

PROGRAM FOR THE CONTROL OF DIARRHEAL DISEASES IN MEXICO

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SECRETARIAT OF HEALTH AND WELFARE
GENERAL ADMINISTRATION OF PUBLIC HEALTH SERVICES IN STATES
AND TERRITORIES

OFFICE OF EPIDEMIOLOGY AND HEALTH CAMPAIGNS
NATIONAL CAMPAIGN AGAINST DIARRHEAL DISEASES

PROGRAM FOR THE CONTROL OF DIARRHEAL DISEASES IN MEXICO

The problem of diarrheal diseases continues to be one of the most important ones in Mexico.

Consideration has always been given to the very large number of children who die each year as a result of this group of causes, and the efforts that the Secretariat of Health and Welfare had been making to combat them were stimulated by the resolutions adopted by the seminars held first in Santiago, Chile, and later in Tehuacan, Mexico.

EPIDEMIOLOGY. Considering the studies we have made on the matter, we believe that in general the epidemiological conditions under which the problem occurs in the country do not differ essentially from those found in other Latin American countries that are affected by the same economic and social, cultural, and climatic conditions that occur in Mexico.

Consequently, just as we have done in other similar studies, we shall present in this paper the quantitative aspects of the problem and its principal epidemiological characteristics.

TABLE 1

TEN LEADING CAUSES OF DEATH IN CHILDREN UNDER ONE YEAR OF AGE IN MEXICO
1 9 6 0

No.	DISEASE	Number of deaths	Rate per 1,000 live births
1	Gastroenteritis and colitis	26,359	16.4
2	Pneumonias	20,852	13.0
3	Poorly defined causes	16,167	10.1
4	Pneumonias in new-born infants	12,450	7.7
5	Bronchitis	6,181	3.8
6	Prematurity	5,534	3.4
7	Birth injuries	5,124	3.2
8	Diarrheas in new-born infants	2,778	1.7
9	Influenza	2,471	1.5
10	Miscellaneous causes	2,460	1.5

As Table 1 shows, diarrheal diseases continue to hold first place among the causes of death of children under one year of age. Soon they will fall back to second place, in view of the sharp decline in the rate that is taking place and of the fact that the campaign against them has received special attention from the health authorities and that the categories of pneumonias could be regrouped, giving a larger figure for those diseases.

In 1960 the diarrheal diseases caused 59,982 deaths, and the average for the years 1958 - 1960 was 59,438, giving a rate of 180.3 both for 1960 and as the average of the three-year period (Table 2).

GEOGRAPHICAL DISTRIBUTION. The lowest mortality rates recorded are for the coastal areas, while the highest rates occur in the mountainous area in the center of the country.

Yucatan is an exception to that statement, since, although it is only slightly above sea level, it has a high mortality rate (Table 3 and Graph 3).

TABLE 2
DEATHS CAUSED BY DIARRHEAL DISEASES IN MEXICO
RATE PER 100,000 POPULATION

YEAR	NUMBER OF DEATHS	RATE
1938	84,489	450.8
1939	89,219	470.0
1940	96,556	490.0
1941	88,521	438.0
1942	93,733	454.0
1943	85,979	406.0
1944	80,558	372.0
1945	76,470	370.0
1946	72,586	335.0
1947	59,882	310.0
1948	64,565	255.0
1949	74,523	296.0
1950	71,822	278.1
1951	91,504	346.4
1952	68,434	249.9
1953	75,529	269.2
1954	59,018	206.0
1955	77,470	260.8
1956	57,942	190.0
1957	68,118	216.7
1958	64,233	198.5
1959	54,100	162.4
1960	59,982	180.3

TABLE 3

DISTRIBUTION OF DEATHS CAUSED BY DIARRHEAL DISEASES BY AREA UNITS OF MEXICO (STATES AND TERRITORIES)

