Knowledge, attitudes, and practices of healthcare professionals working in schools regarding tickborne disease prevention and Lyme disease in New York State and Maryland

Kristen Howard

University at Albany, State University of New York, kristenhoward57@gmail.com

Follow this and additional works at: https://scholarsarchive.library.albany.edu/legacy-etd

Part of the Epidemiology Commons, and the Nursing Commons

Recommended Citation
https://scholarsarchive.library.albany.edu/legacy-etd/2486

This Master's Thesis is brought to you for free and open access by the The Graduate School at Scholars Archive. It has been accepted for inclusion in Legacy Theses & Dissertations (2009 - 2024) by an authorized administrator of Scholars Archive.
Please see Terms of Use. For more information, please contact scholarsarchive@albany.edu.
Knowledge, Attitudes, and Practices of Healthcare Professionals Working in Schools Regarding Tickborne Disease Prevention and Lyme Disease in New York State and Maryland

by

Kristen Howard

A Thesis
Submitted to the University at Albany, State University of New York In Partial Fulfillment of the Requirements for the Degree of Master of Science

School of Public Health Department of Epidemiology and Biostatistics

Spring 2020
ABSTRACT

**Background:** Ticks, Lyme disease, and other tickborne diseases are a concern of public health entities in Maryland and New York State. Children are at an increased risk of contracting a tickborne disease. Healthcare professionals working in schools (HPWS) are often front-line providers and health educators for school-aged children. The knowledge, attitudes, and practices of HPWS regarding ticks and tickborne disease is currently unknown. While there are educational materials available, uptake and use of these programs is also unknown.

**Methods:** A cross-sectional survey was developed by state health departments in New York and Maryland in conjunction with partners at the Centers for Disease Control and Prevention. This survey was disseminated to HPWS across both states with the intention to inform public health professionals where training and resources should be directed. A knowledge index was created based on answers to seven questions in the survey. Then, bivariate analyses were done to show which factors contribute to passing knowledge scores. Lastly, a multivariate logistic regression was utilized to confirm which covariates are most likely to affect HPWS knowledge of ticks and tickborne disease.

**Results:** A total of 1,560 HPWS responded to the survey. Approximately 52% of respondents received a passing score according to the knowledge index. Univariate logistic regression showed that more years as a HPWS, higher confidence in abilities, more experience, increased perception of students’ risk of contracting a tickborne disease, prior training on tickborne disease, and knowledge of the New York State Center for School Health educational materials were associated with passing knowledge scores. The final multivariate logistic regression model showed that more years as a HPWS was not necessarily a predictor of a passing knowledge score. Increased experience with ticks and tickborne disease is a predictor of passing knowledge scores. Perceived risk and confidence in abilities are highly collinear, and increases in both enhance likelihood of a passing knowledge score.
**Conclusion:** The results of our survey have led us to the conclusion that training and resources about ticks and tickborne disease need to be more accessible and available to healthcare professionals who work in schools. The vast majority of HPWS who responded to the survey indicated they had not received any previous training on ticks and tickborne disease. But, many of the respondents have had experience with ticks and tickborne disease. Results also indicate that HPWS are not often treated as health educators, and do not participate in activities to teach students about tick bite and disease prevention. This means that while tickborne diseases are a health issue, it may not be the responsibility of healthcare workers to educate students in the same way as teachers or health educators.
I would like to thank my advisor, Bryon Backenson, and committee member, Jennifer White, for providing me with career and character-building opportunities throughout the past two years. Thank you to my New York TickNET partners, Alison and Adam, for always having time, advice, and patience. Additionally, I would like to thank the staff of NYS DOH Bureau of Communicable Disease Control for providing help when I needed it. I also want to thank TickNET partners at CDC and Maryland DOH for their guidance and input on this project.
# TABLE OF CONTENTS

## INTRODUCTION

## METHODS
- Survey Creation and Implementation 4
- Recruitment and Study Population 5
- Data Analysis 6
  - Univariate Statistics 6
  - Bivariate and Multivariate Statistics 8

## RESULTS

## DISCUSSION
- Limitations 14

## REFERENCES

## TABLES/FIGURES

<table>
<thead>
<tr>
<th>Figure/Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1. Questions contributing to Index Scores</td>
<td>20</td>
</tr>
<tr>
<td>Table 1. Sample Characteristics of HPWS in Maryland and New York</td>
<td>21</td>
</tr>
<tr>
<td>Table 2. Index Scores of HPWS in Maryland and New York</td>
<td>22</td>
</tr>
<tr>
<td>Table 3. Selected Characteristics Associated with Knowledge Score</td>
<td>23</td>
</tr>
<tr>
<td>Table 4. Univariate Logistic Regression of Knowledge Score and Selected Characteristics</td>
<td>24</td>
</tr>
<tr>
<td>Table 5. Multivariate Logistic Regression of Knowledge Score and Selected Characteristics</td>
<td>25</td>
</tr>
<tr>
<td>Figure 2. Impact of Selected Demographic Factors and Index Scores</td>
<td>26</td>
</tr>
<tr>
<td>On Knowledge Score</td>
<td></td>
</tr>
<tr>
<td>Appendix 1. Survey Instrument</td>
<td>27</td>
</tr>
</tbody>
</table>
# LIST OF ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDC</td>
<td>Centers for Disease Control and Prevention</td>
</tr>
<tr>
<td>MD</td>
<td>Maryland</td>
</tr>
<tr>
<td>NYS</td>
<td>New York State</td>
</tr>
<tr>
<td>DOH</td>
<td>Department of Health</td>
</tr>
<tr>
<td>NYSCSH</td>
<td>New York State Center for School Health</td>
</tr>
<tr>
<td>KAP</td>
<td>Knowledge, Attitudes, and Practices</td>
</tr>
<tr>
<td>TBD</td>
<td>Tickborne Disease</td>
</tr>
<tr>
<td>HPWS</td>
<td>Healthcare Professional Working in Schools</td>
</tr>
<tr>
<td>SBHC</td>
<td>School-Based Health Center</td>
</tr>
<tr>
<td>REDCap</td>
<td>Research Electronic Data Capture</td>
</tr>
<tr>
<td>CE Credits</td>
<td>Continuing Education Credits</td>
</tr>
</tbody>
</table>
INTRODUCTION

Lyme disease, caused by infection with the bacteria *Borrelia burgdorferi*, is the most common vector-borne disease in the United States. Lyme disease is characterized in early illness by an erythema migrans (EM) rash, which has a characteristic “bull’s eye” appearance with central clearing. Without antibiotic treatment, the infection can disseminate, and patients can develop multiple EM rashes, and/or overt rheumatologic, cardiac, or neurologic symptoms (Steere et al., 2005). Humans acquire Lyme disease incidentally through the bite of an infected *Ixodes scapularis* tick nymph or adult.

