents to not have any idea on what cases Dengue fever and two more cited infections as a possible cause of Dengue fever. Dengue fever was responded to be a waterborne disease by two respondents, while two other respondents to clearly not know anything on Dengue fever. It was coming out clearly that the Old Town and Majengo wards were well informed on how Dengue fever was transmitted.

Table 5. How Dengue is Transmitted Data

Transmission	Tudor	Ganjoni	Old town	Majengo	Tononoka
Mosquito bite	7	7	10	7	10
Airborne	-	-	-	-	-
Blood transmission	-	-	-	-	-
Waterborne	1	-	-	1	-
Don't know	-	-	-	2	-
Others	2	2	-	-	-

On the time when the Aedes mosquito is usually active to bite, the majority of the respondents (25, 50%) confirmed it to be during the day, while 12 (24%) respondents erroneously had it as the night. Other respondents (13, 26%) had any time, rainy times and weren't aware of the time as their responses to when the Aedes mosquito was active.

Table 6. Time of Mosquito Bite Data

Wards	During the day	Night	Others
Tudor	6	4	-
Ganjoni	5	2	3
Old town	5	2	3
Majengo	2	1	7
Tononoka	7	3	-

On inquiry, if the respondents had received any information on Dengue within the last 14 days, the majority (28, 56%) consented to having received Dengue fever information within the last two weeks, while 22 (44%) respondents had not received any Dengue fever information within the last two weeks. It was important to realize that the majority of the respondents who had received Dengue fever information within the last two weeks came from the Old Town ward, followed by Tononoka Ward, while the ward that had the information gap was the Majengo ward, followed by Ganjoni ward.

Table 7. Information Received on Dengue in last 2 Weeks' Data

Wards	Yes	No
Tudor	6	4
Ganjoni	3	7
Old town	9	1
Majengo	2	8
Tononoka	8	2

On the sources of information the respondents were exposed to within the last two weeks on Dengue fever, the majority of the respondents (22, 44%) listed public announcements as the information source and outdoor media as the least (3, 6%). Nine respondents had other unlisted responses, and Tononoka had five respondents list CHVs 5 times as the source of information on Dengue fever, as shown in the table below.

Table 8. Source of Dengue Information Data

Transmission	Tudor	Ganjoni	Old town	Majengo	Tononoka
Public Announcements	2	-	9	5	6
Printed Media	2	2	-	-	-
Outdoor Media	2	-	-	1	-
Radio [Local/National]	1	1	2	-	-
TV [Local / National]	-	-	-	-	-
Newspaper [Local National]	-	-	-	-	-
Not responded	-	7	-	3	2
Other	3	-	-	1	5

On whether the respondents had been involved in health promotion activities on Dengue fever within the last 14 days, it was realized that a majority of the respondents (42, 84%) had not been involved in any health promotion activities within the last two weeks. It is noticeable that Tudor, Ganjoni, and Majengo wards all had zero involvement in health promotion activities, while Tononoka ward had the highest listed number of respondents who had been involved in health promotion activities.

Table 9. Engagement in Health Promotion Activities Data

Wards	Yes	No
Tudor	0	10
Ganjoni	0	10
Old town	1	9
Majengo	0	10
Tononoka	7	3

Upon inquiry on the type of health promotion activities that the health respondents had been involved in within the last 14 days, it was interesting to note that every ward had some form of health promotion activities that they had been involved in within the last two weeks, even after most had declined to have had any form of engagement. 24 (48%) of the respondents fell under the others response bracket, where ten of the respondents did not offer an answer; one mentioned linkage with a CHV, and another a Polio campaign. Of the other offered responses, small group discussions emerged as the overall common health promotion activity that the respondents had engaged in, followed by individual advice.

