

Maintaining malaria vector surveillance in the context of COVID-19 mitigation

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Context

The COVID-19 pandemic is challenging communities and health systems across the world. Infection prevention and control strategies to mitigate the spread of the virus that causes COVID-19, including physical distancing, the use of medical masks or cloth face coverings, frequent hand hygiene, and regular cleaning of equipment and surfaces, are now recommended across a wide range of healthcare and community settings^{1,2}. In addition, many non-essential businesses and services have been suspended or severely limited in areas where community spread of the virus is ongoing or at risk of becoming established.

Malaria control activities, including vector control, are essential health services that should continue with as little disruption as possible during the COVID-19 response^{1,3,4,5}. Though not often specifically listed among these services^{1,4}, vector surveillance is a key component of malaria vector control. National Malaria Control Programs rely on vector surveillance data to guide decisions about which tools to prioritize and where to effectively deploy them. Prolonged disruptions to surveillance programs will complicate the delivery of optimal vector control and reduce overall program impact.

As such, National Malaria Programs (in conjunction with leadership from Ministries of Health, other government agencies, and community leaders) may determine that vector surveillance should continue as regularly as possible during the pandemic. However, vector surveillance activities, like all essential community-based health services, carry with them the potential for increased risk of exposure to COVID-19 within communities and between malaria control workers and communities.

Purpose

The purpose of this document is to provide guidance for adapting current recommendations for community-based health care workers to the unique challenges faced by vector surveillance personnel and the communities and households where we work.

It is envisioned as an adaptable, evolving framework to help vector control programs incorporate current best practices into updated, locally appropriate surveillance workplans.

Guiding Recommendations

The strategies outlined here are adaptations of principles laid out in several key guidance documents, adopted in ways to protect both vector control surveillance personnel and the communities where they work and live. The primary documents and key source guiding these recommendations include:

- **Community-based health care, including outreach and campaigns, in the context of the COVID-19 pandemic.** World Health Organization and the United Nations Children's Fund (UNICEF), 2020. License: CC BY-NC-SA 3.0 IGO.¹

¹ <https://www.who.int/publications-detail/community-based-health-care-including-outreach-and-campaigns-in-the-context-of-the-covid-19-pandemic>

² <https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html>

³ <https://www.who.int/publications-detail/covid-19-operational-guidance-for-maintaining-essential-health-services-during-an-outbreak>

⁴ <https://www.who.int/malaria/publications/atoz/tailoring-malaria-interventions-in-the-covid-19-response/en/>

⁵ <https://allianceformalariaprevention.com/tools-guidance/covid-19-pandemic/>

- **Tailoring malaria interventions in the COVID-19 response.** Geneva: World Health Organization; 2020. License: CC BY-NC-SA 3.0 IGO.⁴

Safely Conducting Malaria Vector Surveillance in the Context of COVID-19

Malaria vector surveillance is the regular, systematic collection, analysis, and interpretation of entomological data to assist in risk assessment, planning, implementation, monitoring and evaluating of malaria control programs⁶. Vector surveillance includes a range of activities at different levels of the public health system – from the community-based sampling of mosquitoes to the laboratory-based processing and analysis of specimens. Most of the guidance compiled in this note applies to community-based activities involving: (1) sampling of mosquitoes from the environment, (2) monitoring and evaluation of vector control implementation and/or bioefficacy, and (3) community and household engagement needed to support these efforts. However, downstream activities, including the laboratory processing and analysis of specimens and material collected in the field, should also follow the latest relevant guidelines and best practices^{2,7}.

Key recommendations for vector surveillance personnel to observe at all times include:

- Appropriate and open communication with participant households, community members, and local leadership
- Reducing the number of people for all activities to the minimum required, including when
 - Traveling to a surveillance site
 - Entering a house/room to sample mosquitoes or perform a bioassay
 - Working in the insectary or laboratory
- When traveling, limit the number of individuals in a single vehicle, in accordance with local and national guidelines
 - When possible, avoid seating arrangements where occupants are facing one another
 - Maintain the same seating arrangements throughout the day; do not switch seats between stops
 - Ensure daily that every vehicle is equipped with a sufficient supply of cleaning and disinfectant supplies, hand sanitizer, gloves, and masks
 - Cleaning and disinfecting all vehicle interior surfaces before and after each workday⁸
- Performing community and household engagement and coordination activities in large, open spaces – outdoors when possible – whilst still maintaining physical distance
- Maintaining a minimum physical distance of 1 to 2 meters between individuals as much as possible, and avoiding physical contact including handshakes and fist bumps
- Frequent and consistent hand hygiene by vector surveillance personnel, encouraging the same among members of participating households (e.g. before and after each household visit)⁹
- Use of personal protective equipment (clean gloves and face masks) when moving and working in public spaces, and while conducting surveillance activities¹
 - In some situations, reusable cloth masks may be preferable to disposable medical masks, which are often reserved for medical personnel and health care workers caring for potentially infectious individuals. Choice of mask-type should be guided by the local availability and the demand for individuals at highest risk.

