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INFANT MORTALITY IN THE PHILIPPINES: CAUSES AND CORRELATES

Sheila West, Ph.D.
Visiting Professor of Epidemiology
Office of the Chancellor
College of Medicine
University of the Philippines
Pedro Gil, Manila

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TABLE OF CONTENTS

Infant Mortality In The Philippines

INTRODUCTION

Infant mortality statistics are commonly used as a highly sensitive indicator for the relative level of development of a country. High infant mortality rates indicate a combination of environmental hazards and unavailability of health care, problems all too common in developing countries. Gwatkin estimates that well over half of the annual number of infant and child deaths in the world would not occur if the mortality conditions of developed nations prevailed in the less developed nations as well (Gwatkin, 1980). Thus, there is considerable interest in defining factors associated with high infant mortality rates for the purpose of designing effective programs for reducing those rates.

Among developing nations, the Philippines reports an infant mortality rate lower than most, but higher than some other countries in its region (Table 1). Moreover, large regional and provincial differences in the infant mortality rate exist within the Philippines (Flieger, 1980). This variation suggests that risk factors associated with high infant mortality rates could be identified by examining regional and provincial data.

Some work has already been done on correlates of death in childhood in the Philippines. Concepcion used data collected for the 1968 and 1973 National Demographic Survey, and 1978 Republic of the Philippines Fertility Survey to calculate the proportion of children dead relative to the total ever born (Concepcion, 1980). Only women age 15-49 who had been married 10-19 years and had had 3-7 children were included, in order to control for length of exposure to child bearing and marital duration. Age of the children at death was not specified, so the result should not be imputed to infant or early childhood mortality. In addition, the criteria for inclusion in the study resulted in responses from a select group of women. They were probably at least 25, more likely older, and they had three or more children. The data suggest that the mean proportion of children dead is lower among better educated women, and women who have never worked or who have worked at non-agricultural jobs. The presence of a faucet, pump, or artesian well was associated with a lower mean proportion of children dead for the 1973 NDS only. The flush, or antipolo system, was associated with a lower mean proportion of children dead only in the 1968 NDS. Other variables studied with no consistent findings were place of residence, region (Luzon, Visayas and Mindanao), wallmaterials, floor materials, and schooling of the husband.

Mortezo used data from Central Luzon and Metro Manila in the 1979 Area Fertility Survey to study variation in infant mortality by selected factors (Mortezo, 1981). The difficulty of estimating a plausible infant mortality rate is significant when the variation between the two regions is small and the number of cases is small. For this reason, consistent findings within the two regions is of more interest than inter-regional differences. Mortezo found that infant mortality tended to be higher in rural areas, among lower class women, and among women with low educational attainment. Multiple adjustment techniques were not done to separate the effects of the various factors.

Table 1: Infant Mortality Rate in Selected Countries, 1975

Country	Infant Mortality Rate
Nepal	300
Ethiopia	181
Pakistan	145
India	139
Indonesia	125
Kenya	119
Philippines	75
Thailand	68
Mexico	61
Argentina	60
Sri Lanka	51
Malaysia	33
Singapore	20
United Kingdom	18
United States	18
Taiwan	14
Japan	12

Source: U.N., Population and Vital Statistics Report, Data Available October, 1975, Statistical Papers, Series A, Vol. XXVII, No. 4.

Jimeno used retrospective survey data to identify families in Bohol at risk of one or more child deaths (Jimeno, 1980). The factors include early age of marriage, little education, marriage to a farmer, large families, and previous child loss.

In summary, it appears that mortality among children is related to certain socio-economic factors such as maternal education and socio-economic status. However, studies on mortality more precisely among infants are not available, and the author could not find published data (as opposed to conjecture) on possible reasons for the variation in infant mortality rates among regions and provinces. The paucity of data hinders the design of effective interventions designed to reduce infant mortality.

Therefore, the present study was initiated with three objectives: i) to evaluate various estimates of infant mortality rates (IMR) and select a best estimate for further analysis; ii) to evaluate reported causes of infant deaths and determine if excess mortality can be attributed to any specific cause or set of causes; and iii) to determine if some of the variations in IMR by regions and provinces are associated with selected socio-economic, fertility and health variables. The study made use of several data sources and different analytical methods. Thus, each objective has its own section of the report, with sources of data, analytic methods, results, and conclusions described therein. At the end of the report is a section summarizing the conclusions, and discussing implications and recommendations.

ESTIMATES OF INFANT MORTALITY RATES

BACKGROUND

Infant mortality rates are routinely calculated from registered births and deaths in countries with fairly complete vital registration systems. Although the Philippines has an historical tradition of keeping vital records, extensive work has documented the problem of under-registration of births and deaths.

A five-year dual-record study conducted in 1971 assessed the actual registration levels and calculated levels of non-registration in sample areas throughout Philippines (Mijares, 1975). The study found that only two-thirds of all births and 70% of all deaths occurring in 1971 were registered. Considerable variation in registration by region was also reported in the dual-records study.

The causes of under-registration are numerous. One problem is that most births and deaths occur at home, which decreases the probability of registration (Mortel, 1975). Other causes were reported by the evaluative survey of the dual-record study which examined non-registration among families (Table 2). For both births and deaths, lack of interest or ignorance was an important cause of non-registration (Mortel, 1975).

Another cause of non-registration of deaths is purposeful concealment. In a study connected with the dual registration system, Madigan used the randomized response technique to estimate the extent of concealing a death in Misamis Oriental (Madigan, 1976). Adding the estimated concealed deaths to those directly reported raised the crude death rate by almost double (from 7.4 per thousand to 13.4 per thousand in rural areas, and 6.7 to 11.5 per thousand in urban areas). In other provinces, however, purposeful concealment of deaths may be less significant. (Williamson, 1981)

For the purposes of this study, under-registration of births and deaths under one year of age would not be a significant problem if the extent of under-registration were constant for both events within the provinces. This is because, as a rate, the IMR would be insensitive to comparable fractions of the numerator and denominator[a]. However, there are data from the sample areas of the dual-record study suggesting that within regions, infants who died were more likely to have their deaths registered than their births, and only 27% (Region X) to 77% (Region II) had both registered (Mortel, 1975).

