Tick Biology and Control

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Introduction

- Summarize the biology and disease associations of ticks in the United States
- Provide an update on *Rhipicephalus sanguineus* as a vector of spotted fever group rickettsiae
- Discuss fundamentals of tick control
- Discuss prevention, management, and control measures for ticks and RMSF

*The views expressed in this presentation are those of the author and not necessarily those of the Centers for Disease Control and Prevention or Department of Health and Human Services*

Ticks and Tick-Borne Diseases

Tick-borne diseases are increasingly recognized in the United States
Trends in Tick-borne Diseases

- Increasing recognition of novel organisms and recognition as human pathogens
- Increasing incidence of tick-borne diseases worldwide (often attributed to social and environmental changes)
- Geographic ranges of some tick species are expanding

Trends in Tick-borne Diseases

- Increasingly mobile society (and pets)
- Increasingly “green” society
- Increasingly sophisticated diagnostics
- Decrease in medical awareness or suspicion for many TBD (it’s not all Lyme)
- Decreasing expertise in vector biology and control

Incredible diversity

- Over 850 species worldwide, about 80 species in the United States
- Three families:
  - Ixodidae (hard ticks)
  - Argasidae (soft ticks)
  - Nuttalliellidae

About 12 species of public health or veterinary importance in the US
General Life Cycle of a Tick

Blood-feeding strategies

- Soft ticks attach for longer periods as larvae, but then use a feed-and-hide strategy (feed times 30 minutes or less)
- Ixodid ticks attach strongly for varying periods of time (multiple days)
- One-host, two-host, and three-host ixodid ticks
- Vary from host-specific to feeding on a broad range of vertebrate hosts
- Relevant to pathogen transmission

Factors for Tick Survival

- Humidity
- Temperature
- Available hosts
- Hiding spots
- Predation
- Natural disease
- Pathogen-induced mortality
Effects of tick infestation

- Worry
- Blood loss
- Salivary toxicant
- Immune response
- Wounding (secondary pathogen entry)
- Pathogen transmission

Tick paralysis

- Progressive, flaccid, ascending paralysis
- Death can occur 24-48 hours after onset of symptoms
- Often due to undetected tick attachment along spine or base of skull
- Caused by many species of ticks
- Often a single tick can cause severe illness in a person
- Caused by different proteins in tick saliva

Tick Bite Allergies and Reactions

- Wide range of reactions
- Minor inflammatory reactions locally
- Severe systemic reactions (skin rash, fever, nausea, vomiting, diarrhea, shock, and death)
- Severe allergic reactions (edema, pain, erythema, tissue necrosis, ulceration, prolonged healing)
- Expanding erythematous lesions
- Anaphylactic shock
Tick-borne Diseases

General features

Maintenance of pathogen within tick populations

- **Transovarial transmission**: transfer from one generation to the next through the egg
  - Spotted fever group rickettsiae
  - Tick-borne encephalitis virus
  - Colorado tick fever virus
- **Transstadial transmission**: transfer from one life stage to the next stage
  - Lyme borreliae
  - Ehrlichia organisms
  - Anaplasma organisms
  - Babesia parasites

Pathogen Transfer

[Diagram showing the process of pathogen transfer through different life stages of ticks]
Ticks and their associated diseases are seasonally distributed

- Peak of disease activity corresponds with peak of tick activity (especially the life stage of tick most important for transmission).

![Seasonal Distribution Graph]

Ticks and their associated diseases are focally distributed (clustered)

- Non-random
- Clustered
- Random


Disease Occurrence

- Pathogen
- Host
- Vector
- Suitable environment
When to Suspect Tick-borne Illness

- Acute febrile illness without apparent cause (fever, malaise, lethargy + other symptoms)
- Onset during May-September (high tick activity)
- History of tick bite or exposure
- Persons at risk for tick bite
- History of travel to endemic areas (US and global travel)
- Thrombocytopenia, elevated liver enzymes
- Rash not always a feature

