A Retrospective Study on the Relationships of Calving Practices and Vaccination Status of Reactor Animals to the Cost of Eradicating Brucellosis in 79 Dairy Herds

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In 1969, 21 years after the initiation of a program to control and then to eradicate bovine brucellosis, California became a certified brucellosis-free state. In 1971-1972, when a major share of the funds and professional talent available for disease control necessarily were diverted to eradicate an explosive outbreak of Newcastle disease in southern California, it was not possible to maintain continuous surveillance on either the vaccination status or origin of the 25,000 to 50,000 cows annually imported into the state as dairy replacement animals. Many of the animals imported during this period apparently were infected with brucellosis because by late 1972 this disease began to appear among several large dairy herds in southern California. Figure 1 shows the extent of the bovine brucellosis outbreak as detected by the BRT milk test for the years 1971-1977.

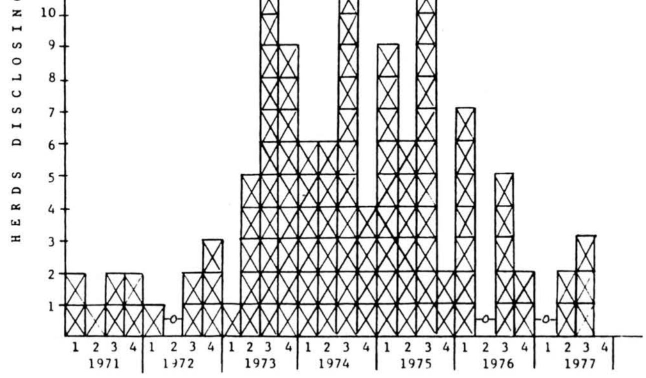

Figure 1. BRT suspicious dairies revealing reactors to the brucellosis blood test (quarterly results); 3100 dairy herds.

By using conventional test and slaughter procedures, these infected herds eventually were restored to a brucellosis-free status but there were marked differences among the herds in the length of time required to achieve this goal. Some herds were restored to a clean status in a matter of months while for other herds this required periods of up to several years.

A recently completed retrospective study designed to evaluate the factors responsible for these time differences revealed that among the 79 herds examined, the vaccination status of the reactor animals directly controlled the pace of eradication. In 33 herds rapidly restored to a clean status, all the reactors were vaccinated animals. In 46 herds restored more slowly to a clean status, each invariably contained one or more non-vaccinated reactor animals. The presence of non-vaccinated reactors in a herd slows the pace or eradication by increasing the number of animals that ultimately become infected, particularly under circumstances of dry pen style of calving practice. They also are responsible for prolonging herd quarantine periods.

Clearly, the factors associated with the non-vaccinated reactors that slow the pace of eradication in a herd will have an adverse impact on the cost of eradication. This paper reports a retrospective study designed to evaluate the differences in the cost of restoring these 79 herds to a brucellosis-free status.

Materials and Methods

The time spanned by this study was four years and five months–from September 1971 through January 1977. The number of herds included for evaluation is 79. All of them are located in southern California, all purchased replacements from out of state or from herds containing such cattle, and all are operated under similar conditions of dry lot feeding with crowding of the animals. Each of the 79 herds became infected after August 1972 and were restored to a brucellosis-free status by February 1977. The test and slaughter procedures to eradicate the disease were similar for each herd. The differences among the herds were vaccination status of reactor animals, and differences in management procedures at calving time.

A herd was classified as infected if the initial positive herd test revealed at least one reactor animal, i.e., positive at 1:200 on both the standard plate test and rivanol precipitation test. Subsequent to finding the first reactor(s), herds were retested by the card test and animals having a positive card test were classified as reactors. Five herds appeared twice in the study. They became infected after August 1972, were cleaned up, later became infected again and were restored to a brucellosis-free status a second time.

The herds ranged in size from 130 to 6,000 cows, for an average herd size of 552 cows. The 6,000-cow herd is classified in a study as four 1,500-cow units, as that is how they are handled, although they all are located on the same premises. The total number of animals within the 79 herds were 43,596.

The cost of eradicating brucellosis from these infected herds was determined by calculating the regulatory costs of herd testing and indemnity for reactors and of estimated losses incurred by the owners.