AVERAGE REPRESENTS 1959-1960
RATE GIVEN IS PER 100,000 POPULATION

A R E A U N I T	1 9 5 8		1 9 5 9		1 9 6 0		A V E R A G E	
	Deaths	Rate	Deaths	Rate	Deaths	Rate	Deaths	Rate
Guanajuato	5,317	332.0	4,036	249.0	4,489	259.0	4,614	280.0
Mexico	4,191	258.0	4,369	266.9	4,921	259.0	4,493	261.3
Oaxaca	4,477	274.0	4,053	246.0	4,375	253.0	4,301	257.6
Yucatan	1,795	294.0	1,353	219.1	1,421	231.0	1,523	248.0
Aguascalientes	591	279.0	444	207.3	566	233.0	533	239.6
Queretaro	744	230.0	609	185.7	852	240.0	735	218.5
Jalisco	4,490	218.0	3,920	188.1	5,264	215.0	4,558	207.0
Colima	367	247.0	270	186.5	302	183.0	313	205.5
Chiapas	2,791	245.0	1,930	172.9	2,204	182.0	2,308	199.9
Tlaxcala	668	195.0	645	186.4	717	207.0	677	196.1
San Luis Potosi	2,208	215.0	1,626	156.0	1,930	184.0	1,921	185.0
Coahuila	1,892	212.0	1,492	162.6	1,593	175.0	1,659	183.3
Zacatecas	1,556	206.0	1,148	150.3	1,463	179.0	1,389	178.4
Campeche	297	192.0	246	161.8	287	170.0	277	177.9
Sonora	1,252	188.0	1,184	179.9	1,281	163.0	1,239	176.9
Puebla	3,700	190.0	3,315	170.0	3,331	169.0	3,449	176.3
Chihuahua	2,143	209.0	1,522	142.4	1,926	157.0	1,864	169.4
Distrito Federal	7,669	163.0	7,393	155.9	7,881	161.0	7,648	159.9
Guerrero	2,039	186.0	1,706	143.0	1,711	144.0	1,819	157.6
Morelos	650	174.0	553	152.6	557	144.0	587	156.8
Nayarit	634	174.0	539	148.2	537	138.0	570	153.4
Baja California S.	150	216.0	97	132.9	89	109.0	112	152.3
Durango	1,485	192.0	872	112.4	1,002	132.0	1,120	145.4
Tabasco	834	191.0	563	127.8	554	112.0	651	143.6
Tamaulipas	1,803	176.0	1,017	103.7	1,420	138.0	1,413	139.0
Michoacan	2,724	165.0	2,123	127.3	2,167	117.0	2,338	136.4
Hidalgo	1,485	162.0	1,221	130.6	1,057	106.0	1,254	132.8
Baja California N.	617	118.0	691	152.7	645	123.0	651	131.0
Veracruz	3,349	137.0	3,193	129.9	3,219	118.0	3,253	128.3
Nuevo Leon	1,231	130.0	1,044	110.6	1,280	118.0	1,185	119.5
Sinaloa	1,040	134.0	801	102.5	895	107.0	912	114.5
Quintana Roo	44	123.0	25	71.2	46	91.0	38	95.0
T o t a l	64,233	199.0	54,100	170.4	59,982	172.0	59,438	180.3

TREND. From 1938 to 1960 (Table 2 and Graph 2) the trend is downward. It should be pointed out that the rise in 1951 was artificially caused by changes in international nomenclature.

TABLE 4

MONTHLY DISTRIBUTION OF DEATHS CAUSED BY DIARRHEAL DISEASES IN MEXICO IN 1959	
January	3,029
February	2,804
March	3,761
April	4,335
May	5,447
June	6,055
July	5,894
August	5,656
September	5,141
October	4,655
November	3,920
December	3,543
T O T A L:	54,240

SEASONAL VARIATION. This group of diseases has shown a seasonal variation over a long period in Mexico (Graph 4 and Table 4).

The number begins to rise in March and its acme is reached in June. As regards number of cases and activity, we consider that diarrhea attacks children intensively in the months from May to September.