Diseases endemic to the USA

- Ehrlichiosis
- Anaplasmosis
- Rickettsioses
- Lyme disease and other borrelioses
- STARI
- Babesiosis
- Tularemia
- Colorado tick fever, Powassan encephalitis
- Bartonellosis, others

*Borrelia burgdorferi*

- Lyme disease is the most common vector-borne disease in US
- Caused by spirochete, *Borrelia burgdorferi*
- Transmitted by *Ixodes scapularis* and *Ixodes pacificus*
- Approximately 20,000 cases reported each year in United States
- Northeast, upper mid-Western United States
Relapsing fever borreliae

- *Borrelia hermsii*, *B. turicatae*, *B. parkeri*
- Uncommon (~25 cases/yr); 14 states
- Associated with stays in cabins infested with rodents, especially after rodent control has occurred
- Soft ticks (Family Argasidae) seek hosts in the absence of their normal rodent hosts

STARI

- Southern Tick Associated Rash Illness
- Originally suspected to be due to “*Borrelia lonestari*” found in lone star ticks, but no good evidence for this
- Many bacteria and viruses extensively evaluated, but no real cause has been determined
- Need for further study

Francisella tularensis

- Tularemia
- Found in a number of ticks, but generally thought to be transmitted to humans by *Amblyomma americanum* or *Dermacentor variabilis*
- Several biotypes, other means of transmission
- Martha’s Vineyard focus (*D.v.*)
- Missouri-Arkansas focus (*A.a.*)
- Increase in cases in recent years (~200 cases/yr)
Babesia species

- First US case reported in 1966 from Nantucket Island, Mass.
- 25% of adults and 50% of children infected with babesiosis are asymptomatic and/or improve spontaneously without treatment.
- Less than 10% of patients with babesiosis have died in the United States, mostly composed of elderly or asplenic patients.
- Approximately 20% of patients with babesiosis are co-infected with Lyme disease. These patients experience more severe symptoms for a longer duration than those with either disease alone.

Babesia species

- Babesia microti (NE and upper Midwestern US)
- Babesia duncani (WA-1; Washington state)
- Babesia sp. (MO-1; Missouri)
- Babesia sp. (CA-1; California)
- Most patients had their spleens removed surgically, and thus were immunocompromised
- Not commonly reported, increasing incidence
- Growing threat to donated blood supply

Powassan virus

- Widely distributed. Found in Ixodes spinipalpis and Dermacentor andersoni in the West and Ixodes cookei and I. marxi in the East
- Flavivirus related to TBE virus
- Groundhogs are one reservoir and good hosts for Ixodes cookei
- Causes neurologic disease in humans
- Not common (17 cases from 1999-2007)
- Incidence appears to be on the rise
Deer Tick Virus

- Described in 1997
- Subtype of Powassan virus, a flavivirus related to the tick-borne encephalitis virus complex
- 3-4% of white-footed mice (*Peromyscus leucopus*) in Massachusetts and Wisconsin are seropositive
- Detected in adult *Ixodes scapularis* ticks in those areas with seropositive mice
- Fatal encephalitis case described in 2009

Colorado Tick Fever

- Transmitted to humans by the Rocky Mountain wood tick, *Dermacentor andersoni*
- Transstadial and transovarial transmission in ticks
- 777 cases (1987-2001)
- Rocky Mountain states

*Anaplasma phagocytophilum*

- Previously known as the human granulocytic ehrlichiosis (HGE) agent, *Ehrlichia phagocytophila*, *Ehrlichia equi*.
- Mainly distributed in the northeastern, upper midwestern, and western states, but also found in the southeast. Distribution of organism is wider than that of human cases.
- Reservoir: Rodents (*Peromyscus*, *Neotoma*); squirrels
In the eastern US, *Anaplasma phagocytophilum* is primarily transmitted by the blacklegged tick (I. scapularis). Additional tick species (I. pacificus, I. spinipalpis) involved in western U.S. and in other parts of the world (I. ricinus, I. persulcatus, others).

