# Q FEVER ANTIBODIES IN DAIRY CATTLE AND IN HUMANS IN WASHINGTON STATE

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RECENT studies indicate that Q fever is much more widespread in the United States than was formerly realized. Infection in cattle has now been demonstrated in 35 States, and human infection has been reported from 18 of these States (*1*). "Significantly," Luoto states, "infections are being detected wherever a search for the disease is made" (*2*).

A limited serologic survey in eastern Washington in 1948–49 (*3*) found Q fever in both humans and animals, and the author concluded that cattle were an important reservoir. To provide up-to-date information on the disease throughout the State, we conducted a screening survey for the presence of Q fever antibodies in dairy cows and in humans in 1959.

## Material and Methods

Milk samples were collected, with the cooperation of the Washington State Department of Agriculture, from all large commercial dairies supplying the main urban centers: Seattle, Yakima, and Spokane. The samples were obtained by withdrawing a small portion of milk from the 15-day composite herd samples retained by the dairies for butterfat testing. Since the composite samples contained a preservative, mercuric chloride, refrigeration of the samples was not required.

The milk samples were identified by numbers assigned to them by the plants. Since each plant had producers in several counties, no further attempt was made to identify the specimens at the time of collection. After the tests were run, the numbers for positive samples were submitted to the milk plants for identification by county and city or town. No differentiation was made between grade A milk producers and factory milk producers.

A total of 4,172 samples were collected, each representing one dairy herd. They came from 26 of the State's 39 counties, as well as three nearby States. Excluding the samples known to be from other States (22 positive samples), the dairy farms represented in the survey constituted approximately 30 percent of the 13,471 such farms counted by the U.S. Department of Agriculture in its 1954 census of commercial milk producers.

Samples of human blood serum were obtained from blood banks in Yakima and Seattle, Wash., and Portland, Oreg. The samples were pilot tubes of blood that either had already been used or were out of date and no longer needed for other studies. They were identified by numbers assigned to them by the blood banks.

Of 3,126 serum samples tested, 2,860 were from residents of Washington, and most of these were from residents of nine counties. The Washington residents contributing samples

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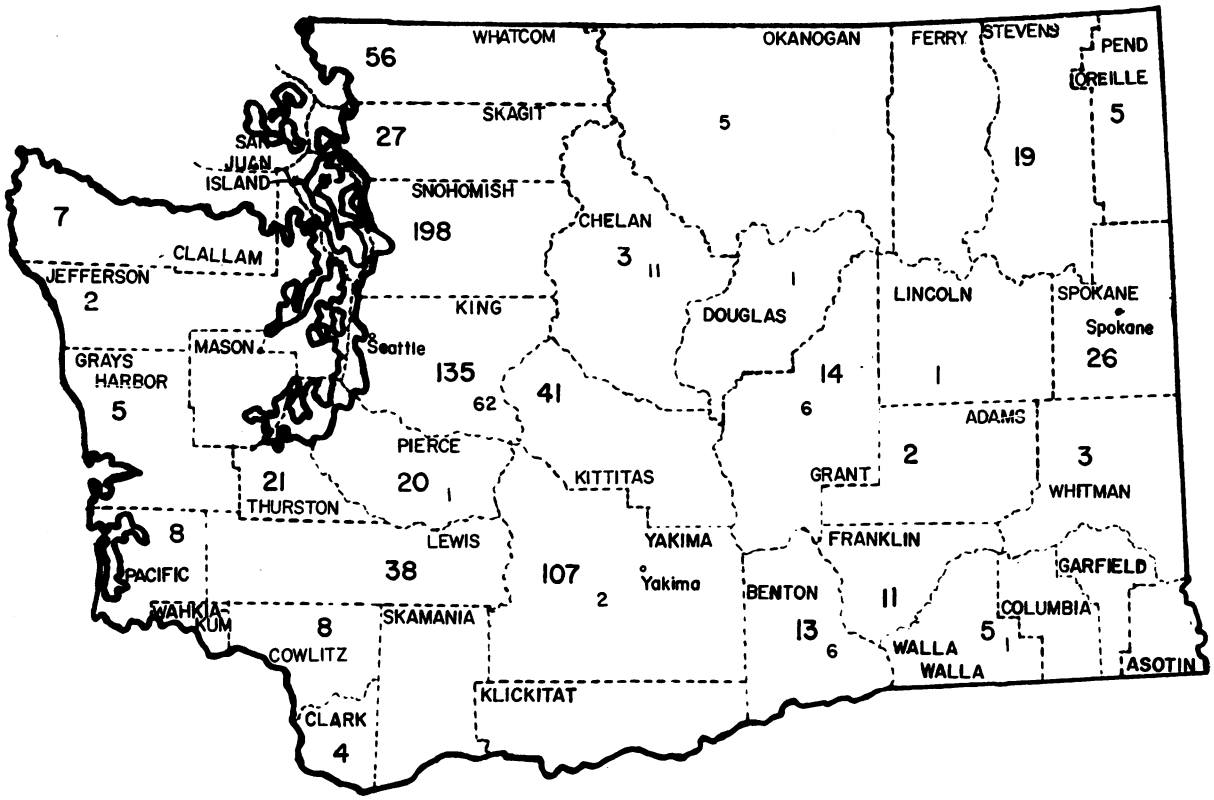
**Figure 1. Number of bovine milk herds and human serums positive for Q fever antibodies, Washington State**




