

# Georgia Tick Attach Study: Illness following a tick bite

Georgia Mosquito Control Association  
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# Outline

- Human-biting ticks in Georgia
- Tickborne disease (TBD) burden in Georgia
- Study methods
- Demographics of study participants
- Preliminary tick testing results
- Preliminary associations with illness
- Conclusions

# *Amblyomma americanum*

## Lone star tick

- *Ehrlichia chaffeensis*,  
*E. ewingii*, Panola  
Mountain *Ehrlichia* –  
ehrlichiosis
- *Borrelia lonestari* –  
suspected cause of  
southern tick-  
associated rash  
illness (STARI)
- *Francisella tularensis*  
– tularemia



# *Dermacentor variabilis*

## American dog tick

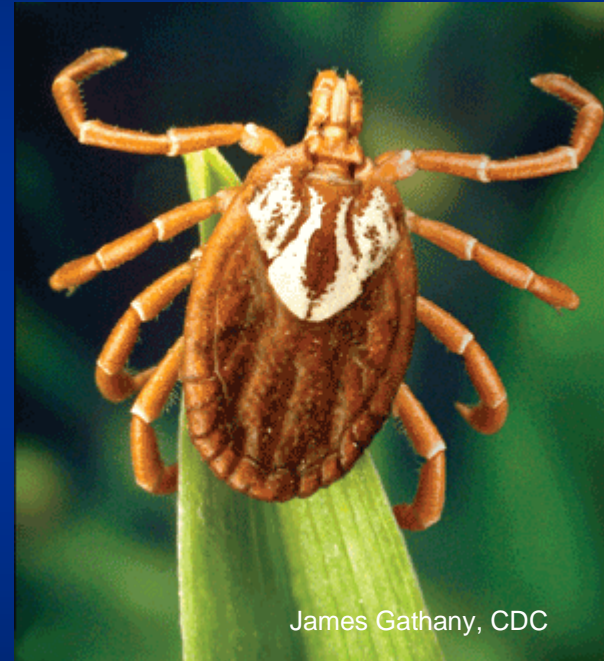
- *Rickettsia rickettsii* – Rocky Mountain spotted fever (RMSF)
- *Ehrlichia chaffeensis*, *E. ewingii*, Panola Mountain *Ehrlichia* – ehrlichiosis
- *Francisella tularensis* – tularemia



# *Amblyomma maculatum*

## Gulf coast tick

- *Rickettsia parkeri* – *R. parkeri* rickettsiosis



# *Ixodes scapularis* Blacklegged tick

- *Borrelia burgdorferi* –  
Lyme disease
- *Anaplasma  
phagocytophilum* –  
human granulocytic  
anaplasmosis (HGA)
- *Babesia microti* –  
babesiosis



