SPATIAL DISTRIBUTION OF PROPORTIONAL INFANT MORTALITY AND CERTAIN SOCIOECONOMIC VARIABLES IN SALVADOR, BAHIA, BRAZIL[1]

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INTRODUCTION

Reduction of infant mortality in developed countries *(1)* and, more recently, in Latin America *(2)* has stimulated research aimed at determining the reason for the decline and identifying the groups remaining at greatest risk with a view to adopting fairer social policies *(3, 4)*. In the case of Brazil, infant mortality has remained high but has shown a downward trend since the end of the 1970s *(5)*. However, studies of state capitals with reduced levels of infant mortality—such as São Paulo *(6)* and Pôrto Alegre *(7)*—have revealed the persistence of an extremely uneven distribution of deaths among infants (children under one year old) in these cities' different districts or neighborhoods.

In Salvador, capital of Bahia State and Brazil's fourth-largest city with a population of 1,501,981 (1980 census), infant mortality studies have undergone little methodologic change over time *(8, 9)*. As a result, the indicators used do not reveal the social or spatial distribution of mortality, nor do they show inequalities in the distribution of goods and services among the various segments of the population. Moreover, even if the infant mortality data showed the indicators most closely associated with death in the first year of life in each zone of Salvador, accurate analysis would be hindered because area-by-area data on the number of live births is lacking.

It was therefore decided to conduct a study using the ratio of infant deaths to total deaths in Salvador as an indicator for analyzing the spatial distribution of infant mortality. The aim of this study was to describe the distribution of infant deaths in each zone of the

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city of Salvador in 1980 and to examine possible correlations between infant mortality and selected socioeconomic, sanitary, and health care variables. For this purpose it was initially assumed that proportional infant mortality (the ratio of infant deaths to total deaths) was higher in areas with a high percentage of low-income residents, a high prevalence of inadequate housing, poor water supplies, and scarce health services.

METHODOLOGY

Data on total and infant deaths among Salvador residents in 1980 were obtained by reviewing the death certificates filed at the Bahia State Health Secretariat's Health Information Center (CIS) (see the death certificate form shown in Annex 1). In the case of noninfant deaths, only certificate items 8 (date of birth), 9 (age), 13 (usual place of residence), and 14 (municipality) were noted. In the case of infant deaths, certificate items 3 (fetal death), 30 (time of death in relation to delivery), and 35 (causes of death) were also noted. In the case of incorrectly completed death certificates, the criteria adopted by the CIS were employed and fetal death was assumed in the case of:

(a) death certificates where the cause of death information indicated that the infant was "emaciated," even if the word "no" was checked under item 3, "fetal death";

(b) death certificates where the word "yes" was checked in item 3 under "fetal death," even if the basic cause of death could also apply to a live-born infant;

(c) death certificates where item 3 was not filled in or where both "yes" and "no" were checked, but where expressions such as "fetus of . . ." or "stillborn infant of . . ." were used in the item calling for the name of the infant, even if the basic cause of death could also apply to a live-born infant.

In addition, those death certificates that presented the greatest difficulty with regard to determination of fetal death were sent to the World Health Organization Center for the Classification of Diseases in Portuguese at São Paulo. Although these incorrectly completed certificates posed difficulties for the center as well, the suggestions made by the center were consistent with the criteria adopted for the present study. In the end, two certificates were considered unclassifiable and were excluded from the study, along with those taken as indicating fetal deaths.

During the data collection process, 912 death certificates from 1980 were found that had not been tabulated by the CIS. These included 261 certificates issued for deaths of infants and 651 issued for deaths occurring at other ages. Nearly all (907) of these certificates corresponded to deaths that occurred in January 1980 and were recorded primarily at various registries (Nina Rodriguez, Vitória, Santo Antonio, Brotas, and Nazaré) of the Medico-Legal Institute. (The other five deaths were recorded at other registries.) According to information from the CIS, these certificates were received by the health secretariat after the date established for final verification had passed, and accordingly were not included in the official publications. These 912 certificates were used in the present study; however, it should also be noted that the number of deaths below age one found by our researchers in the CIS files

(3,312) was smaller than the officially published number (3,608) *(10)*. Also, the situation in regard to deaths at other ages was the reverse; that is, 8,575 certificates were found in the CIS files, while the number published in the official statistical records was 8,099 *(10)*.[6] In all, 11,887 death certificates issued for 1980 fatalities among residents of the municipality of Salvador were included in the study; of these, 3,312 were taken to report the death of infants.

In order to assess the geographic distribution of these deaths, a series of maps prepared by the Salvador Metropolitan Region Development Enterprise (CONDER) was employed. These divided the municipality into 76 reporting zones on the basis of physical infrastructure, administrative and planning criteria, and compatibility with the census sectors adopted by the Brazilian Institutional Foundation of Geography and Statistics (see Figure 1).

In cases where the death certificate provided less than complete information on the decedent's place of residence (for instance, where the decedent's neighborhood was not clearly specified), various publications were consulted—including a list of streets, avenues, and ways arranged by neighborhood that was supplied by the Bahia Sanitation Enterprise (EMBASA); a table of standard land and contracting units; and (primarily) an atlas, maps, and index cards produced by the Metric Numbering Commission of the Salvador Municipal Government using the subdistricts and reporting zones adopted by CONDER. Whenever a decendent's neighborhood of residence could not be identified because there were streets with identical names in different neighborhoods, or because the street named on a certificate passed through several neighborhoods, the neighborhood to which the death was assigned was chosen by lot from among the various possible neighborhoods. In this way, 2.5% of the infant deaths and 3.0% of the noninfant deaths were assigned to specific reporting zones. The zones where over 10% of the deaths were assigned in this manner were zones 3, 6, 13, 19, 21, 35, 37, 46, 56, 64, and 74.