Both Maryland and New York State are highly endemic for Lyme disease. In 2018, New York State, excluding New York City, had a Lyme disease incidence rate of 58.5 confirmed and probable cases per 100,000 persons (NYSDOH, 2019). Maryland had a Lyme disease incidence rate of 22.9 confirmed and probable cases per 100,000 persons in 2018 (MDDOH, 2019). While these numbers are among the highest in the nation, many residents are unaware of their risk, and often do not take preventive measures to avoid tick bites (Hook et al., 2015). Existing methods of public health education about tickborne diseases may be lacking or inappropriate for high risk groups (Gupta et al., 2018; Vázquez et al., 2008).

In addition to Lyme disease, a bite from an infected *I. scapularis* tick can transmit pathogens that cause other diseases, including anaplasmosis, babesiosis, and Powassan virus disease. The total number of tickborne disease cases in the United States has increased over time since 2004 (CDC, 2019e). This has also been accompanied by an expansion in the home range of the *I. scapularis* tick (Khatchikian et al., 2015; Eisen et al., 2016). Knowing that this spread is occurring, it is important to educate people about their risk of exposure to ticks and the diseases they transmit.
Children are a high-risk group for contracting Lyme disease, particularly school-aged children 5-14 years of age, who account for 18.4% of all cases of Lyme disease from 2001-2018 (CDC, 2019b). Healthcare professionals working in schools (HPWS), including school nurses and health care providers employed by school-based health centers (SBHCs), are responsible for providing services to students to promote optimum health for academic success. These professionals are in a unique position to provide instruction on proper tick removal, early identification of disease, and education about tickborne disease prevention to students. HPWS are often the first-line health care providers for students and can serve as a bridge between healthcare and education.

Little is known about the current state of HPWS knowledge and behavior related to tick bites and tickborne disease prevention. A previous study in Indiana showed that local public health nurses were most knowledgeable about personal protection against ticks and less aware of the symptoms, case definition, and reporting criteria for Lyme disease. Authors from this study recommended increased education of Lyme disease among this population of healthcare providers (Capps et al., 1999). School administrators in the Mid-Atlantic region of the United States were surveyed to understand their perceptions of students’ risk. While risk is perceived to be high, administrators may not have the resources to implement education of this risk to students (Machtinger et al., 2019). Recognition of symptoms at an early stage could reduce school absences and developing health plans for students with long-term symptoms could improve overall school performance (Laudenslager and Hartung, 2019). There is widespread consensus that educating children on health issues is optimal for preventing diseases throughout life. Tickborne disease education in particular needs to stimulate children to understand that primary prevention and symptom recognition are both necessary to avoid illness (de Vries & van
Dillen, 2002; Corapi et al., 2007).

A nationwide survey of school nurses by the National Association of School Nurses showed that the top request for continuing education was for evaluation of rashes and other skin conditions (identified by 56.7% of school nurse respondents). The second-highest educational need was for better education of infectious diseases (39.2% of school nurse respondents) (Mangena & Maughan, 2015). This study suggests that HPWS would be very interested in targeted training about tickborne diseases.

It has been shown that providing tickborne disease education to children allows for better uptake of prevention methods and knowledge of symptoms to report to healthcare workers (Beaujean et al, 2016; Shadick et al, 2016). The New York State Center for School Health developed an educational resource toolkit designed to teach school nurses, educators, and students about tickborne diseases and prevention methods. School districts across New York State have been provided with this toolkit, which includes a PowerPoint presentation, lesson plans that can be used for classroom instruction, parent letters, and infographics (NYSCSH, 2019). The level of awareness of the toolkit amongst HPWS, and if uptake has increased HPWS knowledge and proficiency in addressing tick and tickborne disease issues that arise in their school-based practice, is unknown.

Because schools throughout New York and Maryland vary in many different ways, it is important to take different risk-factors into account when creating educational materials. Research has shown that uptake of tick bite prevention measures increases with age (McKenna et al., 2005). This is most important to acknowledge when marketing school-based tickborne disease educational materials to younger age groups. Preventive measures like applying acaricides and wearing permethrin-treated clothing are not appropriate for younger children,
while tick-checks and reporting insect bites to adults would be appropriate (CDC, 2019c). Additionally, it is important to recognize that students who live in geographic areas that have seen new tick activity may not have as much awareness of possible illnesses that ticks can transmit (Klein et al., 1996). Lastly, many school districts have students that speak English as a second language (ESL). Students with these needs should have educational materials available to them in their native language, which can be a challenge for public health professionals and educators (Valente et al., 2015).

In this study, we describe the knowledge, attitudes and practices related to tickborne diseases of HPWS in Maryland and New York State. These findings will inform the design of tickborne disease prevention and symptom recognition education targeted to HPWS. In New York State, the results also provide information about HPWS awareness and uptake of the existing state tickborne disease education toolkit.

**METHODS**

*Survey Creation and Implementation*

To address the aims of the project, we developed and administered a cross-sectional knowledge, attitude, and practices (KAP) survey for HPWS in New York State, excluding New York City, and Maryland. Survey questions covered the following topics: demographics, including descriptive information about the respondent and their school setting, knowledge about ticks and Lyme disease, experiences and practices related to ticks and tickborne disease in the school setting, tick bite prevention recommendations and resources provided to students, perception of risk for tickborne disease and degree of confidence for addressing concerns related to ticks and tickborne disease in the student population, and sources of information about ticks and tickborne disease.
Respondents accessed the self-administered survey via a link in their email invitation or a web address/QR code printed on a mailed invitation. The survey was hosted on Research Electronic Data Capture (REDCap), a secure web-based application used for multi-site data collection (Harris et al., 2009; Harris et al., 2019). The survey introduction explained that participation was anonymous and voluntary.

