Mountain spotted fever. The second search broadened these topics to include a keyword search with the following terms: tick prevention (with permethrin, tick checks, clothing, and habitat management), DEET, and Lyme vaccine. These searches were supplemented by manually searching the references of the obtained articles, existing practice guidelines, and CDC references. All articles were peer reviewed. Methodological scope included randomized controlled trials, observational studies, and case series from both human and animal trials. Given the broad scope of TBI and the limited scope of this CPG, review articles have been cited mainly to augment topics not fully covered by this CPG. However, primary literature was used to derive the graded recommendations within this guideline. All literature searches were performed by study authors, without restrictions placed on date of publication or country of origin. The panel used the American College of Chest Physicians (Table 1) classification scheme for grading evidence and recommendations.

### Ticks and Human Illness

#### TICKS AS A VECTOR FOR DISEASE

Transmission of TBIs to humans requires an interaction between pathogen, vector, and host; each tick species can serve as a vector for a number of different bacterial, viral, and parasitic pathogens (Tables 2 and 3) and may seek out different hosts for blood meals in each of their life stages (https://www.cdc.gov/ticks/index.html) (Figure 1). Disease transmission can occur between vectors and their hosts by sensing heat, exhalations, vibrations, and odors. Once a host has been found, ticks burrow their hypostome under the skin using a cutting movement. Most tick bites are painless. Once the tick is feeding, a complex molecular cascade facilitates the transmission of pathogens from the gut of an infected tick vector to the host. Prostaglandins in tick saliva inhibit the host’s local immune response, and tick salivary apyrase maintains blood flow into the bite site, stimulates local vasodilation, and prevents platelet aggregation. Other tick salivary enzymes inhibit the coagulation cascade, enhancing blood flow to the lesion. Importantly, there is considerable variability in the time it takes to transmit pathogen from tick to human. In Lyme disease, transmission is believed to take >36 h; in contrast, Rocky Mountain spotted fever can be transmitted in approximately 15 minutes.

#### INCIDENCE OF TICK-BORNE ILLNESS

As of 2019, Lyme disease accounted for more than 69% of more than 50,000 reported cases of TBI, whereas anaplasmosis represented 16% and spotted fever rickettsiosis represented 10%. Although summer has been associated with the highest risk of Lyme disease, transmission is possible year-round. For example, hunters must remain vigilant for tick bites through the fall season based on seasonal tick collection surveys. Environmental factors that influence tick and host distribution, feeding patterns, and survivability are rapidly changing. Habitat fragmentation, urbanization,