THE TICK PROJECT

Testing environmental interventions to prevent Lyme and other tick-borne diseases in our communities

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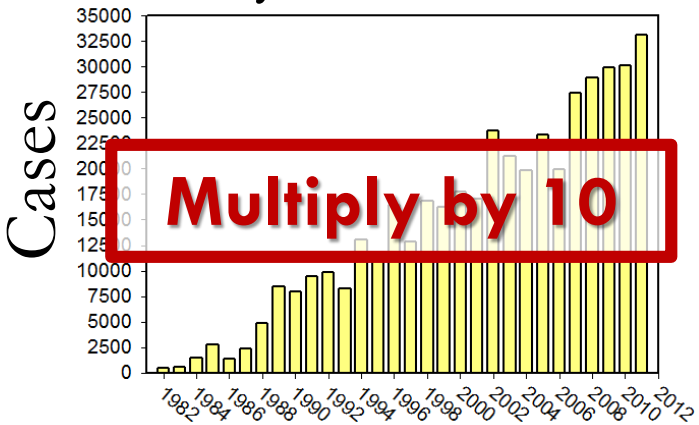
Cary Institute of Ecosystem Studies • Bard College • Centers for Disease Control & Prevention • New York State Department of Health • Dutchess County Department of Behavioral & Community Health