**Large numbers: positive bovine milk herds.**
**Small numbers: positive human serum samples.**

constituted about one-tenth of one percent of the 2.7 million estimated population of the State (1958 figures of the U.S. Bureau of the Census). The survey population, however, was not representative of the total population in age distribution or place of residence. Almost all blood donors are over age 21 years, and a majority of those contributing to the blood banks used in this study live in urban areas.

All specimens were screen tested by means of the capillary agglutination test, a rapid, simple, and economical test applicable to either serum or milk samples. Procedures set down by Luoto (*4–6*) were followed, except the samples were tested only undiluted. The test itself, of course, dilutes the samples almost one-half, and pooled milk represents dilution of milk from infected animals by that from uninfected animals in the same herd.

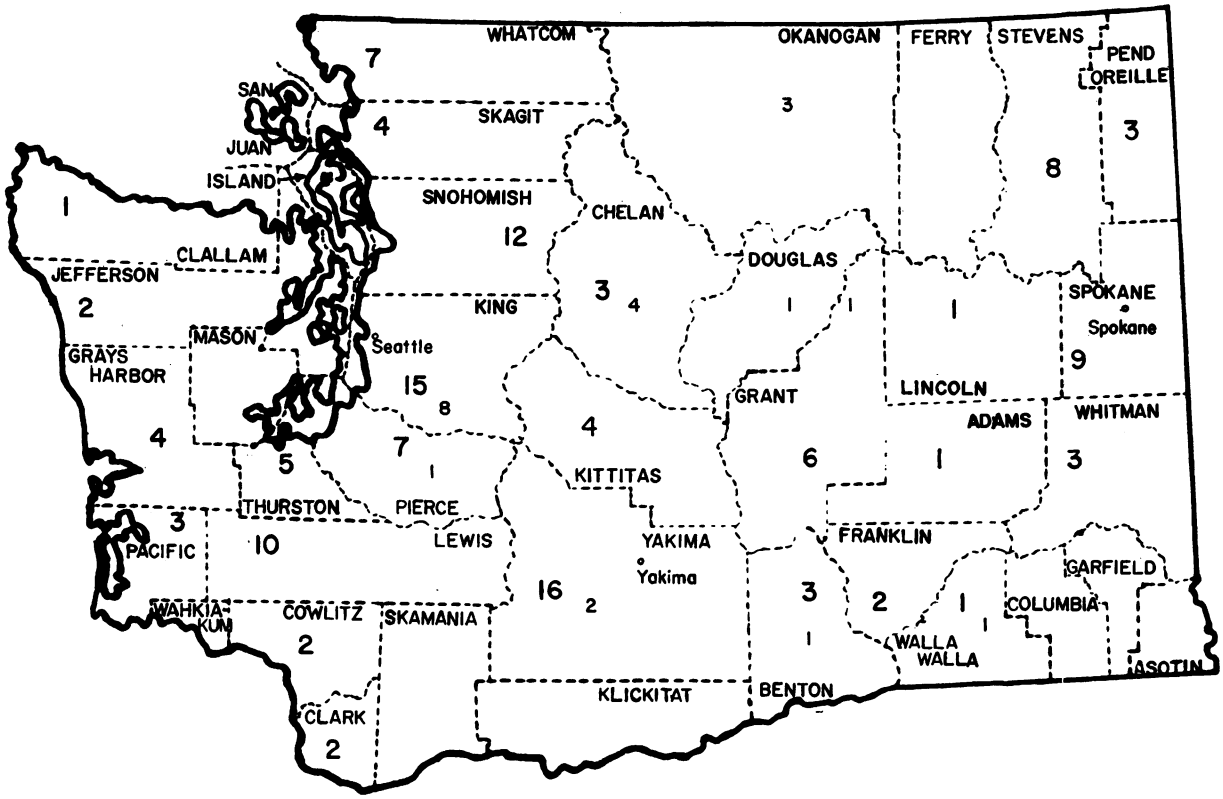
Test reactions varied from slightly positive to strongly positive, but since this was a screening survey, all positive reactions were recorded without regard to degree of positivity. All positive serums were retested to validate the accuracy of the first test readings.

