

Addressing emerging vector borne disease risks through water, sanitation and hygiene: a focus on emergency settings.

Richard Allan



**REDUCING DEATHS AND SUFFERING
FROM TROPICAL DISEASES**

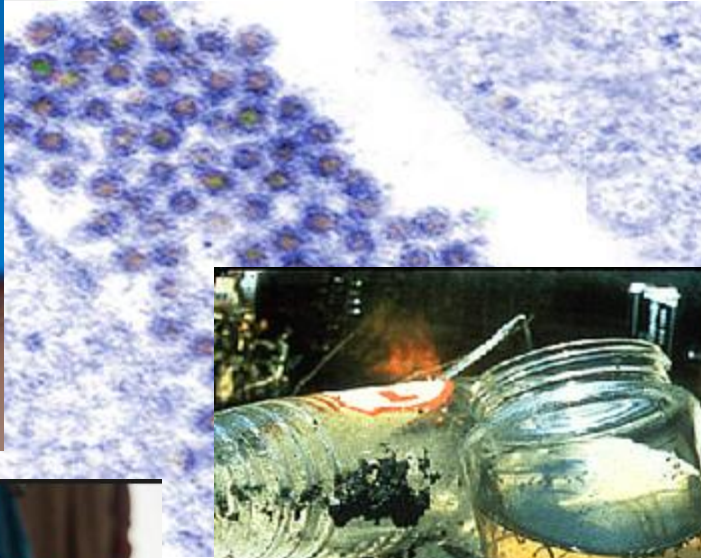


VECTOR		DISEASE		WATER		SANITATION		HYGIENE	
				Infection prevention	Treatment and care	Infection prevention	Treatment and care	Infection prevention	Treatment and care
Mosquitoes	Malaria								
	Dengue								
	Lymphatic filariasis								
	Japanese encephalitis								
	Yellow fever								
	Chikungunya								
	West Nile fever								
	Zika virus disease								
	Rift Valley fever								
Sandflies	Leishmaniasis				 ^a				 ^a
Tsetse flies	Human African trypanosomiasis								
Blackflies	Onchocerciasis								
Triatomine bugs	Chagas disease							 ^b	
Ticks	Tick-borne encephalitis								
	Lyme disease								
Snails	Schistosomiasis								

^a For wound management in cutaneous leishmaniasis

^b For hygiene food preparation

WASH VC _Water



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Water and sanitation interventions to prevent and control mosquito-borne diseases: focus on emergencies



unicef  for every child



Overlapping factors needed for VBDs

1. Suitable arthropods
2. Suitable sites for egg laying/development
3. Basic climatic conditions for arthropod and pathogen
4. Unprotected humans
5. Pathogens

- Some mosquitoes prefer open rainwater pools, others containerized or wastewater (Which? Please name them)



Most of the world have all of these factors, some have 1 to 4.



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Similarities: Mosquito species for VBDs

- Lay their eggs in water
- 3 of 4 mosquito life stages are aquatic – last 10-14 days (depending on temperature and nutrients)
- Emerge from water as flying adults, live for 2-4 wks
- May blood feed and transmit disease within 2-3 wks
- The viability of biological vector insect species, and the pathogens they transmit, are temperature and climate sensitive; most thrive optimally in tropical climates



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Key Differences: Mosquito spp. For VBDs

- What type / format of water they prefer to lay eggs on
- What time of day or night they prefer to take blood meals
- What sort of blood meals they prefer (bird, animal, human) or do they have no strong preference
- The feeding behaviour (are they persistent or skitty?)
- Their resting behaviour

Changes in human behaviour, contexts and climate affect vectors and VBDs



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Pipes & chlorine – changed our urban world

