Michigan Vector-Borne Disease Update

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Putting people first, with the goal of helping all Michiganders lead healthier and more productive lives, no matter their stage in life.



Why do we care?

Mosquito-borne diseases are present in Michigan every year and present a serious risk to human and animal health.

Mosquito Control is one of the foundations of preventive public health practice.

MDHHS performs and supports human and ecologic surveillance for mosquito-borne disease in order to inform the public, healthcare providers, and stakeholder agencies about preventive measures and control options.



Mosquito-borne virus illness

- Generally 3-15 days incubation period
- Symptoms range from acute febrile illness, to painful arthritis, to neuroinvasive disease and hemorrhage
- Depend upon age, medical history, etc.
- Various viruses with different abilities to cause clinical illness
 - West Nile: 1 in 5 morbidity/<1% severe/3-15% severe illness results in death</p>
 - EEE: rare, but high mortality ~33%
 - Chikungunya: >70% morbidity, rarely fatal
 - Zika: mild clinical illness, but may cause severe birth defects
- Treatment is supportive



Neuro-invasive disease



Is an inflammation of the brain, or meninges with symptoms ranging from mild to acute, both physical and mental.

- Headaches
- Neck pain
- Fever
- Confusion
- Irritability
- Tremors
- Coma
- Death



Michigan mosquito-borne diseases



Endemic DiseasesWest Nile VirusSt. Louis EncephalitisEastern Equine EncephalitisCalifornia Group VirusesImported DiseasesChikungunyaDengueZika



Arbovirus Human Cases: Michigan 2018

- Michigan's local health departments (LHDs) and the MDHHS promptly investigate all reports of mosquito-borne disease using the Michigan Disease Surveillance System (MDSS)
- As cases are confirmed, the information is reported to the Centers for Disease Control and Prevention (CDC) through the ArboNET system
- Throughout the arbovirus transmission season, surveillance information is posted to the Michigan Emerging Diseases website at www.michigan.gov/emergingdiseases

Arbovirus	Locally Acquired/Imported	2018 Cases	Fatalities
Eastern Equine Encephalitis	Locally Acquired	1 case (Allegan Co.)	0
Jamestown Canyon Virus	Locally Acquired	2 cases (Oakland, Menominee)	0
West Nile Virus	Locally Acquired	104 cases (3 rd highest year)	9
Dengue	Imported	8 cases	0



West Nile Virus – 2018 National Data*

Figure 2. West Nile virus disease cases reported to ArboNET, by month of onset* — United States, 2018 (as of December 11, 2018)



~2,500 WNV cases >120 fatalities

Figure 3. West Nile virus (WNV) neuroinvasive disease incidence^{*} reported to ArboNET, by state — United States, 2018 (as of December 11, 2018)





*provisional data as of 12/11/18

WNV- MI Epidemiology

Geographic Distribution - Statewide

Seasonal epidemic late summer into fall

Habitat Distribution – primarily urban/suburban

Humans – 1 in 150 severe symptoms; up to 20% mild; and 80% no symptoms

• Age Distribution – all ages, primarily older (50+)

Key Factors – *Culex* species & birds, hot/ dry summers





Michigan: West Nile virus human cases 2002-2018





2018 WNV Epidemiology in Michigan

Cases: 104 Fatalities: 8 Asymptomatic Donors: 12

Neuroinvasive: 79% Fever: 21%

Onset Range: June 19– Oct 20 Age Range: 19–92 Median Age: 65 Male: 64%







2018 Arbovirus EPI Curve





Michigan Mosquito Surveillance Capacity

- Bay area county mosquito control districts (N=4)
- Commercial city and township mosquito control programs
- Federally funded local health department surveillance in WNV high-incidence jurisdictions (N=5)





Local Health Department Mosquito Surveillance

- CDC funded
- MDHHS provides training to LHDs in cooperation with MSU and MMCA
- Provide for timely, low-cost, non-labor intensive surveillance program to detect WNV activity at the community level
- Program to provide "actionable" information
- May provide training, expertise, and experience for future surveillance needs (emerging vector-borne diseases) and public health workforce





2018 Positive Mosquitoes

- 159 West Nile positive pools
- No other arboviruses identified in mosquito pools
- Most mosquito surveillance from Bay Area Mosquito Control Districts
- Michigan State University tests via PCR for EEE, LAC, SLE, and WNV
- Five local health jurisdictions test mosquito pools using VecTOR Test kits



Statewide Human & Mosquito EPI Curves



Mosquito MIR = #infected mosquitoes/1,000 mosquitoes



Arbovirus testing available at the MDHHS Bureau of Labs

When to consider?

