

MORTALITY IN CHILDREN UNDER 15 YEARS OF AGE IN CALI, COLOMBIA ¹

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By means of a sampling of deaths of children under 15, an attempt is made to evaluate the characteristics of medical certification and its effect on the analysis of causes of death in Cali, Colombia.

Introduction

Quantitative and qualitative data on the characteristics of the community to be served are of fundamental importance to the planning of public health activities. In Colombia, as a result of the requirements enforced with respect to burials, quite complete information on the number of deaths is obtainable from death certificates. Their value is diminished, however, not only by the inadequacy of the data they contain but also by the subjective nature of many of them. It is not unusual for diseases regarded as having a social stigma (syphilis, tuberculosis, and even cancer) to be listed as something else, which confuses subsequent analysis of causes of death.

The recording of deaths by cause, supplanting the old, less specific count of total deaths, which indicated only the general mortality rate, was a major victory for epidemiology. It contributed greatly to knowledge of the history of diseases, since it reveals trends in the mortality caused by each of them.

In Colombia, mortality statistics are the only index available for studying and demonstrating the extent of the changes brought about by community health programs and for

setting priorities for these programs, since morbidity records are not adequately kept. But the statistical analysis of death certificates can be no more accurate than the data on cause of death as determined by the physician, who is the person responsible for this part of the certificate. Cali was one of the cities included in the Inter-American Investigation of Mortality,⁵ which was conducted under the sponsorship of the Pan American Health Organization in 10 cities in Latin America, one in the United States, and one in England (1). Over a period of two years the investigators studied the deaths among persons from 15 to 74 years of age in urban Cali, and their preliminary conclusions mentioned the low quality of the death certificates (2).

This paper describes the efforts carried out to complete the picture of mortality in Cali and make possible a better determination of the reliability of the city's vital statistics. The local physicians cooperated in this work.

Method of Work

The study took for its basic the death certificates of children under 15 years of age signed by Cali physicians during the period from 1 July 1964 to 30 June 1965. Every week the Municipal Statistical Office furnished copies of the forms used for issuing death certificates, which were divided, after those for nonresidents had been discarded,

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⁵PAHO Scientific Publication 151, *Patterns of Urban Mortality—Report of the Inter-American Investigation of Mortality* (1967).

into three groups: (1) children under 1 year; (2) children between 1 and 4 years; and (3) children from 5 to 14. From each of these groups a random sample of 25 per cent was selected.

A nurse trained in epidemiological work first visited the family of the deceased to collect information on the medical care received by the child during his last year and particularly during his last illness. She also appraised such data as the condition of the parents' dwelling and their socioeconomic level and occupation, and verified their residence, using as a criterion—independent of their length of stay in Cali—whether they intended to stay in the city or had come merely to seek medical treatment. In the case of children under 1 year questions were asked about prenatal care, attendance at confinement, complications of the mother during pregnancy, the weight, size, and condition of the newborn infant, and so on; the mother's opinion about the causes of the child's death was also solicited. As part of the epidemiology program, a resident physician from the Department of Preventive Medicine visited at the same time the doctor who had signed the certificate in order to reconstruct the clinical history. When the child had received care at a hospital or health center, the records were reviewed. If the certifying physician did not remember the patient, or if death had occurred without medical attendance, the residents visited the family to obtain better information on the course of the disease.

Periodically, the working group, which was composed of two of the authors (Llanos and Escobar), the resident physicians, the nurse, and a pathologist, reviewed the completed histories to discuss each one and determine the basic cause of death. When all agreed on one diagnosis, a single cause was assigned and given a value of three points; when, in the judgment of the group, there were two causes to which the death could be attributed, one more important than the

other, two points were assigned to the former and one to the latter; in the few cases in which there was not unanimous agreement, three causes were indicated and each was given one point. To tabulate according to this system of weighted values, the totals for each cause were added up and divided by three to obtain the weighted number of deaths due to that cause in the group. This is why fractions sometimes occur; they are merely the result of this artificial system.

Emphasis was laid on the child's nutritional state, which was classified according to the weight standard used by Mexican authors (3). Subsequently the data were codified in accordance with the seventh revision of the *International Classification of Diseases* (4) and processed on IBM equipment.

Results

Descriptive Data

During the period of the study there were 2,595 deaths in Cali of children under 15. Of these, the certificates for 615 (23.7 per cent) were reviewed; eight cases were later discarded for not meeting the requirements of the study (six because of nonresidency, one for proving on investigation to be older than 15, and another for being confirmed as a stillbirth).

Table 1 shows the distribution of the deaths studied by age and sex, and also the percentage represented by the sample in

TABLE 1—Distribution of Deaths Studied, by Age and Sex, and Percentage Represented by the Sample in Each Age Group, Cali, Colombia, 1965.

