



Vector borne diseases: An overview

Awele Maduka-Ezeh MD MPH

Important facts:

- This section stands between you and lunch
- Each vector borne disease (VBD) can itself be a 4 hour lecture
- Impossible to cover vector borne diseases in 10 mins





Objectives

- By the end of these 10 mins, participants to understand:
 - Complexity and diversity of vector borne diseases
 - Arthropod vectors of specific agents
 - The changing epidemiology of vector borne disease
 - Personal measures to prevent vector borne diseases
 - Vulnerability of special populations to impact of VBD

Not objectives

- Will not:
 - Discuss signs/symptoms of specific VBD
 - Diagnostic testing of specific VBD
 - Management of VBD
 - Cause death by powerpoint
 - Keep you from lunch

Vector borne diseases (VBD)

According to the World health organization:

- ▶ Vector-borne diseases account for more than 17% of all infectious diseases, causing more than 1 million deaths annually.
- ▶ More than 2.5 billion people in over 100 countries are at risk of contracting dengue alone.
- ▶ Malaria causes more than 400 000 deaths every year globally, most of them children under 5 years of age.
- ▶ Other diseases such as Chagas disease, leishmaniasis and schistosomiasis affect hundreds of millions of people worldwide.
- ▶ Many of these diseases are preventable through informed protective measures.

Different ways to Categorize VBD:

- ▶ Vector type
 - ▶ Mosquito borne
 - ▶ Tick borne
 - ▶ Flea/louse borne
- ▶ Infectious agent (disease causing organism)
 - ▶ Virus → Virus type eg flavivirus, alphavirus
 - ▶ Parasite → Malaria, onchocerciasis, lymphatic filariasis
 - ▶ Bacterium → Lyme, relapsing fever, anaplasma agents
- ▶ Pathologic effect/ target organs
 - ▶ Encephalitis
 - ▶ Relapsing fever
 - ▶ Spotted fever
- ▶ Other →

What vector borne diseases and weddings have in common

All you ever need to remember about VBDs is summarized in the old wedding rhyme:

Something old

Something new

Something borrowed

Something blue

And a sixpence in her shoe



Something old: Historically present in US, and either persist in US or remain a threat

Disease	Infectious Agent	Agent type	Primary vector	Effective treatment/vaccine	Status
Rocky Mountain Spotted fever	<i>Rickettsia rickettsii</i>	Bacterium	Dermacentor ticks	Treatment- Y Vaccine- N	Ongoing threat
Yellow fever	Yellow fever flavivirus	Virus	Aedes mosquitos	Treatment- N Vaccine- Y	Ongoing threat- Importation/Bioterrorism
Plague	<i>Yersinia pestis</i>	Bacterium	Fleas (rat fleas)- Also inhalation	Treatment- Y Vaccine- N	Ongoing threat Bioterrorism + Enzootic in US NW and SW
Tularemia	<i>Franscicella tularensis</i>	Bacterium	Dermacentor ticks, Lone star ticks, Deer fly- Also inhalation	Treatment- Y Vaccine- N	Ongoing threat- Enzootic/Endemic in US + Bioterrorism threat

Something new: These diseases were first identified in the US (and recently too)



Disease	Infectious Agent	Agent type	Primary vector	Effective treatment/vaccine	First described
Lyme disease	<i>Borrelia burgdoferi</i> spp	Bacterium	Blacklegged tick	Treatment- Y Vaccine- Long story	Lyme CT, 1975
Lyme disease	<i>Borrelia mayonii</i>	Bacterium	Blacklegged tick	Treatment-Y Vaccine- N	WI & MN (2014)
Bourbon virus disease	Bourbon virus	Virus (Thogotoviridae)	Tick- species TBD	Treatment- N Vaccine- N	Kansas 2014
Heartland virus disease	Heartland virus	Virus (bunyaviridae)	Lone star tick	Treatment- N Vaccine- N	Missouri 2009
STARI- Southern Tick associated Rash illness	Unknown – ?? Allergic reaction to tick antigens	Unknown	Lone star tick	N	~1997

Something borrowed: Recently arrived in US.
Now makes it's home here (or is trying to)