Participants were screened for eligibility by confirming current employment as a licensed healthcare professional providing health services or consultation to students in a school setting. Eligible respondents completed an approximately 10-minute survey consisting of 40 questions in Maryland, and 41 questions in New York, which included an additional question about NY State tickborne disease curricular materials (Appendix 1). Upon completion, both eligible and ineligible participants were given the opportunity to request free educational materials for use in their school-based health practice.

The protocol, survey instrument, and recruitment materials were reviewed and approved by institutional review boards from the Centers for Disease Control and Prevention, New York State Department of Health, and the Maryland Department of Health.

**Recruitment and Study Population**

In Maryland, 24 public school jurisdictions were identified using Maryland Department of Education databases. Of the 24 public school jurisdictions, 18 participated in the survey. One jurisdiction elected to have their HPWS complete the survey during jurisdiction-wide mandatory staff meetings on April 12 and 15, 2019. Printed surveys were provided to HPWS that met in 10 different locations throughout the jurisdiction. Participants (n=85) were instructed that the survey was voluntary, anonymous, and confidential. Completed surveys were collected by the jurisdiction’s lead school health coordinator and provided to Maryland Department of Health.
Seventeen public school jurisdictions emailed the survey to their school healthcare staff (n=721) on April 24, 2019. Printed surveys were also mailed to 442 non-public schools on April 22, 2019 using a list obtained from the Maryland Department of Education. The online survey was available from April 24-May 26, 2019.

In New York, invitations were mailed to all non-New York City public and non-public schools (n=3,991) listed with the New York State Education Department and school-based health centers (n=97) listed with the NYSDOH on April 29, 2019. Invitations to take the online survey were emailed to HPWS with publicly available contact information (n=4,097) on May 1, 2019. Printed surveys were included in mailings to schools in New York that did not have phone numbers listed (n=70). The online survey was available from May 1-31, 2019.

Data Analysis

Univariate Statistics

All data was analyzed using SAS 9.4 software (SAS Institute, Cary, NC). All questions within the survey were analyzed using descriptive statistics and frequency tables. We also developed indices to further explore responses across the following categories of questions (Figure 1):

Knowledge Index:

Knowledge of Lyme disease transmission, Lyme disease symptoms, and tick removal practices were measured using scored categories. Seven questions on the survey contributed to the index (Questions 9-14, 19). Respondents that left any of the seven questions blank were excluded from index analysis to account for completeness of data. For every correct answer, the participant was awarded one point, for a range of scores between 0-7. Since Question 19 allowed for multiple answers, respondents that answered solely the correct answer, and no other answers, were awarded one point. Those that answered 0-4 correctly were categorized as having a “failing
score.” Those that answered 5-7 correctly were categorized as having a “passing score.”

Confidence Index:

Confidence in practices related to Lyme disease symptom recognition and tick removal was measured using scored categories. Three questions on the survey contributed to the index (Questions 30-32). Respondents that left any of the three questions blank were excluded from index analysis to account for completeness of data. Answers of “Not at all confident” were awarded zero points. Answers of “A little confident” were awarded one point. Answers of “Moderately confident” were awarded two points. Answers of “Very confident” were awarded three points. These scores were pooled for a range of confidence between 0-9. Those that scored between 0-3 points were categorized as “low confidence.” Those that scored between 4-6 points were categorized as “moderate confidence.” Those that scored between 7-9 points were categorized as “high confidence.”

Experience Index:

Frequency of tickborne disease related practice experiences was measured using scored categories. Three questions on the survey contributed to the experience index (Questions 15, 18, 24). Respondents that left any of the three questions blank were excluded from index analysis to account for completeness of data. For every experience that the participant reported, they were given one point. The range of points was 0-3; this translated to “no experience” (zero points), “low experience” (one point), “moderate experience” (two points), and “high experience” levels (three points).

Risk Perception:

Participants were asked to rate their perceived risk of students getting a tick-borne disease (Question 29). Respondents that left the question blank were excluded from index
analysis to account for completeness of data. Due to none of the participants answering, “no risk”, participants were categorized into low, moderate, and high risk categories.

**Bivariate and Multivariate Statistics**

Bivariate analyses were conducted using chi-squared tests to test associations between knowledge index outcome and covariates of interest (<0.05 level of significance). Univariate logistic regressions were also performed on each variable associated with knowledge score. These revealed odds ratios of a passing knowledge score with specific answers or scores within each variable.

To further assess the relationship between covariates and a passing knowledge score, a multivariate logistic regression was performed. Years as a HPWS was used as our exposure of interest, because it is unknown whether HPWS who are new to their job are less knowledgeable than their more tenured colleagues. Collinearity was identified using bivariate scatterplots of the covariates. Using a step-wise backward elimination, covariates were removed from the model. Covariate removal from the regression occurred one at a time, based on the highest occurring p-value over 0.05. The final model included only the exposure variable and the covariates with a p-value of less than 0.05. Lastly, a ROC Curve was calculated and the Area Under the Curve was used to assess the success of the final model in predicting the outcome.

**RESULTS**

Table 1 presents the demographic characteristics of the respondents. After removing iterations of survey responses with excessive missing data, there were a total of 488 respondents from Maryland and 1,072 respondents from New York. Overall, 92.6% of HPWS are Registered Nurses and 72.3% tend to a school population of 200-1000 students. In Maryland, no participants selected Physician’s Assistant or Medical Doctor, and in New York, no participants selected
Certified Medical Technician or Certified Nursing Assistant. Due to this skewed frequency, license and number of students served were not used in the regression model. The original question related to years as a HPWS had five options; this was compressed in the analysis phase due to small numbers in the lower and upper categories. After compression, “years as a HPWS” was equally distributed within the three groups. Student population was also equally distributed between the three groups of populations. When asked if they had received a prior training on tickborne disease, less than 20% of respondents said that they had. In New York, 31% of respondents said that they knew about NYSCSH educational materials on tickborne disease.

Table 2 presents the index scores of the respondents. Knowledge categories were distributed between passing and failing at 52% and 48%, respectively. Experience categories were distributed between none, low, moderate, and high at 33%, 19%, 30%, and 18%, respectively. Confidence category was calculated at 29%, 56%, and 15% for categories low, moderate, and high, respectively. Risk perception categories were distributed between low, moderate, and high at 13%, 47% and 40%, respectively.