Age group	Sex		Total	
	Male	Female	No.	Sample (%)
Under 1 month	108	62	170	23.2
1-11 months	138	124	262	25.2
1-4 years	78	71	149	22.0
5-14 years	17	9	26	17.4
Total (Sample %)	341 23.3	266 23.4	607	23.4

TABLE 2—Infant Mortality Rates, Cali, Colombia, 1965.

Sex	Live births	Deaths under 1 year	Infant mortality rate ^a
Male	12,364	1,013	81.9
Female	12,117	755	62.3
Both sexes	24,481	1,768	72.2

^a Deaths per 1,000 live births.

each age group. It may be observed that the 5-to-14 group is the least represented, which should be borne in mind in examining the results. It is worth while to emphasize that almost three quarters of the total number of deaths (71.3 per cent) were of children under 1 year—a reflection of the high infant mortality in Colombia. From the birth records during the same period (5) the mortality rates in Table 2 were calculated. These two tables indicate that the risk of death is higher among male children than among girls, which remains true of the other age groups considered.

Table 3 shows the percentage of visits that could not be carried out, either because of incorrect address or because the family had moved, as is common in Colombia when a death occurs in a house. Owing to transportation problems, it was difficult to visit the families of the dead children without delay.

The high proportion of home visits not carried out accords with the high number of deaths for which the causes could not be clarified and consequently a definitive diagnosis could not be reached. An attempt was also made to evaluate the kind of medical

TABLE 3—Distribution of Visits to Families of Children Who Died, by Age Groups, Cali, Colombia, 1965.

Age group	Home visit		% not visited
	Yes	No	
Under 1 month	96	74	43.5
1-11 months	141	121	46.2
1-4 years	73	76	51.0
5-14 years	18	8	30.8
Total	328	279	46.0

care received by the child during his last illness; the results are presented in Table 4. The table shows that 17.3 per cent of the children received no medical care; but if those attended by a physician only in the last hours of their illness (19 per cent) are included, the figure jumps to 36.3 per cent.

It is important to note that the tendency to take a child at once for medical attention decreases as he grows, since the proportion of deaths without medical care or with care only in the last hours of illness reaches 73.1 per cent in the 5-to-14 age group.

Analysis of Causes

In analyzing the causes of death the system used to obtain the basic cause should be borne in mind. Table 5 summarizes the findings, which show that in the great majority of cases (76.2 per cent) the investigators agreed on the assignment of a single cause. Only in eight cases (1.3 per cent) were three possibilities considered.

In only 22 of the deaths was there a

TABLE 4—Distribution of Child Deaths According to Medical Care Received during Last Illness, by Age, Cali, Colombia, 1965.

Medical care before death	Deaths and percentage by age				
	% of 170 (under 1 month)	% of 262 (1-11 months)	% of 149 (1-4 years)	% of 26 (5-14 years)	% of 607 (all ages)
None	18.8	13.7	16.2	50.0	17.3
Less than 48 hours	10.0	23.3	21.0	23.1	19.0
More than 48 hours	60.6 ^a	40.8	38.5	26.9	45.2
No data available	10.6	22.2	24.3	—	18.5

^a Including infants under 48 hours seen by a physician before their death.

TABLE 5—Distribution of Deaths by Number of Diagnoses Assigned in the Investigation, Cali, Colombia, 1965.

No. of diagnoses	Deaths by age				
	% of 170 (under 1 month)	% of 262 (1-11 months)	% of 149 (1-4 years)	% of 26 (5-14 years)	% of 607 (all ages)
1	87.0	71.0	70.3	92.3	76.2
2	13.0	27.9	26.4	7.7	22.5
3	—	1.1	3.3	—	1.3

complete autopsy; in 64, medicolegal autopsies, which are of very poor quality in Cali, were carried out. Thus the majority of the cases were discussed on the basis of their clinical history, with very few laboratory findings. Tables 6 and 7 present the causes of death grouped according to the *International Classification*. A mere look at these tables, which supplement the data in the appendix, indicates the differences between the information on the certificates (that is, what the certifying physician declared) and that uncovered in the study. It is notable that on the death certificates diseases of the digestive system amount to almost 40 per cent

and are in first place, whereas the investigation placed them in second place, with only 24 per cent, which is reflected also in the appendix under listing for "Gastroenteritis" in the various age groups. Another significant finding is the slight importance attributed by the physicians to nutritional diseases as a cause of death. According to the certificates only 6 of the deaths (1 per cent) were from this cause; in the investigation, on the other hand, almost 30 deaths (4.9 per cent) were attributed to this cause. If to these are added the 36.6 deaths that, in accordance with the *International Classification*, are included in "Certain diseases of early infancy"

TABLE 6—Causes of Death in Children under 15 Years of Age by Diagnoses Assigned on Death Certificate, According to the International Classification of Diseases, Cali, Colombia, 1965.

