

Risk Evaluation

APHIS Evaluation of the Classical Swine Fever Status of the State of Chihuahua, Mexico

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Introduction

In 1995 and 1997, APHIS staff conducted site visits to Chihuahua, Mexico to evaluate the status of the government's national program to eradicate Classical Swine Fever [1, 2].

In assessing the Classical Swine Fever (CSF) status of Chihuahua, and in accordance with its regulations [3], APHIS evaluated the following factors based on the site visits, and additional information provided by the government of Mexico:

- Authority, organization and infrastructure of veterinary services;
- Disease surveillance;
- Diagnostic laboratory capabilities;
- Disease outbreak history and disease prevalence;
- Active disease control programs, if any, if the agent is known to exist in the region;
- Vaccination status;
- Disease prevalence and outbreak history in adjacent regions;
- Separation of the region from regions of higher risks through physical or other barriers;
- Control of movement of animals and animal products from the regions of higher risk;
- Livestock demographics and marketing practices; and
- Animal health policies and infrastructure for animal disease control.

A summary of the data relating to each of these factors is provided below.

Description of the disease [4, 5]

Classical Swine Fever, previously known as "Hog Cholera" is a highly contagious disease of swine caused by a virus of the togaviridae family. The incubation period is usually 3-4 days, but may range from 2-14 days. In the typical acute form, pigs present with anorexia, fever of 41 degrees C or more, muscle tremors, prostration, mucopurulent ocular discharge, and multiple superficial and internal hemorrhages resulting in a purplish discoloration of the skin. Morbidity and mortality are high. In the final stages, nervous system involvement is manifested through nervous signs, paralysis, and death, usually in 10-15 days. A chronic form exists with milder symptoms, in which mature animals occasionally recover. Chronic CSF is characterized by prolonged and intermittent anorexia, fever, alternating diarrhea and constipation, and alopecia. The

atypical form, associated with low virulence virus strains, may present as Congenital Tremor, characterized by tremors in the head, neck, dorsal area, and hindquarters. Transplacental infection with low virulence strains may result in persistently infected piglets, which are a major cause of virus dissemination to uninfected farms.

The pig is the only natural reservoir of CSF. Blood, tissues, secretions, and excretions from an infected animal contain the virus. Transmission occurs mainly through the oral route, although infection can occur through the conjunctiva, mucous membrane, skin abrasions, and inseminations. Feeding of raw or insufficiently cooked garbage containing infective pork material is a potent source of CSF virus.

Regional Risk Factors

Authority, organization and infrastructure of regional veterinary services [6]

A decree published in the Federal Official Daily of March 25, 1980 in Mexico established the National Campaign for the control and eradication of CSF. The campaign is mandatory and permanent throughout the entire country. The Ministry of Agriculture and Water Resources (SARH) has an office in Chihuahua. The office includes the livestock sub-delegation, which covers the functions of animal health, livestock development and grazing. Under these are the campaigns units, registration and zoo sanitary service units, Federal Inspection Standard (TIF) plant inspectors, livestock development unit, livestock promotion unit, and livestock development center. Chihuahua is divided into two Rural Development Districts with technical staff coordinated by the livestock sub-delegation. A collaborative relationship exists between the pork producers association, the Federal Livestock sub-delegate Office, and the State Animal Health official from the central offices. For international control of movement of livestock and animal byproducts, Chihuahua has three animal health offices with veterinary inspection and ten checkpoints for controlling overland movement, all of which have official SARH staff to operate them on a 24-hour basis. Hog slaughtering and processing is done in TIF establishments in compliance with international sanitary requirements and have veterinary sanitary officers and certification by the countries to which they export.

An APHIS site visit conducted in February 1997 determined that the cooperative relationships between the Federal and State governments and industry are excellent, and that the veterinary infrastructure is efficient and reliable.