A. Regulatory Costs

1. Testing. The costs per blood test were estimated and then applied to each herd according to the number of blood tests conducted en route to eradication. Items included in testing costs are equipment, personnel (professional, paraprofessional, clerical and administrative), laboratory work, branding and appraisal of reactor animals, and supervision of disinfecting procedures following removal of reactor animals. Total cost per test was estimated to have been $1.37.
2. Indemnity. The indemnity funds from both state and federal sources were combined and averaged for the 1,597 indemnified reactors removed. Indemnity per reactor from federal funds was $50.00 and from state funds it averaged $122.00 for a total indemnity of $177.00.

B. Owner Costs

1. Replacements. The difference between average replacement cost and the average price of cull animals was determined for each year of the study. The average paid in indemnity was then subtracted from this figure. The difference was $102.00, which is the average price the owner had to pay for a replacement animal. Table 1 shows the average owner costs to replace brucellosis reactors found in 79 dairy herds, 1973-1976. In these data, the reactors found in late 1972 are included with those of 1973, and the few reactors found in January 1977 are included with those of 1976.
2. Milk loss. This is the amount of milk lost during the 30-day "turn-around" period following removal of a reactor animal and preceding production by a replacement. These costs

Table 1

Average Owner Costs to Replace Brucellosis Reactors Disclosed in 79 Dairy Herds, 1973-1976

Year	Difference-Replacement -Cull Prices	Average Combined Indemnity	Average Owner Costs	No. Reactors	Total Owner's Annual Costs
1973	$274	$195	$ 79	303	$ 23,937
1974	282	204	78	579	45,162
1975	266	165	101	527	53,227
1976	314	100	214	188	40,232
			Totals	1597	$162,558

Average Owner Cost Per Replacement - $162,558 ÷ 1597 = $102

Table 2: Estimated Milk Losses of Brucellosis Reactors Removed from 79 Dairy Herds, 1973-1976, Based on Median Reactor Being in Third Month of Lactation

Year	Average Annual Production	11%	Price CWT	Gross Loss	Net Loss	No. Reactors	Total Milk Losses
1973	15,298	1683	6.47	$108	$54	303	$ 16,362
1974	16,136	1775	8.20	146	73	579	42,267
1975	16,782	1846	8.85	164	82	527	43,214
1976	17,720	1949	9.27	180	90	188	16,920
					Totals	1597	$118,763

Average Milk Losses Per Reactor - $118,763 ÷ 1597 = $74 were determined from records kept by the California Department of Food and Agriculture on average annual milk production and average price received per hundredweight for DHIA herds in southern California. These records also showed that the average feed costs were 50% of the milk receipts for the median reactor animal which was found to be in her third month of lactation. Animals at this period of lactation are expected to produce 11% of their milk production in the next 30 days. Thus, the net value of the milk loss during the "turn-around" period was $74.00 per reactor (see Table 2).

Results and Discussion

Table 3 shows an analysis of the estimated costs of eradicating brucellosis in 79 infected dairy herds according to the vaccination status of the reactor animals. In 33 of these herds, all the reactors were vaccinates. The owner cost was $1.22 and the regulatory cost was $6.88, making a total estimated cost of $8.10 *for each animal in the herd* (on the tables this is identified as "cow unit").

The presence in the herd of non-vaccinated reactors increased the costs to both the owner and the regulatory agencies, and each additional non-vaccinated animal further increased the per cow unit costs. For example, the per cow unit cost was $12.11 for herds in which only one non-vaccinated animal was found. This cost rose to $128.94 per cow unit in herds that had 33 or more non-vaccinated reactors.

Table 4 shows an analysis of the estimated costs of eradication according to the style of management practice at calving. Among the 79 infected herds examined in this study, 18 practiced calving in "close-up" pens where the animals were taken when calving was imminent. These pens usually had only a few animals in them at a time. The estimated owner cost for those practicing this style of calving management was $2.16 per cow.

The remaining 61 herd owners used the dry pen for calving. These pens usually contained a large number of animals at a time and this style of management caused the owner cost to increase to $7.93 per cow in the herd. Regulatory costs also were different between the two management styles (see Table 4).

Some owner losses associated with eradicating brucellosis from a herd are not included in these cost analyses. Items such as depreciation, labor, cleaning and disinfection, the cost of feeding the replacement cow during the 30-day turn-around period and the value of the calf produced by the replacement animal are difficult to assess without individual herd information for each of the 79 herds.