After this was done, 366 deaths remained unallocated because there was insufficient information to justify the procedure of allocation by lot. (In 199 cases no address was entered on the death certificate.) One hundred and sixty-six of these recorded deaths were infant fatalities, and in most (118) of these cases no address had been entered.

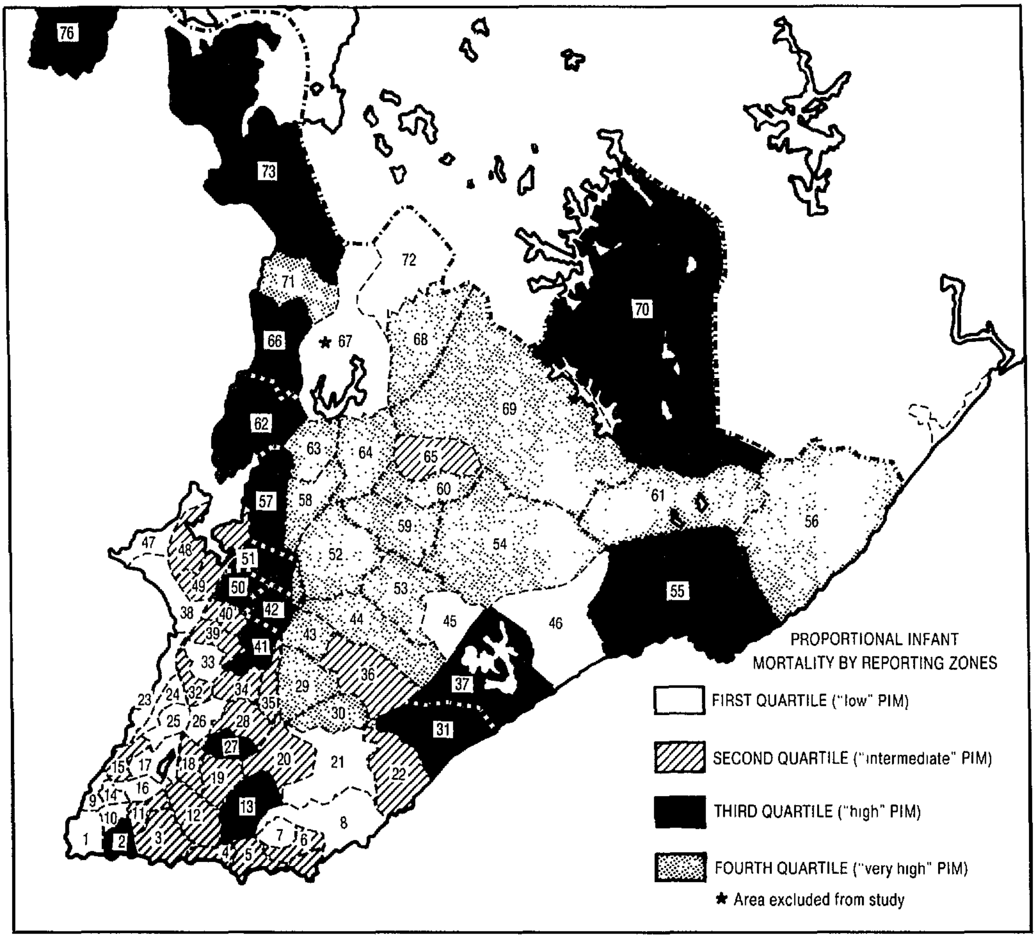
Because these 366 deaths remained unallocated, the study's neighborhood distribution data included a total of 11,521 fatalities (3,146 infant deaths and 8,375 noninfant deaths).

The following definitions were applied to data from the individual reporting zones:

- proportional infant mortality: the number of infant deaths as a percentage of total deaths;
- proportion of low-income families: the percentage of families with incomes not exceeding five times the minimum wage;
- proportion of "type C" housing: the percentage of substandard housing—as indicated by haphazard or disorderly surroundings, difficult access, open sewers, or less than 50 m^2 of covered area per dwelling;

[6] These differences arose from several problems related to transmittal of death certificates to the CIS and their subsequent processing.

FIGURE 1. Proportional infant mortality in the city of Salvador, 1980, by reporting zone quartiles. In the first quartile (considered to have a relatively "low" level) infant mortality ranged from 3.9% to 17.1% of total mortality; in the second (with an "intermediate" level) it ranged from 17.9% to 25.8%; in the third (with a "high" level) it ranged from 26.5% to 37.5%; and in the fourth (with a "very high" level) it ranged from 37.5% to 52.5%. For the name of each reporting zone and more detailed information compiled on it, see Annex 2.



- per capita water supply (indicator): water consumption in liters per inhabitant per day;
- residential density (crowding): the fractional number of residents per hundred square meters of residential area;
- availability of health center and health post physicians: the number of physicians available in heath centers and posts per 10,000 inhabitants;
- availability of maternity beds: the number of maternity beds per 1,000 inhabitants;
- availability of hospital beds (other than maternity beds): the number of hospital beds (other than maternity beds) per 1,000 inhabitants;
- education (indicator): the number of students enrolled in primary public schools per 100 inhabitants.