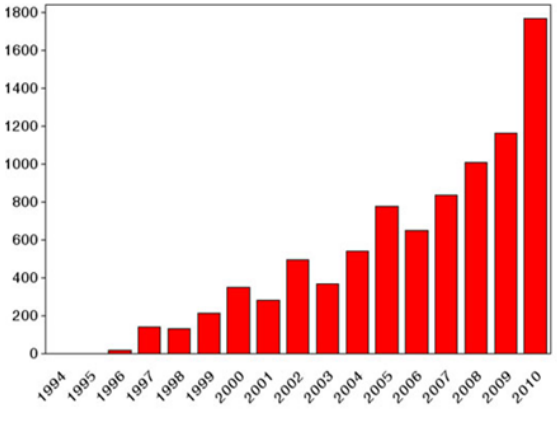
www.tickproject.org

THREE TICK-BORNE DISEASES

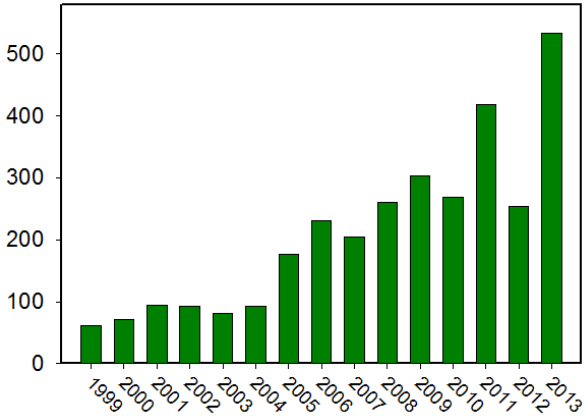
Lyme disease



Anaplasmosis



Babesiosis



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LYME DISEASE 2001

1 dot placed randomly within county of residence for each reported case

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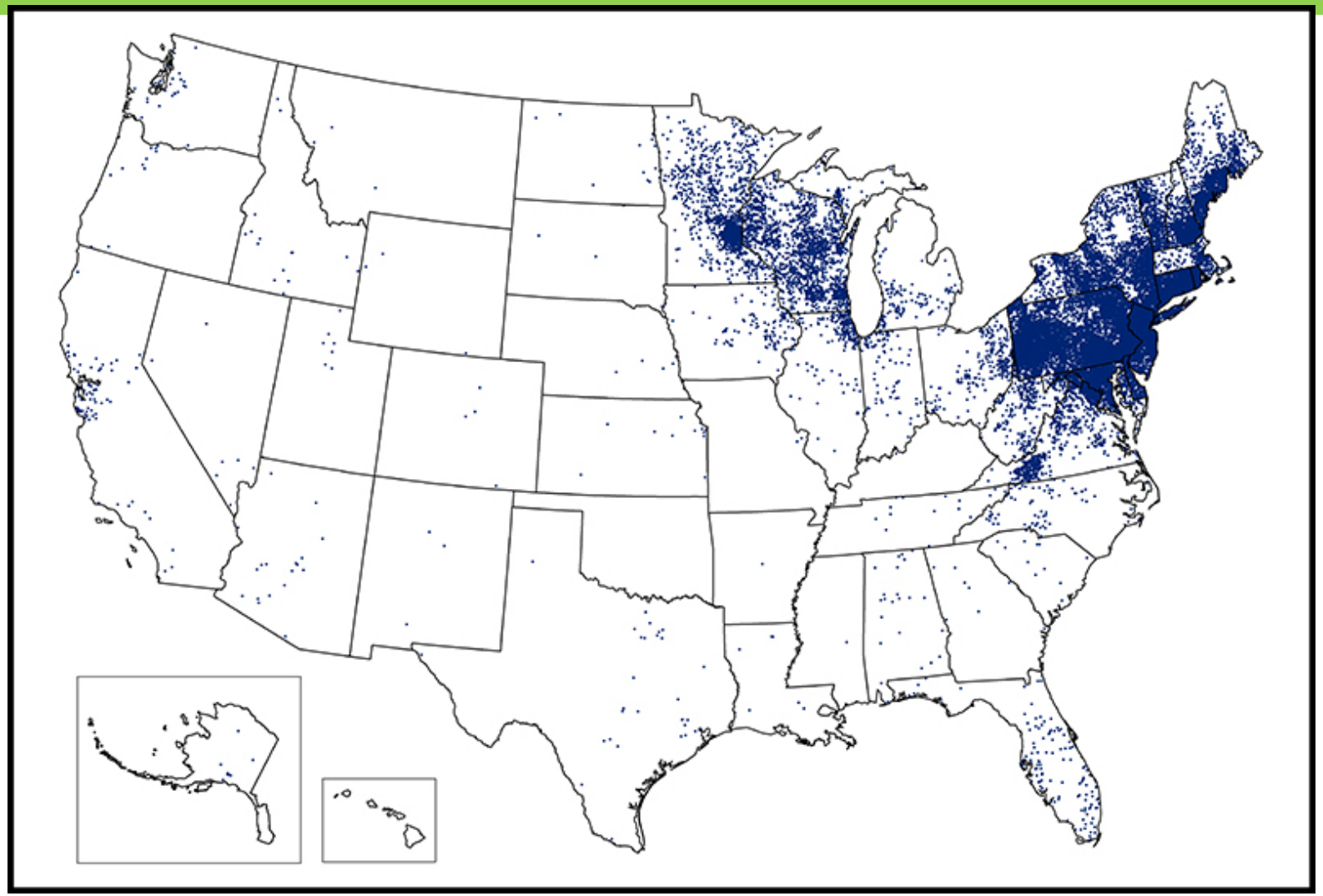
Data from CDC

LYME DISEASE 2017



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Data from CDC

LYME DISEASE IN THE 21ST CENTURY

- Rapidly increasing in incidence and range
- No vaccines available
- Diagnosis and treatment problematic
- Estimated cost: $712M to $1.3B/year
- Effective tick management poorly developed
  - Small scale, poor replication, poor control

MAJOR ARTICLE

JID 2016

Effectiveness of Residential Acaricides to Prevent Lyme and Other Tick-borne Diseases in Humans

Alison F. Hinckley,[1] James I. Meek,[2] Julie A. E. Ray,[2,a] Sara A. Niesobecki,[2] Neeta P. Connally,[3] Katherine A. Feldman,[4] Erin H. Jones,[4,a] P. Bryon Backenson,[5] Jennifer L. White,[5] Gary Lukacik,[5] Ashley B. Kay,[1,a] Wilson P. Miranda,[5] and Paul S. Mead[1]

[1]Division of Vector-Borne Diseases, Centers for Disease Control and Prevention, Fort Collins, Colorado; [2]Connecticut Emerging Infections Program, Yale School of Public Health, New Haven, and [3]Western Connecticut State University, Danbury; [4]Maryland Department of Health and Mental Hygiene, Baltimore; and [5]New York State Department of Health, Albany

2-year, 3-state, 2727-household, placebo-controlled, randomized, double-blind study.

One annual springtime Bifenthrin spray.

