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1431

**PROGRESS REPORT OF THE INTER-AMERICAN INVESTIGATION  
OF MORTALITY IN CHILDHOOD**

**Report presented to the Ninth Meeting of the Advisory Committee on  
Medical Research**

15 June 1970

PROGRESS REPORT OF THE INTER-AMERICAN INVESTIGATION  
OF MORTALITY IN CHILDHOOD

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PROGRESS REPORT OF THE INTER-AMERICAN INVESTIGATION OF MORTALITY IN CHILDHOOD\*

Soon after the initial phases of the Inter-American Investigation of Mortality in Childhood<sup>(1)</sup> were described to this group in 1968, thirteen field projects were established in eight countries in Latin America. The first month of deaths included varied from June 1968 in Jamaica to September 1968 in El Salvador. At the same time field work was initiated for probability sampling of households and living children. The field work has continued and the collection of data for the two years will be completed in late 1970.

In September 1968 the principal collaborators met in Caracas, Venezuela, to plan methods of obtaining complete medical data for assignment of underlying and associated causes of death in accordance with procedures being developed for this important phase of the Investigation. In addition, solutions were discussed for the problems being encountered by the principal collaborators.

Serious epidemics of measles occurred in several areas in the first few months of the Investigation, which indicated that vaccination programs against measles should be introduced. Nutritional deficiency was found to be a far more serious health problem than had been revealed by statistics in the past.

The present analyses are being used to evaluate the completeness and quality of the data as well as to point out needs for preventive programs and for other uses of the results in health planning. This analysis is preliminary not only in its completeness but also in the sense that it is serving as a basis for the development of concepts, especially in the field of multiple causes, nutritional deficiencies and causes of perinatal mortality. This report gives some provisional findings and their interrelationships as well as actions being taken or advisable for health and education programs. Complete data for the first six to eight months were available for analysis for eight projects. Delays have been encountered in

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\*This research project was made possible by a contract with the Agency for International Development of the United States.

Paper prepared for the Ninth Meeting of the PAHO/ACMR by Dr. Ruth R. Puffer, Principal Investigator, and Dr. Carlos V. Serrano, Co-Investigator of the Inter-American Investigation of Mortality in Childhood.

The valuable contributions of the field and central office staff are gratefully acknowledged, especially of Miss Ann Dillon and of the principal collaborators of the eight projects included: Dr. Valois Martinez Colombres of San Juan, Argentina; Dr. Kenneth Standard of Kingston, Jamaica; Dr. Gregorio Mendizabal L. of La Paz, Bolivia; Dr. Dionisio Aceves S. of Monterrey, Mexico; Dr. Fernando Figueira of Recife, Brazil; Dr. Eduardo Suarez M. of San Salvador, El Salvador; Dr. Adela Legaretta of Santiago, Chile; and Dr. Ruy Laurenti of São Paulo, Brazil.

the other five projects, which are in part due to efforts to secure information on unregistered deaths. The areas included in each project, the method of selection of deaths and the time period covered for this report are given in Table 1. The number of deaths being studied at this time varies from 542 in Santiago, Chile to nearly 1,200 in São Paulo, Brazil, with a total of 6,519.

Rural areas are included in several projects. St. Andrew Parish, a rural area, is included in addition to Kingston in Jamaica and this project is referred to as Kingston Area. Four small communities near Santiago are incorporated in that project and thus it is termed the Santiago Area. In El Salvador, the capital city of San Salvador and three small neighboring communities constitute the San Salvador Area. All of San Juan Province in Argentina is included. Deaths in the small community, Viacha, are being studied in the La Paz project, but their records are not analyzed at this time. Subdivision of the findings for urban and rural areas will be possible when data for the two years have been analyzed. In six of the projects all resident deaths under 5 years of age occurring in the designated area are being investigated; in Santiago and São Paulo, deaths of residents were sampled, one in each five in Santiago and one in 4.25 in São Paulo.

A project in the San Francisco Bay Area, California, was initiated in June 1969 and one in the Province of Quebec in Canada in January 1970. Preliminary analyses of results for these projects as well as for the other five Latin American projects will be prepared as soon as sufficient data become available.

### I. Mortality in Childhood by Age Group

At this time provisional death rates in infancy and childhood in several age periods are presented to provide a general background on the size of the problem of child mortality.\* Information regarding deaths in early life, especially in the first 24 hours of life, was incomplete in the first few months of the study. Efforts are being made to find all such deaths and procedures have improved during the course of the Investigation. The infant death rates, especially in the neonatal period, may be slightly low in several of these projects.

Estimates of births and population under five years of age have been used; later, after the records of births in each area have been analyzed, corrected figures will become available. The results of the 1970 census in several countries will be used for estimates of population under five years of age. Thus the data presented at this time are provisional and subject to revision.

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\* At this time the numbers of deaths are relatively small in many of the groups enabling only an exploratory, descriptive presentation of results. However, later the experience for two complete years will be studied in detail using multivariate analysis and other statistical techniques.

## Inter-American Investigation of Mortality in Childhood

Table 1 Deaths under 5 Years of Age, Method of Selection and Period of Report for 8 Projects  
(Provisional Data)

Project and areas	Deaths included		Time period	
	Number	Selection	Months	Dates
Kingston Area, Jamaica	620	All deaths of residents	7	June-December 1968
Kingston (city)	568			
St. Andrew (parish)	52			
La Paz, Bolivia	796	All deaths of residents	6	July-December 1968
Monterrey, Mexico	1 051	All deaths of residents	6	August 1968 - January 1969
Recife (3 districts), Brazil	921	All deaths of residents	6	July-December 1968
Beberibe	330			
Casa Amarela	503			
Encruzilhada	88			
San Juan Province, Argentina	575	All deaths of residents	6	August 1968 - January 1969
Capital Region	284			
Central Region	237			
North Region	39			
West Region	6			
East Region	9			
San Salvador Area, El Salvador	826	All deaths of residents	6	September 1968 - February 1969
San Salvador	634			
Apopa	57			
Nejapa	44			
Quezaltepeque	91			
Santiago Area, Chile	542	Resident deaths	8	July 1968 - February 1969
Gran Santiago	491			
Colina, Lampa, Quilicura, Til-til	51			
São Paulo, Brazil	1 188	Sample of 1 in 4.25 resident deaths	7	June-December 1968

The numbers of deaths in four age periods in the first year of life with estimated annual rates per 1,000 live births and for single years of age from one through four years with estimated annual rates per 1,000 population are given in Table 2. These rates, which are shown in Figure 1, are estimated rates based on deaths for only a portion of a year. Final figures for births and deaths for the two-year period are needed, especially for calculation of death rates by causes. However, because of the importance of immediate use of the results, these provisional data seem justified. The numbers of deaths and percentages are often used because of small numbers and expected instability of rates.

The infant death rates vary widely in these eight projects; they are high in Recife and San Juan Province. The infant death rate of 39 per 1,000 live births in Kingston Area, Jamaica, is the lowest of the eight. The infant death rate in the Santiago Area of Chile was the second lowest. A reduction in infant mortality occurred in 1968 in Chile and the rate for the Province of Santiago was 60.8 per 1,000 live births in that year. The rate for the second half of the year, which was the period of the Investigation, was even lower than in the first six months of the year. Likewise a reduction has occurred in infant mortality in El Salvador which may account for the relatively favourable rate in the San Salvador project. The high infant death rates for Recife and San Juan Province are due in part to epidemics of measles. The infant death rate in La Paz is lower than expected due to deficiencies of deaths in the first few days of life.

Neonatal deaths in accordance with the definition of the World Health Organization are deaths which occur in the first 28 days of life. Based on data for the United States the death rate for the first day of life would be expected to be approximately 10 per 1,000 live births or higher. Although efforts have been made to include all deaths of live born infants in which there was evidence of life in accordance with the WHO definition, probably some of the deaths have been missed. In only São Paulo was the death rate in the first day of life higher than that in the United States. The neonatal death rates vary from 19 to 36 per 1,000 live births and thus all are in excess of the favorable rates of around 13-15 per 1,000 live births being recorded in several countries of the world. The variation was much greater for the death rates for the ages one through four years than for infant deaths. It is hoped that the social and environmental factors contributing to the excessive mortality in these areas will become clarified through the study of the causes of these deaths and interrelationships of these factors.

## II. Patterns of Causes of Mortality

This Investigation was designed so that associated as well as underlying causes would be analyzed and the interrelationships of infectious diseases, nutritional deficiency and social and environmental factors would become known.

## Inter-American Investigation of Mortality in Childhood

Table 2 Deaths under 5 Years of Age by Age Group with Estimated Annual Rates\* for 8 Projects

(Provisional Data)

Age Group	Kingston Area		La Paz		Monterrey		Recife	
	Deaths	Rate	Deaths	Rate	Deaths	Rate	Deaths	Rate
Deaths under 5 years	620	10	796	22	1 051	15	921	26
Infant deaths	517	39	483	64	845	51	630	81
Under 1 day	94	7	34	5	106	6	69	9
1-27 days	229	17	132	18	224	14	182	23
28 days- 5 months	98	7	179	24	368	22	241	31
6-11 months	96	7	138	18	147	9	138	18
Deaths 1-4 years	103	2	313	10	206	4	291	11
1 year	55	4	190	26	120	8	168	24
2 years	24	2	62	8	47	3	74	11
3 years	15	1	41	5	20	1	36	5
4 years	9	1	20	3	19	1	13	2

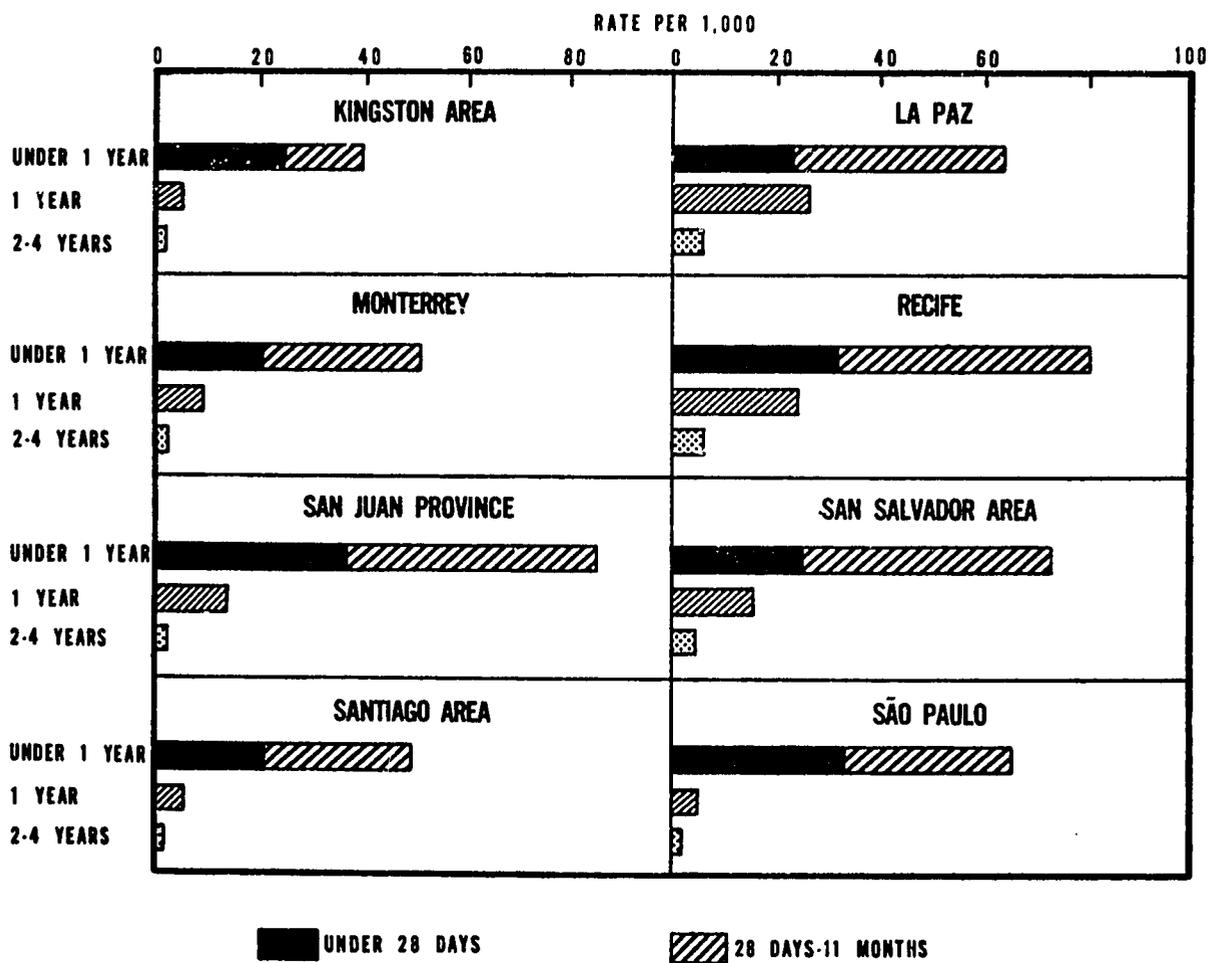
Age Group	San Juan Province		San Salvador Area		Santiago Area		São Paulo	
	Deaths	Rate	Deaths	Rate	Deaths	Rate	Deaths	Rate
Deaths under 5 years	575	23	826**	22	542	11	1 188	16
Infant deaths	477	85	604	73	466	49	1 028	65
Under 1 day	40	7	68	8	64	7	179	11
1-27 days	161	29	140	17	121	13	338	22
28 days - 5 months	196	35	254	31	214	22	387	25
6-11 months	80	14	142	17	67	7	124	8
Deaths 1-4 years	98	5	205	7	76	2	160	3
1 year	68	13	114	15	48	5	77	5
2 years	9	2	46	6	14	1	49	3
3 years	16	3	28	4	5	1	23	2
4 years	5	1	17	2	9	1	11	1

\*Estimated annual rates per 1,000 live births for infant deaths and per 1,000 population for 1-4 years and under 5 years.

\*\* Includes 17 with age not stated.

Figure 1

INFANT DEATHS PER 1,000 LIVE BIRTHS AND DEATHS 1-4 YEARS OF AGE PER 1,000 POPULATION BY AGE GROUP FOR 8 PROJECTS



Provisional Data  
June 1970

Understanding of these relationships is advisable for planning sound community action. The provisional tabulations are revealing marked differences in the patterns of mortality by causes in these areas. Tables in Appendix I provide the numbers of deaths from underlying and associated causes by age group in each one of the eight projects. The rules of the 1965 Revision of the International Classification of Diseases<sup>(2)</sup> have been used for the assignment of the categories of the underlying causes. The associated causes have been classified according to procedures adopted for the Investigation<sup>(3)</sup>.

Mortality in early life is due to maternal causes affecting the condition of the infant at birth, to complications of delivery and to other perinatal conditions, often complicated by immaturity. Although neonatal mortality is being reduced, methods of prevention of some causes of death in this period are not known. Deaths after the neonatal period are often due directly or indirectly to social and environmental conditions and are usually preventable. Thus mortality in these two age periods is analyzed separately and attention is focused principally on deaths in which action can be taken to prevent illness and death. Deaths under five years, excluding neonatal deaths, will be analyzed first, followed by a section on neonatal mortality.

In Table 3 underlying and associated causes of death are given in broad cause groups for deaths under five years of age, excluding neonatal deaths. In this age period infective and parasitic diseases are responsible for more than half of the deaths in Monterrey, San Juan Province, San Salvador Area, La Paz and Recife. Measles was the underlying cause of many of these deaths in La Paz, Recife and San Juan. The percentages of deaths due to infective and parasitic diseases and to measles are shown in Figure 2. Although infective and parasitic diseases were associated causes also in every area, the numbers of deaths from these diseases as underlying causes were larger.

Nutritional deficiency, however, usually was considered an associated rather than an underlying cause of death. Of the deaths under five years of age, excluding the neonatal period, nutritional deficiency was the underlying or associated cause of high proportions of deaths; in Recife of nearly two-thirds (65 per cent) and over 50 per cent in San Salvador Area and Monterrey. In the other areas the percentage varied from 43 to 49 (Figure 3).

Nutritional deficiency is often a contributory cause of death. However, in some of the deaths in early life it is a result of recurring episodes of diarrheal disease and is considered a consequence. In Recife deaths from measles frequently occurred in children with nutritional deficiency. Table 4 and Figure 4 show that nutritional deficiency was an associated cause in a higher proportion of deaths due to infective and parasitic diseases than of deaths from other causes which include diseases of the nervous system and sense organs, diseases of the

## Inter-American Investigation of Mortality in Childhood

Table 3 Deaths under 5 Years of Age, Excluding Neonatal Deaths, in Broad Groups of Underlying and Associated Causes with Ratios per 100 Deaths for 8 Projects

(Provisional Data)

Cause	Underlying		Associated*		Underlying		Associated*	
	Num-ber	Per-cent	Num-ber	Per-100 deaths	Num-ber	Per-cent	Num-ber	Per-100 deaths
	Kingston Area				San Juan Province			
Total	297	99.9	481	162.0	374	100.0	770	205.9
Infective and parasitic diseases	121	40.7	76	25.6	198	52.9	131	35.0
Measles	2	0.7	-	-	67	17.9	5	1.3
Nutritional deficiency	22	7.4	107	36.0	29	7.8	143	38.2
Diseases of nervous system and sense organs	16	5.4	12	4.0	18	4.8	38	10.2
Diseases of respiratory system	49	16.5	92	31.0	86	23.0	166	44.4
Congenital anomalies	31	10.4	17	5.7	10	2.7	11	2.9
Others	58	19.5	177	59.6	33	8.8	281	75.1
	La Paz				San Salvador Area			
Total	630	100.0	897	142.4	601	99.9	1145	190.5
Infective and parasitic diseases	367	58.3	142	22.5	321	53.4	263	43.8
Measles	159	25.2	8	1.3	49	8.2	2	0.3
Nutritional deficiency	26	4.1	270	42.9	79	13.1	224	37.3
Diseases of nervous system and sense organs	12	1.9	14	2.2	11	1.8	23	3.8
Diseases of respiratory system	151	24.0	262	41.6	118	19.6	253	42.1
Congenital anomalies	4	0.6	6	1.0	26	4.3	25	4.2
Others	70	11.1	203	32.2	46	7.7	357	59.4
	Monterrey				Santiago Area			
Total	721	100.0	1579	219.0	357	100.0	611	171.1
Infective and parasitic diseases	404	56.0	321	44.5	126	35.3	89	24.9
Measles	71	9.8	22	3.1	3	0.8	1	0.3
Nutritional deficiency	49	6.8	352	48.8	20	5.6	140	39.2
Diseases of nervous system and sense organs	24	3.3	57	7.9	30	8.4	27	7.6
Diseases of respiratory system	159	22.1	352	48.8	99	27.7	120	33.6
Congenital anomalies	43	6.0	28	3.9	32	9.0	21	5.9
Others	42	5.8	469	65.1	50	14.0	214	59.9
	Recife				São Paulo			
Total	670	100.0	1532	228.7	671	100.1	1419	211.5
Infective and parasitic diseases	443	66.1	389	58.1	299	44.6	259	38.6
Measles	195	29.1	4	0.6	46	6.9	2	0.3
Nutritional deficiency	40	6.0	395	59.0	38	5.7	295	44.0
Diseases of nervous system and sense organs	23	3.4	48	7.2	68	10.1	37	5.5
Diseases of respiratory system	115	17.2	438	65.4	152	22.7	251	37.4
Congenital anomalies	11	1.6	16	2.4	42	6.3	31	4.6
Others	38	5.7	246	36.7	72	10.7	546	81.4

\*A death may be included more than once if multiple causes are diagnosed.