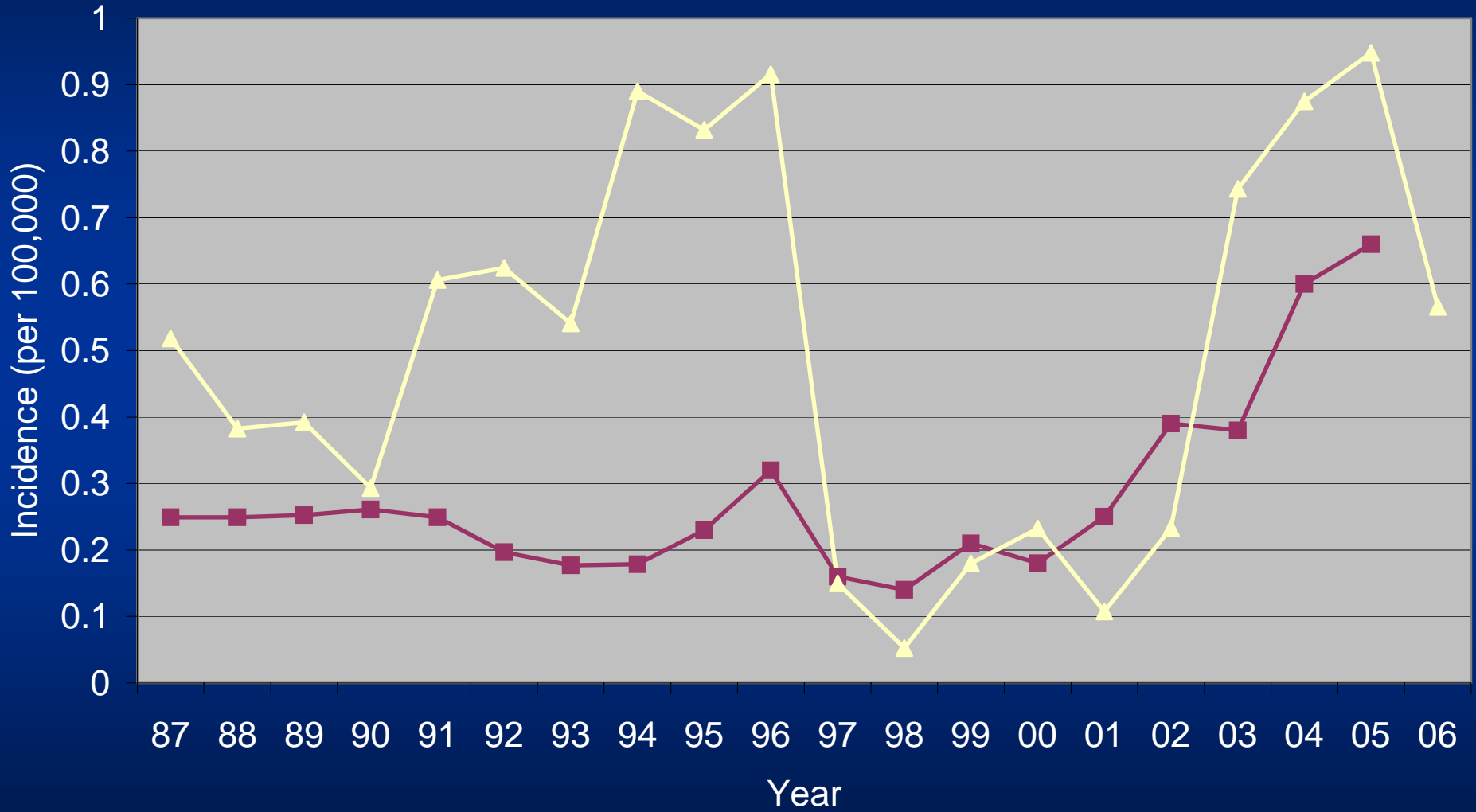
James Gathany, CDC

# Tickborne Disease Burden in GA

- Every year, cases of Rocky Mountain spotted fever (RMSF), human monocytic ehrlichiosis (HME), and Lyme disease are reported to the Georgia Division of Public Health (GDPH).
- GA generally has a higher incidence of RMSF than the national average, but a much lower incidence of Lyme disease.
- Occasionally, cases of human granulocytic anaplasmosis (HGA), tularemia, and suspected southern tick-associated rash illness (STARI) are reported.