The data on numbers of inhabitants, crowding, and types of housing were furnished by CONDER. The information on water usage was collected at EMBASA. The income data were obtained from the Urban Development Master Plan prepared by the Central Planning Organization (OCEPLAN), an agency of the Municipal Government of Salvador. Information about the numbers of physicians staffing municipal health centers and posts in 1980 was provided by the First Regional Health Directorate and the Municipal Health Secretariat. Data on the numbers of maternity and other hospital beds were obtained from the "Cadastramento de Estabelecimentos de Saúde, 1980" (Survey of Health Establishments, 1980) *(11)* and from hospital statistics maps available at the CIS. The information on the number of beds at one hospital (the Professor Edgard Santos Hospital) is for 1981 because no survey of that hospital was made by the health secretariat in 1980. Data on the numbers of students enrolled at the various primary public schools in Salvador in 1980 were provided by the Bahia State Secretariat for Culture and Education and the Municipal Secretariat for Education and Culture.

After each type of information had been obtained for as many reporting zones as possible, the reporting zones were placed in one of four quartiles depending upon the level of proportional infant mortality, and the data for each quartile were analyzed collectively. Reporting zones with fewer than 1,000 inhabitants, those with a proportional infant mortality equal to zero, and those where indicators of the independent variables were unavailable were excluded from this analysis.[7] The Spearman correlation coefficient significance test was performed, using a level of statistical significance of $p<0.05$ with two degrees of freedom.

RESULTS

The spatial distribution of proportional infant mortality in the municipality of Salvador was found to be fairly uneven, ranging from 3.9% in the reporting zone including Vitória and Campo Grande (zone 9) in the center of the old city near the water to 52.5% in Aguas Claras (zone 69), an outlying area. The map in Figure 1 shows the reporting zones grouped into quartiles according to their levels of proportional infant mortality.

As the map indicates, zones in the "low" quartile were generally found near the shoreline of Todos os Santos Bay to the west of the city, a shoreline extending from Ribeira (zone 47) to Barra (zone 1). This is the general area of the city that was first developed. The "low" quartile also includes Pituba (zone 8) and Itaigara (zone 21), upper-middle-class neighborhoods near the Atlantic Coast that experienced rapid growth in the 1970s.

Most zones in the "intermediate" quartile were found toward the tip of the peninsula, starting around zone 36 ("19 BC") and including much of the heart of the city.

[7] Ten zones were excluded for these reasons and eight others were paired (see Annex 2), reducing the original total of 76 zones to 62 for purposes of analysis. Accordingly, each of the four quartiles contained either 15 or 16 zones (quartile 1—15; quartile 2—15; quartile 3—16; quartile 4—16).

However, most zones in the "high" quartile were found in outlying areas (and also in a few central slum areas), and most zones in the "very high" quartile were found in recently settled areas near the highways entering the city. These latter included many communities far removed from the city center that make up the so-called "periphery of Salvador."

Table 1 shows the average levels of proportional infant mortality observed for each quartile, together with the values of the independent variables selected for use in this study. Regarding income, there was a direct correlation between proportional infant mortality and low-income families, such that the proportion of low-income families rose from 23.1% in the first (low proportional infant mortality) quartile to 97.7% in the fourth quartile. Regarding water supplies, an inverse correlation appeared between proportional infant mortality and water consumption, with the "low" proportional infant mortality quartile consuming some 110 liters per inhabitant per day while the "very high" quartile was consuming only 64 liters per inhabitant per day.

Similarly, the percentage of "type C" housing (shacks) was directly associated with proportional infant mortality, rising from 2% in the first quartile to 43% in the fourth. Also, crowding was directly associated with proportional infant mortality, the number of inhabitants per square meter of domicile area going from 5.0 inhabitants per hundred square meters in the first quartile to 9.4 inhabitants per hundred square meters in the fourth.

There was also an inverse correlation between the average number of physicians per inhabitant and proportional infant mortality, the average number of physicians shrinking from 5.7 per 10,000 inhabitants in the first quartile to 1.8 in the fourth. However, maternity beds were available only in the first and fourth quartiles, while nearly all the other types of hospital beds were concentrated in the first quartile.

Finally, the average numbers of public primary school students per 100 inhabitants were somewhat higher in the first and second quartiles than in the third and fourth, but the differences involved were not clearly significant.

The right-hand column in Table 1 shows the correlation coefficients between proportional infant mortality and the aforementioned independent variables for the set of 62 reporting zones in the municipality of Salvador that were included in the study, as well as these correlations' respective levels of statistical significance.

Clear positive correlations were found between proportional infant mortality and the percentage of low-income families, the degree of residential crowding, and the proportion of type C housing ($r = 0.58$–0.72, $p < 0.001$). Also, a strong inverse correlation was found between proportional infant mortality and per capita water consumption ($r = -0.61$, $p < 0.001$).

Of the medical care indicators, however, only the number of hospital beds other than maternity beds per 10,000 inhabitants was found to have a weak inverse correlation with proportional infant mortality ($r = -0.25$, $p < 0.05$).

In the case of the education indicator (the average number of primary school students per hundred inhabitants), the association with proportional infant mortality was not found to be statistically significant ($r = 0.13$, $p > 0.05$).