Type and extent of disease surveillance [6]

Mexico declared Chihuahua free of CSF in September 1993. A year later an epidemiological survey was conducted to confirm that CSF virus was indeed not present. The nine largest municipal abattoirs in the state were sampled. Mexico is currently seeking to eradicate pseudorabies. Blood samples collected for the pseudorabies campaign are also tested for CSF, thus providing additional surveillance. In regions, states or areas under eradication or free of CSF, the federal and state government, as well as swine owners or producers and accredited veterinarians, has responsibility for maintaining epidemiological surveillance for CSF. Surveillance

includes inspection of swine products and byproducts and of the official documentation required for the control of movement from eradication areas into free areas as well as virological monitoring by government and producers. Chihuahua maintains an active surveillance system. This includes reporting of all suspected cases and sampling from community abattoirs, the TIF, and commercial and backyard farms. In the TIF abattoirs, animal tracebacks are done whenever necessary. Each abattoir has an official veterinarian for ante and post mortem inspection. If an abnormality is detected during inspection, the lot to which the animal belongs is determined and the farm of origin identified.

Annual surveillance is required under Nom-037-Z00 1995, National CSF Campaign norms [4]. An APHIS 1997 site visit team determined that surveillance data for 1993-1997 were incomplete and inconclusive. While evidence of infection was not observed, the site visit team recommended new surveillance methods. These were promptly initiated. This surveillance requires 29 samples per commercial herd. The plan for backyard premises requires sampling 299 sites and testing of five pigs per site for an expected total of 1,495 serological tests. Surveillance results from 1997-1999 have been all negative for CSF [7].

CSF surveillance data for Chihuahua was analyzed to determine the most likely true prevalence of disease over the multiple years of testing data. For commercial herds, with the smaller number of total herds and animals tested, a hypergeometric probability function was used. For the more numerous backyard herds, with larger total numbers of animals tested and smaller numbers per herd, a binomial probability function was used. (See attachment 1 for details of this analysis). In both commercial and backyard herds, the most likely estimated prevalence is 0 for every year. In commercial swine, the probability of missing a positive animal if the true CSF prevalence is 1% (1 infection per 100 animals), given that no animals tested positive on surveillance during annual testing from 1997-2000, is 1.81×10^{-2} . The probability that CSF prevalence could be as high as 5% (5 infections per 100 animals) and still escape detection on annual surveillance, is vanishingly small at 9.06×10^{-10} . For backyard herds, the numbers are even more convincing. Analysis indicates that the probability of detecting no positive animals on annual surveys if the true prevalence was 1% (i.e., the probability of missing a truly positive animal) is 7.30×10^{-27} . Therefore, if CSF was present at very low levels, or was recently introduced into backyard herds, the likelihood of detecting infection on annual surveillance is virtually guaranteed. This analysis should not be interpreted as a higher probability of disease in commercial herds versus backyard herds, rather, less statistical power of the analysis for commercial herds due to the smaller sample size (232 commercial herd samples versus 1470 backyard samples submitted). This emphasis on detecting disease at low levels in backyard herds is appropriate since they are considered at higher risk for CSF, if it were reintroduced, than are commercial herds.

Diagnostic Lab Capabilities [6]

Chihuahua State has four diagnostic laboratories: Chihuahua, Cd. Delicias, Cd. Juarez and Nuevo Casas Grandes. Although the state has laboratory capability to diagnose CSF, samples from suspicious cases are sent to the National Health Diagnostic Center, located in State of Mexico. Eight regional laboratories in Mexico are approved to conduct the immunoperoxidase test and ELISA test for CSF. All samples that test

positive are sent to the central laboratory in Mexico City for confirmation and tissues from suspect animals are sent to the CPA laboratory in Mexico City for virus isolation.

Disease Outbreak History and Disease Prevalence [6]

Chihuahua has not reported CSF in over ten years. The last reported outbreak was in 1989 in the municipality of Cuauhtemo, and eradication efforts began in 1990.

Disease Control Program

CSF is considered an exotic disease in Chihuahua. Therefore, while there are no active disease control programs, the state does maintain both active and passive disease surveillance, as well as ongoing animal movement controls, and an emergency response system to respond if CSF were again detected in the state.