# Incidence of Rocky Mountain Spotted Fever, 1987-2006

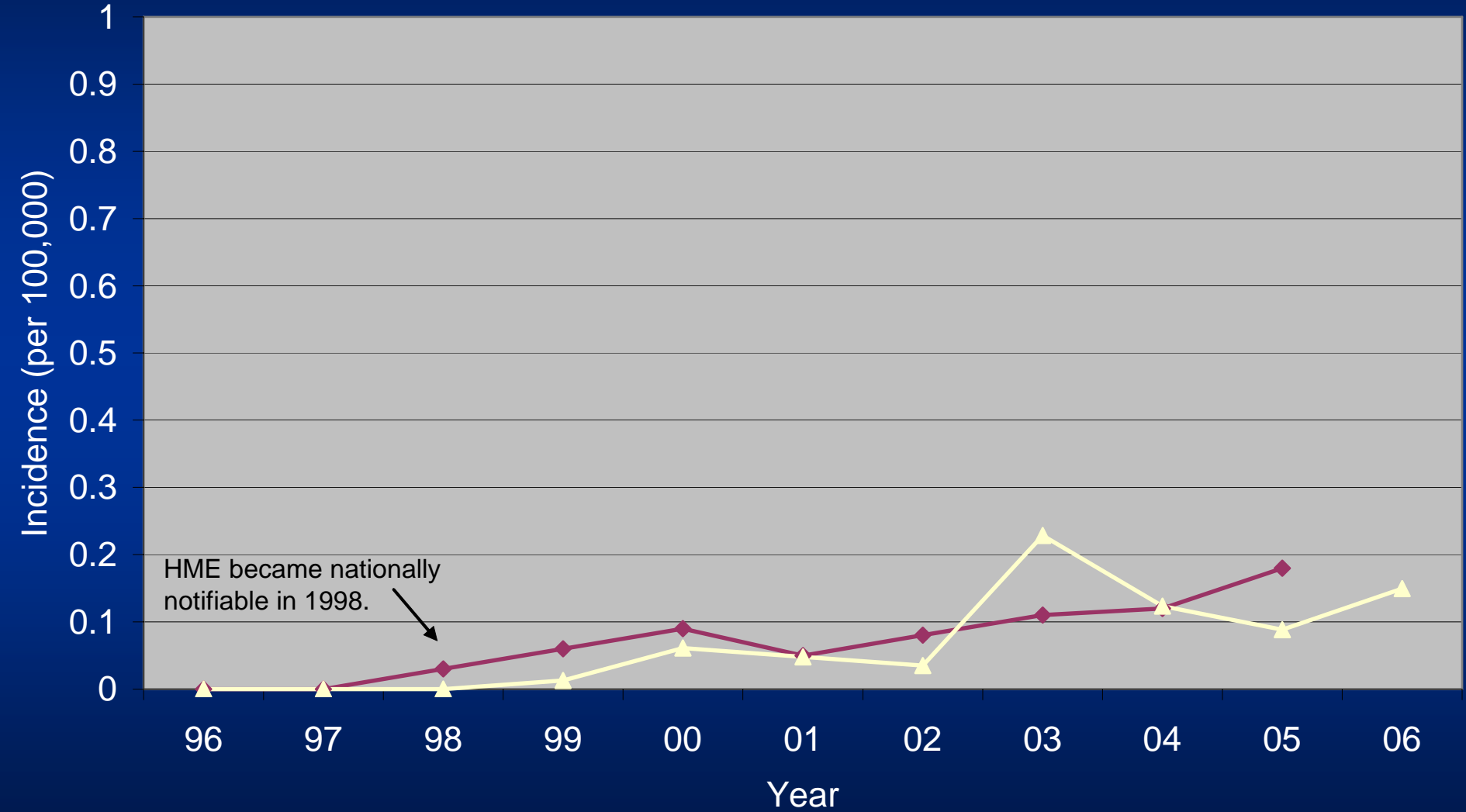
United States Georgia





# Incidence of Human Monocytic Ehrlichiosis, 1996-2006

United States Georgia



# Incidence of Lyme Disease in Georgia, 1996-2006



Nationwide Lyme disease incidence is currently increasing and was 7.9 per 100,000 in 2005.