Additionally, roughly 38% of HPWS reported that they are aware of a policy in their school about tick removal. Nearly 74% of HPWS stated that they were allowed to remove ticks from students, while 9% stated that they were not allowed to remove ticks. In the instance where a tick is removed, most HPWS alert the parent about the event (97.7%) and offer educational materials about tickborne disease (50.7%). Only 12.9% of HPWS recommend testing for Lyme disease, and 6.8% recommend prophylactic antibiotics to prevent Lyme disease. While it is not a major job function of HPWS, 28.2% attempt to identify species of tick. This is most often done with the assistance of a State DOH or CDC provided tick-ID card (54.7%), or the assistance of the CDC website (48.5%).
Only 33.2% of HPWS stated that they typically speak to students about their risk for tickborne disease. When asked if they have ever given a presentation about tickborne disease, only 4.6% of HPWS responded that they had. Other school personnel that communicate with students about tickborne disease risk include health teachers (20.2%) and science teachers (9.1%). But, 24% of HPWS responded that no one communicates with students about tickborne disease risk, and 32.8% said that they did not know if anyone had that responsibility.

Additionally, only 19.9% of HPWS responded that they send home tickborne disease educational materials with students during the school year. This is discordant with the 68% of HPWS that know where they can get educational materials. Almost 87% of HPWS said that the most helpful resource for their school health services program would be paper resources. Nearly 36% of HPWS were interested in trainings and in-person meetings. If CE credits were offered, almost 60% would be more willing to participate in tickborne disease training.

As displayed in Table 3, increased years spent as a HPWS, higher confidence category, higher experience category, increased risk perception, prior training on tickborne disease, and knowledge of NYSCSH Educational materials (in NY) were all associated with a passing knowledge score. Student population age did not show a significant association and was therefore not examined further. The factors associated with a passing knowledge score were further examined to determine their relationship with the outcome.

As shown in Table 4, HPWS with 6-15 years of experience had a higher odds of a passing knowledge score as compared to HPWS with less than 6 years of experience (OR 1.36, 95% CI 1.06,1.76). But, HPWS with more than 15 years of experience did not have significantly different odds of a passing knowledge score compared to HPWS with less than 6 years of experience.
HPWS who have moderate or high levels of confidence in their abilities related to tickborne disease have significantly higher odds of a passing knowledge score compared to HPWS with low confidence. Odds of a passing knowledge score is 2.68 (95% CI 2.07, 3.48) with a moderate confidence score and 7.48 (95% CI 5.03, 11.10) with a high confidence score.

When compared to HPWS with no experience with tickborne disease issues, HPWS with low experience do not have significantly different knowledge scores. HPWS with moderate or high experience with tickborne disease issues have significantly higher odds of a passing knowledge score compared to HPWS with no experience (OR 2.42, 95% CI 1.83, 3.20 and OR 2.58 95% CI 1.86, 3.58 respectively).

HPWS who have moderate or high perception of their students’ risk of contracting a tickborne disease have significantly higher odds of a passing knowledge score compared to HPWS with low risk perception. Odds of a passing knowledge score is 1.77 (95% CI 1.25, 2.50) with a moderate risk perception and 2.18 (95% CI 1.53, 3.11) with a high risk perception.

Lastly, HPWS who have had a previous training on tickborne disease have significantly higher odds of a passing knowledge score than those who have not (OR 1.59, 95% CI 1.20, 2.11).

A multivariate logistic regression was conducted to further determine the relationship between knowledge score, years as a HPWS, and the covariates of interest. Knowledge of NYSCSH educational materials was not included in the regression because of the missing values for Maryland respondents. When all covariates were added to the regression model, it was determined that risk perception and confidence category were highly collinear. An interactive term was added to the regression model to better explain their relationship with knowledge scores. Despite association at a bivariate level, prior training on tickborne disease was no longer
a predictor of knowledge score in the multivariate model (Table 5).

Overall, increased experience, confidence, and risk perception enhance the relationship with passing knowledge scores. The adjusted odds ratio increases with additional experience, additional confidence, and additional perception of risk. While this increase in odds ratio occurred for the covariates, the relationship with years as a HPWS was not significantly associated with passing knowledge scores (Figure 2). A final result of 0.6903 occurred when testing the Area Under the Curve. This shows that the final regression model predicts the outcome nearly 70% of the time.

**DISCUSSION**

The results of our survey have led us to the conclusion that future public health resources should be allocated to provide training and educational resources to HPWS. Most of the HPWS who responded to the survey indicated they had not received specific training about ticks and tickborne disease. HPWS are a key front-line provider that can aid in the prevention of tick encounters on school property and diagnosis of tickborne diseases (Hamlen, 2012).

Early removal of ticks is important for avoiding transmission of tickborne diseases (CDC, 2019a). Nearly half of participating HPWS indicated that they were not confident in their ability to remove a tick, and 9% of respondents indicated that they are not allowed to remove ticks from students. The majority (54%) of participants did not know that a single prophylactic dose of antibiotic can be used to reduce the risk of acquiring Lyme disease (CDC, 2019d). Coordinating care with parents and advising prophylaxis is one additional measure HPWS can take to curtail long-term symptoms of Lyme disease. Nearly half of HPWS in this study also indicated they lack confidence in identifying symptoms of tickborne disease. Recognition of early symptoms of Lyme and other tickborne diseases is necessary to avoid time out of school and possible
development of later neurological symptoms (Hamlen and Kliman, 2009). Two-thirds of survey respondents indicated that their school did not have a policy regarding tick removal. This may have changed in New York due to a recent guideline put in place to ensure medical directors of schools make policies regarding safe tick removal (NYSCSH, 2019). This could likely increase the early and safe removal of ticks from students in school health offices.

Part of this survey was used to assess the knowledge and use of educational materials about tickborne disease. Roughly two thirds of HPWS said that they do not normally speak to students about prevention and their risk of contracting tickborne disease. Less than ten percent of HPWS had given a presentation to students about ticks and tickborne disease. This leads us to understand that the main function of HPWS is to provide care only to students who come to their health office, and offer educational materials if they are available. Some barriers that HPWS encounter are a lack of funds for educational materials, lack of time for activities outside their health office, and educational materials that are not available in languages other than English. While HPWS understand the risk to their students, and they may want to participate in prevention efforts, that may not be their priority during the school day. Teaching prevention methods continues to be the best way to change behaviors in tickborne disease endemic areas, and could ultimately reduce burden of disease before it begins (Daltroy et al., 2007; Malouin et al., 2003).

