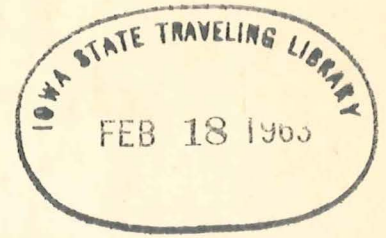
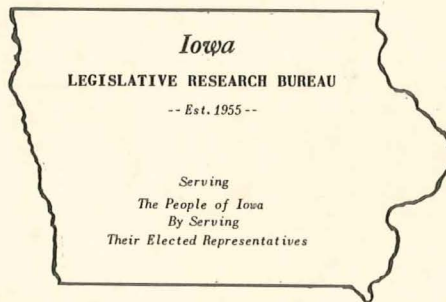


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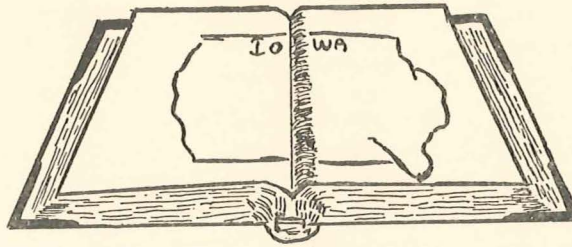
# **Bovine Brucellosis:**

**EFFECTS AND CONTROLS**



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**IOWA LEGISLATIVE RESEARCH BUREAU**  
**REPORT NO. 27**  
**FEBRUARY, 1963**



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Director of Legislative Research Bureau

A. E. Reyhons

Information in this Report is intended to be factual only.  
The contents of the Report are not to be interpreted as  
recommendations of the Research Bureau.

B O V I N E   B R U C E L L O S I S :  
Effects and Controls

LEGISLATIVE RESEARCH BUREAU

Report to the  
60th IOWA GENERAL ASSEMBLY

Research Report No. 27  
February, 1963

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F O R E W O R D

The Report on Bovine Brucellosis has been conducted in compliance with a study request submitted to the Legislative Research Committee during the 59th Iowa General Assembly by five State Representatives: Representatives Russell L. Eldred, Carl Hirsch, Richard F. Stageman, Richard L. Stephens, and Paul M. Walters. The five Legislators asked "that the Legislative Research Bureau make a study of the eradication of bovine brucellosis in Iowa and other states" and study "public health problems of this disease in humans."

The research involved in this Study and the writing of the Report has been the responsibility of Mr. John Spielman of the Research Bureau staff. A legislative advisory committee was not appointed by the Legislative Research Committee to assist the Research Bureau with the Study.

The Bureau wishes to express its appreciation to Dr. Marshall E. Pomeroy, Chief of the Division of Animal Industry, Iowa State Department of Agriculture, and to Dr. Stanley L. Hendricks, Assistant Director of the Division of Preventable Diseases, Iowa State Department of Health. The advice and assistance of Dr. Pomeroy and Dr. Hendricks has greatly facilitated the publishing of this Report.

We also wish to thank Dr. Glen O. Shubert, Assistant Veterinarian in charge of the Des Moines Office of the Animal Disease Eradication Division, Agricultural Research Service, United State Department of Agriculture; Rosalie Kendall, Division of Animal Industry, Iowa State Department of Agriculture; and all other individuals from the State Department of Agriculture, State Department of Health, the Des Moines Office of the Animal Disease Eradication Division, Agricultural Research Service, U.S. Department of Agriculture and the Wallaces Farmer who assisted the Bureau in compiling information in this Study.

A. E. REYHONS  
Director

1-12-66 In Legislative Research Bureau gift



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## I. INTRODUCTION

This Study of brucellosis is restricted almost entirely to a study of the disease in cattle and the transmission of the disease to humans. In discussing brucellosis in cattle, three areas are given primary consideration: causes and effects; control on the federal state level; and brucellosis and its control in Iowa. The causes and effects of brucellosis in humans and the extensiveness of the disease in humans in Iowa are the two main topics considered in the area of human brucellosis.

Although this Study is predominantly concerned with bovine brucellosis, it has been necessary to give limited consideration to the subject of brucellosis in swine. Consideration is demanded due to the extensive role that swine brucellosis plays in transmitting the disease to humans. For this reason, swine brucellosis will be discussed in one Chapter and mentioned from time to time throughout this Report.

Three topics that may be of Legislative interest which are included in this Study are: Federal funds for brucellosis control in Iowa; the New Hampshire bovine brucellosis statute; and public opinion in Iowa concerning eradication of the disease. As will be explained in succeeding Chapters, New Hampshire is the only state that has been certified brucellosis free.



## II. CHARACTERISTICS, CAUSES AND COST OF BRUCELLOSIS

### Characteristics and Causes

Brucellosis is a disease which is found only in breeding animals. Although all domestic animals are susceptible to the disease, brucellosis is a contagious disease affecting primarily cattle, goats, and swine. Brucellosis in animals is characterized by ". . . abortion, sterility, . . . the formation of localized lesions in various tissues . . ."1 and "inflammation of the genital organs . . . and fetal membranes."2

Three species of organisms cause brucellosis. Cattle are most susceptible to an organism called the brucella abortus, swine to the brucella suis, and goats to the brucella melitensis; however, all three types of organisms can cause brucellosis in cattle.

When brucellosis invades a herd of cattle, the infected animals are the principle instruments for spreading the disease. Pregnant cows infected with brucellosis constitute a serious threat to other animals. A pregnant cow infected with brucellosis is likely to abort and with the elimination of an abortus fetus, millions of brucella organisms are expelled. Although abortion is a danger in pregnant cattle infected with brucellosis, abortion does not occur in every instance. An infected cow may give birth to a calf in what appears to be a normal birth and yet the brucella organisms will be eliminated in the process.

There are different ways through which the disease may be spread among cattle. Cattle feeding in a pasture in which a cow has recently aborted may become infected with brucellosis through eating contaminated grass. Brucellosis may be contacted from a feed lot that has been contaminated with the organisms.

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<sup>1</sup>Ival Arthur Merchant, An Outline of the Infectious Diseases of Domestic Animals (Minneapolis: Burgess Publishing Co., 1951), p. 252.

<sup>2</sup>Ibid.

The disease may be transmitted by cows through their milk. An infected cow may shed organisms in her milk and become a serious source of infection to her calf. Organisms may also gain entry to a cow's body through the eyes and through skin wounds.

#### Economic Losses

The cost of brucellosis in the United States has been considerable. Abortion, reduced production of milk, and replacement of unproductive cows has resulted in millions of dollars in losses to the livestock industry. These losses are shown in Table 1 of this Report.

TABLE 1

Estimated Total Cost Of Brucellosis To Cattle Industry  
And Incidence Of Disease In Nation's Cattle

<u>Year</u>	<u>Estimated Losses</u>	<u>Incidence of Disease (Percentage)</u>
1947	\$100,000,000	4.5
1954	58,300,000	2.4
1961	23,300,000	1.04

SOURCE: Cooperative State-Federal Brucellosis Eradication,  
U.S. Department of Agriculture ARS 91-33, pp. 4-5.



### III. ERADICATION OF BRUCELLOSIS IN CATTLE

#### Eradication

Because there is no cure for brucellosis in domestic animals, eradication is the only effective means of coping with the disease. Two methods available in the eradication of brucellosis in cattle are vaccination and compulsory testing and slaughter.<sup>1</sup> An ideal brucellosis eradication program combines vaccinations, compulsory testing and slaughter and proper herd management. Elimination of any of these factors impairs eradication.<sup>2</sup>

#### Vaccination

Calves are vaccinated as a protective measure against brucellosis infection. This method offers relative protection to both calves and adult animals, but vaccination alone will not eradicate brucellosis.<sup>3</sup>

The relative protection provided by vaccination has been demonstrated by a 1958 study conducted in Montana.<sup>4</sup> In vaccinated populations of cattle, protection against brucellosis was from 60 to 65 percent when the cattle were exposed to the disease. The results of the study indicated that 35 to 40 percent of the animals which had been vaccinated remained susceptible to brucellosis and "served to perpetuate the disease among vaccinated populations."<sup>5</sup>

Ordinarily it is agreed that the immunity against brucellosis afforded by vaccination of calves diminishes as the animals mature. Vaccination of adult cattle is not recommended as a regular practice because if the vaccination is followed by blood tests, the animal's reaction to the blood test cannot be easily distinguished

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<sup>1</sup>Letter of A. L. Sundberg, Iowa State Department of Agriculture to the Wallaces Farmer, undated, published in the Wallaces Farmer, July 2, 1960, p. 20.

<sup>2</sup>Ibid.

<sup>3</sup>Wesley W. Spink, The Nature of Brucellosis (Minneapolis: The University of Minnesota Press, 1956), pp. 270-271.

<sup>4</sup>U.S. Department of Agriculture, Agricultural Research Service, Animal Disease Eradication Division, Brucellosis Vaccination Survey, April 1959, pp. 1-7.

<sup>5</sup>Ibid., p.4

from actual brucellosis infection. Due to the fact vaccination is not 100% effective, the cattle owner is not sure if the vaccinated animal is brucellosis free or infected. Therefore, adult vaccination is used primarily in an effort to stop mass abortions that occur in severe outbreaks of brucellosis in herds.

In an article from the Wallaces Farmer, Alvin F. Bull, Managing Editor of that publication states that despite its limitations, vaccination can contribute much to a brucellosis control program. Mr. Bull writes that

"It (vaccination) can limit (the) spread of the disease within a herd. . . . it can gradually reduce the disease level as the older, more susceptible animals are culled from the herd."<sup>1</sup>

Mr. Bull adds, however, that a serious outbreak of brucellosis infection in a herd of cattle can "override the immunity provided by most vaccinations . . . ."<sup>2</sup>

Compulsory programs of vaccinations are desirable but enforcement is extremely difficult as was discovered in California when that State undertook such a program. In trying to enforce a compulsory vaccination program, California was never "able to vaccinate more than 90 percent of the dairy calves and 75 percent of the beef calves."<sup>3</sup> Because of the inability to enforce vaccination of all eligible cattle, the State adopted a program combining vaccination and testing and slaughter.

