The Heat Is On: Killing Blacklegged Ticks in Residential Washers and Dryers to Prevent Tickborne Diseases

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Background

According to the Centers for Disease Control and Prevention (CDC) > 300,000 Americans contract Lyme disease each year, and the incidence of Lyme disease and other tick-borne diseases has steadily increased over the past two decades. Reducing exposure to ticks is important to prevent Lyme disease and other tick-borne diseases. Although the risk of tick bites can be reduced by application of repellents and conducting tick checks, these are often not practiced by individuals due to safety concerns, time constraints, and other factors1. Therefore, it is important to identify additional effective, easily implemented methods to reduce tick bites.

CDC recommends drying clothes on high heat for one hour as a means of killing residual ticks on clothing after spending time outdoors. This recommendation, however, is based on a single study which investigated tick survival under various washing conditions, followed by a single predetermined one-hour drying time2. The objective of this study was to determine the minimum amount of time necessary to kill ticks in residential clothing dryers.

Methods

We conducted a comprehensive series of trials investigating the effects of time, temperature, humidity, and laboratory as (thin and thick), and model of washer and dryer on killing adult & nymphal blacklegged ticks. Five ticks each were secured inside muslin bags during washing and drying (Figure 1).

During each round of testing, 10-20 ticks were placed in petri dishes in the laundry area to serve as controls and assessed for survival at 24 hours.

Water temperature was measured during the beginning of both the wash and rinse cycles using the Cooper-Akins SRH77A Thermo-Hygrometer. We also measured temperature and humidity levels inside the dryer prior to removing ticks at each of the predetermined drying times. Three different washer and dryer models were used for testing.

To date, we have conducted four rounds of testing with a total of 1,080 ticks (600 nymphs and 480 adults).

We used laboratory reared colonies of uninfected ixodes scapularis ticks from the Oklahoma State University Tick Rearing Facility.

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Figure 1: (A) Washing and drying ticks during washing & drying (B) Temperature and humidity probes attached tick dryer (C) Ticks with muslin bags inside dryer

Results

Figure 8: Nymphs (light green) and adults (dark green) washed in cold water then dried on low heat. Nymphs & adults were dead at 10 min. Nymphs: 60 ticks total, adults: 60 ticks total. *includes 60 min adults

Figure 9: Nymphs (light green) and adults (dark green) washed in warm water then dried on high heat. Nymphs & adults were dead at 1 min. Nymphs: 60 ticks total, adults: 60 ticks total. *includes 1 min adults

Figure 10: Nymphs (light green) and adults (dark green) washed in warm water then dried on low heat. Nymphs & adults were dead at 10 min. Nymphs: 60 ticks total, adults: 60 ticks total. *includes 10 min adults

Figure 11: Nymphs (light green) and adults (dark green) washed in warm water then dried on high heat. Nymphs & adults were dead at 40 min. Nymphs: 60 ticks total, adults: 60 ticks total. *includes 40 min adults

Figure 12: Nymphs (light green) and adults (dark green) washed in warm water then dried on low heat. Nymphs & adults were dead at 30 min. Nymphs: 60 ticks total, adults: 60 ticks total. *includes 30 min adults

Figure 13: Nymphs (light green) and adults (dark green) washed in warm water then dried on high heat. Nymphs & adults were dead at 40 min. Nymphs: 60 ticks total, adults: 60 ticks total. *includes 40 min adults

We found that there was no statistically significant effect of wash temperature on subsequent survival in low or high heat dry cycle.

Table 1: Temperature and Relative Humidity Ranges

We found that if both nymphal and adult ticks were washed in hot water greater than 115°F, all ticks died during washing (Table 3).

Additional Variables Tested:

Although statistical analysis is still in progress, thickness of clothes and use of detergent or dryer sheets did not appear to alter tick survival during washing and drying.

Conclusions

In summary, all ticks survived both cold and warm washes. However, tick survival varied considerably depending on the temperature of the wash cycles. Water temperatures > 115°F resulted in complete mortality of all ticks during washing.

For those ticks that survived a wash cycle, it took an additional 30-70 min in the dryer, depending on the temperature of the dryer, to kill all the ticks after washing.

Most significantly, we found that all adult and nymphal ticks were killed when dried with dry towels for 5 min on high heat or 7 min on low heat. Our results seem to indicate that blacklegged ticks are relatively tolerant of moist heat in the dryer but not desiccation (i.e. dry heat).

There are some limitations to our study. The muslin bags which contained the test ticks may have protected the ticks somewhat from heat and dryness. In addition, stopping and restarting the dryer at pre-determined time points may have released heat and decreased temperature. Therefore, the drying times we found necessary to kill ticks are likely conservative and could be even shorter. Lastly, we only used lab-raised I. scapularis ticks but survival of wild-caught ticks and different species of ticks may vary.

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Through this study we have identified an effective and easy method to kill residual ticks on clothing, potentially reducing the risk of tick-borne diseases.

Table 2: Relative Humidity

Possible New Recommendations for Killing Ticks on Clothing:

1) After spending time outdoors, place clothing directly in dryer and run for 5 minutes on high heat or 3 minutes on low heat.

2) If clothes are heavily soiled and require washing first, if possible wash on hot cycle with water temperature greater than 115°F.

3) If it is not possible to wash with a temperature greater than 115°F, clothes should be dried for 70 minutes on low heat or 50 minutes on high heat to kill blacklegged ticks after washing.

References