The final regression model showed that receiving a prior training on tickborne disease did not significantly contribute to a passing knowledge score. This is very likely due to the nature of the other variables included in the regression. Experience with tick removal and diagnosing tickborne disease symptoms likely would diminish a HPWS’ need for additional training. Additionally, training likely would not interest HPWS who are already confident in their abilities
with ticks and tickborne disease. Without knowledge of location, it is difficult to ascertain if HPWS who have received training are seeing students in their office with tickborne disease issues.

The final regression also showed that years of experience may not be an appropriate exposure measure to assess. As we know from previous literature, home setting and geographic location is the most obvious predictor of experience with tickborne disease (Connally et al., 2009; Beaujean et al., 2013). While our regression was reasonably able to predict outcome, location data would likely render a higher predictive value for knowledge scores. Any future studies of this kind should consider adding a question about county-level location of participants and schools served to further assess areas where training and resources can be targeted.

**Limitations**

The biggest limitation of this study is the nature of a cross-sectional design. Since we were only able to collect information at one point in time, we are not able to assess if HPWS learned from provided materials or requested more resources from their administrative body as a result of their participation in the survey. We attempted to maximize resources to HPWS by providing answers to our knowledge index questions at the end of the survey. We also offered HPWS the ability to email NYS and MD Department of Health teams to request tickborne disease educational materials at no cost. Another limitation incurred with a cross-sectional study is the inability to follow up with participants due to anonymity concerns. It would be useful to reach out to participants to encourage participation any future trainings or conferences offered by state departments of health, and other school related healthcare entities.

One major limitation of our data is that we were not able to collect location information. Had we been able to collect location data, or county-level data, we would be able to focus
resources in areas that had less knowledge and experience with tickborne disease. But, knowing that many of the participants would be willing to do training if continuing education credits are offered helps us know that future resources should be marketed with CE credits.

Another limitation of this survey is response bias. Ticks and Lyme disease are a geographically limited health issue. It is possible that HPWS who are more interested in the topic were more likely to respond to the email or postcard for participation, while HPWS who are not familiar with ticks and tickborne disease were not interested in participating. Conversely, some HPWS may be overwhelmed by surveys and information about ticks and tickborne disease and chose not to participate in the survey. Due to anonymity concerns, it is impossible to tell if this type of bias occurred in our study population.

Lastly, there is an extremely limited body of research on this subject. While there are studies done on the effectiveness of school-based health education, it is unknown what the role of HPWS is in that realm. While some HPWS have the resources to teach children about prevention methods, it seems like most HPWS are limited to interactions with children in their health office. In the future it would be interesting to find out if HPWS would want more resources to provide education on tick bite prevention, and if that prevention reduces the amount of tick-related health office visits in schools.
REFERENCES


Figure 1. Questions contributing to Index scores

Knowledge Index
Which tick carries Lyme disease?
About how long does an infected tick need to be attached to a person before transmission of the Lyme disease bacteria can occur?
How long does it take for erythema migrans (commonly referred to as the “bull’s eye rash”) of Lyme disease to develop after the bite of an infected tick?
What is the most common late stage symptom of Lyme disease (months after tick bite)?
True or False: A child who has previously had Lyme disease can get Lyme disease again if they are bitten by another infected tick.
True or False: In the case of a high-risk tick bite, a single prophylactic dose of antibiotic can be used to reduce the risk of acquiring Lyme disease.
In your practice in the school setting, how do you remove an attached tick?

Confidence Index
In general, I feel ____________ about my ability to determine how long a tick has been attached to a person.
In general, I feel ____________ about my ability to remove a tick that is attached to a person.
In general, I feel ____________ about my ability to recognize the symptoms of Lyme disease.

Experience Index
Since the start of the 2018/2019 school year, how many times have you attended to a student for a suspected tick-related issue?
Since the start of the 2018/2019 school year, approximately how many ticks have you removed from students?
Who at your school talks with students about their risk for tick bites and ways to protect themselves from being bitten?