Table 10. Type of Health Promotion Activities Data

Health promotion activity	Tudor	Ganjoni	Old town	Majengo	Tononoka
Public Lecture	1	-	3	3	-
Small-Group Discussion	-	-	-	2	7
Community dialogues	1	-	-	1	-
Source Reduction	-	-	-	-	-
Demonstration	-	-	-	-	-
Individual Advice	-	-	7	1	-
Others:	8	10	-	3	3

The respondents were then subjected to inquiry on what they considered to be the signs and symptoms of dengue fever, where it emerged that high fever and deep muscle and joint pains were considered the tell-tale signs of Dengue fever by the majority of the respondents, followed by headache and extreme fatigue. None of the respondents considered enlarged lymph nodes as a possible sign of Dengue fever. Out of the myth with Dengue fever within the wards, cough, flu, and loss of appetite were interestingly listed as possible Dengue fever symptoms.

Table 11. Signs and Symptoms Data

Signs and symptoms	Tudor	Ganjoni	Old town	Majengo	Tononoka
High fever	2	10	10	7	8
Stomach pain	-	-	1	-	1
Chills	-	4		1	4
Extreme fatigue	3	8	4	1	8
Loss of appetite	-	3	3	5	1
Nausea and vomiting	1	3	2	1	1
Cough	-	-	-	-	1
Enlarge lymph nodes	-	-	-	-	-
Diarrhea	1	-	-	-	-
Deep muscle and joints pain	7	5	10	5	10

Headache	4	2	10	1	8
Eye pain	-	1	1	-	1
Pink or red eyes	-	-	-	1	-
Rash	-	-	-	-	2
Others	3	-	-	1	1

On where the respondents considered the mosquito bred within the house and outside the household, the majority of the respondents had bathrooms and toilets followed by open freshwater containers and dirty stagnant water as possible mosquito breeding sites within the household, and bushy areas followed by stagnant water and dumpsite areas as possible mosquito breeding sites outside of the household. The majority of the respondents has sleeping under a mosquito net as the highest preventive measure for Dengue fever, a very high misconception considering the Aedes mosquito is active during the day. The use of mosquito nets was followed by the use of mosquito coil, mosquito repellent, and cleaning the environment around the house as the next possible preventive measures for Dengue fever.

Discussions

Dengue fever is a global menace currently affecting many households, and Kenya is not being left out. [2] The positive cases picked within the study area in Mombasa raise a lot of concern [9]. There is a noted general gap in the understanding of signs, symptoms, and exposure to Dengue fever [10]. 50% of the respondents had cited the wrong infection time during the day for Dengue infection, and 44% of the respondent not have received any updates on Dengue within the last two weeks prior to the interview.

The majority of the respondents had sleeping under a mosquito net as the highest preventive measure for Dengue fever, a very high misconception considering the Aedes mosquito is active during the day. This gap in knowledge will frustrate all measures at combatting and eliminating the viral infection unless urgently acted upon so the citizenry can actively protect themselves from the infection [3], and identification of key symptoms of Dengue fever infection to enable them to seek appropriate medical services [5]. It is important to embark on community engagement and sensitization to update the community with the correct Dengue Fever related information, possibly via health promotion activities such as community dialogues on Dengue Fever, radio talk shows and commercials on Dengue Fever, and community action days to clear the environment of all the items listed and identified as possible breeding sides if Aedes mosquito by the community.

Intense training should be arranged for community health volunteers as they are the first contact with the community. It is important to all create a supervision checklist to monitor Dengue fever cases in the community. The checklist can be used by public health officers to supervise community health extension workers (CHEWs) and CHVs.

Conclusion

The WHO General Assembly confirmed Dengue fever as a matter of international public health priority on the 18th of May 2002, prioritizing the strengthening of Dengue control and research as a resolution. This study realized misinformation to be the key limiting factor in the fight against Dengue fever infection within the Mvita sub-county, Mombasa County. Behavioral risk factors, individual determinants of outcome, and leading indicators of severe illness are poorly understood, compromising the effectiveness of the expected control measures. Addressing the knowledge gap and the better use of available intervention methods will effectively address the challenge and impact on the early detection and case management practices that have been noted as critical factor for survival.

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Conflict of Interest

The author declares that there is no conflict of interest.

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