A PROGRAM FOR EPIDEMIOLOGIC INVESTIGATION OF INFECTIONS CAUSED BY *SHIGELLA DYSENTERIAE* TYPE 1 IN MEXICO[1]

Adolfo Pérez Miravete, M.D.[2]

Central America's serious shigellosis epidemics have apparently had relatively mild implications for Mexico, even though the overall rate of shigellosis in Mexico has been rising since 1968. More data are needed to clarify the causes of these developments. Research efforts now being planned should help to acquire this information.

Introduction

Extensive dysentery epidemics broke out in Central America (especially in Guatemala, El Salvador, Honduras, and Nicaragua) in November of 1968 and lasted until 1971. This focused attention on the infectious agent held responsible, *Shigella dysenteriae* type 1, in particular a strain showing a well-defined spectrum of sensitivity to antibiotics. This serotype seemed to have disappeared from Middle America long before; or at least, if it were endemic in some communities, it had not demonstrated such unprecedented virulence.

The path of the epidemic, as traced by Gangarosa *et al.* (*1*), shows that it started in an area of Guatemala on the Mexico-Guatemala frontier, in the vicinity of Tapachula (see Figure 1). This indicates that it may well have originated in Mexico, and is certain to have come from an area very close to the border.

Epidemiologic Data for Mexico

Retrospective epidemiologic studies done by the Coordinated Public Health Services in States and Territories at the request of the National Department of Public Health Research (*2*) show that several minor outbreaks occurred in indigenous communities in the State of Chiapas about when the Guatemalan epidemic began or shortly thereafter (see Table 1). None of these were confirmed by bacteriologic studies.

Somewhat earlier, an extensive epidemic occurred in the Papaloapan basin when the flooding of the river there caused a number of health problems.

Subsequently, isolated outbreaks occurred in areas quite far from the Guatemalan border such as Xalapa de Díaz and other villages near the reservoir of the Miguel Alemán Dam between Veracruz and Oaxaca; the City of Oaxaca; Chayuco; the region of Xilitla in San Luis Potosí; Pitillal, near Puerto Vallarta; and other places. In many of these isolated outbreaks the presence of *Shigella dysenteriae* type 1 was confirmed.

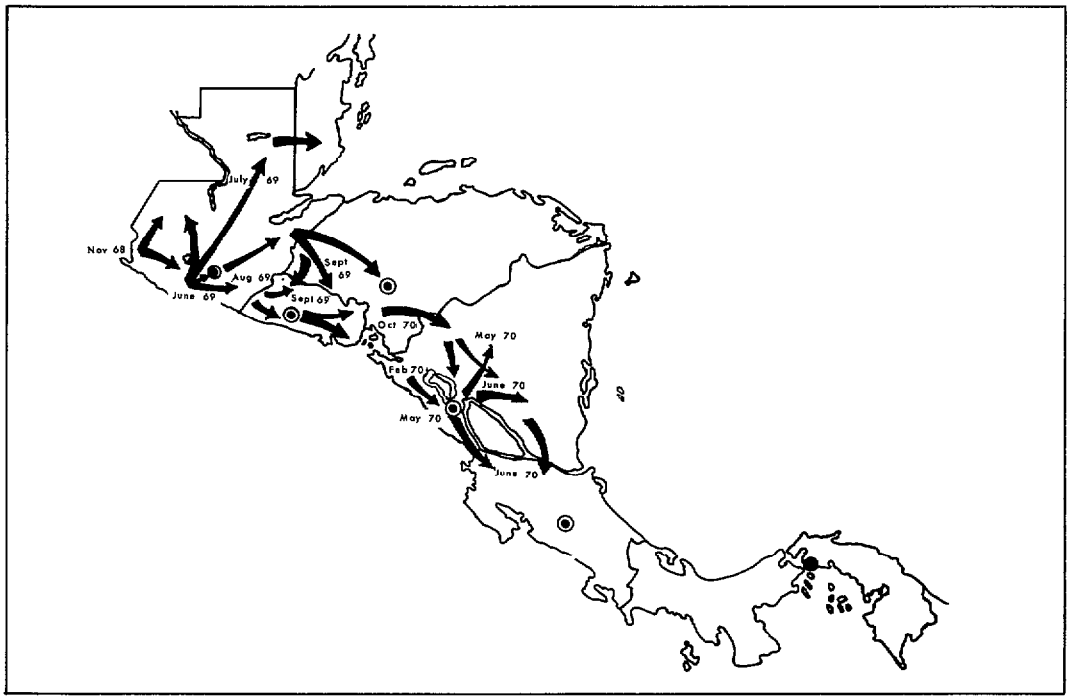
Although no very accurate statistics are available on these outbreaks, the impression is that the case fatality rate was low, in contrast to the Central American epidemics. However, it is very difficult to trace an epidemic trajectory for them, since all appear to have been isolated outbreaks or possible flare-ups of an endemia established some time before (see Figure 2).