Order	Inter-national code	Group of diagnoses	Age groups				All ages	Per cent
			Under 1 month	1-11 months	1-4 years	5-14 years		
1	IX	Diseases of the digestive system	—	163	78	1	242	39.9
2	XV	Certain diseases of early infancy	123	9	—	—	132	21.7
3	I	Infective and parasitic diseases	10	27	20	6	63	10.4
4	VIII	Diseases of the respiratory system	1	41	19	1	62	10.2
5	XIV	Congenital malformations	28	8	2	—	38	6.3
6	E-XVII	Accidents and poisonings	1	—	9	13	23	3.8
7	VI	Diseases of the nervous system and sense organs	3	8	8	2	21	3.4
8	III	Nutritional diseases	—	—	6	—	6	1.0
9	II	Neoplasms	—	—	3	2	5	0.8
10	VII	Diseases of the circulatory system	1	2	1	—	4	0.6
11	X	Diseases of the genito-urinary system	—	2	1	—	3	0.5
12	XIII	Diseases of the bones and organs of movement	—	—	1	1	2	0.3
13	XVI	Symptoms and ill-defined conditions	3	2	1	—	6	1.0
		All causes	170	262	149	26	607	100.0

TABLE 7—Causes of Death in Children under 15 Years of Age by Diagnoses Assigned in the Investigation, According to the International Classification of Diseases, Cali, Colombia, 1965.

Order	Inter-national code	Group of diagnoses	Age groups				All ages	Per cent
			Under 1 month	1-11 months	1-4 years	5-14 years		
1	XV	Certain diseases of early infancy	110.0	38.3	—	—	148.3	24.5
2	IX	Diseases of the digestive system	—	103.4	42.7	—	146.1	24.1
3	I	Infective and parasitic diseases	9.0	18.3	13.3	6.0	46.6	7.7
4	VIII	Diseases of the respiratory system	1.0	33.0	11.3	0.3	45.6	7.5
5	XIV	Congenital malformations	24.0	5.0	3.0	—	32.0	5.3
6	III	Nutritional diseases	—	0.3	28.6	0.7	29.6	4.9
7	E-XVII	Accidents and poisonings	—	1.0	10.0	13.7	24.7	4.1
8	VI	Diseases of the nervous system and sense organs	4.0	6.0	6.0	2.3	18.3	3.0
9	II	Neoplasms	—	—	2.0	2.0	4.0	0.6
10	XIII	Diseases of the bones and organs of movement	—	—	1.0	1.0	2.0	0.3
11	X	Diseases of the genito-urinary system	—	—	1.0	—	1.0	0.2
12	VII	Diseases of the circulatory system	—	0.3	—	—	0.3	—
13	XVI	Symptoms and ill-defined conditions	22.0	56.3	30.0	—	108.3	17.8
		All causes	170.0	261.9	148.9	26.0	606.8	100.0

under the heading "Nutritional maladjustment" (772) as a product of malnutrition, the total rises to 66.6 deaths, or 11 per cent. Malnutrition would thus be the third major cause of death.

This shows up even more clearly in the appendix, where the investigation shows nutritional maladjustment as the second most important cause of death in children from 1 to 11 months, with almost 14 per cent of the deaths, whereas on the certificates it does not appear at all. The same thing happens in the 1-to-4-year group, in which malnutrition occupies fourth place (4 per cent) on

the certificates and second place (19.2 per cent) in the investigation.

Table 8 shows the nutritional state of the children studied, classified according to the weight standard used by the Mexican authors. As can be seen, only 47.6 per cent of the children are of "normal weight," even though this column includes all those on whom there was no information about nutritional state. That is, the 52.4 per cent of cases of malnutrition should be considered a minimum; the real number must be somewhat higher. All stages of malnutrition were found primarily in the 1-to-11-month and

TABLE 8—Distribution of Deaths of Children 1 Month to 14 Years of Age, by Nutritional State as Determined from Clinical History, Cali, Colombia, 1965.

Age group	Normal weight	Malnutrition				Total
		I	II	III	Unqualified	
1-11 months	122	5	30	52	53	262
1-4 years	62	—	13	46	28	149
5-14 years	24	—	—	1	1	26
Total	208	5	43	99	82	437
(%)	(47.6)	(1.1)	(9.8)	(22.7)	(18.8)	(100.0)

the 1-to-4-year groups, as had been expected, since at those ages the child is completely dependent and is growing rapidly, so that the lack of an adequate diet is quickly apparent in the form of malnutrition.

Comments

A knowledge of the causes of death in a community depends on the medical certification of death, since the subsequent stages of compilation, codification, and tabulation of data are performed adequately in most countries. The basic error of many inaccurate mortality statistics thus lies in that first stage; in turn, the lack of importance attributed to vital statistics is due to their poor quality, and unfortunately little is being done to improve them.