**Ehrlichia chaffeensis**

- Disease: Human monocytic ehrlichiosis
- Primary vector: *Amblyomma americanum*
- Reservoirs may be dogs, wild canids, and deer

**Amblyomma americanum**

Common name: Lone star tick
- Transstadial, but not transovarial transmission.
- Distributed throughout the southeastern U.S.
Hypothetical Life Cycle

United States

Amblyomma americanum

Foxes, coyotes, and other wildlife

White-tailed deer

Humans
Domestic Animals
(goats, dogs)

Ehrlichia ewingii

Organisms grow as clusters within the cytoplasm of certain types of white blood cells (neutrophils and eosinophils)

W. L. Nicholson, 1999

Ehrlichia ewingii

- Increasingly recognized as cause of human ehrlichiosis (first cases in humans from Missouri)
- Pathogen not yet cultured, so no specific serologic test was available, new recombinant antigen has been useful for veterinary studies
- Transmitted by *Amblyomma americanum*
- Found in ticks or dogs from several states thus far: Arkansas, Mississippi, Missouri, North Carolina, Oklahoma, Tennessee, Virginia
**Rickettsia parkeri**

- Recently recognized tick-borne pathogen of humans
- Mild spotted fever with eschar, a skin lesion with a necrotic center
- First case identified in Tidewater, Virginia; now have about 30-40 cases identified
- Organism known for >60 years before recognized as a human pathogen

**Cutaneous lesions (Rickettsia parkeri)**

A: Diffuse, pink, macular rash involving the abdomen
B: Small pustule on hand
C: Eschar on right lower leg
D: Eschar on left lower leg

**Amblyomma maculatum**

*Rickettsia parkeri* has been specifically identified in *Amblyomma maculatum* ticks from Alabama, Georgia, Mississippi, Virginia, and Texas (and wider)
“Rickettsia philipii” (serotype 364D)

- 1966: First isolated from a Pacific Coast tick, *Dermacentor occidentalis*, collected in Ventura Co., California
- Serologically distinct from other SFGR
- Found in a high proportion of *Dermacentor occidentalis* ticks in nature
- Suspected as cause of spotted fever infections in California since the early 1980s.

- Now known to be a cause of mild spotted fever with eschar as primary feature
- Molecular and serologic evidence for cases in northern California
- Eschar is primary site of rickettsial concentration resulting in necrotic center.

*Ehrlichia muris*-like agent

- Discovery (2009)
  - Mayo Clinic
  - 20 year old male from Wisconsin
  - County of residence along the border of MN/WI
  - Post-kidney transplant, treated with immunosuppressive drugs
  - Presented with fever, malaise, and headache
  - Lymphopenia and mildly elevated AST/ALT
  - Peripheral blood smear was negative for babesia
  - Serologic panel for babesiosis, anaplasmosis, and ehrlichiosis was negative
  - Tick-borne disease PCR panel was performed
Ehrlichia muris-like agent

- **Epidemiology**
  - All patients had documented history of tick exposure
  - <30 human cases have been identified thus far
  - All from Minnesota and Wisconsin
  - Some had history of organ transplant
  - Investigations underway among Mayo, MN and WI DOH, US Army, and CDC

- **Field studies**
  - *Ixodes scapularis* ticks were collected from areas of suspected tick exposure of the patients in Wisconsin
  - 1/100 pools were positive (*I. scapularis* nymphs)

Potential and emerging pathogens

- **Rickettsia massiliae**
  - Found in brown dog ticks in multiple countries; known from Arizona and California
  - Cause of human illness in Argentina and Sicily
  - Not yet found to cause disease in humans in the USA

“Non-pathogenic” rickettsiae

- **Rickettsia rhipicephali**
  - Associated with brown dog ticks in Arizona and other states
  - Not known to cause human illness
  - Inapparent infection in dogs; varying pathogenicity in guinea pigs and mice; can be fatal to immunosuppressed voles
  - Experimental inoculation of dogs with *R. rhipicephali* resulted in partial protection from virulent *R. rickettsii* challenge
Imported rickettsial diseases