Effects on ticks and cases of TBDs

MAJOR ARTICLE

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63% reduction in questing nymphal blacklegged ticks

But……

Table 2. Proportion of Participating Households Reporting Tick Encounters or Physician-Diagnosed Tick-borne Disease, by Treatment Group, Study Year, and Study Site

Outcome, Year(s), Site	Acaricide	Placebo	*P* Value
Ticks crawling			
2011	185/762 (24.3)	209/769 (27.2)	.19
2012	139/541 (25.7)	150/518 (29.0)	.23
Overall	324/1303 (24.9)	359/1287 (27.9)	.08
CT	133/474 (28.1)	157/491 (32.0)	
MD	68/319 (21.3)	60/289 (20.8)	
NY	123/510 (24.1)	142/507 (28.0)	
Ticks attached			
2011	127/762 (16.7)	145/769 (18.9)	.26
2012	86/541 (15.9)	84/518 (16.2)	.89
Overall	213/1303 (16.3)	229/1287 (17.8)	.33
CT	78/474 (16.5)	103/491 (21.0)	
MD	35/319 (11.0)	30/289 (10.4)	
NY	100/510 (19.6)	96/507 (18.9)	
Self-reported illness			
2011	27/739 (3.7)	25/755 (3.3)	.72
2012	14/534 (2.6)	14/513 (2.7)	.91
Overall	41/1273 (3.2)	39/1268 (3.0)	.78
Verified illness			
2011	13/739 (1.8)	14/755 (1.9)	.89
2012	6/534 (1.1)	6/513 (1.2)	.94
Overall	19/1273 (1.5)	20/1268 (1.6)	.90

WHY?

- 63% reduction in tick abundance is too modest?
- Two years is too short?
- Treating individual yards is too restricted?

WHY?

- 63% reduction in tick abundance is too modest? ►Two tick-killing methods
- Two years is too short? ►Five years
- Treating individual yards is too restricted? ►Neighborhood scale

GOAL

Develop and test a safe, effective, and affordable means of preventing tick-borne disease at the scale of whole neighborhoods

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TWO INTERVENTIONS

Metarhizium brunneum (=M. anisopliae)

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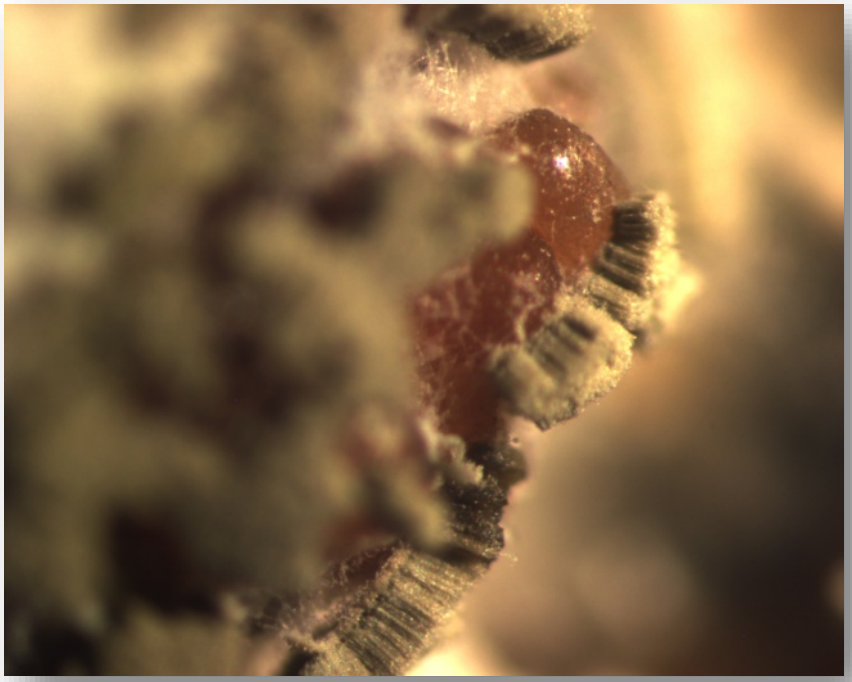
TWO INTERVENTIONS

Metarhizium brunneum (=M. anisopliae)



TWO INTERVENTIONS

Metarhizium brunneum (=M. anisopliae)

Photos: Ray Young, Novozymes

The tick biocontrol agent *Metarhizium brunneum* (= *M. anisopliae*)(strain F52) does not reduce non-target arthropods

