

Outbreak of a Febrile Illness at a High School Football Camp — Arizona, 2014

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Arizona Department of Health Services



Initial Call

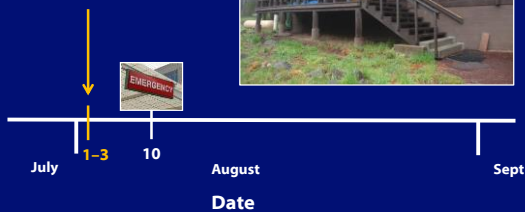


- Coconino County Public Health
- 5 teenagers hospitalized
 - Fever
 - Headache
 - Myalgias



Environmental Investigation

- All patients members of high school football team
- Attended camp Aug 1–3

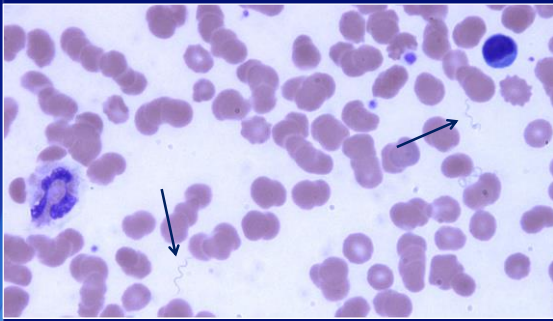


Hantavirus?



- Diagnosed with viral syndrome
- Students exposed to rodent feces
- Parents' Internet research suggested Hantavirus
- 4 students transferred to tertiary care center

Diagnosis of Tick-borne Relapsing Fever



Tick-borne Relapsing Fever

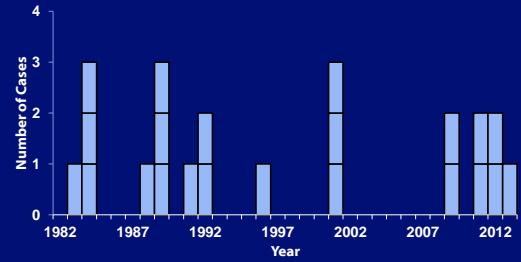
- Infection with *Borrelia* spp. spirochetes
- Symptoms
 - Relapsing fever
 - Headache and myalgias
- Endemic in western US in forested mountains
- Carried by *Ornithodoros* species ticks
 - Soft ticks
 - Feed on rodents
 - Bites painless with short feeds

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Tick-borne Relapsing Fever in Arizona — 1982–2013 (n = 22)



Questions for Investigation

- What were the risk factors?
- Are there additional cases?
- How can we prevent additional cases?

Case Definitions

- Probable case
 - 3 of 4 major symptoms: fever, chills, myalgias, headache
 - Attended camp during August 1–3
- Confirmed case
 - Met probable case criteria
 - Laboratory confirmation
 - Spirochetes on blood smear
 - *Borrelia hermsii* isolated by blood culture

Methods

- Epidemiologic investigation
- Environmental investigation




Epidemiologic Investigation

- Phone interviews with camp attendees
- Standardized survey
 - Demographic
 - Clinical data
 - Activities



Environmental Investigation

- Inspected for rodents and ticks
- Rodent traps
- Tick traps
- Nesting collected