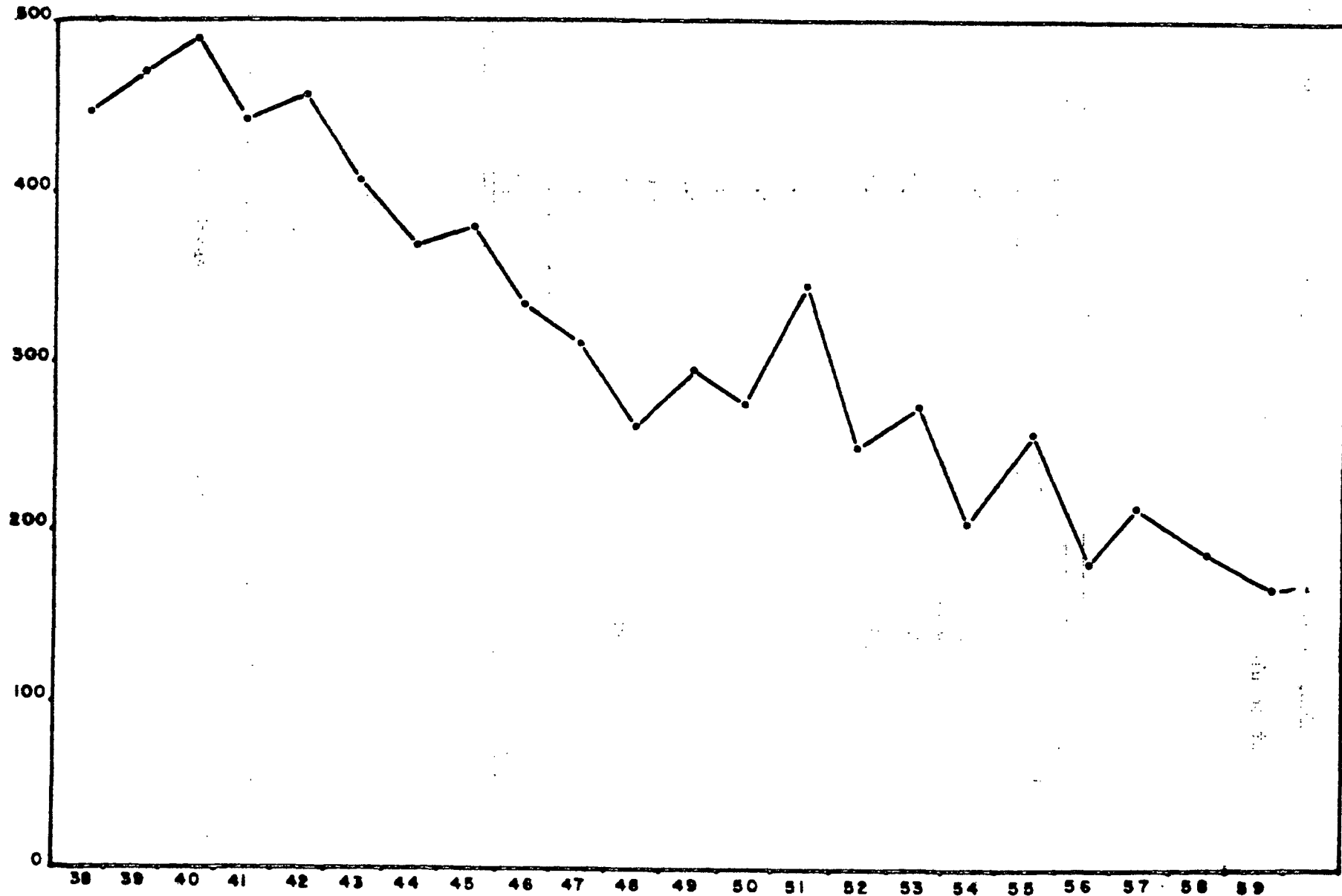
GRAPH 2

MORTALITY CAUSED BY DIARRHEA AND ENTERITIS IN THE REPUBLIC OF MEXICO
OFFICE OF EPIDEMIOLOGY AND HEALTH CAMPAIGNS

Nº 5

Rate per 100,000 population

1938 - 1959



Y E A R

GRAPH 3

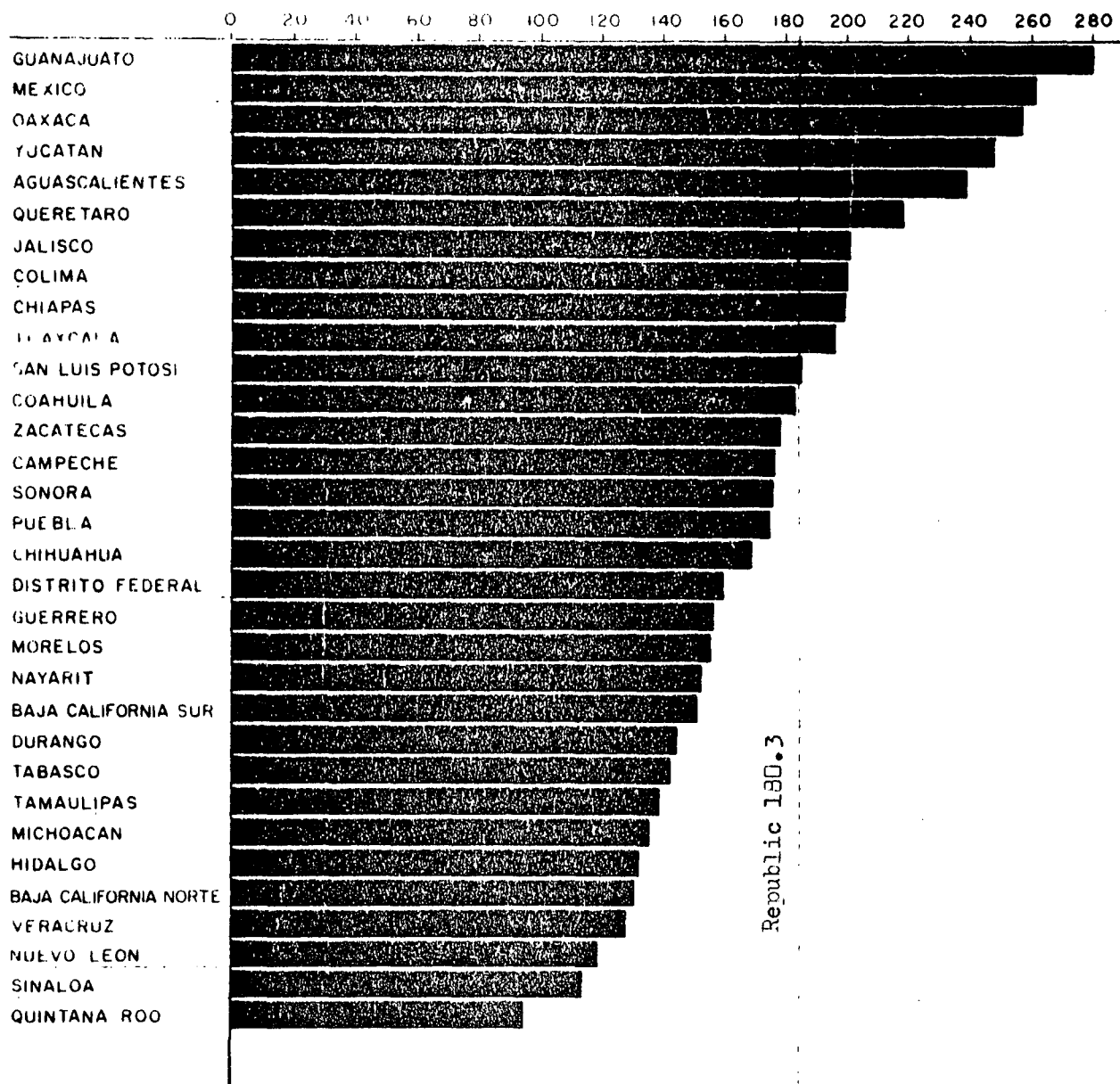
DIARRHEA

GEOGRAPHICAL DISTRIBUTION OF MORTALITY

MEXICO

AVERAGE 1958-1960

Rate per 100,000 Population



DIARRHEA

SEASONAL VARIATION OF DEATHS

MEXICO

1959

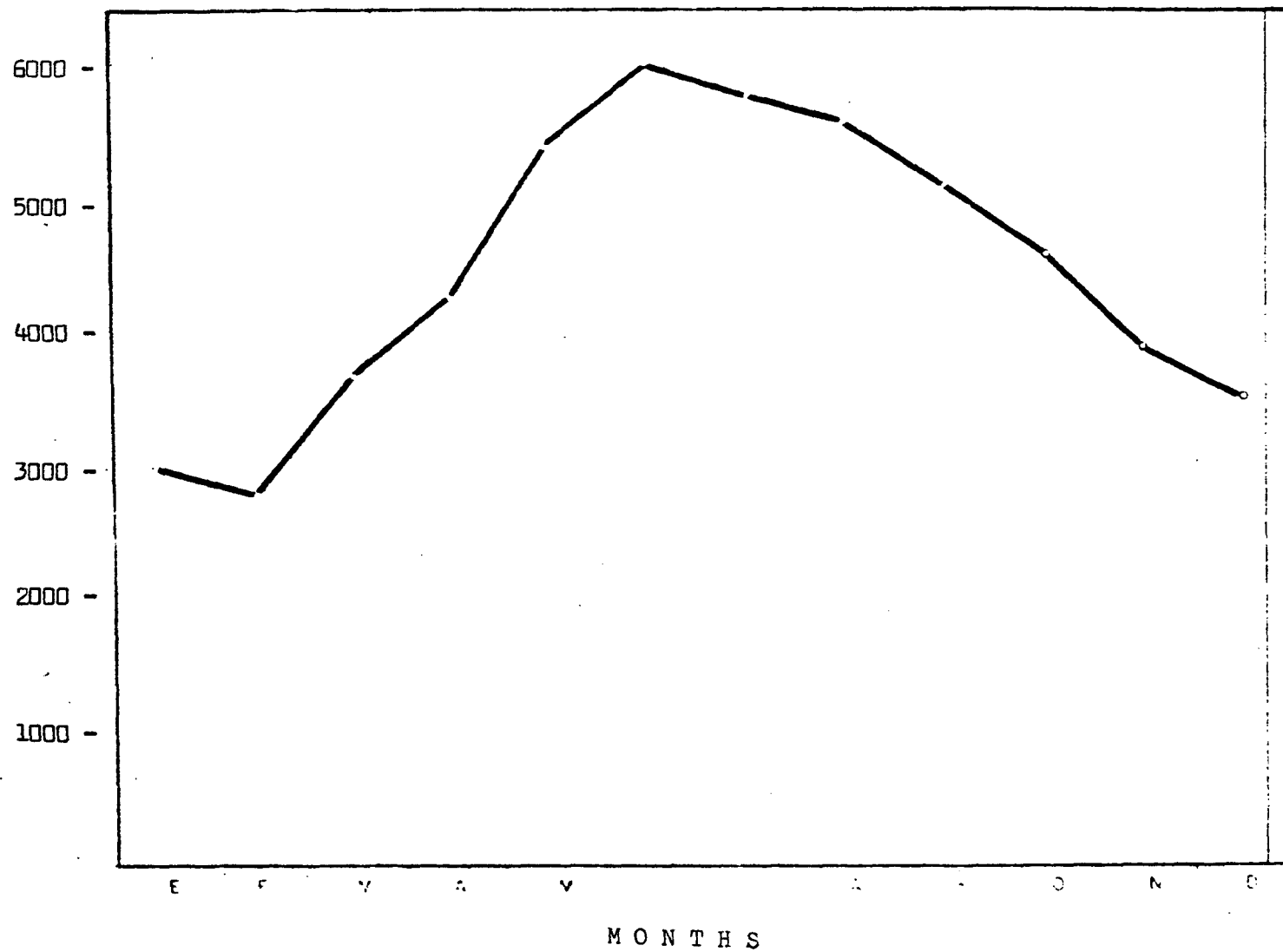
No. OF
DEATHS

TABLE 6

DEATHS CAUSED BY DIARRHEAL DISEASES IN MEXICO IN 1959
DISTRIBUTION BY AGE-GROUPS

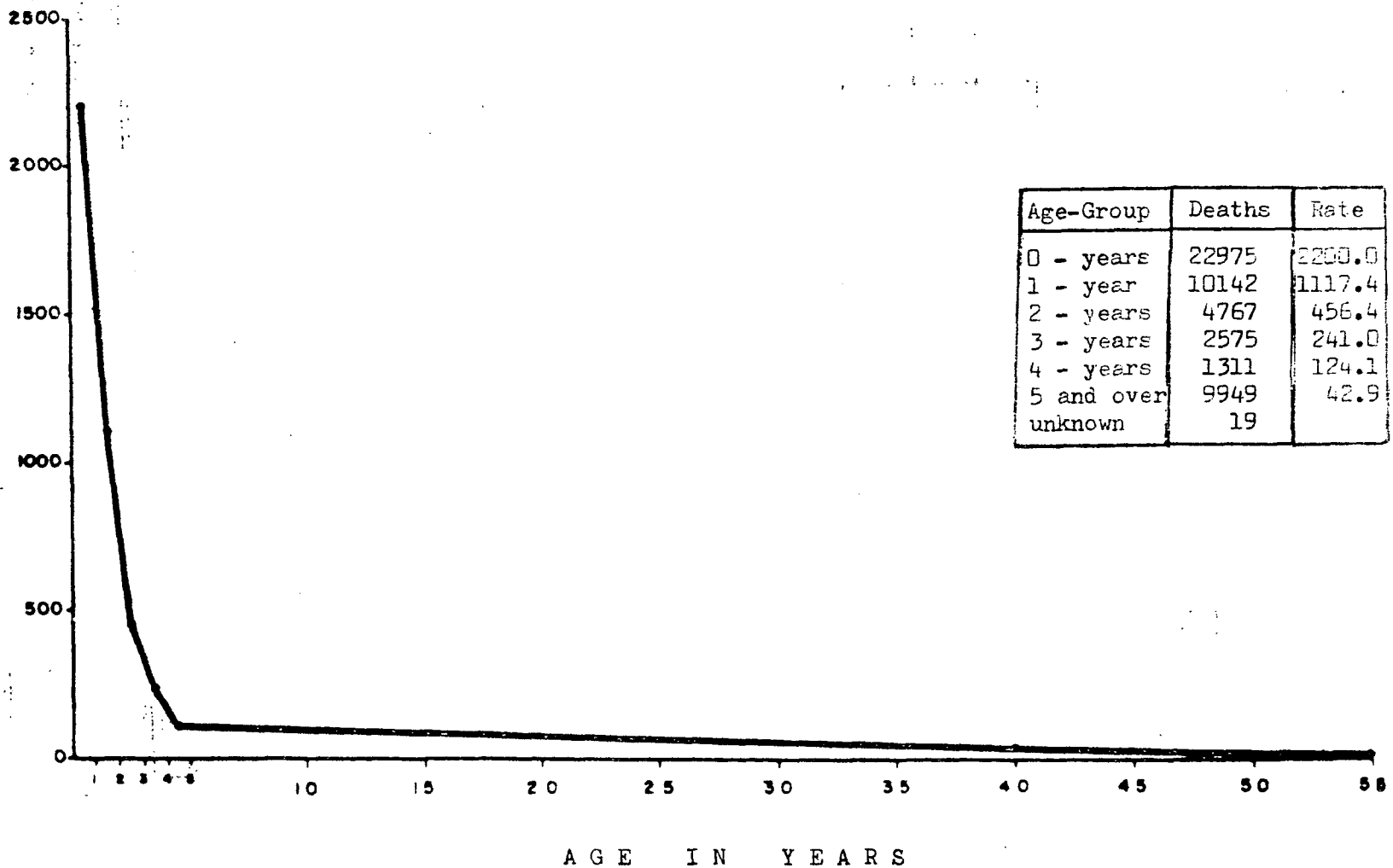
AGE-GROUP IN YEARS	NUMBER OF DEATHS	RATE PER 100,000 POPULATION
- 1	22,945	2200.0
1	10,037	1117.4
2	4,766	456.4
3	2,575	241.0