#### Compulsory Testing and Slaughter

A second method of controlling brucellosis in cattle is through the use of the blood test to determine which animals are infected with the disease. Upon finding an animal infected, the cow is condemned and slaughter is required.

<sup>1</sup> Alvin Bull, "We Have Tools to Whip Brucellosis," Wallaces Farmer, December 17, 1960, p. 8.

<sup>2</sup> Ibid.

<sup>3</sup> Sundberg, p. 20.

Cattle may react to the test in varying degrees and are classified according to their test reactions. The classifications are as follows:

1. Reactors - Cattle whose positive reaction to the test indicates they are infected with brucellosis.
2. Suspects - Cattle whose reaction to the test indicates they are harboring brucella organisms but not to the extent they warrant being classified as reactors.
3. Negatives - Cattle whose blood test reveals that they are not infected with brucellosis.<sup>1</sup>

Because vaccine used to prevent brucellosis can cause an animal to have a partial reaction to the blood test, allowances must be made in interpreting the results of blood tests conducted on official vaccinates.

A Report prepared by the United States Department of Agriculture emphasizes the need to include blood testing in an effective brucellosis eradication program. The Report states "vaccination alone cannot be expected to eradicate brucellosis nor to free the majority of infected herds from the disease. Infected animals must be identified and eliminated."<sup>2</sup> The blood test is one method which may be used to identify an infected animal.

#### Identifying Infected Animals

In addition to the blood test, two other methods are used in identifying brucellosis in cattle; the milk ring test and the market cattle test.

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<sup>1</sup>Occasionally cattle which are not harboring brucella organisms react positively or suspiciously to the blood test. The presence of certain foreign bodies in the animal's blood other than brucella organisms can occasionally cause such a reaction.

<sup>2</sup>U.S. Department of Agriculture, Agricultural Research Service, Animal Disease Eradication Division, Brucellosis Vaccination Survey, April 1959, p. 7.

### Milk Ring Testing

The brucellosis (milk) ring test (BRT) is a "test applied to milk and cream and used as a presumptive test for locating possible brucellosis infected herds according to . . . (an approved) technique . . ." <sup>1</sup> This method is used primarily for testing dairy herds.

The statement has been made that "three clean (milk ring) tests 6 months apart have about 97 percent chance of being correct." <sup>2</sup> A clean milk ring test is one which reveals no brucella organisms in milk that is tested.

As of 1961, seven states conducted milk ring tests four times a year while the majority of states conducted the tests two or three times a year. One state tested some of its herds only once a year.

### Market Cattle Testing

Market tests are blood tests performed on breeding cattle of a beef type offered for sale at sale barns and slaughtering establishments under Federal supervision.

The market cattle testing program has expanded rapidly, and tests are being performed extensively in most states. Only a few states lag behind with small scale programs. At the end of 1961, only 5 states did not have a market cattle testing program. <sup>3</sup>

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<sup>1</sup>This definition provided by the Animal Industry Division, Iowa State Department of Agriculture.

<sup>2</sup>Bull, p. 8

<sup>3</sup>C. K. Mingle, Cooperative State-Federal Brucellosis Eradication, A Progress Report prepared by the Animal Disease Eradication Division, Agricultural Research Service, U.S. Department of Agriculture, Washington 25, D.C., February 1962, p. 8.

#### IV. FEDERAL-STATE PROGRAMS

##### Modified Certified Brucellosis Area; Certified Brucellosis Free Area

In eradicating brucellosis in cattle, the Federal Government has established two programs under which states may qualify. The two programs are two stages through which a state or areas within a state progress in the eradication process. Under the preliminary Federal program, an area may be designated a Modified Certified Brucellosis Area when the number of cattle reacting positively to the blood test does not exceed one percent of all the breeding cattle in the area and herd infection does not exceed five percent. Areas are certified through the use of blood tests, milk ring tests, and market tests and area certification tests must be performed within an eighteen month period.

When all the areas in a state have qualified as Modified Certified Brucellosis Areas, the state may work toward achieving Certified Brucellosis Free Area status, the next stage in the eradication program. Among the qualifications which a state or areas within the state must meet before they can qualify for Certified Brucellosis Free status are:

- "1. Not more than one percent of the herds, or one herd, whichever is greater, shall have been found to be infected during the 18 months immediately preceding the request for Certified Brucellosis Free Area status.
2. Not more than 0.2% of the cattle shall have been found to be reactors during the 18 months immediately preceding the request for Certified Brucellosis Free status."<sup>1</sup>

##### Modified Certified Brucellosis Areas

As of June 30, 1961 half of the states had obtained Modified Certified Brucellosis Area status. During 1961, 252 counties in the United States achieved Modified Certified Brucellosis Area status while 13 counties lost their certified status. At the close of 1961, 551 counties had not yet entered the Modified

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<sup>1</sup>U.S. Department of Agriculture, Agricultural Research Service, Recommended Uniform Methods and Rules, February 1962, p. 19.

Certified Program.<sup>1</sup> In 1962, Dr. C. K. Mingle of the United States Department of Agriculture wrote:

"It is entirely possible that all areas can achieve Modified Certified Brucellosis Area status by the end of (the) fiscal year 1965. Therefore, a goal of June 30, 1965 has been established for Modified Certified Brucellosis Area status for the entire Nation. There are a few states in which the present program must be accelerated in order to meet this goal. In the several intervening years, however, adjustments should be possible, even in the most difficult situations."<sup>2</sup>

The importance of an area's achieving Modified Certified Brucellosis status is indicated by a United States Department of Agriculture survey of cattle checked after interstate shipment. The survey showed "one brucellosis reactor for each 135 tested cattle shipped from uncertified areas . . . ." <sup>3</sup> while one reactor for each 2,104 cattle was found in animals transported from Modified Certified Brucellosis Areas.

A comparison of farms and ranches in which Brucellosis infected cattle were found for fiscal years 1960 and 1961 shows a higher incidence of the disease in noncertified than in certified states.<sup>4</sup> In 1960, 31,910 premises contained infected cattle with 8,948 premises located in states that were certified and 22,964 in states without certification. 28,741 premises contained infection in 1961 with 6,251 located in certified states and 22,490 in states without certification. By far the greatest reduction of bovine brucellosis during 1961 occurred in certified states, a fact which emphasizes the efficiency of the program in proceeding toward total eradication in certified areas.

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<sup>1</sup>C. K. Mingle, Cooperative State-Federal Brucellosis Eradication, A Progress Report prepared by the Animal Disease Eradication Division, Agricultural Research Service, U.S. Department of Agriculture, Washington 25, D.C., February 1962, p. 6.

<sup>2</sup>Ibid.

<sup>3</sup>Alvin Bull, "Iowa's Leadership in Livestock Threatened by Brucellosis," Wallaces Farmer, November 5, 1960, p. 48.

<sup>4</sup>Mingle, p. 7.

Dr. Mingle states "to be satisfied only with maintaining Modified Brucellosis Area status is to jeopardize the substantial investment already made in brucellosis eradication."<sup>1</sup> Recertification of Modified Certified Brucellosis Areas is now a major activity in brucellosis eradication with over 700 counties per year presently coming due for recertification. After a county has been initially certified, the increased use of surveillance procedures such as market cattle tests and milk ring tests is necessary to screen cattle population and detect new infection. It is generally agreed that each state must use all available procedures for reaching Certified Brucellosis Free Area status.

#### Certified Brucellosis Free Areas

The certification in 1961 of 57 counties as Brucellosis Free Areas brought the National total of such counties so certified to 100. The certified counties were located in 11 states. New Hampshire is the only state which has achieved Certified Brucellosis Free Area status in all of its counties, although Maine is expected to achieve the distinction soon.<sup>2</sup>

Records show that only one infected herd "is being found each three years, on the average, in each Certified Brucellosis-Free County . . . ." <sup>3</sup> However, there is emphasis on the need for surveillance procedures in these counties to detect and eliminate infection that might gain entrance and spread to other herds.

The following map illustrates the present status of the state-federal brucellosis program. The map shows the location and number of Certified Brucellosis Free counties, Modified Certified Area counties, Complete Area Testing counties, and Individual Herd Participation counties.