Figure 2 PERCENTAGE OF DEATHS UNDER 5 YEARS OF AGE, EXCLUDING NEONATAL DEATHS,  
DUE TO INFECTIVE AND PARASITIC DISEASES FOR 8 PROJECTS

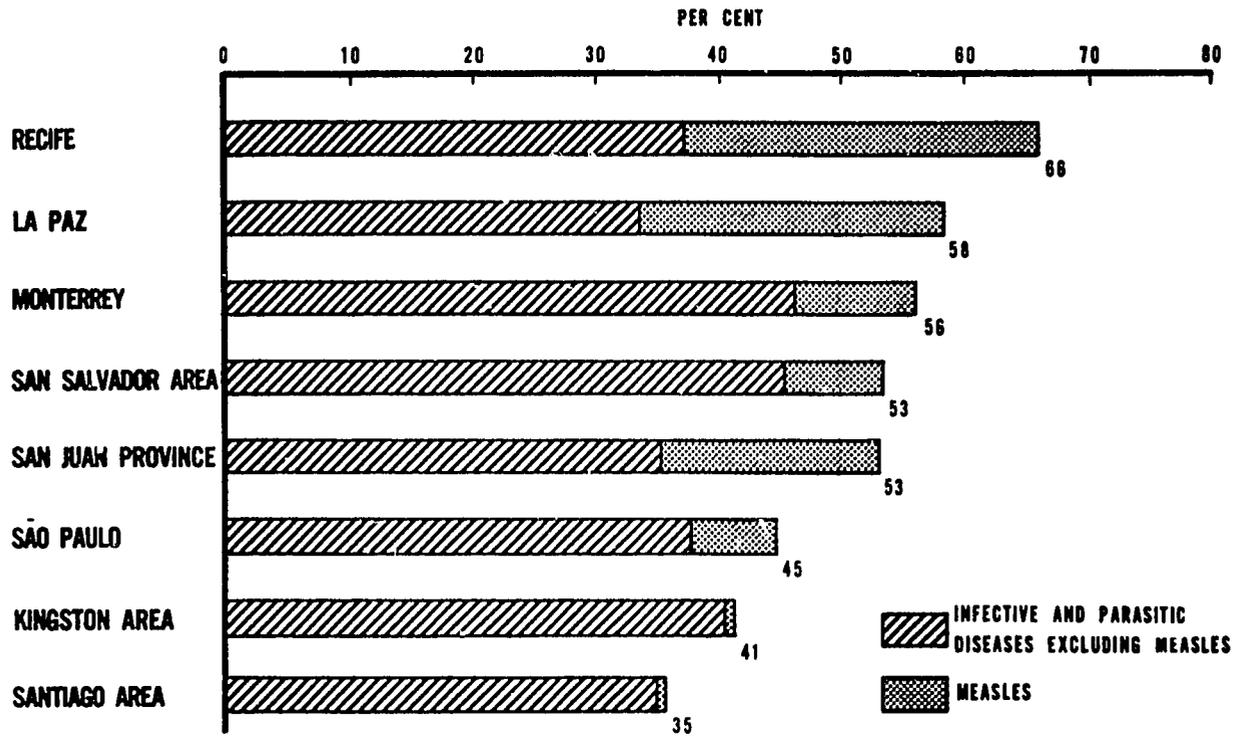
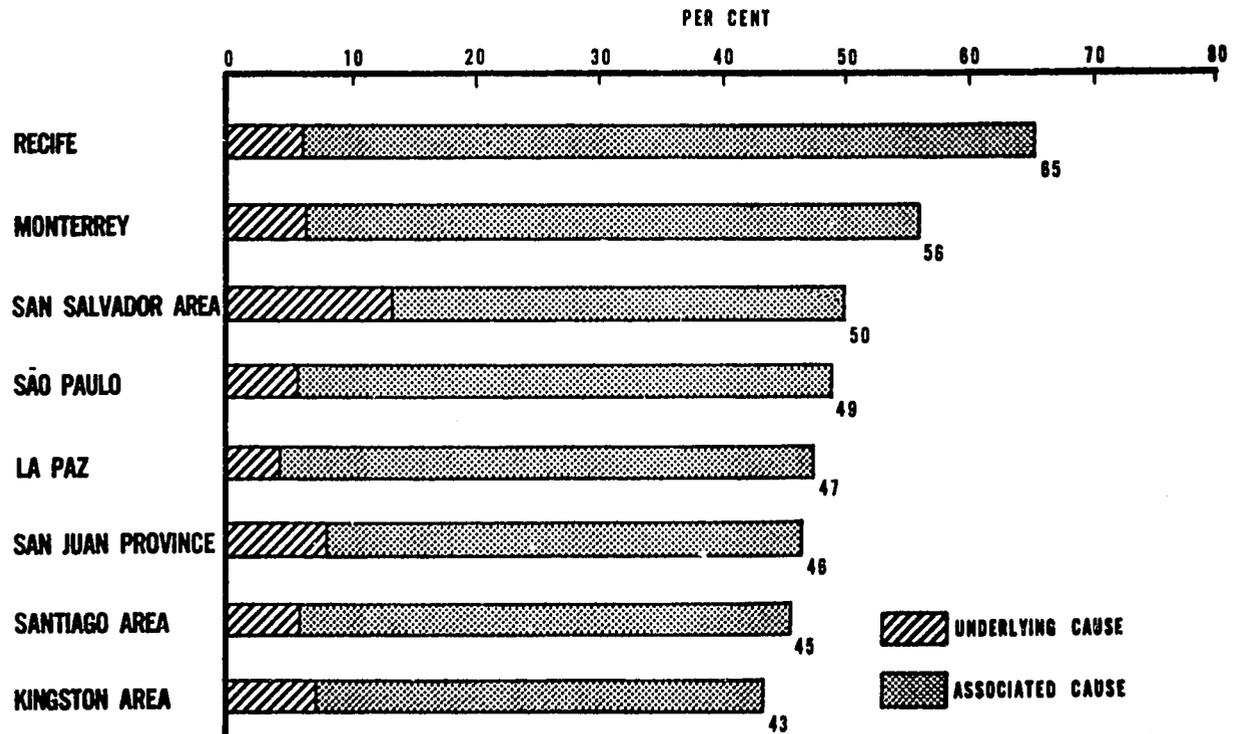


Figure 3 PERCENTAGE OF DEATHS UNDER 5 YEARS OF AGE, EXCLUDING NEONATAL DEATHS,  
WITH NUTRITIONAL DEFICIENCY FOR 8 PROJECTS



Provisional Data  
June 1970

## Inter-American Investigation of Mortality in Childhood

Table 4 Deaths under 5 Years of Age, Excluding Neonatal Deaths, Due to Infective and Parasitic Diseases and Other Causes as Underlying Cause, and Percentage with Nutritional Deficiency as Associated Cause for 8 Projects

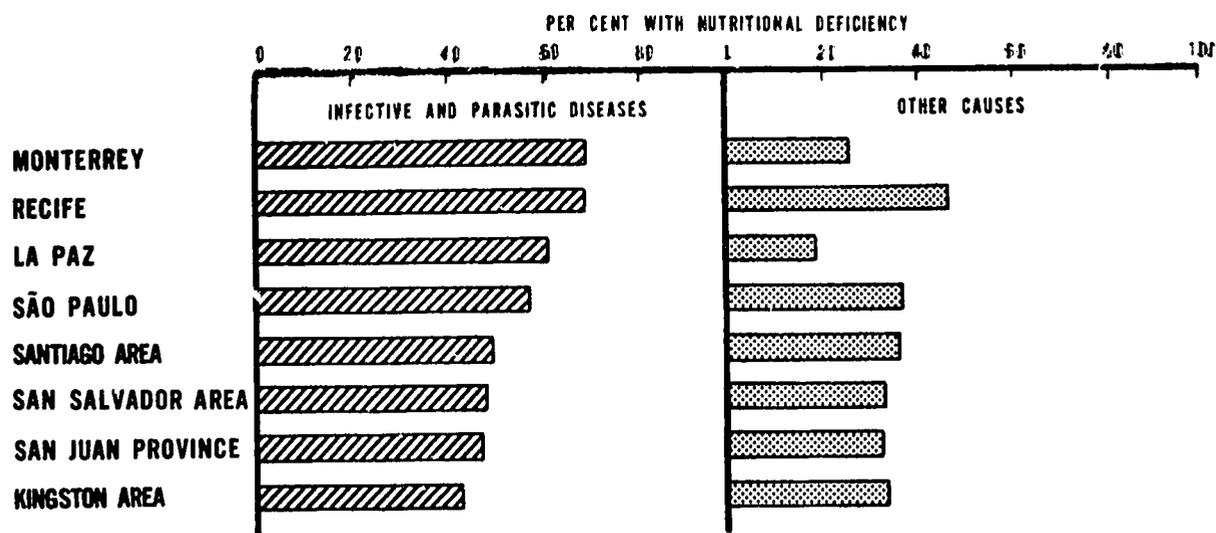
(Provisional Data)

Project and underlying cause	Total deaths	With nutritional deficiency as associated cause	
		Number	Per cent
<b>Kingston Area</b> <b>Total</b>	297	107	
Infective and parasitic diseases	121	53	43.8
Nutritional deficiency	22	2	
Other causes	154	52	33.8
<b>La Paz</b> <b>Total</b>	630	270	
Infective and parasitic diseases	367	226	61.6
Nutritional deficiency	26	-	
Other causes	237	44	18.6
<b>Monterrey</b> <b>Total</b>	721	351*	
Infective and parasitic diseases	404	280*	69.3
Nutritional deficiency	49	-	
Other causes	268	71	26.5
<b>Recife</b> <b>Total</b>	670	395	
Infective and parasitic diseases	443	307	69.3
Nutritional deficiency	40	-	
Other causes	187	88	47.1
<b>San Juan Province</b> <b>Total</b>	374	143	
Infective and parasitic diseases	198	95	48.0
Nutritional deficiency	29	-	
Other causes	147	48	32.7
<b>San Salvador Area</b> <b>Total</b>	601	224	
Infective and parasitic diseases	321	155	48.3
Nutritional deficiency	79	2	
Other causes	201	67	33.3
<b>Santiago Area</b> <b>Total</b>	357	140	
Infective and parasitic diseases	126	63	50.0
Nutritional deficiency	20	1	
Other causes	211	76	36.0
<b>São Paulo</b> <b>Total</b>	671	295	
Infective and parasitic diseases	299	171	57.2
Nutritional deficiency	38	2	
Other causes	334	122	36.5

\* Excludes one associated cause in a death with two types of nutritional deficiency.

Figure 4

PERCENTAGE OF DEATHS FROM INFECTIVE AND PARASITIC DISEASES AND OTHER CAUSES  
WITH NUTRITIONAL DEFICIENCY AS ASSOCIATED CAUSE OF DEATHS UNDER 5 YEARS  
OF AGE, EXCLUDING NEONATAL DEATHS, FOR 8 PROJECTS



Provisional Data  
June 1970

digestive system and of the respiratory system, etc. The differences in these frequencies of nutritional deficiencies as an associated cause were large in the three projects which had high percentages of deaths due to infective and parasitic diseases, namely, Recife, La Paz and Monterrey. Thus this interrelationship of infective diseases and nutritional deficiency indicates the need for an integrated program of prevention of the infective diseases and nutritional deficiency. These observations are in accordance with previous research indicating the importance of the host as well as the infectious agent in the development of disease. Also they indicate the need for study of the interrelationship of diseases as a basis for community action.

The pattern of mortality appears to be distinct in each project. For example, in the Santiago Area the proportion of deaths due to respiratory diseases was higher than in others. In the same area 8 per cent of the underlying causes were diseases of the nervous system and sense organs and 9 per cent were congenital anomalies. In São Paulo also diseases of the nervous system and sense organs were responsible for a relatively high percentage (10.1). The recognition of certain causes is dependent on the availability and quality of diagnostic procedures including pathological examination. Congenital anomalies were reported much more frequently in the Santiago and Kingston Areas than in the other projects.

### III. Infective and Parasitic Diseases

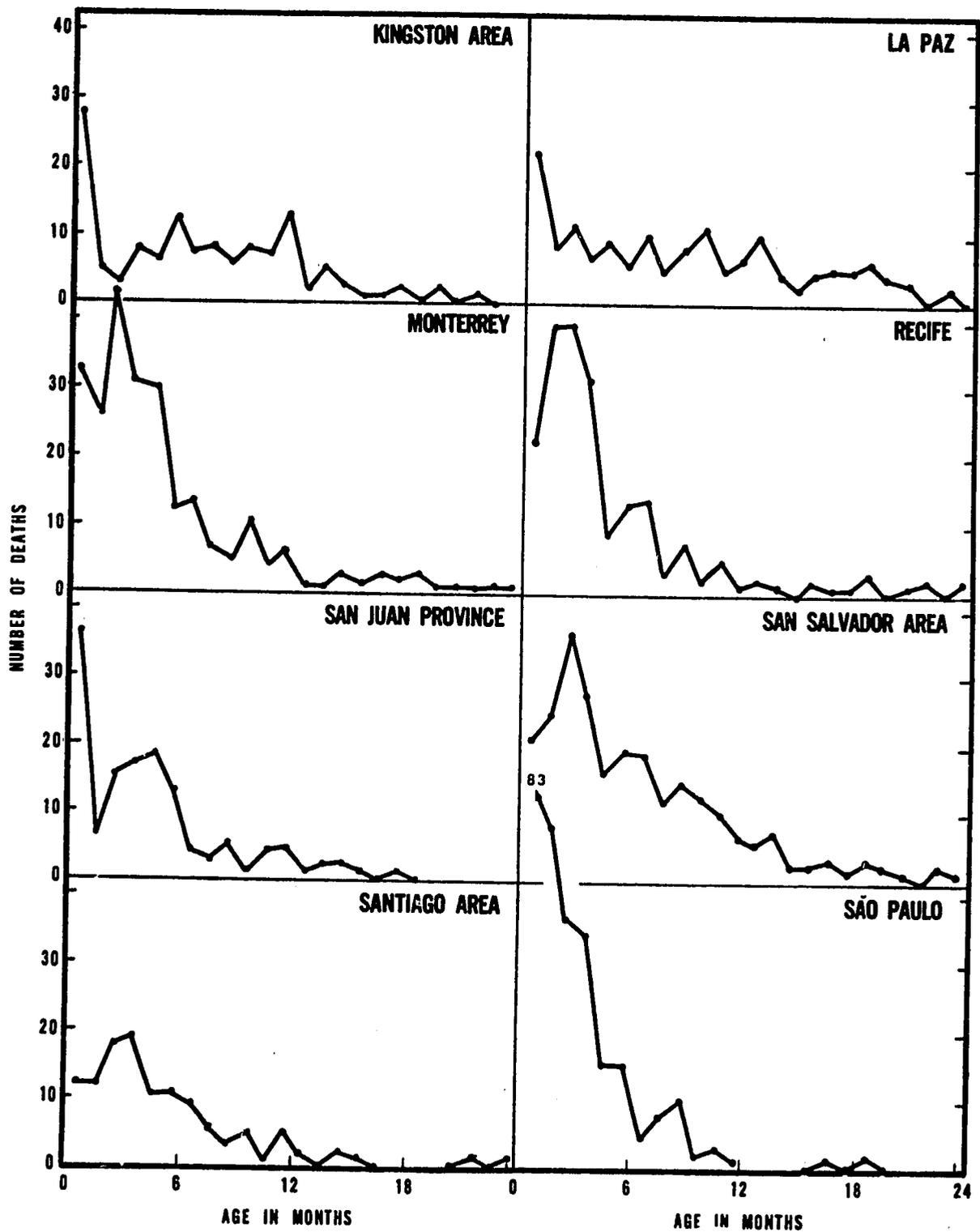
Infective and parasitic diseases were responsible for more than half of the deaths under 5 years of age in several projects and in all projects were the underlying cause of at least one-third of the deaths. With the change in the 1965 Revision, diarrheal disease (category 009) is considered an infectious disease when not known to be non-infectious in origin. Thus diarrheal disease is the major contributor to deaths in this broad group. Measles is the other single cause responsible for a large portion of the deaths in this group in several projects where epidemics occurred. Mortality from these two causes will be analyzed in detail, followed by data on other infectious diseases.

#### Diarrheal Disease and Other Intestinal Infectious Diseases

Diarrheal disease was the underlying cause of many deaths in the age period under 6 months. There appeared to be differences in the distribution of the diseases in the projects in the age group under 1 year in which the largest number of these deaths occurred (Figure 5). In Recife the largest numbers of deaths occurred in children one and two months of age (39 in each month of age) and in the San Salvador Area and Monterrey the numbers were largest at two months, 36 and 45 respectively. In the Kingston Area, San Juan Province and São Paulo patterns were distinctly different with many deaths in the first month of life. In fact, in San Juan Province there were 36 deaths in this age period and 28 of these were premature infants. In the Kingston Area, there were 27 deaths in the first month of life and 25 were prematures. The number of deaths in infants was 83 in São Paulo of which 38 occurred in premature infants. Many of these premature babies were born in hospitals and the prevention of deaths from diarrheal disease is in part a hospital problem. Deaths from diarrheal disease in the Kingston Area and La Paz were distributed throughout the first year of age without a concentration at the second, third and fourth months. In San Juan Province and São Paulo the numbers of deaths were relatively large through 3 months of age. These differences may be related to the pattern of breast feeding on which data will be given in a later section.

The death rates from diarrheal diseases as underlying and associated causes are given in Table 5 and shown in Figure 6. The death rates from diarrheal disease in infancy are the highest in Recife, San Juan Province and the San Salvador Area, over 200 per 10,000 live births, with the rates higher for underlying than for associated causes. However, the reverse was usually true for those dying at one year of age when diarrheal disease was more frequently an associated cause in the projects with relatively high mortality.

Figure 5  
 NUMBER OF DEATHS FROM DIARRHEAL DISEASE BY AGE IN MONTHS  
 UNDER 2 YEARS FOR 8 PROJECTS



Provisional Data  
 June 1970

## Inter-American Investigation of Mortality in Childhood

Table 5 Deaths and Death Rates\* from Diarrheal Disease as Underlying and Associated Causes by Age Group under 5 Years of Age for 8 Projects

(Provisional Data)

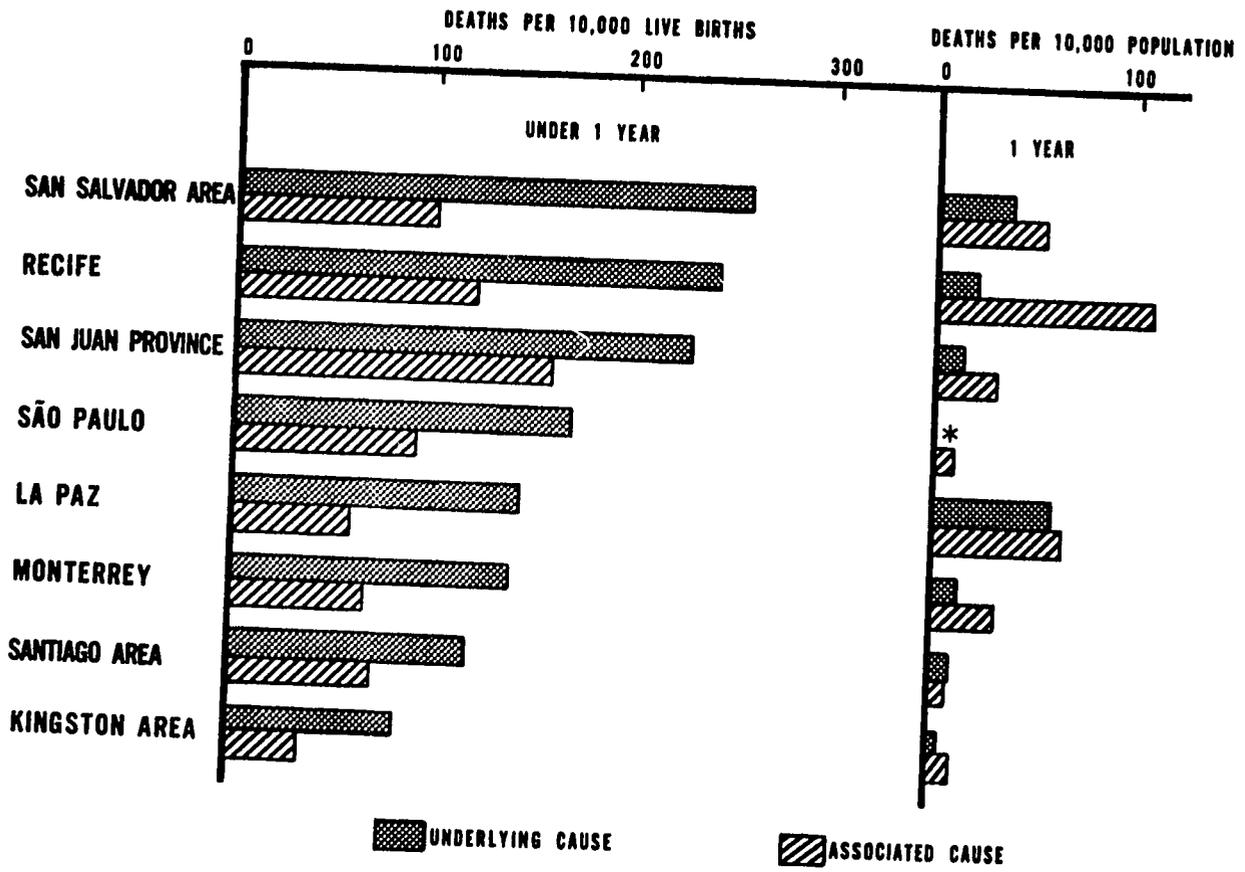
Type of cause and project	Under 1 year								1 year		2-4 years	
	Total		Under 28 days		28 days - 5 months		6-11 months		1 year		2-4 years	
	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate
<b>Underlying Cause</b>												
Kingston Area	110	83	23	17	38	29	49	37	17	3	1	**
La Paz	109	145	22	29	41	55	46	61	45	61	18	8
Monterrey	230	139	29	12	150	91	51	31	19	13	7	2
Recife	185	237	20	26	133	170	32	41	15	21	7	3
San Juan Province	127	227	35	62	71	127	21	38	7	14	2	1
San Salvador Area	213	257	19	23	124	149	70	84	29	39	12	5
Santiago Area	109	114	11	11	70	73	28	29	7	8	2	1
São Paulo	264	168	76	48	159	101	29	18	2	1	4	1
<b>Associated Cause</b>												
Kingston Area	46	35	9	7	15	11	22	17	12	10	3	1
La Paz	44	59	9	12	17	23	18	24	49	66	28	12
Monterrey	106	64	29	18	44	27	33	20	45	30	31	7
Recife	92	118	8	10	48	62	36	46	76	109	45	22
San Juan Province	89	159	30	54	38	68	21	38	17	33	5	3
San Salvador Area	83	100	8	10	34	41	41	49	43	57	41	18
Santiago Area	68	71	14	15	43	45	11	11	6	7	2	1
São Paulo	144	92	28	18	79	50	37	24	14	10	16	4

\* For rates under 1 year per 10,000 live births, for 1 year and 2-4 years per 10,000 population

\*\* Less than 0.5

Figure 6

DEATH RATES FROM DIARRHEAL DISEASE AS UNDERLYING AND ASSOCIATED CAUSES  
BY AGE GROUP UNDER 2 YEARS FOR 8 PROJECTS



\*  
1 PER 10,000 POPULATION

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Amebiasis was the underlying cause of 46 deaths in Monterrey; 29 were of infants, 10 of one year old children, 3 of two year old and 4 of four year old children. In addition amebiasis was the contributory cause in 16 others. The seriousness of this endemic condition was revealed by the findings of the etiologic agent in essentially all cases, by the history and by the serious complications as for example liver abscess in several of these deaths.

### Measles

In several of the areas epidemics of measles occurred during this period of the investigation. Many of these deaths occurred early in life. In San Juan Province, the San Salvador Area and São Paulo over half occurred before 15 months of age. In Recife and La Paz the 3-month age groups with the largest numbers were 9-11 months, 12-14 months and 15-17 months (Figure 7). Thus the indication is that prevention of measles by immunization is needed before 9 months of age.

In La Paz, Monterrey, Recife and the San Salvador Area relatively high proportions of the children who died from measles had nutritional deficiency as an associated cause (56, 75, 72 and 62 per cent respectively). In San Juan Province and São Paulo the percentages with nutritional deficiency were 34 and 41. Only 3 deaths from measles as the underlying cause occurred in the Santiago Area and only two in the Kingston Area. Deaths from measles occurred in several children of a few months of age with normal weights or with only a mild degree of malnutrition in San Juan Province.

