

# Suppression of Host-Seeking Ticks and Relevance to Human Health: Standard Pesticides

**Alison Hinckley, PhD**

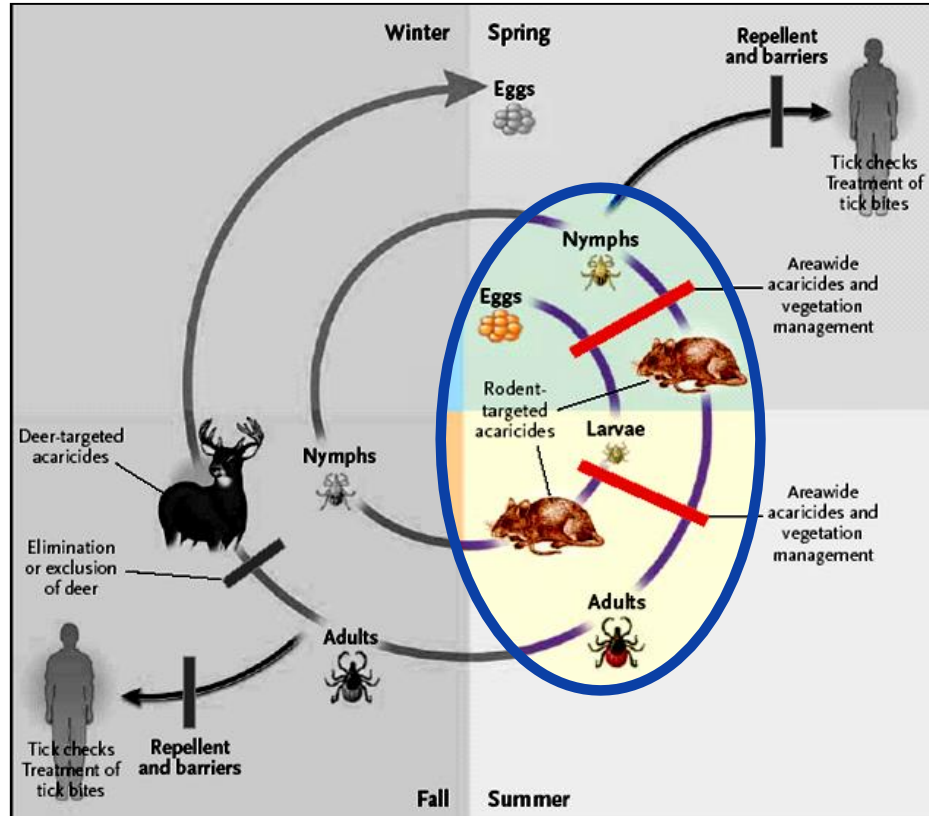
**Epidemiologist, Division of Vector-Borne Diseases**

Integrated Tick Management Symposium: Solving America's Tick-Borne Disease Problem

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# Avenues for prevention



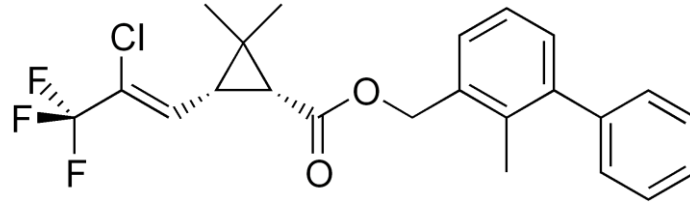
# Synthetic pesticide applications

- Granules
- Sprays
  - High pressure, high volume
  - Low pressure, low volume
- Restrictions
  - Water
  - Vegetable gardens
  - Select ornamentals



# Pesticides evaluated

- Organophosphates
  - Chlorpyrifos
  - Diazinon
- Pyrethroids
  - Bifenthrin
  - Cyfluthrin
  - Deltamethrin
- Carbaryl



# Entomologic studies<sup>1,2</sup> of synthetic acaricide efficacy in **woodland** settings (optimal)

Chemical	Application method	References	%Reduction	Sites (n)	Timing of eval
Bifenthrin	Spray	2010 Rand	100	7/9	1-4 wks
Bifenthrin	Spray	2013 Elias	100	15/15	1-4 wks
Cyfluthrin	Spray	1992 Solberg	96-100	7/7	1-8 wks
Cyfluthrin	Granules	1992 Solberg	87-97	7/7	1-8 wks
Chlorpyrifos	Spray	1995 Allan & Patrican	94-100	6/6	1-6 wks