4	1,311	124.1
5 to 9	2,521	53.5
10 to 14	653	16.3
15 to 19	425	12.6
20 to 24	498	16.9
25 to 29	496	19.1
30 to 34	425	23.1
35 to 39	528	26.6
40 to 44	460	33.6
45 to 64	2,556	68.7
65 and +	3,889	267.7
Unknown	15	
ALL AGES	54,100	162.4

DISTRIBUTION BY AGE-GROUPS. The age-group most affected in 1959 was that of infants under one year of age. This general distribution by age-groups has consistently prevailed for many years. A study of mortality by months during the first year of life shows the highest rates between the second and third months (Table 6, Graph 6 and Table 7).

GRAPH 6

D I A R R H E A
MORTALITY IN MEXICO IN 1959
DISTRIBUTION BY AGE-GROUPS

RATE PER 100,000 POPULATION



The accuracy of the data under discussion may be gauged by the extent of medical certification; its average for the years 1959-60 was 70.9 per cent of all deaths.

TABLE 7
DEATHS CAUSED BY DIARRHEAL DISEASES IN CHILDREN UNDER ONE YEAR
OF AGE BY AGE-GROUPS
1 9 5 9

AGE	NUMBER
- 1 day	-
1 to 6 days	-
7 to 27 days	-
28 to 59 days	2,422
2 to 3 months	5,448
4 to 5 months	4,390
6 to 7 months	4,028
8 to 9 months	3,659
10 to 11 months	2,725
T O T A L:	22,672

INFANT MORTALITY. For the period 1946-1950 the average rate of infant mortality was 102.2, and that caused by diarrheal diseases in children under one year of age was 44.9, per 1,000 population. This situation has undergone a favorable change, since for the period 1955-1959 the corresponding rates are 77.9 and 26.8 respectively.

