

# THE INCIDENCE AND CONTROL OF FOOT-AND-MOUTH DISEASE AND SIMILAR ANIMAL DISEASES IN THE AMERICAS

1 OCTOBER 1952 TO 30 SEPTEMBER 1953\*

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## INTRODUCTION

One of the activities of the Pan American Foot-and-Mouth Disease Center,† during the past two years has been the collection and dissemination of information on vesicular diseases in the Americas. It appears that there is very little interchange of information between individual countries in this respect. The Center therefore decided to review the status of these diseases and their control, and in order to provide a basis for comparison the period of 1 October 1952 to 30 September 1953 was selected. Much historical information will thus be omitted but it is hoped that a similar review may be prepared annually in the future so as to provide a permanent record of the changes which occur. All information used in this report came from official sources in the various countries.

Since before the turn of the century, foot-and-mouth disease has been recognized as the foremost animal disease problem in the Americas. To the countries which are infected, it means a constant drain on their resources due to heavy losses in meat and milk, and to those which are free, a constant source of danger against which they must protect themselves. No extensive estimates have been made of the actual losses caused by the disease but authorities in several South American Countries place them at approximately one year's production in four, or 25 % of annual production. It can readily be seen that this loss is not only an economic one but also has serious repercussions on human health, since the loss consists of vital foods for human consumption.

## FOOT-AND-MOUTH DISEASE

*Foot-and-Mouth Disease* is caused by one of the smallest known viruses and is among the most contagious virus diseases, whether of human or animal origin. It has a size of approximately 8 to 20 millimicrons and six immunologically distinct types have been recognized. These have been

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classified as "O" and "A" by Vallée and Carré (1) "C" by Waldmann and Trantwein (2) and SAT-1, SAT-2 and SAT-3 by Galloway, Brooksby and Henderson (3), respectively. The first three types "O", "A" and "C" were reclassified in Germany as "A", "B" and "C", respectively (4). Both classifications are still used. In addition to the six basic types a number of sub-types or so called "Variants" have been identified which show immunological differences from the basic types, while retaining most of the characteristics of these types.

*Vesicular Stomatitis* can never be excluded from a discussion on the foot-and-mouth disease problem because the clinical signs of the two diseases in cattle are often indistinguishable. Only by laboratory or animal inoculation tests can the two be distinguished with certainty. Vesicular Stomatitis is also caused by a filtrable virus and has a size of 60-100 millimicrons. Two immunologically distinct types have been recognized and identified as "New Jersey" and "Indiana" types, respectively. In general, the disease is not as severe as foot-and-mouth disease nor does it appear to spread as rapidly.

*Other Similar Diseases:* Several other clinical conditions may stimulate foot-and-mouth disease but, from information received, it would appear that vesicular exanthema is the only one which merits serious attention. This too is a virus disease. It affects only pigs by natural methods of infection and as yet appears to be confined to the U.S.A. The occurrence of the disease seems to be closely related to the feeding of uncooked garbage to pigs. Four immunologically distinct types of virus were identified by Crawford (5), in early outbreaks (1933-34) of the disease but later, Madin and Traum (1940) (6) were able to isolate only three.