Date

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Environmental Investigation

- Retrieved rodents
- Collected blood samples
- Tested for *Borrelia hermsii*

Date

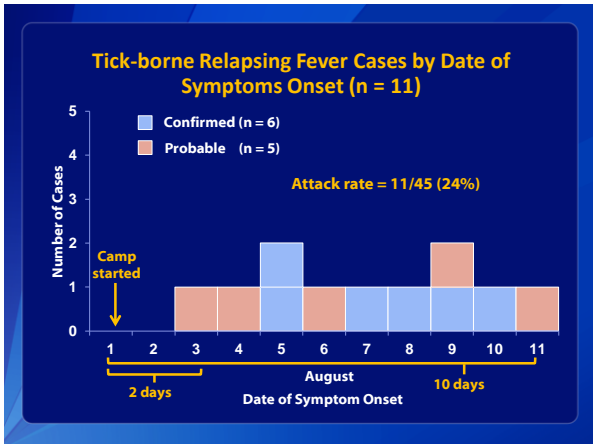
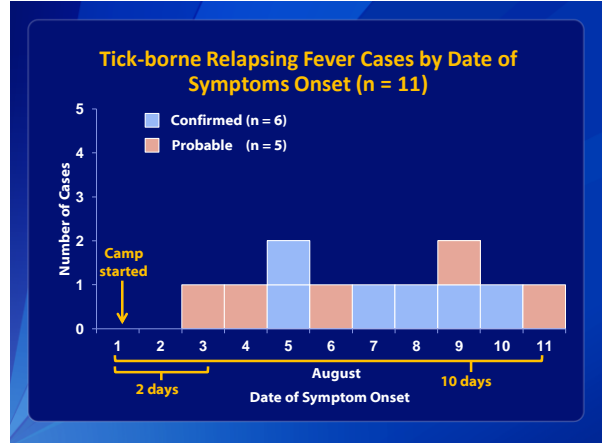
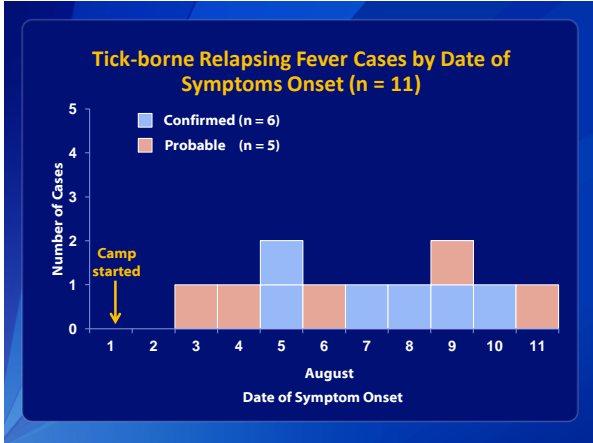
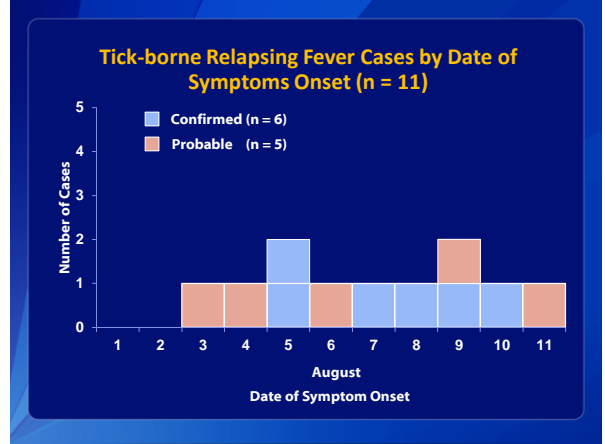
Survey Results

All camp attendees (n = 45)

Group	No. (%)
High school students	39 (87)
Adult coaches	6 (13)
Sex	
Male	43 (96)
Female	2 (4)

Survey Results

Group	All camp attendees (n = 45)	Cases (n = 11)
	No. (%)	No. (%)
High school students	39 (87)	10 (91)
Adult coaches	6 (13)	1 (9)
Sex		
Male	43 (96)	10 (91)
Female	2 (4)	1 (9)





Survey Results

- Slept in cabin
 - 42/45 attendees
 - 10/11 cases

Environmental Investigation

- Pest control company hired
 - Rats trapped and removed
 - Steel wool placed
 - No fumigation for ticks






Environmental Investigation Findings

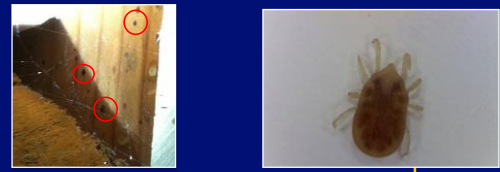

- Cabin
 - Rodent droppings
 - Dead rats
 - Large amounts of nesting
- Rodent traps
 - 1 vole, 1 deer mouse, 4 chipmunks
 - 2/6 tested positive for *Borrelia hermsii*
- No ticks obtained

Initial Interventions

- Removed items in crawl space
- Applied tick fumigation
- Improved rodent-proofing

Reinspection

Reopening




<http://steelwooldirect.com/>

Summary

- Largest outbreak of tick-borne relapsing fever in Arizona since 1990
- Communication between hospital and health department
 - Quick diagnosis and treatment
 - Prevention of additional cases

