

# Evaluating General Public Knowledge of Ticks (Acari: Ixodidae) and Tick-Borne Diseases

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Edited by: Megan Kopecki

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**Abstract:** Tick-borne disease is an ever-present and ever-growing threat in the United States, with Lyme disease being the most commonly diagnosed vector borne disease in the country overall. Despite this threat, recent studies have reported broad knowledge deficits in regard to tick-borne disease prevention methods even in endemic areas and with high-risk groups including those regularly working outdoors in highly tick populated areas. This study aimed to assess the level of knowledge of the general public in terms of basic tick biology, tick-borne disease, and tick bite prevention methods through the use of an anonymous, internet-based survey spread through social media as well distributed at a local high school. The results of this survey showed broad gaps in knowledge of the surveyed population in each of the three aforementioned areas, possibly signaling the need for disease-prevention based public outreach and informational campaigns in order to better protect against tick-borne disease.

*Keywords: Tick-borne disease, Ixodidae, disease, vector, Lyme Disease*

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Ixodidae ticks, or hard ticks, as they are commonly referred, are obligate parasites of humans and animals as well as important vectors of pathogens. In humans, these ticks are responsible for disease such as Rocky Mountain spotted fever, ehrlichiosis, tularemia, babesiosis, Colorado tick fever, relapsing fever, and Lyme disease (Bratton 2005). Tick-borne diseases (TBD's) are on the rise geographically and with around 45,000 cases of reported tick-borne disease annually in the United States alone, ticks pose a direct threat to human health (Paules et al. 2018).

One particular health threat is Lyme disease, the most common TBD in the United States. Lyme disease is caused by the bacteria *Borrelia burgdorferi* and is spread by various species in the genus of *Ixode*. (Eisen 2020). Lyme disease has garnered increased media

attention in recent years due to coverage of “Chronic Lyme disease” of which the

existence has been hotly debated (Feder et al. 2007). Despite this increased media attention and the growing threat of tick-borne disease, there is little focus on disease prevention in terms of public outreach or informational campaigns. Unlike with mosquito-borne disease, there are not usually outbreaks of TBD's that create a public desire for information on prevention methods. Instead, these diseases linger as endemic infection in many U.S. states, and as a result, draw less attention.

This lack of focus appears to have consequences in the form of broad knowledge deficits surrounding ticks and the diseases they spread. In one study it was found that even among occupational and recreational users of the outdoors, who are at

a much higher risk for tick bites, there was a low level of knowledge of Lyme disease as well as tick bite prevention methods (St. Pierre et al. 2020). Another study regarding tick-borne disease prevention methods among U.S forest workers, a very high-risk group for tick exposure, showed a high level of concern among participants surrounding tick-borne disease, but relatively low participation in tick bite prevention methods (Schotthoefer et al. 2020). Both of these surveys targeted groups who were at a much higher risk of tick bites than the general public and, theoretically, should be more knowledgeable on the topic of tick-borne disease. Despite this, both studies reported low levels of knowledge. Because of these results, research is needed in order to gather an understanding of the relative level of knowledge that the general public has in terms of tick-borne disease and tick bite prevention methods.

### **Materials and Methods**

This evaluation was conducted through the use of an internet-based survey that took roughly five minutes to complete and could be accessed through any internet connected device. The survey consisted of 15 questions of multiple choice, true/false, and checkbox varieties. (See appendix for copy of survey) The evaluation was conducted through the program, Google Forms (Mountain View, CA), and was distributed through the use of social media (Instagram, Menlo Park, CA) as well as a distribution at a local public high school. The survey gathered 30 individual responses. As this was a survey spread through social media as well as among high school students, participation was heavily skewed towards under 18 and 18–23-year-olds. The questions implemented were designed to gather information regarding the surveyed population’s level of knowledge surrounding basic tick biology and feeding

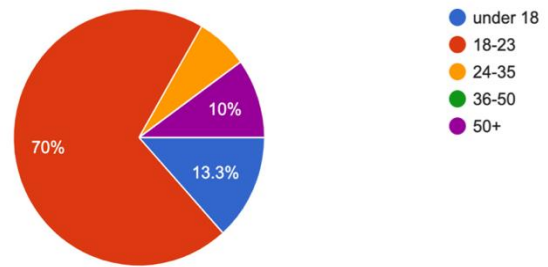
methods, base level information of tick-borne disease, and tick bite prevention methods.