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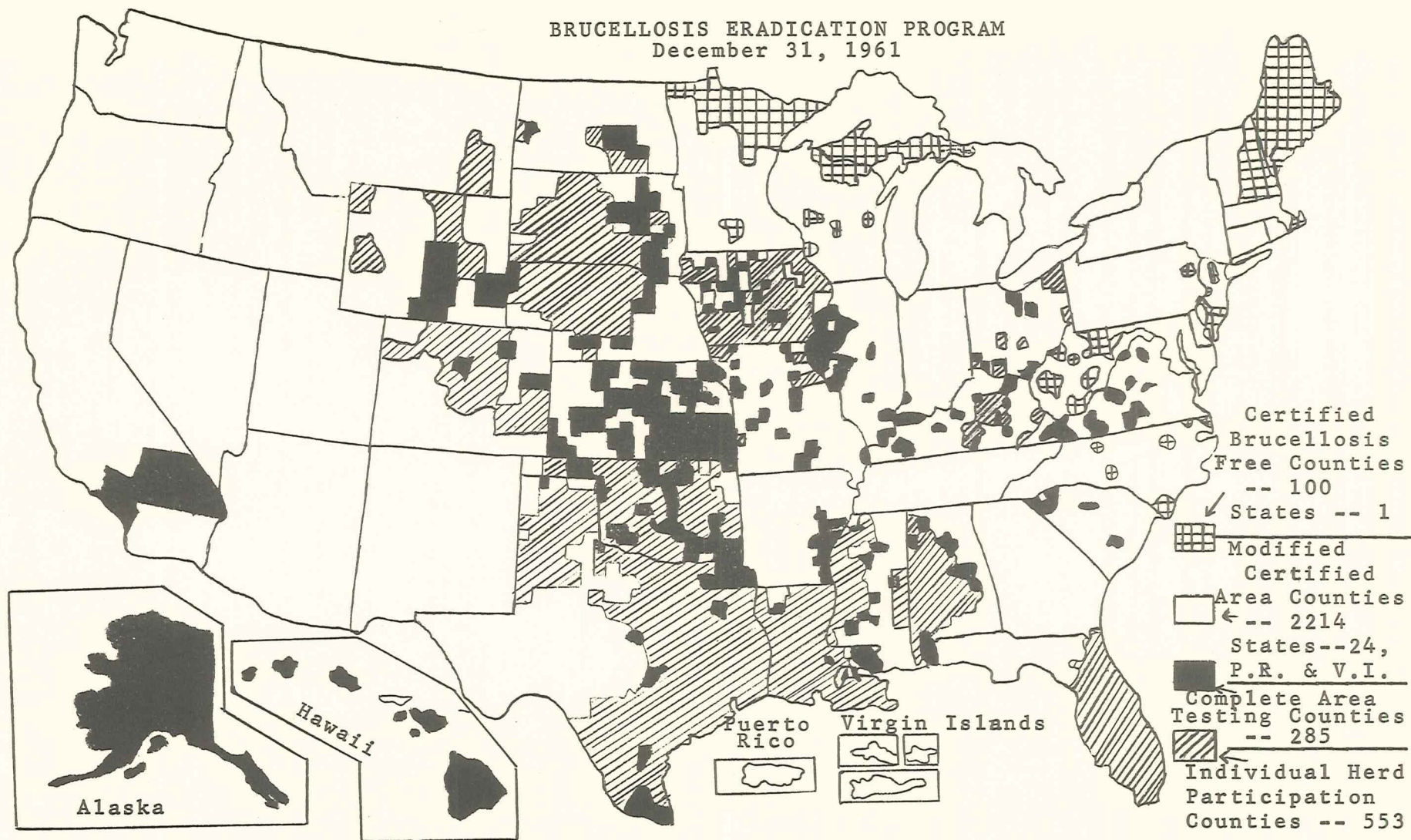
<sup>1</sup>Ibid.

<sup>2</sup>Ibid., p. 6.

<sup>3</sup>Ibid.

COOPERATIVE STATE-FEDERAL

BRUCELLOSIS ERADICATION PROGRAM  
December 31, 1961



Reprint: Cooperative State-Federal Brucellosis Eradication,  
U.S. Department of Agriculture, Agricultural Research Service,  
ARS 91-33, February, 1962.



### Program For Herds Having Special Problems

The "Problem Herd" Program is being implemented in Modified Certified Brucellosis Areas to hasten eradication of brucellosis. This Program which consists of requiring added tests to identify reactors and eliminate brucellosis from herds is necessary when regular program methods have failed to eradicate brucellosis. The eradication failure sometimes arises because cattle owners have failed to observe the "minimum recommendations for brucellosis eradication."<sup>1</sup> The "Problem Herd" Program is presently in operation in seventeen states and activities are directed by veterinary specialists trained in brucellosis eradication techniques. It is believed that probably every state will have to adopt the "Problem Herd" Program in order to achieve eradication.<sup>2</sup>

### Future Outlook

In his Report, Cooperative State-Federal Brucellosis Eradication, Dr. Mingle makes the following summation.

"1962 should be a banner year in brucellosis eradication achievements. Those States which expect to attain Certified Brucellosis-Free Area status are Maine, Connecticut, Rhode Island and Utah. The goals given by the various states for new Certified Brucellosis-Free Area counties indicate an expected increase of 163.

Those States which expect to achieve Modified Certified Brucellosis Area status are South Carolina, California, Arkansas, Virginia, Alaska, Illinois, Kansas and Missouri. If all of these are successful, this will be the largest number of states ever to qualify in a single year. Individual goals of the various states indicate that 304 new counties will earn this designation.

The one dark spot on this otherwise bright picture is that only 120 of the 534 counties remaining to be certified at the close of 1962 are expected to be working toward Modified Certified Brucellosis Area status on a complete area basis. Counties not yet participating will be located in the following eleven States: Alabama, Colorado, Florida, Iowa, Louisiana, Mississippi, Nebraska, North Dakota, South Dakota, Texas and Wyoming. Let's strive for '65!"<sup>3</sup>

---

<sup>1</sup>Ibid., p. 9.

<sup>2</sup>Ibid.

<sup>3</sup>Ibid., p. 10.

It is possible that complete eradication of brucellosis in the United States can be achieved by 1975 if each state achieves Certified Brucellosis Free Status by or before 1972.<sup>1</sup> Brucellosis can be eliminated from livestock other than cattle between 1972 and 1975. Thus the national goal of complete brucellosis eradication can be realized by 1975 if every state does its part by attaining Certified Brucellosis Free status.

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<sup>1</sup>Ibid., p. 5.

## V. BRUCELLOSIS ERADICATION PROGRAM IN IOWA

### Iowa's Brucellosis Testing Law (Blood Tests)

The Division of Animal Industry, Iowa State Department of Agriculture, states that despite the absence of a stringent law, Iowa has made considerable progress in the control and eradication of bovine brucellosis. Even though progress has been made in control and eradication, problems remain because of the weakness of Iowa's blood testing law.

Section 164.17, Code of Iowa (1962) states in part:

"The department (of agriculture) may cooperate with any township or county for the control and eradication of Bang's disease within the state or with the United States department of agriculture for the prevention of the spread and the control of Bang's disease in cattle and its eradication in the United States.

Whenever petitions signed by seventy-five percent of the resident owners of breeding cattle residing in a county representing seventy-five percent or more of the breeding cattle therein owned by residents of that area, as disclosed by the last assessment rolls of such area, shall be presented to the department asking that all breeding cattle herds in said county be tested for brucellosis, the department is hereby authorized to make such tests without expense to the owners, to the extent of the funds available therefor. . . . When such a petition has been duly presented the state department of agriculture shall promulgate regulations for the carrying out of this work which will be known as area testing. The provisions of this subsection do not apply to herds composed entirely of official vaccinates."<sup>1</sup>

When first introduced, the bill that became Section 164.17, contained a provision stating "it is mandatory that all cattle in any county declared eligible for area work be tested."<sup>2</sup>

---

<sup>1</sup>Because only breeding animals can develop brucellosis, spayed heifers and steers are exempt from the provisions regarding area testing.

<sup>2</sup>Senate Files, Fifty-seventh General Assembly, Senate File 65, January 23, 1957.

This provision was stricken by the Senate Committee on Agriculture to which the bill was assigned, and the statute was adopted in its present form.

The stringency of Section 164.17, Code of Iowa (1962) is not known. The Division of Animal Industry has been reluctant to attempt to force cattle owners to test because the Division believes that the present statute does not give the Division authority to compel cattle owners not participating in the area testing program to submit their breeding cattle for blood testing. Because of the absence of a court decision, it is not known if Section 164.17 requires all resident cattle owners in a county to submit their breeding animals for testing after a petition requesting an area testing program has been signed by the requisite number of owners and presented to the Department of Agriculture.

Although no court decision is available to establish whether Section 164.17 empowers the Department of Agriculture to compel owners of breeding cattle to submit their animals for testing, the Iowa Attorney General in a staff opinion has discussed the provisions of Section 164.17. The Opinion dated June 27, 1962 states in part:

"Section 164.17 provides a method whereby the producers in an area can, through collective effort, control the spread of brucellosis, (sic) the clear intent of the statute is to preclude the infection of many cattle by the movement of an infected few. It provides that if 75% of the producers with 75% of the breeding cattle want to enter into an area plan under 164.17, then the department of agriculture can enter upon any farm in that area for the purpose of testing. Refusal to allow testing would be sufficient grounds in most cases for the department to issue a quarantine order pursuant to 164.16 in order to prevent movement of the suspect cattle. The issuance of such an order is at the discretion of the Secretary of Agriculture or his designate."<sup>1</sup>

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<sup>1</sup>Opinion of Attorney General to Iowa Secretary of Agriculture L. B. Liddy, June 27, 1962.

### Enforcement of Blood Testing

Even if a court decision were to establish that the State Department of Agriculture has the authority under Section 164.17 to compel blood testing of breeding cattle, the question arises whether Chapter 164 of the Iowa Code contains provisions which would enable the Department of Agriculture to enforce compulsory testing.

The Division of Animal Industry states that it is confronted by many problems because it does not have the authority to compel blood testing of breeding cattle. Under Section 164.17, an area program may be started upon petition signed by seventy-five percent of the county's resident owners representing seventy-five percent of or more of the county's breeding cattle. In order to qualify as a Modified Certified Brucellosis Area, the number of reactors in the county must not exceed one percent and the herd infection must not exceed five percent at the end of the eighteen month testing period. The Division of Animal Industry states that as many as ninety-eight percent of a county's breeding cattle might be tested, but if the owners of the remaining two percent refuse to permit testing of their cattle, the county cannot be certified. The Division reports that it has no alternative but to classify the untested cattle as reactors. Therefore, the county cannot be certified because the untested cattle represent more than one percent of the county's breeding cattle. Herds composed entirely of official vaccinates are not considered in Iowa when establishing a Modified Certified Brucellosis area.

In a program of Area testing, the Iowa Department of Agriculture can quarantine the breeding herds of owners who refuse to permit their animals to be tested. However, according to the Division of Animal Industry, some owners of beef cattle prefer to allow their animals to be quarantined rather than tested because under quarantine the animals can still be sold to slaughter under proper permit. Similarly, dairy cattle placed under quarantine

can be sold or moved to slaughter only under proper permit, although the milk from such cattle can be sold as ungraded for manufacturing purposes.