## REVIEW

### INCIDENCE OF FOOT-AND-MOUTH DISEASE 1952-1953

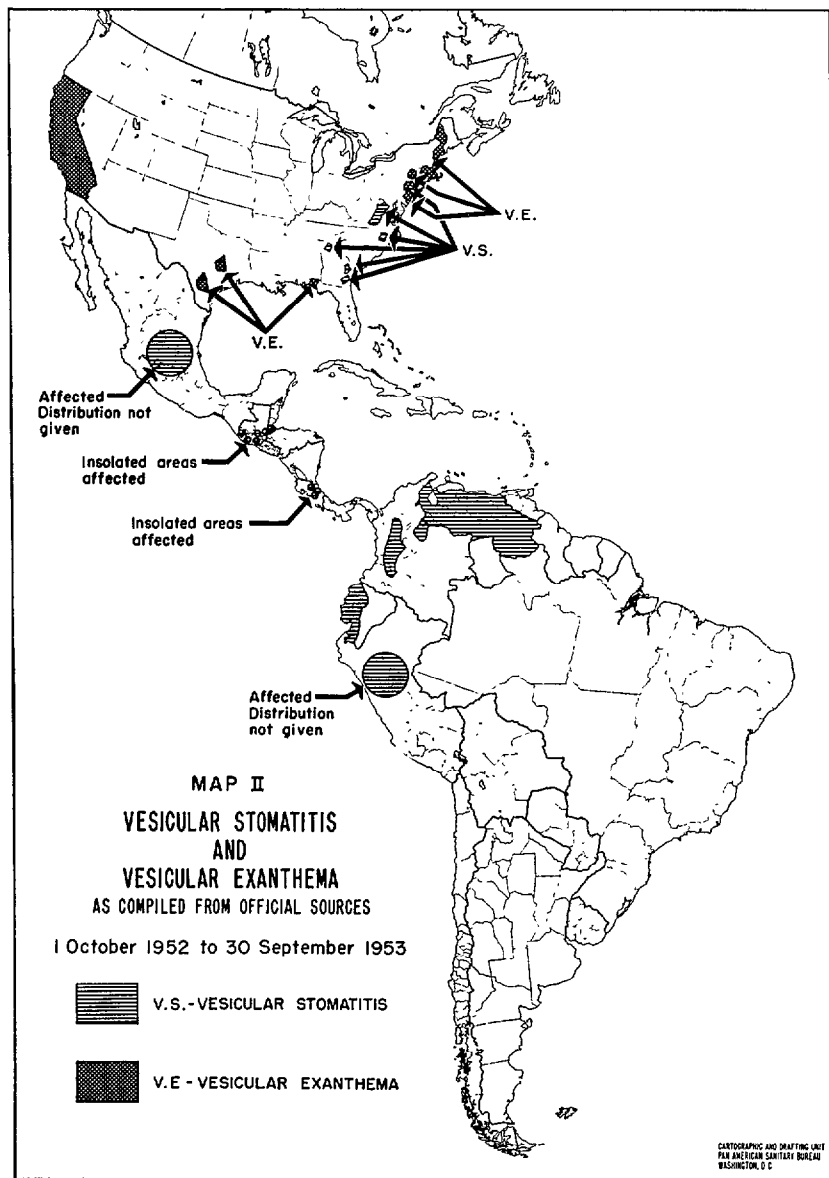
No attempt has been made at quantitative estimate of these diseases since examinations in some countries are very irregular and the number of examinations bears no relation to the actual number of outbreaks. Thus, the various countries were asked to state only whether or not foot-and-mouth disease, vesicular stomatitis or other similar diseases had occurred during the period in question.

Map 1 shows the areas affected by foot-and-mouth disease. In examining this map it must be remembered that the shaded parts include areas of potential infection as well as actual infection, i.e. all areas which must be included in the control program if it is to be effective. For example, only seven outbreaks of foot-and-mouth disease were discovered in Venezuela during the period but about half of the country has been included in the control area. Even so, it becomes apparent that the nature of the foot-and-mouth disease problem varies with the different regions of the Americas. This observation is confirmed when refer-

ence is made to the first three columns of Table I. With the exception of Mexico and Martinique all of North, Central America, Panama and the Caribbean area appears to be free of foot-and-mouth disease. During the period a further small outbreak was discovered in Mexico which was immediately dealt with by an intensive eradication program. The occurrence in Martinique consisted of a short but violent outbreak with no apparent continuation.



South America presents a number of different pictures. No outbreaks were reported from Peru, Ecuador, British Guiana, Dutch Guiana or French Guiana, although Peru did record outbreaks during the early part of 1952. It will be noted that only two types of foot-and-mouth disease virus have been identified in Venezuela and Colombia (the



presence of the disease was only confirmed in 1950 and 1951 respectively). The two types of virus are Vallée types "O" and "A", and only part of the country was affected in each case. The situation in Bolivia and Paraguay is somewhat obscure due to the fact that very few virus typings have been made. However, both countries consider themselves to be infected by the disease. The remaining countries, Argentina, Brazil, Chile and Uruguay all recorded the presence of Vallée types "O" and "A", and Waldmann types "C" virus. Map 1 shows that the infection was only found in part of Chile and part of Argentina. The southern limit of the disease appeared to approximate latitude 42°S.

From reports received there is no evidence to suggest that any of the remaining three types of virus, SAT-1, SAT-2 or SAT-3 occur in South America.

#### INCIDENCE OF VESICULAR STOMATITIS

Map 2 shows the general distribution of vesicular stomatitis. The countries which recorded the presence of this disease are Colombia, Ecuador, Guatemala, Mexico, Peru, U.S.A. and Venezuela. All, except Ecuador were infected with both "New Jersey" and "Indiana" types of virus. Only "New Jersey" type virus was identified in Ecuador. The relative incidence of the two types varied from country to country but in the South American countries affected, "New Jersey" type virus predominated.

