Rocky Mountain Spotted Fever (RMSF) in Arizona: 2003-2012

Erica Weis, MPH
Laboratory Surveillance Epidemiologist
Office of Infectious Disease Services
Arizona Department of Health Services
Overview

• Overview of RMSF
• Brief history the emergence of RMSF in Arizona
• Background information on the vector
• The role of dogs in RMSF in Arizona
• Ongoing and planned control efforts
RMSF : Background

• The most severe rickettsial illness of humans, caused by *Rickettsia rickettsii*
  – First specific notation of the disease in 1896
  – Endemic to North and South America
• Intracellular rickettsial pathogen
• Infects endothelial cells, causes widespread vascular damage
Rickettsia Taxonomy

ORDER: Rickettsiales
FAMILY: Rickettsiaceae
TRIBE: Rickettsieae
GENUS: Rickettsia

SPECIES:
- R. aeschlimannii
- R. africae
- R. akari
- R. australis
- R. conorii
- R. felis
- R. honei
- R. helvetica
- R. japonica
- R. massiliae

Spotted Fever Group:
- R. "mongolotimonae"
- R. montanaensis (formerly R. montana)

Typhus Group:
- R. bellii
- R. canadensis (formerly R. canada)

Other:
- R. prowazekii
- R. typhi
National RMSF Incidence by County, 2000-2007

Rate per 1,000,000 persons

- Yellow: > 0 – < 5
- Orange: 5 – < 15
- Red: 15 – < 30
- Deep Red: >= 30
The Primary U.S. Tick Vectors of RMSF

*Dermacentor variabilis*
American dog tick

*Dermacentor andersoni*
Rocky Mountain wood tick
RMSF in Arizona: Background

• Until 2003 RMSF was rarely seen in Arizona
• In 2002 the first case in an AZ resident with no travel was identified
  – From a tribal community in eastern AZ (Reservation 1)
• In 2002 14 month old child died of suspected sepsis following a febrile rash
  – From same tribal community in eastern AZ as 2002 case
  – PCR positive for *R. rickettsii*
• Environmental investigation found no *Dermacentor variabilis* or *Dermacentor andersoni*. 1000+ *Rhipicephalus sanguineus* found
• 5.6% of trapped ticks positive for *R. sanguineus*
  – 10.5% of dogs in the community positive for RMSF
  – First time *R. sanguineus* identified as a vector for RMSF
RMSF in Arizona: Background

• Pediatric serosurvey identified antibodies to spotted group
  – 10% seroprevalence in Reservation 1
  – 16% seroprevalence in a neighboring reservation (Reservation 2)
• Control efforts implemented in Reservation 1 and Reservation 2, but limited by lack of funding and resources
• In 2009, three human cases (one death) identified in a third reservation (Reservation 3)
  – Limited spread. 5% of dogs were seropositive. No new cases since 2009
  – Dog seroprevalence comparable to areas with no human cases
• In 2011, first human cases identified in a forth reservation (Reservation 4) in southern Arizona
  – 29% of dogs seropositive, but >50% in some communities
• Two additional reservations with RMSF in dogs (Reservations 5 and 6)
Affected Reservations in Arizona
Arizona RMSF Cases and Incidence
The Primary Arizona Tick Vector of RMSF

*Rhipicephalus sanguineus*

Brown dog tick

![Image of Rhipicephalus sanguineus, the brown dog tick, and a map showing its distribution in the United States.]
Tick Biology

• Most ticks have moisture and temperature requirements
  — Vulnerable to desiccation, like high humidity, low tolerance for temperature extremes

• The brown dog tick is different
  — Thrives in hot climates
  — Requires less water than other ticks
  — Vulnerable to colder temperature
  — Can live indoors as long as there are dogs
  — Can crawl up and hide in walls, stucco, cracks, carpet, and hide in crevices
Brown Dog Ticks in the Human Environment
The Role of Dogs in RMSF

- Dogs cannot transmit RMSF, but they are preferred hosts.
- The ticks require a dog to find a mate.
- Free-roaming dogs spread ticks into nearby homes and yards.
- New puppies (especially sick ones) may increase the number of infected ticks.
- Seropositivity in dogs and human risk:
  - In general, no human cases have occurred in communities where canine seropositivity is ~5%.
  - Human cases observed in communities where canine seropositivity is >50%.
  - Threshold for human cases somewhere in between.
  - Canine seropositivity has been observed prior to first reported human cases in some reservations.
RMSF Control Efforts: ADHS

- Developed and implemented RMSF transfer protocol
- Outreach to counties
- Develop surveillance tools for emergence of RMSF in new areas
- Assist in Epi-Aids and prevention projects
- Statewide Tribal RMSF Stakeholder meetings
  - February 2012 & Fall (October/November) 2012
- Provide tick control supplies
- Ongoing surveillance for cases and laboratory testing
Outcome of RMSF Transfer Protocol Pilot

Percent of patients given doxycycline prior to transfer

<table>
<thead>
<tr>
<th>Month</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>March</td>
<td>15</td>
<td>20%</td>
</tr>
<tr>
<td>April</td>
<td>10</td>
<td>40%</td>
</tr>
<tr>
<td>May</td>
<td>18</td>
<td>70%</td>
</tr>
<tr>
<td>June</td>
<td>14</td>
<td>80%</td>
</tr>
<tr>
<td>July</td>
<td>5</td>
<td>100%</td>
</tr>
</tbody>
</table>
Outcome of RMSF Transfer Protocol Pilot

- **Appropriate therapy continued at transfer hospital**
- **Appropriate therapy not started at hospital**
- **Appropriate therapy started at hospital without county, state, or CDC intervention**

March (total=15)  
April (total=10)  
May (total=18)  
June (total=14)  
July (total=5)
Outcome of RMSF Transfer Protocol Pilot

- Did not receive doxycycline after intervention by county, state and/or CDC: 10%
- Did receive doxycycline after intervention by county state and/or CDC: 90%
RMSF Control Efforts: Counties

- Outreach to clinicians to improve recognition of RMSF
- Follow-up for transfer patients
- Participation in RMSF prevention stakeholder meetings
- Assistance to tribal animal control programs
- Assistance with tick treatment and dog collaring on tribal lands
RMSF Control Efforts: CDC

- Multiple Epi-Aids
- RMSF Rodeo Prevention Project
  — Demonstration project of best practices for 525 homes in a high RMSF risk neighborhood
- Integrated Pest Management training targeting ticks and RMSF prevention
- Canine serosurveys
- Provide tick control supplies
- Funding for ADHS RMSF efforts through ELC grant
- Ongoing laboratory testing and clinical education support
RMSF Control Efforts: Future

• Use findings of RMSF Rodeo Prevention Project to better implement control programs
• Expand transfer protocol to other IHS and tribal 638 facilities
• Education and protocol for advice line nurses that serve affected communities
• Improved education on animal health and wellness, including spay and neuter
• Expand and improve animal control programs
• Expand and improve tick control programs
Contact information

Erica Weis: erica.weis@azdhs.gov

ADHS RMSF Website:
Questions?