Discussion

- Pest control company removed rodents without fumigating for ticks
 - Ticks lost source of food
 - High school team arrived
- Unaware of recommendation to apply tick fumigation
- Arizona Department of Health previously assisted with pest control training
 - Disease prevention
 - Currently not done
- Tick-borne relapsing fever not on physician differential

Limitations

- 20/45 attendees not interviewed
 - Including 4 confirmed case patients
- No laboratory testing on most probable case patients
- Only 1 testable tick found

Recommendations

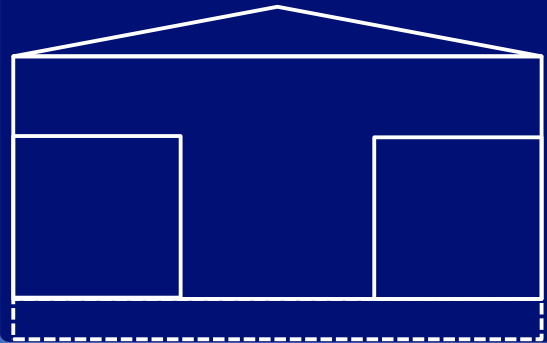
- Health departments
 - Provide education to healthcare providers and the public
- Pest control companies and cabin owners
 - Apply tick fumigation
 - Rodent-proofing
- Campers sleeping in seasonally-occupied cabins
 - Wear long clothing
 - Apply insect repellants

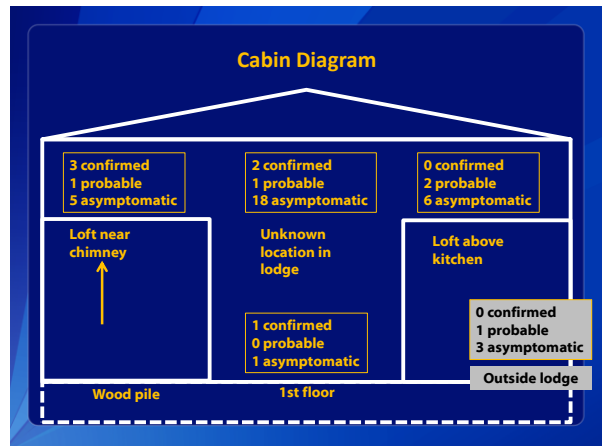
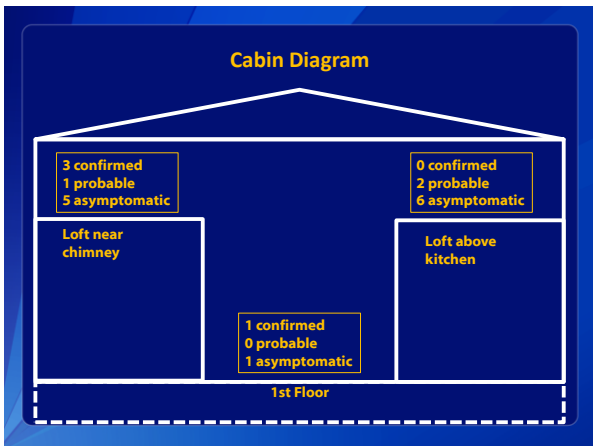
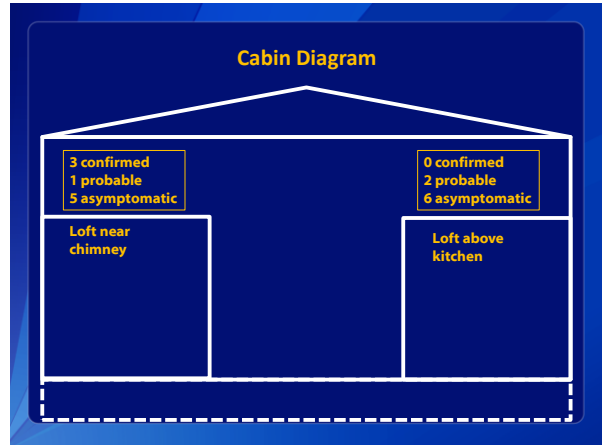
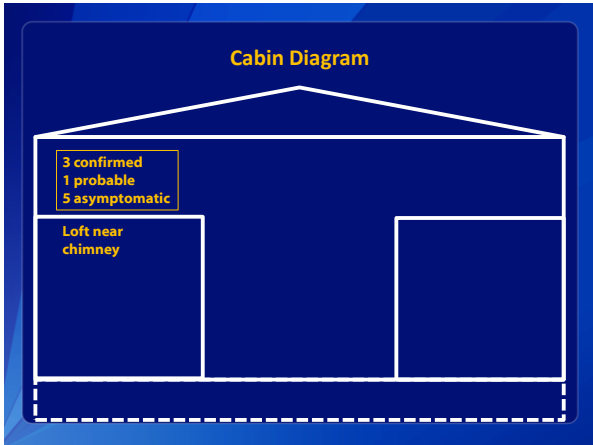
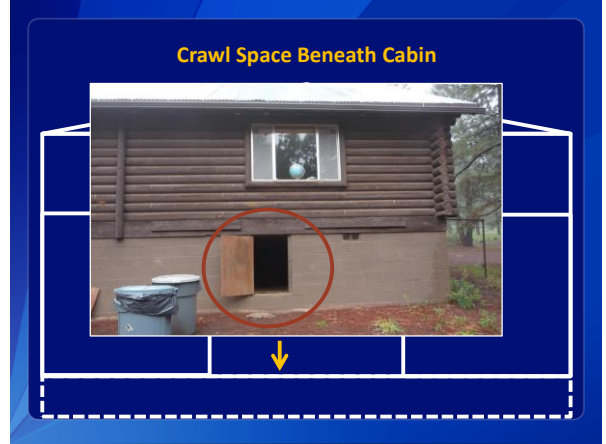
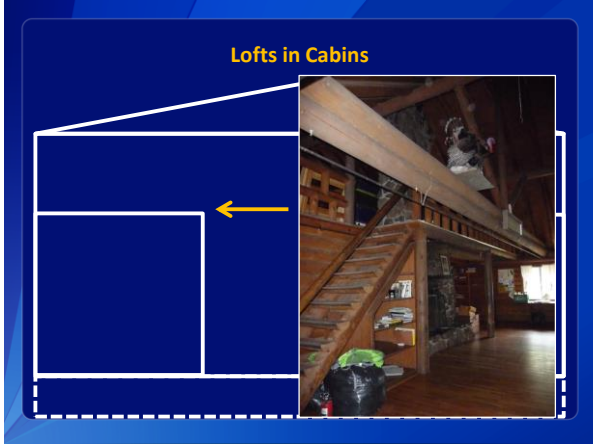
Acknowledgments