Vaccination Status [6]

All swine in Chihuahua were vaccinated for CSF until 1989. Vaccination has not been permitted since then.

Disease status of adjacent regions [6]

Chihuahua is the largest state in Mexico. Located in northern Mexico, it borders New Mexico and Texas to the north and northeast, Coahuila on the east, Durango on the south Sinaloa on the southwest, and Sonora on the west. All these border states are declared free of CSF by the U.S. or Mexico.

Degree of separation from areas of higher risks [6]

The eastern part of Chihuahua is desert, which provides an additional boundary between Chihuahua and Coahuila. The Sierra Madre Occidental mountain range in the west separates Chihuahua from Sonora and Sinaloa. Between Chihuahua and Durango is a region of mountains and valleys, in addition to an extensive permanent internal quarantine system designed to control movement of animals between states.

Control of Animal Movement from High Risk Areas [6]

The primary means for preventing reintroduction of CSF into Chihuahua is through regulations controlling the movement of land and air traffic. Chihuahua has no maritime traffic. Movement of live hogs from control zones into free zones is not allowed, thus avoiding the greatest source of risk. Products and byproducts from eradication zones and control zones are not allowed to move to free zones unless they originate in TIF facilities with a current registration and which are authorized by the General Division of Animal Health to market their products and byproducts into CSF free zones. Products must be moved in vehicles sealed with metal straps.

Passenger baggage at airports is examined. Because most domestic flights originate from areas not yet declared free of CSF, food served on airplanes is not permitted to

contain pork.

Federal regulations exist to control inter and intrastate animal movement and the government monitors vehicle movements within the state. Any vehicle without proper documentation is returned and if one is carrying prohibited products; the product is confiscated and destroyed. A network of radio communications links inspection stations. Inspection stations disinfect vehicles entering the state and have incinerators to destroy confiscated agricultural products [2].

Pork products from states of lower health status may be imported only if they meet time and temperature processing requirements (68.90 C for 30 minutes or 80.50 C for three minutes) and if they originate from an approved TIF (federal) plant [6].

Livestock demographics and marketing patterns [7]

The 2000 swine inventory lists 2,626 head distributed among 5 commercial herds, which range in size from 128 to 1,280 head. In addition, there are 169,183 head of swine distributed among 45,714 backyard operations. Swine represent 5.8% of the total gross value of livestock production in Chihuahua [6]. Chihuahua is a net exporter of pork. The Carnes Selecta Baeza Favez plant in Chihuahua is allowed to ship fresh and frozen pork to markets in Japan and other countries [7].

Policies and infrastructure for animal disease control

If CSF were introduced, Chihuahua would implement a stamping-out policy [4].

Conclusions:

- 1) CSF has not been diagnosed in Chihuahua since 1989, despite extensive and ongoing surveillance.
- 2) No vaccination for CSF has occurred since 1989.
- 3) Chihuahua has effective controls on animal movements from areas of higher risk to prevent the reintroduction of CSF.
- 4) Chihuahua maintains a surveillance system capable of rapidly detecting CSF if it were reintroduced.
- 5) Chihuahua has the laws, policies, and infrastructure in place to detect, respond to, and eliminate any occurrence of CSF.
- 6) Given the virulent nature of the disease in this naive population, and the proven ability to detect disease if it were re-introduced, the ongoing surveillance indicates that the likelihood of CSF virus being present in the commercial swine operations of Chihuahua is low.

References

- 1) APHIS Site Visit to the State of Chihuahua to allow the transit of fresh/frozen pork through the United States, April, 1995.
- 2) APHIS Site Visit Report: Review of the States of Sinaloa and Chihuahua for consideration of CSF-Low Risk Status and Background Information for the Future Review of Exotic Newcastle Disease Status in Chihuahua, February, 1997.
- 3) Regionalization Final Rule; Importation of Animals and Animal Products. 62 FR 56000-56026.
- 4) Ministry of Agriculture and Rural Development, Official Mexican Standard NOM-037-ZOO-1995, National Classical Swine Fever Campaign.
- 5) Hog Cholera. In Foreign Animal Diseases, United States Animal Health Association, p. 273-282, 1998.
- 6) Report on Characterization of the State of Chihuahua for International Recognition as a Classical Swine Fever Free Zone. Subsecretaria de Ganaderia, Direccion General de Salud Animal, Mexico, June 1994.
- 7) Additional Information Requested for the Recognition of the States of Baja California, Baja California Sur, Sinaloa, and Chihuahua as Low Risk Regions for Classical Swine Fever, 2001.