- Arbovirus serology
 - West Nile virus
 - Eastern Equine Encephalitis
 - St. Louis Encephalitis
 - LaCrosse Encephalitis
- Arbovirus travel panel
 - 🗋 Chikungunya
 - Dengue
 - Zika





Human Diagnostic Testing for Arboviruses

Patients presenting with meningitis/encephalitis from May-Nov should be tested for all arboviruses potentially circulating in Michigan; WNV, SLE, EEE, California Group viruses (LaCrosse)

CSF is the preferred specimen

MDHHS turn-around is approximately 1 week

Paired sera is an alternative to CSF

 At MDCH, reserved for hospitalized patients for whom CSF is not available, more prolonged turn-around time

Flavivirus (SLE, WNV) cross-reaction poses a diagnostic dilemma, particularly for commercial labs that lack an equivalent EIA for SLE.



Other arboviruses identified in Michigan: 2018*

Jamestown Canyon Virus

- Member of the California Group viruses
- Emerging arbovirus with focus in the Upper Midwest
- First human cases identified in Michigan in 2018
 - Two cases
 - Oakland and Menominee Counties



*provisional data as of 12/11/18



Other arboviruses identified in Michigan: 2018*

Eastern Equine Encephalitis

- Periodic outbreaks in horses in MI
 - Generally SW Lower MI, however recently identified further north
 - □ Last large outbreak 2010
- \square Sporadic cases identified in white-tailed deer
 - □ Two identified in MI 2018
 - Cass County (1), Barry County (1)
- □ Sporadic human cases and during outbreak years
 - One case identified in MI 2018
 - Allegan County





Aedes albopictus in Michigan

- On August 20, 2018 the Asian tiger mosquito was identified in Wayne County for the second year in a row
- Focal introduction/infestation near a tire business
- Wayne County health department, MDHHS, MSU, and the City of Romulus coordinated surveillance and response to the identification
- Mosquito control was initiated early September
- Increase in population until late October





Using Tick Surveillance to Estimate Lyme Disease Risk and Drive Public Healthy Action in Michigan



Lyme disease: background information

- Lyme disease is the most common vector-borne disease in the United States (Mead 2015)
- Vector: Ticks
 - Main vector in northeastern and north central U.S.: *Ixodes scapularis* (AKA blacklegged and deer tick)
- Pathogen: Borrelia burgdorferi
 - Bacterium
 - Spirochete





What is a tick?



- Ticks are more closely related to spiders and mites than insects
- They must feed on blood to complete their life cycle
- Ticks feed on a variety of animals from small and medium sized mammals, to birds and lizards
- It is generally within the enzootic, or tick/animal cycle that tick-borne diseases are maintained
- There are two major families of ticks
 - Argasidae Soft ticks
 - Ixodidae Hard ticks



Ticks are common in Michigan



Images: Kent Loeffeler, Cornell University

IDe descreto la vis (inlaitis legged tick)

(A free i can dog cicle of a wood stick) a bitats

- SpoalleriaizedbaredDarverisebility habitats
- Rausidesharktsektanvirengangray abdomen
- Adults and my with swiller and iking is provide.
 Adults Adults April July, October November
- Mynukheo Mayon Auguetand are active from early-
- Verteg: through the senanoplanmesis, babesiosis,
- · deet dicks, Nabuliation sported ikeever



How do ticks sense their environment?