Table 6 Number and Percentage of Deaths from Measles with Nutritional Deficiency as an Associated Cause for 6 Projects

Project	Measles deaths	Nutritional deficiency	
		Number	Per cent
La Paz	159	89	56
Monterrey	71	53*	75
Recife	195	140	72
San Juan Province	67	23	34
San Salvador Area	50	31	62
São Paulo	46	19	41

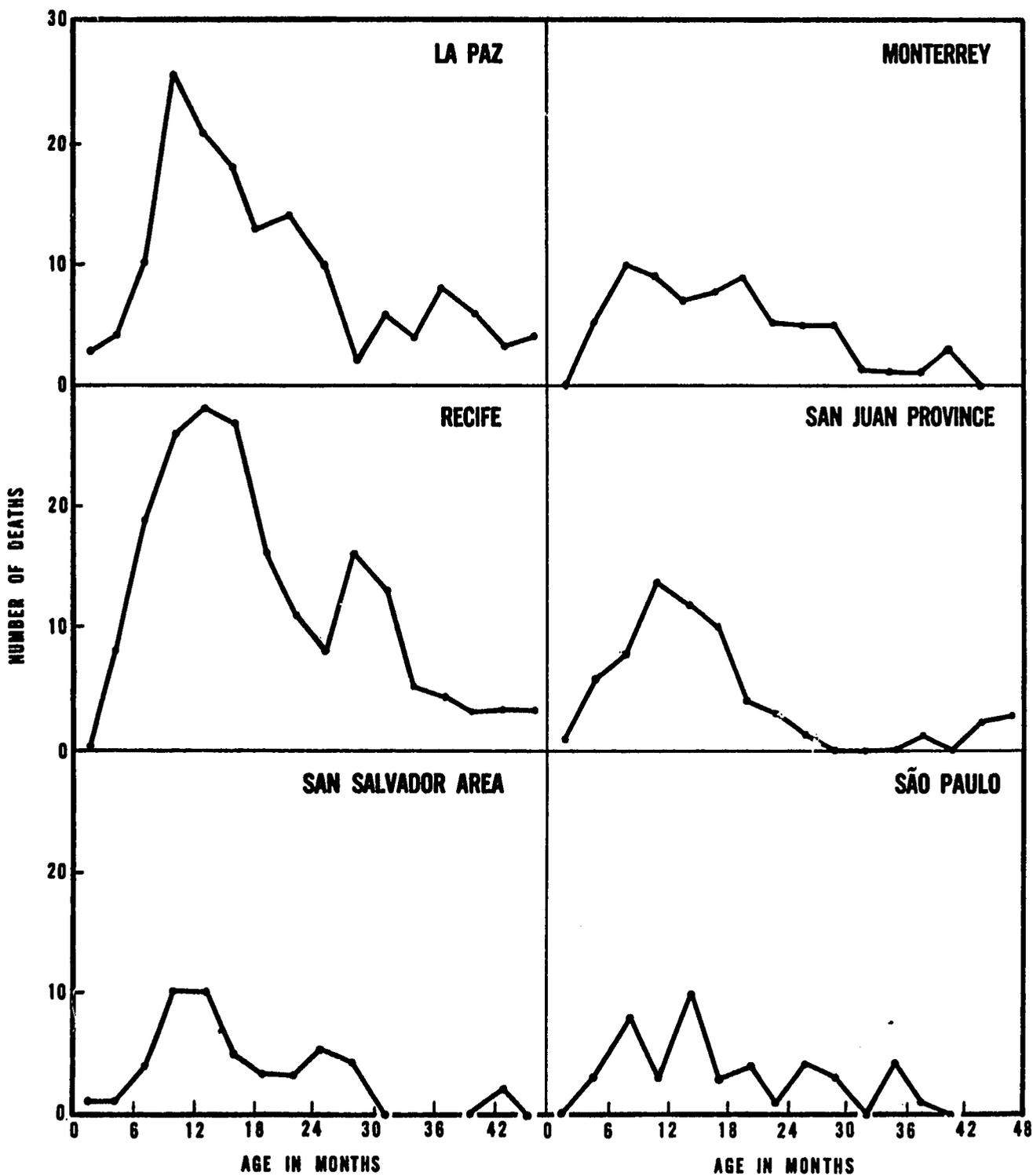
\*Excludes one associated cause in a death with two types of nutritional deficiency as a consequence.

### Diphtheria, Tetanus and Whooping Cough

The number of deaths and death rates for diphtheria, tetanus and whooping cough are given in Table 7. The lowest rates for these three causes were observed in the Santiago Area where no death was assigned to diphtheria or whooping

Figure 7

**NUMBER OF DEATHS FROM MEASLES BY 3-MONTH AGE GROUPS  
UNDER 4 YEARS FOR 6 PROJECTS**



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cough, and only one to tetanus. On the other hand, diphtheria seems to be a serious problem in the San Salvador Area and Recife, while whooping cough was found to be more serious in La Paz and San Juan Province. Tetanus was by far more serious in the San Salvador Area than in the others. All tetanus deaths were neonatorum type. The situation of the projects in relation to mortality due to the three mentioned causes as well as to measles is a reflection on the need to establish and/or strengthen the preventive aspects of medical care in maternal and child health.

Table 7 Deaths from Diphtheria, Tetanus and Whooping Cough under 5 Years of Age with Rates per 100,000 Population for 8 Projects

Project	Diphtheria		Tetanus		Whooping Cough	
	Number	Rate	Number	Rate	Number	Rate
Kingston Area	2	3	6	9	5	8
La Paz	-	-	-	-	18	49
Monterrey	1	1	7	10	12	17
Recife	8	23	4	11	7	20
San Juan Province	-	-	2	8	9	36
San Salvador Area	7	19	18	48	2	5
Santiago Area	-	-	-	-	1	2
São Paulo	2	3	3	4	15	21

### Tuberculosis

Tuberculosis was the underlying cause of 28 deaths in La Paz, 27 deaths in Monterrey and 20 in Recife; in the other areas the numbers of deaths due to this cause and rates were small. (Table 8). These death rates from tuberculosis in at least three projects indicate serious problems.

Table 8 Deaths from Tuberculosis, All Forms, with Rate per 100,000 Population under 5 Years of Age in 8 Projects

Project	Number	Rate
Kingston Area	2	3
La Paz	28	76
Monterrey	27	38
Recife	20	57
San Juan Province	4	16
San Salvador Area	2	5
Santiago Area	1	2
São Paulo	8	11

### Other Infective and Parasitic Diseases

Helminthiasis was the underlying cause in a few deaths of children 1-4 years of age and occurred frequently as an associated cause (78 deaths in Recife and 51 in San Salvador Area).

Moniliasis was an important associated cause of death especially in small infants; in Recife moniliasis contributed to 42 deaths, in the Province of San Juan to 70 deaths, in São Paulo to 59 and to less than 25 in each of the other projects.

Congenital syphilis was the underlying cause of 16 deaths, of which 7 occurred in Recife, 3 in Kingston Area and 3 in São Paulo. Also, congenital syphilis was reported as a contributory cause in 7 deaths of which 3 occurred in San Salvador Area.

Other rare causes were noted, such as meningococcal infections, 7 deaths of which 6 occurred in São Paulo; congenital toxoplasmosis 4 deaths, 3 of them in São Paulo; American trypanosomiasis (Chagas' disease) 3 deaths in which transplacental transmission was thought to have occurred, 2 in San Juan Province and 1 in Santiago Area; and finally, smallpox and visceral leishmaniasis each produced 1 death in São Paulo.

### IV. Nutritional Deficiency

As indicated in Section II, Patterns of Mortality, nutritional deficiency was directly or indirectly responsible for relatively high proportions of the deaths under 5 years of age, excluding neonatal deaths. High death rates from all causes in the age period of 1-4 years are principally due to many deaths of children with serious nutritional deficiency (Tables 9 and 10 and Figure 8). To bring these death rates down to the level of those recorded in several countries of Europe, of 0.7 - 0.9 per 1,000 population, would require major improvement in conditions for children in nearly all areas of Latin America, especially directed to adequate nutrition.

Table 9 Deaths from All Causes with Rates per 1,000 Population and with Nutritional Deficiency as Underlying or Associated Cause with Percentage of All Deaths, for Age Group 1-4 Years, for 8 Projects

Project	Deaths all causes		Deaths* with nutritional deficiency	
	Number	Rate	Number	Per cent
Kingston Area	103	2.0	44	43
La Paz	313	10.4	161	51
Monterrey	206	3.6	134	65
Recife	291	10.6	203	70
San Juan Province	98	4.9	40	41
San Salvador Area	205	6.9	138	67
Santiago	76	2.0	28	37
São Paulo	160	2.7	69	43

\*Excludes two deaths in Kingston Area, two in San Salvador Area, two in São Paulo and one in Santiago Area with nutritional deficiency as an associated cause as well as an underlying cause and one associated cause in Monterrey of a death with two types of nutritional deficiency.

In the classification of associated causes a distinction is made in regard to those considered contributory and those a consequence of the underlying cause. In Table 10 deaths from nutritional deficiency are shown in these three groups for the eight projects.

Table 10 Deaths from Nutritional Deficiency as Underlying or Associated Cause with Rates per 1,000 Population for Age Group 1-4 Years for 8 Projects

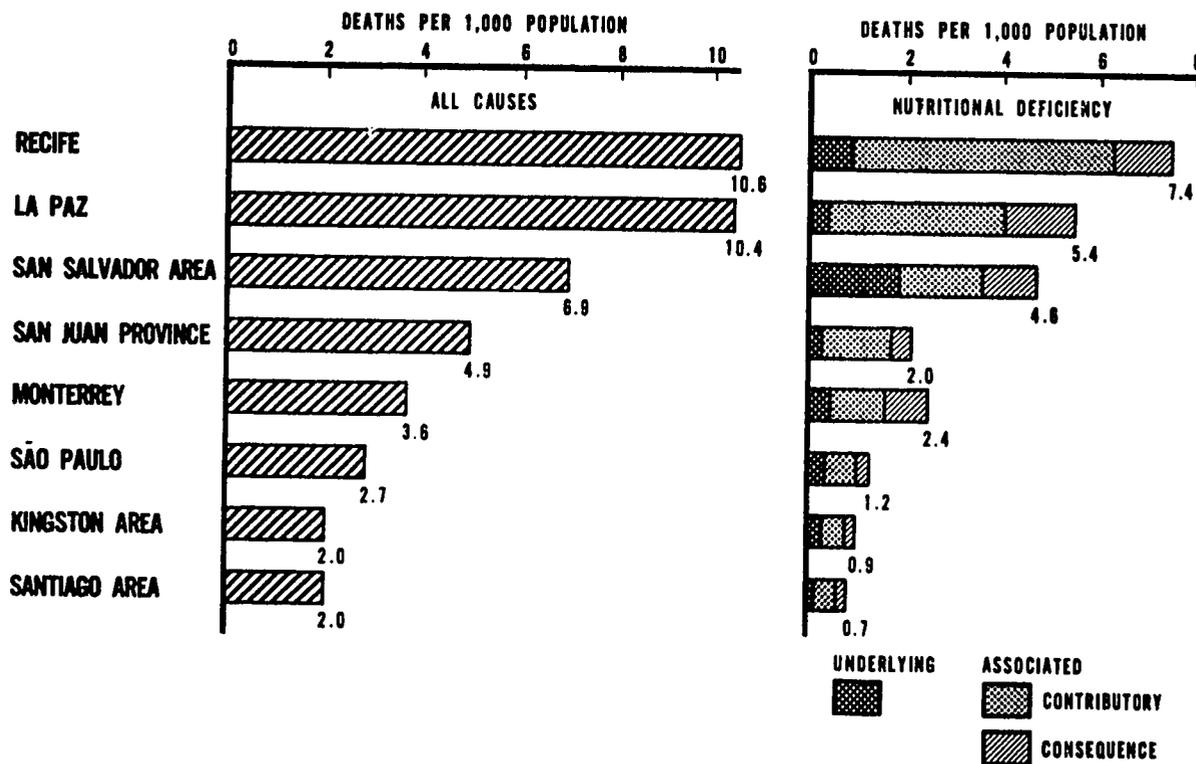
Project	Total*		Underlying cause		Associated cause*			
	Num-ber	Rate	Num-ber	Rate	Consequence		Contributory	
					Num-ber	Rate	Num-ber	Rate
Kingston Area	44	0.9	8	0.2	11	0.2	25	0.5
La Paz	161	5.4	11	0.4	44	1.5	106	3.5
Monterrey	134	2.4	23	0.4	51	0.9	60	1.1
Recife	203	7.4	23	0.8	31	1.1	149	5.4
San Juan Province	40	2.0	4	0.2	8	0.4	28	1.4
San Salvador Area	138	4.6	54	1.8	32	1.1	52	1.7
Santiago Area	28	0.7	4	0.1	6	0.2	18	0.5
São Paulo	69	1.2	16	0.3	19	0.3	34	0.6

\*Excludes two deaths in Kingston Area, two in San Salvador Area, two in São Paulo and one in Santiago Area with nutritional deficiency as an associated cause as well as an underlying cause and one death in Monterrey with two types of nutritional deficiency as a consequence of measles.

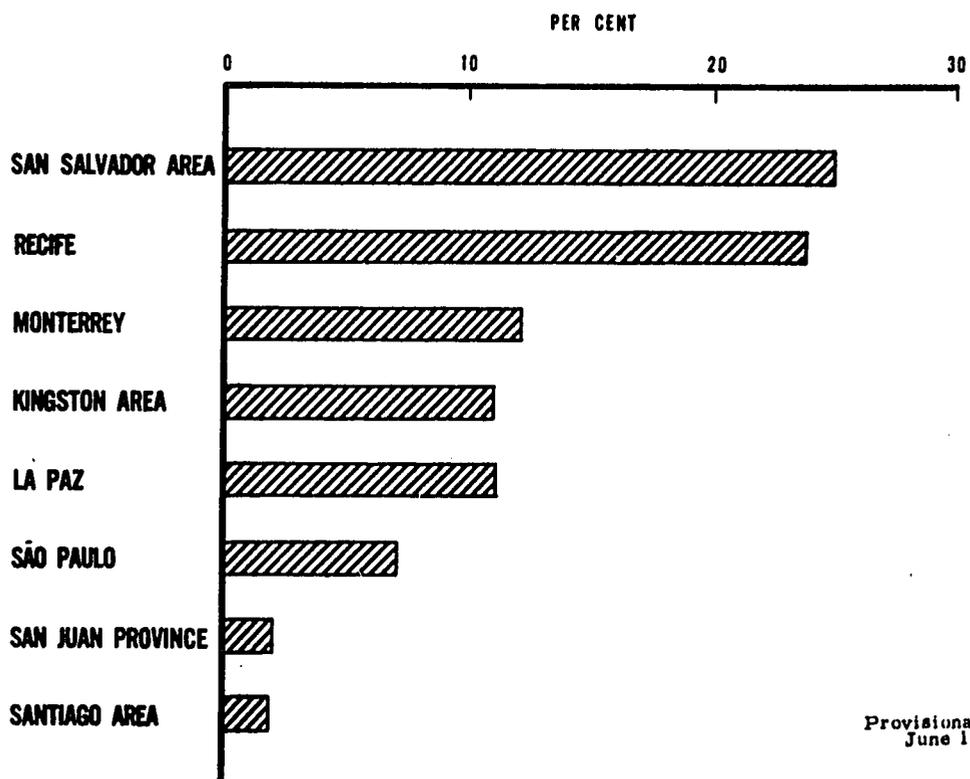
In approximately 70 per cent of the deaths in which nutritional deficiency was found to be an associated cause, this deficiency state was classified as a contributory condition, pre-existing to the underlying cause of death. In Figure 8 the death rates from nutritional deficiency are shown for comparison with the death rate from all causes in the same figure. The bars have been divided into three parts to show the rates from nutritional deficiency as underlying and contributory causes and as a consequence. The seriousness of nutritional deficiency and the field for action is indicated mainly by the size of the rates for underlying and contributory causes. The close relationship of nutritional deficiency to the death rate from all causes in the age group 1-4 years is clear from this chart.

The types of nutritional deficiency differ in these projects (Table 11). In only 8 deaths were single vitamin deficiency states mentioned, one as the underlying cause (death from scurvy) and seven as associated causes (three deaths with Vitamin A deficiency, three with Vitamin D deficiencies and one with an unspecified type of avitaminosis). In the Kingston Area, La Paz, Recife and the San Salvador Area at least half of the deaths from nutritional deficiency as the underlying cause were due to protein malnutrition (category 267).

**Figure 8 DEATH RATE FROM ALL CAUSES AND FROM NUTRITIONAL DEFICIENCY AS UNDERLYING OR ASSOCIATED CAUSE FOR AGE GROUP 1-4 YEARS FOR 8 PROJECTS**



**Figure 9 PERCENTAGE OF DEATHS FROM NUTRITIONAL DEFICIENCY DUE TO PROTEIN MALNUTRITION FOR 8 PROJECTS**



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Table 11 Deaths under 5 Years of Age, excluding Neonatal Deaths, according to the Type of Nutritional Deficiency as Underlying and Associated Causes for 8 Projects.

(Provisional Data)

Area and type of deficiency	Underlying				Associated			
	Total Num-ber	Per cent	28 days - 11 months	1 - 4 years	Total Num-ber	Per cent	28 days - 11 months	1 - 4 years
Kingston Area Total	22	100	14	8	107	100	69	38
Avitaminoses 260-266	1	5	-	1	-	-	-	-
Protein malnutrition 267	11	50	6	5	3	3	1	2
Nutritional marasmus 268	10	45	8	2	28	26	19	9
Other nutritional deficiency 269	-	-	-	-	76	71	49	27
La Paz Total	26	100	15	11	270	100	120	150
Avitaminoses 260-266	-	-	-	-	-	-	-	-
Protein malnutrition 267	13	50	5	8	19	7	4	15
Nutritional marasmus 268	13	50	10	3	29	11	14	15
Other nutritional deficiency 269	-	-	-	-	222	82	102	120
Monterrey Total	49	100	26	23	352	100	240	112
Avitaminoses 260-266	-	-	-	-	1	*	-	1
Protein malnutrition 267	22	45	4	18	25	7	4	21
Nutritional marasmus 268	19	39	16	3	51	14	41	10
Other nutritional deficiency 269	8	16	6	2	275	78	195	80
Recife Total	40	100	17	23	395	100	215	180
Avitaminoses 260-266	-	-	-	-	-	-	-	-
Protein malnutrition 267	27	67	7	20	77	19	14	63
Nutritional marasmus 268	13	33	10	3	117	30	79	38
Other nutritional deficiency 269	-	-	-	-	201	51	122	79
San Juan Province Total	29	100	25	4	143	100	107	36
Avitaminoses 260-266	-	-	-	-	2	1	2	-
Protein malnutrition 267	3	10	1	2	1	1	-	1
Nutritional marasmus 268	26	90	24	2	28	20	22	6
Other nutritional deficiency 269	-	-	-	-	112	78	83	29
San Salvador Area Total	79	100	25	54	224	100	138	86
Avitaminoses 260-266	-	-	-	-	2	1	-	2
Protein malnutrition 267	49	62	12	37	25	11	5	20
Nutritional marasmus 268	29	37	12	17	41	18	26	15
Other nutritional deficiency 269	1	1	1	-	156	70	107	49
Santiago Area Total	20	100	16	4	140	100	115	25
Avitaminoses 260-266	-	-	-	-	-	-	-	-
Protein malnutrition 267	1	5	-	1	2	1	-	2
Nutritional marasmus 268	17	85	15	2	28	20	25	3
Other nutritional deficiency 269	2	10	1	1	110	79	90	20
São Paulo Total	38	100	22	16	295	100	240	55
Avitaminoses 260-266	-	-	-	-	2	1	-	2
Protein malnutrition 267	11	29	-	11	12	4	4	8
Nutritional marasmus 268	25	66	21	4	79	27	71	8
Other nutritional deficiency 269	2	5	1	1	202	68	165	37

\* Less than 0.5

When all deaths in which malnutrition was stated as the underlying or as an associated cause were combined, the severe form of nutritional deficiency, protein malnutrition (kwashiorkor), was more common in Recife and the San Salvador Area than in the other areas, as shown in Table 12 and Figure 9. This form of nutritional deficiency was relatively rare in San Juan Province and in the Santiago Area.

The reduction of nutritional deficiency, particularly of the protein-calorie type, is essential for the reduction of the death rate from all causes in childhood. Moderate and severe forms of protein malnutrition resulting from inadequate diets and from repeated infections must be prevented in order to reduce the frequency of serious consequences on growth and development as well as on mortality in this age group.

Table 12 Number and Percentage of Deaths\* from Nutritional Deficiency under 5 Years of Age, excluding Neonatal Deaths, due to Protein Malnutrition (267) for 8 Projects

Project	Number	Protein malnutrition	
		Number	Per cent
Kingston Area	127	14	11
La Paz	296	32	11
Monterrey	400	47	12
Recife	435	104	24
San Juan Province	172	4	2
San Salvador Area	301	74	25
Santiago Area	159	3	2
São Paulo	331	23	7

\*Excludes two deaths in Kingston Area, two in San Salvador Area, two in São Paulo and one in Santiago Area with nutritional deficiency as an associated cause as well as an underlying cause and one death in Monterrey with two types of nutritional deficiency as a consequence of measles.

#### V. Congenital Anomalies

In the Investigation all congenital anomalies diagnosed in the deceased children are being classified and included in the analysis. Some are the underlying cause of death, while others are associated causes and a few are not serious enough for inclusion as either the underlying or an associated cause. Information regarding the presence of an anomaly is dependent in part on the availability and completeness of medical records. Some of the anomalies are discovered at autopsies and thus the number of pathological studies also affects the findings in an

area. With improvement of pathology in several projects during the Investigation, the number of anomalies diagnosed can be expected to increase. For the children who died in the first year of life the number of anomalies per 1,000 live births varied from 3.5 in La Paz to 11.0 in the San Salvador Area. (Table 13 and Figure 10). The rate for the Santiago Area (10.6) was only slightly below that for San Salvador.

Variations were noted in the systems affected by anomalies in this series of deaths. In the Santiago Area there were 3.9 anomalies of the circulatory system per 1,000 live births, which was slightly higher than the rates in the other projects. In the San Salvador Area the number of anomalies of the nervous system and eye of 2.7 per 1,000 live births was higher than the corresponding rate in any of the other projects. In three areas Down's disease was noted in slightly more than one death per 1,000 live births. These data are indicative of differences in patterns of anomalies which will be clarified when the results for the two-year period are analyzed.

The number of children who died in infancy in which congenital anomalies were diagnosed varied from 2.9 to 7.7 per 1,000 live births. However, for only one project, La Paz, was the rate below 4.9.

#### VI. Other Causes

One of the groups of other causes of specific interest is leukemia and other malignant neoplasms. For these eight projects, the number of deaths due to leukemia and other types of malignant neoplasms was 29 of which 13 were leukemia. Only in the Kingston Area and São Paulo were the provisional death rates relatively high, 14 per 100,000 population under 5 years of age in each project for leukemia and other malignant neoplasms combined, due to 9 deaths in the Kingston Area and 10 in São Paulo.

Later, after the data are available for the two years, analyses by other specific causes and groups will be prepared.

#### VII. Neonatal Mortality

The neonatal death rates for these eight projects varied from 19 per 1,000 live births in the Santiago Area in Chile to 36 in San Juan Province in Argentina. Since registration of deaths in the first 24 hours and the first few days of life has been incomplete, the size of these rates in some areas is in part dependent on the success of the efforts exerted by the staff of the projects to discover such deaths.