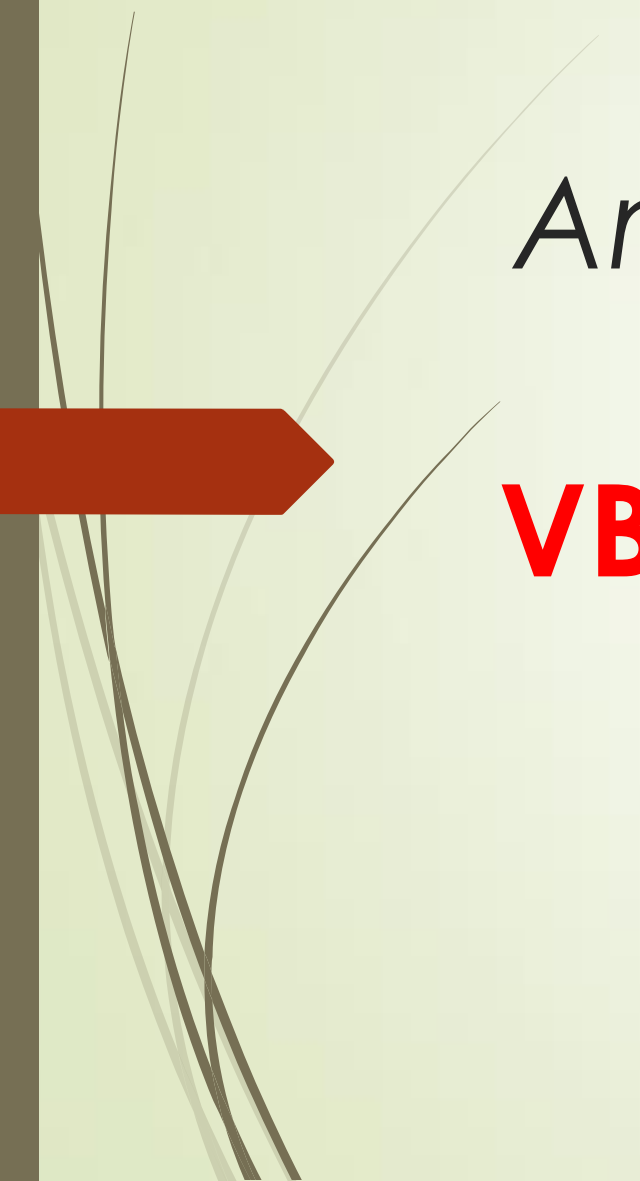
Disease	Infectious Agent	Agent type	Primary vector	Effective treatment/vaccine	Year in US
West Nile virus disease	West Nile virus	Virus (flavivirus)	Culex & other Mosquitos	Treatment- N Vaccine- N	1999
Chikungunya	Chikungunya virus	Virus (alphavirus)	Aedes Mosquitos	Treatment- N Vaccine- N	~ 2006
Zika virus disease	Zika virus	Virus (flavivirus)	Aedes mosquitos	Treatment- N Vaccine- N	2014/15

~~Something blue~~ Something “Ew!!!”

Diseases	2013 Reported Cases	Median (range) 2004–2013 ^b
Tick-Borne		
Lyme disease	36,307	30,495 (19,804–38,468)
Spotted Fever Rickettsia	3,359	2,255 (1,713–4,470)
Anaplasmosis/Ehrlichiosis	4,551	2,187 (875–4,551)
Babesiosis ^b	1,792	1,128 (940–1,792)
Tularemia	203	136 (93–203)
Powassan	15	7 (1–16)
Mosquito-Borne		
West Nile virus	2,469	1,913 (712–5,673)
Malaria ^c	1,594	1,484 (1,255–1,773)
Dengue ^{b,c}	843	624 (254–843)
California serogroup viruses	112	78 (55–137)
Eastern equine encephalitis	8	7 (4–21)
St. Louis encephalitis	1	10 (1–13)
Flea-Borne		
Plague	4	4 (2–17)

***Numbers are increasing for many of these + most cases unreported*

Source: <https://health2016.globalchange.gov/vectorborne-diseases>



*And a sixpence (not a dollar) in
her shoe:*

**VBDs disproportionately impact
certain groups...**

... But first: Detour for “an ounce of prevention”

Prevent tick borne dx: **BLAST**

- **B**-Bathe within 2 hr
- **L**- Look for ticks on body & light colored clothing
- **A**- Apply repellent
- **S**- spray yard
- **T**- Treat pets, treat clothing