Even if the IMR figure itself were not precise, it could still be used, provided, the imprecision were constant across all provinces and regions so that the IMR's bore a relationship to one another similar to their true

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(a) a = True number of infant deaths; 80% registered
b = True number of live births; 80% registered
IMR = .80a/.80b = a/b

Table 2: Percent Distribution of Infant Deaths by Age, Philippines, 1976

Age	Percent
0 - 6 days	29.5%
7 - 13 days	8.1%
14 - 20 days	3.7%
21 - 27 days	2.4%
28 - 59 days	8.5%
2 months	4.6%
3 months	4.1%
4 months	3.7%
5 months	3.6%
6 months	4.1%
7 months	4.4%
8 months	4.7%
9 months	4.3%
10 months	3.4%
11 months	10.9%

relationship. In essence, the nature of the variability is more important than the absolute value. However, this relationship cannot be assumed, as the IMR estimate from vital registration data varies widely as the level of registration varies. Thus, for example, the true difference in IMR's between Region X and Region II is not likely to be reflected in the vital registration rates where in 1972 about 65% of infant deaths were not registered in Region X versus 17% in Region II (Mortel, 1975). In 1970, one of the lowest infant mortality rates recorded (5 per 1000) was in Sulu.

Another problem in calculating the IMR is determining the exact age at death. About 68% of deaths under age one year occur prior to age six months (see Table 2), so the majority of these deaths can probably be accurately labeled as infant deaths even if the precise birthdate is unknown. However, among older infants, inexact determination of age may result in under- or over-registration of infant deaths. Evidence of inexact age determination is shown in Table 2 where a disproportionate number of infants are dying at age 11 months. In theory, one could approach the problem by also examining mortality rates for children between ages one and two. In practice, however, death registration problems undoubtedly also occur in this group and much less data are available to evaluate biases; moreover, the denominator must be calculated from census data, which introduces a new set of problems. Therefore, no attempt is made to correct for imprecise age determination, although it should be noted that this problem is less important than the problem of under-registration. One must assume that the bias in age determination is, more or less, similar in all provinces.

In summary, the use of vital registration estimates of infant mortality required the following assumptions:

1. Fairly complete registration of births and infant deaths (known to be untrue) with accurate determination of age at death for older infants (questionable) or;

2. The proportion of under-registration of births and infant deaths was a constant within each province (known to be untrue) and the bias in age determination was similar for all provinces (unknown) or;

3. At least, the relationship of each provincial IMR to the other is a reasonable approximation of the true relationship (cannot be assumed).

Without confidence in the direct measurement of infant mortality rates, we must turn to the indirect estimates. In the next section, sources of indirect estimates are evaluated.

Dual-Record System Estimates

The dual-record system attempted to quantify the level of under-registration of births and deaths using the Chandrasekar - Demings formula (Mijares, 1975). However, the project operated only in sample areas, so estimates for the provinces are not available. Moreover, there appear to be no published figures on IMR by region. Problems identified in the projects, including purposeful concealment of deaths, operational difficulties, applicability

of the rates to the region as a whole, etc., suggest other estimates may be more suitable (Mijares, 1975), (Madigan, 1976).

Estimates from the NDS, RPFS, AFS.

Extensive surveys on demographic variables, particularly fertility, have been conducted in the Philippines with much of the analyses done by the University of the Philippines, Population Institute. These are the 1968 National Demographic Survey, 1973 Demographic Survey (national data), 1978 Republic of the Philippines Fertility Survey (regional data), and the Area Fertility Surveys (selected regions). Infant mortality data were calculated using a variety of techniques on data from mother's reporting of deaths among children ever born. For extensive review of the techniques and findings, the reader is referred to the individual surveys and reports by Zablan (Zablan, 1975), Cabigon (Cabigon, 1980), Morteza (Morteza, 1981), and Zafra (Zafra, 1981).

Cabigon found the IMR's obtained from these data were in serious question because: 1) of sampling variability; 2) of differential rates by age of mother at time of birth; and 3) the rates were lower than vital registration rates for comparable years, which are known to be low (Cabigon, 1980 a,b, unpublished manuscript). Zablan's estimate of national IMR, while higher than the vital registration estimate, cannot be referred to a specific time period (Zablan, 1975, Cabigon, unpublished). Lastly, Flieger raises the question of undercounting infant deaths in the surveys as a reason for the low estimates (Flieger, 1980).

A comparison of regional estimates from vital registration and estimates from demographic and fertility surveys is shown in Table 3. There was no clear pattern of increase or decrease in the IMR by regions between the 1968 and 1973 UPPI estimates. If infant mortality were postulated to be decreasing, the 1973 estimates would have been lower than the 1968 estimate and the 1970 vital registration figure; however, the 1973 estimates were greater than both for four regions.

U.P.P.I. investigators are currently working on obtaining the best estimate for IMR from their data, including perhaps a correction factor for under-reporting. For this and other reasons it is premature to simply select a set of estimates at this point for use in the regional analyses.

Office of Population Studies Estimates

The Office of Population Studies at the University of San Carlos (OPS) has constructed life tables by sex for each province and region in the Philippines. They used the 1970 and 1975 censuses vital registration data adjusted by the Zlotnik procedure (to correct for under-counting deaths), and Brass techniques to estimate probabilities of surviving to various ages in 1970 (Flieger, 1980).

The technique requires the assumption of unchanging mortality; as mortality

Table 3: Regional and Total Infant Mortality Estimates for the Philippines.

		UPPI[b] 1968	OPS[b] 1970	Vital[c] Registration 1970	UPPI[b] 1973		Vital[c] Registration 1976	UPPI[d] 1978	UPPI[d] 1979
I	Ilocos	47.6	87.8	53.9	64.1		51.7	-	-
II	Cagayan	76.2	103.1	63.8	81.9		63.3	-	-
III	C. Luzon	69.1	82.5	52.4[e]	50.3		45.9	42	60
IV	S. Tagalog	86.9	75.0	58.5	62.9		56.4	-	55
V	Bicol	64.8	99.0	58.2	51.6		54.8	-	74
VI	W. Visayas	65.9	85.4	95.7	70.2		72.8	-	-
VII	C. Visayas	81.7	78.3	58.6	61.6		55.4	64	-
VIII	E. Visayas	82.1	97.3	76.5	86.9		75.5	-	-
IX	W. Mindanao	-	131.8	76.0	81.5		62.8	-	-
X	N. Mindanao	78.8	135.0	67.9	90.3	X[a]	52.9	85	85
XI	S. Mindanao	-	111.6	43.6	67.8	XI[a]	37.0	62	-
	Metro Manila	64.7	62.7	(e)	37.8	XII[a]	68.5	57	58
	T o t a l:	76.2	93.1	60	67.6		57	57	-

(a) These regions were reorganized after 1973, and region XII created.