# Tick Attach Study Objectives

- Partners
  - Georgia Division of Public Health (GDPH)
  - University of Georgia (UGA)
  - Georgia Poison Center (GPC)
- Objectives
  - **Better characterize the epidemiology** of tickborne diseases in Georgia by describing prevalence of infected ticks
  - **Estimate the importance** of various tick species regarding human disease
  - **Identify regions** in Georgia where risk of acquiring tickborne disease is greatest

# Tick Attach Study Methods

- Between April 1, 2005 and December 31, 2006
- Accepted ticks that were ATTACHED to PEOPLE for species identification and testing
- Ticks were attached to GA residents OR were acquired in GA



# Tick Attach Study Methods

- Person finds an attached tick and calls Georgia Poison Center (GPC)
- GPC explains tick removal (if not already done) and asks if they want to be involved in research study
- If yes, person mails the tick (in rubbing alcohol) to GDPH
- GDPH de-identifies and sends to UGA
  - Tick species identification
  - Tests for bacteria that cause RMSF, HME, HGA, Lyme, STARI, and tularemia
- GDPH administers questionnaire ascertaining exposures and symptoms via phone 3 weeks later

# Advertising

- Press release resulting in stories in
  - Newspapers
  - Radio
  - TV news
- Websites (state, district, county)
- E-mail to public health workers across the state
- Partnered with DNR
  - Brochures to 60 state parks and 75 wildlife mgmt areas
  - Posters for 200 deer check stations
  - Press release for outdoor news media
- Lots of advertising in 2005, but not much in 2006 (GDPH efforts were the same, but media did not pick up in 2006.)

# Participation

- There were 807 enrollees in the study, and 462 submitted their tick for testing (57.3%).
- There were no statistically significant differences between people who enrolled and did NOT submit their tick and people who enrolled and DID submit their tick based on:
  - Median household income by census tract ( $p=0.10$ )
  - Percent white by census tract ( $p=0.78$ )
  - Percent Hispanic by census tract ( $p=0.66$ )
  - Demographic profiles (from OASIS) ( $p=0.07$ )
- Conclusion: selection bias was not present among enrollees and participants based on available variables

# Barriers to Enrolling in the Study After Finding an Attached Tick

- Knowledge of the existence of the study
- Interest in the study
- Saving the tick
- Having time to enroll
- Access to phone
- Calling GPC the same day to get instructions for putting the tick in alcohol