#### Milk Ring Tests and Quarantine<sup>1</sup>

Control of brucellosis in dairy cattle is attempted through milk ring tests and quarantine. Milk ring tests are conducted in Iowa every six months and are used to recertify counties. The milk is tested at dairies and if the tests reveal that the milk from animals in a herd is suspicious, the Iowa Department of Agriculture can order a retest (blood test) of the entire herd. If an owner refuses to permit a retest of his cattle, the Division of Animal Industry can quarantine all animals in the herd over eight months of age. A herd may also be quarantined if the owner of a herd or a member of the owner's family contracts brucellosis and the owner refuses to permit testing of his cattle. Under quarantine, an owner's cattle may not be sold or moved from the premises except to slaughter under proper permit. The Division of Animal Industry states that all milk from a herd under quarantine cannot be sold as Grade A milk, although after pasteurization, the milk may be sold as Grade B or cream. Because of the price difference between Grade A and Grade B milk, there has not been much difficulty in getting owners of dairy cattle to retest their herds.

#### Herds Composed of Official Vaccinates

In Iowa, calves vaccinated for brucellosis between the ages of 4 to 8 months are designated official vaccinates.<sup>2</sup> Section 164.17, Code of Iowa (1962), exempts herds composed entirely of

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<sup>1</sup>Information in this section obtained from an interview with Marshall E. Pomeroy, Chief of the Division of Animal Industry, Iowa State Department of Agriculture.

<sup>2</sup>Code of Iowa (1962), sec. 164.1.

official vaccinates from the provisions of law relating to cooperative state federal brucellosis eradication programs conducted in Iowa counties. The exemption in Section 164.17 means that cattle owners participating in a state federal brucellosis eradication program cannot be compelled to submit animals from herds composed entirely of official vaccinates for blood testing.

In regard to the exemption in Section 164.17, an Attorney General's Opinion dated June 20, 1957 states that:

" . . . we believe that a petition asking that a Brucellosis test be conducted throughout a certain county should contain wording to the effect that 'herds composed entirely of official vaccinates' are not to be considered as being included therein, as such herds have been specifically exempt from the necessity of such test by the action of the Legislature."<sup>1</sup>

Before a program of area testing can be started in a county, a petition requesting such testing must be circulated in the county. The petition must be signed by at least seventy-five percent of the county's breeding cattle owners representing at least seventy-five percent of the county's breeding cattle. However, cattle owners whose herds are composed entirely of official vaccinates cannot be compelled to submit their cattle for blood testing even if a petition is signed agreeing to participate in an area testing program. The Division of Animal Industry has therefore found it necessary to request cattle owners to sign a waiver of the provision in Section 164.17 which exempts herds composed entirely of official vaccinates from area testing. Owners having herds composed entirely of official vaccinates are requested to sign both the waiver and the petition requesting area testing.

Another weakness of Chapter 164 involving official vaccinates is subsection 164.11(6) which permits "sale or movement of cattle without blood test from herds composed entirely of official vaccinates...."<sup>2</sup>

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<sup>1</sup>Opinion of Attorney General to Iowa Secretary of Agriculture Clyde Spry, June 20, 1957.

<sup>2</sup>Bull, "We Have Tools . . .," p.8.

Mr. Bull of the Wallaces Farmer writes that because:

". . . Vaccination does not give the complete protection that this section of the law [Section 164.11(6), Code of Iowa, 1962] implies, the federal government does not recognize official vaccinates over 30 months of age for interstate shipment without a negative brucellosis test, . . . ."1

Thus far only Section 164.17 has been cited in discussing the provisions relating to the blood testing of the cattle. Section 163.1, Code of Iowa (1962), should also be cited. Section 163.1 reads in part:

"In the enforcement of this chapter the department of agriculture shall have power to:

. . . . .

6. Enter any place where any animal is at the time located, or where it has been kept, or where the carcass of such animal may be, for the purpose of examining it in any way that may be necessary to determine whether it was or is infected with any contagious or infectious disease."

Section 163.2 states that Bang's disease (brucellosis) shall be regarded as one of the contagious and infectious diseases for the purpose of Chapter 163.

It must be pointed out that Section 163.1 was enacted in 1924. Section 163.2 was not amended to include Bang's disease until 1939. Section 164.17, the statute which specifically provides for area testing was enacted in 1957.

It is believed by the Division of Animal Industry that there has never been any attempt to force resident owners not participating in an area testing program to submit their breeding cattle for testing under the provisions of Section 163.1.<sup>2</sup> The Division states that blood testing of animals was not performed in 1925 when Section 163.1 was enacted. However, blood testing was being done in 1939 when Section 163.2 was amended to include brucellosis as a contagious or infectious disease for the purposes of Chapter 163.

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<sup>1</sup> Ibid.

<sup>2</sup> Information in this section obtained from an interview with Marshall E. Pomeroy, Chief of the Division of Animal Industry, Iowa State Department of Agriculture.



The Problem Of Cattle Brought Into Iowa Under Feeder Quarantine

Section 164.11, Code of Iowa (1962), states in part:

"It shall be unlawful for any person to sell or transfer ownership of any bovine animal unless it is accompanied by a negative brucellosis test report issued by an accredited veterinarian, conducted within thirty days.

The provisions of this section do not apply to the following:

.....

7.b. Cattle of recognized beef type over eighteen months of age if shipped into the state for feeding purposes under feeding quarantine for a period not to exceed one hundred twenty days, provided, however, that this provision shall not apply to springer heifers and springer cows, or heifers and cows with calves, said animals being classified as breeding cattle."

Diseased cattle are often brought into the State under this feeding quarantine provision and are not tested until they have entered the State.<sup>1</sup> Some of these cattle are with calf though they show no visible signs of pregnancy. Between the time these animals are brought into the State and the time they are tested there is ample opportunity for the disease to spread and affect breeding animals. If a diseased cow brought into the State under feeding quarantine is pregnant and aborts, she leaves a fetus and afterbirth teeming with brucella organisms. Not only is the feeding lot contaminated but other animals, such as birds and dogs coming in contact with the organisms, can spread the organisms to other parts of the premises, thereby exposing breeding cattle to infection.

Iowa has more cattle in feed lots than any other state. About ninety-five percent of the cattle brought into Iowa under feeder quarantine are under one year of age. However, the remaining five percent are of breeding age. Sometimes the animals of breeding age carry brucella organisms when they enter Iowa. Also some of these infected animals may be pregnant heifers which later abort. The Division of Animal Industry states that sometimes quarantine regulations are broken and cattle brought into

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<sup>1</sup> Ibid.

Iowa under feeder quarantine are confined in pastures with breeding animals. The records of the Division of Animal Industry account for only 2,518,101 of the total number of cattle brought into Iowa in 1961. Most of these animals were placed under feeder quarantine. The Division estimates that many additional cattle were brought into Iowa under feeder quarantine in 1961 although the total number is not known. There are about seventy specially approved markets in Iowa through which perhaps hundreds of thousands of feeder cattle passed in 1961. The cattle were placed under feeder quarantine regulations by veterinarians at these specially approved markets and were then sent to the premise on which they were to feed. Because the cattle were quarantined by veterinarians at the specially approved markets, the Division of Animal Industry did not tabulate how many feeders were brought into the State.

Nine district veterinarians and six lay inspectors are employed by the Iowa Department of Agriculture, Division of Animal Industry. The lay inspectors check violations of the rules and regulations of the Division of Animal Industry. This work involves checking obedience to rules and regulations relating to sheep and swine as well as regulations relating to cattle. There are about 180 auction markets where cattle are sold that must be checked. Considering the tremendous number of cattle imported under feeder quarantine, it is virtually impossible for the lay inspectors, even with help from Federal inspectors, to make certain that feeder quarantine rules are not being violated.<sup>1</sup> It is therefore possible for persons receiving cattle under feeder quarantine to pasture such cattle with breeding cattle without being detected. If the disease exists among the feeder cattle, it can easily be transmitted to the breeding animals.

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<sup>1</sup> Ibid.

### Bulls Leased for Breeding Purposes

In Iowa, bulls may be leased for breeding purposes if their reaction to a brucellosis blood test is negative. However, there is no provision in the Iowa statutes compelling the retesting of these breeding bulls. Therefore bulls whose reactions to blood tests are negative may be sent to various farms for breeding purposes without having to be retested. The Division of Animal Industry states that should these breeding bulls develop brucellosis they can easily transmit the disease to the cows which are bred. The cows in turn can spread the disease to other breeding animals on the premises.

### Cattle Sold at Auction

Cattle owners can bring brucellosis to their premises through the purchase at public auctions of cattle harboring brucella organisms. As an example, an owner may put up for sale twenty cattle at the sale barn. Blood tests performed at the sale barn reveal that nineteen animals are negative and one animal is a reactor. The reactor is condemned and sent to slaughter. The other nineteen cattle may be sold to any buyer who wishes to add to his herd.

The Division of Animal Industry states that although these animals were negative to the sale barn test, they may still be carrying brucella organisms.<sup>1</sup> All of the animals have been exposed to the disease because they were part of a herd which contained a reactor. Since the incubation period of the brucella organisms varies from ". . . a week to from two to thirty weeks,"<sup>2</sup> it is possible that although the reaction to the sale barn test was negative, the illness may still be developing within several or all of the animals. When the cattle become reactors, brucellosis could be transmitted to the herd to which the cattle were added.

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<sup>1</sup>Ibid.

<sup>2</sup>Spink, p. 70.

### Market Cattle Testing Program

On May 1, 1962, a voluntary market cattle testing program was begun in Warren County.<sup>1</sup> Warren County is being used as a pilot county in the market cattle testing program since that county has achieved Modified Certified Brucellosis status. The market cattle testing program is being used to recertify Warren County.

