GUIDELINES FOR DENGUE VECTOR (S) CONTROL DURING OUTBREAKS/EMERGENCIES

ABSTRACT: In Pakistan dengue has been endemic in the southern parts of Sindh and Balochistan since 1994. However since 2004/05 this disease has spread across the country. Directorate of Malaria Control (DoMC) Ministry of Health is playing an active role for better management of this disease and so far has produced 10 filed investigation reports and 4 guiding documents. DoMC has also confirmed another vector of dengue named Aedes albopictus other than A. aegypti in Pakistan. This document has been prepared in the light of best practices available in the world for dengue mosquito control and mainly deals with prevention of vectors mosquitoes during outbreaks of dengue with major emphasis on health promotion campaign for personal protection through use of repellants, cloth treatment, bednets, followed by fogging, residual spraying and larviciding etc. The overall objective of the document is to interrupt the Man-Vector contact to keep dengue under control through the application of these preventive measures. This is an approach that aims at strengthening provincial/district level capacities in entomology and vector control as well as the promotion of functional national mechanisms for inter-sectoral coordination for cost-effective and sustainable dengue vector control interventions through active involvement of local government and communities. This is a key element in a successful Aedes borne-disease prevention program.

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Directorate of Malaria Control
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INTRODUCTION

This document mainly deals with prevention of vectors mosquitoes of dengue during outbreaks or emergencies. The objective of the guiding document is to interrupt the Man-Vector contact to keep dengue under control and has been prepared in the light of best practices available in the world for dengue mosquito control under outbreaks and epidemics situations. This is an approach that aims at strengthening provincial/district level capacities in entomology and vector control as well as the promotion of functional national mechanisms for inter-sectoral coordination for cost-effective and sustainable dengue vector control interventions through active involvement of district governments and communities.

A good understanding of the vector (s) habits like breeding, feeding, resting, and the timing/duration of transmission, is crucial in determining which intervention is appropriate and cost-effective and also timings of intervention. Since dengue vector has specific breeding sites that are mainly man-made and are mainly active during day times, therefore, vector control efforts should be mainly focus on community based environmental management, personal protection through health promotional campaign. This is a key element in a successful Aedes aegypti borne-disease prevention program. Since both dengue and malaria vectors have entirely different resting feeding and breeding habits, therefore it is very important to understand that type and timing of intervention are also different for both diseases. Following table shows a comparison of prioritization and appropriateness of vector control interventions for dengue and malaria;

<table>
<thead>
<tr>
<th>Disease Scenario</th>
<th>SIRS(^1)</th>
<th>LLNs</th>
<th>Personal protection</th>
<th>Larval control</th>
<th>Fogging</th>
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In the light of field investigations carried out by Directorate of Malaria Control (DoMC) in the country following key guiding points have been recommended for the control of dengue during out break in Pakistan;

1. **DENGUE-A NOTABLE DISEASE**

Promote dengue/dengue hemorrhagic fever (DHF) as priority among health officials and general public (notifiable disease). For this purpose following are important decisions/steps should be made

- Appointment of Disease Surveillance Officer (DSO): The availability of accurate data (patients addresses, start of epidemics, vector density trend etc) is fundamental factor to prioritize the areas for vector control and time of intervention. Therefore there should be a designated Disease Surveillance Officer preferably at provincial level for regularly monitoring of situation by collecting the relevant data.

\(^1\) Selective Indoor Residual Spraying
• At district level nomination of a “focal person preferably entomologist” for better coordination with provincial and federal offices.

• Strengthening of Dengue Epidemiological Investigation Cell (DEIC) at National Institute of Health in close collaboration of Directorate of Malaria for better disease surveillance.

• Establishing sentinel sites in hospitals (both public and private sector) receiving Dengue cases and reporting this information to DEIC on daily basis.

• Preparation of separate PC-I for dengue control at federal and provincial levels.

• District government must allocate funds for dengue vector control interventions and develop District Implementation Plan (DIP).

2. PARTNERSHIP BETWEEN LOCAL GOVERNMENT, HEALTH DEPARTMENT AND COMMUNITY

A strong and effective partnership between district government, malaria control authorities and community should be established and strengthened to ensure community understanding of importance of issue and their active involvement in implementation of vector control measures. The role of district government would be most important. For this following steps are recommended;

• Promotion of school-based community awareness programmes targeting children and parents for improved water storage practices to control vector breeding at home level.

• Lady volunteers from community and UHW should be trained to convey the messages to house wives for better water storage practices and Recognition of disease symptoms for prompt treatment seeking behavior.

• Promotion of “On-spot” health education campaign at public places like parks, schools/collages, hospitals etc.