TABLE 1. Levels of proportional infant mortality (PIM) and values of the selected independent variables in each reporting zone quartile in the municipality of Salvador, Bahia, Brazil in 1980. The right-hand column shows the correlation coefficient and p values derived from comparison of the PIM figures with the independent variable data (NS = not significant).

Variable	Reporting zone quartile: Low	Intermediate	High	Very high	Correlation coefficients and p values
Proportional infant mortality	11.8	21.7	31.6	42.5	
Income (percentage of "low-income" families)	23.1	67.0	83.5	97.7	+0.72($p<0.001$)
Water availability (liters consumed per inhabitant per day)	110.2	96.0	83.8	64.2	−0.61($p<0.001$)
Housing (percentage of "type C" housing units)	2	19	33	43	+0.58($p<0.001$)
Crowding (inhabitants per hundred square meters of residential area)	5.0	6.3	7.2	9.4	+0.58($p<0.001$)
Physicians per 10,000 inhabitants	5.7	2.7	2.1	1.8	+0.19(NS,$p>0.05$)
Maternity beds in hospitals per 1,000 inhabitants	0.4	0.0	0.0	0.4	+0.06(NS,$p>0.05$)
Other hospital beds per 1,000 inhabitants	3.6	0.1	0.1	0.0	−0.25($0.001<p<0.05$)
Education (primary schoolchildren per 100 inhabitants)	16.6	18.4	13.2	12.6	+0.13(NS,$p>0.05$)

Sources: Health Information Center (CIS) of the Bahia State Health Secretariat; Salvador Metropolitan Region Development Company (CONDER); Bahia Sanitation Enterprise (EMBASA); Secretaria Municipal de Saúde, Secretaria Municipal de Educação; Secretaria de Educação e Cultura.

Discussion

Analysis of the spatial distribution of infant mortality in Salvador reveals that an especially high proportion of those dying were infants residing in certain zones of the city, particularly outlying neighborhoods and slums. Even though proportional infant mortality does not really express the risk of death for a newborn in a given population the way the infant mortality coefficient can do, it does at least indicate localities where infant deaths account for an unusually large share of total deaths. Therefore, the findings obtained are important from a public health standpoint, partly because the proportional infant mortality indicator is derived from very basic information that is commonly available, and partly because it permits needs to be identified and indicates where services should be directed to meet those needs.

Regarding the observed correlations between proportional infant mortality and selected socioeconomic variables, a few words should be said about methodologic constraints on correlations of this kind *(12)*. Among other things, an "ecological" fallacy occurs when associations found to exist among groups of groups are interpreted as if they necessarily occurred among groups of individuals, i.e., as if group attributes corresponded to individual attributes. Thus, a study revealing a high degree of correlation between proportional infant mortality and the proportion of low-income households in a particular city district could not conclude, on the sole basis of those findings, that the infant deaths occurred in low-income households.

Nonetheless, because studies based on different designs have already shown associations between infant mortality and certain socioeconomic variables, the objections to studies of the "ecological" type in this particular case may be only partly valid. Furthermore, if the correlations found are not regarded as definitive causal relationships but rather as ones that provide significant information for health planning, the correlations indicated by such "ecological" studies as the one reported here can be considered relevant to public health.

Regarding the present study, all of the socioeconomic variables employed tend in some degree to reflect urban land use patterns; but there is no reason to suppose that they reflect the historical and social processes that led to those land use patterns.

Overall, however, and in spite of these contraints, there seems good reason to conclude that use of research designs such as the present one may be indicated until such time as available health data are broken down in terms of geographic and social differences, and until improvements in the quality of those data permit studies that are theoretically and methodologically more refined.

Starting from these premises, the findings reported here appear to demonstrate that the infant deaths studied were not evenly distributed throughout the city. Also, the various correlations found point up the importance of certain socioeconomic and sanitation variables in the spatial distribution of proportional infant mortality—an importance that appears far greater than that of locally available medical and hospital facilities.

Previous studies by Guerreiro et al. in Mexico *(3)*, Guimarães and Fischmann in Pôrto Alegre, Brazil *(7)*, and Monteiro et al. in São Paulo *(6)*, have also reported high mortality differentials indicating significant contrasts among diverse population groups. That by Guerriero et al. *(3)*, based on data for Mexico's Federal District, found proportional infant mortality to be 3.6 times greater in some localities than in others (and found proportional infant mortality due to diarrhea to be 5.6 times greater in some localities than in others). Similar results were obtained in Pôrto Alegre *(7)*, where it was found that outlying areas had an infant mortality coefficient twice as high as that found in the central city, a differential that was even wider in all areas when the rates among slum dwellers (75.5 infant deaths per thousand live births) and other residents (24.4 infant deaths per thousand live births) were compared. Contrasts such as these were also apparent in the study by Monteiro et al. *(6)*, which found proportional infant mortality to vary from 10.53% to 46.54%. These findings are generally consistent with the present Salvador study findings indicating that proportional infant mortality varied greatly from one set of districts to another, ranging from 11.8% of total mortality in the first quartile of reporting zones to 42.5% in the fourth. These combined findings suggest that the same social factors conditioning the use of urban land and the distribution of goods and services among the population also tend to influence proportional infant mortality in diverse districts of the study cities. Indeed, as Monteiro et al. *(6)* observed in São Paulo, the available public resources, instead of softening the impact of uneven income distribution among the inhabitants, seem to heighten the impact by providing the most adequate resources to the relatively prosperous districts that need them least.