## Inter-American Investigation of Mortality in Childhood

Table 13 Congenital Anomalies in Deceased Children under 1 Year of Age by System with Rates per 1,000 Live Births for 8 Projects

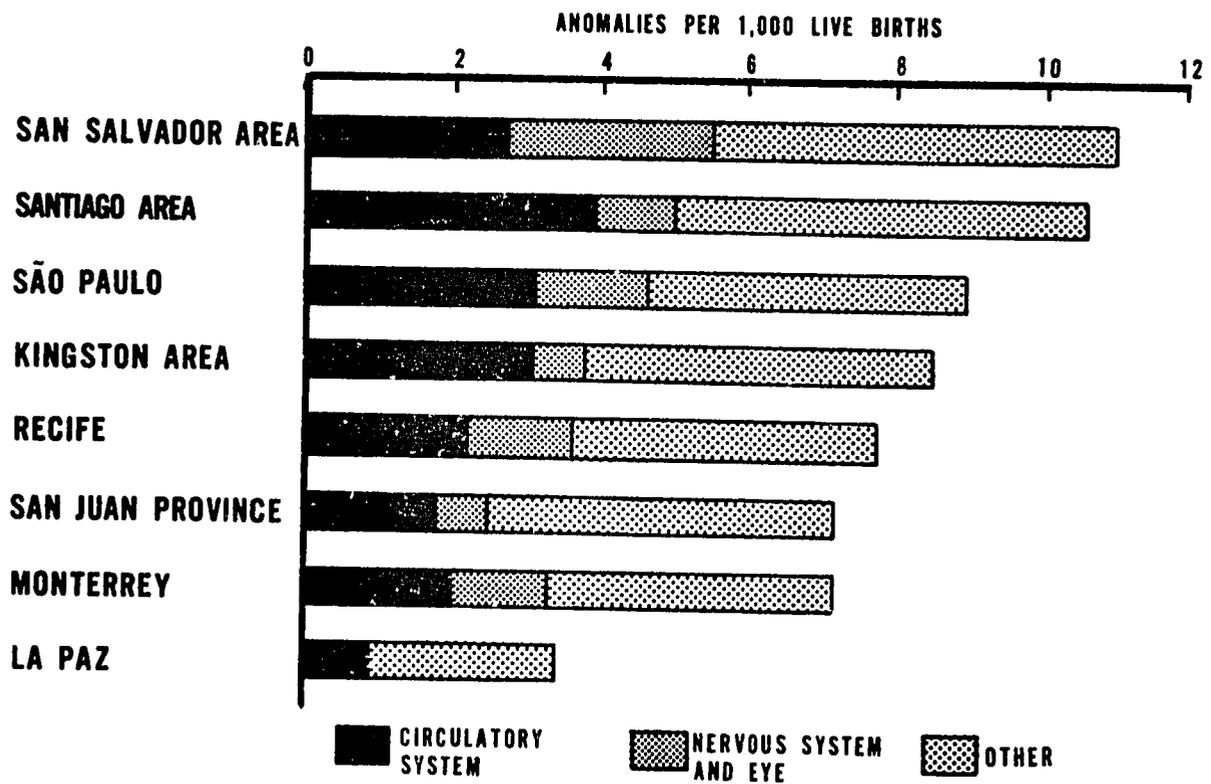
(Provisional Data)

System*	Kingston Area		La Paz		Monterrey		Recife	
	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate
Total anomalies	114	8.6	26	3.5	120	7.3	61	7.8
Nervous system and eye . . . . . 379,740-744	9	0.7	-	-	21	1.3	11	1.4
Circulatory system . . 746,747	41	3.1	7	0.9	33	2.0	17	2.2
Respiratory system . . . . . 748	-	-	1	0.1	2	0.1	-	-
Digestive system . . . . . 211,550-553, 749-751	21	1.6	7	0.9	21	1.3	14	1.8
Genito-urinary system . . . . . 584,605, 629,752,753	15	1.1	5	0.7	18	1.1	8	1.0
Musculoskeletal system . . . 170,524,754-756	15	1.1	3	0.4	9	0.5	5	0.6
Down's disease . . . . . 759.3	8	0.6	-	-	8	0.5	4	0.5
Other anomalies 214,216,227, 243,272,273,389,745, . . . . . 757,758, Rest of 759	5	0.4	3	0.4	8	0.5	2	0.3
Children with anomalies	68	5.2	22	2.9	86	5.2	38	4.9

System*	San Juan Province		San Salvador Area		Santiago Area		São Paulo	
	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate
Total anomalies	41	7.3	91	11.0	102	10.6	141	9.0
Nervous system and eye . . . . . 379,740-744	4	0.7	22	2.7	11	1.1	23	1.5
Circulatory system . . 746,747	10	1.8	23	2.8	37	3.9	48	3.1
Respiratory system . . . . . 748	-	-	-	-	-	-	2	0.1
Digestive system . . . . . 211,550-553, 749-751	7	1.2	12	1.4	16	1.7	34	2.2
Genito-urinary system . . . . . 584,605, 629,752,753	3	0.5	5	0.6	1	0.1	12	0.8
Musculoskeletal system . . . 170,524,754-756	7	1.2	17	2.0	22	2.3	14	0.9
Down's disease . . . . . 759.3	6	1.1	10	1.2	11	1.1	6	0.4
Other anomalies 214,216,227, 243,272,273,389,745, . . . . . 757,758, Rest of 759	4	0.7	2	0.2	4	0.4	2	0.1
Children with anomalies	32	5.7	64	7.7	70	7.3	103	6.6

\*Congenital anomalies are those listed in the Section XIV Congenital Anomalies 740-759 of the International Classification of Diseases and any other anomalies present at birth classified in other sections of the Classification. The category numbers of all these anomalies are given in the table.

Figure 10  
**CONGENITAL ANOMALIES PER 1,000 LIVE BIRTHS IN DECEASED CHILDREN  
 UNDER 1 YEAR OF AGE BY SYSTEM FOR 8 PROJECTS**



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Table 14 and Figure 13 illustrate the neonatal death rates for the eight projects and for two countries, England and Wales and the United States. Despite the slightly low registration of deaths under 24 hours of age, known to occur in most areas of the Investigation, it is evident that the neonatal rates are higher in these projects than in the two countries included for comparison. Mortality during the first week of life (the postnatal part of the perinatal period) is probably most affected by under-registration. However, analysis of these rates reveals that there is still room for reduction in mortality in this age group.

Table 14 Neonatal Deaths by Age Group with Rates per 1,000 Live Births for 8 Projects and 2 Countries

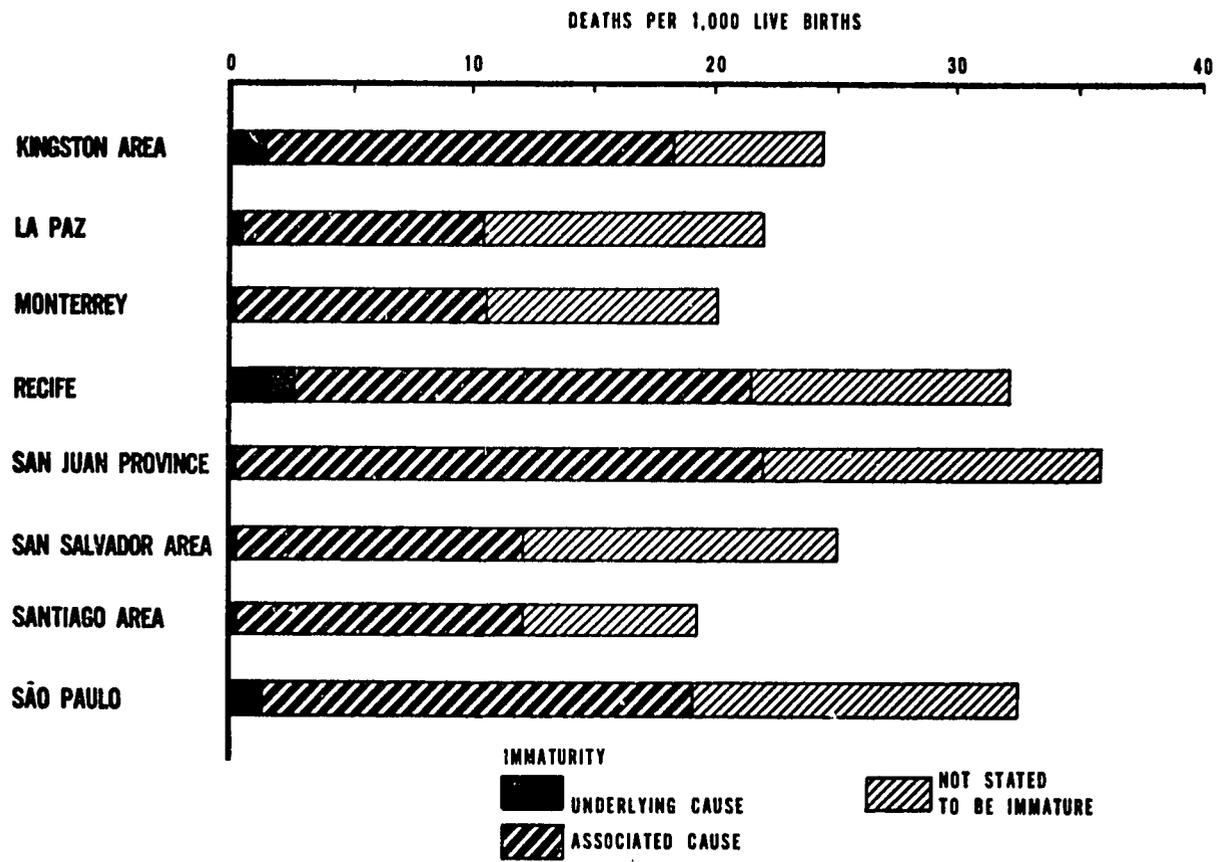
Project	Total		Under 7 days		7-27 days	
	Number	Rate	Number	Rate	Number	Rate
Kingston Area	323	24.5	217	16.4	106	8.0
La Paz	166	22.1	76	10.1	90	12.0
Monterrey	330	20.0	207	12.5	123	7.5
Recife	251	32.2	185	23.7	66	8.4
San Juan Province	201	35.9	113	20.2	88	15.7
San Salvador Area	208	25.1	134	16.1	74	8.9
Santiago Area	185	19.3	136	14.2	49	5.1
São Paulo	517	32.9	308	19.6	209	13.3
England and Wales 1966	10 933	12.9	9 446	11.1	1 487	1.7
United States 1966	61 941	17.2	56 025	15.5	5 916	1.6

The mortality in the neonatal period after the first week of life (non-perinatal) may still be the result of the so-called perinatal causes of mortality. However, in this period the role of environmental factors is evident and the great differences in the rates among these projects and between these and the two countries are a measure of the need for action. As can be seen, the death rate in this period in San Juan is three times greater than the rate in Santiago and almost ten times that in the United States.

The underlying and associated causes of neonatal deaths are given in Appendix Table VII and the death rates are shown for five broad groups of causes in Figure 12. The group of certain causes of perinatal mortality is responsible for around two-thirds of the neonatal deaths (Table 15). However, from 10 to 20 per cent of the neonatal deaths are due to infective and parasitic diseases. Congenital anomalies are not included in the Section of Certain Causes of Perinatal Mortality of the International Classification of Diseases and are relatively less important causes when compared to other groups of causes.

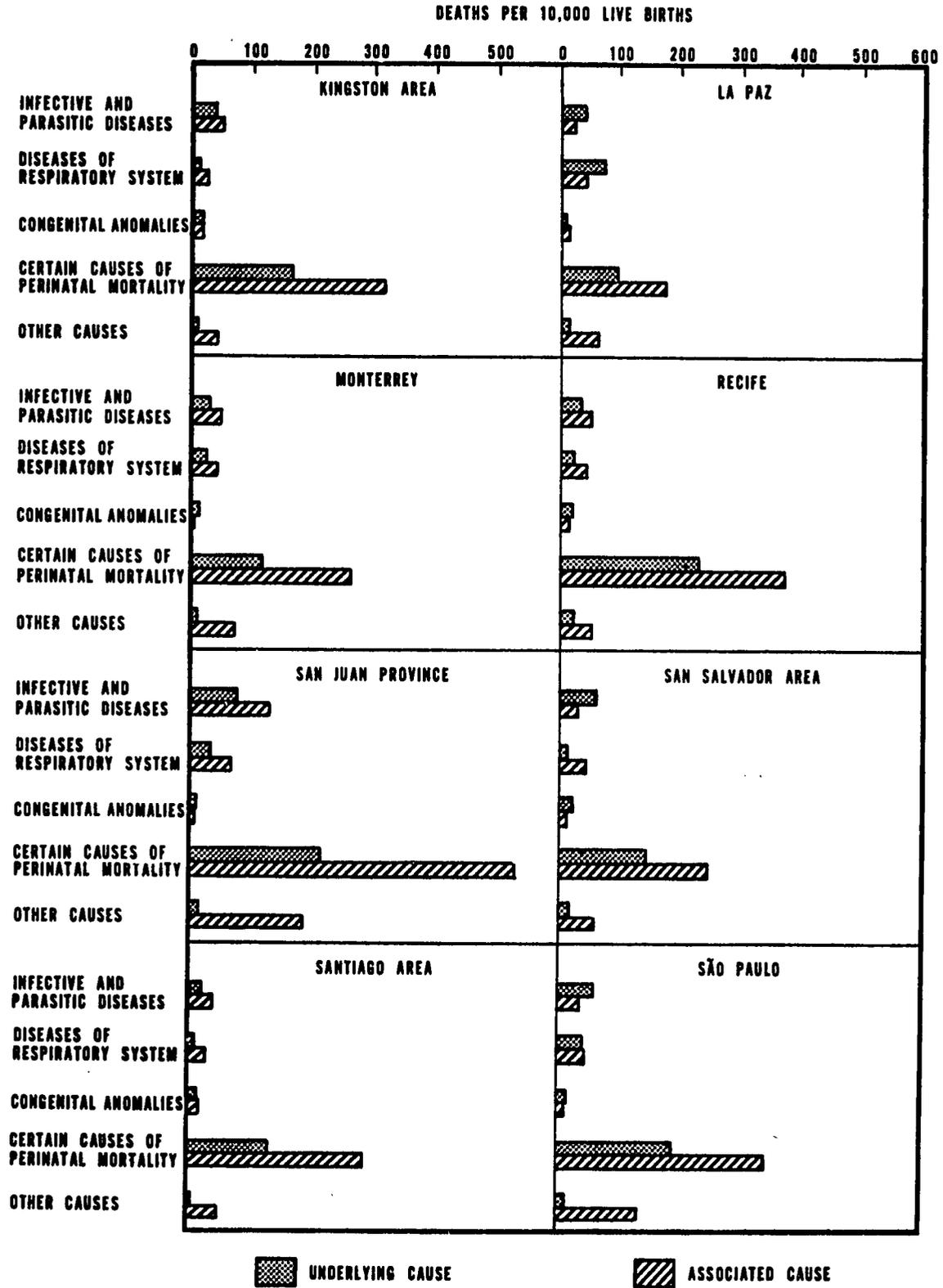
Figure 11

NEONATAL DEATHS PER 1,000 LIVE BIRTHS WITH IMMATURETY AS  
UNDERLYING OR ASSOCIATED CAUSE FOR 8 PROJECTS



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Figure 12  
 NEONATAL DEATHS IN BROAD GROUPS OF UNDERLYING AND ASSOCIATED CAUSES  
 PER 10,000 LIVE BIRTHS FOR 8 PROJECTS



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Table 15 Neonatal Deaths by Diagnosis of Immaturity as Underlying or Associated Cause in 8 Projects

Project	Total		Certain causes of perinatal mortality		Congenital anomalies		Other causes	
	Num-ber	Per cent	Num-ber	Per cent	Num-ber	Per cent	Num-ber	Per cent
Kingston Area	323	100	216	67	22	7	85	26
La Paz	166	100	70	42	3	2	93	56
Monterrey	330	100	195	59	24	7	111	34
Recife	251	101	177	71	15	6	59	24
San Juan Province	201	100	122	61	5	2	74	37
San Salvador Area	208	101	116	56	18	9	74	36
Santiago Area	185	100	125	68	15	8	45	24
São Paulo	517	100	296	57	26	5	195	38

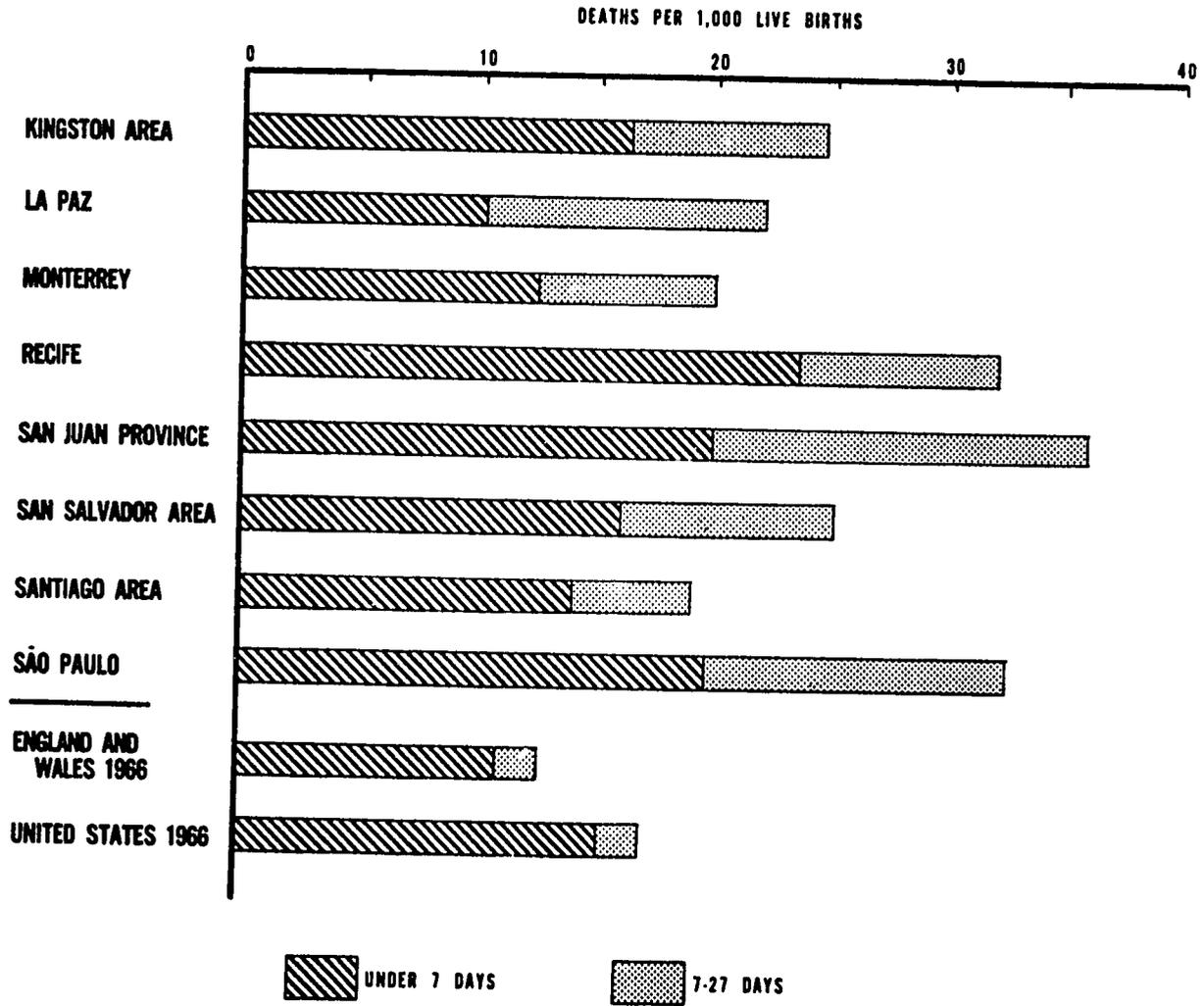
Of the neonatal deaths due to certain causes of perinatal mortality maternal conditions were recognized as the underlying cause of 38 deaths in the Kingston Area, giving a relatively high rate of 29 per 10,000 live births. Generally, the most frequent causes were the anoxic and hypoxic conditions grouped as 776 in the Classification.

According to the international rules for selection of the underlying cause unqualified immaturity or prematurity is not to be classified as the underlying cause of death when any other cause of perinatal mortality is reported. Table 16 and Figure 11 show the neonatal deaths in which immaturity, unqualified, was stated and how it was classified. Immaturity is without doubt a very important associated cause of death in the neonatal period. From 47 to 74 per cent of the neonatal deaths were given the code for immaturity as an underlying or associated cause.

Table 16 Neonatal Deaths by Diagnosis of Immaturity as Underlying or Associated Cause in 8 Projects

Project	Total neonatal deaths	Immaturity				Immaturity not stated
		Total		Under-lying cause	Associ-ated cause	
		Num-ber	Per cent			
Kingston Area	323	240	74	16	224	83
La Paz	166	78	47	3	75	88
Monterrey	330	174	53	4	170	156
Recife	251	167	67	19	148	84
San Juan Province	201	124	62	1	123	77
San Salvador Area	208	99	48	2	97	109
Santiago Area	185	118	64	2	116	67
São Paulo	517	298	58	18	280	219

Figure 13  
NEONATAL DEATHS PER 1,000 LIVE BIRTHS BY AGE GROUP  
FOR 8 PROJECTS AND 2 COUNTRIES



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Table 17 Immaturity as a Consequence or Contributory Cause of Neonatal Deaths Due to Certain Causes of Perinatal Mortality as Underlying Cause in 8 Projects

(Provisional Data)

Underlying cause	Total	Immaturity		Total	Immaturity	
		Conse- quence	Contri- butory		Conse- quence	Contri- butory
		Kingston Area			La Paz	
Total	216	76	84	70	14	30
Maternal conditions .. 760-763	38	35	-	8	7	-
Birth injury, difficult labor ..... 764-768, 772	26	-	13	17	-	5
Conditions of cord and placenta ..... 770, 771	3	3	-	4	3	-
Hemolytic disease of newborn ..... 774, 775	6	-	6	2	-	1
Anoxic, hypoxic conditions .776	73	-	58	28	-	22
Immaturity unqualified.... 777	16	-	-	3	-	-
Other ..... 769, 778	54	38	7	8	4	2
		Monterrey			Recife	
Total	195	62	67	177	17	96
Maternal conditions... 760-763	20	16	-	8	5	1
Birth injury, difficult labor ..... 764-768, 772	40	1	11	35	-	15
Conditions of cord and placenta ..... 770, 771	23	21	1	15	10	4
Hemolytic disease of newborn ..... 774, 775	3	1	-	3	-	2
Anoxic, hypoxic conditions .776	67	2	47	83	-	63
Immaturity unqualified.... 777	4	-	-	19	-	-
Other ..... 769, 778	38	21	8	14	2	11
		San Juan Province			San Salvador Area	
Total	122	26	53	116	25	52
Maternal conditions... 760-763	8	8	-	21	9	6
Birth injury, difficult labor ..... 764-768, 772	40	1	19	19	-	10
Conditions of cord and placenta ..... 770, 771	9	6	1	14	4	4
Hemolytic disease of newborn ..... 774, 775	6	-	3	6	-	1
Anoxic, hypoxic conditions .776	36	-	23	32	-	23
Immaturity unqualified.... 777	1	-	-	2	-	-
Other ..... 769, 778	22	11	7	22	12	8
		Santiago Area			São Paulo	
Total	125	31	53	296	62	120
Maternal conditions .. 760-763	8	5	1	23	17	-
Birth injury, difficult labor ..... 764-768, 772	26	-	15	57	2	22
Conditions of cord and placenta ..... 770, 771	12	10	-	25	16	5
Hemolytic disease of newborn ..... 774, 775	6	-	2	8	-	3
Anoxic, hypoxic conditions .776	46	-	30	130	-	86
Immaturity unqualified.... 777	2	-	-	18	-	-
Other ..... 769, 778	25	16	5	35	27	4

The causes of death of immature infants dying in the neonatal period in the eight projects are shown in Table 17. The importance of the groups of maternal conditions, of conditions of cord and placenta and of other conditions in which immaturity was a consequence, is evident from this table. It also shows that in those deaths in which the underlying cause of death is assigned to a condition grouped under birth injury and difficult labor or to anoxic or hypoxic conditions, immaturity is usually a contributory condition in many premature infants who die within the neonatal period from causes other than those included in the section on Certain Causes of Perinatal Mortality of the Eighth Revision of the International Classification of Diseases. The complexity of mortality in the neonatal period when studied within the context of multiple causes is thus evident.