⁶ Malaria surveillance, monitoring & evaluation: a reference manual. Geneva: World Health Organization; 2018. Licence: CC BY-NC-SA 3.0 IGO. <https://www.who.int/malaria/publications/atoz/9789241565578/en/>

⁷ <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance>

⁸ <https://www.who.int/publications-detail/cleaning-and-disinfection-of-environmental-surfaces-in-the-context-of-covid-19>

⁹ <https://www.who.int/who-documents-detail/interim-recommendations-on-obligatory-hand-hygiene-against-transmission-of-covid-19>

- When used, reusable Cloth masks should be washed and rinsed daily using soap or detergent and clean water, and allowed to dry completely before reuse²
- Frequent and consistent cleaning of vector surveillance equipment and supplies⁸
- As possible, label and assign surveillance and laboratory equipment **for individual use only** – avoid the sharing of supplies and equipment among individuals.
- Regular health monitoring (and, as available, COVID-19 tests) for vector surveillance workers, following appropriate national guidelines for isolating, treating, and contact tracing for any cases identified.
- Any team member who has fever, cough, fatigue, or otherwise feels sick, or who has had contact with a person who has tested positive for COVID-19, should not travel or engage in field or laboratory work. Local testing, isolation, treatment, and contact tracing guidelines should be followed by any team member that feels unwell or has symptoms characteristic of a respiratory illness.
- Surveillance activities should not occur in any sentinel households in which a household member has tested positive for COVID-19, has fever, cough, fatigue, or otherwise feels sick, or has had contact with a person who has tested positive for COVID-19. Surveillance activities should occur in a suitable alternative sentinel location until local isolation and quarantine procedures have been satisfied. A brief checklist or questionnaire administered prior to each collection could help quickly identify households with active or potential cases and help determine appropriate action.

Vector surveillance workers should also be trained to confidently and consistently relay appropriate public health messages surrounding malaria, including:

- Reassuring families not to delay seeking care for suspected cases of malaria or other life-threatening conditions
- Stressing the importance of continued participation in community-wide malaria control activities like bed net distributions, indoor residual spray campaigns, and seasonal malaria chemoprevention - which will also proceed with modified procedures designed to keep communities and health care workers safe.

In addition to these key recommendations, special considerations for common vector surveillance methods and procedures include the following.

Larval collections

Mosquito larvae collections are likely to be one of the vector surveillance activities least impacted by COVID-19, and easily maintained during the pandemic response. No additional special considerations beyond those outlined in the previous section are likely.

Collection of Adult Mosquitoes by Aspiration

The collection of living mosquitoes by aspiration is critical, particularly during resting and landing collections. When available and as possible, the use Prokopack, backpack, or mechanical handheld aspirators instead of manual mouth aspirators is recommended. Other alternatives often used that could be considered more widely include:

- The use of test tube and modified tube collection methods

- The use of personal mouth aspirators equipped with a HEPA filter (e.g. 10,11) would allow the safe aspiration of mosquitoes and prevent the contamination of specimens. Note that personal aspirators should never be shared, and the daily cleaning of aspirators and periodic changing of filters should follow the standard cleaning disinfection procedures ⁸.