Table 5 shows an analysis of the costs according to vaccination status of reactor animals and style of management practices at calving time. Herds wherein all the reactors were vaccinates and practiced close-up pen calving had the lowest costs for eradication–$8.05 per cow unit. This increased only slightly to $8.12 where dry pens were used for calving in this type of herd. In sharp contrast, for herds containing non-vaccinated reactors and practicing dry

Table 3: Costs to Eradicate Brucellosis from 79 Dairy Herds Grouped by Vaccination Status of Reactor Animals Estimated on "Per Cow Unit" Basis

Vaccination Status of Reactors	Herds	Reactors	Cattle	Tests	Costs Per Cow Unit: Owner	Gov't.	Total
All vaccinated	33	131	18,967	78,442	1.22	6.88	8.10
≥ 1 nonvaccinated							
1 nonvaccinated	14	69	5,837	33,794	2.08	10.03	12.11
2 nonvaccinated	8	57	4,967	32,314	2.02	10.94	12.96
3 nonvaccinated	6	76	2,609	13,337	5.13	12.16	17.29
4-5 nonvaccinated	6	96	4,453	47,222	3.79	18.35	22.14
8-16 nonvaccinated	6	164	2,101	25,925	13.74	30.72	44.46
33-113 nonvaccinated	6	1004	4,662	180,080	37.90	91.04	128.94
Average in herds with nonvaccinated reactors					10.11	29.05	39.15
Average for all 79 herds					6.45	19.40	25.85

Table 4: Role of Calving Practices on Estimated Costs Per Cow Unit to Eradicate Brucellosis from 79 Dairy Herds

Calving Practices	Herds	Reactors	Cattle	Tests	Costs Per Cow Unit: Owner	Gov't.	Total
Closeup Pen	18	138	11,229	70,672	2.16	10.80	12.96
Dry Pen	61	1459	32,367	340,442	7.93	22.39	30.32

Table 5: Relationships of Calving Practices and Vaccination Status of Reactor Animals to the Cost of Eradicating Brucellosis from 79 Dairy Herds

Calving Practices Within Vaccination Status of Reactors	Herds	Reactors	Cattle	Tests	Costs Per Cow Unit: Owner	Gov't.	Total
All Reactors Vaccinated							
Closeup Pen Calving	8	28	4,381	18,535	1.12	6.98	8.05
Dry Pen Calving	25	103	14,586	59,907	1.24	6.88	8.12
≥1 Reactors Not Vaccinated							
Closeup Pen Calving	10	110	6,848	52,137	2.83	13.27	16.10
Dry Pen Calving	36	1,356	17,781	280,535	13.42	35.12	48.54

pen calving, the costs rose to a remarkable $48.54 per cow unit.

It is clear that the presence of non-vaccinated reactors in dairy herds not only slows the pace or eradication by significantly influencing the course of the disease, but these type animals markedly affect the cost of eradicating the disease. Only 14 of the 46 herds with non-vaccinated reactors had a single non-vaccinated reactor–all others had two or more. For each additional non-vaccinate present, the cost of eradication increased $3.00 for every cow in the herd (see Table 6).

The style of calving management also dramatically influences the overall costs of eradication for both the owner and the regulatory agencies. It is remarkable that herd owners who practice dry pen calving and have non-vaccinated reactors in their herds can bear the expenses to stay in the dairy business even when a favorable tax structure offsets a portion of the expenses.

This study shows that sound herd management is conducive to disease control and this, in turn, reduces the cost of eradication. The destiny of the herd is in the hands of the owner. Only he can decide upon management procedures, purchase vaccinated replacement animals, and practice calfhood vaccination. And only he can balance them against the cost of eradicating brucellosis should it enter his herd.

Table 6: Estimated Combined Costs Per Cow Unit Grouped by Vaccination Status of Reactor Animals and Showing a Projected Increase of $3 per Cow Unit for Each Nonvaccinated Reactor Disclosed

Vaccination Status of Reactors	Costs Per Cow Unit Owner	Gov't.	Total	Projected
All vaccinated	1.22	6.88	8.10	8.10
1 nonvaccinated	2.08	10.03	12.11	11.10
2 nonvaccinated	2.02	10.94	12.96	14.10
3 nonvaccinated	5.13	12.16	17.29	17.10
4-5 nonvaccinated	3.79	18.35	22.14	21.60
8-16 nonvaccinated	13.74	30.72	44.46	44.10
33-113 nonvaccinated	37.90	91.04	128.94	227.10