### VIII. Breast Feeding

In many of the areas of the Investigation there is very little breast feeding or it is of very short duration. Data regarding breast feeding are presented in Table 18 and Figure 14 for deceased children, excluding those who died in the neonatal period.

The length of breast feeding among the children who died after the neonatal period but prior to the fifth birthday varied widely. In La Paz and the Kingston Area, only approximately 20 per cent of these children were not breast fed at all or had breast feeding for less than one month. This is in sharp contrast to the situation in Recife where the corresponding percentage was 69.

In all areas, children who died after the first year of life appear to have been breast fed longer than those who died under one year of age. The same appeared to be true with children who died between 6-11 months of age compared with those who died between 28 days and 5 months of age. For example, in the San Salvador Area, of those who died from 28 days through 5 months of age, 74 per cent had been breast fed for less than one month; of those who died from 6 through 11 months of age, 53 per cent had been breast fed for less than one month and of those who died at 1-4 years of age only 34 per cent had been breast fed for less than one month. The relationship between breast feeding and diarrheal disease will be discussed later.

### IX. Environmental Conditions

During the family interview information is obtained regarding the water supply and toilet facilities, evaluation of the house and neighborhood and the number of rooms in the living quarters. Thus the environmental conditions in which these children lived can be described. Later in the Investigation the interrelationship of diseases and environmental factors may be analyzed. At a later stage of the Investigation data on environmental conditions in these communities will become available from the study of the probability sample of households.

## Inter-American Investigation of Mortality in Childhood

Table 18 Numbers of Deceased Children\* with Less Than One Month of Breast Feeding\*\* and Number and Percentage by Age Group under 5 Years for 8 Projects

(Provisional Data)

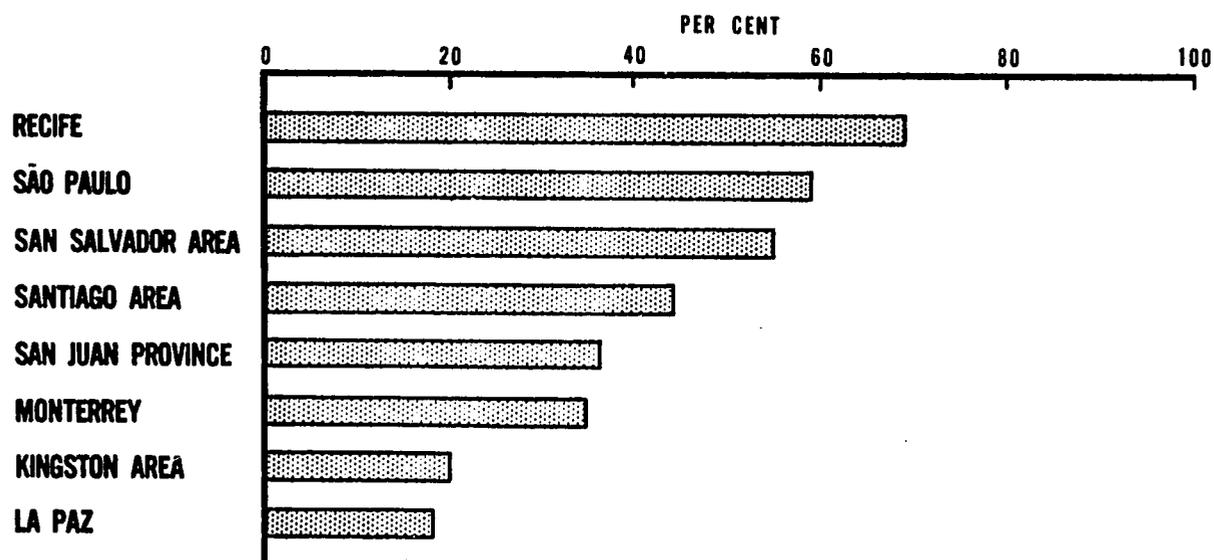
Project	Total			28 days - 5 months			6-11 months			1-4 years		
	Number of children	Breast fed less than 1 month		Number of children	Breast fed less than 1 month		Number of children	Breast fed less than 1 month		Number of children	Breast fed less than 1 month	
		Num-ber	Per-cent									
Kingston Area	284	56	20	94	27	29	92	14	15	98	15	15
La Paz	391	70	18	114	44	39	77	8	10	200	18	9
Monterrey	594	207	35	309	138	45	114	33	29	171	36	21
Recife	610	422	69	221	174	79	121	85	70	268	163	60
San Juan Province	360	131	36	189	91	48	77	21	27	94	19	20
San Salvador Area	587	325	55	250	184	74	138	73	53	199	68	34
Santiago Area	299	133	44	178	88	49	57	23	40	64	22	34
São Paulo	559	330	59	333	228	68	96	50	52	130	52	40

\*Excluding neonatal deaths and deaths from families without interviews.

\*\* Without breast feeding and with breast feeding for less than one month.

Figure 14

## PERCENTAGE OF DECEASED CHILDREN UNDER 5 YEARS OF AGE\* WITH LESS THAN ONE MONTH OF BREAST FEEDING FOR 8 PROJECTS



\*EXCLUDING NEONATAL DEATHS AND DEATHS FROM FAMILIES WITHOUT INTERVIEWS

Provisional Data  
June 1970

## Inter-American Investigation of Mortality in Childhood

Table 19 Number and Percentage of Homes\* of Deceased Children under 5 Years of Age by Type of Water Supply for 8 Projects

(Provisional Data)

Project	Total		Piped Water				Other		Unknown	
			In house		Outside					
	Num- ber	Per cent								
Kingston Area	577	100	98	17.0	447	77.5	28	4.9	4	0.7
La Paz	511	100	99	19.4	180	35.2	213	41.7	19	3.7
Monterrey	862	100	245	28.4	431	50.0	158	18.3	28	3.2
Recife	834	100	44	5.3	86	10.3	699	83.8	5	0.6
San Juan Province	547	100	81	14.8	52	9.5	412	75.3	2	0.4
San Salvador Area	782	100	59	7.5	369	47.2	351	44.9	3	0.4
Santiago Area	447	100	294	65.8	96	21.5	42	9.4	15	3.4
São Paulo	984	100	397	40.3	182	18.5	380	38.6	25	2.5

\*With family interviews

Table 20 Number and Percentage of Homes\* of Deceased Children under 5 Years of Age by Type of Toilet Facility for 8 Projects

(Provisional Data)

Project	Total		Flush toilet				Other		None		Unknown	
			House		Communal							
	Num- ber	Per cent	Num- ber	Per cent	Num- ber	Per cent	Num- ber	Per cent	Num- ber	Per cent	Num- ber	Per cent
Kingston Area	577	100	94	16.3	281	48.7	197	34.1	1	0.2	4	0.7
La Paz	511	100	82	16.0	79	15.5	320	62.6	10	2.0	20	3.9
Monterrey	862	100	229	26.6	191	22.2	338	39.2	75	8.7	29	3.4
Recife	834	100	25	3.0	1	0.1	569	68.2	233	27.9	6	0.7
San Juan Province	547	100	58	10.6	7	1.3	101	18.5	376	68.7	5	0.9
San Salvador Area	782	100	50	6.4	236	30.2	443	56.6	47	6.0	6	0.8
Santiago Area	447	100	216	48.3	12	2.7	169	37.8	36	8.1	14	3.1
São Paulo	984	100	261	26.5	55	5.6	523	53.2	116	11.8	29	2.9

\*With family interviews

Figure 15 **PERCENTAGE OF HOMES OF DECEASED CHILDREN UNDER 5 YEARS OF AGE WITH PIPED WATER IN HOUSE OR OUTSIDE, FOR 8 PROJECTS**

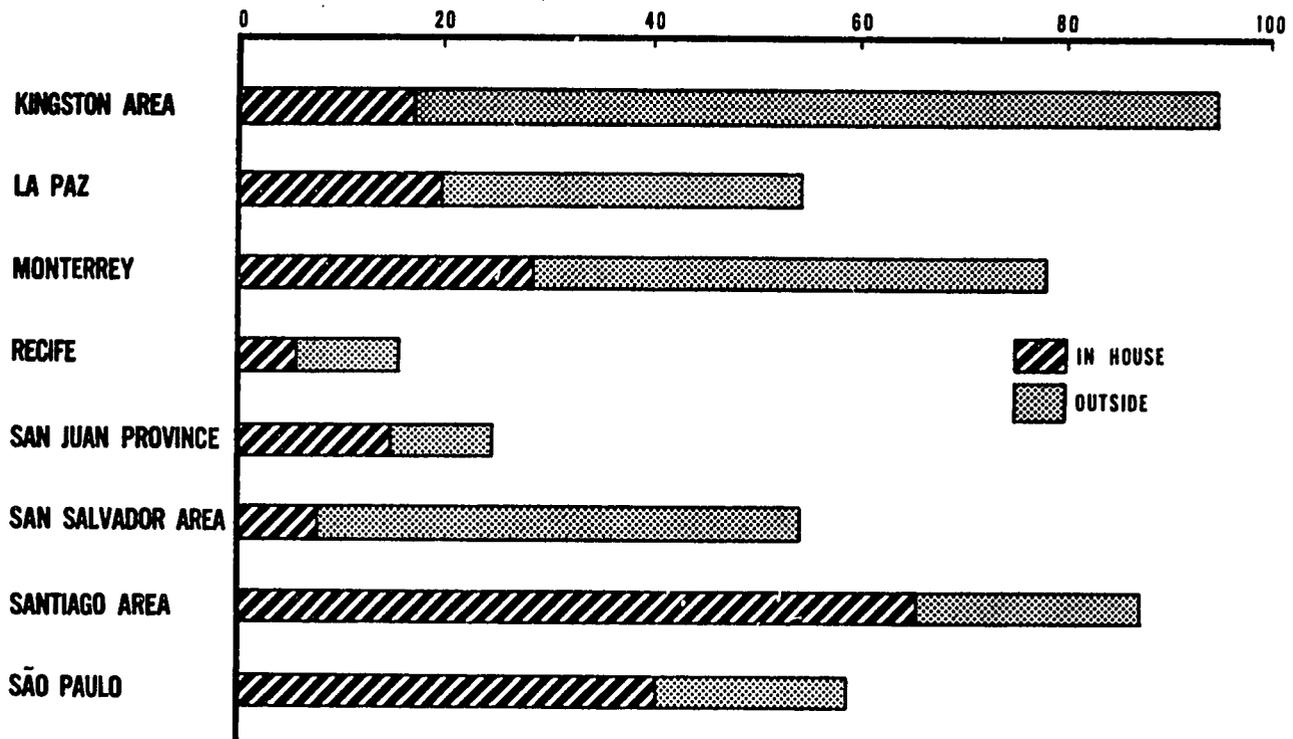
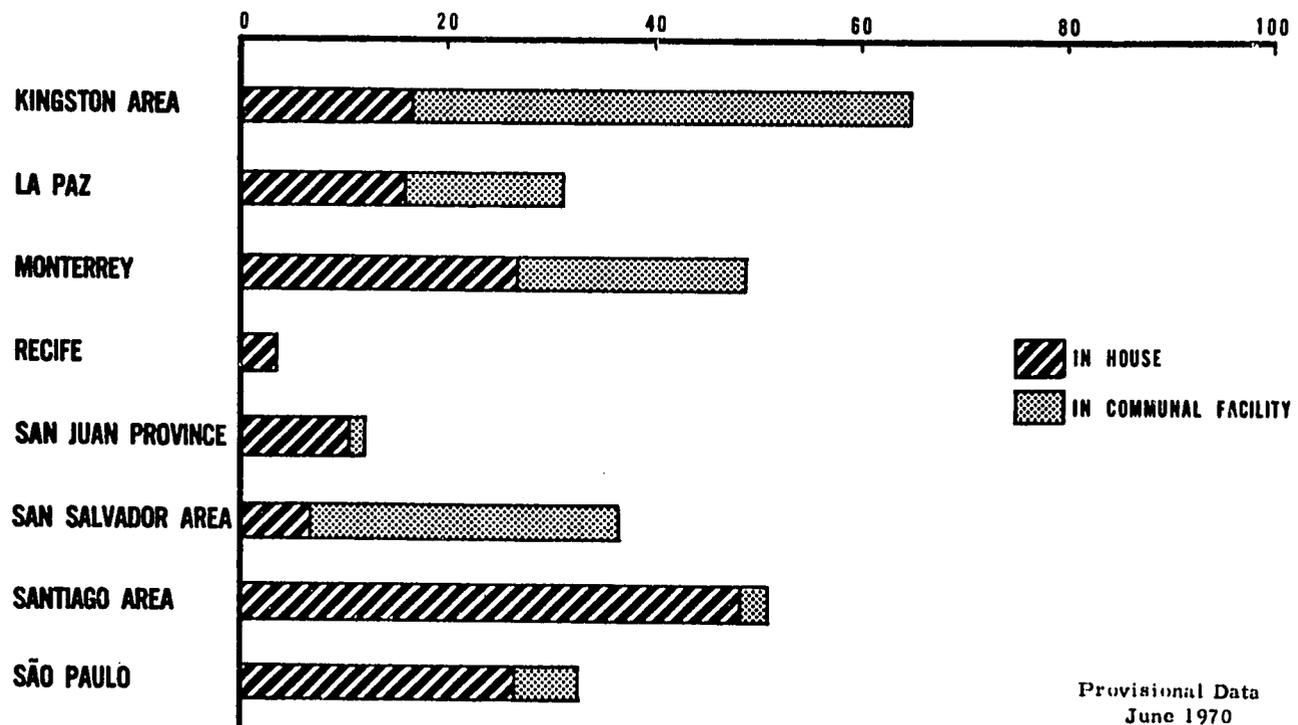


Figure 16 **PERCENTAGE OF HOMES OF DECEASED CHILDREN UNDER 5 YEARS OF AGE WITH FLUSH TOILETS IN HOUSE OR IN COMMUNAL FACILITY FOR 8 PROJECTS**



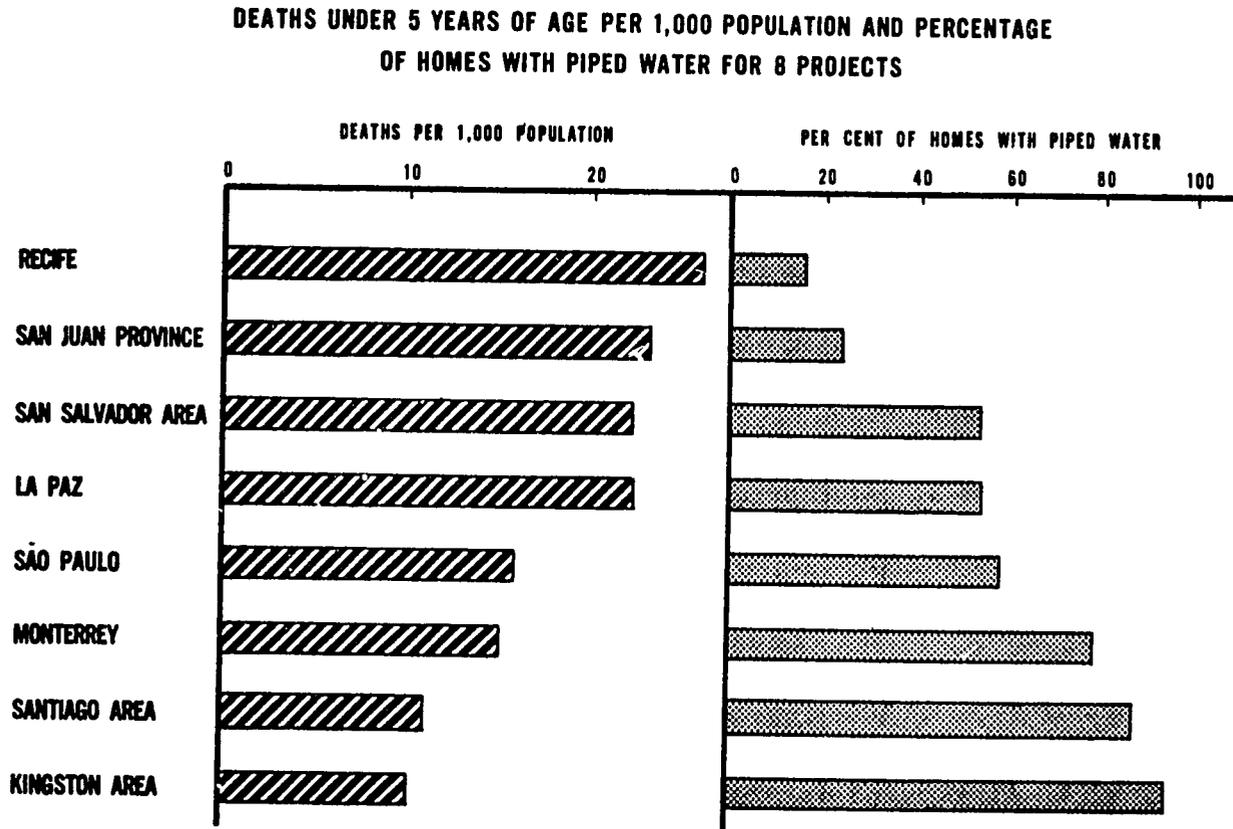
Provisional Data  
June 1970

The source of water supply is given in Table 19 and shown in Figure 15. The most favorable conditions were noted in the Kingston and Santiago Areas where over 80 per cent of the homes had piped water in the house or outside. In the Santiago Area 66 per cent of the houses of these deceased children had piped water in the house.

The Kingston Area and the Santiago Area likewise had the highest proportions of homes with flush toilets (Table 20 and Figure 16).

When the death rates under 5 years of age from all causes were placed in rank order a reverse relationship was noted between these death rates and the percentage of homes with piped water. The areas with high death rates were the ones with low percentages of homes with piped water supplies (Figure 17). Similarly toilet facilities were limited in the areas with high death rates.

Figure 17



Provisional Data  
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## X. Associations and Interrelationships of Causes of Death

The provisional results of the Inter-American Investigation of Mortality in Childhood clearly show that each community has a characteristic pattern of mortality. They also reveal that each community has a wide variety of underlying causes of death and that this variety is increased when the associated causes of death are included. Furthermore, the interrelationships between mortality from all causes and from specific causes by age group and factors governing them are being clarified.

It is evident from the data available that the study of deaths using various sources of information permits a better understanding of all the disease conditions that participate directly or indirectly in each death. Both the occurrence and importance of certain common associations, neither of which can be determined by the concept of the underlying cause, can be revealed by the study of multiple causes. Likewise, the use of the information available for each death makes it possible to understand the close interrelationships between socio-cultural and environmental factors and disease, and between diseases and groups of diseases.

The distinction between the three main groups of causes, namely the underlying, the contributory and the consequence (including the terminal) is not always easy, in fact it may be extremely difficult in some cases. Furthermore, with the vital statistics systems in use and the resources available, one may not go beyond the classification of multiple causes into underlying and associated causes at the present time. Further subdivision of the associated causes into contributory and consequences may be impossible. However, within the framework of the Investigation an effort has been made to establish a cause-effect relationship between pathological conditions leading to death in hopes that by so doing a better understanding of disease will be obtained and sounder recommendations may be given. The following two examples illustrate the importance of studying associations and their interrelationships.

The material presented in Table 21 and Figure 18 illustrates the interrelationships of the main pathological conditions involved in the deaths from measles. The numbers of deaths attributed to measles as the underlying cause in six areas in which this disease constituted a serious problem in this period were as follows: La Paz 159; Monterrey 71; Recife 195; San Juan Province 67; San Salvador 50; and São Paulo 46. When these deaths were evaluated from the point of view of nutrition, it was found that serious nutritional deficiency was an associated cause of death in the following percentages: 56, 75, 72, 34, 62 and 41 respectively. Further investigation revealed that in all but a few deaths the nutritional deficiency, although aggravated by measles and its complications, was usually a pre-existing or contributory condition. The implication of this finding is that prevention of measles alone may not affect substantially the deaths

## Inter-American Investigation of Mortality in Childhood

Table 21 Frequency of Pneumonia, Diarrheal Disease and Nutritional Deficiency as Contributory Causes and Consequences of Measles for Deaths under 5 Years of Age in 6 Projects.