Although not generally as infectious as foot-and-mouth disease, where vesicular stomatitis has occurred it has often been as severe and occasionally more severe in individual herds, than outbreaks of foot-and-mouth disease. In addition, atypical forms of the disease have been observed, the most striking of which was an outbreak of udder infection, resembling cow-pox in Peru. Communications from Guatemala indicate that the same condition was observed there. Material from both Peru and Guatemala was found to contain vesicular stomatitis virus.

#### INCIDENCE OF VESICULAR EXANTHEMA

The only other disease resembling foot-and-mouth disease which was reported was Vesicular Exanthema and this was confined to the U.S.A. The extension of the disease beyond the limits of the State of California was first confirmed on July 1, 1952. Thereafter, the spread was very rapid and it continued throughout the survey period, to affect a total of 40 states. However, by the end of the period the disease had been eliminated from all but 9 of the affected states.

The incidence of the disease was closely related to the feeding of raw garbage to pigs.

Many other conditions which might be confused with foot-and-mouth disease in the individual animal or herds, undoubtedly exist but none were reported.

## CONTROL METHODS

*Foot-and-Mouth Disease:* The last three columns of Table I are devoted to the methods used in controlling foot-and-mouth disease during the survey period. The programs used by all the countries appear to fall into one of the the three categories.

No country or territory was attempting to eradicate the disease by slaughter alone, but a combined slaughter and vaccination program was being used in Mexico and Venezuela. In both cases, the aim of the program was to reduce the spread of the disease by intensive vaccination in the infected areas and restriction of movement of animals within and out of the areas. Routine disinfection was also being carried out. By the end of the survey period both countries appeared to be approaching the goal of eradication.

The control programs in the remaining affected countries were based on vaccination. The intensity of the program varied from country to country. In Colombia the program was administered by the national authorities who maintain a large staff of veterinarians to operate the program and apply vaccines. Other countries were beginning work on an intensive scale in limited areas primarily to demonstrate the value of regular vaccination as well as to establish areas relatively free of the disease. Included in this group were Argentina and Chile. It appears that regular vaccination has become a custom amongst the more enlightened livestock owners throughout South America. Thus, in those countries and areas where no intensive program is in operation a large part of the cattle population is vaccinated on a voluntary basis.

Of the eight countries which operated control programs three permit the use of trivalent vaccines. Four countries only permit the use of bivalent or monovalent vaccines and the status of the remaining country is not known. With regard to the source of vaccines five countries maintain laboratories which produce vaccine but permit commercial production as well under their supervision. In the other three countries the vaccine is only produced by official laboratories.

As far as can be ascertained none of the countries which are free from foot-and-mouth disease have permitted the use of foot-and-mouth disease vaccine amongst their stock. All these countries rely on the prohibition or restriction of imports which might introduce the disease.

*Vesicular Stomatitis:* Despite its importance and the severe losses it often causes, no country reported the adoption of an organized control program for vesicular stomatitis.

*Vesicular Exanthema:* When the disease began to spread beyond the limits of the State of California, the Federal Government of the U.S.A. initiated an eradication program. The program included the systematic liquidation of all infected animals and all states were encouraged to enact legislation to prohibit the feeding of raw garbage to hogs.

## DISCUSSION

It is not within the scope of this report to consider the various factors which influence the incidence of foot-and-mouth disease but it is obvious from an examination of Map 1 that the incidence of the disease varies markedly from region to region.

The countries of the northern part of South America do not appear to be as extensively affected as those of southern South America. This is undoubtedly connected with the recent infection of some of the countries and the effectiveness of the control programs. However, the fact that Colombia and Venezuela appear to have remained free for so many years despite the proximity of the disease is of significance. It is also significant that Peru, which has been periodically affected for many years, can apparently remain free for more than a year, under the same conditions. These facts would tend to suggest that conditions in these countries are such that foot-and-mouth disease does not enter or spread as easily as in the southern part of the continent. Such an observation is logical when geographical and topographical factors are taken into consideration. All these countries, Peru, Ecuador, Colombia and Venezuela, are subdivided by vast mountain ranges and the climatic conditions are such that the livestock industry is made up of a series of isolated units with few connections between them. In common with the three Guianas they have natural barriers of forest and semi-desert which make the movement of animals and associated products, by land, from the southern South American countries almost impossible.

The reverse is true of the remaining South American countries. All of them are closely interconnected both geographically and ecologically. Brazil and Bolivia, for all practical purposes, fall into the same group as Argentina, Chile, Paraguay and Uruguay. There are few natural barriers to impede the movement of livestock from one country to another and the nature of the terrain permits the dissemination of virus in many ways which are beyond human control. Thus, we also have a logical explanation for the enzootic nature of the disease in southern South America. In the extreme south, conditions are different again but a logical explanation can, doubtless, be found to account for the freedom of that area from foot-and-mouth disease.