(b) Source: Flieger, 1980.

(c) Source: Vital Statistics, 1970 and 1976.

(d) Source: UPPI unpublished data; Trussel estimates for age 20-24 reported (West Model).

(e) Includes Metro Manila in region III.

rates appear to be declining, the OPS estimates may be high (Flieger, personal communication, 1981). No correction is made for under-enumeration of births which, by reducing the denominator, may also result in higher estimates.

Nevertheless, the estimates at the provincial level appear to be reasonable. They were tested by summing the estimates and comparing them to independent estimates at the regional and national level with similar findings (Flieger, personal communication, 1981, and 1980). It should be noted that the mortality rate for children under one year of age in the life table is not equivalent to the infant mortality rate, but the values are very close (Madigan, 1977).

The comparison of OPS estimates with other estimates is shown in Table 3. The estimates were consistently higher, especially in the disadvantaged regions of Mindanao where reporting was poor and vital registration estimates were low.

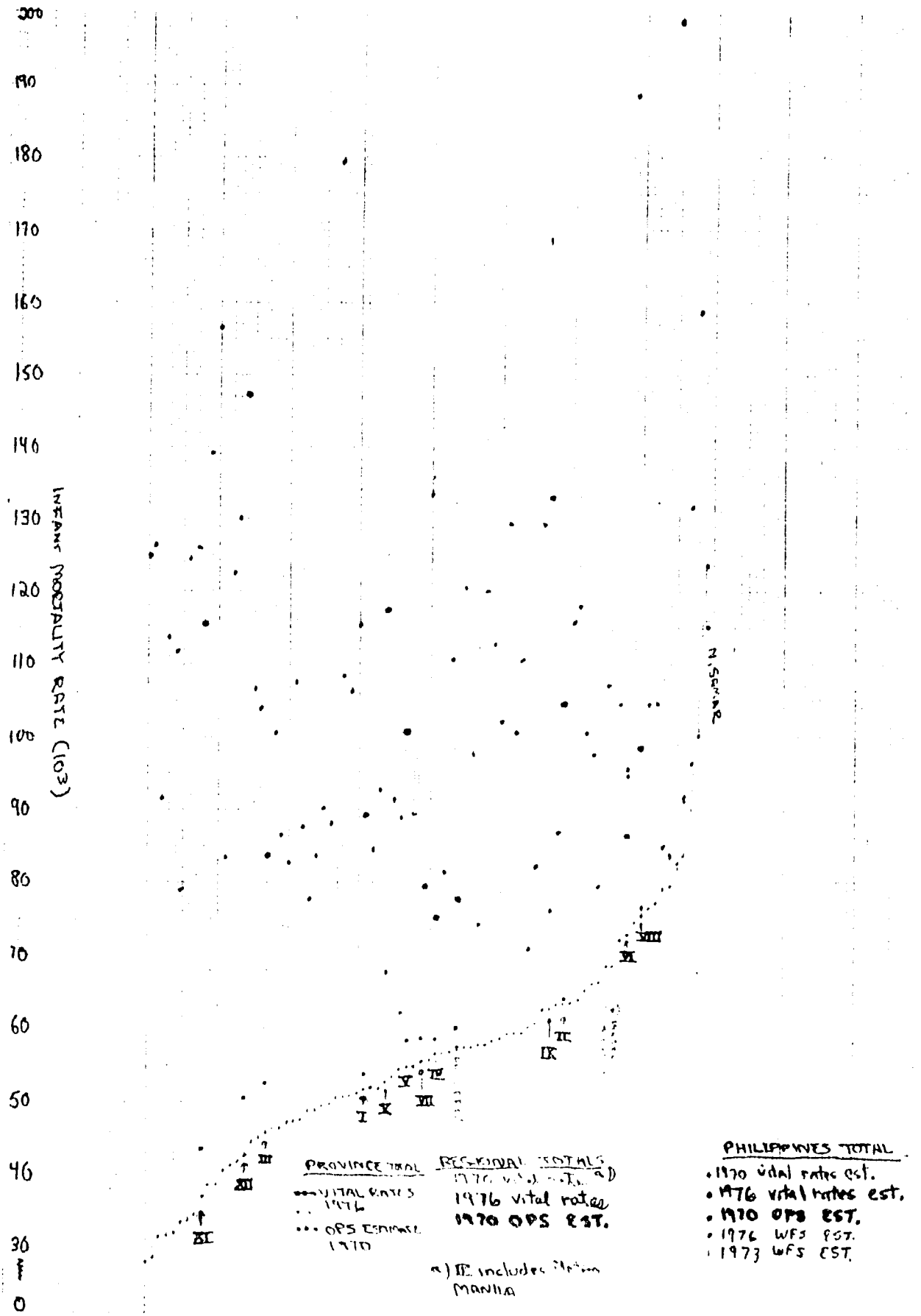
At the provincial level, the only comparison possible is between the OPS estimates and the vital registration estimates. The 1976 vital registration estimates were calculated for the comparison although the rates would be certainly lower than the OPS estimates for 1970. However, the 1976 rates would reflect whatever benefit existed from the dual-record system project to improve vital registration, so that the relationship between the various provincial estimates for 1976 might therefore have been more accurate than 1970 estimates. The relationship between the OPS estimates and vital registration estimates is illustrated with an admittedly confusing graph (Figure 1). When the 1976 vital registration rates were arranged in increasing order of estimate, the corresponding OPS estimate showed no pattern. Some of the lowest estimates from vital registration came from some of the more disadvantaged provinces. For example, IMR's less than 60 per thousand were reported for S.Leyte, E. Samar, Zamboanga del Norte, Bukidnon, and Surigao del Norte; all the comparable OPS figures were over 100 per thousand.