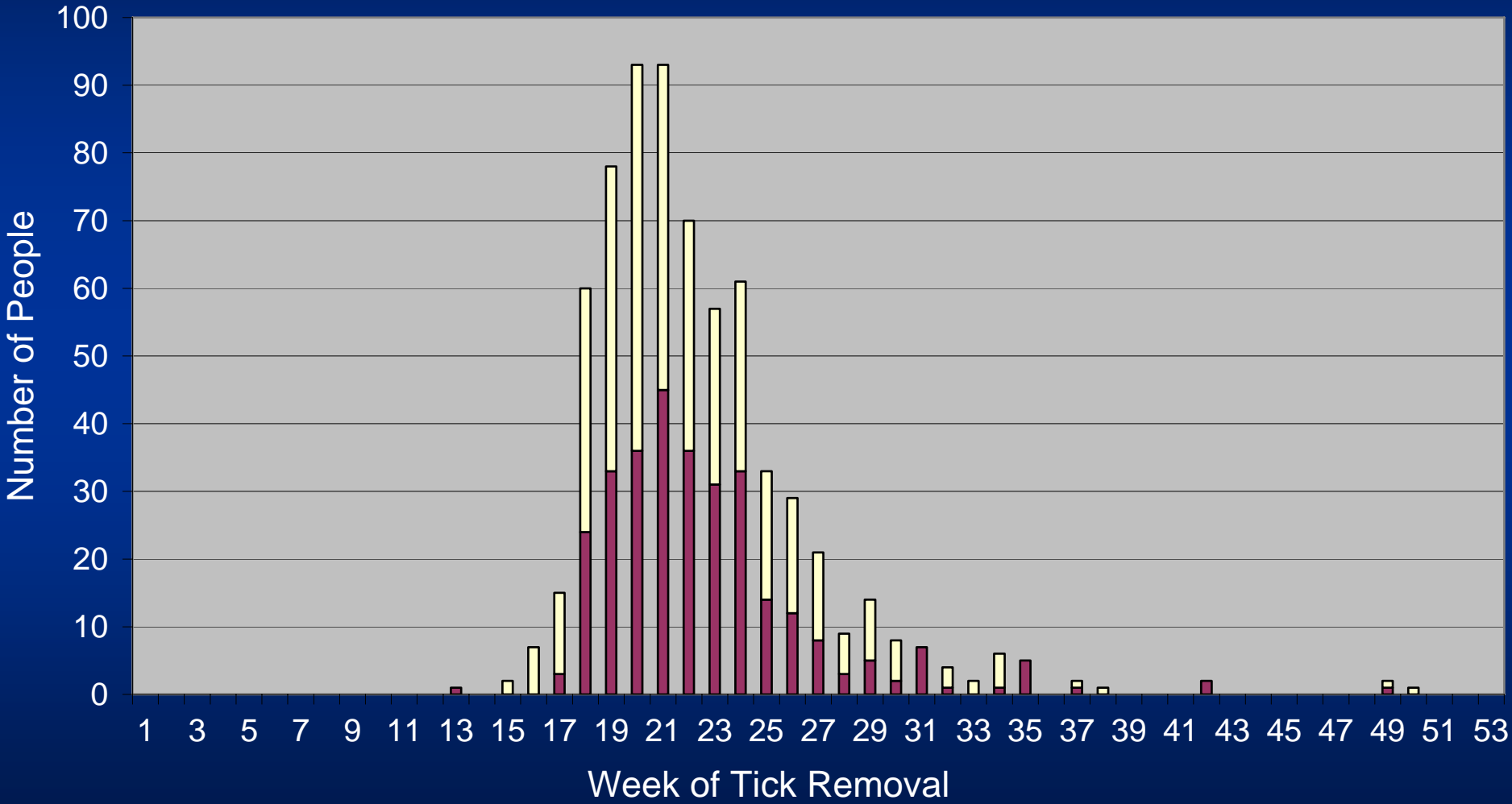


# Barriers to Mailing the Tick After Enrollment

- Finding rubbing alcohol, a suitable container for the tick, and a suitable box for mailing
- Proximity to and transportation to the post office
- Remembering to mail the tick
- Busy lifestyles
- Cost (or perceived cost) of mailing the tick (about \$1-\$2)
- Perceived complexity of the process
- Lag time for results