It is obvious that the physician often signs the death certificate just to get out of the situation and make his escape from the family. This explains the considerable differences between the true cause of death and the one to which he has attested. Moreover, it is only recently that our medical schools have begun to teach the true importance of tabulating the causes of death; as a result, physicians have not been interested in properly filling out the certificate.

One means of improving the statistics, perhaps the right one for promoting the proper certification of death, is to establish registration areas similar to those created in the United States at the beginning of this century. In this way, and with periodic studies like the one described, more would come to be known about mortality trends in the Latin American countries.

It may be that one reason for the poor representation of malnutrition among the causes of death is the "sole cause" system, which overlooks equally important contributing causes. In addition, the physician, obses-

sed by gastroenteritis, finds no one to blame for the high infant mortality.

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Summary

In 1964-1965, with a view to obtaining detailed knowledge of the problem of mortality in Cali, Colombia, a study was carried out on the basis of a method similar to that of the Inter-American Investigation of Mortality. A sampling was taken of data on deaths among children under 15 years of age and all clinical, pathological, laboratory and other data were carefully investigated; a clearer idea of the causes of death was thus obtained. The findings of this investigation were compared with the data contained in death certificates (which provide the basis for official statistics), and it was noted that, among the cases of death, nutritional diseases appeared more frequently in the study findings than in the certificates, whereas the exact opposite occurred in the case of diarrheal diseases.

It was concluded that the inaccuracies of mortality statistics are due, basically, to errors in medical certification. In most countries, the subsequent phases of compilation, codification, etc., are carried out satisfactorily. With a view to improving these statistics and obtaining better knowledge of mortality trends in the Latin American countries, it is recommended that medical schools continue to attribute to adequate certification and tabulation the importance that they deserve. It is also recommended that registration areas be established, similar to those created in the past in the United States, and, furthermore, that studies such as the present one be carried out periodically in order to evaluate progress achieved. □

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Appendix

COMPARISON OF PRINCIPAL CAUSES OF DEATH IN CHILDREN UNDER 15 YEARS OF AGE, ACCORDING TO THE CERTIFICATES OF DEATH AND THE ASSIGNMENT MADE IN THE INVESTIGATION, CALI, COLOMBIA, 1965

(Numbers in parentheses are those from the *International Classification of Diseases, WHO, seventh revision*)

A. Under 1 month (total deaths: 170)

Death Certificate	%	Investigation	%
1. Postnatal asphyxia and atelectasis (762)	21.8	1. Immaturity (774, 776)	26.9
2. Immaturity (774, 776)	14.7	2. Postnatal asphyxia and atelectasis (762)	11.9
3. Pneumonia (763)	11.8	3. Birth injury (760, 761)	8.2
4. Diarrhea of newborn (764)	8.2	4. Pneumonia (763)	5.7
5. Congenital malformations of heart (754)	7.6	5. Diarrhea of newborn (764)	4.7
All other causes	35.9	All other causes	42.6

B. From 1 to 11 months (total deaths: 262)

Death Certificate	%	Investigation	%
1. Gastroenteritis (571, 572)	62.2	1. Gastroenteritis (571, 572)	39.1
2. Bronchitis and bronchopneumonia (491, 500)	15.6	2. Nutritional maladjustment (malnutrition) (772)	13.8
3. Tuberculosis (001-008)	5.0	3. Bronchitis and bronchopneumonia (491, 500)	12.6
4. Purulent meningitis (057)	3.0	4. Whooping cough (056)	2.8
5. Whooping cough (056)	2.7	5. Purulent meningitis (057)	2.3
All other causes	11.5	All other causes	29.4

C. From 1 to 4 years (total deaths: 149)

Death Certificate	%	Investigation	%
1. Gastroenteritis (571, 572)	52.3	1. Gastroenteritis (571, 572)	28.6
2. Bronchitis and bronchopneumonia (491, 500)	12.7	2. Nutritional deficiency (280, 286)	19.2
3. Tuberculosis (001-008)	6.0	3. Bronchitis and bronchopneumonia (491, 500)	7.6
4. Nutritional deficiency (280-286)	4.0	4. Accidents in home (E-870, E-900, E-904, E-917, E-918)	5.4
5. Meningitis (057)	3.4	5. Whooping cough (056)	3.4
All other causes	21.6	All other causes	35.8

D. From 5 to 14 years (total deaths: 26)

Death Certificate	%	Investigation	%
1. Other and unspecified accidents (E-010-E-915, E-920-E-928, etc.)	26.9	1. Motor vehicle traffic accidents (E-810-E-835)	30.8
2. Accidental drowning (E-929)	19.2	2. Accidental drowning (E-929)	19.2
3. Epilepsy (353)	7.7	3. Epilepsy (353)	8.8
All other causes	46.2	4. Tuberculosis (010)	7.7
		All other causes	33.5