The true value of the IMR for each province and region and the relationship between the values is simply unknown. However, the OPS estimates make intuitive sense. Cabigon has termed them the most plausible rates, at least by region (Cabigon, 1980b). For this reason, the OPS estimates were selected for use in determining factors associated with infant mortality rates.

CAUSES OF DEATH AMONG INFANTS

There were two objectives in the analysis of the causes of death among infants under one year of age. First, the most important causes of death needed to be identified in order to assess their susceptibility to reduction; second, the probably causes of excess mortality in certin high risk provinces needed to be determined. Therefore, the most recently published data on causes of death for each province were obtained from the National Census and Statistics Office (NCSO Vital Statistics Report,1976).

Figure 1: Divergence of provincial IMR Estimates derived from Vital Statistics (1976) with OPS Life Table indirect Estimate (1970)



While other, more detailed, data on causes of death may be available for selected provinces, currently only NCSO routinely collects statistics on all provinces. The most recent year, 1976, was selected, but the distribution of deaths appears comparable to previous years (Table 4).

Many of the reservations and caveats about using vital registration data, as discussed earlier, applied to using data on causes of death as well. Some of the problems and assumptions are presented in the next section, followed by a brief description of the analytic methods. The data and results of the analyses are presented last.

Problems Using Vital Registration as Data Source

As noted above, there are good reasons to believe that under-registration of deaths is an important problem in the Philippines. Techniques are available to correct somewhat for the problems, and various corrected estimates have been presented. However, several problems exist with vital registration data on causes of death in addition to under-enumeration. First, an estimated 28% of registered deaths (all ages) are unattended by trained medical personnel, the number varies from 20% in Manila to 50% in Region VIII. The cause must be presumed in such circumstances on the basis of symptoms reported by families. The result is clearly seen in causes of infant death up to one day of age (Table 5). About 85% of deaths are nonspecific "anoxia" or "other", categories reflecting inabilities to determine cause of death precisely. Thus, some of the variations in provincial causes of death data may reflect differences in medical attendance at death and diagnostic recording.

A second problem is the inability, currently, to assess whether the causes of infant deaths which are reported are representative of all causes, reported and unreported. Different cause-specific mortality rates may reflect inconsistent reporting of that cause within provinces, as well as possibly true differences. There are sufficient data documenting regional inconsistencies in reporting births and deaths to suggest reporting causes of death may also be inconsistent (Mijares, 1977).

A third problem is the difficulty of determining the precise age at death. Thus, illnesses which tend to kill infants in the latter half of their first year of life may be over- or under-represented in infant mortality statistics, depending upon the determination of age at death. If determination of age is facilitated by birth registration, the problem is simplified. However, data from the sample vital registration system in the Philippines suggest that only 47% of the time is both an infant's birth and death recorded, while 33% of the time the death is recorded and the birth is not. (Mortel, 1975). Regional variation is also large. Evidence of imprecision in age determination was illustrated in Table 2, where a disproportionate number of infants was dying at age 11 months. For some diagnostic categories the problem is more pronounced, as is shown in Table 6 for "Avitaminosis and other nutritional problems."

The problem can be ameliorated somewhat by examining causes of death for

Table 4: Ten (10) Causes of Death Among Infants Less Than One Year Old For Philippines, 1970 - 1974 average, 1976.

Cause	1970 - 1974 % of all deaths	1976 % of all deaths
Pneumonia	26.9%	22.6%
Gastro-Enteritis	8.8%	8.5%
Congenital Abnormalities	3.1%	3.5%
"Avitaminosis"	6.1%	Beri-Beri, Malnutrition: 10.8%
Anoxia, Hypoxia	6.5%	6.6%
Bronchitis, Asthma	5.5%	5.5%
Tetanus	1.1%	4.2%
Measles	1.1%	1.7%
Meningitis	1.0%	1.1%

Source: NCSO Vital Statistics Report, 1976.
NEDA Statistical Yearbook, 1980.

Table 5: Distribution of Reported Causes of Death for Infants Aged Up to One Day, Philippines, 1976.

Cause	Number	% of all Deaths[a]
Total Deaths	12,258	
Diarrheal Disease	39	0.3
Other Bacterial disease	145	1.2
Avitaminosis	341	2.8
Congenital Heart Anomaly	315	2.6
All other congenital anomalies	441	3.6
Birth injury	257	2.1
Condition of placenta & cord	146	1.2
Hemolytic Disease of newborn	41	0.3
Anoxia not elsewhere classified	3139	25.6
Other causes of perinatal mortality	6739	55.0
Symptoms and ill defined conditions	499	4.1
All other & unspecified effects of external cause	39	0.3

(a) causes accounting for less than 0.1% are not shown.

Source: Philippine Health Statistics, 1976. Disease Intelligence Center, Ministry of Health table 29.

Table 6: Percent Distribution of Infant Deaths from Avitaminosis by Age. Philippines, 1976.

Age	Number	%
0 - 6 days	803	9.7
7 - 13 days	316	3.8
14 - 20 days	124	1.5
21 - 27 days	109	1.3
26 - 59 days	407	4.9
2 months	236	2.8
3 months	175	2.1
4 months	141	1.7
5 months	124	1.5
6 months	158	1.9
7 months	171	2.1
8 months	161	1.9
9 months	186	2.2
10 months	126	1.5
11 months	5044	60.9
Total	8281	99.8[(a)]

Source: Philippine Health Statistics, 1976 Table 29

(a) rounding error

children aged 0-4, but the reduced mortality level in older children plus a large denominator may obscure important differences in mortality among infants. While provincial overall mortality rates for infants can be compared with childhood mortality rates, a comparison of cause-specific mortality rates would be a major undertaking and beyond the scope of this contract.

These problems of interpreting data on causes of death are presented in order to urge caution in attaching significance to any but the most obvious of differences. Use of vital registration data requires the following assumptions:

1. All provinces and regions have roughly similar proportions of unregistered births and unregistered deaths (known to be untrue).

2. All provinces and regions have similar proportions of undiagnosed or misdiagnosed deaths for any cause of death (highly unlikely).

3. For any specific cause, the reported deaths are some uniform proportion of all deaths (reported and unreported) for that cause in all provinces and regions; a further refinement on this assumption, which would permit a more accurate assessment of infant mortality, is that the proportion be the same across all causes of death.