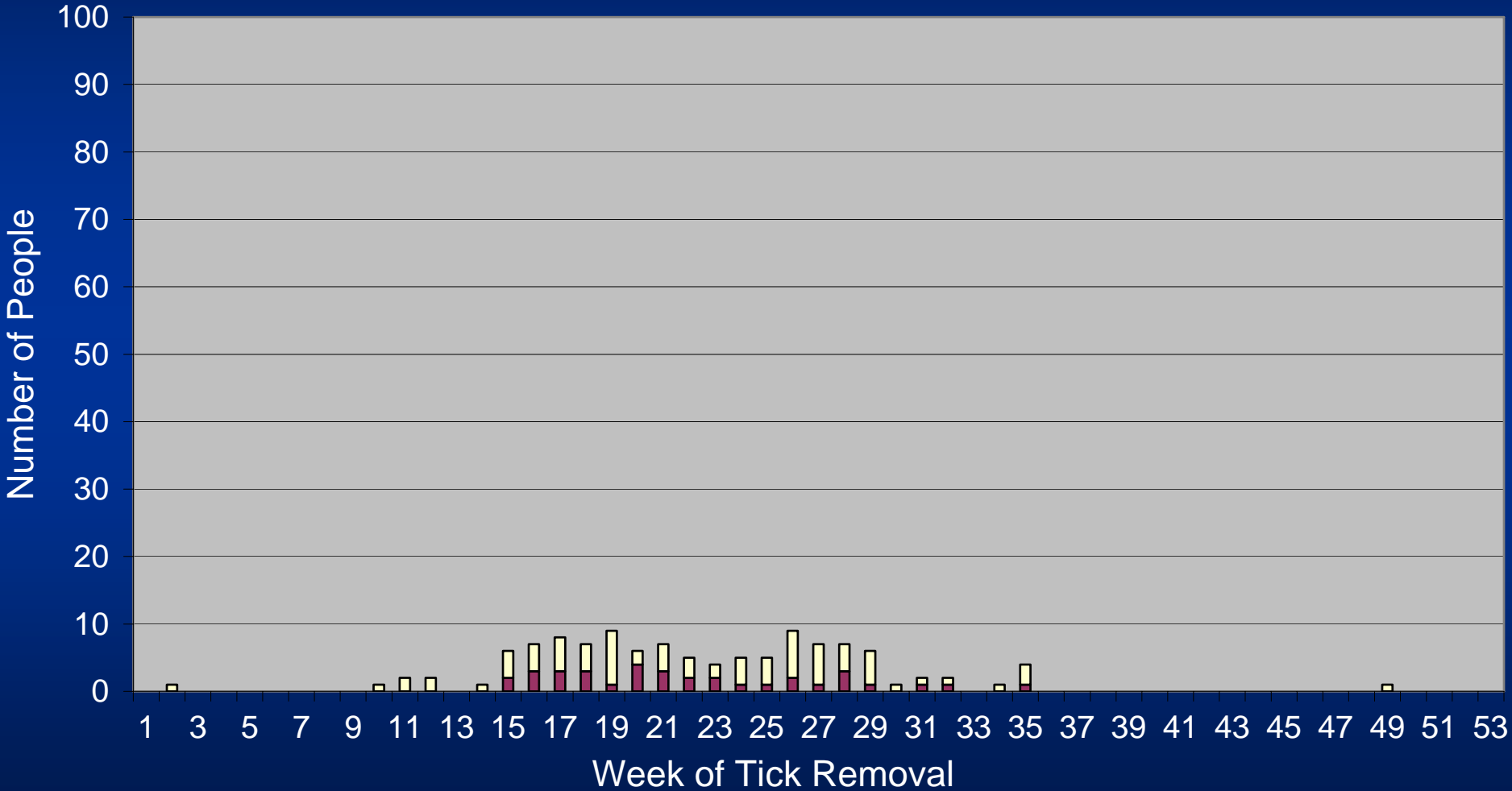
# Number of Tick Attach Study Enrollees and Participants by Week of Tick Removal 2005