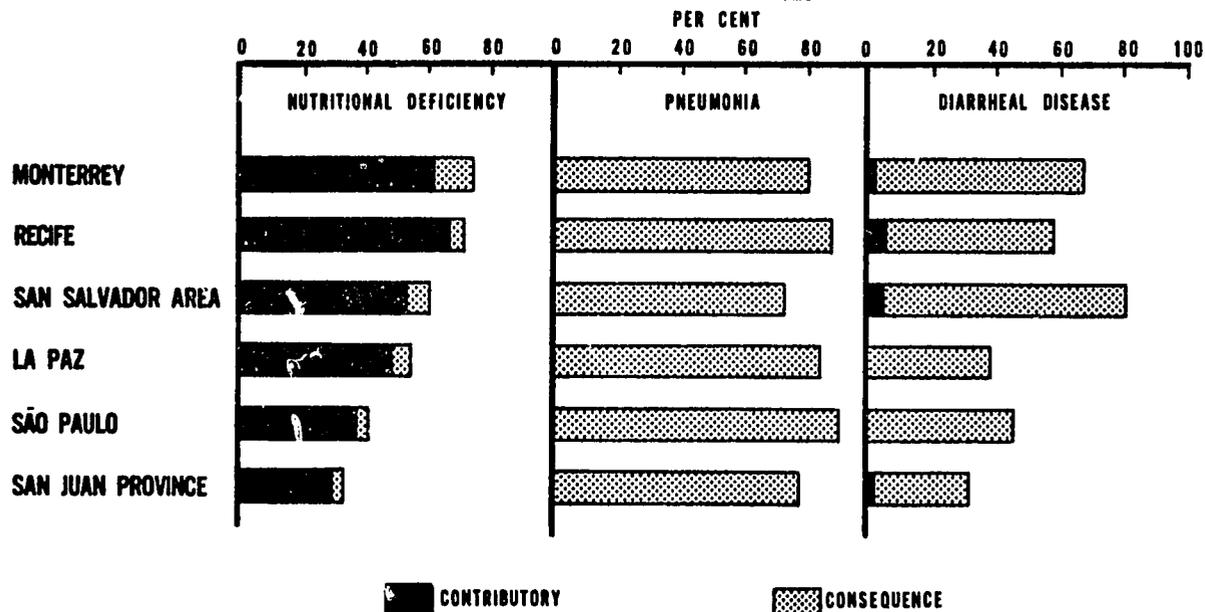
(Provisional Data)

Project and associated cause	Total		Consequence		Contributory	
	Num-ber	Per cent	Num-ber	Per cent	Num-ber	Per cent
<b>La Paz</b>						
Total measles deaths	159					
Pneumonia	134	84	134	84	-	-
Diarrheal disease	59	37	59	37	-	-
Nutritional deficiency	89	56	9	6	80	50
<b>Monterrey</b>						
Total measles deaths	71					
Pneumonia	58	82	58	82	-	-
Diarrheal disease	48	68	47	66	1	1
Nutritional deficiency	53*	75	10	14	43	61
<b>Recife</b>						
Total measles deaths	195					
Pneumonia	174	89	174	89	-	-
Diarrheal disease	114	58	107	55	7	4
Nutritional deficiency	140	72	7	4	133	68
<b>San Juan Province</b>						
Total measles deaths	67					
Pneumonia	52	78	52	78	-	-
Diarrheal disease	22	33	21	31	1	1
Nutritional deficiency	23	34	3	4	20	30
<b>San Salvador Area</b>						
Total measles deaths	50					
Pneumonia	37	74	37	74	-	-
Diarrheal disease	41	82	39	78	2	4
Nutritional deficiency	31	62	4	8	27	54
<b>São Paulo</b>						
Total measles deaths	46					
Pneumonia	42	91	42	91	-	-
Diarrheal disease	21	46	21	46	-	-
Nutritional deficiency	19	41	2	4	17	37

\*Excludes one associated cause in a death with two types of nutritional deficiency

Figure 18

**PERCENTAGE OF DEATHS FROM MEASLES WITH NUTRITIONAL DEFICIENCY, PNEUMONIA AND DIARRHEAL DISEASE AS CONTRIBUTORY CAUSES AND AS CONSEQUENCES IN DEATHS UNDER 5 YEARS OF AGE FOR 6 PROJECTS**



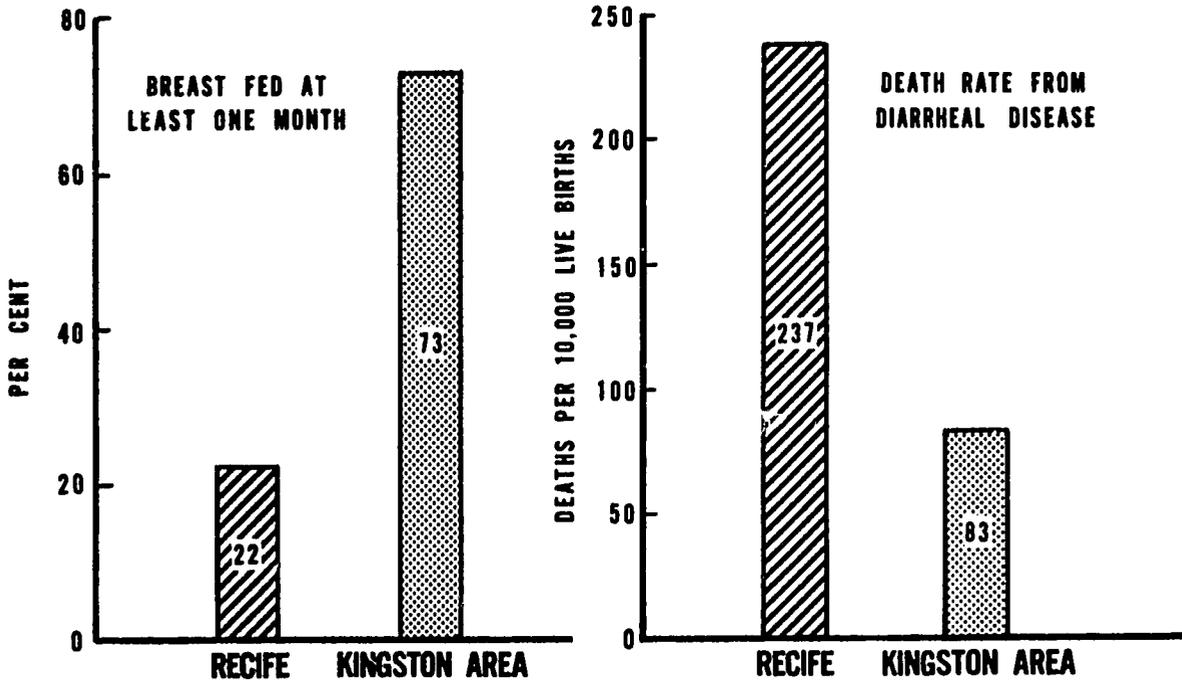
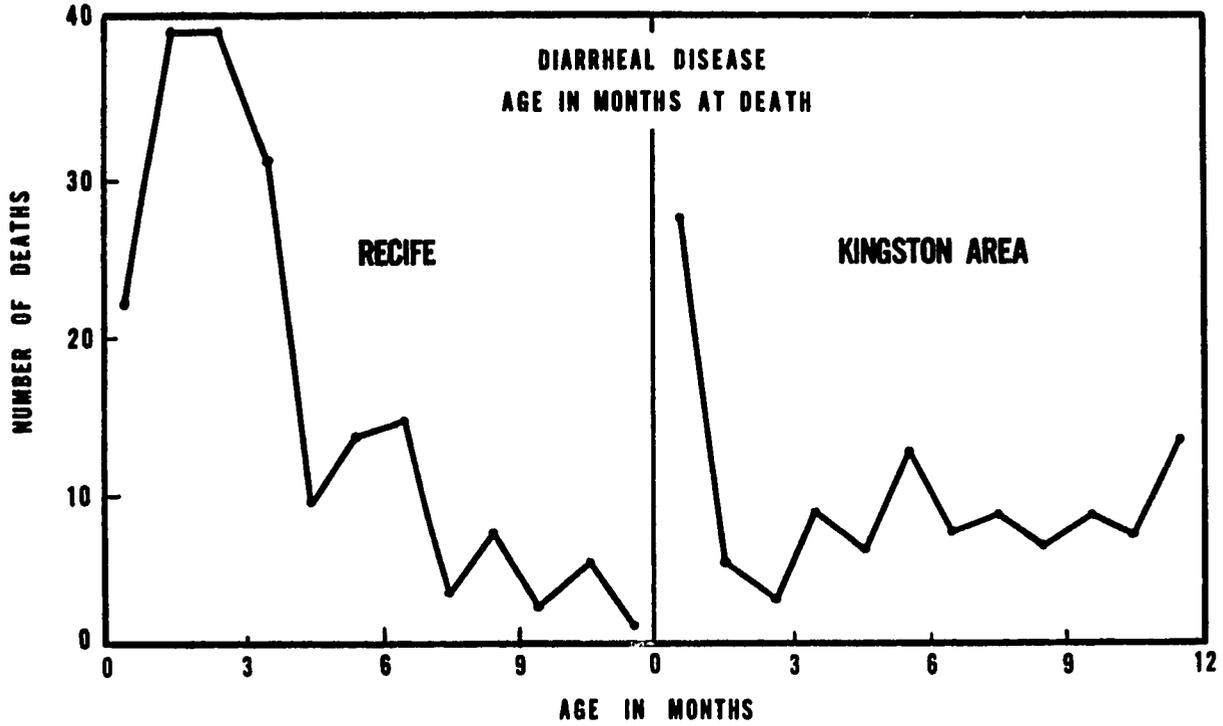
Provisional Data  
June 1970

of these children. On the other hand, the study of these deaths revealed that the very common lower respiratory conditions found in measles deaths, other than the respiratory forms of tuberculosis, that is the pneumonias, are always complications or consequences. In the same category (consequences) is diarrheal disease which was commonly found in this series of deaths from measles. A second implication of this phenomenon is that the respiratory and gastro-intestinal complications are usually consequences of the measles-nutritional deficiency complex. These respiratory and gastro-intestinal complications, more directly responsible for death and more demanding of medical attention, are probably less susceptible to prevention than the measles-nutritional deficiency complex.

The comparison of patterns of mortality due to diarrheal disease as the underlying cause of death in children less than one year of age reveals distinct differences as previously shown in Table 5 and Figures 5 and 6. Figure 19 illustrates the relationship of the patterns of mortality under one year of age from diarrhea and the length of breast feeding in the Kingston Area and in Recife. There seems to be a close relationship between early weaning and excessive mortality from diarrheal disease in the first months of life. As reported earlier, the high death rate from diarrheal disease within the neonatal period occurs primarily

Figure 19

**EXAMPLE OF RELATING INDICES TO DIARRHEAL DISEASE IN FIRST YEAR OF LIFE IN RECIFE AND KINGSTON AREA**



Provisional Data  
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in premature infants under hospital care. This calls for prevention of infection in this high risk group. Environmental conditions, such as crowding, lack of adequate water supply and toilet facilities, as well as early weaning, are important determining factors that can explain high death rates due to diarrhea.

Diarrheal disease in early months is, at the same time, intimately related to a frequently reported serious consequence, nutritional deficiency, predominantly of the marasmatic and intermediate forms resulting in deaths after the first few months of life. Moreover, after the first year of life, diarrheal disease is more often an associated condition (usually a consequence of other infective diseases) while nutritional deficiency, mainly the multiple deficiency syndrome or the intermediate forms of protein-calorie malnutrition, becomes more important as an underlying or contributory cause of death.

An age group in which associations and interrelationships of causes of death are of great importance is the neonatal period. Deaths during this period of life may be the result of prenatal factors, either maternal or fetal, of conditions present during birth, of postnatal conditions or even of combinations of factors belonging to these three groups. Among the prenatal maternal factors, some are related to pregnancy itself and some to other conditions. The latter, however, may be intimately related to an obstetric or postnatal condition.

The following example taken from the study illustrates the complexity of multiple causes of death in this age group. A child who died at 3 days of age was a product of a 7-month pregnancy and born to a pre-eclamptic mother who had a partial separation of placenta prior to delivery. At birth, the weight was 1,030 grams and the condition of the infant was fair. The clinical course was characterized by progressive respiratory distress and death occurred at 3 days of age after a bleeding episode from respiratory and digestive systems.

The multiple causes assigned were:

Pre-eclampsia of pregnancy	762.1	} underlying cause
Premature separation of placenta	770.1	
Immaturity	777.X	} consequences
Respiratory distress syndrome	776.2	
Hemorrhagic disease of the newborn (terminal)	778.2	

At the time of death neither the maternal nor the placental conditions were acting upon this child. The immaturity or prematurity was a consequence of the previous conditions and, at the same time, an important factor in development of the respiratory distress and hemorrhagic condition. The only cause mentioned

in the medical certificate of cause of death was prematurity and yet all the necessary information related to the underlying cause and its consequences was available in the hospital record. The sequence element is very important to understand the cause-effect relationship within the multiple cause constellation in this age period, and the maternal, fetal, obstetric and postnatal factors must be taken into account to provide adequate medical care.

## XI. Uses of the Findings of the Investigation in Health and Education Programs

The Organization is aware of the great potential value of this continental collaborative research program and plans to promote the maximum utilization of the results as they evolve. The following are some of the fields in which the Investigation is expected to produce the greatest impact.

### A. Maternal and Child Health

Mortality in childhood, studied in the light of multiple causes and related factors, constitutes a faithful reflection of the basic situation of maternal and child health in a community, thus giving precise indications as to necessary actions to be taken. During the course of the Investigation, as the findings have evolved, solutions to many problems have been applied, mainly with the purpose of creating interest in effective actions and always in the conviction that health problems (in particular in maternal and child care) are extremely complex and that their solution requires coordinated multidisciplinary approaches within the context of comprehensive programs. The infective and parasitic diseases and the nutritional deficiencies, so closely interrelated, and at the same time so dependent on socio-cultural and environmental factors, are priority sectors where action is to be concentrated in most areas of the Investigation in order to lower mortality. Examples follow of the use of the results of the Investigation to promote activities oriented toward the solution of maternal and child health problems.

#### 1. Prevention of Infecto-contagious Diseases - Immunization Programs

As referred to previously, one of the early revealing findings reported in the meeting of principal collaborators in October 1968 was the excessive mortality due to measles in Recife and La Paz. This finding was reported in the Special Meeting of Ministers of Health<sup>(4)</sup> held in Buenos Aires in October 1968. The Final Report of the Meeting contains the following statement and recommendations:

“ As in the case of poliomyelitis, the production of a modified live virus vaccine with considerable immunizing capacity has opened up the possibility of controlling measles. In some countries in the Americas, as has been demonstrated by the Inter-American

Investigation of Mortality in Childhood, measles is a major cause of death in children under five years of age and is aggravated by the generalized malnutrition of the population. The large-scale use of measles vaccine makes it possible to interrupt the epidemic outbreaks which occur every two or three years. The seriousness of respiratory complications, in particular laryngitis and pneumonia, and of encephalitic complications, has become apparent. The more undernourished the children, the greater the lethality of measles.

“ We hope that vaccine production will be increased and the unit cost reduced, so that a larger proportion of susceptible persons in each country can be covered.

#### Recommendations

- “ 1. That the Pan American Health Organization assist the Governments in the planning and conduct of national measles vaccination programs to protect the largest possible number of susceptible children under 5 years of age.
- “ 2. That the Pan American Health Organization promote the production of measles vaccine so as to reduce its cost and thereby permit the routine use of this vaccine to protect susceptible persons. ”

An immunization program initiated with mass vaccination of all children 8 months through 3 years of age in Recife is being conducted and is now in its second stage. The vaccine was provided by the Pan American Development Foundation. This program will permit evaluation of the effect of immunization on mortality as the Investigation proceeds. A vaccination program was conducted in La Paz for which vaccine was provided by the Brother's Brother Foundation. National programs for prevention of measles are being planned or have already been started in several countries, based on the recommendations of the Special Meeting of Ministers of Health and on the very successful experience in programs in Chile and the United States. A vaccination program in Argentina will be started in June 1970.

Extension of the coverage of immunization programs for the prevention of diphtheria, tetanus and whooping cough is also indicated in some of these areas. Analyses of the findings in the probability sample of households and children in these areas will reveal the coverage of immunization programs at present.

## 2. Nutrition Programs

The Inter-American Investigation of Mortality in Childhood is the first large scale study in which efforts have been made to determine the qualitative and quantitative aspects of nutritional deficiencies within the context of multiple causes of death. Understanding of the role of nutritional deficiencies in death

and of their interrelationships with other causes of mortality constitutes strong support for action for nutrition programs within comprehensive health programs.

The nutritional aspects of the Investigation as well as some provisional results were discussed during an internal meeting of experts in the field of nutrition<sup>(5)</sup>, held on 16-18 March 1970. The procedures followed by the Investigation for the classification of nutritional deficiencies were reviewed and found useful. Important recommendations were formulated for the improvement of classification and terminology of nutritional deficiencies in the Ninth Revision of the International Classification of Diseases, based on the experience already obtained in this and previous investigations.

Efforts will be made shortly to introduce operational nutrition programs within the context of comprehensive health programs in at least one of the areas of the Investigation, using resources such as those of the World Food Program in order to demonstrate methods of preventing the excessive death rates in childhood. The valuable information already obtained through the study of dead and of living children will constitute a sound basis for evaluation of actions in the field of nutrition.

#### B. Medical Education and Pediatric Pathology

All field projects of this Investigation, with one exception, are being conducted in Schools of Medicine or Public Health under the direction of a principal collaborator who is also a professor on the faculty. This integration with university institutions has reciprocal advantages, such as utilization of highly qualified personnel and services and full use of all aspects of the Investigation in education and training of health manpower and promotion of community centered research.

Close to 200 persons, of whom approximately 100 are physicians and 50 are nurses or social workers, dedicate part or full time to the Investigation in its various phases and the majority will work in projects for the entire period of collection of data. Many of these young physicians and nurses have demonstrated great potential for academic and health activities connected with research and have manifested interest in consolidating their experience through further formal training.

The methodology being used in the Investigation as well as the unfolding results are being used for teaching and training of medical students, residents and students of public health, and have been widely presented in local meetings and publications. Also the probability sample design is being used in several projects for community research in areas such as nutrition, demographic studies, evaluation of medical care, etc. The project in Sherbrooke, Canada, has requested authorization to send selected medical students and residents in pathology to projects in Latin America.

The qualitative and quantitative improvement of pediatric pathology has been a constant aim of the Investigation. Essentially all projects have improved tremendously in this respect. In the project in San Juan Province, for example, the number of autopsies increased from one in the first month of the study to 50-60 per month at present. The Investigation, together with the Department of Human Resources of the Organization, promoted a three-week workshop in Pediatric Pathology for 13 pathologists who are chiefly responsible for the pathological studies in 11 projects, from 23 March through 10 April 1970. This workshop was successful and was also the basis for planning of long-term training programs in the field of pathology, to be arranged by the Department of Human Resources.

It is the intention of the staff of the Investigation to assist the institutions engaged in the Investigation in the field in the best way possible, so that the results and experience of each project may be fully used for teaching, for publications and for collateral research. The data analyzed in the central office will also be provided to them so that maximum benefits may be obtained.

#### C. Improvement in Hospital Procedures with Births and Deaths and Hospital Records and Reports

In many of the projects the Investigation is uncovering serious deficiencies in hospitals and other health institutions in the quality and handling of clinical records, as well as in reporting births and deaths, particularly of small premature infants. Great efforts are being made by the local teams of the Investigation, by health and university authorities and by staff of the Organization to correct these deficiencies. Although the results so far have been encouraging, the need for continuous action at local, national and international levels is evident. Consultants in medical records of the Organization have provided courses for local personnel and are assisting in the establishment of procedures for handling records of infants and for current tabulations of deliveries and their outcome for the information of hospital administrators.

#### D. Improvement in Vital Statistics

Incomplete registration of vital events is recognized as a serious problem in developing countries and affects significantly the recognition of health problems essential for sound planning. The Inter-American Investigation of Mortality in Childhood, through careful search for all births and deaths and through the study of the vital events recorded in the households in the probability sample, aims to obtain the most complete knowledge possible about births and deaths in all the areas of the Investigation. The procedures being applied in each area to detect births and deaths are serving to plan improvements in recording of vital events in hospitals and local areas and in registration of these events for analysis at the national levels.

The extent and quality of medical certification has been ascertained in all projects and concomitant efforts are being made to promote the correct use of the international form of medical certificate of cause of death, through the activities of the Latin American Center for Classification of Diseases in Caracas, Venezuela. The staff of this Center has been involved in this collaborative research since its initiation and will benefit from the experience of the Investigation.

#### E. Use of Findings in Other Studies

Besides the use of methodology and the whole framework of the Investigation in collateral investigations, the findings constitute basic information for important community centered studies, such as for the operational research program known as Organization and Strategy of Health Services, to be conducted in Colombia under the sponsorship of PAHO/WHO and the Ministry of Health of that country. This research program will use basic data collected in the Inter-American Investigation of Mortality in adults and in this Investigation in Childhood.

#### F. Contribution to the 1975 Revision of the International Classification of Diseases

As with the group of Avitaminoses and other Nutritional Deficiencies, it is hoped that recommendations will be made on classification and terminology for the improvement of Section XV on Certain Causes of Perinatal Mortality in the International Classification of Diseases. An internal meeting of experts in the field of obstetrics, pediatrics and human reproduction has been planned. One of the purposes is to obtain assistance on the formulation of recommendations for the Ninth Revision, based on the data and experience accumulated in this Investigation.

The study of multiple causes of death in the pediatric age group is one of the great potential contributions of this Investigation. It is expected that this study will contribute to the change in orientation of the Classification towards the concept of multiple causes of morbidity and mortality.

\*\*\*            \*\*\*            \*\*\*            \*\*\*

The staff of the Investigation is planning meetings with the staff of the Organization so the results, although provisional, are known as they evolve, and may be utilized. Coordinating meetings with national health and university authorities and with principal collaborators and staff of the Organization will also be held in order to discuss the most important results and define the lines of action accordingly.