Once the survey was completed, the data was analyzed simply by what percentage of the total participants answered the question correctly.

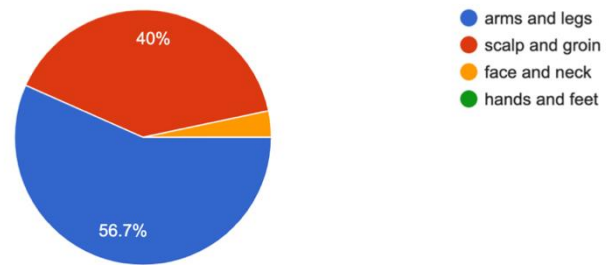
### **Results**

This study of the general public’s knowledge of ticks and tick-borne diseases found a broad range of knowledge levels as well as a lack of knowledge in key areas. The results of the age survey questions revealed a skew towards younger generations with 70% of participants being in the 18–23-year-old category (figure 1). The region question yielded a similar result with 96.7% of participants stating that they lived in the state of Texas. In terms of the true survey questions, 56.7% of survey participants stated that they had found a tick attached to their body in the past, with 43.3% stating that they had not ever found a tick attached to their body, and 6.7% of participants stating that they were unsure if they had ever found a tick on their body. 100% of participants correctly responded that ticks primarily fed on blood. However, when asked which parts of the body they were most likely to find a tick attached, the correct answer: “warm moist areas like the scalp and groin” (Burke 2018) was chosen by only 40% of participants (figure 2). 93.3% of participants correctly selected that they would most likely be at risk for ticks in grassy, brushy, or wooded areas. The question “Which age group has the highest incidence of tick bites had a broad range of responses with only 27.6% of participants correctly choosing the answer “young children” (Bryant and Marshall, 2000). When asked what group ticks belong to, 30% of participants

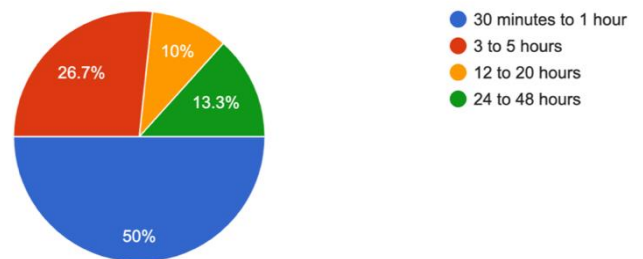
responded correctly with arachnids, with 56.7% believing them to be insects, 10% believing them to be crustaceans, and 3.3% of participants believing ticks to be mollusks. 90% of participants correctly identified Lyme Disease to be the most common tick-borne disease in the United States (Murray and Shapiro 2013) with 10% of respondents believing the answer to be Rocky Mountain Spotted Fever. For the question as to whether some tick-borne diseases could be transmitted within 15 minutes of attachment, 73.3% correctly stated that the statement was true (Bryant and Marshall 2000). When asked how long a tick must usually be attached in order to transmit Lyme Disease, 13.3% of participants chose the correct response of 24-48 hours (Murray and Shapiro 2013) (figure 4). For the question regarding the yearly incidence of tick-borne disease in the United states, 36.7% of participants correctly chose “roughly 45,000 cases” with 50% of participants responding, “roughly 2,000 cases” (Paules et al. 2018) (figure 5). The question regarding tick prevention methods found a broad range of answers that can be seen in figure 6. For the question regarding how to best remove an attached tick, 36.7% of participants responded correctly that the tick should be removed using tweezers to pull steadily upward without twisting (CDC 2019) (figure 7). On the last survey question 93.3% of participants correctly responded that the tick head could become detached from the body during removal and cause infection (CDC 2019).