■ Number of Enrollees ■ Number of Participants



# Number of Tick Attach Study Enrollees and Participants by Week of Tick Removal 2006

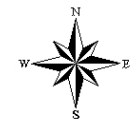
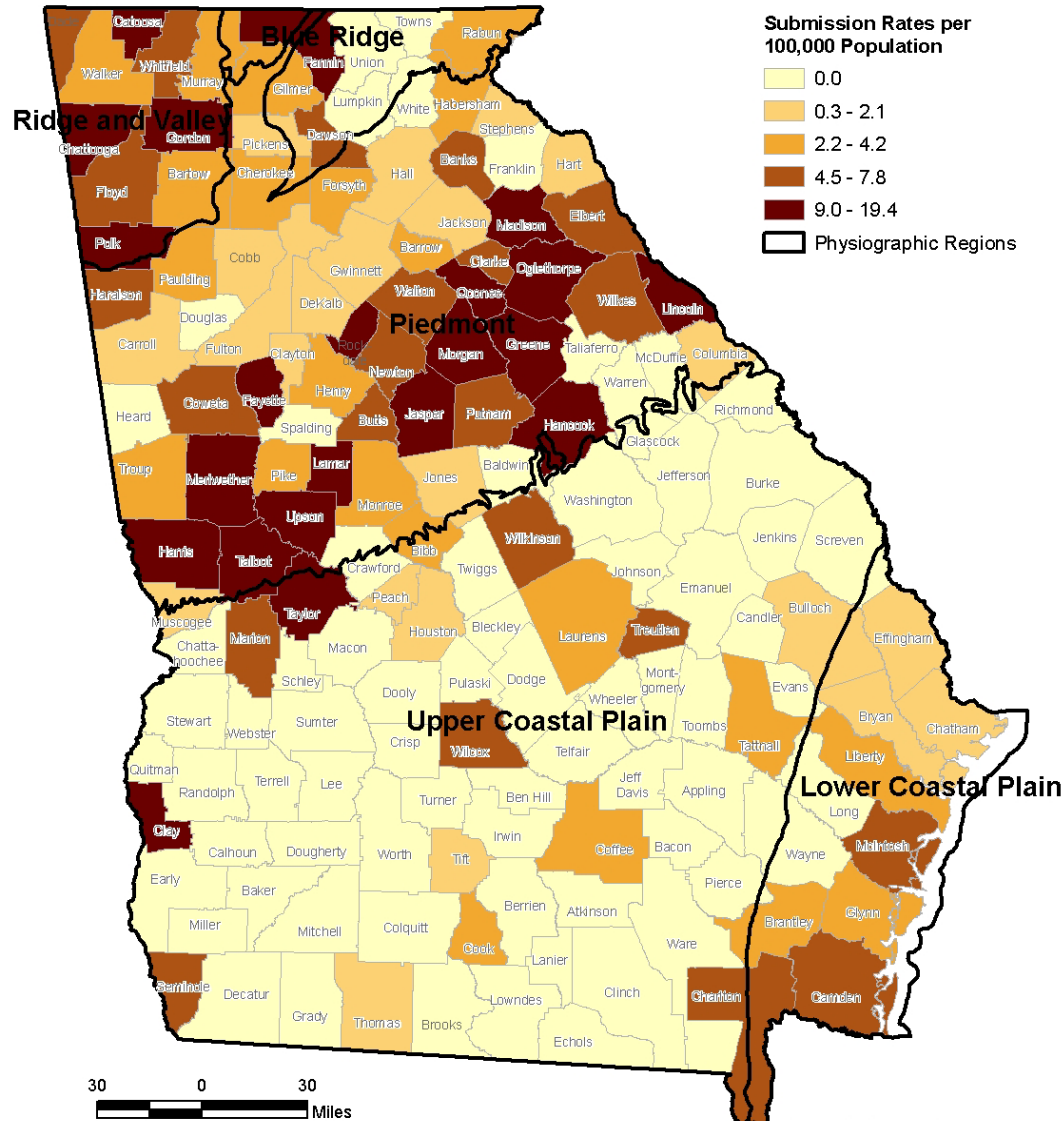
■ Number of Enrollees ■ Number of Participants



# Overall Demographics for People Who Sent in a Tick and Completed the Questionnaire

- The total number of people submitting ticks equaled 462 between April 1, 2005 & December 31, 2006.
- Of these, demographic information is available for 413 (89.4%) (those who completed the questionnaire).
- 50.6% male
- Median age = 50 (range 1-90)
- 95.9% non-Hispanic white (in GA in 2005, 59.6% of the population was non-Hispanic white)

# Tick Attach Study Submission Rates by County Where Bitten



# Preliminary Results

- Of the 462 participants who mailed their tick(s), complete tick testing results are available for 339 participants who submitted 449 ticks and completed the questionnaire between April 1, 2005 and April 4, 2006.

# Preliminary Tick ID Results

- *Amblyomma americanum* (n=322)
  - *Dermacentor variabilis* (n=103)
  - *Amblyomma maculatum* (n=11)
  - *Ixodes scapularis* (n=6)
  - *Amblyomma* sp. (n=4)
  - Unknown (n=3)
- 
- There were twice as many adults submitted as nymphs. There were no larvae submitted.

# Preliminary Prevalence of Infected Ticks

- Of 322 *A. americanum* submitted:
  - 88 (27.3%) were positive for *Rickettsia amblyommii*
  - 1 (0.3%) was positive for *Ehrlichia chaffeensis*
  - 1 (0.3%) was positive for *Borrelia lonestari*
- Of 103 *D. variabilis* submitted:
  - 12 (11.7%) were positive for *Rickettsia montanensis*
  - 2 (1.9%) were positive for *Ehrlichia ewingii*
  - 1 (0.97%) was positive for the Panola Mountain *Ehrlichia*
- 1 of 11 (9.1%) *A. maculatum* was positive for *Rickettsia parkeri*



# Positive Ticks

117 (26.1%) ticks submitted were bacteria-positive, 6 (1.3%) for a known human pathogen.