4. Age at death is accurately determined, or misclassification by age is similar for all causes, across all regions and provinces.

Analytic Method

Thirteen causes of death appeared to be the major factors in infant mortality, all the rest accounting for between 7% and 25% of deaths. For each province and region, a proportionate mortality ratio (PMR) analyses was done by sex (see Appendix A).

$$PMR = \frac{\text{number of deaths from a given cause, 1976 in X}}{\text{total number of deaths in X}}$$

X = region, province

The proportionate mortality ratio was selected because it provides a measure of the relative importance of a specific cause of death in relation to all deaths. Thus, a province with a high infant mortality rate due primarily to one cause would show a high proportionate mortality ratio for that cause.

Cause-specific death rates, while reflective of risk of death, were not calculated because they would have introduced another source of variation, namely number of births. As noted, levels of registration of births were not particularly correlated with levels of registration of deaths within regions, so the decision was made to exclude another possible confounding factor in the interpretation of results.

The ratio was not calculated for Batanes and Tawi-Tawi, which had only 17 and 16 registered deaths, respectively. Ratios for Mt. Province, Ifugao, Siquijor, Basilan, Camiguin and Lanao del Sur are unstable because of small numbers of reported deaths.

Correlation analyses were done, when indicated, between infant mortality rates, using Flieger's estimates as noted, and the proportionate mortality estimates. Several provinces were not included in the analyses because they did not exist as separate provinces in 1970 when Flieger's estimates were made; the provinces were Quirino, Siquijor, Tawi-Tawi, Basilan, Maguindanao, and Sultan Kudarat.

The results are presented by region, by province within region, and by province.

Results

The proportionate mortality ratios in Appendix A for some diagnoses show sufficient overlap to suggest grouping them together. For example, grouping bronchitis and pneumonia together made a stable category of "respiratory problems", where before each seemed to vary immensely with the other (e.g., Region III had ratios of 2% for bronchitis and 22% of pneumonia, and Misamis Occidental had 10% for bronchitis, and 16% for pneumonia). The categories grouped together were: beri-beri and malnutrition; bronchitis and pneumonia; asphyxia of the newborn, immaturity and other newborn conditions.

Regions

A comparison of causes of death by region showed an association between increasing infant mortality rates (IMR) and an increasing proportion of deaths due to tetanus (Table 7), Meningitis, measles, and septicemia showed little variation. Enteritis, malnutrition, pneumonia, and immaturity showed no clear relationship with infant mortality rates (Figures 1, 2). The proportionate mortality ratio for congenital abnormalities appeared to decline with increasing infant mortality rates, but the decline is very slight and the correlation not significant.

The association of the IMR with an increasing proportion of deaths due to tetanus does not explain very much of the difference in IMR by region. Even if the 10% of deaths due to tetanus had been prevented in Region XII, the IMR would have dropped to only 133.

These data support the general impression that no particular cause of death dominates high IMR regions; rather more infants die, but in similar proportions, from all(the 13 mentioned at outset) the major causes of death. However, it may be possible that within regions, inter-provincial differences in mortality cancel each other and that provincial differences do exist. This possibility is examined in the next section.

Table 7: Proportion of Deaths due to Each Cause and IMR by Region, Philippines, 1976.

Region	Overall IMR	Enteritis	Tetanus	Septicemia
Total	94.4	8.5	4.2	3.9
I	89.0	5.2	3.4	2.4
II	104.6	3.9	8.3	2.2
III	83.7	7.2	2.1	3.0
IV	76.1	9.7	2.7	4.1
MM	62.7	8.0	< 1	9.6
V	100.3	7.8	5.6	2.3
VI	86.6	11.1	7.5	2.9
VII	79.4	7.1	5.2	2.5
VIII	98.6	7.0	4.0	2.1
IX	133.0	12.0	5.6	2.2
X	117.3	12.1	3.5	2.3
XI	115.5	11.1	7.3	2.6
XII	147.3	11.4	9.9	2.5

Table 7: Proportion of Deaths due to Each Cause and IMR by Region, Philippines, 1976. (Continued)

Measles	Malnutrition Beri-Beri	Meningitis	Pneumonia Bronchitis	Cong. Abnormality	Condition of Newborn
1.7	11.0	1.1	28.0	3.5	24.0
1.0	11.8	< 1	26.8	3.3	28.7
< 1	15.2	1.1	26.0	2.7	25.9
1.1	12.7	1.4	24.0	4.3	31.3
< 1	9.1	1.8	22.9	5.3	28.2
2.4	8.0	1.3	28.5	3.2	28.4
1.4	3.5	1.1	37.4	3.0	18.5
1.5	9.5	1.1	28.7	3.0	19.2
1.1	13.2	< 1	28.3	4.1	22.4
3.2	18.3	< 1	34.6	1.8	14.1
1.5	10.8	< 1	30.0	3.4	18.0
2.9	9.9	< 1	29.8	2.1	19.5
3.5	8.9	1.4	26.8	3.6	17.4
3.3	7.5	1.2	24.6	2.5	18.1

Source: Vital Statistics, 1976.

Figure 2: Graph of Infant Mortality Rate vs. Proportionate Mortality Ratios of Causes of Death for Each Region.