In the particular case of health services, this pattern becomes worrisome to the extent that it tends to nullify the potential effects of primary care in reducing infant mortality *(13)*. Among other things, the concentration of health care facilities in parts of Salvador with better living conditions penalizes the residents of outlying areas by hindering their access to such facilities and reduces health care coverage for precisely those population groups that appear to run the greatest risk of disease and death.

Overall, the distribution of proportional infant mortality in the municipality of Salvador indicates not only a need to redefine the urban development model prevailing in Latin American cities but also to redefine the aims of the health services. It is not simply a question of seeking efficiency, efficacy, and effectiveness. If these three objectives are not accompanied by social policies that give priority to equity, it is possible to predict certain problems in attaining the proposed primary care goals implicit in the worldwide objective of "health for all by the year 2000."

Insofar as sanitation is concerned, despite the expansion of water-supply coverage in Brazilian state capitals during the 1970s, an expansion that in certain cases may explain recent reduction of infant mortality *(6)*, the business-oriented approach of the National Sanitation Plan (PLANASA) has hindered the extension of water-supply systems to low-income groups *(14)* that run the greatest potential risk from diarrheal disease.

Finally, it is worth noting that the highest correlation coefficient found in the present study was the coefficient of association between proportional infant mortality and the percentage of low-income residents. While this finding should not be surprising to students of infant mortality, it bolsters the hypothesis that economic structure plays a basic role as a factor in infant deaths, despite efforts to employ technologies that influence specific causes of morbidity and mortality in childhood. Hence, the recent decline in the rate of infant deaths in the city of Salvador *(5)* does not signify an improvement in the quality of life for the whole population, because the persistence of adverse social conditions among particular segments of the population is associated with substantial variations of infant mortality in different city districts.

SUMMARY

The study reported here, which was conducted in Salvador, Brazil, examines patterns of infant mortality in different portions of that city. Because the available 1980 data on the number of live births were not broken down by reporting zones, the study employs proportional infant mortality (the number of infant deaths as a percentage of all deaths) as an indicator. It also groups the city's reporting zones into quartiles according to their levels of proportional infant mortality and makes statistical comparisons between these quartiles with respect to various socioeconomic and medical indicators.

This analysis shows that proportional infant mortality varied greatly in the different quartiles—from 11.8% in the first to 42.5% in the fourth. It also finds clear and highly significant associations between proportional infant mortality and several socioeconomic and sanitation variables—these being the percentage of low-income families in the reporting zones, water consumption, the prevalence of substandard housing, and crowding. In contrast, no statistically significant associations were found between proportional infant mortality and the number of physicians per 10,000 inhabitants, the number of maternity beds in hospitals per 1,000 inhabitants, or the number of students in public primary schools per 100 inhabitants; and only a weak association was found between proportional infant mortality and the number of nonmaternity hospital beds per 1,000 inhabitants.

These findings demonstrate that the infant deaths studied were not evenly distributed throughout the city. They also point to an important association between certain socioeconomic and sanitation variables and infant survival. Finally, they suggest that a recent decline in the rate of infant deaths in Salvador *(5)* does not signify an improvement in the quality of life for the whole population—because of the persistence of adverse social conditions and relatively high proportional infant mortality in certain city districts.

REFERENCES

1 Grant, J. P. *Estado mundial de la infancia.* United Nations Children's Fund (UNICEF), Washington, D.C., 1984, 53 pp.

2 Rico-Velasco, J. Marco de referencia para el estudio de la mortalidad infantil: Políticas de salud y mortalidad infantil en las Américas. Mimeographed document. Paper presented at the Regional Workshop on Primary Care Strategies and Child Mortality held in Mexico City, Mexico, on 7–11 May 1984.

3 Guerreiro, R. L., S. A. L. L. López, O. Pedrotta, and R. Y. Pizarro. Mortalidad diferencial en el Distrito Federal. Mimeographed document. Pan American Health Organization, Mexico, D.F., Mexico, 1978, 37 pp.

4 Osuna, J. Enfoque de riesgo en la atención maternoinfantil. In: Pan American Health Organization. *Salud maternoinfantil y atención primaria en las Américas: Hechos y tendencias.* PAHO Scientific Publication 461. Washington, D.C., 1984.

5 Paim, J. S., and M. da C. N. Costa. Variação da mortalidade infantil em diferentes capitais brasileiras (1960–1979). *Rev Baiana Saúde Pública (Salvador)* July and December 1982, pp. 125–135.

6 Monteiro, C. A., M. H. D. Benício, and M. F. A. Baldijão. Mortalidade no primeiro ano de vida e a distribuição de renda e de recursos públicos de saúde, São Paulo (Brasil). *Rev Saúde Pública (São Paulo)* 14:515–539, 1980.

7 Guimarães, J. J. de L., and A. Fischmann. Desigualdades na mortalidade infantil entre favelados e não favelados no município de Pôrto Alegre, Rio Grande do Sul, em 1980. *Bol Of Sanit Panam* 101(1):19–38, 1986.

8 Paim, J. S. Indicadores sócio-econômicos e evolução da mortalidade infantil no Município de Salvador 1969–1977. *Rev Baiana Saúde Pública (Salvador)* January 1980 and June 1981, pp. 26–40.

9 Paim, J. S., C. N. Dias, and J. D. de Araújo. Influência de fatores sociais e ambientais na mortalidade infantil. *Bol Of Sanit Panam* 88(4):327–340, 1980.