It would seem that the problem of vesicular stomatitis has been somewhat overshadowed by that of foot-and-mouth disease. Because of its lower level of infectivity, vesicular stomatitis is more or less ignored when foot-and-mouth disease is also involved. However, as has been observed in Guatemala and Peru, vesicular stomatitis is capable of causing severe losses and when it co-exists with foot-and-mouth disease it tends to complicate the application of control measures for the latter disease. It is worthy of note that in Colombia and Venezuela during the survey period many more outbreaks of vesicular stomatitis were confirmed than out-

TABLE I

The Incidence and Control of Vesicular Diseases in the Americas  
1 October 1952 to 30 September 1953

Country	Foot-and-Mouth Disease Virus			Vesicular Stomatitis Virus		Other Similar Diseases	Type of Control Program Used		
	Type "O"	Type "A"	Type "C"	Type "Indiana"	Type "New Jersey"		(1)	(2)	(3)
Alaska.....	-	-	-	-	-	-	-	-	-
Argentina.....	+	+	+	-	-	-	-	-	+
Bahamas Is. ....	-	-	-	-	-	-	-	-	-
Bolivia.....	-	-	+	-A	-A	-A	-	-	-
Brazil.....	+	+	+	-	-	-	-	-	+
Br. Guiana.....	-	-	-	-	-	-	-	-	-
Br. Honduras.....	-	-	-	+	+	-	-	-	-
Canada.....	-	-	-	-	-	-	(+) B	-	-
Chile.....	+	+	+	-	-	-	-	-	+
Colombia.....	+	+	-	+	+	-	-	-	+
Costa Rica.....	-	-	-	+D	+D	-	-	-	-
Cuba.....	-	-	-	-	-	-	-	-	-
Dominican Rep. ....	-	-	-	-	-	-	-	-	-
Dutch Guiana.....	-	-	-	-	-	-	-	-	-
Ecuador.....	-	-	-	-	+	-	-	-	-
El Salvador.....	-	-	-	-	-	-	-	-	-
French Guiana.....	-	-	-	-	-	-	-	-	-
Guatemala.....	-	-	-	+	+	-	-	-	-
Haiti.....	-	-	-	-	-	-	-	-	-
Honduras.....	-	-	-	-	-	-	-	-	-
Jamaica.....	-	-	-	-	-	-	-	-	-
Martinique.....	-	+	-	-	-	-	-	-	-
Mexico.....	-	+	-	+	+	-	-	+	-
Nicaragua.....	-	-	-	-	-	-	-	-	-
Panama.....	-	-	-	-	-	-	-	-	-
Paraguay.....	?C	?C	?C	?C	?C	?C	-	-	+
Peru.....	-	-	-	+	+	-	-	-	-
Puerto Rico.....	-	-	-	-	-	-	-	-	-
Trinidad.....	-	-	-	-	-	-	-	-	-
Uruguay.....	+	+	+	-	-	-	-	-	+
U. S. A.....	-	-	-	+	+	Ves. Exanthema	(+) B	-	-
Venezuela.....	+	+	-	+	+	-	+	+	-

## CONTROL METHODS

(1) Slaughter of infected and exposed susceptible animals combined with strict quarantine and disinfection.

(2) Slaughter of infected and exposed susceptible animals combined with systematic vaccination in the affected area.

(3) Systematic vaccination in the affected area combined with quarantine restrictions.

A = No examinations have been made for these viruses.

B = Method used in former outbreaks.

C = Vesicular diseases including foot-and-mouth disease are known to exist but typification of virus has been very limited.

D = Vesicular Stomatitis is known to exist but no typing has been made.



breaks of foot-and-mouth disease. Thus, it would seem that more attention should be given to the development of control measures for this disease and their integration in an overall vesicular disease control program, where necessary.

Vesicular exanthema is not as yet an international problem. However, the possibility that it may appear in other countries cannot be ignored. Measures must therefore be taken to insure that if it does appear a prompt diagnosis can be made.

With regard to control methods for foot-and-mouth disease, the three basic types of program have already been reviewed. To those who know South American conditions it is obvious that a program based on the slaughter of infected and exposed animals, without vaccination, is impractical for nearly all the affected countries. As will be seen in Table I most of the countries have programs based more or less on systematic vaccination and for a number of years nothing more than the intensification and extension of these programs can probably be expected.