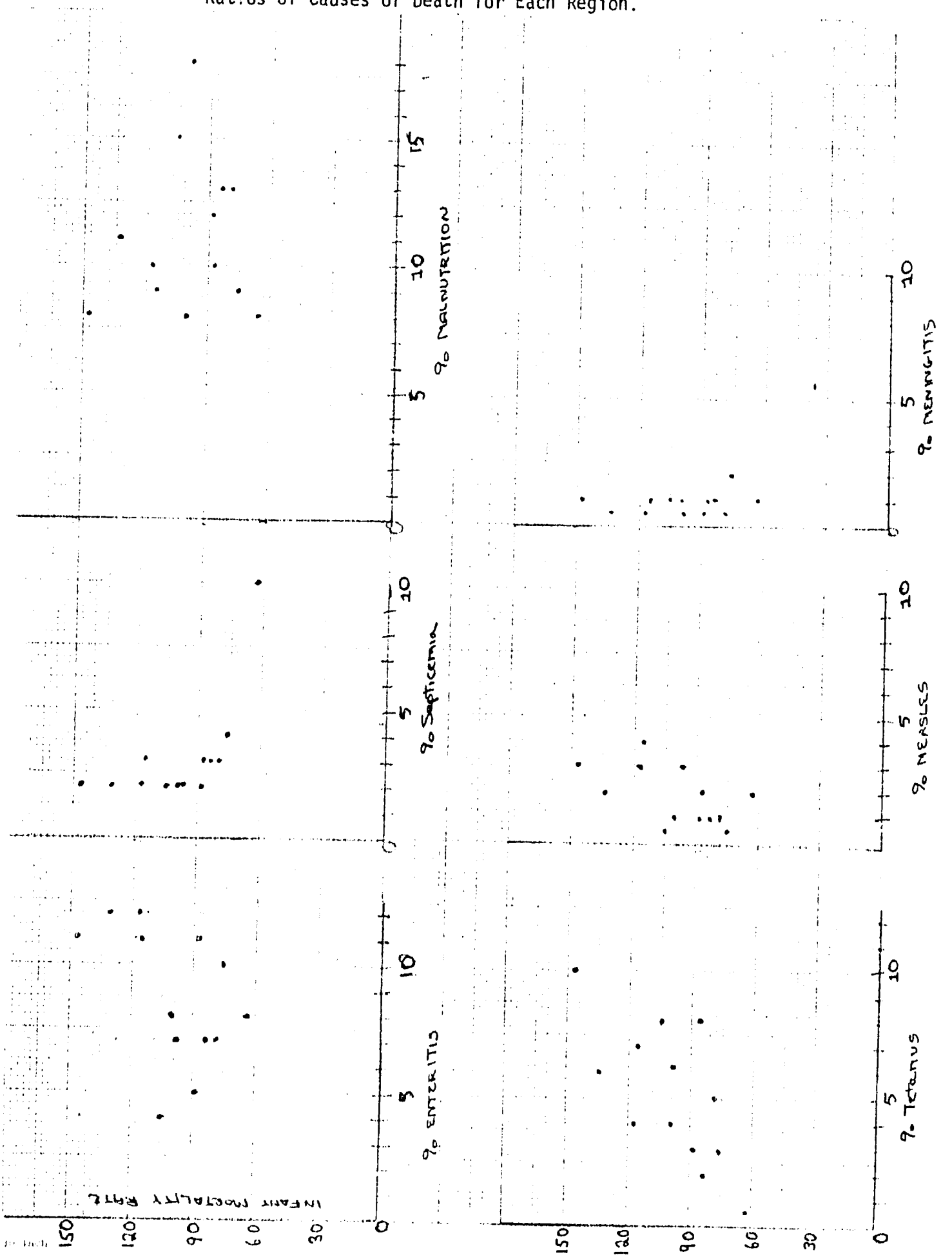
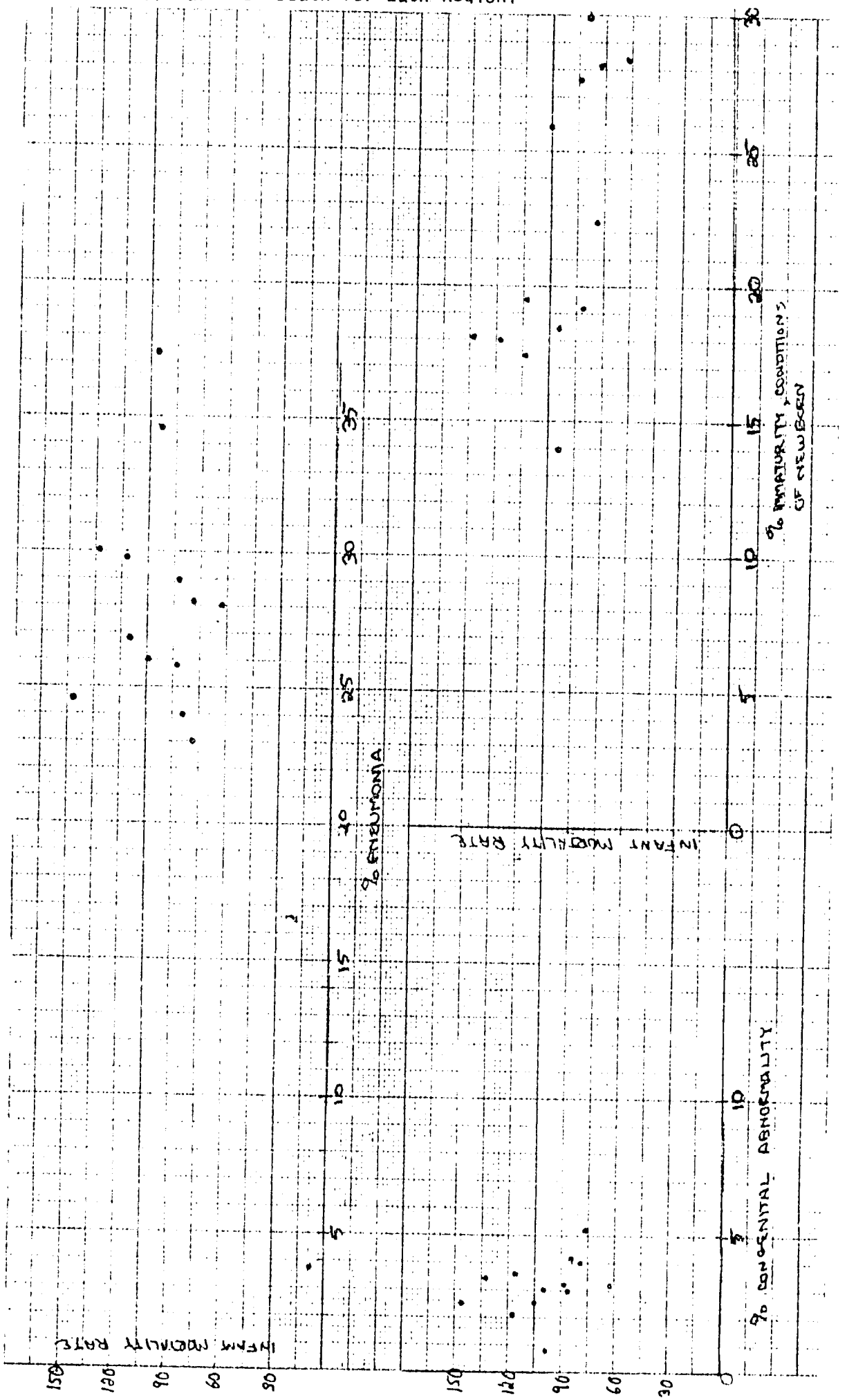


Figure 3: Graph of Infant Mortality Rate vs. Proportionate Mortality Rate of Cause of Death for Each Region.