10 Brasil, Ministério de Saúde, Secretaria Nacional de Ações Básicas de Saúde, Divisão Nacional de Epidemiologia. *Estatística de Mortalidade: Brasil: 1980.* Centro de Documentação, Brasília, 1983, 354 pp.

11 Bahia, Secretaria de Saúde, Centro de Estatística e Processamento de Dados. *Estabelecimentos de Saúde: Região Metropolitana de Salvador, Estado da Bahia, Cadastramento das Unidades de Saúde.* Salvador, 1980.

12 Almeida Filho, N. M. de. Problemas e perspectivas atuais da pesquisa epidemiológica em medicina social. In: C. A. de Souza and J. A. de A. C. Taddei (eds.). *Textos de Epidemiologia.* Secretaria de Planejamento, Conselho Nacional de Pesquisas—Coordenação Editorial, Brasília, 1984, pp. 9–37.

13 Taller sobre Atención Primaria y Mortalidad del Niño. Working document. Mexico City, Mexico, 7–11 May 1984.

14 *A. Construção.* Os erros da política centralizadora. *A. Construção (São Paulo)* 134:12–16, 1984.

ANNEX 1. Brazil's Death Certificate Form

DEATH CERTIFICATE NO.

I — REGISTRY

FEDERAL REPUBLIC OF BRAZIL
MINISTRY OF HEALTH

1 UNIT OF THE FEDERATION (NAME OF STATE OR TERRITORY)

2 REGISTRY
REGISTRATION NO.
REGISTRATION DATE

II — IDENTIFICATION OF THE DECEASED

3 FETAL DEATH
YES ☐ NO ☐

4 NAME

5 DATE OF DEATH

HOUR	DAY	MONTH	YEAR

6 MARITAL STATUS
SINGLE ☐ MARRIED ☐ WIDOWED ☐
SEPARATED ☐ OTHER ☐ UNKNOWN ☐

7 SEX
MALE ☐ FEMALE ☐ UNKNOWN ☐

8 DATE OF BIRTH

DAY	MONTH	YEAR

9 AGE

COMPLETE YEARS	LESS THAN A YR (MOS.)	LESS THAN A MO (DAYS)	LESS THAN A DAY (HRS.)	UNK

10 PLACE OF OCCURRENCE
HOSPITAL ☐ PUBLIC WAY ☐
HOME ☐ OTHER ☐ UNKNOWN ☐

11 ADDRESS

12 MUNICIPALITY

13 USUAL RESIDENCE (STREET, NUMBER, NEIGHBORHOOD, ETC.)

14 MUNICIPALITY

15 STATE OR TERR.

16 USUAL OCCUPATION OF DECEASED

17 BIRTHPLACE

18 EDUCATION
NONE ☐ PRIMARY ☐ SECONDARY ☐ HIGHER ☐ UNKNOWN ☐

PARENTS

19 FATHER'S NAME

20 MOTHER'S NAME

III — INFANT OR FETAL DEATH

FATHER

21 USUAL OCCUPATION

22 EDUCATION
NONE ☐ PRIMARY ☐ SECONDARY ☐ HIGHER ☐ UNKNOWN ☐

MOTHER

23 USUAL OCCUPATION

24 AGE

25 EDUCATION
NONE ☐ PRIMARY ☐ SECONDARY ☐ HIGHER ☐ UNKNOWN ☐

26 NO. OF CHILDREN BORN

LIVE BIRTHS	STILLBIRTHS	TOTAL

27 LENGTH OF GESTATION (IN WEEKS)
LESS THAN 20 ☐ 20-27 ☐ 28 OR MORE ☐ UNKNOWN ☐

28 PREGNANCY
SINGLE ☐ DOUBLE ☐ TRIPLE ☐ MORE ☐ UNKNOWN ☐

29 DELIVERY
SPONTANEOUS ☐ CESAREAN ☐ FORCEPS ☐ UNKNOWN ☐

30 DEATH (IN RELATION TO DELIVERY)
BEFORE ☐ DURING ☐ AFTER ☐ UNKNOWN ☐

31 FOR DEATHS OCCURRING BEFORE THE 28TH DAY OF LIFE OR FOR FETAL DEATHS, WEIGHT AT BIRTH
________g UNKNOWN ☐

IV — MEDICAL CERTIFICATION

32 RECEIVED MEDICAL CARE DURING THE ILLNESS THAT CAUSED DEATH

YES ☐ NO ☐ UNKNOWN ☐

33 THE UNDERSIGNED PHYSICIAN ATTENDED THE DECEASED

YES ☐ SUBSTITUTE ☐ IML ☐ SVO ☐ OTHER ☐

34 THE DIAGNOSIS WAS CONFIRMED

BY SUPPLEMENTARY EXAMINATION	BY SURGERY	BY AUTOPSY
YES ☐ NO ☐	YES ☐ NO ☐	YES ☐ NO ☐

35 CAUSE OF DEATH (ENTER ONLY ONE DIAGNOSIS PER LINE)

Interval from onset of disease to death

PART I

DISEASE OR PATHOLOGIC CONDITION THAT DIRECTLY CAUSED DEATH — a)__________

DUE TO OR AS A CONSEQUENCE OF

ANTECEDENT CAUSES

PATHOLOGIC CONDITIONS, IF ANY, THAT LED TO THE CAUSE CITED ABOVE. (ENTER THE BASIC CAUSE LAST) — b)__________

DUE TO OR AS A CONSEQUENCE OF

c)__________

36

PART II

OTHER SIGNIFICANT PATHOLOGIC CONDITIONS THAT CONTRIBUTED TO DEATH BUT WERE UNRELATED TO THE DISEASE OR PATHOLOGIC CONDITION THAT RESULTED IN DEATH