Following up the work of Mata, Gangerosa, and others in Central America, a few studies were begun at the Children's Hospital in Mexico City (*1, 3-9*), at the Institute of Public Health and Tropical Diseases by Olarte and Varela (*10*), and later by Bessudo and González Cortés (*11, 12*). These gave bacteriologic confirmation of the presence of *Shigella dysenteriae* type 1 in

[1] Also published in Spanish in *Boletín de la Oficina Sanitaria Panamericana*, Vol. LXXIII, No. 5 (November 1972).

[2] Director General of Public Health Research, Mexico, D.F., Mexico.

FIGURE 1–Development of the shiga dysentery epidemic of 1968-1970 in Central America.



Source: Gangarosa *et al.* "Epidemic Shiga Bacillus Dysentery in Central America." *Journal of Infectious Diseases,* Vol. 122 (1970), pp. 181-190.

TABLE 1–Dysentery morbidity and mortality in 14 communities of Chiapas State, for cases observed between April and July of 1970.

Communities	Total population	No. of cases observed	Morbidity per 1,000 inhabitants	No. of deaths	Mortality rate (%)
Pichucalco	2,978	674	226.33	?	?
Tapilula	2,010	261	129.85	31	11.8
Rancho Mateo	?	453	?	33	7.3
Bochil	2,489	202	81.16	6	2.9
Col. E. Zapata	?	164	?	6	3.6
Ocosingo	1,533	337	219.83	8	2.3
Ostuacán	887	260	293.12	4	1.5
El Bosque	1,310	170	129.77	?	?
Puerto Madero	974	194	199.18	6	3.1
Col. Rizo de Oro	600	165	275.00	0	0
Chicomuselo	1,779	133	74.76	20	15.0
Tila	2,093	104	49.69	15	14.4
Pantelho	2,258	161	71.30	8	4.9
Tecpatán	1,922	104	54.11	3	2.8
Total	20,833	2,765	132.72*	101	5.25†

*This figure does not include the communities of Col. E. Zapata or Rancho Mateo.
†This figure only includes communities where population and mortality data were available.

FIGURE 2–Recent dysentery epidemics in the Republic of Mexico.