<sup>1</sup>Effect on nymphal tick populations

<sup>2</sup> Spring/Early summer applications

# Entomologic studies<sup>1,2</sup> of synthetic acaricide efficacy in **residential** settings (less optimal)

Chemical	Application method	References	%Reduction	Sites (n)	Timing of eval
Bifenthrin	Spray	2010 Stafford & Allan	86-87	5/18	2-6 wks
Cyfluthrin	Spray	1993 Curran	88-95	14/25	2-6 wks
Deltamethrin	Granules	2005 Schulze	97-100	10/10	1-5 wks
Chlorpyrifos	Spray	1993 Curran	84-100	14-16/25	2-6 wks
Chlorpyrifos	Granules	1993 Curran	90-100	15/25	2-6 wks
Carbaryl	Spray	1993 Curran	64-87	14-15/25	2-6 wks
Carbaryl	Spray	1991 Stafford	43-93	5/2	2-13 wks
Carbaryl	Granules	1993 Curran	70-89	13/25	2-6 wks
Carbaryl	Granules	1995 Schulze & Jordan	46-96	6/6	1-8 wks

<sup>1</sup>Effect on nymphal tick populations

<sup>2</sup> Spring/Early summer applications

# Barrier pesticide application

- Recommended by entomologists, public health agencies
- Target ecotone between human and tick occupied habitat
- In 2003 survey, 29% of 2,400 Connecticut households reported using pesticides in previous year to control ticks<sup>1</sup>

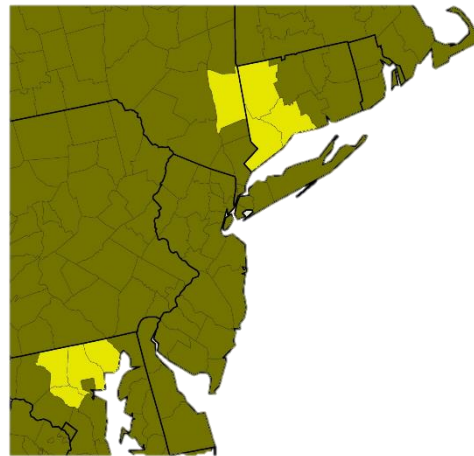


...but do they prevent  
tickborne illness?

1. Gould *et al.* *Vector-Borne Zoo Dis* 2007

# Lyme and other tickborne diseases prevention study

- Randomized, blinded, placebo-controlled trial (CT, MD, and NY)
- 2,727 households (.5 – 5 acre properties) surveyed and randomized to receive single barrier application
  - pesticide (bifenthrin)
  - placebo (water)
- Applications
  - May 1-June 15 using backpack or truck sprayers
  - lawn/brush border per industry practice