Fischhoff, Keesing, Ostfeld, PLOS ONE 2017

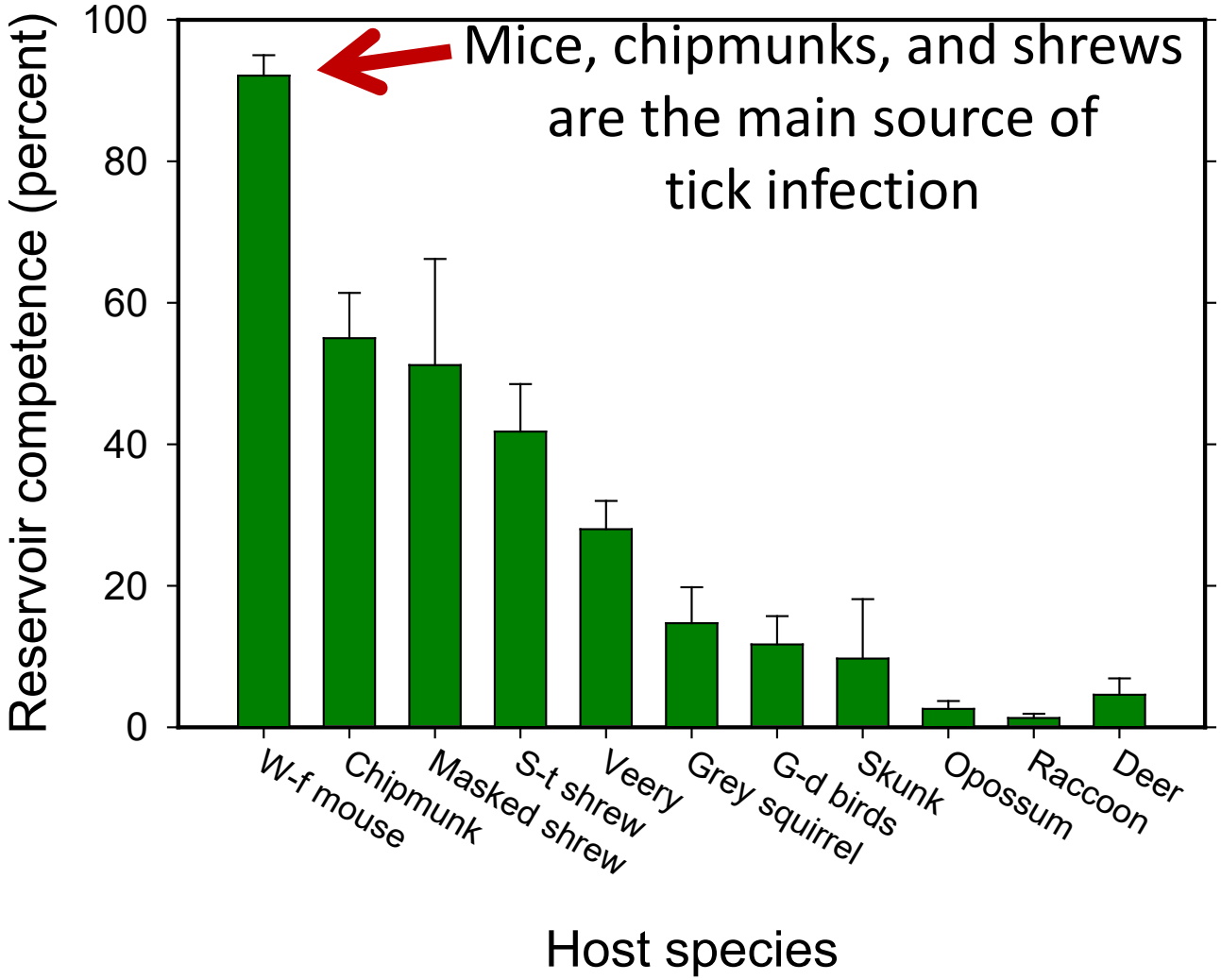
TWO INTERVENTIONS

TCS Bait boxes

Mean = 5.6, mode = 4

TWO INTERVENTIONS

TCS Bait boxes



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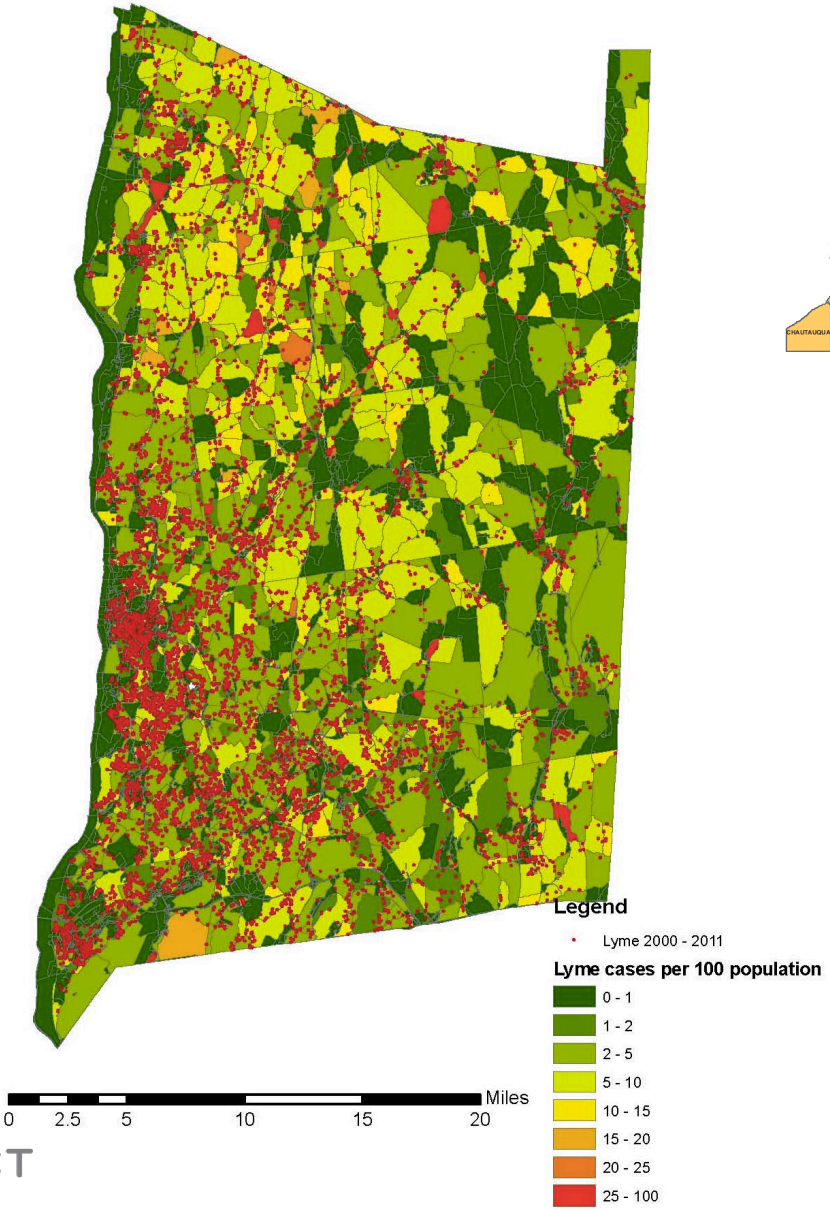
TWO INTERVENTIONS

Met52 kills ticks in the environment

TCS Bait boxes kill ticks on “reservoir hosts” responsible for feeding and infecting many ticks

STUDY DESIGN

Location



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STUDY DESIGN

Neighborhoods

STUDY DESIGN

Interventions, imposed on neighborhoods

(~100 homes)

	Bait boxes	Inactive bait boxes
Fungus	6 replicates	6 replicates
Inactive fungus	6 replicates	6 replicates

Real controls

randomized, placebo-controlled, double-blind

STUDY DESIGN

Response variables

Reporting by participants on: diagnosed cases of tick-borne disease and on encounters with ticks by themselves and their pets

Surveillance by healthcare providers: we contact providers to follow up self-reported cases of tick-borne disease

Tick collection and mammal-trapping by our team: we estimate tick abundance and infection prevalence with four tick-borne pathogens