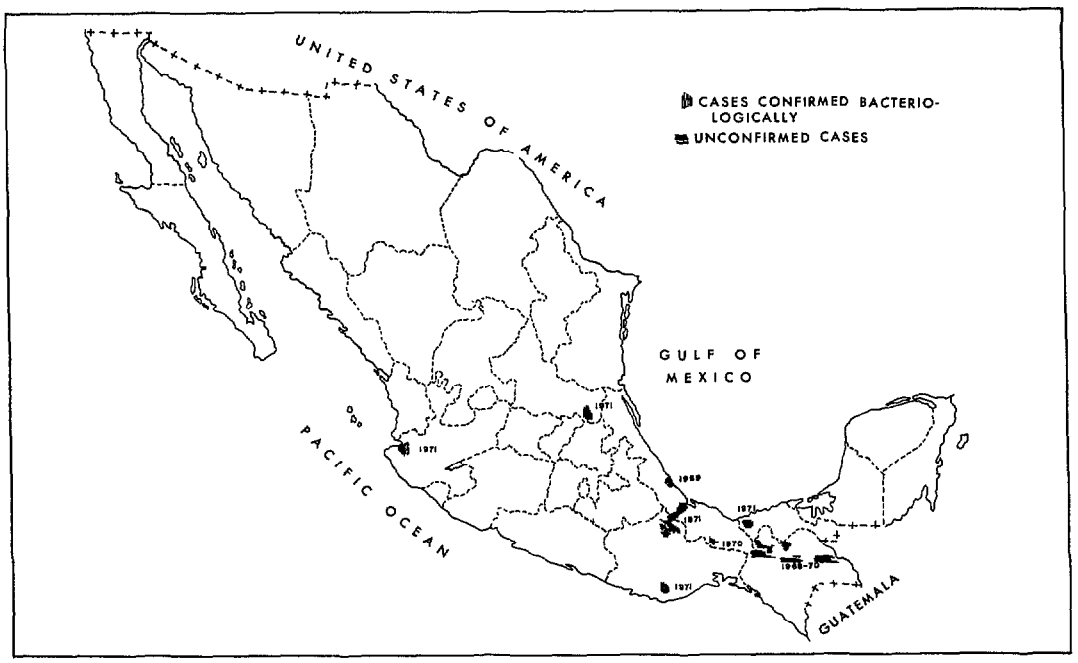
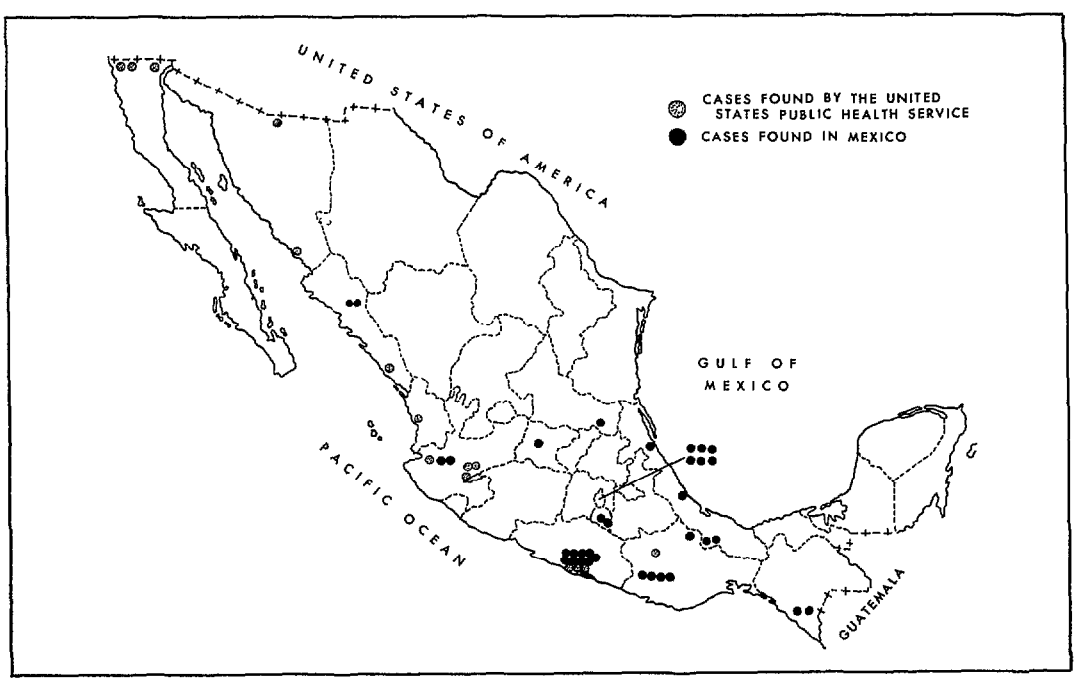


FIGURE 3–Shigellosis cases caused by *S. dysenteriae* type 1 and bacteriologically confirmed.



some of the most recent outbreaks just mentioned, and in some of the isolated cases originating in different parts of the country.