V — VIOLENCE

37 TYPE

HOMICIDE ☐ SUICIDE ☐ ACCIDENT ☐ UNKNOWN ☐

38 WORK ACCIDENT

YES ☐ NO ☐ UNKNOWN ☐

39 PLACE OF ACCIDENT

TRANSIT ☐ HOME ☐ OTHER ☐ UNKNOWN ☐

VI — PHYSICIAN

40 PHYSICIAN'S NAME

41 CRM

42 DATE OF CERTIFICATE

43 PHYSICIAN'S ADDRESS

44 TELEPHONE

45 SIGNATURE

VII — NO ATTENDING PHYSICIAN

46 DECLARER

47 1ST WITNESS

48 2ND WITNESS

VIII — CEMETERY

49 CEMETERY WHERE DECEASED WILL BE INTERRED

50 MUNICIPALITY

BEFORE COMPLETING, DETACH SET IN DUPLICATE AND READ INSTRUCTION MANUAL CAREFULLY.

ANNEX 2. 1980 data compiled for each reporting zone in Salvador, Bahia, Brazil, on population, numbers of infant and total deaths, and seven socioeconomic and health care indicators, by number of reporting zone (see map in Figure 1).

Reporting zone No.	Reporting zone Name	Population	No. of infant deaths (<1 year)	Total no. of deaths (all ages)	Infant deaths as % of all deaths	No. of residents per 100 square meters of housing area	% of type C housing	Water use (liters per capita per day)	% of inhabitants with incomes in range C[a]	No. of physicians (at health centers and posts) per 10,000 inhabitants	No. of hospitals beds per 1,000 inhabitants	No. of students enrolled in primary public schools per 1,000 inhabitants
01	Barra	30,744	20	199	10.0	3.6	3	136.6	—[b]	—	—	5.4
02	Jardim Apipema	12,966	13	36	36.1	3.9	5	136.6	14.6	—	—	—
03	Ondina	5,430	8	31	25.8	4.4	7	136.6	49.6	—	—	5.6
04/05	Rio Vermelho	19,883	47	199	23.6	4.5	6	135.0	64.8	8.0	—	34.7
06	*Avaralina*	28,753	16	89	18.0	7.0	25	133.3	84.3	—	—	5.6
07	Nordeste	39,016	87	295	29.5	13.8	75	133.3	100.0	9.5	—	12.2
08	Pituba	24,873	27	158	17.1	3.8	1	133.3	1.3	—	—	4.9
09	Vitória/Campo Grande	9,070	2	51	3.9	4.0	—	136.6	—	2.2	—	15.7
10	Graça	13,583	8	98	8.2	3.9	—	136.6	—	—	—	—
11/12	Alto das Pombas/Federação/ Eng. Velho Federação	59,693	91	440	20.7	7.2	37	136.6	76.3	2.0	—	12.0
13	Horto Florestal	9,107	7	23	30.4	5.2	17	133.3	78.4	—	—	—
14	Canela	8,536	3	47	6.4	3.9	3	136.6	—	—	41.6	4.1
15	Centro Histórico	21,854	32	179	17.9	4.4	7	133.3	13.0	—	—	13.0
16	Garcia	12,890	14	100	14.0	4.9	9	136.6	67.9	3.9	—	36.4
17	Barris/Ponte Nova	15,009	14	100	14.0	4.6	—	133.3	20.9	33.3	—	16.3
18	Eng Velho Brotas	32,317	44	204	21.6	6.2	23	100.0	78.4	0.6	—	18.7
19	Acupe	21,290	11	59	18.6	5.6	19	100.0	78.4	—	—	0.8
20	Brotas	25,926	77	398	19.3	5.5	23	100.0	78.4	2.3	2.7	41.7
21	Pq N S Luz/Itaigara	12,102	2	12	16.7	4.5	—	133.3	1.3	—	—	13.5
22	Stiep/Armação	13,959	9	40	22.5	3.8	—	73.3	36.0	—	—	20.5
23	Frederico Pontes	1,988	5	32	15.6	8.2	—	133.3	18.7	—	—	3.2
24	Pilar/Rua Chile/B. Sapateiro	14,755	26	158	16.5	5.6	—	133.3	18.7	—	—	10.2
25	*Nazaré/Daúde*	23,874	28	261	10.7	5.5	—	133.3	18.7	12.6	5.3	33.4
26	Matatu	12,561	9	120	7.5	4.7	—	100.0	36.8	—	—	26.0
27	Cosme de Farias	34,207	82	270	30.4	10.1	58	100.0	96.6	1.8	—	14.0
28	Luis Anselmo/Vila Laura	15,016	10	52	19.2	5.0	15	100.0	36.8	—	—	1.8
29	Cabula	16,437	124	311	39.9	4.5	3	73.3	86.4	1.2	—	44.8
30	Pernambués	31,321	123	315	39.0	12.1	71	73.3	86.4	4.2	—	4.8
31	Boca do Rio	29,211	90	277	32.5	6.7	29	73.3	84.4	1.7	—	6.4
32	Barbalho/Lapinha	18,412	35	180	19.4	5.6	1	70.0	86.0	1.6	—	51.2
33	Caixa D'Agua	29,699	16	102	15.7	6.6	9	70.0	86.0	—	7.4	18.9
34	Quintas/Cidade Nova	36,451	68	309	22.0	7.8	26	70.0	86.0	0.8	—	23.7
35[c]	Acesso Norte	718	8	33	24.2	—	—	—	—	—	—	95.3
36	19 BC	5,190	1	5	20.0	3.7	18	73.3	99.8	—	—	—
37	Pituaçu	6,782	6	21	28.6	5.6	26	73.3	84.4	—	—	—