- Travel-associated
- Usually recognized as acute illness in 2-4 weeks following return from travel
- *Rickettsia conorii*-Mediterranean SF
- *Rickettsia africae*-Tick bite fever
- *Rickettsia typhi*-Murine typhus
- Others

*Rickettsia rickettsii*

- Rocky Mountain spotted fever: the most severe rickettsial illness of humans
- Tropism for endothelial cells

*Rickettsia rickettsii*

- Primary vectors in USA: *Dermacentor variabilis*, *Dermacentor andersoni*
- Other tick species may be involved in other areas
  - (e.g. *Rhipicephalus sanguineus*)
- Transstadial and transovarial transmission in ticks
RMSF in Arizona

- High infestations of brown dog ticks, *Rhipicephalus sanguineus* (all stages)
- Many confirmed bites by nymphs (usually behind ears or back of neck)

When first investigated in AZ, the annual incidence of RMSF in this area was 300x that of rest of country

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RMSF in Arizona

- Now seen in four widely separated tribal lands. From 2002-2009, we identified 95 cases
  - 527 cases per million persons/yr
  - Fatal Cases
    - $N = 9$
    - Case fatality rate = 9.5%
RMSF Cases and Incidence

Mexicali Outbreak

- Initial report: 4 Sept. 2008 to 19 Feb. 2009, eight deaths reported from Los Santorales area of Mexicali, Baja California, Mexico
- Additional 52 cases, 2 deaths in early 2009
- CDC assisted local and federal health officials in confirming these as due to Rickettsia rickettsii
- Large numbers of ticks on dogs and in environment (earlier studies had shown 50-79% of dogs infested with a seroprevalence of 17% to R. rickettsii)

Cases continue in multiple states

Rhipicephalus sanguineus

Brown dog tick

Found worldwide, primarily feeding on dogs as preferred host

Larval and nymphal ticks occasionally feed on humans, especially when tick populations are high

Transmit spotted fever rickettsiae in other parts of the world
Rhipicephalus sanguineus was shown to be a vector of Rickettsia rickettsii in at least 4 states in Mexico in the 1940s (work by Bustemante, Varela, and Marriote).

Rocky Mtn Labs: R.R. Parker conducted laboratory studies to show that R. sanguineus was effectively maintained through successive stages to the second generation.

Role of this tick species in the United States had been discounted for decades due to the perception of this species not feeding on humans. Yet a number of studies document human feeding in the U.S. and elsewhere.

Labruna and associates (2008) showed that R. sanguineus was readily infected by R. rickettsii (89-100% infected) and mortality did not differ from uninfected vs. infected ticks (8-21% died).

Naturally infected ticks found in Sao Paulo, Brazil (Moraes-Filho et al. 2008) and southern California (Wikso et al.)

Brown dog ticks can complete their life cycle in as little as 93 days. Each engorged female can lay 3000-4000 eggs. Ticks can be transported to new locations as dogs move around from house-to-house. It takes a very short time to re-colonize an area after dogs have been removed or control efforts have been conducted.
Biological Features

- Ticks move among hosts during high tick activity (interrupted feeding may shorten transmission time to second host)
- Nocturnal detachment of nymphal and adult engorged ticks concentrates ticks and facilitates host contact
- Increased height of questing and human biting rate with elevated temperature (Melendez et al. 1995; Parola et al. 2008)
- Survives temperatures and humidities that other ticks cannot (Yoder et al. 2006a,b): 90% survival at 40°C and 33% survival at 50°C

Prevention

- Proper Use of EPA-approved Products
- Skin Applications
  - DEET
  - Picaridin
  - Oil of Eucalyptus
  - BioUD
- Clothing Applications
  - Permethrin (Permanone)
  - BioUD

- Clothing adjustment & access prevention measures (e.g., pants in sock, double-stick tape)
- Use of repellents
- Avoidance of tick habitat
- Body checks after spending time in tick habitat
Prevention