- Unlike insects ticks have no antennae
- Unlike insects or spiders, hard ticks have 2 simple eyes or no apparent eyes
- Ticks sense their environment with sensory organs on their legs and palps
- They can detect heat, CO2, movement, and other ticks





How do ticks find their prey?

The ticks that concern us in human health in the U.S. find their prey by "questing"

Ticks climb onto vegetation to await a passing animal often along animal and man-made trails

They may also crawl short distances in response to CO2

Ticks DO NOT jump, fly, or drop onto people from trees

Blacklegged tick & B. burgdorferi biology





Nymphal stage: the epidemiologically most important stage for humans!

Responsible for the majority of Lyme disease illness in the U.S. This is due to:

Small size

First infectious stage

Active during peak outdoor recreation periods in the NE and Upper Midwest U.S.

CDC 🥝 @CDCgov · May 4

Ticks can be the size of a poppy seed. Can you spot all 5 ticks in this pr Learn how to prevent tick bites. bit.ly/2rjox6U





Ecology of Lyme disease

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Lyme bacteria

What are symptoms of Lyme disease?

- •Fever
- •Fatigue
- •Muscle aches (myalgia)
- •Joint aches (arthralgia)
- •Headache
- •Erythema migrans ("bull's-eye") rash (3-30 days post-tick bite)
- •Lameness/arthritis



If untreated: may manifest as disease of the nervous system, the musculoskeletal system, or the heart



Prevention

Avoid tick habitats

- Protect your body from ticks
 - Repellents: DEET for exposed skin, and 0 permethrin for clothing

Use tick

CDC.gov

Avoid tick-

infested areas

prevention

Perform daily tick checks

Lyme disease vaccination

Find and remove ticks promptly

- Daily tick checks/shower 0
- Remove attached ticks with tweezers 0

Protect pets from ticks

Not all ticks are infected

•Only blacklegged ticks transmit Lyme disease

•Only two stages of blacklegged ticks transmit Lyme disease

Adult Female

36-40%

B. burgdorferi infection rate*

Nymph 9-15%

B. burgdorferi infection rate*



*Endemic Locations Hamer *et al.*, 2010; Foster, 2004.

Public health significance

✗ In 2013, Lyme disease was the 5th most commonly reported notifiable disease in the U.S.

(1. Chlamydia, 2. Gonorrhea, 3. Syphilis, 4. Salmonellosis)

- Approximately 3.4 million LD tests nationwide in 2008 from 7 large commercial laboratories⁴
 - ✗ Cost estimates for laboratory services of \$492 million
 - 🗶 Estimate 288,000 LD cases/year
- 2005-2010 Truven Health MarketScan Commercial Claims and Encounters Database analyzed⁵
 - 🕷 Estimate 329,000 LD cases/year

Leading vector-borne disease, with increasing incidence over time...







... and over space



http://www.cdc.gov/lyme/stats/index.html



First detection of ticks, pathogen, and cases: Michigan's UP late '80s, early '90s





Brief History of Lyme Disease in Michigan

- Low-incidence, emerging Lyme disease state
- Michigan's Upper & Lower Peninsulas differ in case incidence
 - UP >10/100,000
 - LP approx.
 1/100,000
- Currently tracking the invasion of infected blacklegged ticks into new areas in the state



Who does tick-borne disease affect?

Anyone <u>working</u> or recreating in forested or forest-edge habitats, including:

Man-made trail systems

Trails used by animals

Campgrounds

Brushy or grassy areas near buildings or yards

Wooded river banks



Riverside Park, Ottawa County, MI





MDHHS Surveillance Efforts

- Targete RASS Mellance
- NecMore specific geographic location of tick submissions location of ticks & potential tick-borneseiserseillanse
- Emerging tick submissions Emerging tick and pathogen surveillance



- Routing
- Required by publicalth health codetions
- Broad pite up by tick investigations activity Follow-up investigations
- May baokispesifioity due to difficulty

determining exposure location

Ticks and

Michigan Lyme Disease Cases by Year: 2002-2017



No. Cases



Reported Lyme disease cases in Michigan: 2017 EPI Curve



251/291 cases reporting onset date



2017 Human Lyme Disease Cases by County of Residence





Lyme disease testing available at the MDHHS Bureau of Labs

When to consider?