38	Calcada/Mares/Roma	23,107	26	264	9.8	6.0	—	70.0	46.8	26.8	—	30.5
39/40	Liberdade	86,983	167	700	23.9	8.5	30	70.0	86.0	7.9	—	13.2
41	Iapi	29,342	53	168	31.5	5.7	28	70.0	86.0	—	—	10.0
42	Fazenda Grande	37,830	88	299	29.4	13.8	74	70.0	86.0	0.5	—	16.6
43	S. Gonçalo do Retiro	12,227	57	139	41.0	9.5	54	73.3	99.8	—	—	31.6
44	Engomadeira	41,190	36	93	38.7	9.3	62	73.3	99.8	—	—	2.3
45[c,d]	Centro Adm. da Bahia	2	1	12	8.3	—	—	—	—	—	—	—
46[c]	Iata/Patamares	601	0	3	0.0	—	—	—	—	—	—	30.9
47	Bomfim/Ribeira	29,083	28	227	12.3	5.7	3	70.0	46.9	—	8.5	14.3
48	Jardim Cruzeiro	50,682	82	392	20.9	8.9	34	70.0	46.9	2.4	—	28.2
49	Uruguai	38,627	69	271	25.5	9.8	43	70.0	46.9	—	—	13.6
50/51	São Caetano	82,961	164	616	26.6	9.5	40	70.0	86.0	1.6	—	13.1
52	Mata Escura	11,896	51	111	45.9	11.5	59	73.3	99.8	—	—	8.8
53	Sussuarana	18,531	82	167	49.1	10.7	60	73.3	92.0	—	—	2.3
54	Paralela/Estrada Velha do Aeroporto	12,708	17	38	44.7	8.7	35	73.3	92.0	—	—	3.8
55	Itapoá	23,782	75	206	36.4	5.9	13	73.3	87.1	10.1	—	16.7
56[c,d]	Praias do Flamenco/ Aeroporto/Stella Mares	122	15	32	46.9	—	—	—	—	—	—	—
57	Lobato/Pirajá	32,707	84	247	34.0	13 2	71	70.0	96.0	—	—	11.6
58	Campinas	16,136	29	76	38.2	11.0	57	43.3	96.0	—	—	4.8
59	Pau da Lima	29,983	144	329	43.8	11.5	58	60.0	92.0	3.7	—	19.8
60	Sete de Abril	13,738	64	139	46.0	10.0	48	60 0	92.0	9.5	—	5.6
61	Mussurunga/S. Cristovão	21,368	56	134	41.8	6.4	2	73.3	100.0	2.8	—	25.1
62	Plataforma	42,416	113	346	32.7	8.4	23	43.3	94.2	—	—	16.1
63	Pirajá	14,447	56	148	37.8	11.8	62	43.3	96.0	2.0	—	18.3
64	Pirajá/Portoseco	6,501	15	40	37.5	11.8	62	43.3	96.0	—	—	5.0
65	Castelo Branco	14,927	24	105	22.9	7.7	9	60.0	92.0	8.7	—	28.8
66	Escada/Periperi	35,493	106	314	33.8	6.8	7	66.7	94.2	—	—	19.9
67[c]	São Bartolomeu	926	2	2	100.0	—	—	—	—	—	—	—
68	Valéria	6,367	46	102	45.1	7.4	12	43.3	94.2	1.6	—	22.0
69	Aguas Claras	10,276	32	61	52.5	8.7	33	60.0	100.0	—	—	7.2
70	Estrada Cia-Aeroporto	3,796	20	56	35.7	6.9	38	73.3	100.0	—	13.2	9.4
71	Coutos	15,620	50	116	43.1	8.1	21	66.7	94.2	—	—	11.2
72[c]	Limite C/Usiba	651	—	1	—	—	—	—	—	—	—	—
73	Paripe/Base Naval	34,568	109	302	36.1	6.7	7	66.7	94.2	—	0.9	21.4
74[c]	Islands: Bom Jesus, Frades, Capeta, Vacas Maria Guarda	2,383	2	6	33 3	—	—	—	—	—	—	18.4
75[c]	Madre de Deus	7,943	14	39	35.9	—	—	—	—	13.8	—	0.9
76[c]	Ilha de Maré	2,702	6	16	37.5	—	—	—	—	—	—	16.2
Unknown		—	48	199	24.2							
Unregistered		—	118	167	70.7							

Sources: Health Information Center (CIS) of the Bahia State Health Secretariat; Salvador Metropolitan Region Development Company (CONDER); Bahia Sanitation Enterprise (EMBASA).

[a] The % of people living in households with incomes less than five times the minimum wage.

[b] — = no information.

[c] Excluded from study.

[d] The disparity between the number of inhabitants and number of deaths in the two indicated zones (neither of which were included in the study) could be partly due to the fact that the population and mortality data were obtained from different sources.