Provinces Within Each Region

Each region was evaluated separately, using Appendix A. The results are listed below by region, with an overall summary at the end.

1. Region I

   a. All provinces but Abra and Mt. Province had an IMR less than the Philippine total.

   b. The proportion of deaths not covered by common causes varied from 12 to 22%.

   c. Enteritis: The proportion of deaths due to enteritis was lower than nationwide.

      Tetanus: The proportion was higher than nationwide in Ilocos Norte and Abra.

      Beri-Beri, Malnutrition: Females showed a consistently higher proportion of deaths. Only Ilocos Sur had a proportion relatively greater than nationwide.

      Bronchitis, Pneumonia: The proportion of deaths was lower than nationwide, but the diseases were still the leading causes of death. No gradient by IMR level was apparent.

      Problems of Newborns: There was a generally slightly higher proportion of deaths than nationwide, especially in Benguet.

   d. Summary: There was no obvious excess of deaths from any one cause; there were just generally more deaths.

2. Region II

   a. All provinces had an IMR greater than the Philippine total.

   b. The proportion of deaths not covered by common causes varied from 9% to 26%.

   c. Enteritis: The proportion of deaths was lower than nationwide

      Tetanus: The proportion was generally twice as high as the proportion nationwide.

      Beri-Beri, Malnutrition: The proportion was higher than nationwide and greater among females.

      Bronchitis, Pneumonia: Kalinga reported a high proportion of deaths, otherwise, the proportion was similar to that of the natives as a whole (more bronchitis, less pneumonia).

      Problems of Newborns: There was generally a greater proportion of deaths, but the excess was in "other conditions". There was no clear gradient by IMR.

d. Summary: Tetanus, problems of newborns, and malnutrition-Beri-Beri seemed excessive in this region, but there was no clear gradient with IMR.

3. Region III

a. All provinces had an IMR lower than the Philippine total.

b. The proportion of deaths not covered by common causes varied from 7% to 21%.

c. Enteritis: The proportion of deaths was roughly the same as that nationwide.

Tetanus: The proportion was generally lower than that nationwide; the high IMR region had a tendency towards proportionally more deaths.

Beri-Beri, Malnutrition: The proportion was slightly greater than nationwide. Nueva Ecija and Tarlac were greater than Bataan, Pampanga and Bulacan. Females again showed a greater proportion of deaths.

Bronchitis, Pneumonia: The proportion was slightly lower than nationwide.

Problems of Newborns: The rate was greater than nationwide for asphyxia (except Bataan), immaturity, and others (except Zambales, Bulacan).

d. Summary: Deaths in this region may be due to problems of newborns and reflective of fewer deaths from other causes. There was some evidence of a gradient with IMR and proportion of deaths due to tetanus.

4. Region IV

a. The region overall had a lower IMR than nationwide. Specifically, Laguna, Rizal, Mindoro Oriental, Cavite and Batangas were lower, while the rest were higher.

b. The proportion of deaths not covered by the common causes varied from 12% to 23%.

c. Enteritis: The proportion of deaths was only slightly greater than nationwide. A greater proportion was reported in Rizal, Laguna, Cavite and Mindoro Occidental (the first three being urban provinces).

Tetanus: There was generally a lower proportion of deaths than nationwide, especially in urban areas (Rizal, Laguna and Cavite).

Septicemia: A high proportion of deaths due to this disease was reported in Marinduque.

Beri-Beri, Malnutrition: The region had a generally lower proportion of deaths than nationwide.

Bronchitis, Pneumonia: There was a generally lower proportion of deaths compared to the nation as a whole.

Problems of Newborns: The region generally had a slightly higher proportion than nationwide.

d. Summary: Enteritis was greater in more urban areas, while tetanus was lower. A higher proportion of deaths due to problems of newborns in urban areas may reflect fewer deaths from all other causes. There was no clear gradient with IMR and any cause of death.

5. Metro Manila

a. The IMR was lower than nationwide, and only about 9% of deaths were not covered by common causes.

b. There was a low proportion of deaths from tetanus, and beri-beri, malnutrition. The proportion was roughly the same as nationwide for enteritis, meningitis, bronchitis, pneumonia and congenital abnormalities. A higher than nationwide proportion was found for septicemia, measle problems of newborns.

c. Summary: The causes of death were reflective of a more developed setting.

6. Region V

a. All provinces except Albay and Camarines Sur had an IMR greater than the Philippine total.

b. The proportion of deaths not covered by common causes varied from 10% to 18%.

c. Enteritis: The regional proportion of deaths was the same as nationwide, but a gradient with IMR was evident (see Figure 4).

Tetanus: The proportion was generally great ~ than nationwide in all provinces except Sorsogon and Albay.

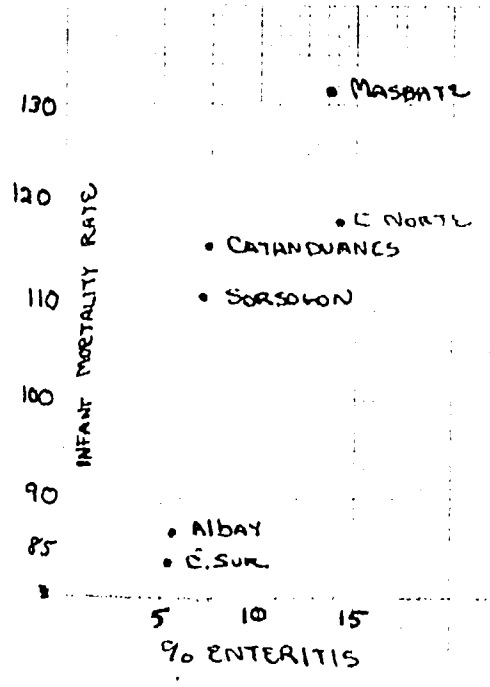
Malnutrition, Beri-Beri: The proportion of deaths was the same as nationwide and females showed a greater proportion of deaths.