No attempt was made to isolate *Coxiella burnetii*, since all the milk samples contained a preservative. Because of the large number of specimens collected, it was not possible to visit individual dairy farms to collect fresh milk for isolation of the organism or to locate the persons with positive reactions.

## Results

Of the 4,172 herd milk samples, 844, or 20.23 percent, were found positive for Q fever antibodies by the capillary agglutination test. Forty-three of the positive samples could not be identified by the milk plants because of errors in numbering or because the producer subsequently discontinued selling his milk to that plant. Twenty-two positive samples came from

**Figure 2. Number of cities and towns with bovine milk herds or human serums positive for Q fever antibodies, Washington State**

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three nearby States. Subtracting the 22, the percentage of positive milk samples from herds in Washington was 19.81 percent.

The number of positive milk herds in each county is shown in figure 1, and the number of cities or towns where positive herds were located, in figure 2. No percentages are given because only positive samples were identified and the total number of samples for each county is therefore unknown. Hence, the figures on the maps do not indicate prevalence of Q fever antibodies by county. Counties with the largest number of positive samples, King, Snohomish, and Yakima, undoubtedly provided the largest number of milk samples. The counties which showed no positive samples either provided no samples at all for this survey or a very small number.

Ninety-five, or 3.32 percent, of the 2,860 human serum specimens from Washington residents were positive for Q fever antibodies. Nineteen of the 266 samples from a neighboring State were also positive. The number of positive specimens by county in Washington is shown in figure 1, and the number of cities and towns represented, in figure 2. Again, the numbers do not indicate prevalence by county. King County has the greatest number of positive samples, but this county, which has the largest population in the State, probably supplied the largest number of samples.

Positive human serums were found in two counties from which no milk specimens were tested. These counties are sparsely populated and have few dairy herds. Population movements may explain the occurrence of these positive human specimens.

## Discussion

The capillary agglutination test, according to Luoto (*2*), is highly specific and sensitive for antibody against *C. burnetii* in serum or milk.

Stoenner and co-workers (*7*) used the test on milk samples in 1958 to determine the prevalence of bovine Q fever in previously identified endemic areas of Idaho. The reliability and validity of the test, as performed on pooled herd milk samples, for identifying infected herds was further demonstrated in 1959 by Tjalma and Braun (*8*). In their study, results of tests on an average of 12 samples from each of 160 herds over a 26-week period were remarkably consistent. There was a high correlation between milk and blood Q fever titers of individual animals, and rickettsiae were isolated from positive milk samples.

Assuming, on the basis of such reports, that the capillary agglutination test is a valid indication of the presence of Q fever antibodies, the findings of our survey suggest that Q fever, at least in cattle, is on the increase in Washington. The survey made in 1948–49, though limited primarily to animals and students of the State College of Washington in Pullman, is pertinent. That survey, using the complement fixation test, found infection rates of 2.75 percent (9 of 327) in cattle and 2.08 percent (6 of 289) for humans. Most of the positive cattle serums were from the college beef herd, and the three human serums with the highest titers were from veterinary students with a past history of respiratory infections.

Results of the capillary agglutination test, as performed in our study, are not directly comparable with results of the complement fixation test. However, if one accepts the 1949 infection rate for cattle of 2.75 percent, the finding of 19.81 percent positive would not represent an unprecedented increase in Q fever over a 10-year period (*1*). The 1959 rate for humans of 3.32 percent would represent a minimal increase for a 10-year period. It should be remembered that the blood samples in the 1959 survey were taken from blood banks in urban centers. Blood samples from residents of agricultural areas would be expected to yield higher proportions of positives.

Despite the relatively high percentages of dairy cattle and humans apparently carrying Q fever antibodies, only one serologically proved case of Q fever in man was reported in Washington in 1959. It seems likely that many cases of this disease are not being diagnosed. Q fever in man is often very nearly asymptomatic or subclinical, or the symptoms are easily confused with those of other diseases. Laboratory confirmation requires isolation of the causative organism from blood of the patient or a demonstration of a rise in antibody titer between acute and convalescent stages of infection.

The results of our survey are intended only to illustrate the presence of Q fever in the State. More detailed serologic and isolation studies are necessary to determine the incidence of the acute and chronic stages of this disease.

## Summary

In a screening survey, 4,150 herd milk samples from 26 of the 39 counties in the State of Washington were examined for Q fever antibodies by the capillary agglutination test. Eight hundred and twenty-two, or 19.81 percent, were positive. Blood serum specimens numbering 2,860 from residents of nine counties in the State were also examined by the same test, and 95, or 3.32 percent, were positive. The capillary agglutination test is simple to perform and is easily read, and a screen test is a valid indication of the presence of Q fever antibodies in both dairy herds and humans.

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