Only beef cattle of breeding age are being used in the testing program. Steers and spayed heifers are not included in the computation of the County's cattle population. In compliance with Iowa statute, official vaccinates under thirty months of age are not included in such computation.

Back tags are used in marking cattle included in the program. These tags enable the officials at the sale barns and packing plants where the cattle are being tested to identify the owners of the cattle. Officials are then able to trace reactors to the herds of origin. If reactors are found within a herd, the entire herd is quarantined and before the quarantine is lifted, the herd must be blood tested.

The Warren County market cattle testing program is being conducted in accordance with the Recommended Uniform Methods and Rules established by the Agricultural Research Service of the United States Department of Agriculture. If the owners of beef breeding cattle in Warren County meet the requirements of these methods and rules, Warren County may be recertified for a three year period.

One of the rules requires that during the three year period of certification, a herd owner must submit a total of fifteen percent of his beef breeding cattle to market testing to qualify for recertification. If the breeding cattle submitted by the owner do not represent fifteen percent of his cattle, an

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<sup>1</sup>Information in this section obtained from an interview with Marshall E. Pomeroy, Chief of the Division of Animal Industry, Iowa State Department of Agriculture.

owner may still qualify for recertification if he has a certain percentage of his cattle tested at the farm level. Another rule states that at the end of the certification period during which the market cattle testing program is conducted, the county cannot be recertified if the tests reveal that more than one percent of the cattle population are infected and that herd infection exceeds five percent. Special provision is made, however, for a method of recertifying a county under the market cattle testing program if the percentage of cattle infected is more than one percent but does not exceed two percent. If the percentage of cattle infected exceeds two percent, the county must be recertified in the same manner in which certification was originally obtained.

The Division of Animal Industry is of the opinion that market cattle testing such as the Warren County program is valuable and economical. By testing fifteen percent of an owner's beef breeding cattle over a three year period, with testing to be done at sale barns and packing plants, much farm level testing can be eliminated in the recertification of a county. Many cattle owners will not have to do any farm level testing if market cattle tests reveal that there are no reactors in their herds. At present, this type of extensive planned program is being carried on in Iowa only in Warren County. The only other market cattle testing done in Iowa is at places where Federal inspectors are employed.



## VI. AREA PLAN TESTING IN IOWA

Seventy-six Iowa counties, as of November, 1962 had presented petitions to the Iowa State Department of Agriculture requesting the area plan for bovine brucellosis eradication provided in Iowa statute.<sup>1</sup> The Division of Animal Industry stated that fifteen of the counties which presented petitions were not opened for area testing because of the virtual impossibility of certifying the counties during the allotted eighteen month period. The fifteen counties were:

- |             |                |
|-------------|----------------|
| 1. Benton   | 9. Mills       |
| 2. Cedar    | 10. Muscatine  |
| 3. Dallas   | 11. Plymouth   |
| 4. Hardin   | 12. Sioux      |
| 5. Henry    | 13. Tama       |
| 6. Jasper   | 14. Washington |
| 7. Jones    | 15. Worth      |
| 8. Marshall |                |

Twenty-six of the seventy-six counties which presented petitions had attained Modified Certified Brucellosis status.

The twenty-six Modified Certified counties were:

- |              |                |               |
|--------------|----------------|---------------|
| 1. Audubon   | 11. Lyon       | 21. Scott     |
| 2. Boone     | 12. Mitchell   | 22. Wapello   |
| 3. Carroll   | 13. Monona     | 23. Warren    |
| 4. Clinton   | 14. O'Brien    | 24. Winnebago |
| 5. Delaware  | 15. Osceola    | 25. Woodbury  |
| 6. Dickinson | 16. Palo Alto  | 26. Wright    |
| 7. Emmet     | 17. Pocahontas |               |
| 8. Fayette   | 18. Polk       |               |
| 9. Greene    | 19. Sac        |               |
| 10. Hamilton | 20. Shelby     |               |

Area testing was being conducted in the following counties:

- |            |            |
|------------|------------|
| 1. Calhoun | 3. Guthrie |
| 2. Ida     | 4. Webster |

It was not known if any of these counties would achieve certification within the allotted eighteen month period.

Area testing had to be stopped in thirty-one counties due to the number of cattle owners who refused to permit testing.

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<sup>1</sup>Code of Iowa (1962) sec. 164.17.

The number of cattle not included in the testing that would have had to be classified as reactors would have exceeded the maximum number of reactors a county can have among its breeding cattle at the end of the eighteen month testing period to qualify for a Modified Certified Brucellosis Area. As has been previously stated, regulations require that all cattle not tested be designated as reactors and no county can have more than one percent reactors among breeding cattle in the county to qualify as a Modified Certified Brucellosis Area. There was no hope of the counties reaching their goal of Modified Certified Brucellosis status during the allotted eighteen month period. The counties in which area testing was discontinued were:

1960

1. Harrison
2. Jackson
3. Keokuk

1961

- |                |                |
|----------------|----------------|
| 1. Allamakee   | 10. Howard     |
| 2. Bremer      | 11. Iowa       |
| 3. Butler      | 12. Kossuth    |
| 4. Cerro Gordo | 13. Linn       |
| 5. Chickasaw   | 14. Louisa     |
| 6. Clayton     | 15. Marion     |
| 7. Crawford    | 16. Van Buren  |
| 8. Floyd       | 17. Winneshiek |
| 9. Franklin    |                |

As of November 15, 1962:

- |               |                |
|---------------|----------------|
| 1. Black Hawk | 7. Hancock     |
| 2. Buchanan   | 8. Humboldt    |
| 3. Clay       | 9. Mahaska     |
| 4. Des Moines | 10. Montgomery |
| 5. Dubuque    | 11. Story      |
| 6. Grundy     |                |

The number of Modified Certified Brucellosis Area counties in Iowa is considerably less than the number of Modified Certified Brucellosis Area counties in neighboring states. Using November, 1962 statistics for Iowa and November, 1960 statistics for the other states, it is found that Iowa had 26 Modified Certified counties, Illinois had 60, Missouri had 66, Nebraska had 46,



and every county in Minnesota and Wisconsin qualified as Modified Certified Brucellosis Areas.<sup>1</sup>

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<sup>1</sup>"Iowa is Being Left Behind," Wallaces Farmer, November 19, 1960, p. 14.



## VII. CUTS IN FEDERAL AID TO IOWA

Iowa's brucellosis eradication program has been severely handicapped by a reduction in federal funds; a reduction which has been made because Iowa does not have a stringent testing law. Table 2 shows the amount of Federal funds the state of Iowa has received for brucellosis eradication purposes from 1956 to 1961.

TABLE 2

Total Annual Federal Funds Received By The Iowa Department Of  
Agriculture For the State Brucellosis Program

<u>Fiscal Year</u>	<u>Funds Received</u>
July 1, 1955 - June 30, 1956	\$613,421
July 1, 1956 - June 30, 1957	912,514
July 1, 1957 - June 30, 1958	780,785
July 1, 1958 - June 30, 1959	677,459
July 1, 1959 - June 30, 1960	500,000
July 1, 1960 - June 30, 1961	400,000
July 1, 1961 - June 30, 1962	310,000

SOURCE: Des Moines Office of the Animal Disease Eradication Division, Agricultural Research Service, United States Department of Agriculture.

In fiscal year 1958-1959, Federal funds allotted to Iowa were used to pay vaccine costs and veterinarian vaccination service fees. Federal funds were also used for indemnity payments of "up to \$12.50 for each grade animal and up to \$25 for each registered purebred. . . ." <sup>1</sup> for condemned cattle which went to slaughter. The Federal indemnity payments were matched by indemnity payments from Iowa county brucellosis eradication funds.

In fiscal year 1959-1960, Iowa suffered another Federal allotment funds reduction for brucellosis control.

"Iowa was allotted about \$500,000, a deeper cut proportionately than in many states. Federal brucellosis control officials felt that the limited funds could buy more control in states with a more advanced program and with effective brucellosis control laws."<sup>2</sup>

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<sup>1</sup>Alvin Bull, "On Brucellosis Control Iowa is Being Left Behind," Wallaces Farmer, November 19, 1960, p. 14.

<sup>2</sup>Ibid.

Because of the cut in Federal funds, State Department of Agriculture and Federal officials decided to stop indemnity payments and to use available Federal and State funds to pay vaccination costs. Consequently the State Department of Agriculture stopped payment on reactors on August 15, 1959, and began using county brucellosis eradication funds formerly used for paying indemnities to pay veterinary fees for vaccination. Vaccine costs were paid with Federal funds.

The Federal Government discontinued free vaccine on October 1, 1961. The State Department of Agriculture also stopped payment of veterinary services for vaccination of calves at that time.

## VIII. THE PROBLEM OF SWINE BRUCELLOSIS

Dr. Glen O. Shubert, Assistant Veterinarian in charge of the Des Moines office of the Animal Disease Eradication Division, Agricultural Research Service, United States Department of Agriculture states that Iowa is different from many states in that the State has a mixture of brucellosis problems.<sup>1</sup> In addition to a large beef and dairy population, Iowa has a large swine population which compounds brucellosis problems.

In 1959, Iowa had a swine population of 14,789,165. Illinois had the next largest number of swine with 8,284,669. In 1960, Iowa's 18,714,000 swine made up 21.1% of the National total swine population of 88,492,000.

The swine brucellosis problem in Iowa is significant because swine are responsible for most of the brucellosis in human beings. The problem is also significant because the brucella suis organism which is the usual cause of brucellosis in swine can be transmitted by swine to cattle and from cattle the organism can be transmitted to human beings. The Division of Animal Industry, however, states that hogs will contract brucellosis from cattle more readily than cattle will contract the disease from hogs.