Pyrethrum Spray Collections

The monitoring of adult mosquito populations by pyrethrum spray collections (PCS) involves interactions between vector surveillance workers and members of sentinel households. Special considerations should include:

- Consider limiting the number of team members active in each house to two
- Minimize the touching of surfaces (including doors) and objects when entering houses and collecting mosquitoes. Doors are to be opened by homeowners.
- Use newly cleaned and disinfected sheets and collection cups at each house
- Hand hygiene for all team members and household members present before preparations for each pyrethrum spray
- Maintenance of a physical distance of at least 1m between individuals
- Standard use of new gloves and clean masks during the pyrethrum spray
- Continued use of gloves and masks after the spray and throughout insect collections
- Only one person should collect mosquitoes by aspirator from a house at one time
 - Alternatives to the mouth aspiration of mosquitoes (e.g. mechanical or direct collection in modified test tubes) should be prioritized to minimize transmission risk
- Use consistent hand hygiene for all team members **and encourage the same among household members** at the conclusion of activities at each house
- As per standard procedures, household members should remain outside the house for 10-15 minutes after the collection is done to allow for it to air out and allow the dust to settle

Light Trap Collections

The monitoring of adult mosquito populations by light traps (LT) involves brief interactions between vector surveillance workers and the members of sentinel households and the use of equipment in and near homes. Special considerations include:

- Limit light trap setup and collection to one person per household
- Maintain a physical distance of at least 1m between individuals
- Hand hygiene before and after each trap setup
- Cleaning and disinfecting all light trap components prior to setup
- Use of clean masks when setting indoor traps, or whenever maintaining appropriate physical distance is difficult
- Cleaning and disinfecting all light trap components at collection from the household
- Hand hygiene before and after collection of each trap

Mosquito resting collections

¹⁰ <https://bioquipinc.com/catalog/collecting-equipment-supplies/aspirators-vacs/aspirator-filter/>

¹¹ <https://www.johnwhock.com/products/aspirators/mouth-aspirators/>

Similar to PSC and LT collections, the monitoring of adult mosquito populations through resting collections is likely to involve brief interactions between vector surveillance workers and the members of sentinel households and the use of equipment in and near homes. Special considerations include:

- Maintain a physical distance of at least 1m between individuals
- Hand hygiene before and after each collection
- Use of clean masks when collecting indoors
- Clean and disinfect all aspirators and collection equipment before and after each collection
- Use test tubes and mechanical aspirators, such as backpack or Prokopack aspirators, when possible
- Household members should remain outside the house for 10-15 minutes after the collection is done to allow for it to air out and allow the dust to settle

Human Landing Collections

Human Landing Collections (HLC) are likely to be the vector surveillance activity most impacted by COVID-19 mitigation. HLCs are the most prolonged activity and, in the case of indoor collections, include potentially close interactions between vector surveillance workers and sentinel household family members. Additionally, the number, frequency, location, and timing of HLCs typically preclude the use of mechanical aspirators and often rely on mouth aspiration techniques. Special considerations include:

- Have trained HLC workers collect mosquitoes only in and near their own households, with brief supervision visits by surveillance technicians and/or entomologists
- When alternate approaches are available and appropriate (e.g. human-bated light traps, tent traps, etc.), consider replacing HLCs to minimize transmission risk
- When alternatives to mouth aspiration of mosquitoes are available and appropriate (e.g. mechanical or direct collection in modified test tubes), consider replacing mouth aspirations to minimize transmission risk
- Use mouth aspirators equipped with a HEPA filter
- Permanently assign labeled collection equipment (e.g., aspirators, collection tubes, containers, etc.) to each HLC worker.
- Clean and disinfect all HLC equipment and supplies prior to delivery to participating households
- Hand hygiene before and after delivery of HLC supplies and equipment to participating households
- Use of clean gloves and masks when delivering HLC supplies and equipment to participating households
- Hand hygiene before and after collection of HLC supplies and equipment from participating household
- Use of clean gloves and masks when collecting HLC supplies and equipment from participating households
- Cleaning and disinfecting all HLC equipment and supplies after collection from participating households

Wall and laboratory cone bioassays

The visiting of sentinel structures to perform wall cone bioassays involves brief interactions between vector surveillance workers and the members of participating households and usually includes the mouth aspiration of test mosquitoes indoors. Special considerations include:

- Pre-load holding tubes with test mosquitoes at the field laboratory, when possible

- If aspiration of test mosquitoes into or out of the test cones is required, the use of mechanical aspirators operating at the lowest setting or mouth aspirators equipped with a HEPA filter should be used
- Maintain a physical distance of at least 1m between individuals
- Hand hygiene before and after each bioassay step
- Clean and disinfect all aspirators and test equipment before and after each bioassay step
- The use of mechanical aspirators, such as backpack or Prokopack Aspirators, to collect test mosquitoes at the end of the exposure

Household Surveys for Durability Monitoring

Household surveys for durability monitoring involve interviews with household members.