Appendix 1

Data Analysis of Commercial and Backyard Herds based on Annual Surveillance Data for CSF in the State of Chihuahua

Chihuahua Surveillance Information

CSF in Chihuahua	Year	1997	1998	1999	2000
	Total Population (Commercial)			920	2626
	Number of Herds			8	5
	Herd 1			200	1280
	Herd 2			200	256
	Herd 3			30	198
	Herd 4			200	128
	Herd 5			90	570
Three herd total (#6, 7, 8) is 200	Herd 6			66.66666	0
	Herd 7*			66.66666	0
	Herd 8*			66.66666	0
	sample size	29	29	29	29
	Total Samples (Commercial)	233	232	232	145
	Presumed Prevalence=10%				
	Total Population (Back Yard)			228568	169183
	Number of Herds (Back Yard)			45714	45714
	sample size	5	5	5	5
	Total Samples (Back Yard)	1520	1527	1471	1470
	Presumed Prevalence=1%				
	Grand Total Samples	1753	1759	1703	1615
Immunoperoxidase Test	Sensitivity		0.97		
	Specificity		0.97		

Hypergeometric Probability Function of Commercial Herds

Prevalence (P)	1997 ^a	1998	1999	2000	Tot Prob ^b	1-Tot Prob ^c
0.10%	.907	.907	.855	.936	.685	.315
1.00%	.411	.411	.2	.535	1.81x10 ⁻²	.982
2.00%	.165	.165	.0436	.289	3.43x10 ⁻⁴	1.00
5.00%	9.25x10 ⁻³	9.25x10 ⁻³	2.58x10 ⁻⁴	4.1x10 ⁻²	9.06x10 ⁻¹⁰	1.00
(n/N) ^d			25.22%	5.52%		

a: Probability of observing zero positive animals in that one survey year if the actual prevalence of CSF was P in the total population.

b: Probability of observing zero positive animals through all years of surveillance, given that there was an ongoing infection in the population of prevalence P.

c: Probability of observing one or more positive animals through all years of surveillance, given that there was an ongoing infection in the population of prevalence P; i.e., a measure of survey confidence.

d: Number of samples collected divided by total population in all commercial herds for that year.

Binomial Approximation to the Hypergeometric Probability Function of Backyard Herds

Prevalence (P)	1997	1998	1999	2000	Tot Prob ^a	1-Tot Prob ^b
0.10%	2.19x10 ⁻¹	2.17x10 ⁻¹	2.3x10 ⁻¹	2.3x10 ⁻¹	2.5x10 ⁻³	.997
1.00%	2.32x10 ⁻⁷	2.16x10 ⁻⁷	3.8x10 ⁻⁷	3.83x10 ⁻⁷	7.30x10 ⁻²⁷	1.00
2.00%	4.61x10 ⁻¹⁴	x10 ⁻¹⁴	1.08x10 ⁻¹²	1.27x10 ⁻¹³	2.90x10 ⁻⁵³	1.00
5.00%	1.38x10 ⁻³⁴	9.64x10 ⁻³⁵	1.70x10 ⁻³³	1.79x10 ⁻³³	4.06x10 ⁻¹³⁴	1.00
(n/N) ^c	.76%	.77%	.64%	.87%		

a: Probability of detecting zero positive animals through all years of annual surveillance given that the true prevalence was P

b: Probability of detecting one or more positive animals in all years of surveillance given that the true prevalence was P.

c: sample size (n) divided by total population in backyard herds (N) to give percent of population tested each year during annual surveillance.