- Routine tick check and removal
  - Transmission unlikely to occur if promptly removed (grace period varies)
  - Use fine-tipped tweezers
  - Mirrors help
  - Record date/save tick

Carbon dioxide, heat

- Ticks find a host by sensing light changes, temperature, and certain chemicals
- Their “noses” are sensory organs on the front legs

Questing Behavior
Surveillance for ticks

- Carbon dioxide (dry ice) trap
- Flagging
- Dragging
- Host exam
- Limitations and bias to each method

Carbon Dioxide Attractant

Simple Dry Ice Trap for Ticks

CO₂
2.9 times heavier than air

Tick Drag

Tick drag is pulled slowly through vegetation. Ticks attach to fabric, which is checked periodically for tick attachment.
Tick Flag

Tick flag is wiped slowly across and around vegetation. Ticks attach to fabric, which is checked periodically for tick attachment.

Fabric is checked and ticks removed

Species, life stage, distribution by location, season, infestation level, infection rate

*Rhipicephalus sanguineus*
Home assessment

- Examine for suitable microhabitats in the peridomestic environment
- Engorged ticks crawl into cracks and crevices (dark and tight) to develop and molt into the next life stage.
- Various places have the appropriate microclimate needed for survival.

*Rhipicephalus sanguineus* Infestation

Vegetation in surrounding areas increased moisture levels under houses on piers.

"Shady places where dogs lie"

What are we looking for?

- Are animals (dogs especially) present?
- Is pet housing present?
- Are there access points to the crawl space?
- Is vegetation present and maintained?
- Are there any wood piles, other debris?
- Furniture and other outdoor storage?
Home assessment

- Exterior:
  - Examine cracks and crevices, along window and door openings, siding
  - Woodpiles, dog houses, outbuildings, under bushes, items stored outdoors
- Interior:
  - Baseboards, along door and window trim, behind curtains, under furniture

*Rhipicephalus sanguineus* Infestation

Voids in the concrete piers can contain ticks of all stages.

Larvae and nymphs can quest from the surface.
Mattresses discarded or stored under houses can provide dog resting sites and tick hiding spots. Stucco siding can harbor ticks. Over 150 ticks were removed from this single mattress. (Adults, nymphs, and nymphs molting into adults)

**Rhipicephalus sanguineus** Infestation

The situation

- Brown dog ticks feed primarily on dogs
- Brown dog ticks feed rarely on people
- When dog populations rise, there is also a rise in tick numbers
- When tick numbers are high, even the occasional feeding on people becomes significant
- Close contact of humans with dogs and their ticks sets up the ideal situation for transmission.

Stopping the Cycle of RMSF

- The most effective way to eliminate the tick problem (and thus the disease transmission) is by the use of several approaches:
  - Management of habitat
  - Management of tick numbers
  - Management of dog population
  - Avoidance of tick contact
Tick Control and Management

- Management of habitat
  - Reduce tick survival
  - Reduce suitable host habitats
- Management of free-living ticks
  - Reducing contact with host-seeking ticks
- Management of parasitic ticks
  - Preventing reinfestation of environment and blocking acquisition of pathogen
- Management of host population
  - Decrease the load of ticks in environment

Management of Habitat

- Decrease harborage of tick hosts
  - Decrease outdoor storage, clean up debris
  - Skirt houses to exclude animals
- Decrease harborage of molting ticks
  - Caulk openings, cracks, crevices, trim
- Reduce moisture
  - Reducing weeds and mowing grass allows wind and sun to dry the areas (which will reduce tick survival)

Management of free-living ticks

- Constant new source of parasitic infestation
- Can repopulate area by ticks dropped off dogs
- Questing ticks are risk to humans
Targeted approach

- Target areas where ticks are located
- Target timing of acaricide application to coincide with optimal numbers and life stage for best control
- Target repeat applications to maximize effectiveness and minimize waste.