In reality the three columns of the table represent the steps which each of the countries will probably need to take if foot-and-mouth disease is to be eradicated, unless, of course, a greatly improved immunizing agent is discovered. Where the disease is enzootic the first stage must be vaccination on large scale with the best available vaccines, properly handled and applied. A voluntary program can only have limited success because livestock owners are not necessarily interested in maintaining their animals completely free of the disease. It is sometimes more practical from a farmer's point of view, to suffer a few cases periodically rather than increase the frequency of vaccination. In addition, there are those who are unwilling or unable to vaccinate regularly. Therefore, at some state in the program vaccination must become obligatory. This, of course, implies an adequate source of vaccine and some assistance in its application which in turn imply a greater financial obligation on the part of the authorities. Other important measures are effective quarantine and veterinary police restricting the movement of infected and/or other animals, animal products and material which might act as mechanical carriers. In addition, a rapid and efficient diagnosis service is imperative. It has been proved in Mexico and Venezuela and on the Continent of Europe that a program of this type can be very successful.

The aim of any control program should be to bring about the eventual eradication of the disease concerned. To accomplish this most authorities believe that the vaccination program must be augmented by the slaughter of infected animals or herds. This conclusion was reached by the O.I.E. after the catastrophic experience in the European Epizooty of 1951-1952, since which, several countries have indicated their intention to use a combined vaccination-slaughter program. The final stage of this program is, of course, the introduction of test animals and the cessation of vaccination when the country is considered free of virus,

Most of the countries which are free from the disease would probably give first consideration to the type 1 program, should the disease appear. If an outbreak is identified before it has become well established this is certainly the wisest policy to follow. The adoption of a vaccination program under these circumstances, ought to be viewed with greatest of caution, since the total cost can easily exceed that of a slaughter program, well applied, at the start of an outbreak.

The final and, perhaps, the most important observation which may be drawn from the review is that foot-and-mouth disease and the other vesicular diseases are regional rather than national problems. No nation can make itself completely secure against these diseases without the cooperation of its neighbours; no nation can hope to control these diseases without due consideration of what its neighbours are doing. Thus, if eradication of the vesicular diseases, and especially foot-and-mouth disease is ever to be achieved in the Americas the countries must approach the problem on an international basis. The diseases have no respect for national frontiers and the programs should be designed accordingly.

#### SUMMARY

The Pan American Foot-and-Mouth Disease Center has compiled and reviewed all *available* information on foot-and-mouth disease and other vesicular disease in the Americas. With the exception of Mexico, all information used was obtained from *official* sources in the respective countries and, as far as possible, only that pertaining to the period 1 October 1952 to 30 September 1953 has been considered.

The Center wishes to thank all those officials who provided information for this report and the various Zone Offices of the Pan American Sanitary Bureau for their assistance in handling correspondence.

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INCIDENCIA Y CONTROL DE LA FIEBRE AFTOSA  
Y ENFERMEDADES ANIMALES AFINES  
EN LAS AMERICAS (*Resumen*)

Una de las actividades del Centro Panamericano de Fiebre Aftosa durante los últimos dos años consistió en estudiar y divulgar informes acerca de las enfermedades vesiculares en las Américas. Como el intercambio de informes entre países parece ser mínimo, el Centro decidió llevar a cabo un estudio de la incidencia y del control de esas enfermedades entre el 1° de octubre de 1952 y el 30 de septiembre de 1953. Los informes presentados en este estudio se obtuvieron de fuentes oficiales de los distintos países.

Según el estudio Colombia, Venezuela y Perú han permanecido al parecer, libres de la enfermedad durante más de un año, lo cual pudiera atribuirse al hecho geográfico de hallarse estos países separados por cadenas montañosas, y a las condiciones climatológicas que hacen que la industria ganadera en esas regiones esté formada por centros aislados, lo cual no sucede en la parte sur del continente, donde no existen barreras naturales que impidan la fácil comunicación entre países y la propagación de la enfermedad.

Al discutir la fiebre aftosa es imposible excluir la estomatitis vesicular por ser ambas difíciles de distinguir a menos que se recurra a pruebas en animales. A pesar de las pérdidas ocasionadas por esta enfermedad en diferentes países, no se cuenta aún con un plan organizado para combatirla.

Según el informe del Centro hubo un brote de exantema vesicular en California, cuya aparición fuera del estado se confirmó el 1° de julio de 1952. La enfermedad se propagó rápidamente a otros 40 estados. Se tomaron las medidas necesarias, y al finalizar el período del estudio, la enfermedad había sido erradicada en 31 de ellos.

La erradicación de estas enfermedades, es posible mediante el plan combinado de vacunación y de exterminio de los animales afectados. Debiera llevarse a cabo un plan de tal naturaleza en escala internacional, ya que las enfermedades no reconocen fronteras.