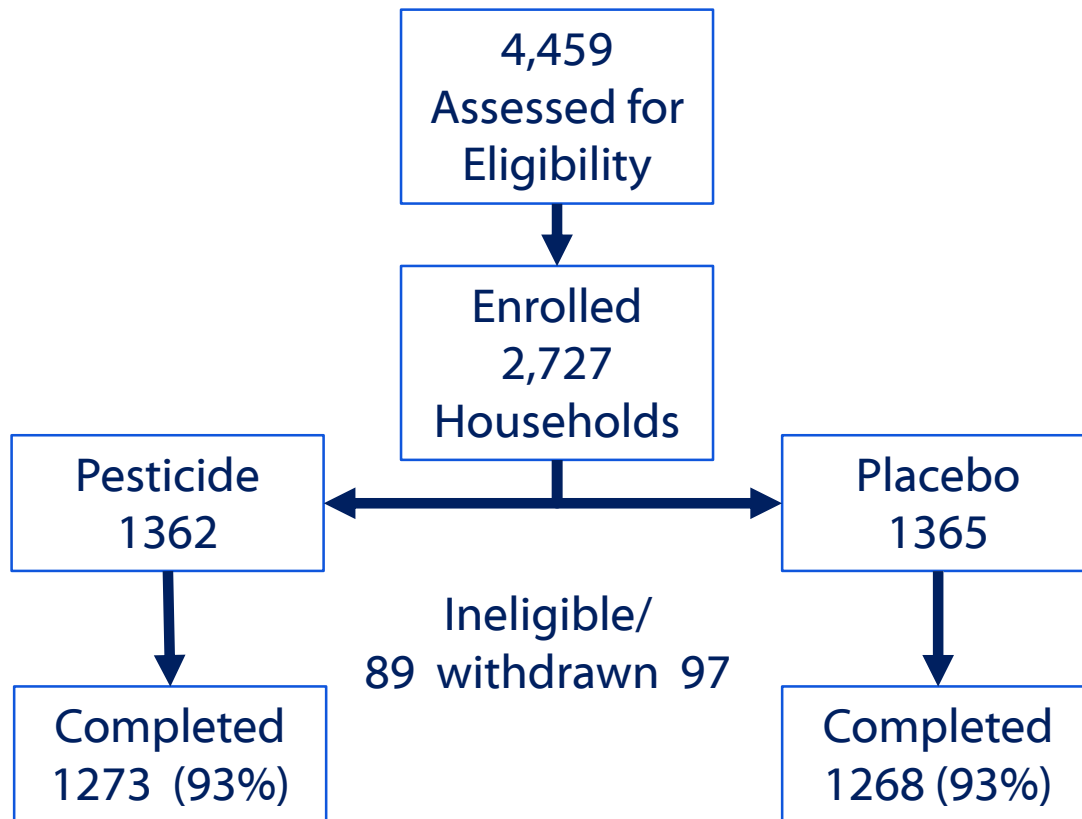


# Study outcomes

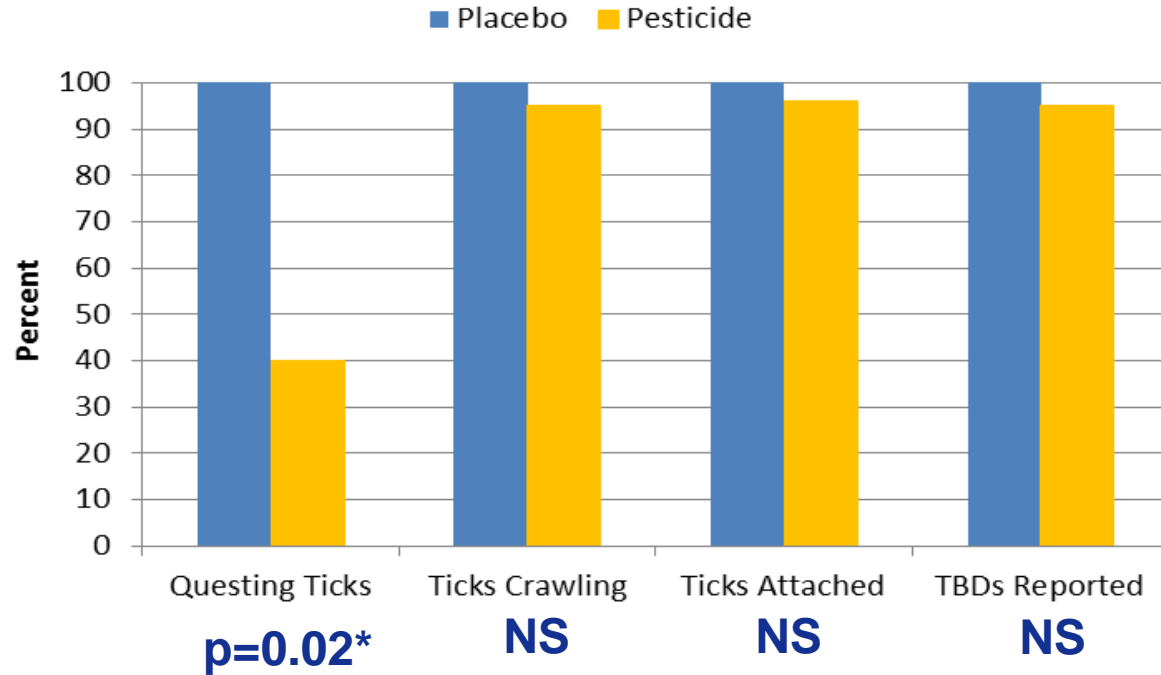
- Entomologic: 10% of properties (n=267) flagged for questing ticks 3-4 weeks post-treatment
- Human:
  - Ticks crawling and attached (ascertained through 4 monthly web-based surveys)
  - Final survey for physician-diagnosed tickborne disease during study periods
  - Medical records to validate illness reports



# Enrollment and completion



# Acaricide trial outcome by treatment group



\*Based on a one-sided Wilcoxon Rank Sum test

# Findings

- Many properties excluded due to water
- Randomization and blinding worked well
- 63.4% fewer ticks on pesticide-treated properties
  - 68.8% in 2011
  - 45.1% in 2012
- Human illness and tick encounters not similarly reduced

# Possible reasons for lack of effect on human outcomes

- Spraying does not include all high risk areas
- Most exposures outside of immediate yard
- Non-linear relation between tick abundance and human exposure
  - “tick-prone” people?
  - tick reduction threshold?



## Summary – synthetic pesticides

- Synthetic pesticides work well to kill ticks
- Residential barrier spray did not protect people from tick encounters or tickborne diseases
- We need to change how/where they are used to protect people
- Commonly used entomologic outcomes (e.g., tick drags) are not sufficient by themselves for assessing effectiveness

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Mark Lamias

For more information, contact CDC  
1-800-CDC-INFO (232-4636)  
TTY: 1-888-232-6348 [www.cdc.gov](http://www.cdc.gov)

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