□ Nationally recognized two-step testing algorithm

- Step 1. Enzyme Immunoassay screen (EIA)
 - □ Highly sensitive test

If Step 1 is equivocal or positive proceed to Step 2

□ Step 2. IgM and IgG Immunoblot (IB/Western Blot)

- □ Highly specific test
- □ 2+ of 3 bands positive for IgM positive
- □ 5+ of 10 bands positive for IgG positive



Positive western blot Image: CDC



Passive Tick Surveillance: Public Tick Submission

Providential and the solution of the solution



Active Tick Surveillance: Focused Tick Drags

Benefits:

 Results can be verified

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 Indicates high risk for human illness



- Personnel & time constraints
 - Influenced by weather & location





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n:

Active Tick Surveillance: Focused Tick Drags

2018 Drag Field Sites



- Field surveillance coordinated with academic partners
- Locations directed by:
 - Public tick submissions
 - Veterinary submissions
 - Reported disease cases
- > 2018 activities:
 - Over 220 total km sampled at 143 sites
 - 1,537 ticks collected April-November
 - Collaboration with CDC for emerging pathogen screening



Invasive Asian Longhorned Tick

- •Not normally found in the Western Hemisphere, these ticks were first reported in the United States in 2017
- •Have been found on pets, livestock, wildlife, and people
- •The female tick can lay eggs and reproduce without mating
- In other countries, bites from these ticks can make people and animals seriously ill
 - •As of October 2018, no harmful germs have been found in the ticks collected in the United States; research is ongoing
- As of October 2018 longhorned ticks have been found in: Arkansas,
 Connecticut, Maryland, North Carolina,
 New Jersey, New York, Pennsylvania,
 Virginia, West Virginia







Hands on Training: Local Health Department staff will gain hands-on experience in standard methods for field collection and identification of medically important ticks and mosquitoes.

Vector Surveillance Program Essentials: The workshop curriculum covers the essentials of maintaining a vector surveillance program, including methods for data collection, equipment and personnel considerations.





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Expert Instruction: Workshop instructors include experts from public health, vectorcontrol agencies, and academia that have extensive experience in the fields of tick and mosquito surveillance, identification, and control.

Networking: Participants will have multiple opportunities to engage with colleagues and counterparts from across Michigan, as well as interact with our team of vector-borne disease expert instructors.





Workshop Specifics



Designed for environmental health professionals working at Michigan Local Health Departments (two staff per health jurisdiction)

At the end of the training, attendees will:

- Understand vector-borne disease epidemiology in Michigan
- Be able to conduct sampling for medically important mosquitoes and ticks
- Be able to arrange for diagnostic testing of specimens from their jurisdiction
- Be able to consult with stakeholders regarding vector control

Cost: FREE – meals and lodging provided



Workshop FAQs

Who are the vector-borne surveillance workshops meant for?

Generally LHD Environmental Health staff, however if other LHD programs areas or partner agencies are interested in participating in vector surveillance, they may also attend.

What costs are supported for the vector-borne surveillance workshops?

The workshops are free. Participant lodging (up to two nights) and meals will be provided for the duration of the workshop. The MDHHS will not reimburse mileage.

What should I bring to the training?

Materials for taking notes. Attendees will also participate in a field exercise, appropriate outdoor clothing and footwear are recommended.





Workshop FAQs

What will we take with us from the workshop?

Participants will gain an understanding of vector-borne disease epidemiology in Michigan, methods for surveillance of medically important ticks and mosquitoes, the ability to identify mosquitoes and ticks, and a basic understanding of vector control.

Participants will also take home some surveillance equipment necessities, including:

BG2 mosquito trap lures

Tick drags (two per jurisdiction)

Collection equipment for tick surveillance

Flash drive with resources such as mosquito and tick keys, data sheets and reporting information, sample collection protocols, and a media tool kit.





Michigan Disease Mapper

www.michigan.gov/midiseasemapper



Search

Michigan Emerging Disease Issues

Diseases that may affect humans or animals.