The samples identified up to now are located on the map in Figure 3. Knowing these locations paves the way for finding the precise distribution of well-documented shigellosis cases caused by the classic Shiga bacillus. Figure 3 also shows the place of origin of *Shigella* samples studied by state public health agencies of the United States of America and confirmed by the Center for Disease Control (CDC) in Atlanta. The only U.S. cases shown are those that appear to have been contracted in Mexico, and to have a point of initial exposure that is fairly accurately known. It is noteworthy, however, that many shigellosis cases in the United States occur in states bordering Mexico. Bearing in mind the frequent movement of people across the border, it is very possible that many of these cases were really contracted in Mexico (see Table 2 and Figure 4).

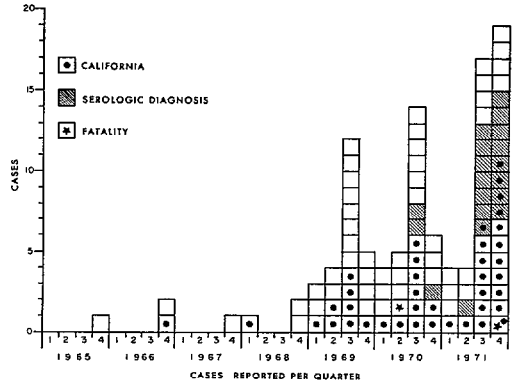
TABLE 2–Cases of *S. dysenteriae* infection in the United States of America, 1970-1971.

State of residence	Number of cases	
	1970	1971
California	10	20
(County of Los Angeles)	(4)	(14)
Arizona	0	9
Texas	1	8
New Mexico	2	1
Border state total	13	38
Other states	15	4
Total (all states)	28	42

*Source: Morbidity and Mortality 21:*91, 1972.

Along with the bacteriologic studies, serologic studies were begun using the passive agglutination method developed by Mata and Cáceres (*7*), and additional data were obtained. These showed a clear need for more extensive studies in order to define the full extent, past and present, of the problem. Started with collaboration of the CDC and the Department of Microbiology of the Institute of Nutrition of

FIGURE 4–Persons infected with shiga bacillus in the United States of America, January 1965-December 1971.



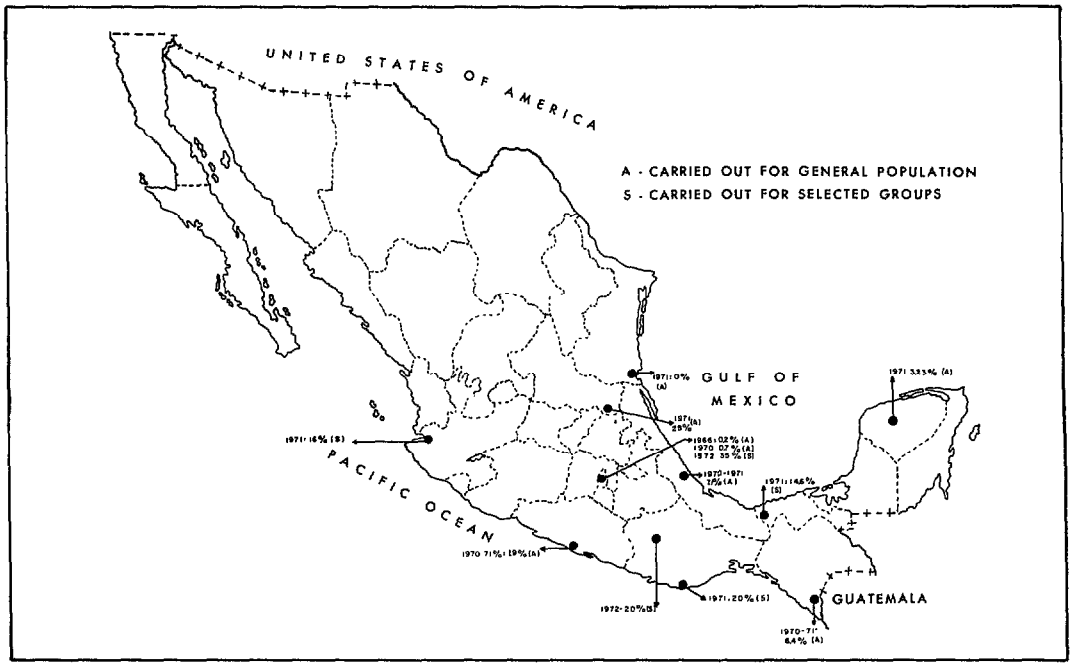
Source: Morbidity and Mortality, 18 March 1972.