• District Government should make sure the regular/adequate supply of water for discouragement of prolonged water storage.

3. HEALTH EDUCATION CAMPAIGN

Previous investigation proved that dengue vector mosquitoes showed significant association with water containers with no or poor coverage. Therefore health education campaign through public participation should be the top most priority/activity to;

• Change the behaviour of people for improved water storage practices that include proper coverage of containers, periodically complete change of water (at interval of 6-7 days) and straining of water stored in small (< 20 L) containers with fine wire screening or cloth material, especially during normal & non-epidemic times.

• Recognize the symptoms of disease for prompt treatment seeking behavior
• Promote the self protection practices (use of bed nets, creams, oils, coils and other repellents)
• Cleanliness of the surroundings
• Draining out of stagnant water
• Treat the stagnant water with used mob oil and chemicals (larvicides) where necessary for other nuisance mosquitoes.
• The best approach in our context is to involve local leaders, Imams, teachers, and LHWs in imparting health education messages.
• School based and “On-Spot” awareness raising campaign at public places can also play a vital role in achieving tangible successes in control of this rapidly spreading viral disease.
• Home residents should also be trained using mass media and community volunteers.
• The extensive distribution of posters and pamphlets should also be one of the key strategies for the success of such campaigns.
• The larval profile and photographs of the different breeding sites which were developed during field surveys should be used to develop health education messages to ensure the community understanding and involvement.
• Other recommended events for awareness raising should be;
  • Special walks
  • Dengue day
  • Events with celebrities
  • Matches (football, cricket)
  • Health mela
  • Kids competition

4 PERSONAL PROTECTION

During the dengue outbreak personal protection through the use of repellants, bednets, coils, lotions cloth treatments is one of the best recommended interventions for mosquito (both nuisance and vector) control. This intervention gives rapid relief and is also equally important for all age groups and for population living in dense vegetation areas like armed forces particularly when they are deployed in forests. However their efficiency depends on their acceptance and proper usage by affected population. Following are the main methods of personal protection;

A). Use of repellents

• The repellents containing N, N-Diethyl-m-toluamide (DEET), ICARIDINE (odorless and more advance form of repellants) etc are highly recommended.
• The repellants should be applied
particularly to exposed part of body to prevent mosquito bites.

- Children <5 and pregnant women (PW) should use cream, lotion and other repellent at time of sleeping, particularly when sleeping outside. During dengue outbreak and particularly when population displaced in areas with thick vegetation, the replants should also be used by children and PW even when they are not sleeping. In case of children <5 years repellants should not be applied to their hand and/or faces.

- However, prolonged use of repellants for more than 2 months should be consulted with doctor.

- Clothing can also be treated with DEET, ICARIDINE etc to repel Aedes mosquitoes.

- The repellents (DEET) containing concentration above 30% should be avoided.

- The repellent which gives at least 8 hrs should be used.

- For acceptance to community a repellent should not cause any irritation on skin.

- Natural repellants like Garlic, onion, neem, Cedar, Eucalyptus spp, cloves oils, can also be used during outbreak of dengue or complex emergencies.

- For room treatment, burn the leaves of neem, Eucalyptus spp (smoke only) inside and close the door and windows for at least half an hour. This practice should be done at least 1-2 hours before sleeping. During daytime it should be done at late hrs of morning (08-00 to 09-00 a.m).

This practice is also very effective to control adult Aedes mosquitoes when carried out in store rooms (under strict supervision for avoiding fire hazards).

B). Use of Long lasting Insecticidal bed nets (LLINs)

The use of Long Lasting Insecticides Treated mosquito nets (LLINs) should be mainly for the isolation of patients. At community level, following are the major instruction for better use of LLINs during dengue outbreak as per national guidelines:

- **ONLY** WHOPEs (World Health Organization Pesticides Evaluation Scheme) Recommended (Dawa Plus, PermaNet 2, PermaNet 2.5, PermaNet 3, Olyset, Interceptor, NetProtect, DuraNet) bednets should be promoted and will be used in the country.

- All dengue cases (both suspected and confirm) should be provided bed nets to prevent the further spread of disease.

- Dengue patient must sleep under net till its recovery.

- After opening of packet, LLIN should be spread under shade for 1 hrs before use particularly polyester made LLINs (Dawa Plus, PermaNet 2, PermaNet 2.5, PermaNet 3, and Interceptor).
• Before sleeping put/tuck the hanging edges under bed sheet/mattress.
• Bednets should be washed after at least 3-4 months. However it should not be washed during rainy days particularly polyethylene made (Olyset, NetProtect, DuraNet).
• During emergency/epidemic/natural disaster washing of net should also be avoided.
• Avoid the washing of bed net during peak transmission months.
• If there is any hole in bed net it must be replaced when with new one. However, if new one is not available it must be repaired immediately.
• Never use torn or broken bednet for dengue patient.