MI Disease Mapper

Ticks and Your Health

Mosquitoes and Your Health

Being Safe Around Animals

Bed Bugs, Head Lice, and Scables

Diseases affecting wildlife



Agricultural Exhibits and Events



Anaplasmosis



Avian Influenza

UPDATED! *Mobile-friendly *Great info. for the public

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9

Bab

www.michigan.gov/emergingdiseases



Chikunguya



Chronic Wasting Disease (CWD)



Dengue

More resources available online

Looking for a bull's eye rash? Look again erythema migrans can take many forms. A 10 10 10 10 10 10 10 And an entry of the sector Column contraction and disease central Cleaning Uniformity Red Lesions towers quantizates (Prod. Tanget Lesiens We there does not been an enforth activity of any send sets off el selle a la serie de la s Free departments ages are consistent of Same and which there dependenting the an Share each a transactive backets. The regists at two decard strike inter-I weeks of information the large a den by their control or own where and desse division o logo, paren dan Kan Cardestin yan Barrie out of the lot of the lot of the indification september at the Tale shard 20% of Tame description den spachol fornar weeksted ad in here with the radie ar that have been executed a being on Reckland cription in dimensionle for the decision spectrum st ner a mår nøyt dapter pre dependence and the activity and a the thread must Vet date in restance the local MI Tick ID Card Actual Size Comparison Blacklegged (Deer) tick **** American dog (Wood) tide Ter 豪振. Lone startick . ·* ** * Common ticks foard in Michigan Scott provided Pitors left to right: Blackingget tick nymph. Mail Meneral tick livingle, home was take Percenti, Male, Symph. um.c. terral a. American Deg dick formale Ticks and on the define Tick removal tips www.michigen.gov/lyme Remove as quickly as possible. Your Health Use tweezers to grasp the head close to the skin. C Pull sently. Use speciard water, or antiseptic on the bite. Preventing tick-borne illness ... preventing tick bites in Michigan Use a repellent containing no more than 30 percent DEET. Lise repellents that contain permethrin on clothing. See your healthcare provider if you have symptoms of fever. Michigan Department of Health & Human Services rash, body aches or fatigue after a tick bite. Michigan Department of Agriculture & Rural Development Brick gas to partner's of Handle & Harber Service Michigan Department of Natural Resources

www.michigan.gov/lyme



www.cdc.gov/lyme

If you find a tick... Don't get Ticked! We can Help!



CITIZEN SUBMITTED TICK PROGRAM

- Identify the tick
- Test blacklegged ticks (if alive & off a human)

www.Michigan.gov/lyme

Got a Tick? Submit a Pic!

Identify the tick electronically

MDHHS-Bugs@Michigan.gov

FREE service available to MI residents!

Why Report Communicable Diseases?

- ✓ Identification of outbreaks & epidemics.
- Enabling preventative treatment and/or education to be provided.
- ✓ Successful targeting of:
 - Prevention Programs
 - Identify Care Needs
 - Efficient Use of Resources
- Evaluation of the success of long-term control efforts
- ✓ Facilitation of epidemiologic research to uncover a preventable cause.
- Assistance with national & international disease surveillance.
- ✓ Compliance with Michigan's public health laws.



Disease Reporting Guidance Documents

Guide to Disease Reporting in Michigan (Brick Book)