Central America and Panama (INCAP), the serologic studies have been continued by the recently modernized Laboratory of Enteric Bacteriology of the Institute of Public Health and Tropical Diseases.

Figure 5 shows serologic findings derived from two types of research, the first dealing with the general population and the second with selected groups of cases and contacts in localities which were experiencing or had experienced epidemic outbreaks. In the former are the 1966-1970 data for Mexico provided by Olarte and Varela (*10*), showing a low general incidence of reactors (0.2 per cent in 1966 and 0.7 per cent in 1970); and showing Tampico with no cases, Acapulco with 1.9 per cent, and Merida with 3.23 per cent. However, the incidence in Tapachula was 6.4 per cent and in Veracruz it was 7.1 per cent.

These high rates are not surprising, if one bears in mind the proximity of Tapachula to the zone of the Central American epidemic and the closeness of Veracruz to the endemic zone of Papaloapan. The information obtained from selected population groups in Xilitla, Puerto Vallarta, and Mexico City in 1972 confirm the bacteriologic results, and the findings of Cárdenas in the State of Tabasco and on the coast of Oaxaca State provide additional data on distribution of the disease in Mexico.

FIGURE 5–Serologic surveys conducted to diagnose cases of shigellosis caused by *S. dysenteriae* type 1 in the Republic of Mexico. (The numbers show the percentage positive reactors found at each site).



The Case for an Epidemiologic Campaign

The studies made thus far pose a series of problems and demonstrate a need to identify the conditions under which this infectious phenomenon operates in Mexico, so as to learn about its likely future development. In so doing, it would be worthwhile to consider the following:

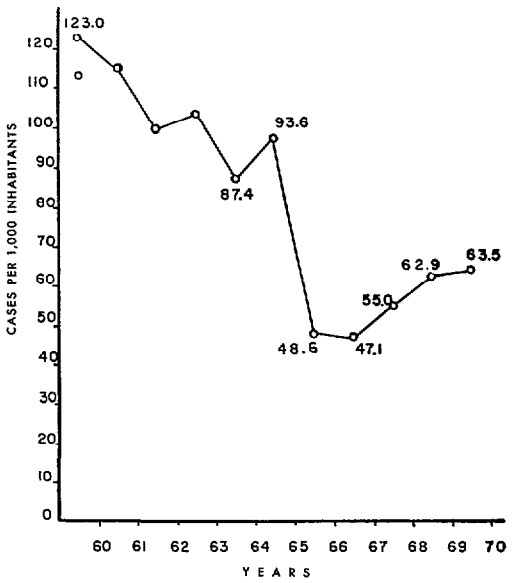
1) The behavior of the strains isolated in Mexico does not seem to differ greatly from the behavior of those isolated in Central America, at least in terms of serotype and susceptibility to antibiotics. So far we have no other means of identifying these strains.

2) Nevertheless, their epidemiologic behavior in Mexico seems to be different, since the disease does not occur with the same virulence as in Central America, the fatality rate is relatively low, and the explosive spread seen in Central America has not been observed.