- Interviews should occur in open, outdoor spaces near the home
- Maintenance of a physical distance of at least 1m between individuals
- Use of clean masks for interviewer and participants at each house
- Hand hygiene for interviewer and participants before and after each survey
- Assigning and labeling data collection materials, including surveys, pens, and/or electronic data collection tools for individual use, and ensuring that these materials are properly cleaned and disinfected appropriately⁸

Inspection and/or Collection of ITNs for durability monitoring

Interactions between vector surveillance workers and household members during the collection of used ITNs from sentinel households for durability monitoring are substantially similar to those during PSC, LT, and resting collections. As such, special considerations include:

- Maintenance of a physical distance of at least 1m between individuals
- Hand hygiene for field workers and participants before and after each ITN collection and delivery of replacement ITN
- Use of clean gloves and masks for field workers and participants at each household
- A member of the household should collect the bed net to be sampled from the house, bring it outdoors, and place it on the ground for collection by a field worker
- Cleaning and disinfecting of replacement ITN packaging before delivery
- Used nets may provide a surface on which virus particles could survive for a short (but unknown) time after exposure to an infected person. Therefore:
 - The inspection of ITNs should occur outdoors
 - Gloves, face coverings, and other appropriate PPE should be worn when handling and inspecting nets
 - Supplies used for net inspection (e.g. PCV tube frames, if used) should be cleaned and disinfected before and after each inspection
 - After inspection, nets selected for collection and subsequent laboratory evaluation should remain undisturbed in labeled collection bags for a minimum of 24hrs, or according to national recommendations, before processing using the latest relevant guidelines^{2,7}

Storage of used ITNs collected from households for durability monitoring

Special considerations for the storage and processing of used ITNs collected from participating households may include:

- After inspection, storage of sealed nets for a minimum of 24hrs, or according to national recommendations, before further handling and processing of nets following the latest relevant guidelines ^{2,7}

Processing of mosquito specimens

It is not likely that mosquitoes collected as larvae, in light traps, by a mechanical aspiration, or by mouth aspiration using an aspirator equipped with a HEPA filter will present any special COVID-19 transmission risk to laboratory personnel. However, specimens should be handled with standard extra precautions in place, including

- Hand hygiene before and after the handling of specimens
- Use of clean gloves and masks when handling, identifying, processing, or storing specimens
- Frequent cleaning and disinfecting all collection equipment and materiel, as well as work surfaces and laboratory equipment such as microscopes, forceps etc

Laboratory and insectary practices (applies to permanent and temporary facilities)

- Limit work to one person in a room at a time and design a schedule so that individuals rotate to ensure limited or no contact. For example, when two technicians are working in the insectary, one could be in the larval room and the other one in the adult room. Where this is not feasible, no more than two persons should work in a room, maintaining a distance of at least 2 meters at all times and using face masks and gloves.
- Ensure handwashing stations with soap or hand sanitizer are available, as well as gloves.
- Disinfect equipment (microscope, forceps, etc.) and surfaces between individual use and at the end of the day.
- Label and assign entomological laboratory equipment to each person (e.g., forceps, microscopes); in particular, aspirators should not be shared between individuals.

Additional Costs and Budget Implications

Performing malaria vector surveillance in the context of COVID-19 will be more expensive and logistically challenging than before. Additional costs are expected include:

- Additional gloves
- Additional cloth face coverings/non-surgical masks
- 60% to 80% alcohol-based hand rub⁴
- Appropriate bleach or alcohol-based solution, or another locally available suitable product, for cleaning and disinfecting vector surveillance equipment¹²
- Additional vehicles, drivers and fuel to accommodate fewer team members per vehicle
- Additional soap and/or detergent for washing reusable facemasks
- Increased staffing requirements, pending country guidance on work schedules and limits on exposure times
- Additional tools e.g. handheld aspirators, forceps etc to ensure staff are assigned to particular tools and one tool is not used by everyone to promote transmission

Other potential costs include:

¹² <https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2>

- Additional costs associated with potential shifts to mechanical aspirators during HLC (aspirators and batteries)
- Costs of COVID-19 testing of key personnel, if and as required by local guidelines

Contributors

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