There is a downward trend in deaths caused by diarrheal diseases per 1,000 live births, as well as per 1,000 children under one year old, as can be seen in the table covering the years 1938 to 1960 (Table 8 and Graph 8).

TABLE 8

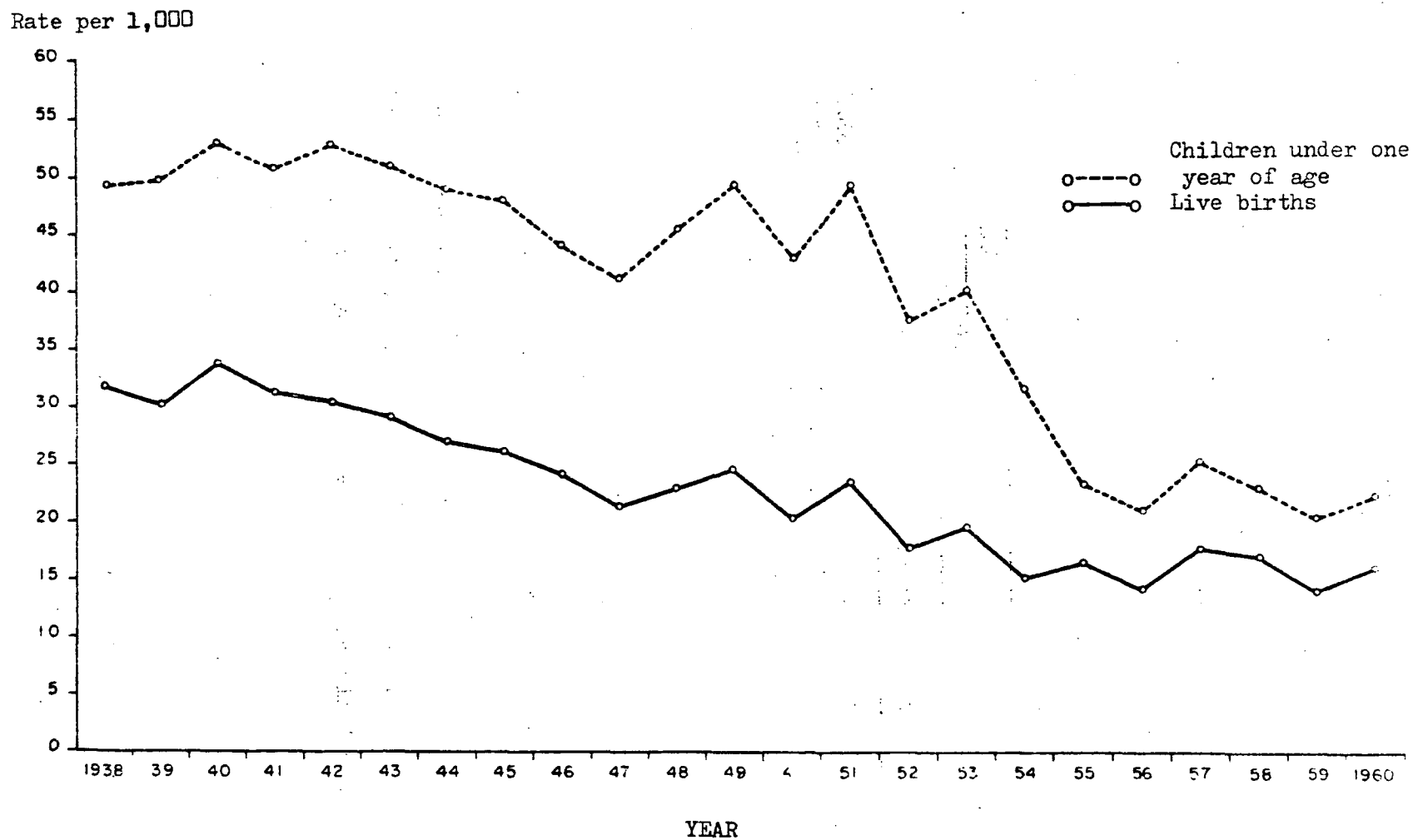
DIARRHEAL DISEASES

DEATHS AND MORTALITY RATES FOR CHILDREN UNDER ONE YEAR OF AGE IN MEXICO

1938 - 1960

YEAR	DEATHS	MORTALITY PER 1,000 LIVE BIRTHS	PER 1,000 CHILDREN UNDER ONE YEAR OF AGE
1938	26,650	31.8	49.6
1939	26,725	30.9	50.0
1940	29,891	34.0	55.7
1941	27,654	31.5	51.3
1942	28,955	30.8	53.5
1943	28,003	29.1	51.5
1944	26,767	27.9	49.0
1945	26,503	26.5	48.3
1946	24,288	24.4	44.0
1947	22,992	21.3	41.5
1948	24,545	23.4	45.9
1949	27,870	24.8	49.8
1950	24,253	20.6	43.5
1951	27,900	23.6	49.9
1952	24,444	17.9	38.3
1953	24,892	19.7	40.8
1954	21,015	15.7	31.9
1955	23,242	16.9	23.7
1956	21,208	14.9	21.0
1957	26,591	17.9	25.6
1958	24,852	17.2	23.2
1959	22,945	14.4	20.8
1960	26,359	16.4	22.8

GRAPH 8
DIARRHEAL DISEASES
MORTALITY OF CHILDREN UNDER ONE YEAR OF AGE
MEXICO



THE ENVIRONMENT

As is well known, the chief environmental factors that affect the prevalence of diarrheas are water service in homes, removal of human waste, and elimination of the breeding-places of flies.