3) The characteristics described above could correspond to an organism whose association with the population being studied is sufficiently old for selective mechanisms to have operated in the hosts or the parasite. Regrettably, Mexico's bacteriologic diagnostic facilities are not sufficiently developed to detect the existence of this *Shigella* serotype in the bulk of the population. However, where there are such facilities, and where continuing surveillance of intestinal infections has been carried out–as in the enteric biology laboratories of the Children's Hospital and the Institute of Public Health and Tropical Diseases–presence of this serotype had not been reported for 16 years, except in three isolated cases. Nevertheless, it should be noted that these two laboratories are in Mexico City, and that specimens which come from other localities do not arrive in optimum conditions for the recovery of *Shigella*.

4) Statistics indicate that the annual percentage of cases and deaths due to dysentery has been rising since 1968 (see Figure 6). This reversal of the downward trend for preceding years suggests the possible presence of an extraneous parasite. However, the situation is difficult to interpret, as somewhat similar trends exist for gastroenteritis and other infectious diseases, and since the data for dysentery include all dysenteric syndromes regardless

FIGURE 6—Dysentery morbidity in Mexico, 1960-1970 (per 1,000 inhabitants).



Source: "Boletín Epidemiológico." *Salud Pública de México,* Vol. 12 (1970), p. 887.

of etiology. Such deductions are especially open to question when made for countries, including Mexico, whose people suffer widespread infections of *Entamoeba histolytica.*

5) It has also been suggested that Mexico's sanitary conditions may be different from those prevailing in Central American communities, which could explain the slow spread of the disease. In the author's opinion, however, this infection affects mostly rural communities and not the cities, which enjoy better sanitary facilities. And there seems no reason to conclude that the affected Central American communities—many with water supply systems—have poorer living conditions than Mexican rural communities.

All these considerations show urgent need for an exploratory study giving sufficient attention to etiologic and epidemiologic research, so as to permit evaluation of the problem's scope and magnitude. These studies will only attempt to define the problem, since corrective measures come under other areas of responsibility. They should be carried out by experiment stations set up in important regions or in areas expected to yield especially useful data. These stations are intended to perform the following activities:

1) Bacteriologic analysis of all cases occurring in the region and follow-up study of contacts and relatives. The bacteriologic analysis will be limited to isolation and preliminary identification of the microorganism. This identity will then be confirmed at the research center of the Institute of Public Health and Tropical Diseases in Mexico City. This type of investigation should be conducted systematically, under endemic conditions as well as during epidemic flare-ups. It should begin before the fall rainy season and end during the last few months of the year.

2) Concurrent epidemiologic research seeking to establish transmission mechanisms and incidence patterns at different times of the year. This research will also try to relate incidence patterns to natural events (such as floods and heavy rains) and to characteristics of populated places (such as sanitation, water supply, sewerage, overcrowding, cultural and food habits, population movements, etcetera).

3) Extensive serologic surveys of the general populace, making full use of the services of public health and social security institutions to collect serum samples. These surveys should be conducted periodically throughout the entire target area and should be continued for several years among separate population groups with similar living conditions. If population movements are extensive and frequent, the survey could cover those areas where the largest numbers of migrants originated.

The total research effort is to operate in two ways. First, permanent rural units are to be set up, initially in Tuxtepec (to monitor the Papaloapan and Santo Domingo basins); in Chicahuaxtla (to cover the nearby areas of Oaxaca, and possibly to extend coverage as far as the coast); and in Puerto Vallarta. Second, two mobile units will be used to study epidemic outbreaks reported by the Coordinated Public Health Services, by taking samples and making preliminary bacteriologic investigations in the affected areas. Serologic and epidemiologic studies will also be completed—in cooperation with the appropriate public health service.

It should be noted that the Coordinated Public Health Services have been insisting that their state offices work to improve the reporting of dysentery cases and epidemics. In ad-

dition, a note was circulated to the laboratories of the Mexican Institute of Social Security (IMSS) and the Institute of Social Security and Services for State Workers, requesting them to send suspected *S. dysenteriae* samples to the Enteric Bacteriology Laboratory of the Institute of Public Health and Tropical Diseases for verification. Despite accompanying distribution of over 1,600 culture tubes (to serve as means of transport) this request has produced no results—with the exception of two strains isolated in the *Hospital de la Raza* of the IMSS. (The loss of some samples in transit has played a part in our decision to establish rural units.) In all other cases the samples sent in did not appear to contain *S. dysenteriae.* This indicates it may be advisable to organize courses to train public health laboratory technicians in the isolation and identification of this micro-organism.