The 59th Iowa General Assembly enacted a statute to control brucellosis in swine. Section 163A.3, Code of Iowa (1962), provides for the compulsory testing of boars before they can be sold, leased, or loaned for breeding purposes. Retesting must be done before every change in ownership or service and the boars must react negatively to each test. Section 163A.3 also provides requirements that must be met in order for owners to make additions to herds that have achieved Validated Brucellosis Free status.

Section 163A.5 relates to the importation of swine for exhibition or breeding purposes. The states of origin must test the animals and the test results must be negative before the

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<sup>1</sup> Information in this section obtained from an interview with Glen O. Shubert, Assistant Veterinarian in charge of the Des Moines Office of the Animal Disease Eradication Division, Agricultural Research Service, United States Department of Agriculture.

animals can enter Iowa. In lieu of such tests, the animals may enter Iowa if they come from a Validated Brucellosis Free herd.

It is the opinion of the Division of Animal Industry that the statute enacted by the 59th Iowa General Assembly has been very helpful in controlling the disease in swine.<sup>1</sup> During the first half of 1961, 11,190 swine were tested in Iowa. After the brucellosis law became effective, 65,775 swine were tested during the last six months of 1961. The animals tested revealed an infection rate of a little less than five percent with 165 herds involved by the infection. During the last six months of 1961, 80 herds achieved Validated Brucellosis Free status which gave Iowa a total of 168 Validated Brucellosis Free herds at the end of 1961.

It is not known for certain what percentage of swine in Iowa are infected with brucellosis.<sup>2</sup> Blood tests based on a random sample might produce figures and percentages different from those prepared by the State Federal Brucellosis Laboratory at Iowa State University where animals selected for testing are not chosen on a random sample basis. In 1960, 25,304 swine representing 2,198 herds were tested at the State Federal laboratory. Two hundred fifty-eight (1%) of the swine were found to be reactors and 421 (1.6%) were found to be suspects.

If the actual swine infection is similar to the 1% found at the State Federal laboratory, the swine infection rate in Iowa would appear to be low.<sup>3</sup> However, the statement has been made that "despite the apparently low infection rate among herds and individual animals, a significant public health hazard exists. . . ."<sup>4</sup> Swine raisers and their families can come in contact with infected animals, and "in a large packing house a single infectious hog passing through the slaughtering line may expose dozens or even

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<sup>1</sup>Information in this section obtained from an interview with Marshall E. Pomeroy, Chief of the Division of Animal Industry, Iowa State Department of Agriculture.

<sup>2</sup>Stanley L. Hendricks, Swine Brucellosis as a Public Health Problem, Reprinted from Proceedings United States Livestock Sanitary Association, Sixty-fifth Annual Meeting, November, 1961, (1962), p. 106.

<sup>3</sup>Ibid., pp. 106-107.

<sup>4</sup>Ibid., p. 107.

hundreds of employees. . . ."1

The Division of Animal Industry states that it may be necessary to strengthen the swine brucellosis statute by including compulsory testing for sows and gilts.<sup>2</sup> At present, there are no mandatory testing provisions relating to sows and gilts of the native swine population. These animals if diseased constitute a source of infection for both cattle and human beings.

In the article, Swine Brucellosis as a Public Health Problem, Dr. Hendricks concludes "eradication of the disease (brucellosis) from swine as well as cattle is necessary in order to prevent human brucella infection. . . ."3

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<sup>1</sup>Ibid.

<sup>2</sup>Information in this paragraph obtained from an interview with Marshall E. Pomeroy, Chief of the Division of Animal Industry, Iowa State Department of Agriculture.

<sup>3</sup>Hendricks, Swine Brucellosis . . ., p. 107.





## IX. HUMAN BRUCELLOSIS

### Origin of Human Brucellosis

Several names, including Maltese fever, Malta or Mediterranean fever, Bang's fever, and Undulant fever, have been used to designate human brucellosis. Human beings can contract brucellosis only from a diseased animal. Brucella bacteria can be transmitted from animals to human beings in several ways among which are penetration through the broken or unbroken skin and inhaling dust from soils contaminated with brucella organisms. Consumption of raw milk or products made from raw milk containing brucella bacteria can also cause brucellosis in human beings; however, pasteurization of milk destroys the organisms and eliminates the danger of human infection.

Human beings are susceptible to all three types of brucella organisms. Human brucellosis caused by brucella abortus, the organism most likely to cause infection in cattle, is usually milder than brucellosis caused by the other two brucella organisms. The brucella suis organism, the germ most likely to infect hogs, usually produces a form of human brucellosis more severe than that caused by brucella abortus. However, it must be remembered that cattle can also develop brucellosis caused by the brucella suis organisms and transmit these organisms to human beings. Cattle are known to become infected with the brucella suis organism when kept in an area occupied by hogs infected with brucellosis.

The brucella melitensis organism is more often found in goats than in swine or cattle. This organism causes a more severe form of illness in human beings than does brucella abortus. In Iowa, the goat population is not large enough to constitute much of a reservoir of brucellosis infection. Consequently, the brucella melitensis organism is usually transmitted to human beings by swine.

### Symptoms of Human Brucellosis During the Natural Course of the Disease

The onset of human brucellosis can be gradual or abrupt, but despite the rapidity or slowness with which the illness develops, the symptoms are usually the same. The symptoms

of brucellosis caused by the brucella abortus organism usually include during the acute stages of the illness "weakness, generalized aches and pains, frontal headaches, pain in the back of the neck, backache, anorexia, nervousness, mental depression, insomnia, low-grade fever, and sweats . . . ." <sup>1</sup> The symptoms caused by brucella suis and brucella melitensis organisms are of the same type but are often more severe in degree.

A University of Minnesota Clinic's survey of patients infected with brucellosis caused by the brucella abortus organism revealed fever was present in 97.5% of the cases. <sup>2</sup> Almost half of the patients had enlarged spleens and enlargement of the lymph glands occurred " . . . in one-fourth to slightly more than one-third of the cases . . . ." <sup>3</sup> Enlargement of the liver occurred also but not nearly so often as enlargement of the spleen. Cardiac abnormalities occurred in 5% of the cases. These organic disturbances are seen as signs of human brucellosis during the natural course as the diseases develop.

#### Complications of Human Brucellosis

Human brucellosis is sometimes complicated by accompanying disorders of a type different from the signs and symptoms associated with the disease during its normal course. However, in discussing complications it must be remembered that:

" . . . the frequency and severity of the complications are related to the species of Brucella causing disease, to the underlying nutritional state, and to the general health of the host before infection." <sup>4</sup>

Therefore, complications accompanying brucellosis caused by brucella suis and brucella melitensis organisms are likely to be more severe than complications associated with brucellosis caused by brucella abortus.

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<sup>1</sup> Spink, p. 162.

<sup>2</sup> Ibid., p. 156.

<sup>3</sup> Ibid., p. 157.

<sup>4</sup> Ibid., p. 171.

Because brucella organisms have a serious effect on the nervous system, neuro psychiatric complications can occur in persons suffering from brucellosis. Data compiled by the University of Minnesota Clinics on patients most of whose infections were caused by brucella abortus organisms, revealed that 10% of the illnesses were complicated by neuro psychiatric disorders.<sup>1</sup> Bones and joints complications also occurred in 10% of the patients. Complications of the liver and complications of the heart and blood vessels occurred in some of the patients. Complications involving the lungs and complications of the eyes were also present in some of the patients in the survey.

#### Problem of Chronic Brucellosis

The complaints usually associated with chronic brucellosis are "weakness, easy fatigability, mental depression, nervousness, sexual impotence. . . ." <sup>2</sup>

There are some differences of opinions among doctors concerning the definition of chronic brucellosis. Some doctors consider chronic brucellosis an illness of long duration involving complications and localization. Some doctors feel that a case of brucellosis lasting even a few months should be regarded as chronic, while other doctors would insist on a duration of many months before designating the illness chronic. In a study on brucellosis, the University of Minnesota Clinics regarded brucellosis as acute if the illness lasted less than three months.<sup>3</sup> The illness was regarded as subacute if it endured from three to twelve months, and if the illness lasted longer than twelve months it was designated as chronic.

Chronic brucellosis is more likely to occur in persons whose illness is caused by brucella suis or brucella melitensis organisms. The comparative mildness of brucellosis caused by

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<sup>1</sup> Ibid.

<sup>2</sup> Wesley W. Spink, "Brucellosis-Epidemiology, Clinical Manifestations, Diagnosis," Seminar, Summer, 1954, p. 18.

<sup>3</sup> Ibid.

brucella abortus and modern antibiotics makes chronic brucellosis less of a problem than prior to the use of antibiotics. Dr. Wesley W. Spink, Professor of Medicine, University of Minnesota, writes that in patients seen at the University of Minnesota Clinics in the last few years before 1954, the illness lasted more than twelve months in only 10% of the cases. According to Dr. Stanley L. Hendricks, Assistant Director of the Division of Preventable Diseases, Iowa State Department of Health, the above mentioned percentage of cases represented chronic brucellosis caused by brucella abortus.

Chronic infection remains a problem for some patients. If the onset of brucellosis develops slowly, the disease may not be diagnosed correctly because of the lack of diagnostic evidence of infection. Other brucellosis patients properly diagnosed and treated with antibiotics may continue to feel ill even after control and probably eradication of the illness has occurred; a circumstance which can be partially explained by the tremendous impact that the brucellosis has on the nervous system. Brucellosis patients who were emotionally unstable before the onset of infection may continue to feel ill after the disease has been eradicated. Such patients are suffering from the residuals of an eradicated illness.

Another problem involves infection which may persist in some patients. Dr. Hendricks, commenting on this problem, states that when the onset of brucellosis is abrupt, the patient may be properly treated and still develop a chronic illness.<sup>1</sup> If the brucella organisms become localized in some organ of the patient, the organ's tissue may function as a barrier between the brucella organisms and the drugs used in treatment. In such cases, the drugs cannot reach the organisms to destroy them. Such localization can also occur when the onset of the disease has been slow as the lack of diagnostic evidence in cases of insidious develop-

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<sup>1</sup>Information in this section obtained from an interview with Stanley L. Hendricks, Assistant Director of the Division of Preventable Diseases, Iowa State Department of Health.

ment makes a proper diagnosis difficult. In such circumstances, patients are not likely to receive drugs which will destroy the brucella bacteria.