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## Appendix I A

Inter-American Investigation of Mortality in Childhood  
Underlying and Associated Causes of Death in Children Under 5 Years of Age by Age Group  
Kingston Area, Jamaica, June-December 1968  
(Provisional Data)

Cause	Underlying cause						Associated cause					
	Total	Age group					Total	Age group				
		Under 28 days	28 days - 5 mos.	6-11 mos.	1 year	2-4 years		Under 28 days	28 days - 5 mos.	6-11 mos.	1 year	2-4 years
All causes	620	323	98	96	55	48	1 074	593	153	151	104	73
Infective and parasitic diseases ... 000-136	177	56	42	52	21	6	140	64	26	25	16	9
Diarrhea, other intestinal infectious diseases ... 000-009	130	24	39	49	17	1	61	9	15	22	12	3
Tuberculosis ... 010-019	2	-	-	-	1	1	2	-	-	-	1	1
Diphtheria ... 032	2	-	-	-	1	1	-	-	-	-	-	-
Whooping cough ... 033	5	1	1	-	2	1	-	-	-	-	-	-
Tetanus ... 037	6	6	-	-	-	-	-	-	-	-	-	-
Septicemia ... 038	23	22	1	-	-	-	56	42	7	1	2	4
Measles ... 055	2	-	-	2	-	-	-	-	-	-	-	-
Congenital syphilis ... 090	3	2	1	-	-	-	-	-	-	-	-	-
Moniliasis ... 112	1	1	-	-	-	-	18	12	4	1	1	-
Helminthiasis ... 120-129	1	-	-	-	-	1	-	-	-	-	-	-
Other infective and parasitic diseases ... Rest of 000-136	2	-	-	1	-	1	3	1	-	1	-	1
Leukemia ... 204-207	4	-	1	-	1	2	-	-	-	-	-	-
Malignant neoplasms, other ... 208, 209	5	1	1	-	1	2	4	2	1	-	-	1
Neoplasms, benign and unspecified 210-239	-	-	-	-	-	-	-	-	-	-	-	-
Nutritional deficiency ... 260-269	24	2	3	11	7	1	110	3	31	38	25	13
Vitamin deficiency ... 260-266	1	-	-	-	1	-	-	-	-	-	-	-
Protein malnutrition ... 267	11	-	-	6	4	1	3	-	-	1	1	1
Nutritional marasmus ... 268	10	-	3	5	2	-	29	1	8	11	6	3
Other nutritional deficiency ... 269	2	2	-	-	-	-	78	2	23	26	18	9
Endocrine and metabolic diseases ... 240-258, 270-279	1	1	-	-	-	-	2	1	-	-	-	1
Deficiency anemias ... 280-281	1	-	-	-	1	-	10	3	1	4	2	-
Other diseases of blood and blood-forming organs ... 282-289	5	-	-	-	1	4	18	-	5	3	7	3
Inflammatory diseases of central nervous system ... 320-324	10	3	1	3	3	-	5	1	1	3	-	-
Other diseases of nervous system and sense organs ... 310-315, 330-389	9	-	-	2	1	6	22	14	2	1	2	3
Diseases of circulatory system ... 390-458	1	-	-	-	-	1	42	6	10	8	8	10
Pneumonia and influenza ... 470-486	48	12	15	8	5	8	99	27	15	25	20	12
Other diseases of respiratory system ... 460-466, 490-519	13	-	3	4	5	1	24	4	8	2	4	6
Diseases of digestive system ... 520-577	11	3	3	1	1	3	7	2	2	1	-	2
Diseases of genito-urinary system 580-629	2	-	-	-	1	1	8	1	3	3	-	1
Diseases of skin, subcutaneous tissue ... 680-709	4	1	-	1	-	2	11	1	5	-	3	2
Diseases of musculoskeletal system ... 710-738	-	-	-	-	-	-	2	1	-	-	-	1
Congenital anomalies ... 740-759	53	22	14	10	4	3	39	22	9	5	2	1
Nervous system and eye ... 740-744	8	1	2	3	-	2	1	-	1	-	-	-
Heart, circulatory system ... 746, 747	27	11	8	5	2	1	14	9	2	2	1	-
Respiratory system ... 748	-	-	-	-	-	-	-	-	-	-	-	-
Digestive system ... 749-751	12	8	3	1	-	-	4	4	-	-	-	-
Genito-urinary system ... 752, 753	3	1	1	1	-	-	8	4	2	1	-	1
Musculoskeletal system ... 754-756	2	1	-	-	1	-	2	1	-	1	-	-
Down's disease ... 759, 3	1	-	-	-	1	-	9	4	3	1	1	-
Other and unspecified ... 745, 757, 758 Rest of 759	-	-	-	-	-	-	1	-	1	-	-	-
Certain causes of perinatal mortality ... 760-778	220	216	1	2	-	1	429	421	7	-	-	1
Symptoms ... 780-789	1	1	-	-	-	-	83	14	22	29	14	4
Sudden death ... 795	14	3	10	1	-	-	-	-	-	-	-	-
Other ill-defined conditions ... 790-794, 796	-	-	-	-	-	-	1	-	-	-	-	1
External causes ... E800-E999	17	2	4	1	3	7	18	6	5	4	1	2

Appendix I B

Inter-American Investigation of Mortality in Childhood  
 Underlying and Associated Causes of Death in Children Under 5 Years of Age by Age Group  
 La Paz, Bolivia, July - December, 1968  
 (Provisional Data)

Cause	Underlying cause						Associated cause					
	Total	Age group					Total	Age group				
		Under 28 days	28 days - 5 mos.	6-11 mos.	1 year	2-4 years		Under 28 days	28 days - 5 mos.	6-11 mos.	1 year	2-4 years
All causes	796	166	179	138	190	123	1121	224	197	209	300	191
Infective and parasitic diseases ... 000-136	398	31	60	97	123	87	155	13	20	22	61	39
Diarrhea, other intestinal infectious diseases ... 000-009	176	23	41	47	45	20	121	9	17	18	49	28
Tuberculosis ... 010-019	28	1	-	6	9	12	9	-	-	1	3	5
Diphtheria ... 032	-	-	-	-	-	-	-	-	-	-	-	-
Whooping cough ... 033	18	1	5	5	3	4	1	-	-	-	-	1
Tetanus ... 037	-	-	-	-	-	-	-	-	-	-	-	-
Septicemia ... 038	7	6	1	-	-	-	2	2	-	-	-	-
Measles ... 055	159	-	7	36	66	50	8	-	-	1	4	3
Congenital syphilis ... 090	-	-	-	-	-	-	-	-	-	-	-	-
Moniliasis ... 112	-	-	-	-	-	-	11	2	3	2	4	-
Helminthiases ... 120-129	1	-	-	1	-	-	1	-	-	-	-	1
Other infective and parasitic diseases ... Rest of 000-136	9	-	6	2	-	1	2	-	-	-	1	1
Leukemia ... 204-207	-	-	-	-	-	-	-	-	-	-	-	-
Malignant neoplasms, other ... 140-203, 208, 209	3	-	-	-	-	3	1	-	-	-	-	1
Neoplasms, benign and unspecified ... 210-239	-	-	-	-	-	-	1	-	1	-	-	-
Nutritional deficiency ... 260-269	26	-	12	3	9	2	286	16	50	70	92	58
Vitamin deficiency ... 260-266	-	-	-	-	-	-	-	-	-	-	-	-
Protein malnutrition ... 267	13	-	4	1	7	1	19	-	1	3	8	7
Nutritional marasmus ... 268	13	-	8	2	2	1	30	1	7	7	9	6
Other nutritional deficiency ... 269	-	-	-	-	-	-	237	15	42	60	75	45
Endocrine and metabolic diseases ... 240-258, 270-279	-	-	-	-	-	-	2	1	-	1	-	-
Deficiency anemias ... 280-281	-	-	-	-	-	-	2	1	-	-	-	1
Other diseases of blood and blood-forming organs ... 282-289	1	-	1	-	-	-	2	-	-	1	-	1
Inflammatory diseases of central nervous system ... 320-324	8	1	3	1	2	1	5	-	1	1	1	2
Other diseases of nervous system and sense organs ... 310-315, 330-389	5	-	1	-	1	3	10	1	-	2	4	3
Diseases of circulatory system ... 390-458	1	-	1	-	-	-	8	1	2	1	3	1
Pneumonia and influenza ... 470-486	175	49	65	20	31	10	267	29	49	61	75	54
Other diseases of respiratory system ... 460-466, 490-519	29	4	12	7	3	3	25	1	6	9	4	5
Diseases of digestive system ... 520-577	2	-	1	-	1	-	12	2	4	1	3	2
Diseases of genito-urinary system ... 580-629	-	-	-	-	-	-	5	-	3	-	2	-
Diseases of skin, subcutaneous tissue ... 680-709	1	1	-	-	-	-	7	2	1	1	1	2
Diseases of musculoskeletal system ... 710-738	-	-	-	-	-	-	-	-	-	-	-	-
Congenital anomalies ... 740-759	7	3	3	-	-	1	11	5	2	1	1	2
Nervous system and eye ... 740-744	1	-	-	-	-	1	-	-	-	-	-	-
Heart, circulatory system ... 746, 747	3	1	2	-	-	-	5	2	1	1	-	1
Respiratory system ... 748	-	-	-	-	-	-	-	-	-	-	-	-
Digestive system ... 749-751	3	2	1	-	-	-	3	2	1	-	-	-
Genito-urinary system ... 752, 753	-	-	-	-	-	-	1	-	-	-	1	-
Musculoskeletal system ... 754-756	-	-	-	-	-	-	1	1	-	-	-	-
Down's disease ... 759, 3	-	-	-	-	-	-	1	-	-	-	-	1
Other and unspecified ... 745, 757, 758, Rest of 759	-	-	-	-	-	-	-	-	-	-	-	-
Certain causes of perinatal mortality ... 760-778	72	70	2	-	-	-	143	132	11	-	-	-
Symptoms ... 780-789	-	-	-	-	-	-	173	17	47	38	53	18
Sudden death ... 795	6	-	4	1	1	-	-	-	-	-	-	-
Other ill-defined conditions ... 790-794, 796	44	4	14	7	14	5	-	-	-	-	-	-
External causes ... E800-E999	18	3	-	2	5	8	6	3	1	-	-	2

Appendix I C

Inter-American Investigation of Mortality in Childhood  
 Underlying and Associated Causes of Death in Children Under 5 Years of Age by Age Group  
 Monterrey, Mexico, August 1968 - January 1969  
 (Provisional Data)

Cause	Underlying cause						Associated cause					
	Total	Age group					Total	Age group				
		Under 28 days	28 days - 5 mos.	6-11 mos.	1 year	2-4 years		Under 28 days	28 days - 5 mos.	6-11 mos.	1 year	2-4 years
All causes.....	1051	330	368	147	120	86	2289	710	747	315	293	224
Infective and parasitic diseases... 000-136	464	60	187	89	75	53	397	76	100	65	90	66
Diarrhea, other intestinal infectious diseases..... 000-009	312	31	173	63	30	15	204	31	50	38	53	32
Tuberculosis..... 010-019	27	-	2	6	7	12	19	-	1	6	4	8
Diphtheria..... 032	1	-	-	-	-	1	-	-	-	-	-	-
Whooping cough..... 033	12	-	4	-	5	3	1	-	-	-	1	-
Tetanus..... 037	7	7	-	-	-	-	-	-	-	-	-	-
Septicemia..... 038	24	21	2	-	1	-	102	37	37	11	8	9
Measles..... 055	71	-	5	19	29	18	22	-	1	5	11	5
Congenital syphilis..... 090	-	-	-	-	-	-	-	-	-	-	-	-
Moniliasis..... 112	1	1	-	-	-	-	23	8	10	4	-	1
Helminthiasis..... 120-129	4	-	-	-	2	2	24	-	-	1	12	11
Other infective and parasitic diseases..... Rest of 000-136	5	-	1	1	1	2	2	-	1	-	1	-
Leukemia..... 204-207	-	-	-	-	-	-	-	-	-	-	-	-
Malignant neoplasms, other..... 140-203, 208, 209	-	-	-	-	-	-	-	-	-	-	-	-
Neoplasms, benign and unspecified..... 210-239	1	-	-	-	1	-	-	-	-	-	-	-
Nutritional deficiency..... 260-269	51	2	13	13	16	7	380	28	171	69	61	51
Vitamin deficiency..... 260-266	-	-	-	-	-	-	1	-	-	-	1	-
Protein malnutrition..... 267	22	-	-	4	13	5	25	-	-	4	11	10
Nutritional marasmus..... 268	19	-	9	7	2	1	52	1	29	12	6	4
Other nutritional deficiency..... 269	10	2	4	2	1	1	302	27	142	53	43	37
Endocrine and metabolic diseases..... 240-258, 270-279	2	-	1	-	-	1	2	1	-	1	-	-
Deficiency anemias..... 280-281	-	-	-	-	-	-	8	4	1	-	2	1
Other diseases of blood and blood-forming organs..... 282-289	-	-	-	-	-	-	31	1	13	4	5	8
Inflammatory diseases of central nervous system..... 320-324	21	2	12	5	2	-	35	5	18	5	6	1
Other diseases of nervous system and sense organs..... 310-315, 330-389	6	1	3	1	-	1	33	6	10	7	1	9
Diseases of circulatory system..... 390-458	2	-	1	1	-	-	30	3	18	3	3	3
Pneumonia and influenza..... 470-486	116	34	57	15	6	4	376	68	141	71	58	38
Other diseases of respiratory system..... 460-466, 490-519	81	4	42	17	11	7	47	3	12	12	12	8
Diseases of digestive system..... 520-577	5	1	3	-	-	1	50	10	18	6	6	10
Diseases of genito-urinary system..... 580-629	5	-	3	1	-	1	40	4	19	8	5	4
Diseases of skin, subcutaneous tissue..... 680-709	4	3	1	-	-	-	18	6	6	2	3	1
Diseases of musculoskeletal system..... 710-738	-	-	-	-	-	-	1	-	-	1	-	-
Congenital anomalies..... 740-759	67	24	30	2	4	7	33	5	15	5	2	6
Nervous system and eye..... 740-744	21	7	8	1	2	3	3	1	2	-	-	-
Heart, circulatory system..... 746, 747	27	7	18	1	-	1	10	1	6	1	-	2
Respiratory system..... 748	2	1	-	-	-	1	-	-	-	-	-	-
Digestive system..... 749-751	15	8	3	-	2	2	3	-	1	1	-	1
Genito-urinary system..... 752, 753	1	-	1	-	-	-	2	-	-	1	-	1
Musculoskeletal system..... 754-756	-	-	-	-	-	-	1	-	1	-	-	-
Down's disease..... 759.3	1	1	-	-	-	-	13	2	5	2	2	2
Other and unspecified..... 745, 757, 758, Rest of 759	-	-	-	-	-	-	1	1	-	-	-	-
Certain causes of perinatal mortality..... 760-778	196	195	1	-	-	-	463	437	25	1	-	-
Symptoms..... 780-789	4	2	1	-	1	-	298	41	160	52	31	14
Sudden death..... 795	10	1	6	2	1	-	-	-	-	-	-	-
Other ill-defined conditions..... 790-794, 796	4	1	2	-	-	1	1	-	1	-	-	-
External causes..... E800-E999	12	-	5	1	3	3	46	12	19	3	8	4

## Appendix I D

## Inter-American Investigation of Mortality in Childhood

Underlying and Associated Causes of Death in Children Under 5 Years of Age by Age Group  
Recife, Brazil, July - December, 1968  
(Provisional Data)

Cause	Underlying cause						Associated cause					
	Total	Age group					Total	Age group				
		Under 28 days	28 days - 5 mos.	6-11 mos.	1 year	2-4 years		Under 28 days	28 days - 5 mos.	6-11 mos.	1 year	2-4 years
All causes	921	251	241	138	168	123	1948	416	481	299	427	325
Infective and parasitic diseases... 000-136	468	25	160	85	114	84	435	46	108	62	123	96
Diarrhea, other intestinal infectious diseases ..... 000-009	216	21	137	33	17	8	218	8	50	36	77	47
Tuberculosis ..... 010-019	20	-	3	3	3	11	16	-	4	2	2	8
Diphtheria ..... 032	8	-	-	2	5	1	-	-	-	-	-	-
Whooping cough ..... 033	7	-	3	1	2	1	1	-	-	-	1	-
Tetanus ..... 037	4	2	2	-	-	-	-	-	-	-	-	-
Septicemia ..... 038	1	-	1	-	-	-	66	30	23	7	3	3
Measles ..... 055	195	-	8	45	82	60	4	-	2	-	-	2
Congenital syphilis ..... 090	7	2	5	-	-	-	1	-	1	-	-	-
Monilliasis ..... 112	-	-	-	-	-	-	42	8	22	4	6	2
Helminthiasis ..... 120-129	5	-	-	-	4	1	78	-	3	9	34	32
Other infective and parasitic diseases ..... Rest of 000-136	5	-	1	1	1	2	9	-	3	4	-	2
Leukemia ..... 204-207	-	-	-	-	-	-	-	-	-	-	-	-
Malignant neoplasms, other ..... 140-203, 208, 209	-	-	-	-	-	-	-	-	-	-	-	-
Neoplasms, benign and unspecified ..... 210-239	-	-	-	-	-	-	-	-	-	-	-	-
Nutritional deficiency ..... 260-269	40	-	6	11	12	11	403	8	134	81	101	79
Vitamin deficiency ..... 260-266	-	-	-	-	-	-	-	-	-	-	-	-
Protein malnutrition ..... 267	27	-	-	7	9	11	77	-	-	14	32	31
Nutritional marasmus ..... 268	13	-	6	4	3	-	117	-	49	30	24	14
Other nutritional deficiency ..... 269	-	-	-	-	-	-	209	8	85	37	45	34
Endocrine and metabolic diseases ..... 240-258, 270-279	-	-	-	-	-	-	14	1	9	3	-	1
Deficiency anemias ..... 280-281	-	-	-	-	-	-	16	1	2	3	6	4
Other diseases of blood and blood-forming organs ..... 282-289	-	-	-	-	-	-	33	-	4	7	15	7
Inflammatory diseases of central nervous system ..... 320-324	14	1	6	-	3	4	13	4	2	4	1	2
Other diseases of nervous system and sense organs ..... 310-315, 330-389	10	-	2	3	3	2	39	-	16	7	5	11
Diseases of circulatory system ..... 390-458	-	-	-	-	-	-	38	1	10	6	10	11
Pneumonia and influenza ..... 470-486	102	17	38	22	16	9	404	33	96	86	116	73
Other diseases of respiratory system ..... 460-466, 490-519	30	-	12	5	11	2	68	1	13	12	32	10
Diseases of digestive system ..... 520-577	5	2	1	2	-	-	31	3	10	3	5	10
Diseases of genito-urinary system ..... 580-629	2	-	-	-	-	2	12	2	5	1	1	3
Diseases of skin, subcutaneous tissue ..... 680-709	16	7	4	3	-	2	27	2	12	6	2	5
Diseases of musculoskeletal system ..... 710-738	-	-	-	-	-	-	-	-	-	-	-	-
Congenital anomalies ..... 740-759	26	15	6	4	-	1	27	11	7	7	-	2
Nervous system and eye ..... 740-744	8	3	3	2	-	-	3	-	2	1	-	-
Heart, circulatory system ..... 746, 747	9	6	2	1	-	-	9	4	2	2	-	1
Respiratory system ..... 748	-	-	-	-	-	-	-	-	-	-	-	-
Digestive system ..... 749-751	7	4	1	1	-	1	3	1	1	1	-	-
Genito-urinary system ..... 752, 753	-	-	-	-	-	-	6	4	1	1	-	-
Musculoskeletal system ..... 754-756	1	1	-	-	-	-	-	-	-	-	-	-
Down's disease ..... 759, 3	-	-	-	-	-	-	5	1	1	2	-	1
Other and unspecified ..... 745, 757, 758, Rest of 759	1	1	-	-	-	-	1	1	-	-	-	-
Certain causes of perinatal mortality ..... 760-778	177	177	-	-	-	-	301	287	14	-	-	-
Symptoms ..... 780-789	-	-	-	-	-	-	77	10	38	11	8	10
Sudden death ..... 795	1	1	-	-	-	-	-	-	-	-	-	-
Other ill-defined conditions .. 790-794, 796	16	3	5	2	5	1	-	-	-	-	-	-
External causes ..... E800-E999	14	3	1	1	4	5	10	6	1	-	2	1

Appendix I E

Inter-American Investigation of Mortality in Childhood

Underlying and Associated Causes of Death in Children Under 5 Years of Age by Age Group  
San Juan Province, Argentina, August 1968 - January 1969  
(Provisional Data)

Cause	Underlying cause						Associated cause					
	Total	Age group					Total	Age group				
		Under 28 days	28 days - 5 mos.	6-11 mos.	1 year	2-4 years		Under 28 days	28 days - 5 mos.	6-11 mos.	1 year	2-4 years
All causes.....	575	201	196	80	68	30	1288	518	394	176	143	57
Infective and parasitic diseases....000-136	243	45	89	52	41	16	204	73	69	33	20	9
Diarrhea, other intestinal infectious diseases.....000-009	139	35	74	21	7	2	111	30	38	21	17	5
Tuberculosis.....010-019	4	-	-	1	-	3	2	-	-	1	-	1
Diphtheria.....032	-	-	-	-	-	-	-	-	-	-	-	-
Whooping cough.....033	9	-	4	2	3	-	1	-	-	-	1	-
Tetanus.....037	2	2	-	-	-	-	-	-	-	-	-	-
Septicemia.....038	8	8	-	-	-	-	13	10	3	-	-	-
Measles.....055	67	-	7	22	29	9	5	-	-	1	2	2
Congenital syphilis.....090	1	-	1	-	-	-	1	-	-	1	-	-
Moniliasis.....112	-	-	-	-	-	-	70	33	28	8	-	1
Helminthiasis.....120-129	-	-	-	-	-	-	-	-	-	-	-	-
Other infective and parasitic diseases Rest of 000-136	13	-	3	6	2	2	1	-	-	1	-	-
Leukemia.....204-207	2	-	-	1	-	1	-	-	-	-	-	-
Malignant neoplasms, other.....140-203, 208, 209	-	-	-	-	-	-	-	-	-	-	-	-
Neoplasms, benign and unspecified 210-239	-	-	-	-	-	-	-	-	-	-	-	-
Nutritional deficiency.....260-269	30	1	16	9	3	1	168	25	73	34	26	10
Vitamin deficiency.....260-266	-	-	-	-	-	-	2	-	-	2	-	-
Protein malnutrition.....267	3	-	-	1	1	1	1	-	-	-	1	-
Nutritional marasmus.....268	27	1	16	8	2	-	30	2	17	5	4	2
Other nutritional deficiency.....269	-	-	-	-	-	-	135	23	56	27	21	8
Endocrine and metabolic diseases.....240-258, 270-279	1	1	-	-	-	-	2	2	-	-	-	-
Deficiency anemias.....280-281	-	-	-	-	-	-	10	8	2	-	-	-
Other diseases of blood and blood-forming organs.....282-289	1	-	-	-	1	-	13	2	4	7	-	-
Inflammatory diseases of central nervous system.....320-324	13	-	7	4	1	1	18	-	5	7	3	3
Other diseases of nervous system and sense organs.....310-315, 330-389	5	-	2	-	2	1	22	2	7	6	2	5
Diseases of circulatory system....390-458	1	-	-	-	1	-	11	-	3	1	3	4
Pneumonia and influenza.....470-486	75	19	43	5	7	1	170	36	51	37	33	13
Other diseases of respiratory system.....460-466, 490-519	31	1	18	6	4	2	33	1	19	4	7	2
Diseases of digestive system.....520-577	5	1	2	-	2	-	36	6	18	5	6	1
Diseases of genito-urinary system 580-629	1	-	1	-	-	-	3	-	-	2	1	-
Diseases of skin, subcutaneous tissue.....680-709	2	1	1	-	-	-	14	9	3	1	1	-
Diseases of musculoskeletal system 710-738	-	-	-	-	-	-	-	-	-	-	-	-
Congenital anomalies.....740-759	15	5	5	1	2	2	15	4	6	3	2	-
Nervous system and eye.....740-744	4	2	1	-	-	1	-	-	-	-	-	-
Heart, circulatory system.....746, 747	6	1	4	-	-	1	5	2	2	1	-	-
Respiratory system.....748	-	-	-	-	-	-	-	-	-	-	-	-
Digestive system.....749-751	4	2	-	1	1	-	1	-	1	-	-	-
Genito-urinary system.....752, 753	1	-	-	-	1	-	-	-	-	-	-	-
Musculoskeletal system.....754-756	-	-	-	-	-	-	1	1	-	-	-	-
Down's disease.....759.3	-	-	-	-	-	-	8	1	3	2	2	-
Other and unspecified 745, 757, 758 unspecified.....Rest of 759	-	-	-	-	-	-	-	-	-	-	-	-
Certain causes of perinatal mortality.....760-778	122	122	-	-	-	-	305	298	6	1	-	-
Symptoms.....780-789	1	-	1	-	-	-	250	49	125	34	33	9
Sudden death.....795	9	2	7	-	-	-	-	-	-	-	-	-
Other ill-defined conditions...790-794, 796	4	2	2	-	-	-	-	-	-	-	-	-
External causes.....E800-E999	14	1	2	2	4	5	14	3	3	1	6	1

## Appendix I F

Inter-American Investigation of Mortality in Childhood  
 Underlying and Associated Causes of Death in Children Under 5 Years of Age by Age Group  
 San Salvador Area, El Salvador, September 1968 - February 1969  
 (Provisional Data)