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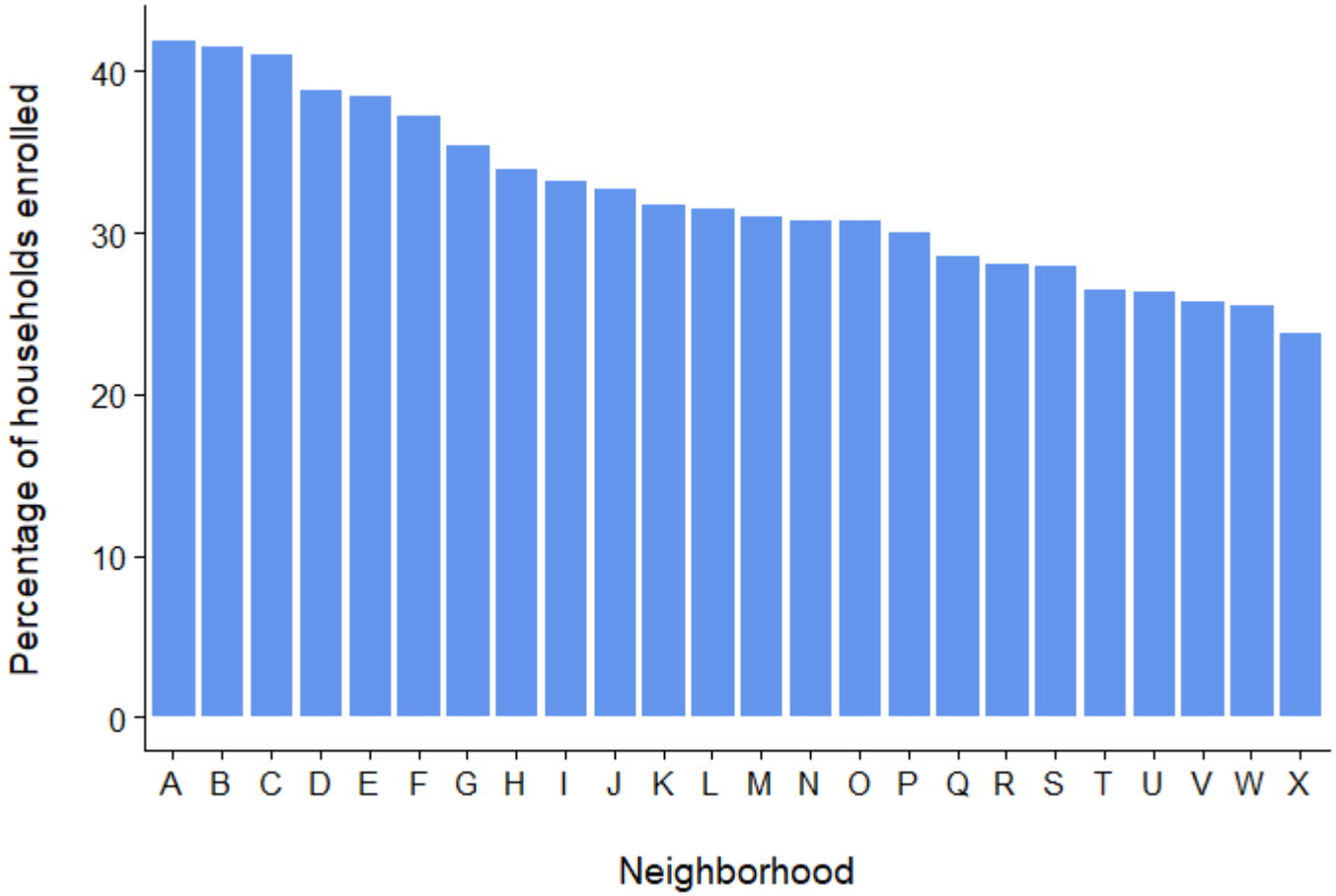
PROGRESS TO DATE: 2016