C). Cloth treatment

Aedes mosquitoes can also bite through cloths particularly when they are skin tight. However, the treatment of cloths with quick-acting insecticides of pyrethroid group such as “permethrin” can be the best choice to prevent the Aedes mosquito bites during outbreaks of dengue. Though these compounds don’t repel the mosquitoes but allow them to make contact with fabric and irritate or kill them before they manage to bite. The application of repellants to cloths is prefer to application on skin because of reduction of likelihood allergic reaction on skin. Some of the other pyrethroids like “cyfluthrin” can also be effective however degrade quickly in sunlight. However if the clothing is treated with non-repellent pyrethroids, flying insects including mosquitoes can bite on uncovered skin, necessitating the application of repellant to skin. Synthetic insecticides should generally be preferred to volatile repellents for clothing treatment because;

• They are most feasible and effective during dengue out break and peak breeding season of mosquitoes.
• Act quickly and repel or kill Aedes mosquitoes quickly.
• They are long lasting and to some extend withstand weathering, sunlight and washing with cold water.
• The use of repellants is also best choice for dengue patients when they are not using LLINs.
• They are more pleasant to use (no odor, color or greasiness).
• The recommended dose of pemethrin is 1.25 mg/m². The Chaddar (Doupatta) of female (particularly of pregnant women) can also be treated with this insecticide at same dose.
• They are long lasting up to several weeks depending upon washing and exposure to rain and sun.
• Effective up to 10-12 washes in clod water. However, washing in hot water and during peak transmission period should be avoided.
• To avoid any irritation on skin, it should be applied at right dose mentioned above.

Since these synthetic pyrethroids are non-volatile in nature, therefore there is risk of attack of mosquitoes to bare part of body. Therefore during out breaks or peak transmission period the use of volatile repellents should be preferred. They remain effective on cloths up to a week. Treated cloths also provide protection against biting midges, fleas, sand flies, and body lice.

How to treat clothing

The clothing can be treated with permethrin by spraying the insecticides from a pressurized can or by soaking in an aqueous emulsion. The recommended dose for long sleeve shirt is 1.25mg/m².

► Protective cloths

During outbreaks or peak breeding of mosquitoes the protective cloths can offer one of the best protections from mosquito bite particularly when they are thick and loose. Following important measures should be considered during transmission period particularly outbreaks;

• Wear long sleeves while sleeping particularly during day time
• Wear the sock and also cover other exposed body parts
• Full trousers
• Loose fittings
• light color clothings

However, these cares are particularly recommended for dengue patients (both confirm and suspected) and even for children <5 years of age against malaria. These measures are very effective for personal protection from mosquito biting and should be promoted through health promotion campaign.

D). Screening of houses.

• Mosquito-proof screens on doors and windows should be used to prevent the entry of Aedes mosquitoes.
• Screen of mesh size 156/ inch² or 25/cm² should be used.
• In case of any damage/broken to screen, it should be immediately repaired.

5. USE OF CHEMICALS

1. LARVAL CONTROL

Best practice to control vector densities and disease transmission is to find and eliminate their breeding places. Normally larviciding should be focused only to those water bodies which are close to human population (within 1kilometres radius). For most efficient larviciding program, treatments must be repeated at fairly short cycles which may vary from 10-15 days depending upon larval density and availability of resources (2-3 cycles per month). Larvicides should be carrier out for at least 2 months. For dengue mosquito control;
Guidelines for Dengue Vector (s) Control during Outbreaks and Emergencies. 2009

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- Larviciding is recommended for larger water storages (>100 lits).
- Recommended larvicides are Abat/Temephos, Methoperene/Altosid (XR Briquets), Bacillus Thuringienesis (BT), Diflubenzuron (Dimlin).
- Strictly follow the dose criteria of manufactures, particularly when use for drinking water.

Since dengue mosquitoes have very specific breeding preference to towards man-made small habitats, therefore the use of larvicides in such types of habitats is only recommended when well experience technical expertise is available.

2. ADULT MOSQUITO CONTROL

i). Space spraying

The space spraying is not recommended for routine vector control operations in Pakistan at present. Space spraying should be considered as epidemic contingency measure particularly during dengue outbreak or complex emergencies.