Risk Perception
How high do you believe the risk of getting a tickborne disease is for students in your community?
<table>
<thead>
<tr>
<th>Table 1. Sample Characteristics of HPWS in Maryland and New York</th>
<th>Maryland (n=488)</th>
<th>New York (n=1072)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>total</td>
<td>%</td>
</tr>
<tr>
<td><strong>License</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMT or C.N.A</td>
<td>21</td>
<td>4.3</td>
</tr>
<tr>
<td>LPN</td>
<td>24</td>
<td>4.9</td>
</tr>
<tr>
<td>RN</td>
<td>440</td>
<td>90.2</td>
</tr>
<tr>
<td>PA</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>NP</td>
<td>3</td>
<td>0.6</td>
</tr>
<tr>
<td>MD, DO</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Years as HPWS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;6 years</td>
<td>202</td>
<td>41.5</td>
</tr>
<tr>
<td>6-15 years</td>
<td>175</td>
<td>35.9</td>
</tr>
<tr>
<td>16+ years</td>
<td>110</td>
<td>22.6</td>
</tr>
<tr>
<td><strong>Number of Students</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;200</td>
<td>38</td>
<td>7.9</td>
</tr>
<tr>
<td>200-1000</td>
<td>274</td>
<td>57.1</td>
</tr>
<tr>
<td>1001-2000</td>
<td>111</td>
<td>23.1</td>
</tr>
<tr>
<td>&gt;2000</td>
<td>57</td>
<td>11.9</td>
</tr>
<tr>
<td><strong>Student population</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prek-elementary only</td>
<td>180</td>
<td>37.0</td>
</tr>
<tr>
<td>mix of grades</td>
<td>181</td>
<td>37.2</td>
</tr>
<tr>
<td>middle-high only</td>
<td>126</td>
<td>25.9</td>
</tr>
<tr>
<td><strong>Prior training on TBD</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>365</td>
<td>79.0</td>
</tr>
<tr>
<td>Yes</td>
<td>80</td>
<td>17.3</td>
</tr>
<tr>
<td>Don't know</td>
<td>17</td>
<td>3.7</td>
</tr>
<tr>
<td><strong>Knowledge of NYSCSH materials</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Yes</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*New York State participants only
<table>
<thead>
<tr>
<th>Table 2. Index scores of HPWS in Maryland and New York</th>
<th>Maryland (n=488)</th>
<th>New York (n=1072)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>total</td>
<td>%</td>
</tr>
<tr>
<td>Knowledge Score</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passing</td>
<td>229</td>
<td>50.9</td>
</tr>
<tr>
<td>Failing</td>
<td>221</td>
<td>49.1</td>
</tr>
<tr>
<td>Confidence Category</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>111</td>
<td>24.2</td>
</tr>
<tr>
<td>Moderate</td>
<td>294</td>
<td>64.2</td>
</tr>
<tr>
<td>High</td>
<td>53</td>
<td>11.6</td>
</tr>
<tr>
<td>Experience</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>153</td>
<td>33.1</td>
</tr>
<tr>
<td>Low</td>
<td>97</td>
<td>21.0</td>
</tr>
<tr>
<td>Moderate</td>
<td>138</td>
<td>29.9</td>
</tr>
<tr>
<td>High</td>
<td>74</td>
<td>16.0</td>
</tr>
<tr>
<td>Risk Perception</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>48</td>
<td>10.4</td>
</tr>
<tr>
<td>Moderate</td>
<td>230</td>
<td>49.9</td>
</tr>
<tr>
<td>High</td>
<td>183</td>
<td>39.7</td>
</tr>
<tr>
<td>Table 3. Selected Characteristics Associated with Knowledge Score</td>
<td>Failing Knowledge Score (&lt;5 correct)</td>
<td>Passing Knowledge Score (&gt;4 correct)</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>-------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td></td>
<td>total</td>
<td>%</td>
</tr>
<tr>
<td><strong>Years as HPWS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;6 years</td>
<td>265</td>
<td>39.6</td>
</tr>
<tr>
<td>6-15 years</td>
<td>226</td>
<td>33.8</td>
</tr>
<tr>
<td>16+</td>
<td>178</td>
<td>26.6</td>
</tr>
<tr>
<td><strong>Student population</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prek-elementary only</td>
<td>270</td>
<td>40.3</td>
</tr>
<tr>
<td>mix of grades</td>
<td>204</td>
<td>30.5</td>
</tr>
<tr>
<td>middle-high only</td>
<td>196</td>
<td>29.3</td>
</tr>
<tr>
<td><strong>Confidence Category</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>266</td>
<td>41.2</td>
</tr>
<tr>
<td>Moderate</td>
<td>334</td>
<td>51.7</td>
</tr>
<tr>
<td>High</td>
<td>46</td>
<td>7.1</td>
</tr>
<tr>
<td><strong>Experience Category</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>263</td>
<td>40.9</td>
</tr>
<tr>
<td>Low</td>
<td>141</td>
<td>21.9</td>
</tr>
<tr>
<td>Moderate</td>
<td>153</td>
<td>23.8</td>
</tr>
<tr>
<td>High</td>
<td>86</td>
<td>13.4</td>
</tr>
<tr>
<td><strong>Risk Perception</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>109</td>
<td>16.7</td>
</tr>
<tr>
<td>Moderate</td>
<td>304</td>
<td>46.7</td>
</tr>
<tr>
<td>High</td>
<td>238</td>
<td>36.6</td>
</tr>
<tr>
<td><strong>Prior training on TBD</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>102</td>
<td>16.5</td>
</tr>
<tr>
<td>No</td>
<td>518</td>
<td>83.6</td>
</tr>
<tr>
<td><strong>Knowledge of NYSCSH materials</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>112</td>
<td>26.4</td>
</tr>
<tr>
<td>No</td>
<td>312</td>
<td>73.6</td>
</tr>
</tbody>
</table>

*P-value shows chi-square test of homogeneity between groups of knowledge score within each covariate variable, values <0.05 show association between covariate and knowledge score

**New York State participants only
<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds Ratio (95% CI)</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Years as HPWS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;6 years</td>
<td>ref</td>
<td></td>
</tr>
<tr>
<td>6-15 years</td>
<td>1.36 (1.06, 1.76)</td>
<td>0.0165</td>
</tr>
<tr>
<td>&gt;15 years</td>
<td>1.26 (0.96, 1.66)</td>
<td>0.1025</td>
</tr>
<tr>
<td><strong>Confidence Category</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>ref</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>2.68 (2.07, 3.48)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>High</td>
<td>7.48 (5.03, 11.10)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td><strong>Experience Category</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>ref</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>1.19 (0.87, 1.63)</td>
<td>0.2777</td>
</tr>
<tr>
<td>Moderate</td>
<td>2.42 (1.83, 3.20)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>High</td>
<td>2.58 (1.86, 3.58)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td><strong>Risk Perception</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>ref</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>1.77 (1.25, 2.50)</td>
<td>0.0013</td>
</tr>
<tr>
<td>High</td>
<td>2.18 (1.53, 3.11)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td><strong>Prior training on TBD</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1.59 (1.20, 2.11)</td>
<td>0.0012</td>
</tr>
<tr>
<td>No</td>
<td>ref</td>
<td></td>
</tr>
</tbody>
</table>

*P-value shows chi-square test of homogeneity between groups of knowledge score within each variable's possible values, p-values of <0.05 show association between covariate values and knowledge score.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Adjusted OR (95% CI)</th>
<th>Chi-sq p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Years as HPWS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;6 years</td>
<td>ref</td>
<td></td>
</tr>
<tr>
<td>6-15 years</td>
<td>1.14 (0.86, 1.50)</td>
<td>0.361</td>
</tr>
<tr>
<td>&gt;15 years</td>
<td>1.18 (0.87, 1.60)</td>
<td>0.2916</td>
</tr>
<tr>
<td><strong>Experience Index</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>ref</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>0.98 (0.70, 1.38)</td>
<td>0.9184</td>
</tr>
<tr>
<td>Middle</td>
<td>1.62 (1.18, 2.21)</td>
<td>0.0028</td>
</tr>
<tr>
<td>High</td>
<td>1.52 (1.04, 2.22)</td>
<td>0.0317</td>
</tr>
<tr>
<td><strong>Low risk perception</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low confidence category</td>
<td>ref</td>
<td></td>
</tr>
<tr>
<td>Moderate confidence category</td>
<td>6.59 (3.03, 14.34)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>High confidence category</td>
<td>14.18 (3.30, 60.95)</td>
<td>0.0004</td>
</tr>
<tr>
<td><strong>Moderate risk perception</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low confidence category</td>
<td>ref</td>
<td></td>
</tr>
<tr>
<td>Moderate confidence category</td>
<td>2.31 (1.56, 3.43)</td>
<td>0.0181</td>
</tr>
<tr>
<td>High confidence category</td>
<td>5.27 (2.79, 9.94)</td>
<td>0.2201</td>
</tr>
<tr>
<td><strong>High risk perception</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low confidence category</td>
<td>ref</td>
<td></td>
</tr>
<tr>
<td>Moderate confidence category</td>
<td>1.59 (1.01, 2.50)</td>
<td>0.0019</td>
</tr>
<tr>
<td>High confidence category</td>
<td>5.04 (2.68, 9.48)</td>
<td>0.2003</td>
</tr>
</tbody>
</table>