SUMMARY

This article treats the implications of the recent Central American shigellosis epidemics for Mexico. Preliminary findings indicate that a *Shigella* type very like the troublesome one in Central America has been causing outbreaks of dysentery in Mexico. However, the Mexican outbreaks have been far less serious, without the high fatality rate or explosive sort of spread that typified the epidemics to the south.

Available data explain neither the reasons for this mildness nor the causes of a general rise in the overall rate of Shiga dysentery in Mexico since 1968. More information is thus urgently needed.

Current plans call for setting up special experiment stations to conduct serologic, bacteriologic, and epidemiologic research on the subject. Both fixed stations and mobile units are expected to play major roles in this campaign.

REFERENCES

(*1*) Gangarosa, E., L. J. Mata, C. Mendizábal-Morris, D. Perera, G. Guzmán, and L. Barth. *Epidemic Shiga Bacillus Dysentery: Evolution and Prognosis.* U.S. Department of Health Education, and Welfare; Public Health Service, Atlanta, Georgia, 1971.

(*2*) Dirección General de Servicios Coordinados en Estados y Territorios de México. Informes del Departamento Técnico, 1971 (mimeographed).

(*3*) Alvarado, R., M. Figueroa, E. Pujol, O. Tejada, and P. H. Trochez. *Estudio Epidemiológico de la Disentería Bacilar, 1969-1970,* Universidad de Honduras, Tegucigalpa, Honduras, 1971.

(*4*) Gangarosa, E. J., D. R. Perera, L. J. Mata, C. Mendizábal, G. Guzmán, and L. B. Reller. "Epidemic Shiga Bacillus Dysentery in Central America: II. Epidemiologic Studies in 1969." *J Infect Dis 122:* 181-190, 1970.

(*5*) Gangarosa, E. "Disentería por el Bacilo de Shiga en Centro América." *Salud Pública Mex 13:* 301-304, 1971.

(*6*) Mata, L. J., J. J. Urrutia, B. García, R. Fernández, and M. Béhar. "Shigella Infection in Breast-Fed Guatemalan Indian Neonates." *Am J Dis Child 117:* 142-146, 1969.

(*7*) Mata, L. J., E. J. Gangarosa, A. Cáceres, D. R. Perera, and M. L. Mejicanos. "Epidemic Shiga Bacillus Dysentery in Central America: I. Etiologic Investigations in Guatemala, 1969." *J Infect Dis 122:* 170-180, 1970.

(*8*) Mendizábal-Morris, C., L. J. Mata, E. Gangarosa, and G. Guzmán. "Epidemic Shiga-Bacillus Dysentery in Central America: Derivation of the Epidemic and its Progression in Guatemala, 1968-1969." *Am J Trop Med Hyg 20:* 927-933, 1971.

(*9*) Reller, L. B., E. Navarro Rivas, R. Masferrer, M. Bloch, y E. Gangarosa. "Epidemic Shiga-Bacillus Dysentery in Central America: Evolution of the Outbreak in El Salvador, 1969-1970." *Am J Trop Med Hyg 20:* 934-940, 1971.

(*10*) Olarte, J., G. Varela, and E. Galindo. "Infección por *Shigella dysenteriae* 1 (Bacilo de Shiga) en México." *Bol Med Hosp Infant 28:* 605-612, 1971.

(*11*) González-Cortés, A. "Disentería por el Bacilo de Shiga en México." *Salud Pública Mex 13:* 295-300, 1971.

(*12*) Bessudo, D. and A. González-Cortés. Personal Communication. 1972.

Reller, L. B., E. J. Gangarosa, and P. S. Brachman. "Shigellosis in the United States: Five-Year Review of Nationwide Surveillance, 1964-1968." *Am J Epidem 91:* 161-169, 1970.