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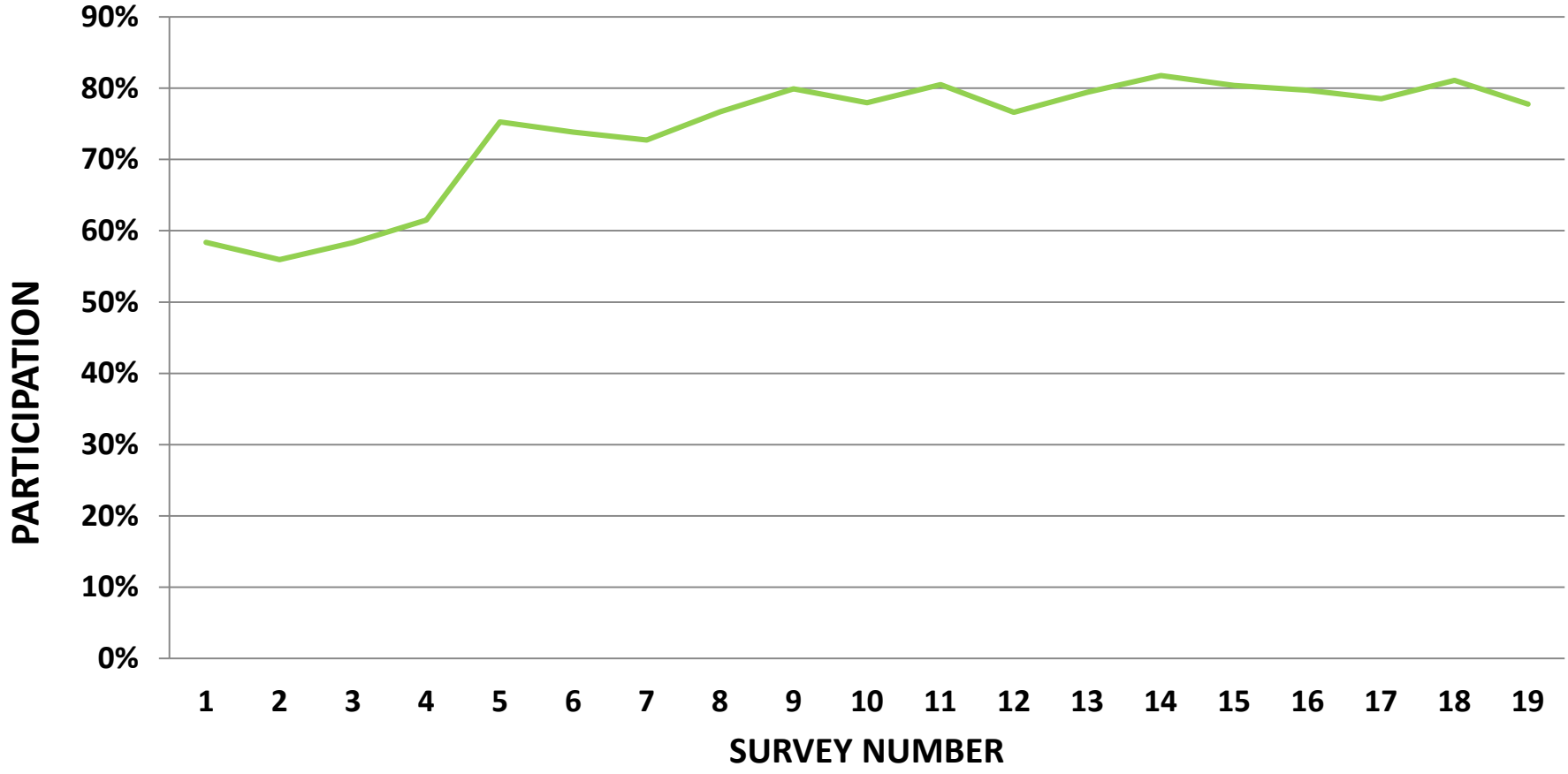
PROGRESS TO DATE: 2019

Response to biweekly surveys on tick encounters and tick-borne disease.



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PROGRESS TO DATE: 2019

- 985 participating households
- ~2520 participating people
- 29,274 surveys completed
- 517 properties sampled for ticks
- 289 properties sampled for small mammals
- Beginning 3rd year of interventions in all 24 neighborhoods

EXPECTATIONS

- Two interventions will be more powerful than one
- Longer duration (spray twice, boxes all season, four years of treatments) more effective
- TCS bait boxes will reduce infection prevalence as well as abundance of ticks
- Treatment of neighborhoods more effective than single yards

LOGISTICS

- Five year project, 2016 through 2021
- 2017 was the first year of interventions
- 2018 first year of full effects
- Funding from the Steven & Alexandra Cohen Foundation
- Additional funding from numerous smaller donations

FOR MORE INFORMATION

www.tickproject.org

ostfeldr@caryinstitute.org

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