Tick Species	Results +	Results +
<i>A. americanum</i>	<i>Ehrlichia chaffeensis</i>	<i>Rickettsia amblyommii</i>
<i>A. americanum</i>	<i>Borrelia lonestari</i>	
<i>D. variabilis</i>	<i>Ehrlichia ewingii</i>	<i>Rickettsia montanensis</i>
<i>D. variabilis</i>	<i>Ehrlichia ewingii</i>	
<i>D. variabilis</i>	Panola Mtn <i>Ehrlichia</i>	
<i>A. maculatum</i>	<i>Rickettsia parkeri</i>	

# Illness After Tick Bite

- Sixty-one (18.0%) people reported being sick in the 3 weeks following their tick bite, and 23 (37.7%) of these illnesses were clinically compatible with a tickborne disease.
- Clinically compatible illness: based on surveillance case definitions
  - Fever or rash, plus either headache or muscle aches or both
  - OR bulls-eye shaped rash
- Those who were clinically compatible were no more likely than those who were sick but not clinically compatible to seek medical treatment, have blood drawn, or be prescribed medicine for their illness.

# Frequencies of Symptoms\*

Being “sick” after tick bite was not statistically associated with having been bitten by a positive tick. Conclusion: many illnesses after tick bite are not related to the tick bite.

Symptom	n (%)
Fever	22 (37.3)
Rash	15 (25.4)
Headache	28 (47.5)
Myalgia	21 (35.6)
Malaise	37 (62.7)
Chills	19 (32.2)
Nausea	30 (50.9)
Vomiting	12 (20.3)
Diarrhea	15 (25.4)
Stomach pain	22 (37.3)

Symptom	n (%)
Loss of appetite	18 (30.5)
Confusion	6 (10.2)
Cough	21 (35.6)
Dizziness	15 (25.4)
Joint pain	19 (32.2)
Photophobia	5 (8.5)
Sweats	16 (27.1)
Altered sense of taste	4 (6.8)
Weight loss	5 (8.5)

\* 2 people who reported being sick did not have symptoms recorded

# Illness After Tick Bite

- What might logically make a difference in whether someone developed a clinically compatible TBD in the 3 weeks following their tick bite?
  - Tick tested positive
  - Tick engorgement status
  - Species of tick, if certain species are more likely to carry human pathogens
  - Submitting multiple attached ticks, since getting bitten by multiple ticks increases the chance that one might be infected. (However, submitting multiple ticks is not the same thing as being bitten by multiple ticks.)
  - Physiographic region, if related to species
  - Length of time tick was attached
  - Presence of chronic conditions
  - Age

# Illness After Tick Bite

- The risk of developing a clinically compatible illness following a tick bite was 1.72 times higher among those who submitted a bacteria-positive tick compared to those who submitted only negative ticks (95% CI: 1.12-2.63)
- All other variables listed in previous slide showed no association with development of a clinically compatible illness

# Conclusions

- Other than infectivity status of the tick, we did not identify any variables that might assist in determining whether or not a person will develop a clinically compatible illness.
- Georgians are exposed to a variety of bacteria via tick bites.
- Many illnesses after a tick bite are not related to the tick bite.

# Limitations

- Selection bias (see “Barriers to Enrolling in the Study” and “Barriers to Mailing the Tick”)
- Selection bias due to high and low periods of media interest
- Subject to recall bias due to self-reported information 3 weeks after tick bite
- Study is not generalizable to all Georgians due to demographic differences between the volunteer study population and the state population

# Acknowledgements

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  - Meghan Weems
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- Georgia Department of Natural Resources
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