- 1834 in Marseille
- 1866 in London
- 1882 in Hamburg

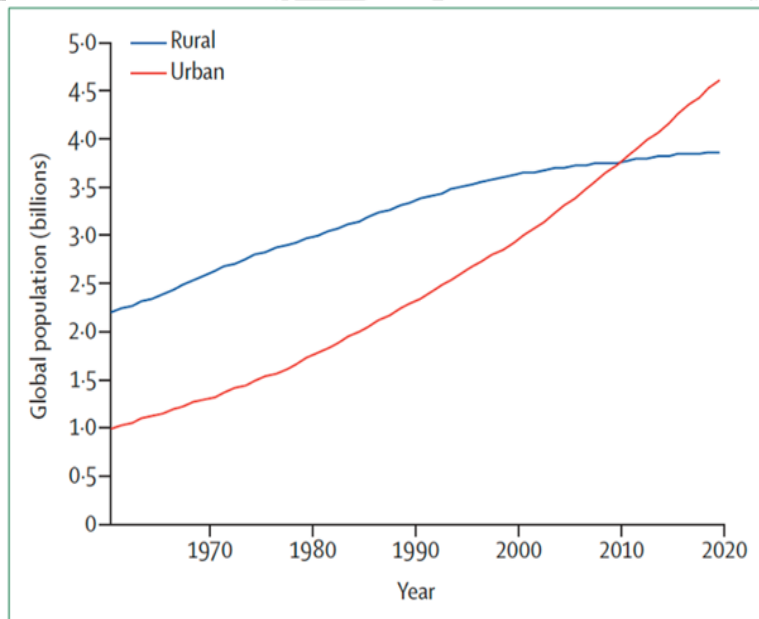
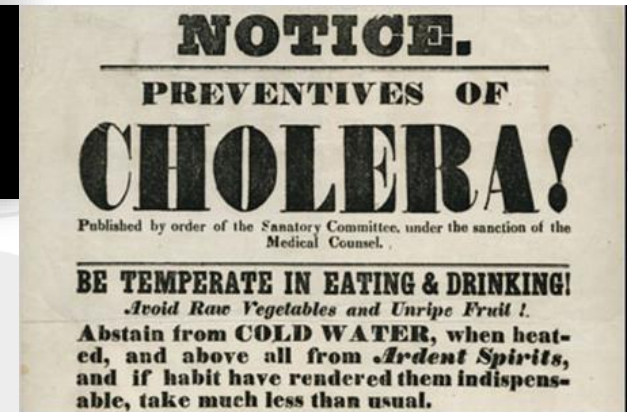


Figure 5. Proportion of the world's population in urban and rural areas, 1960-2020

This figure was created from World Bank data on basis of World Development Indicators

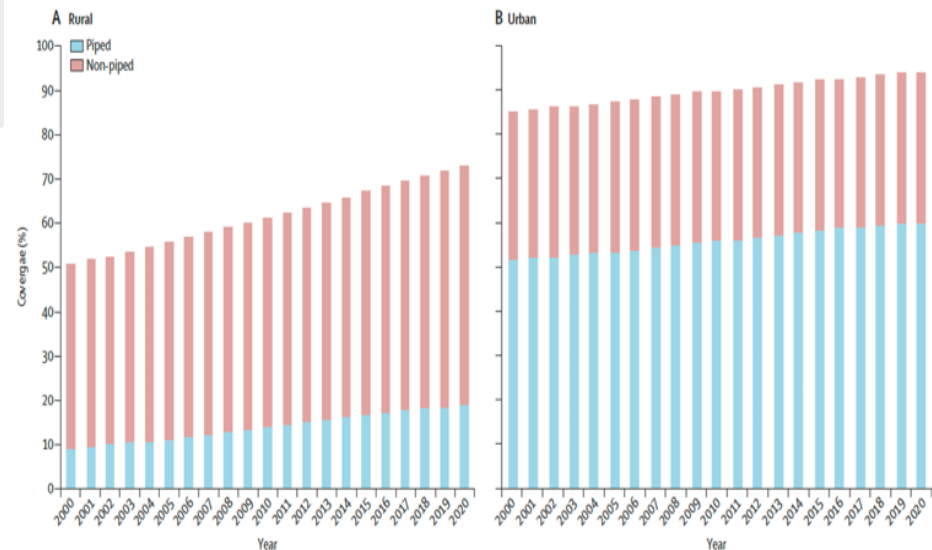
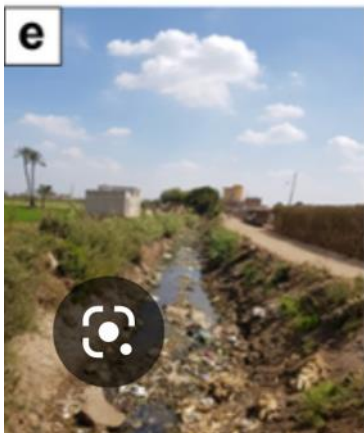


Figure 6. Coverage of house-hold drinking water by facility type across rural and urban areas for the least developed countries, 2000-2020. Facility types are piped and non-piped.

This figure was created from data from the WHO-UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene.