WATER SUPPLY. The population estimate for 1960, to which the following data refer, is 34,923,129; this population occupies 6,409,096 dwellings.

HOUSEHOLD WATER SUPPLY

	NUMBER		PER CENT	
	Dwellings	Inhabitants	Dwellings	Inhabitants
With water service	2,069,981	11,028,862	32.3	31.6
Without water service	4,339,115	22,986,214	67.7	65.8
T O T A L:	6,409,096	34,015,076	100.00	97.4

In Mexico there are still 22,986,214 inhabitants, or about 65.8 per cent of the total, who do not have water service.

Two and six-tenths per cent of the population is supplied with water by means of water points, or faucets, in the streets.

Eleven million, twenty-eight thousand, eight hundred and sixty-two people, or about 31.6 per cent of the total population, have water service in their homes (Statistical Yearbook, 1963).

The smallest communities in the rural area, are the ones least supplied with domiciliary water service; this is where the highest infant mortality resulting from diarrheal diseases arise, at least among the geographical units most affected by this group of causes of death (Ortiz Mariotte et al. 1955).

DISPOSAL OF HUMAN WASTE. In Mexico some 50 per cent of the people still defecate in the open; most of these are in the rural areas.

OTHER EPIDEMIOLOGICAL FACTORS

NUTRITION. Nutrition is very deficient in the rural Mexican environment. Corn supplies more than 60 per cent of the caloric intake. The diet is deficient in calories, protein, riboflavin, ascorbic acid, and vitamin A. In some areas it is deficient in calcium and niacin.

The nutrition of the pre-school child is a very important aspect of family nutrition; it is not in accordance with his bodily needs, especially so far as protein supply is concerned.

About 2 per cent of the population in the rural areas studied is clearly malnourished.

An important aspect of malnutrition is the low resistance to disease and the severity of disease among badly fed children, that is, malnourished children.

EDUCATION. About 36 per cent of the Mexican population is still illiterate, but a knowledge of hygiene is being spread even to the communities of people who speak only indigenous languages.

DIAGNOSIS AND TREATMENT

Diagnosis, that is, identification of the etiological agent, is necessary in order to institute a specific treatment. However, in practice, we can state in almost absolute terms that no one diagnoses the disease, for in the great majority of cases it would be known only when it is no longer necessary, either because of a rapid fatal termination or because of an immediate recovery.

In health practice, laboratory diagnosis and knowledge of the leading clinical forms of the disease, obtained by sampling, are important for the protection of communities or the conduct of a campaign.

Studies of this nature should be made periodically in the areas that it is desired to protect in order to inform the doctor who would deal with a pediatric emergency in order that he may properly orient his therapy (Tables 9 and 10), showing identification of etiological agents.

From the point of view of health, especially whenever it is a matter of acting within a plan of campaign, "restoration of water and electrolytes, the universally accepted basis of treatment of these patients, is for many cases the only rational treatment of their disorder" (Ramos Alvares, 1963).

Early oral rehydration at home, as is used in Mexico, should be the treatment of choice, as it is the one that most effectively prevents death, by forestalling serious conditions in the child.

Pediatric care, especially venoclysis, in emergency centers, where the child may be kept in bed for two or three days, is complementary to the above-mentioned method.

ETIOLOGY OF DIARRHEAL DISEASES

TABLE 9

AUTHOR	GERMS FOUND IN HUMAN BEINGS	DATE OF REPORT	PLACE OF STUDY	INSTITUTION	TYPE OF STUDY
VARELA, G.	E. Coli 111 Salmonellas, and Shigellas	1955	Mexico City	Institute of Health and Tropical Diseases	Summary of work done by the author during recent years.
VARELA G.	E. Coli enteropathogens	1961	Mexico City	Institute of Health and Tropical Diseases	Discussion of food poisonings botulism or coli-bacillus infections
VARELA G.	E. Coli, enteropathogens	1957	Mexico City	Institute of Health and Tropical Diseases	Compilation of known facts on the role of bacteria in diarrheal diseases
VARELA, G.; ZOZAYA, J. AND OLARTE. J.	Salmonellas: New- port and typhi- murium	1943	Mexico City	Institute of Health and Tropical Diseases	Positive test in 6.7 per cent of fecal ma- terials of children under one year of age in Mexico City
VARELA, G.; LAGUNA, J.; AND ZOZAYA, J.	Salmonellas: typhi-murium, Derby, Newington, Thompson, Newport, Oregon, anatum	1947	Mexico City	Institute of Health and Tropical Diseases	100 studied cases of salmonellosis
OLARTE, J.; ALDAMA, A. AND VARELA, G.	Salmonellas: typhi-murium, anatum Derby, Newport, Munich and Newington	1952	Mexico City	Institute of Health and Tropical Diseases	Study of a group of children with diarrhea
CAMPILLO, S; DE MUCHA, J; AND LAVALLE P.	Entero-viruses	1961	Mexico City Hospitals	National Institute of Virology of the Secretariat of Health and Welfare	Study of viruses in newborn full-term and premature infants