*P-value shows chi-square test of homogeneity between groups of knowledge score within each variable's possible values, p-values of <0.05 show association between covariate values and knowledge score.
Figure 2. Impact of Demographic Factors and Index Scores on TBD Knowledge Score

- 6-15 years vs <6 years experience
- >15 years vs <6 years experience
- Experience category low vs none
- Experience category middle vs none
- Experience category high vs none
- Moderate confidence category vs low at low risk perception
- High confidence category vs low at low risk perception
- Moderate confidence category vs low at moderate risk perception
- High confidence category vs low at moderate risk perception
- Moderate confidence category vs low at high risk perception
- High confidence category vs low at high risk perception

Odds Ratio with 95% Confidence Interval
Appendix 1. Survey instrument

Eligibility Determination

1. Are you currently employed as a licensed healthcare professional that provides health services or consultation to students in a school setting?
   a. Yes
   b. No If “No,” please specify the reason below: (Circle all that apply)
      a) I am not currently employed
      b) I am not a licensed healthcare professional
      c) I do not provide health services or consultation to students in a school setting
      d) I provide mental health services and counseling only
      e) There is no licensed healthcare professional employed at this school
      f) Other: ________________

If you selected “No,” you do not meet the eligibility criteria to complete this survey. Thank you for your time. Please mail the survey back in the envelope provided. We would be happy to provide you with FREE tickborne disease educational materials. If you are interested, please fill out the enclosed order form and include it in the envelope with your survey.

If you selected “Yes,” please answer the following questions based on your experience in the school setting. If you work in a school with more than one healthcare professional, then your answers should be based on your own individual experience, not the school setting as a whole.

Section I: General Demographics

This section contains questions that provide descriptive information about you and the school setting in which you work.

2. What is your current healthcare license?
   a. Certified Nursing Assistant or Certified Medical Technician (CNA or CMT)
   b. Licensed Practical Nurse (LPN)
   c. Registered Nurse (RN)
   d. Physician Assistant (PA)
   e. Nurse Practitioner (NP)
   f. Physician (MD, DO)
   g. Other: ____________

3. Are you employed at a school-based health center?
   a. Yes
   b. No
   c. Don’t know
4. In total, how long have you worked as a healthcare professional in a school setting as of the start of the 2018/2019 school year?
   a. Less than 1 year
   b. 1-5 years
   c. 6-15 years
   d. 16-30 years
   e. More than 30 years

5. At how many school sites do you work?
   Number: _________

6. Approximately how many hours do you work in a typical workweek?
   Number: _________

7. What is the total number of students that you serve?
   a. Less than 200 students
   b. 200 - 1,000 students
   c. 1,001 - 2,000 students
   d. More than 2,000 students

8. What student populations do you serve? (Circle all that apply)
   a. Preschool/Pre-Kindergarten
   b. Elementary (example: Kindergarten - 5th)
   c. Middle/junior high (example: 6th – 8th)
   d. High school (example: 9th – 12th)
   e. Other (please specify): _________________________

Section II: Knowledge Section

This section contains questions to assess your current knowledge of ticks and Lyme disease, since it is the most commonly reported tickborne disease in your state.

9. Which tick carries Lyme disease? (select only one)
   a. *Ixodes scapularis* (Blacklegged Tick/ Deer Tick)
   b. *Amblyomma americanum* (Lonestar Tick)
   c. *Dermacentor variabilis* (American Dog Tick)
   d. *Rhipicephalus sanguineus* (Brown Dog tick)

10. About how long does an infected tick need to be attached to a person before transmission of the Lyme disease bacteria can occur?
    a. Less than one hour
    b. 1-24 hours
    c. Greater than 24 hours
    d. Don’t know
11. How long does it take for erythema migrans (commonly referred to as the “bull’s eye rash” of Lyme disease) to develop after the bite of an infected tick?
   a. Within 3 hours after a tick bite
   b. 3 hours to 2 days after a tick bite
   c. 3 to 30 days after a tick bite
   d. 31 to 60 days after a tick bite
   e. Don’t know

12. What is the most common late stage symptom of Lyme disease (months after tick bite)?
   a. Swollen joint(s)
   b. Confusion
   c. Erythema migrans (commonly referred to as “bull’s eye rash”)
   d. Chest pain
   e. Don’t know

13. True or False: A child who previously had Lyme disease can get Lyme disease again if they are bitten by another infected tick.
   a. True
   b. False
   c. Don’t know

14. True or False: In the case of a high-risk tick bite, a single prophylactic dose of antibiotic can be used to reduce the risk of acquiring Lyme disease.
   a. True
   b. False
   c. Don’t know

Section III: Experiences and Practices
This section contains questions about your experiences and practices in your school setting related to ticks and tickborne disease.