- Space spraying is usually designed to provide a rapid knock-down effect on exophillic vector mosquito during peak breeding season or during outbreak after monsoon season.
- It should be implemented in a compact community and should be within 1000 meter radius of affected areas.
- For endophilic vector mosquito control during emergencies situation, particularly for dengue control space spraying should also be an important component of vector control. However, it should be concentrated inside houses with the help of hand carrying fog machines (Inside thermal fogging).
- Space spraying must be conducted at the time of peak activity of adult vector mosquitoes.
- During dengue outbreak fogging should be done (preferable at dawn) on alternate days during first week of outbreak and later on every 3rd day for whole month. During second month the operation should be conducted on weekly basis.
- A team of 2 persons should target 75-100 houses per day.
- The person operating should move backwards, from one end of house to other, starting with upper floors.
- Other persons should assist in moving furniture, exposing hidden sites and guide the spray man through tight spaces.
- During indoor fogging windows and doors should be closed.
Residents and pets should move out.

Leave the room closed for at least 15-30 minutes after treatment.

**For outdoor fogging**, first prepare plan with respect to layout of streets and wind directions.

Fogging should be done perpendicular to the wind direction. While using vehicle mounted fog machine, maintain speed of vehicle 5-10 km/hr.

There should be 3-4 cycles/month during the epidemic/emergency situation.

In case of outdoor fogging, the operation should not be carried out when:

- Wind speed is >10 km/h.
- Wind speed is less than 2-3 km/h
- Relative humidity is >90% (during/immediately after rains)

At least 1 day before fogging operation, the community should be informed through announcement and should be advised to keep open doors and windows during fogging operation.

Follow the dose criteria of manufacturer mentioned on label.

N.B: Blood cholinesterase must be monitored on regular basis, if organophosphates compounds are used.

**ii). Indoor Residual Spraying (IRS)**

As routine activity IRS should be only focused in high risk union councils (based on at least previous 2 years data) and is generally not highly recommended intervention during outbreak of dengue. However, it should mainly focus on schools, public meeting places, hospitals and offices during outbreak.

- Special mobile squads (Entomologists, Assistant Entomologists, Malaria Superintendent, M. Supervisors, district government staff etc) should be raised to carry out vector density surveys in epidemic prone districts.

- In case of confirmed case, 8-10 surrounding houses should also be sprayed thoroughly with residual insecticides and this activity should be completed as soon as possible by involving district government staff and logistics.

- Within selected house all sleeping rooms, stores, and bath rooms should be sprayed thoroughly.
• Doors and windows from inner side and undersides of furnitures must be sprayed.
• Backside of curtains must be focused for spraying.
• After spraying, close the rooms for at least one hour.
• Keep the children and animals away from room for this period.
• Never leave any food item inside room during spraying and always transfer food item insides at least after one hour of spray.
• Never clean (broom) the wall after spray.
• Hang a black cloth sheet (CHADDAR) in rooms (preferably in corners) and spray it thoroughly. This will give maximum mortality of vector mosquitoes resting inside.
• No need of spraying in open air or on debris/garbage during dengue outbreaks.

6. SOLID WASTE MANAGEMENT

1 Quick and safe disposal of solid waste that includes small containers, pieces of plastic bags, and plastic boxes, tin cans that retain clean water particularly from rains. Local authorities/municipalities should play key role through health promotion campaign.

2 Clean-up” and public hygiene campaigns should be organized on regular basis in all community settings, particularly before and during outbreak.

3 Participation by municipal sanitation bodies and Public Health Engineering departments should be encouraged to assume a leading role in the implementation of these clean-up campaigns.

At present Federal Directorate of Malaria Control (DoMC) has a comprehensive technical expertise for dengue investigation particularly for vector operational research, capacity building programs and monitoring and evaluation of any intervention. At federal level, vector control staff and others experts are readily available for any technical assistance to provinces/district government.
So far DoMC has completed 10 field investigation reports and 4 guidelines as under;

A). Guiding/Policy documents

1. National strategic plan for dengue control
2. Emergency guideline for vector control during and post monsoon season 2008.

B). Investigations

5. Dengue outbreaks in Karachi. September 09, 2005
7. To assess the current epidemic situation of dengue and dengue hemorrhagic fever in Karachi) (4th to 8th October 2006).
12. Investigations of cases and deaths of dengue in District Attock-Punjab. 27th September 2008.

The copies of these documents can be obtained from Research & Development wing of Directorate of Malaria Control-Ministry of Health Islamabad for future reference and guidelines. Contact Muhammad Mukhtar: mukasbilumm@gmail.com Ph. 051-9255771, 9255775, Fax: 051-9255770

Protection from Mosquitoes
Prevention from Dengue and Malaria