Reportable Diseases by Condition

Report the unusual accurrence, outbreak or epidemic of any disease or condition, including healthcare-associated inf		
Acute faccial myelitie [3]	Listeriods (Listeria monocytopenes) (5.6)	
Anaplaumosis (Anaplasma phagocytophilum)	Lyree Disease (Somelia burgdorferi)	
Anthrax (Becilius anthracis and B. census service anthracis) (4)	Malaria (Plasmodium species)	
Arboviral encephalitides, neuro- and non-neuroinvasive:	Measles (Measles/Rubeola virus)	
Chikungunya, Eastern Equilite, Jamestown Canyon, La Crosoa,	Melloidosis (Burkholderis pseudornallei) (4)	
Powassan, St. Louis, Wast Nile, Wastern Equine, 2ka (6)	MoningRts: bacterial, viral, fungal, parasitic and arrelt	
Babesiosis (Babesia mikrob)	Meningococcal Disease (Netsena meningibilis, sterili	
Retudare (Clastridium hetudicare) [4]	Murran (Murran virun)	
Bracellosis (Bracella species) (4)	Orthones violants, includion: Smallnes, Markennes	
Campylobacterizzio (Campylobacter species)	Pertussis (Bordetella pertussis)	
Candidatis (Candida suris) (4)	Plague (Yersinia pectis) (4)	
Carbapenemase Producing - Carbapeners Resistant	Pole (Fellovina)	
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Cholera [Vibrio cholera] (4)	Salmonelloois (Salmonella species) (Si	
Coccidioidomycosis (Coccidiaides immitis)	Severe Acute Respiratory Sandressa (SARS) (S)	
Cryptosporidiosis (Cryptosperidium species)	Shigellosis (Shigella species) (5)	
Cyclospariasis (Cyclaspora species) (5)	Spatted Fever (Rickettsia species)	
Dengue Feuer (Dengue vinus)	Staphylococcus aureus, vancomycin intermediate/	
Diphtheria (Corynebecterium diphtheriae) (5)	resistant (VISA (S)/VRSA (6))	
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(liandiasis ifiandia species)	Sushilis (Transportana autobard) (5)	
Glanders (Burkholderia maßei) (4)	Tetanus (Clostridium tetani)	
Ganarrhea (Neisseria ganarrhaeae) (3, 6)	Toxic Shock Syndrome (non-streptococcal) (1)	
Galilain-Barre Syndrome (1)	Trichinellosis (Trichinella spiralis)	
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secotyping for patients < 15 years of age (5)	report preliminary and final rapid test and culture r	
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indeterminate) for children 5 5 years of age) (6)	LEGEND	
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arenoon, mun, and genotype tests)(6)	(2) Reporting within 7 days is required.	
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Reportable Diseases by Pathogen

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Coxiella Isumetii (Q Fever) (4)	Paratyphi 8 (tartrate negative), and Paratyphi C (5)	
Gryptosporidium species (Gryptosporidiosis)	Salmonella typhi (Typhoid Fever) (5)	
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senatypes (including HUS) (\$)	Treponema palldum (Syphilic) (6)	
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Guilain-Barre Syndrome (1)	Visito dicersi (Crosers) (4)	
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Hepatitis A virus (Anti-HAV (gM, HAV/genotype)	LEGEND	
Hepatitis B virus (HilsAg, HilleAg, anti-Hille (gM, HEV NAAT, HEV	(2) Reporting within 7 days is required.	
genotype; report all HEsAg and anti-HEs (positive, regative,	(3) Sexually transmitted infection for which expedited partner therapy	
indeterminate for children 5.5 years of age (5)	is authorized. See www.michigan.gov/Nixetd for details.	
https:// Bill holiopation herei //	(4) A laboratory shall immediately salenit suspect or coeffirmed	
Vistoolauma caooulatum (Histoolaumosis)	isolates, subcultures, or specimens from the patient being tested	
W/ facts including: reactive immunoassavs is a . Ab/As. T01/T02 WR.	to the MOHPS Lansing laboratory.	
EIA, IAL detection texts (a.g., VL, NAAT, p34, genotypes), CD4	(5) Isotate requested. Enteric: If an isolate is net available from norv	
counts/percents; and all tests related to perinatal exposures) (2,6)	markets based telling, the positive brans and/or moving interruport	
influenza virus (weekly appreprie counts)	feminetery Scheit mariners if available	
Pediatric influenza mortality, report individual cases (5)	(4) Depart prepriative status, if evaluable,	
Novel influenza viruses, report individual cases (5, 6)	Blue build feat - Category A bioterrariam or select agent, notify the	
Kawasati Cisease (2)	terrent adversary in a district to a long and	

.pdf of RD List by Pathogen



Questions?