15. Since the start of the 2018/2019 school year, how many times have you attended to a student for a suspected tick-related issue?
   a. None
   b. 1-5 times
   c. 6-15 times
   d. 16-30 times
   e. 31-50 times
   f. More than 50 times

16. Does your school have a policy regarding the removal of ticks from students?
   a. Yes
   b. No
   c. Don’t know
17. In your practice in the school setting, are you allowed to remove attached ticks from students?
   a. Yes
   b. No
   c. Don’t know

18. Since the start of the 2018/2019 school year, approximately how many ticks have you removed from students?
   a. None-I’m not allowed to remove attached ticks from students
   b. None-No students presented with attached ticks
   c. 1-5 ticks
   d. 6-15 ticks
   e. 16-30 ticks
   f. 31-50 ticks
   g. More than 50 ticks
   h. Don’t know

19. In your practice in the school setting, how do you remove an attached tick? (Circle all that apply)
   a. Apply fingernail polish
   b. Smother the tick with a cotton ball soaked in rubbing alcohol
   c. Grasp the mouthparts of the tick with fine tip tweezers & gently pull it out
   d. Smother the tick with petroleum jelly such as Vaseline
   e. I don’t remove attached ticks
   f. Other: _________________________

20. What do you do for a student who has had a tick bite? (Circle all that apply)
   a. Send the student home
   b. Tell the student to be alert for fever and rash
   c. Contact the parents/guardians
   d. Contact the student’s primary care provider
   e. Offer educational resources on tick bite prevention
   f. Recommend antibiotics to prevent Lyme disease
   g. Recommend Lyme disease testing for the student
   h. Recommend that the tick be tested for evidence of infection
   i. None of the above
   j. Other: _________________________

21. Do you attempt to identify ticks?
   a. Yes
   b. No (Please skip the next question)
22. If yes, how do you go about identifying a tick? (Circle all that apply)
   a. Submit to a laboratory for identification
   b. Ask a colleague
   c. Contact the department of health
   d. CDC website
   e. Internet search engine (e.g. Google)
   f. Tick ID card
   g. Other (please specify): _______________________________

23. In your current role, have you given a presentation on ticks or tickborne disease at the school?
   a. Yes
   b. No
   c. Does not apply to me

Section IV: Prevention
This section contains questions about your recommendations to students to prevent tick bites and resources provided to students.

24. Who at your school talks with students about their risk for tick bites and ways to protect themselves from being bitten? (Circle all that apply)
   a. I do
   b. Health teacher
   c. Science teacher
   d. Physical education teacher
   e. Guest speaker
   f. PTA member
   g. No one
   h. Don’t know
   i. Other (please specify): _______________________________

25. What do you recommend to students to prevent tick bites? (Circle all that apply)
   a. Use an EPA-registered insect repellent on skin or clothes
   b. Wear light colored clothes when outside in wooded or grassy areas
   c. Tick checks after being outdoors
   d. Shower soon after being outdoors
   e. Change clothes after being outdoors
   f. Tumble dry clothes on high heat after being outdoors
   g. Avoid tick habitat (such as thick brush and tall grass)
   h. Wear clothing treated with permethrin
   i. I do not provide recommendations to students to prevent tick bites
   j. Other (please specify): _______________________________
26. Do you routinely send home health-related educational resources with students? (i.e. pamphlets, flyers, informational booklets)
   a. Yes
   b. No
   c. Does not apply to me

27. Do you send home tickborne disease-related educational resources with students?
   a. Yes
   b. No
   c. Does not apply to me

28. Do you know where you can obtain educational resources for students on tick bite and tickborne disease prevention?
   a. Yes
   b. No

Section V: Attitudes and Perceptions

This section contains questions to assess your perception of risk for tickborne disease in your student population and your degree of confidence in addressing concerns related to ticks and tickborne disease.

29. How high do you believe the risk of getting a tickborne disease is for students in your community?
   a. No risk
   b. Low risk
   c. Medium risk
   d. High risk

30. In general, I feel ____________ about my ability to determine how long a tick has been attached to a person.
    a. Not at all confident
    b. A little confident
    c. Moderately confident
    d. Very confident

31. In general, I feel ____________ about my ability to remove a tick that is attached to a person.
    a. Not at all confident
    b. A little confident
    c. Moderately confident
    d. Very confident
32. In general, I feel ____________ about my ability to recognize the symptoms of Lyme disease.
   a. Not at all confident
   b. A little confident
   c. Moderately confident
   d. Very confident

Section VI: Resource Information

This section contains questions on where you obtain information and educational materials on ticks and tickborne disease.

33. Are you familiar with the New York State Education Department curriculum titled “Tick and Tick-borne Disease Resource Toolkit” that contains information on tickborne disease prevention, including sample education strategies?
   a. Yes
   b. No

34. Have you ever received specific education about tickborne disease prevention for a school setting?
   a. Yes
   b. No
   c. Don’t know

35. Which of the following are your top three sources of information about tickborne disease? *(Please circle your top 3)*
   a. Professional societies
   b. Professional journals
   c. Medical conferences
   d. State or local health department
   e. My school district
   f. Federal organizations (e.g. CDC, NIH)
   g. Television or radio
   h. Newspapers or magazines
   i. Friends and family
   j. Professional colleague (e.g. other school-based healthcare professional)
   k. Other healthcare providers
   l. Other (please specify): ___________________________________________
36. Which of the following are your top three **ONLINE** sources for information about Lyme disease? (Please circle your top 3)
   a. Medical advice websites (e.g. WebMD, Mayo Clinic, Medscape)
   b. Federal organization websites (e.g. CDC, NIH)
   c. State or local health department websites
   d. Social media (e.g. Facebook, Twitter, etc.)
   e. Google search (or other search engine)
   f. Online blogs
   g. YouTube
   h. Lyme and tickborne disease advocacy websites (e.g. Lyme Disease Association, Global Lyme Alliance, etc.)
   i. I don’t use online sources for information about Lyme disease
   j. Other (please specify): _____________________________________________

37. Which of the following resources about tick bites and tickborne disease prevention would be helpful to you in your school health services program? (circle all that apply)
   a. Paper resources (informational pamphlets, brochures, flyers, posters)
   b. Online resources (PowerPoints, PDFs, Audio/visual web sessions)
   c. Regular email updates
   d. In-person meetings/trainings
   e. Other (please specify): _____________________________________________

38. Would continuing education credits increase your willingness to participate in education for tickborne disease prevention?
   a. Yes
   b. No
   c. Does not apply to me

   What, if any, barriers do you face in using educational resources on tick bite and tickborne disease prevention? (Free text response)
   ______________________________________________________________________

   What more would you like to learn about Lyme disease, ticks, and/or tickborne diseases? (Free text response)
   ______________________________________________________________________

   Is there anything else that you think we should know about? (Free text response)
   ______________________________________________________________________