Cause	Underlying cause						Associated cause					
	Total	Age group					Total	Age group				
		Under 28 days	28 days -5 mos.	6-11 mos.	1 year	2-4 years		Under 28 days	28 days -5 mos.	6-11 mos.	1 year	2-4 years
All causes.....	826*	208	254	142	114	91	1462	317	445	266	259	175
Infective and parasitic diseases....000-136	371	50	139	92	54	36	285	22	54	60	75	74
Diarrhea, other intestinal infectious diseases.....000-009	267	19	130	74	30	14	178	9	36	44	45	44
Tuberculosis.....010-019	2	-	-	1	1	-	4	-	-	2	1	1
Diphtheria.....032	7	-	-	-	2	5	-	-	-	-	-	-
Whooping cough.....033	2	-	1	1	-	-	1	-	-	-	1	-
Tetanus.....037	18	17	1	-	-	-	-	-	-	-	-	-
Septicemia.....038	15	9	4	2	-	-	26	10	7	1	5	3
Measles.....055	50	1	1	14	21	13	2	-	-	-	1	1
Congenital syphilis.....090	1	-	1	-	-	-	3	-	1	-	2	-
Moniliasis.....112	4	3	1	-	-	-	18	3	7	4	4	-
Helminthiases.....120-129	1	-	-	-	-	1	51	-	1	9	16	25
Other infective and parasitic diseases.....Rest of 000-136	4	1	-	-	-	3	2	-	2	-	-	-
Leukemia.....204-207	-	-	-	-	-	-	-	-	-	-	-	-
Malignant neoplasms, other.....208, 209	2	-	-	-	1	1	1	-	-	-	-	1
Neoplasms, benign and unspecified 210-239	1	-	-	-	-	1	-	-	-	-	-	-
Nutritional deficiency.....260-269	79	-	9	16	17	27	236	12	89	49	53	33
Vitamin deficiency.....260-266	-	-	-	-	-	-	2	-	-	-	1	1
Protein malnutrition.....267	49	-	2	10	13	24	25	-	1	4	11	9
Nutritional marasmus.....268	29	-	7	5	14	3	41	-	17	9	10	5
Other nutritional deficiency.....269	1	-	-	1	-	-	168	12	71	36	31	18
Endocrine and metabolic diseases.....240-258, 270-279	1	-	-	-	1	-	1	-	1	-	-	-
Deficiency anemias.....280-281	-	-	-	-	-	-	-	-	-	-	-	-
Other diseases of blood and blood-forming organs.....282-289	-	-	-	-	-	-	24	-	9	5	4	6
Inflammatory diseases of central nervous system.....320-324	8	-	3	4	-	1	14	3	6	1	4	-
Other diseases of nervous system and sense organs.....310-315, 330-389	3	-	-	-	2	1	17	5	5	3	2	2
Diseases of circulatory system....390-458	-	-	-	-	-	-	41	2	22	5	7	5
Pneumonia and influenza.....470-486	65	8	36	13	6	2	245	32	73	55	56	29
Other diseases of respiratory system.....460-466, 490-519	62	1	34	11	14	2	41	3	12	9	13	4
Diseases of digestive system.....520-577	4	-	1	-	2	1	33	4	10	9	6	4
Diseases of genito-urinary system 580-629	3	2	-	-	-	1	6	-	3	1	2	-
Diseases of skin, subcutaneous tissue.....680-709	5	3	1	-	1	-	18	3	6	-	3	6
Diseases of musculoskeletal system.....710-738	1	-	-	-	-	1	-	-	-	-	-	-
Congenital anomalies.....740-759	44	18	17	4	1	4	33	8	17	5	1	2
Nervous system and eye.....740-744	16	12	3	-	-	1	7	3	2	1	-	1
Heart, circulatory system.....746, 747	15	3	7	2	-	3	12	-	8	2	1	1
Respiratory system.....748	-	-	-	-	-	-	-	-	-	-	-	-
Digestive system.....749-751	6	3	3	-	-	-	2	-	2	-	-	-
Genito-urinary system.....752, 753	-	-	-	-	-	-	2	1	1	-	-	-
Musculoskeletal system.....754-756	2	-	2	-	-	-	3	3	-	-	-	-
Down's disease.....759.3	4	-	1	2	1	-	7	1	4	2	-	-
Other and unspecified.....745, 757, 758 Rest of 759	1	-	1	-	-	-	-	-	-	-	-	-
Certain causes of perinatal mortality.....760-778	117	116	1	-	-	-	214	198	16	-	-	-
Symptoms.....780-789	2	-	1	1	-	-	242	23	116	63	31	9
Sudden death.....795	7	3	4	-	-	-	-	-	-	-	-	-
Other ill-defined conditions...790-794, 796	33*	6	5	1	-	4	-	-	-	-	-	-
External causes.....E800-E999	18	1	3	-	5	9	9	2	4	1	2	-

\* Includes 17 deaths with age not stated

Appendix I G

Inter-American Investigation of Mortality in Childhood  
 Underlying and Associated Causes of Death in Children Under 5 Years of Age by Age Group  
 Santiago Area, Chile, July 1968 - February 1969  
 (Provisional Data)

Cause	Underlying cause						Associated cause					
	Total	Age group					Total	Age group				
		Under 28 days	28 days -5 mos.	6-11 mos.	1 year	2-4 years		Under 28 days	28 days -5 mos.	6-11 mos.	1 year	2-4 years
All causes	542	185	214	67	48	28	1 023	412	364	129	73	45
Infective and parasitic diseases ... 000-136	147	21	79	32	10	5	127	38	62	16	6	5
Diarrhea, other intestinal infectious diseases ... 000-009	121	11	72	29	7	2	76	14	43	11	6	2
Tuberculosis ... 010-019	1	-	-	-	-	1	2	-	-	-	-	-
Diphtheria ... 032	-	-	-	-	-	-	-	-	-	-	-	-
Whooping cough ... 033	1	-	1	-	-	-	-	-	-	-	-	-
Tetanus ... 037	-	-	-	-	-	-	-	-	-	-	-	-
Septicemia ... 038	9	8	1	-	-	-	43	23	15	4	-	1
Measles ... 055	3	-	1	1	1	-	1	-	1	-	-	-
Congenital syphilis ... 090	1	1	-	-	-	-	1	1	-	-	-	-
Moniliasis ... 112	-	-	-	-	-	-	1	1	-	-	-	-
Helminthiasis ... 120-129	-	-	-	-	-	-	-	-	-	-	-	-
Other infective and parasitic diseases ... Rest of 000-136	11	1	4	2	2	2	3	-	3	-	-	-
Leukemia ... 204-207	2	-	-	-	-	2	-	-	-	-	-	-
Malignant neoplasms, other ... 140-203, 208, 209	1	-	-	-	-	1	-	-	-	-	-	-
Neoplasms, benign and unspecified ... 210-239	1	-	1	-	-	-	-	-	-	-	-	-
Nutritional deficiency ... 260-269	20	-	11	5	3	1	148	8	83	32	17	8
Vitamin deficiency ... 260-266	-	-	-	-	-	-	-	-	-	-	-	-
Protein malnutrition ... 267	1	-	-	-	1	-	2	-	-	-	1	1
Nutritional marasmus ... 268	17	-	10	5	2	-	28	-	15	10	1	2
Other nutritional deficiency ... 269	2	-	1	-	-	1	118	8	68	12	15	5
Endocrine and metabolic diseases ... 240-258, 270-279	7	1	3	2	1	-	6	5	-	1	-	-
Deficiency anemias ... 280-281	-	-	-	-	-	-	9	4	1	-	1	3
Other diseases of blood and blood-forming organs ... 282-289	-	-	-	-	-	-	4	-	2	1	-	1
Inflammatory diseases of central nervous system ... 320-324	23	2	9	3	5	4	11	3	5	3	-	-
Other diseases of nervous system and sense organs ... 310-315, 330-389	9	-	-	5	3	1	19	-	9	4	3	3
Diseases of circulatory system ... 390-458	-	-	-	-	-	-	31	5	9	6	9	2
Pneumonia and influenza ... 470-486	91	13	61	9	7	1	127	29	56	23	14	5
Other diseases of respiratory system ... 460-466, 490-519	21	-	14	3	3	1	24	2	11	4	5	2
Diseases of digestive system ... 520-577	1	-	1	-	-	-	22	6	9	4	-	3
Diseases of genito-urinary system ... 580-629	1	-	1	-	-	-	15	-	10	4	-	1
Diseases of skin, subcutaneous tissue ... 680-709	4	4	-	-	-	-	9	3	4	1	1	-
Diseases of musculoskeletal system ... 710-738	-	-	-	-	-	-	-	-	-	-	-	-
Congenital anomalies ... 740-759	47	15	16	7	4	5	38	17	12	2	3	4
Nervous system and eye ... 740-744	11	3	2	1	1	4	7	3	-	-	2	2
Heart, circulatory system ... 746, 747	21	8	7	4	2	-	17	9	8	-	-	-
Respiratory system ... 748	-	-	-	-	-	-	-	-	-	-	-	-
Digestive system ... 749-751	9	2	5	1	-	1	1	-	1	-	-	-
Genito-urinary system ... 752, 753	-	-	-	-	-	-	2	1	-	-	-	1
Musculoskeletal system ... 754-756	1	-	1	-	-	-	1	-	-	1	-	-
Down's disease ... 759, 3	4	1	1	1	1	-	10	4	3	1	1	1
Other and unspecified ... 745, 757, 758, Rest of 759	1	1	-	-	-	-	-	-	-	-	-	-
Certain causes of perinatal mortality ... 760-778	128	125	3	-	-	-	287	275	12	-	-	-
Symptoms ... 780-789	-	-	-	-	-	-	123	11	70	27	10	5
Sudden death ... 795	11	1	9	1	-	-	-	-	-	-	-	-
Other ill-defined conditions ... 790-794, 796	3	-	3	-	-	-	-	-	-	-	-	-
External causes ... E800-E999	25	3	3	-	12	7	23	6	9	1	4	3

## Appendix I H

Inter-American Investigation of Mortality in Childhood  
Underlying and Associated Causes of Death in Children Under 5 Years of Age by Age Group  
Sao Paulo, Brazil, June - December, 1968  
(Provisional Data)

Cause	Underlying cause						Associated cause					
	Total	Age group					Total	Age group				
		Under 28 days	28 days -5 mos.	6-11 mos.	1 year	2-4 years		Under 28 days	28 days -5 mos.	6-11 mos.	1 year	2-4 years
All causes	1188	517	387	124	77	83	2 317	898	863	260	156	140
Infective and parasitic diseases . . . 000-136	400	101	189	53	27	30	317	58	133	57	38	31
Diarrhea, other intestinal infections												
diseases . . . . . 000-009	275	77	163	29	2	4	177	28	81	37	15	16
Tuberculosis . . . . . 010-019	8	-	1	2	1	4	3	-	-	-	-	3
Diphtheria . . . . . 032	2	-	1	-	-	1	-	-	-	-	-	-
Whooping cough . . . . . 033	15	-	8	3	2	2	1	-	-	1	-	-
Tetanus . . . . . 037	3	3	-	-	-	-	-	-	-	-	-	-
Septicemia . . . . . 038	14	11	3	-	-	-	31	11	13	2	2	3
Measles . . . . . 055	46	-	3	11	18	14	2	-	-	2	-	-
Congenital syphilis . . . . . 090	3	3	-	-	-	-	1	-	1	-	-	-
Moniliais . . . . . 112	5	5	-	-	-	-	59	18	25	7	5	-
Helminthiases . . . . . 120-129	2	-	-	1	-	1	28	-	2	3	14	9
Other infective and parasitic diseases . . . . . Rest of 000-136	27	2	10	7	4	4	15	1	7	5	2	-
Leukemia . . . . . 204-207	5	-	-	-	2	3	-	-	-	-	-	-
Malignant neoplasms . . . . . 140-203												
other . . . . . 208,209	5	-	-	-	-	5	-	-	-	-	-	-
Neoplasms, benign and unspecified 210-239	1	1	-	-	-	-	-	-	-	-	-	-
Nutritional deficiency . . . . . 260-269	40	2	9	13	12	4	342	47	182	58	28	27
Vitamin deficiency . . . . . 260-266	-	-	-	-	-	-	2	-	-	-	2	-
Protein malnutrition . . . . . 267	11	-	-	-	7	4	12	-	1	3	2	6
Nutritional marasmus . . . . . 268	26	1	9	12	4	-	84	5	56	15	2	6
Other nutritional deficiency . . . . . 269	3	1	-	1	1	-	244	42	125	40	22	15
Endocrine and metabolic diseases . . . . . 240-258,270-279	3	1	-	1	-	1	4	1	3	-	-	-
Deficiency anemias . . . . . 280-281	-	-	-	-	-	-	4	3	1	-	-	-
Other diseases of blood and blood-forming organs . . . . . 282-289	1	-	-	1	-	-	56	4	27	14	8	3
Inflammatory diseases of central nervous system . . . . . 320-324	26	2	10	9	4	1	18	4	10	3	1	-
Other diseases of nervous system and sense organs . . . . . 310-315,330-389	50	6	26	13	1	4	26	3	13	3	4	3
Diseases of circulatory system . . . . . 390-458	4	-	-	1	2	1	46	5	17	8	7	9
Pneumonia and influenza . . . . . 470-486	188	65	82	20	12	9	273	67	103	44	34	25
Other diseases of respiratory system . . . . . 460-466,490-519	30	1	14	3	6	6	47	2	20	6	12	7
Diseases of digestive system . . . . . 520-577	8	3	4	-	-	1	36	8	23	2	-	3
Diseases of genito-urinary system . . . . . 580-629	10	-	7	2	-	1	24	5	11	4	2	2
Diseases of skin, subcutaneous tissue . . . . . 680-709	1	-	1	-	-	-	22	4	12	4	1	1
Diseases of musculoskeletal system . . . . . 710-738	-	-	-	-	-	-	1	-	1	-	-	-
Congenital anomalies . . . . . 740-759	68	26	27	5	3	7	47	16	21	4	1	5
Nervous system and eye . . . . . 740-744	16	6	7	1	-	2	7	1	5	1	-	-
Heart, circulatory system . . . . . 746,747	36	13	15	2	2	4	19	8	8	1	-	2
Respiratory system . . . . . 748	-	-	-	-	-	-	2	2	-	-	-	-
Digestive system . . . . . 749-751	14	6	5	2	1	-	6	3	3	-	-	-
Genito-urinary system . . . . . 752,753	-	-	-	-	-	-	2	-	1	1	-	-
Musculoskeletal system . . . . . 754-756	-	-	-	-	-	-	2	-	-	1	-	1
Down's disease . . . . . 759,3	1	-	-	-	-	1	8	2	4	-	1	1
Other and unspecified . . . . . 745,757,758 Rest of 759	1	1	-	-	-	-	1	-	-	-	-	1
Certain causes of perinatal mortality . . . . . 760-778	304	296	8	-	-	-	588	549	39	-	-	-
Symptoms . . . . . 780-789	1	1	-	-	-	-	448	114	242	52	17	23
Sudden death . . . . . 795	9	2	5	-	1	1	-	-	-	-	-	-
Other ill-defined conditions . . . . . 790-794,796	12	6	3	2	1	-	-	-	-	-	-	-
External causes . . . . . E800-E999	22	4	2	1	6	9	18	8	5	1	3	1

## Appendix II

### Inter-American Investigation of Mortality in Childhood

Number of Deaths under 5 Years of Age by Calendar  
Month for 8 Projects  
(Provisional Data)

Month	Kingston Area	La Paz	Monterrey	Recife	San Juan Province	San Salvador Area	Santiago Area	São Paulo
1968								
June	97	-	-	-	-	-	-	170
July	78	159	-	133	-	-	73	171
August	110	134	180	125	63	-	86	143
September	73	127	178	175	101	128	57	149
October	95	124	167	163	99	107	70	179
November	85	135	178	156	106	165	61	187
December	82	117	177	169	104	133	73	189
1969								
January	-	-	171	-	102	143	67	-
February	-	-	-	-	-	150	55	-
Total	620	796	1 051	921	575	826	542	1 188

## Appendix III

Number of Families of Deceased Children under 5 Years of  
Age by Social Interview for 8 Projects

(Provisional Data)

Project	Total	Interview	
		With	Without
Kingston Area	620	577	43
La Paz	796	511	285
Monterrey	1 051	862	189
Recife	921	834	87
San Juan Province	575	547	28
San Salvador Area	826	782	44
Santiago Area	542	447	95
São Paulo	1 188	985	203

## Appendix IV

## Inter-American Investigation of Mortality in Childhood

Number of Deaths from Diarrheal Disease (009) by Month of Age  
under 2 Years for 8 Projects

(Provisional Data)

Month of Age	Kingston Area	La Paz	Monterrey	Recife	San Juan Province	San Salvador Area	Santiago Area	São Paulo
Total	127	154	249	200	134	242	116	266
Under 1 month	27	22	33	22	36	21	12	83
1 month	5	8	27	39	7	24	12	50
2 months	3	11	45	39	15	36	18	37
3 months	8	7	31	31	17	27	19	35
4 months	6	9	30	9	18	16	10	15
5 months	12	6	13	13	13	19	10	15
6 months	7	10	14	14	4	18	9	5
7 months	8	5	8	3	3	11	5	8
8 months	6	8	6	7	5	14	3	10
9 months	8	11	11	2	1	12	5	2
10 months	7	5	5	5	4	9	1	3
11 months	13	7	7	1	4	6	5	1
1 year 0 months	2	10	1	2	1	5	2	-
1 year 1 month	5	4	1	1	2	7	-	-
1 year 2 months	3	2	3	-	2	2	2	-
1 year 3 months	1	4	1	2	1	2	1	-
1 year 4 months	1	5	3	1	-	3	-	1
1 year 5 months	2	5	2	1	1	1	-	-
1 year 6 months	-	6	3	3	-	3	-	1
1 year 7 months	2	4	1	-	-	2	-	-
1 year 8 months	-	3	1	1	-	1	-	-
1 year 9 months	1	-	1	2	-	-	1	-
1 year 10 months	-	2	1	-	-	2	-	-
1 year 11 months	-	-	1	2	-	1	1	-

Appendix V

Inter-American Investigation of Mortality in Childhood  
 Number of Deaths from Measles in 3-Month Age Groups under  
 5 Years in 6 Projects

(Provisional Data)

Age group in months	La Paz	Monterrey	Recife	San Juan Province	San Salvador Area	São Paulo
Total	159	71	195	67	50	46
Under 3	3	-	-	1	1	-
3 - 5	4	5	8	6	1	3
6 - 8	10	10	19	8	4	8
9 - 11	26	9	26	14	10	3
12 - 14	21	7	28	12	10	10
15 - 17	18	8	27	10	5	3
18 - 20	13	9	16	4	4	4
21 - 23	14	5	11	3	2	1
24 - 26	10	5	8	1	5	4
27 - 29	2	5	16	-	4	3
30 - 32	6	1	13	-	-	-
33 - 35	4	1	5	-	-	4
36 - 38	8	1	4	1	-	1
39 - 41	6	3	3	-	-	-
42 - 44	3	-	3	2	2	-
45 - 47	4	-	3	3	-	-
4 years	7	2	5	2	2	2

Appendix VI

Number of Deaths from Measles by Calendar Month for  
 6 Projects

(Provisional Data)

Calendar Month	La Paz	Monterrey	Recife	San Juan Province	San Salvador Area	São Paulo
1968						
June	-	-	-	-	-	4
July	30	-	17	-	-	9
August	29	17	20	-	-	3
September	38	14	45	3	4	6
October	17	15	32	17	7	5
November	31	14	43	19	9	6
December	14	5	38	19	6	13
1969						
January	-	6	-	9	8	-
February	-	-	-	-	16	-
Total	159	71	195	67	50	46

Appendix VII

Inter-American Investigation of Mortality in Childhood

Underlying and Associated Causes of Neonatal Deaths with Estimated Annual Rates per 10,000 Live Births in 8 Projects

(Provisional Data)

Cause	Kingston Area				La Paz				Monterrey				Recife			
	Underlying Cause Num-ber	Rate	Associated Cause Num-ber	Rate	Underlying Cause Num-ber	Rate	Associated Cause Num-ber	Rate	Underlying Cause Num-ber	Rate	Associated Cause Num-ber	Rate	Underlying Cause Num-ber	Rate	Associated Cause Num-ber	Rate
Total	323	245	593	449	166	221	224	299	330	200	710	430	251	322	416	533
Infective and parasitic diseases . . . . . 000-136	56	42	64	48	31	41	13	17	60	36	76	46	25	32	46	59
Diseases of respiratory system . . . . . 460-519	12	9	31	23	53	71	30	40	38	23	71	43	17	22	34	44
Congenital anomalies 740-759	22	17	22	17	3	4	5	7	24	15	5	3	15	19	11	14
Certain causes of perinatal mortality . . . 760-778	216	164	421	319	70	93	132	176	195	118	437	265	177	227	287	368
Maternal conditions 760-763	38	29	17	13	8	11	5	7	20	12	16	10	8	10	7	9
Birth injury and difficult labor . . . . . 764-768, 772	26	20	24	18	17	23	7	9	40	24	32	19	35	45	10	13
Conditions of cord and placenta . . . . 770, 771	3	2	6	5	4	5	6	8	23	14	15	9	15	19	6	8
Hemolytic disease of newborn . . . . . 774, 775	6	5	-	-	2	3	-	-	3	2	-	-	3	4	-	-
Anoxic, hypoxic conditions . . . . . 776	73	55	73	55	28	37	17	23	67	41	119	72	83	106	56	72
Immaturity unqualified . . 777	16	12	224	170	3	4	75	100	4	2	170	103	19	24	148	190
Other . . . . . 769, 778	54	41	77	58	8	11	22	29	38	23	85	52	14	18	60	77
Other causes	17	13	55	42	9	12	44	59	13	8	121	73	17	22	38	49
	San Juan Province				San Salvador Area				Santiago Area				São Paulo			
Total	201	359	518	925	208	251	317	382	185	193	412	429	517	329	898	572
Infective and parasitic diseases . . . . . 000-136	45	80	73	130	50	60	22	27	21	22	38	40	101	64	58	37
Diseases of respiratory system . . . . . 460-519	20	36	37	66	9	11	35	42	13	14	31	32	66	42	69	44
Congenital anomalies 740-759	5	9	4	7	18	22	8	10	15	16	17	18	26	17	16	10
Certain causes of perinatal mortality . . . 760-778	122	218	298	532	116	140	198	239	125	130	275	286	296	189	549	350
Maternal conditions 760-763	8	14	14	25	21	25	12	14	8	8	19	20	23	15	30	19
Birth injury and difficult labor . . . . . 764-768, 772	40	71	24	43	19	23	12	14	26	27	26	27	57	36	34	22
Conditions of cord and placenta . . . . 770, 771	9	16	6	11	14	17	2	2	12	13	6	6	25	16	7	4
Hemolytic disease of newborn . . . . . 774, 775	6	11	2	4	6	7	1	1	6	6	2	2	8	5	3	2
Anoxic, hypoxic conditions . . . . . 776	36	64	66	118	32	39	54	65	46	48	63	66	130	83	104	66
Immaturity unqualified . . 777	1	2	123	220	2	2	97	117	2	2	116	121	18	11	280	178
Other . . . . . 769, 778	22	39	63	112	22	27	20	24	25	26	43	45	35	22	91	58
Other causes	9	16	106	189	15	18	54	65	11	11	51	53	28	18	206	131