If the localization occurs and treatment with drugs is not effective, surgery is necessary to remove the brucella organisms from the infected organs.

It is necessary to point out that there is no vaccine effective against the development of brucellosis in human beings. Human brucellosis provides only relative immunity for further occurrences of brucellosis and recovered patients can still suffer subsequent attacks of the disease.

#### Human Brucellosis Situation in the United States

The incidence of human brucellosis, based on provisional data, dropped to a reported 580 cases in 1961, 219 of which occurred in Iowa.<sup>1</sup> The 580 cases was the lowest reported total since human brucellosis has been regarded as a public health problem. Because the swine brucellosis level has remained constant, the incidence of human brucellosis has not declined as rapidly during the past few years as it did during an earlier period. In the last four years, the decline has not been as much as 50%. It is believed that the level of human brucellosis will not be much reduced until control and eventual eradication of brucellosis in swine is achieved.

It is stated that:

"The rate of infection in swine is estimated to be between 1 and 2 percent, with about 5 percent of the herds affected. If the lower estimate of 1 percent is applied against the 88,000,000 pigs marketed in the United States in 1961, it can readily be determined that about 880,000 brucella-infected swine were handled and processed. It has been previously estimated that some 850,000 persons are exposed in handling these animals on the farm and in commercial channels. There are about 1,847,000 farms in the United States on which pigs are raised. About 131,000 herds are infected, with the same number of farm families at risk of infection, or some 579,000 people. . . ."2

<sup>1</sup>James H. Steele, Chairman of the Public Health Subcommittee, National Brucellosis Committee, Human Brucellosis in the United States, date unknown, pp. 1, 2.

<sup>2</sup>Ibid., p. 1.

The upper section of the Midwest continues to have the highest incidence of human brucellosis.<sup>1</sup> In 1961, Iowa reported the largest number of cases, 219; followed by Illinois with 61 and Kansas with 54. Nebraska reported 29 cases, South Dakota 18, and Minnesota 18. California (20), Arkansas (19), Virginia (18), Texas (15), and Louisiana (12) are other areas where the incidence of human infection was high. Tennessee and Georgia reported 12 cases each, and New York reported 11 cases. The relatively high incidence in Tennessee, Georgia, and New York was considered unusual because of the reduction of bovine brucellosis in those states. Persons working near infected animals and consumption of infected raw milk accounted for most of the cases in the South. In the West and North, butchers and workers in packing houses were the main victims of the disease. Infected raw milk also accounted for some of the disease occurring in the West and North. It must be remembered that there are many persons infected with brucellosis who do not become clinical cases. These people are not among the cases reported by the various states.

In 1960 and 1961, packing house workers accounted for 42% of the total number of human brucellosis cases reported in the United States. Farm infection constituted 18.5% of the total reported cases in 1960 and 19% in 1961. 14% of the total cases reported in 1960 involved children and housewives and 12% of the total involved this same group in 1961. Infection among veterinarians and laboratory workers constituted 6% of the total reported cases in 1960 and 5.5% in 1961.

#### Human Brucellosis in Iowa

Since the beginning of the nationwide bovine brucellosis eradication program, the incidence of human infection in the United States has declined. Of the total number of reported cases in the Nation during 1961, Iowa was responsible for about 38%. A breakdown of the total number of reported cases in the United States and Iowa during the past five years is shown in Table 3.

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<sup>1</sup>Ibid., Table 3.

TABLE 3

Total Number of Human Brucellosis Cases in the Nation and in Iowa,  
1957-1961

<u>Year</u>	<u>United States</u>	<u>Iowa</u>
1957	983	214
1958	924	283
1959	892	361
1960	751	379
1961	580	219

SOURCE: Division of Preventable Diseases, Veterinary Public Health Section, Iowa State Department of Health, June 16, 1962.

APPENDIX I of this Report shows the number of cases of Human Brucellosis in each state in the Nation for 1961.

APPENDIX II of this Report shows the annual average case rate of reported Human Brucellosis Morbidity per 100,000 population in each state in the Nation, 1948-1960.

Of the 219 cases of human brucellosis reported in Iowa in 1961, information regarding cause of the disease was available in 178 cases. The information shows that:

"Swine were the principal source of infection, being involved in at least 114 cases and suspected in 39 other cases, while cattle were the source in only 40 cases. Raw milk was thought to be the cause of infection among students and children. Packing plant workers were involved more than any other occupational group; a total of 122 cases were reported. Occupational disease among farmers is down on the basis of these reports. Only 35 cases were reported. It is thought that many infections among farmers were not reported as such. Only two cases were identified in veterinarians, one of whom was a meat inspector. . . ."<sup>1</sup>

The fact that 122 packing house workers suffered brucellosis infection emphasizes the danger of exposure to the disease among persons coming in contact with diseased animals or with fresh tissues of such animals.

The incidence of brucellosis in Iowa packing plant employees has usually been sporadic. In recent years, packing plants employing 1,000 or more workers have reported an annual disease

<sup>1</sup>Steele, p. 2.

incidence ranging from 0 to 15 cases. Table 4 records a breakdown of reported brucellosis cases during the past few years in Iowa packing houses having 1,000 or more employees.

TABLE 4

Reported Cases of Human Brucellosis in Iowa Packing Houses with 1000 or More Employees

<u>Plant</u>	<u>Total Employees</u>	<u>Cases</u>	
		<u>Yearly Average</u>	<u>Range</u>
A	1,600	3.2*	2-6
B	1,000	5.0	4-7
C	3,500	2.5	0-5
D	6,500	5.5	4-8
E	2,500	1.8	1-3
F	2,900	7.2*	1-15
G	1,000	2.7	2-4
J	1,200	1.0	0-3

\*Plants A and F, 1954-1958, all other plants 1956-1959.

SOURCE: "Brucellosis Outbreak in an Iowa Packing House," American Journal of Public Health, Vol. 52, No. 7, 1962, p. 1175.

In the past, there have been more reported cases of brucellosis among Iowa cattle owners than among packing house employees, but in 1961 packing house employees accounted for the largest percentage of cases reported in Iowa.<sup>1</sup> There are several reasons which may explain why the incidence of disease among cattle owners has gone down faster than the incidence has decreased among packing house workers. Pasteurization of milk and the gains that have been made in controlling bovine brucellosis are factors. Education regarding the dangers of brucellosis to personal health is another factor as persons living on farms are now more aware of the danger of brucellosis and the ways in which the disease can be transmitted from animals to human beings. Through education,

<sup>1</sup>Information in this paragraph obtained from an interview with Stanley L. Hendricks, Assistant Director of the Division of Preventable Diseases, Iowa State Department of Health.



cattle owners have become aware of precautions that can be taken, many of which are not available to packing house employees who come in contact with diseased animals. Fewer cattle owners are likely to handle with their bare hands materials contaminated with brucella organisms. Also, more cattle owners are likely to pasteurize the milk that is consumed by their families. Packing house employees are exposed to all animals which enter the plant. If some of the animals are infected with brucellosis, the possibility exists that some of the workers may develop the disease.

#### Brucellosis Fatalities In Iowa

Despite the fact that brucellosis has been reduced among farm families in recent years, infection is still a danger. One case of brucellosis occurring in 1962 in Iowa resulted in death.

An article which appeared in the October 25, 1962 issue of the Des Moines Register cited the death of an Iowa high school student due to brucellosis and explained the need for a stricter brucellosis testing law. The article states in part:

"The high proportion of human brucellosis cases in Iowa is due in large measure to Iowa's inadequate testing law. The Iowa law on testing for brucellosis leaves it up to each farmer to determine if his animals should be tested under the federal state testing program. The result of this voluntary approach is failure to obtain 100 percent cooperation in many counties. Iowa ranks fifth from the bottom in the list of states in the proportion of its counties meeting national testing standards.

A measure to tighten up brucellosis control passed the House in the last session of the Legislature but died in the Senate. The coming session of the Iowa Legislature should see to it that Iowa is armed with an effective brucellosis testing law. The 'freedom to infect' is one freedom that should be curbed without further delay."<sup>1</sup>

Table 5 shows the total number of deaths in Iowa for the years 1949-1961 which were directly the result of brucellosis.

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<sup>1</sup>Des Moines Register, October 25, 1962

TABLE 5

## Iowa Brucellosis Cases Resulting in Death, 1949-1961

<u>Year</u>	<u>Number of Deaths</u>
1949	2
1950	0
1951	2
1952	Not Available
1953	1
1954	2
1955	1
1956	0
1957	1
1958	0
1959	0
1960	0
1961	2

SOURCE: Vital Statistics Division, Iowa State Department of Health.

#### Brucellosis In an Iowa Packing Plant

A severe human brucellosis outbreak involving 128 clinical cases and at least 31 subclinical cases occurred in an Iowa packing plant during the nine month period between November 1, 1959 and July 31, 1960.<sup>1</sup> The establishment affected slaughters and processes swine only.

With certain exceptions, plant employees worked in specified areas in the plant when the outbreak occurred. Of the 128 brucellosis cases, 60 occurred in the Kill Department, 24 in the Cut Department, and 20 in the Casings Department. The remaining 24 cases were distributed fairly evenly throughout other departments with no department having more than four cases.

It was observed that the attack rate of the disease was generally higher among younger and newer employees. However, the younger and newer employees did not appear to be assigned to jobs involving greater danger of exposure to disease than older workers with more seniority. In an effort to isolate the cause of the

<sup>1</sup>Stanley L. Hendricks, "Brucellosis Outbreak In an Iowa Packing House," Reprinted from American Journal of Public Health, Vol. 52, No. 7, July 1962, pp.1166, 1178.

infection, air samples were obtained and sanitary procedures, employment practices, sources of swine, and physical facilities were studied to discover factors that might have caused the epidemic. Blood samples were collected from both plant employees and swine and employee's medical records were reviewed.