Aedes, Culex & Invasive Anopheles Cross Over Egg Laying Sites in Camp & also Urban Spaces



Abdel-Meguid, A.D. Effect of physicochemical factors of breeding sites on larval density and detoxification enzymes activities of *Culex pipiens* (L.) (Diptera: Culicidae) in qalyubia governorate, Egypt. Int J Trop Insect Sci 42, 235–244 (2022).



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WASH management = invasive vector control



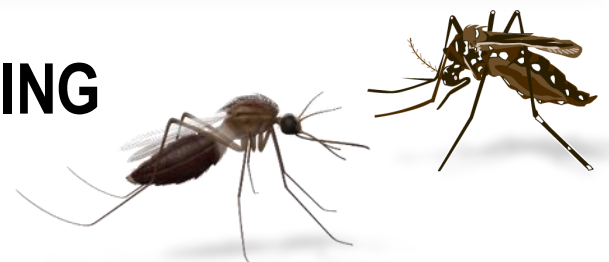
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Clean safe water – or mosquito breeding site?



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Three WASH areas to control invasive vectors in Camps & Urban Settlements

1. Preventing still water formation in camps and urban slums:

- Ensure WASH services do not create surface water spillage / pools
- Ensure good drainage of surface
- Ensure open water channels are kept clear and free flowing



LWF volunteers clean the surface drains at the side of the camp roads. Photo: LWF / C. Kistner



Open drains and solid waste in poor urban slums, Northern Venezuela – 2023. Photo: MENTOR Initiative

2. Preventing mosquito entry into water storage containers/tanks



Supply and promote use of water storage containers with tight fitting lids



Supply and promote simple but tight-fitting lids for existing containers



Stack tyres under cover or inside



Treated curtains deterring entrance of *Aedes* into dwellings, killing effect



Covered containers, eliminating breeding sites, killing mosquitoes landing or emerging



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Environment Management – Community Clean-Up



- Much more than a standard clean up
- All potential container breeding sites must be emptied, turned up side down, filled or covered.
- Emptied breeding sites (e.g. water containers) must be scrubbed clean as eggs can survive dry conditions



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3. Modifying containerised water such that it cannot support development of the mosquito aquatic phase.



Promoting household water storage management (empty and scrub weekly) is easy and can be very effective in all settings

Domestic water container management in poor urban slums,



Targeted larvicide treatment of large drinking water tanks etc.



Solid waste management in poor urban slums, Northern Venezuela – 2023. Photo: MENTOR Initiative

Promoting household & community solid waste management removed accidental water containers



Filling coconut shells with sand to prevent aedes spp. egg laying. Yangon city. Cyclone Nargis – May 2008. Photo: MENTOR Initiative