RESERVOIRS OR VEHICLES OF ETIOLOGICAL AGENTS OF DIARRHEAL DISEASES

TABLE 10

AUTHOR	GERMS FOUND IN RESERVOIRS AND VEHICLES	DATE OF REPORT	PLACE OF STUDY	INSTITUTION	VEHICLE OR RESERVOIR
Varela, G.; Zozaya, J.; Olarte, J.	Salmonellas: typhi-murium, Newington, Chester, cholera-suis, urban, Montevideo, Newport, Oregon, anatum, and Derby.	1944	Mexico City	Institute of Health and Tropical Diseases	Positive test in 1.3 per cent of 1,528 chickens examined
Varela, G.; Zozaya, J.	Salmonellas: paratyphi A and B, Derby, Chester, typhi-murium, Newport, Munich, Newington, anatum, Give, and Sentenberg	1944	Mexico City	Institute of Health and Tropical Diseases	Positive test in 9.6 per cent of 1,333 samples of milk and viscera of cattle and swine
Varela, G.; Olarte, J.; and Mate, F.	Salmonellas: Pensacola, Varg, and Anahuac	1948	Mexico City	Institute of Health and Tropical Diseases	Spleens of 1,927 Norway rats.
Varela, G.; Ravelo, R.; Olarte, J.	Salmonellas: New Brunswick, Give, cerro, Montevideo, Derby, meleagridis, Shigellas, sonnei, various Alkaleesens	1951	Mexico City	Institute of Health and Tropical Diseases	Positive tests in 9 per cent of rectal mucosa smears of dogs
Bernard Greenberg; Varela, G.; Alexis Bowstein; and Hernández, H.	Salmonellas: anatum Derby, Kentucky, New Brunswick, Worthington, Olachea, Give, meleagridis, Newport, Panama, and Munich	1962	Mexico City	Institute of Health and Tropical Diseases	Study of contamination of flies and rats by Salmonellas in a slaughterhouse

EXPERIMENTAL WORK IN LOS ALTOS

The Secretariat of Health and Welfare carried out a pilot project in 1957 and 1958 for the control of diarrheal diseases in Los Altos, Jalisco, an area of high mortality.

Study was made of the effect that prompt case-finding and early oral rehydration at home could have on infant mortality.

Work was done in nine localities, each with between 500 and 3,000 inhabitants; in the seven trial areas auxiliary nurses were used, while in the two used for control purposes no change was introduced.

During 1959 almost all the cases of diarrhea in seven localities of work were promptly detected and rehydrated and there was a significant decrease in the specific mortality; the saving in lives amounted to more than 70 per cent, although there was also a 15 per cent decline in mortality compared with the previous rate in the control areas.

The satisfactory results of the experience and the ease, simplicity, and low cost of application involved led to the creation of a national plan; this will be kept going until environmental sanitation and educational and nutritional conditions finally solve the problem (Ortiz Mariotte et al. 1961).

DISCUSSION

In Mexico a large-scale water supply program is being carried out; urban works are the responsibility of the Secretariat of Hydraulic Resources, and work in the small rural communities is the responsibility of the Secretariat of Health and Welfare.

As to urban water supply, 112 supply systems were constructed, benefiting 371,000 inhabitants, and in the rural area 576 systems supplying 1,010,000 persons were built; in addition, 502 water units were built in that many other rural communities.

The distribution of 1,500,000 school breakfasts (desayunos escolares) in 1,686 municipalities, or about 71.6 per cent of the total aids children in the most remote areas (V Presidential Report, 1963).

Food provided by international aid is being distributed.

Cattle raising and agriculture are being expanded and improved daily; this situation will undoubtedly result in better nutrition of the people.

The continual increase in the number of rural health centers not only supplies needed therapeutic resources but is also spreading health education in the rural communities.

On the basis of these data, one is justified in concluding that the health and well-being of the people of Mexico are safely on the way to early attainment of acceptable levels.

CONCLUSIONS

It follows from the foregoing, which summarizes our experience in the control of diarrheal diseases among children, that the bases for decreasing the morbidity and mortality caused by diarrheal diseases in children fall into two broad categories:

1. Maintenance of a continuing program of environmental sanitation, improvement of nutrition, and health education of the public.

2. In order to lower the mortality rate immediately while the aforementioned program is making its effects felt, development, concurrently with it, of a treatment program, to operate preferably in the most affected areas and on the basis of oral rehydration at home, with serious cases being channeled for emergency treatment to pediatric clinics that are easily accesible and operate continuously during the diarrhea season.

Mexico City, September 9, 1963

Prepared by Dr. Carlos Ortiz Mariotte, with the collaboration of Dr. Victor Cevallos C.

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