Targeted Control: Ideal Situation

- Environmentally-friendly: widespread pesticide application is not necessary
- Ticks are found mostly in specific locations (shady places where dogs rest: under decks, under porches, under houses)
- Minimizes pesticide use, minimizes exposure to people

Who does it?

- Commercial applicators
- Housing authorities
- Municipal authorities
- Public health authorities

Today, I am speaking of:

- Residents of home using pesticides appropriately
Tools for management

- Biological/Mechanical
  - Soaps
  - Dessicants
  - Fungal pathogens
  - Pheromone attractants
- Chemical
  - Many registered products in various formulations (spray, granules, dust)
  - Topicals and impregnated collars for animals

Environmental concerns

- Pesticide safety
- Environmental loading
- Environmental runoff
- Non-target pesticide application
- Resistance

Biological control of ticks

- Nematodes
  - *Steinernema* spp.
  - *Heterorhabditis* spp.
- Fungal pathogens
  - *Metarhizium anisopliae*
  - *Gliocladium roseum*
Management of Ticks: Chemical

- Most effective and rapid way to reduce tick numbers
- Chemicals should be chosen for effectiveness against ticks, and for their relative safety to people and animals
- These products should give 3-4 weeks of protection, reducing frequency of followup applications

Chemical Safety Plans

- Education of control staff
  - Knowledge of chemicals to be used
  - Adverse reactions surveillance
  - Personal protective equipment
- Limit access to sprayed areas until dry
  - Caution signs
  - Clearing of area
- Proper disposal of materials

Chemicals for tick control

- Encourage SMART use!
- Rationale and proper use of pesticides
- Proper timing of application
- Proper dosage
- Approved chemicals for state and for specific usage
- Maximize safety for applicators and public
Applications

- Indoors
  - Treatment of cracks and crevices, edges
  - Do not treat food preparation areas
- Outdoors
  - Treatment of tick-infested areas
  - Treatment of animal sleeping areas
  - Do not treat ground water or areas where contaminated runoff could occur.

Treatment of premises

- Indoor
  - Dusts/powders
    - Dessicants/scarification
    - Dessicants + chemical pesticide
  - Sprays
    - Pyrethrins
    - Pyrethroids

Use of trade names does not imply endorsement by CDC or other agencies.

Treatment of premises

- Outdoor
  - Sprays
    - Pyrethrins, Bifenthrin, Permethrin, Lambda-Cyhalothrin, carbaryl
  - Granules
    - Carbaryl, Bifenthrin, Permethrin, Lambda-Cyhalothrin
  - Dusts
    - Carbaryl, Permethrin, Deltamethrin
Control of ticks around houses on piers

Area to treat (under house and 6-10 feet beyond edge of house)
Also treat under and around dog houses, porches, decks, or other shady places that dogs lay regularly

Control of ticks around houses on slabs

Area to treat (band 6-10 feet beyond edge of house)
Also treat under and around dog houses, porches, decks, or other shady places that dogs lay regularly

Granular formulations

- Can be applied by homeowner
- Can be purchased in shaker containers
- Penetrates ground vegetation
- Effectively used in early part of the RMSF response
- Apply appropriate dosage!
Application of pesticides

- Granules: Water in to activate pesticide (rains will also cause the chemical to leach from the granule)
- Re-apply if ticks return
- Many products will not kill eggs, so hatching ticks may appear after treatment
- New ticks may drop in the treated area

Granules: Calculation of dosage

- Determine square footage to be treated.
- Dosage rate is listed on label.
- Calculate amount to be applied to the targeted square footage.
- Weigh out the amount, add it to a spreader, and spread the area until measured material is depleted from spreader.

Timing

- Appropriate timing is essential
- Focus on spring tick emergence, peak tick populations
- Monitor for ticks after treatment and retreat when necessary
The real problem

Dogs and RMSF

- Dogs, like people, can become infected with RMSF
- Causes illness and death in infected dogs.
- Recovered dogs are immune to reinfection.
- Dogs can circulate rickettsiae in their bloodstream for 6-11 days upon infection.