Sand fill, crush, turn upside down, or bag and dispose of accidental containers

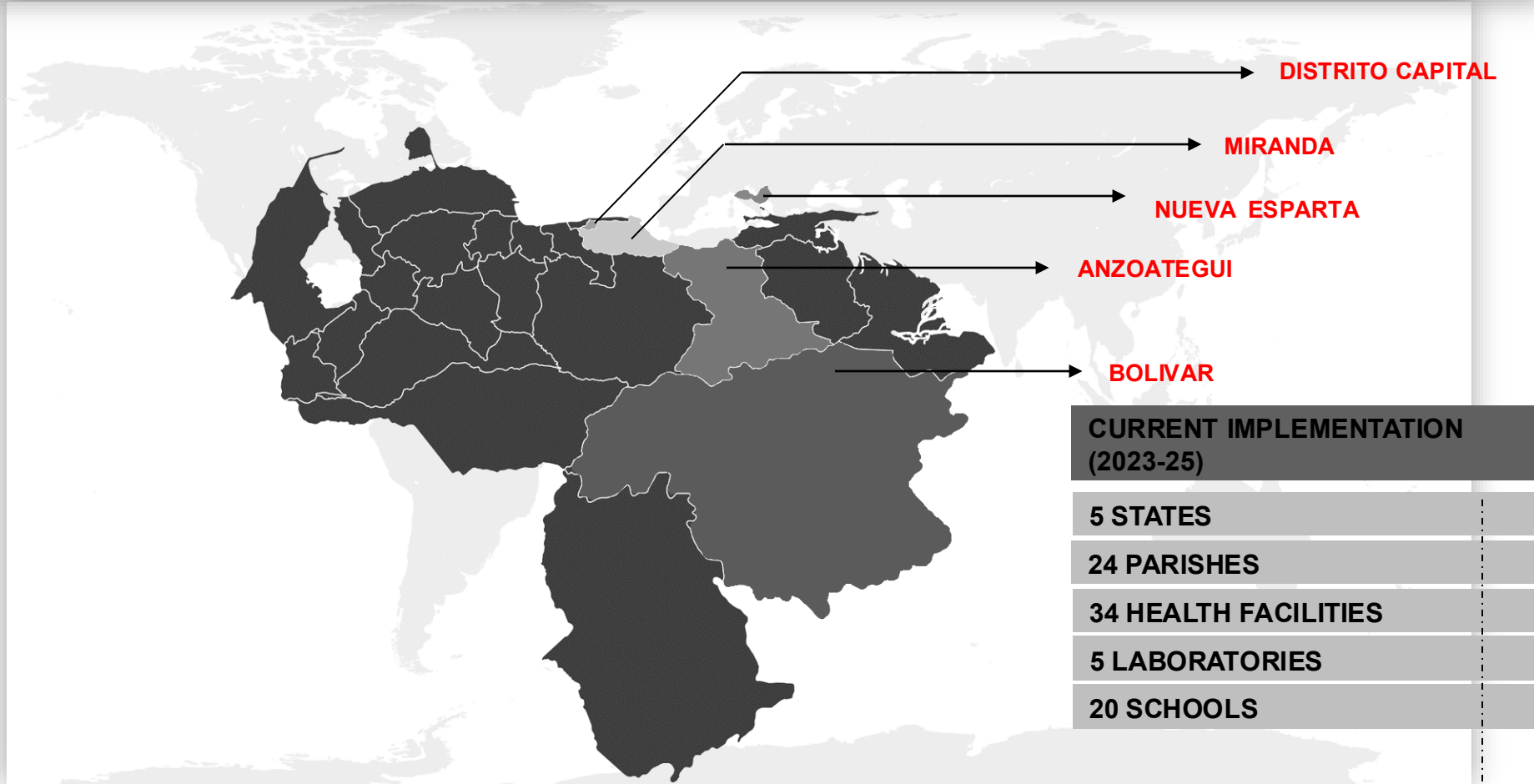
Supplemental VC Actions – aimed at adults stages

Because *aedes spp.* and *An. Stephensi* have blood feeding and resting behaviour that match with when many people are still outside and active (and to a lesser extent inactive and indoors), ITNs and IRS will have very limited benefit, and high cost.

- Spatial repellent devices do not require vector contact with A.I. Study data shows they expel aedes from shelters
- ATSB inside and outside of camp shelters / houses also have proven to be effective in low vegetation settings.
- Mosquito proofing of windows, doors and eaves may also help, in urban settings



Example: MI Venezuela - control of aedes spp. & flavivirus in urban slums



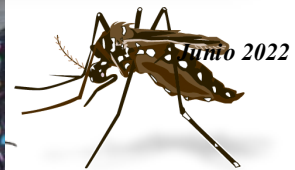
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Example: MI Venezuela - Urban control of aedes spp. & flavivirus

- Campaign workers

- Selected from the community
- Trained and equipped in one week
- One supervisor per 10 campaign workers (APA)
- Each APA is assigned and visits 25 households (could be more) in their neighborhood, to register and visit once a week.
- Deliver a package of messages and training in each HH:



Campaign workers –house to house WASH VC

- Demonstrating how to scrub out buckets to remove aedes spp. eggs.



- Distributing water storage containers with close fitting lids (to prevent aedes entry).



Entomological Monitoring in Urban Communities to measure WASH VC impact



HH density
of flying
adult
mosquitoes



Mosquito pupa and larval
density in water containers

<https://tdr.who.int/docs/sop-pupal-surveys-pdf>



<https://www.ecdc.europa.eu/files/documents>



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Community Mobilisation

- Cover all household containers that hold water, if possible with insecticide treated materials
- Clean out smaller water storage containers weekly, and scrub sides
- Larvicide water storage containers that are too large to clean weekly – pyriproxyfen granules or discs are easy and safe to use
- Remove or destroy debris/waste containers
- Proper waste disposal
- Spatial repellents are safe and effective at reducing aedes and anopheles house hold density
- ATSB are effective at reducing aedes and anopheles if there are very few plants for them to feed on
- Screen windows, doorways and other openings