Sixty-nine blood samples were collected from 65 patients and cultured.

"Eleven strains of *Brucella melitensis* and seven strains of *Brucella suis* were recovered from 18 of the 69 blood cultures. In addition, one strain of *B. melitensis* was recovered from one of 141 blood clots that were cultured. . . ."<sup>1</sup>

As a result of the Study, it was found that sanitary conditions throughout the packing plant were excellent and ventilation and lighting were good. The plant also had an excellent medical program. Since other plants slaughtered hogs which were raised in the same area as the hogs slaughtered at the plant which experienced the epidemic and since the slaughtering and processing operations in the plants were similar but no other plant experienced an epidemic, direct contact with diseased swine did not appear to be the primary method of transmission. It was also revealed that food, water, and milk consumed by plant employees did not appear to be involved in the disease outbreak.

As was pointed out, the incidence of human infection was greater in certain departments and areas than in others. This fact indicated that an employee's coming into contact with the fresh tissues of infected swine bore little relationship to contracting the infection since employees of many of the departments all handled the infected meat.

From the information obtained in the investigation of the plant, it was concluded that "the distribution of cases would

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<sup>1</sup>Ibid., p. 1174.

seem to indicate that air-borne transmission may have been a factor. . ."<sup>1</sup> in bringing about the outbreak. However, the air-borne transmission of the disease could not be proven since there was no indication that the organisms "were or were not present in the air at times or in selected locations in densities sufficient to cause human infection. . . ."<sup>2</sup>

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<sup>1</sup>Ibid., p. 1177.

<sup>2</sup>Ibid., p. 1178.

## X. NEW HAMPSHIRE BRUGELLOSIS TESTING LAW

New Hampshire, the only state in the Nation to achieve Certified Brucellosis Free status in all counties in the state, has a stringent bovine brucellosis testing law. It is possible that the law has aided in the achievement of the Certified Brucellosis Free status. Section 443:47 of the New Hampshire law reads:

"When sixty-five percent of the cattle owners in any given town or county apply or have applied to the state for the tuberculin or Bang's disease test, or when sixty-five percent of all the cattle in a town or county are under state supervision, the commissioner (of agriculture) may declare any town or county a quarantine area and proceed to test all animals within said area. When said area has been declared practically free from tuberculosis or Bang's disease by the commissioner, said area may be declared a modified accredited area and the commissioner may issue rules and regulations prohibiting the shipment or transportation into said area of any bovine animals without permit and proper health certificates. On July 1, 1942 or within thirty days thereafter the commissioner shall declare the entire state of New Hampshire a quarantine area and proceed to test for Bang's disease all animals within said area. The commissioner shall make such tests as he sees fit at the expense of the state, but if any reactors shall at any time be found they shall be appraised, slaughtered, and paid for as provided by this chapter, or may be returned in strict quarantine as herein provided. The commissioner may retest any animal or animals when in his judgment the conditions warrant it."<sup>1</sup>

An annotation to Section 443:47 interprets the section as follows:

"Since the law contemplates the testing of all cattle within a quarantine area, an owner is not entitled to any hearing upon the question whether his cattle are subject to test. *Dederick v. Smith* (1936) 88 NH 63, 184 A 59, app disp 299 US 306, 81 L ed 575, 57 S Ct 38."<sup>2</sup>

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<sup>1</sup> New Hampshire, Revised Statutes Annotated (1955), sec. 443:47.

<sup>2</sup> Ibid.



## XI. WALLACES FARMER POLL

In early 1960, the Wallaces Farmer Poll asked the following question of persons living on Iowa farms:

"Would you approve or disapprove of compulsory testing for brucellosis of all cattle in your county and compulsory slaughter of all reactors, provided 75 percent of the cattle owners in the county signed petitions asking for such actions?"<sup>1</sup>

Answers to the Wallaces Farmer Poll question were as follows:

Approved 83%  
Disapproved 9%  
Undecided 8%

After pointing out that a huge majority of the persons interviewed in the poll favored a compulsory brucellosis program, the Wallaces Farmer stated that "The lack of teeth in the present Iowa law is the bottleneck in Iowa's move for becoming a Modified Certified state."<sup>2</sup>

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<sup>1</sup>Alvin F. Bull, "Here's Why We're Not Stopping Brucellosis," Wallaces Farmer, December 3, 1960, p. 14.

<sup>2</sup>Ibid.





APPENDIX I

NUMBER OF CASES OF HUMAN BRUCELLOSIS IN EACH  
STATE IN THE NATION

<u>STATE</u>	<u>1961</u>	<u>STATE</u>	<u>1961</u>
Alabama	2	Montana	3
Alaska	1	Nebraska	29
Arizona	3	Nevada	-
Arkansas	19	New Hampshire	-
California	20	New Jersey	2
Colorado	3	New Mexico	2
Connecticut	4	New York	11
Delaware	-	North Carolina	6
District of Columbia	-	North Dakota	2
Florida	10	Ohio	4
Georgia	12	Oklahoma	8
Hawaii	1	Oregon	2
Idaho	-	Pennsylvania	3
Illinois	61	Rhode Island	-
Indiana	5	South Carolina	-
Iowa	219	South Dakota	18
Kansas	54	Tennessee	12
Kentucky	3	Texas	15
Louisiana	12	Utah	7
Maine	-	Vermont	1
Maryland	-	Virginia	18
Massachusetts	2	Washington	2
Michigan	9	West Virginia	-
Minnesota	18	Wisconsin	7
Mississippi	7	Wyoming	3
Missouri	3	TOTAL	580

SOURCE: NOVS Weekly Morbidity and Mortality Reports



APPENDIX II

ANNUAL AVERAGE CASE RATE OF REPORTED HUMAN BRUCELLOSIS MORBIDITY  
PER 100,000 POPULATION IN EACH STATE IN THE NATION, 1948-1960

<u>STATE</u>	<u>1948-50</u>	<u>1951-53</u>	<u>1954-56</u>	<u>1957-59</u>	<u>1960</u>
Alabama	2.1	1.3	0.4	0.2	0.5
Arizona	2.4	0.8	0.8	0.4	0.2
Arkansas	2.0	2.1	1.8	1.0	0.5
California	1.3	0.8	0.4	0.2	0.2
Colorado	10.3	1.6	0.7	0.3	0.1
Connecticut	3.6	1.0	0.4	0.1	0.1
Delaware	0.3	0.3	0.1	0.1	0.0
District of Columbia	0.1	0.2	0.1	0.0	0.0
Florida	2.4	0.3	0.3	0.2	0.1
Georgia	3.5	1.9	1.1	0.7	0.1
Idaho	4.9	3.1	1.4	0.2	0.4
Illinois	5.7	3.7	1.7	0.9	0.7
Indiana	1.3	0.5	0.3	0.2	0.2
Iowa	17.3	25.1	13.7	10.1	11.2
Kansas	6.9	3.3	1.8	3.8	2.2
Kentucky	0.7	0.4	0.7	0.5	0.2
Louisiana	1.3	1.1	1.2	0.5	0.4
Maine	1.3	0.6	0.1	0.1	0.1
Maryland	2.1	0.8	0.2	0.04	0.03
Massachusetts	0.7	0.3	0.3	0.1	0.02
Michigan	2.7	0.9	1.0	0.2	0.1
Minnesota	10.7	5.1	3.4	1.1	0.4
Mississippi	3.0	2.3	1.1	0.4	0.4
Missouri	2.4	1.3	1.1	0.7	0.2
Montana	2.1	1.5	0.7	0.4	0.4
Nebraska	3.8	0.4	2.2	2.8	1.4
Nevada	1.9	0.5	0.1	0.2	0.4
New Hampshire	0.9	0.1	0.1	0.0	0.0
New Jersey	0.8	0.3	0.1	0.1	0.05
New Mexico	0.8	0.3	0.7	0.2	0.1
New York	1.2	0.5	0.2	0.1	0.1
North Carolina	0.5	0.4	0.1	0.2	0.1
North Dakota	4.0	2.1	3.2	2.6	1.4
Ohio	1.5	0.2	0.1	0.1	0.04
Oklahoma	5.3	2.7	1.4	0.3	0.2
Oregon	3.0	0.5	0.5	0.2	0.2
Pennsylvania	0.9	0.4	0.2	0.1	0.1
Rhode Island	0.7	0.4	0.3	0.04	0.1
South Carolina	1.0	0.4	0.1	0.1	0.04
South Dakota	6.5	4.0	5.0	2.9	3.8

## APPENDIX II - page 2 (Continued)

<u>STATE</u>	<u>1948-50</u>	<u>1951-53</u>	<u>1954-56</u>	<u>1957-59</u>	<u>1960</u>
Tennessee	1.6	1.2	1.0	0.6	0.3
Texas	5.2	1.4	0.6	0.2	0.2
Utah	8.2	2.5	1.3	0.7	1.3
Vermont	4.1	8.6	2.8	0.8	0.0
Virginia	2.2	1.8	1.0	0.6	0.9
Washington	1.5	1.7	0.3	0.1	0.0
West Virginia	0.4	0.4	0.3	0.03	0.0
Wisconsin	7.1	3.5	1.9	0.5	0.1
Wyoming	<u>2.9</u>	<u>2.4</u>	<u>1.2</u>	<u>0.4</u>	<u>0.0</u>
Totals	2.9	1.6	0.9	0.5	0.4
Alaska					0.4
Hawaii					0.0

SOURCE: Annual, Supplements, Notifiable Diseases. NOVS.1948-1960  
Populations, Mid-year Estimates, Bureau of the Census.



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