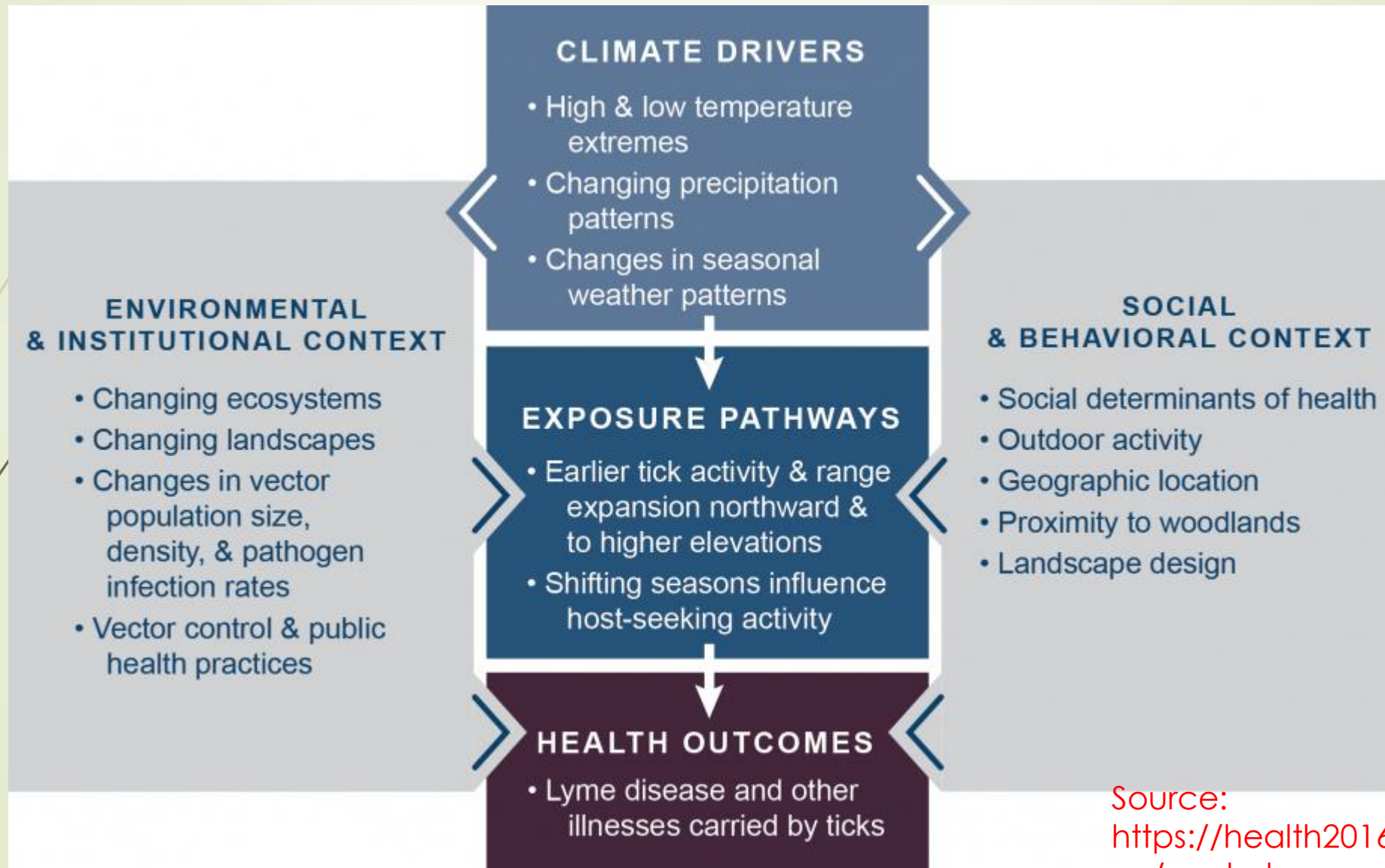
Prevent mosquito dx- **PACTS**

- **P**- protective clothing
- **A**- apply repellent
- **C**- Clean up your yard
- **T**- Follow travel recs:
 - prophylactic meds, (malaria)
 - vaccine (YF)
 - postpone travel (zika)
- **S**- Screens
 - Doors and windows
 - Or Air-conditioning + sealed doors

**** Notice that all require time commitment and many require significant \$\$\$ commitment**

And a sixpence (not a dollar) in her shoe:

How Climate, social determinants and VBDs interact to impact the most vulnerable



Source:
<https://health2016.globalchange.gov/vectorborne-diseases>

Determinants of Vulnerability

EXPOSURE

Exposure is contact between a person and one or more biological, psychosocial, chemical, or physical stressors, including stressors affected by climate change.

SENSITIVITY

Sensitivity is the degree to which people or communities are affected, either adversely or beneficially, by climate variability or change.

ADAPTIVE CAPACITY

Adaptive capacity is the ability of communities, institutions, or people to adjust to potential hazards, to take advantage of opportunities, or to respond to consequences.



VULNERABILITY of Human Health to Climate Change



HEALTH IMPACTS

Injury, acute and chronic illness (including mental health and stress-related illness), developmental issues, and death



Thank You