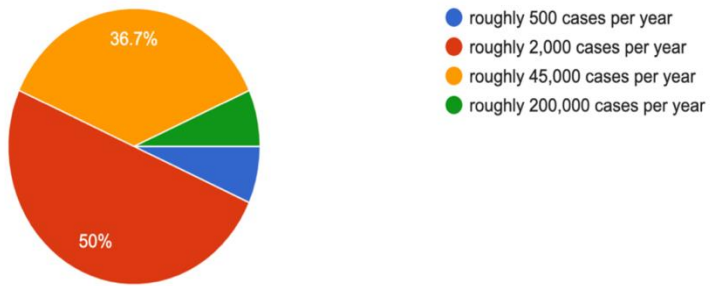
**Fig. 1:** Survey responses from question “What is your age”



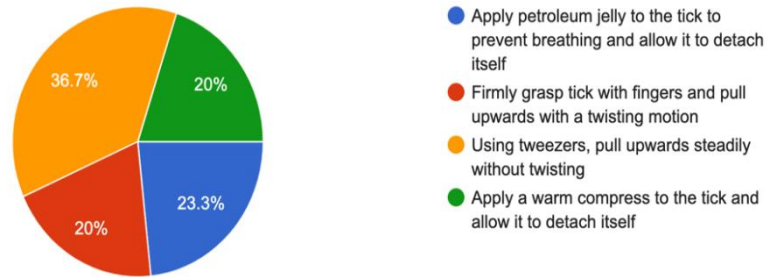
**Fig. 2** responses to the question “Which areas of the body are you most likely to find a tick attached?”



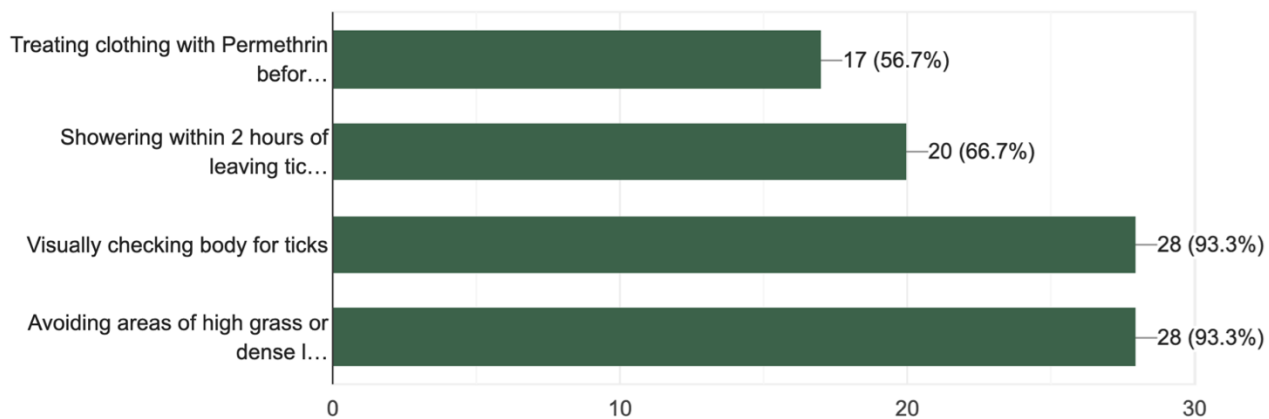
**Fig. 4:** Survey responses from question “How long must a tick usually be attached to transmit Lyme Disease?”



**Figure 5:** Survey responses from question: “What is the yearly reported incidence of tick-borne disease in the United States”



**Figure 7:** Survey responses from question: “How should a tick be removed”



**Figure 6:** Survey responses from question: “Select all valid tick prevention methods” the answer choices being “treating clothing with Permethrin before visiting tick heavy areas”, “showering within 2 hours of leaving tick heavy areas”, “visually checking body for ticks” and “avoiding areas of high grass or dense leaf litter”.

## Discussion

The purpose of this study was to get an idea of the level of knowledge that the surveyed population had regarding key details of ticks and tick-borne diseases. The level of knowledge was assessed in a broad sense by simply quantifying what percentage of the surveyed population answered each question correctly. And from this point of view, a general lack of knowledge was found in key

areas. While most participants knew of Lyme disease and its presence as the most common tick-borne illness in the United States, there was a lack of knowledge regarding the details of the disease as well as prevention methods. This can be seen with the questions regarding what parts of the body ticks commonly attach to, which age group has the highest incidence of tick bites, and how long a tick must be

attached to transmit Lyme disease. In all of these questions the majority of participants answered incorrectly. This is in line with the St. Pierre study regarding knowledge of Lyme disease and Lyme disease prevention methods in occupational and recreational users of the outdoors. In this study, the researchers found that, despite the surveyed population being more at risk for developing Lyme disease due to their time spent outdoors, the surveyed participants showed a level of knowledge that was insufficient to effectively protect them from tick-borne illness. (St. Pierre et al. 2020). A similar lack of knowledge was found in the survey question regarding the number of reported cases of tick-borne illness in the United States per year. 50% of the participants of the study believed that there were only roughly 2,000 cases of reported tick-borne illness per year, a far cry from the roughly 45,000 cases that there are in actuality (Paules et al. 2018).