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Cabin Diagram





Case Control: Risk Factors

Risk factor	Confirmed/ Probable (n=11)	Control (n=34)	Odds Ratio	95% Confidence Interval
	No. (%)	No. (%)		
Slept in lodge	10 (91)	31 (91)	1.0	(0.1–11.1)
Loft by chimney	4 (36)	5 (25)	1.7	(0.3–8.4)
Cleaned lodge	2 (100)	10 (59)	n/a	n/a
Worked with woodpile	5 (71)	11 (65)	1.4	(0.2–9.3)
Cleaned bathhouse	7 (70)	5 (36)	4.2	(0.7–23.9)

Notable Arizona Outbreaks

Year	Location	No. of Cases
1972	Grand Canyon	62
1990	Grand Canyon	17

Symptoms

Symptom	Total (n=11)	Confirmed (n=6)	Probable (n=5)
	No. (%)	No. (%)	No. (%)
Fever	11 (100)	6 (100)	5 (100)
Headache	12 (100)	6 (100)	5 (100)
Myalgias	13 (100)	6 (100)	5 (100)
Arthralgias	10 (91)	6 (100)	4 (80)
Abdominal pain	7 (64)	5 (83)	2 (40)
Chills	6 (55)	4 (67)	2 (40)
Fatigue	6 (55)	2 (33)	4 (80)
Vomiting	4 (36)	4 (67)	1 (20)
Dizziness	3 (27)	3 (50)	0
Syncope	2 (18)	2 (33)	0
Rash	2 (18)	2 (33)	0

Laboratory Values n=6

Laboratory Value	Abnormal No (%)	Median	Range
Platelets (No./uL)	6 (100)	71	30–94
INR	2 (40)	1.4	1.1–1.7
Albumin (g/dL)	4 (67)	2.6	2.1–4.2
Total Bilirubin (mg/dL)	4 (67)	1.8	0.3–3.2
ALT (u/L)	2 (33)	41	23–72

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Trapped Rodents