Targeting the Hosts

- Reduce host contact with vector
  - Self-applicator bait stations
  - Topicals/collars
- Reduce vector contact with pathogen
  - Host vaccination strategy (against pathogen, tick)
  - Host treatment with long-acting tetracyclines
- Reduce overall host numbers
  - Exclusion, active removal or relocation
  - Spay and neuter programs
  - Modification of habitat
Control of Ticks on Dogs

- Topicals
  - Spot-on treatment
- Tick collars
- Reduction in dog numbers

Management of Ticks on Dogs

- More difficult portion of the effort
- Household dogs will be easier to treat than stray dogs
- Large number of dogs in area
- Many approaches require direct contact with the dog

Management of Ticks on Dogs

- Sprays/dips:
  - Effective, but not long-lasting (< 2 weeks)
  - Products of various chemical classes:
    - Organophosphates
    - Carbamates
    - Pyrethrins
    - Pyrethroids
Dusts/powders

- Desiccants
  - Silica gel
  - Diatomaceous earth
  - Boric acid
- Desiccants + chemical pesticide

Topicals

- Pyrethrins
- Permethrin, Permethrin + pyriproxyfen
- Fipronil
- Fipronil + methoprene
- Fipronil + amitraz + methoprene
- Metaflumizone + amitraz
- Selamectin

Collars

- Tetrachlorvinphos (Hartz Ultraguard)
- Tetrachlorvinphos + (S)-methoprene (Hartz Ultraguard Plus)
- Propoxur (Zodiac, Breakaway Plus)
- Amitraz (Preventic)
- Amitraz + pyriproxifen (Preventic Plus)
- Deltamethrin (Adams Delta Force, Preventef-D, Scalibor)
- Flumethrin + propoxur (Kiltix)

Mention of trade names does not imply endorsement by CDC or other agencies
Collars: Important reminders

- Pay attention to the active ingredients in flea/tick collars. Pesticides effective for fleas may not be effective for ticks.
- Dogs and cats are not the same. Some dog products are highly toxic to cats. Do not use inappropriate products on cats!
- Never use collars on humans!!!

Effective tick control targets all life stages

Management of host animals

- Reduction of host animals available to ticks for feeding
Reminder: Dog Population Control

- Animal control efforts and tick management efforts go hand-in-hand
- Decrease in dog numbers will result in a reduction of tick numbers
- Spay/neuter programs can stabilize the situation
- Animal-directed efforts can provide a long-term effect

Animal Control

- Activity must be sustainable
- Activity can become costly
- Activity is often not widely acceptable to the population
- Education is needed to convince residents that the reduction in animals is needed for public health protection

Benefits of the Control Effort

- Improved health of people
- Possible reduction in other household pests (cockroaches, bedbugs) with premises treatment
- Improved health of dogs
- Reduction in other dog pests (fleas, lice, mites) with dog and dog-area treatment
Responsibility

- Governmental
  - Federal, state, county, municipal, tribal
- Community
- Individual

AZ: Potential for control

- One primary tick species
- Tick species strongly prefers one host (dog) in all life stages
- Ticks primarily located in a limited peridomestic environment
- Demonstrated effective methods of management

AZ: Challenges for control

- Magnitude of the stray dog problem and lack of animal control (est. 25,000 dogs with 2500 removals/year)
- Limited political will and sustained effort for community-wide control
- Difficulty in treating individual animals
- Retreatment, identification, logistics
- Cost
AZ: Challenges

- Sustainability: Long-term control requires a coordinated integrated approach
- Ongoing effort in community education, habitat modification, and chemical management
- Ongoing efforts to educate health care professionals

Resources

- State agricultural extension agency
- Entomology departments at land grant universities
- Environmental Protection Agency (EPA)
- U.S. Department of Agriculture (USDA)
- CDC (NCEH, NCEZID)
- Commercial pest control operators
- Armed Forces Pest Management Board

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THANKS!