Despite the prevalence of tick-borne illness in the United States, these results show a knowledge deficit in the surveyed population and indicates a need for further public awareness of tick-borne disease and tick bite prevention methods especially in areas with a high incidence of tick bites. This public awareness could be achieved in a number of ways including broad information campaigns or the distribution of simple informative materials to high-risk groups such as

elementary aged children on how to prevent tick bites.

This study, being of a small sample size, would benefit from further surveys being done on a larger scale, covering different areas, and having a better distribution of age ranges. The small scope and relatively small diversity of age range in this study is a limitation of knowledge and further research is needed to strengthen and affirm its results. Further limitations of this study include the inherent bias present in many internet-based studies. This was a study distributed through social media that gave no compensation or incentive for giving accurate answers. Because of this, the possibility of individual lying or misrepresentation of level of knowledge must be taken into account. Despite these limiting factors, the data presented can be useful in providing insight into the general level of knowledge of the general public regarding ticks, tick-borne illness, and tick bite prevention methods. In summary, the result of this survey found a deficit in the surveyed population's knowledge of tick prevention methods and tick-borne illness. A deficit that, if filled, could allow for individuals to better protect themselves from this very present public health threat.

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**Appendix**  
**(copy of survey)**

4/4/2021

## General Knowledge of Ticks and Tick Borne Diseases

1. What is your age

*Mark only one oval.*

- under 18
- 18-23
- 24-35
- 36-50
- 50+

2. Select your region

*Mark only one oval.*

- Texas
- Other US state
- Outside of US

3. Have you ever found a tick on your body?

*Check all that apply.*

- Yes
- No
- Unsure

4. What do ticks feed on?

*Mark only one oval.*

- Dead skin
- Mites living within the skin
- Blood
- Hair

5. Which areas of the body are you most likely to find a tick attached?

*Mark only one oval.*

- arms and legs
- scalp and groin
- face and neck
- hands and feet

6. In which region are you most at risk for ticks?

*Mark only one oval.*

- dry, arid regions with sparse brush
- grassy, brushy, or wooded areas
- urban areas

7. What age group has the highest incidence of tick bites?

*Mark only one oval.*

- young children
- young adults
- adults age 50-70
- all ages have equal incidence of tick bites

8. Which of these groups do ticks fit into?

*Mark only one oval.*

- Insects
- Arachnids
- Crustaceans
- Mollusks

9. What is the most common tick borne disease in the United States

*Mark only one oval.*

- Rocky Mountain Spotted Fever
- Lyme Disease
- Anaplasmosis
- Tick Borne Relapsing Fever

10. True or False, some viral tick borne diseases can be transmitted within 15 minutes of attachment

*Mark only one oval.*

- True
- False

11. How long must a tick usually be attached in order to transmit Lyme Disease

*Mark only one oval.*

- 30 minutes to 1 hour
- 3 to 5 hours
- 12 to 20 hours
- 24 to 48 hours

12. What is the yearly incidence of tick borne disease in the United States

*Mark only one oval.*

- roughly 500 cases per year
- roughly 2,000 cases per year
- roughly 45,000 cases per year
- roughly 200,000 cases per year

13. Select all valid tick bite prevention methods in the list below

*Check all that apply.*

- Treating clothing with Permethrin before going outside
- Showering within 2 hours of leaving tick heavy area
- Visually checking body for ticks
- Avoiding areas of high grass or dense leaf litter

14. How should a tick be removed?

*Mark only one oval.*

- Apply petroleum jelly to the tick to prevent breathing and allow it to detach itself
- Firmly grasp tick with fingers and pull upwards with a twisting motion
- Using tweezers, pull upwards steadily without twisting
- Apply a warm compress to the tick and allow it to detach itself

15. True or False, the tick head can become detached during removal and cause infection

*Mark only one oval.*

- True
- False