Pneumonia, Bronchitis: All provinces showed a greater proportion of deaths from this cause.

Conditions of Newborns: All provinces showed lower proportion of deaths in these areas.

d. Summary: There appeared to be an association between the IMR and the proportion of enteritis deaths. The area also had a

Figure 4: Proportion of Deaths Due to Enteritis in Region V by IMR.



relatively greater proportion of deaths due to tetanus. Respiratory infections were an important cause of death in all provinces.

7. Region VI

   a. All provinces except Aklan and Antique had an IMR lower than the nationwide rate.

   b. The proportion of deaths not covered by common causes varied from 12% to 24%.

   c. Enteritis: Generally, the region had a greater proportion of deaths, than nationwide though the proportion was only slightly higher in Negros Occidental, Iloilo, Capiz (lower IMR areas).

      Tetanus: The region had almost twice the proportion of deaths as did the nation as a whole. The highest proportions were in Antique, Capiz, Iloilo; no gradient with IMR was seen.

      Malnutrition, Beri-Beri: The proportion of deaths was slightly lower than nationwide.

      Pneumonia, Bronchitis: Generally, the proportion was the same as that nationwide, with Capiz showing an increased proportion.

      Problems of Newborns: The proportion was generally lower.

   d. Summary: Enteritis accounted for a greater proportion of deaths in the lower IMR area. Tetanus was high in general. No gradient with IMR was seen.

8. Region VII

   a. The region and the individual provinces with the exception of Bohol, had IMR's less than nationwide.

   b. The proportion of deaths not covered by causes listed varied from 12% to 20%.

   c. Enteritis: There was a generally lower proportion than the national total.

      Tetanus: Cebu had a slightly greater proportion; the rest of provinces were similar.

      Beri-Beri, Malnutrition: There was a slightly greater proportion of deaths in all provinces than nationwide.

      Pneumonia, Bronchitis: No gradient with IMR was seen. The proportion was about the same as nationwide.

      Problems of Newborns: Generally the proportion was the same as nationwide.

d. Summary: Region and province resembled the national figure except for Cebu, which had proportionately more deaths from tetanus.

9. Region VIII

a. The region and the individual provinces with the exception of Leyte had IMR's greater than the Philippine total.

b. The proportion of deaths not covered by common causes varied from 9% to 16%.

c. Enteritis: There was a high proportion of deaths in E.Samar, while the rest of the provincial proportions were similar to those of the nation or lower.

Tetanus: The proportion was generally the same as nationwide, and somewhat higher in S. Leyte.

Beri-Beri, Malnutrition: Generally, there was a greater proportion of deaths than nationwide which was excessive in W. Samar, Leyte, S. Leyte. No gradient was seen with IMR.

Pneumonia, Bronchitis: A greater proportion of deaths was seen in all provinces than was seen nationwide. No gradient was seen with IMR.

Problems of Newborns: Generally, the proportion was slightly lower than the national proportion.

d. Summary: Pneumonia and bronchitis generally accounted for a greater proportion of deaths than nationwide. Problems of newborns had a proportion only slightly lower than nationwide. No gradient was seen with IMR.

10. Region IX

a. All provinces had IMR's much greater than the Philippine total.

b. The proportion of deaths not covered by the common causes varied from 13% to 19%.

c. Enteritis: The proportion of deaths was greater in each province than nationwide.

Tetanus: The region and the high IMR provinces showed a greater proportion of deaths due to tetanus. There were too few provinces to note a trend.

Beri-Beri, Malnutrition: The proportion of deaths was about the same as nationwide. The female proportion was similar to the male.

Pneumonia, Bronchitis: The proportion of deaths was only slightly greater than nationwide.

Problems of Newborns: All provinces showed lower proportions of deaths due to problems of newborn.

d. Summary: There were too few provinces to evaluate trends with IMR. Enteritis and tetanus caused proportionately more deaths in this region.

11. Region X

a. All provinces had IMR's much greater than the Philippine total.

b. The proportion of deaths not covered by common causes varied from 10% to 25%, with most over 15%.

c. Enteritis: Each province generally had a greater proportion of deaths due to enteritis. No gradient with IMR was seen.

Tetanus: The proportion was generally similar to nationwide rates.

Beri-Beri, Malnutrition: Bukidnon showed a greater proportion of deaths due to this cause, while all others were similar to natiowide figures. Females showed a higher proportion than males.

Bronchitis, Pneumonia: Agusan del Norte showed a greater proportion of deaths from this cause, while all others were similar to nationwide.

Problems of Newborns: The proportion of deaths was low compared to nationwide.

d. Summary: No gradient was seen with IMR and any cause of death. Enteritis generally was the cause of a greater proportion of deaths, while problems of the newborns were the cause of a lesser proportion.

12. Region XI

a. Except for Davao del Sur, all individual provinces and the region had IMR's greater than the Philippine total.

b. The proportion of deaths not covered by common causes varied from 15% to 23%.

c. Enteritis: The proportion of deaths was generally greater for all provinces compared to nationwide. No gradient with IMR was seen.

Tetanus: Generally, the proportion of deaths was almost twice as great as that nationwide. No gradient with IMR was seen.

Beri-Beri, Malnutrition: No gradient was seen with IMR, but the two lowest IMR provinces had low proportions of deaths, while two of the higher IMR provinces had the highest proportion of deaths. Females

showed consistently higher proportions of deaths than males.

Bronchitis, Pneumonia: Surigao del Sur showed a greater proportion of the nationwide deaths, while the rest were comparable or lower to nationwide.

Problems of Newborns: All provinces showed a lower proportion of deaths from these causes than nationwide.

d. Summary: Enteritis and tetanus caused a greater proportion of deaths compared to nationwide while problems of newborns caused a lesser proportion. No gradient with IMR was seer.

13. Region XII

a. IMR's were available only for Lanao del Sur and del Norte, and Northern Cotabato, all of which were much greater than nationwide.

b. The proportion of deaths covered by common causes varied from 15% to 35%.

c. Enteritis: Generally, a greater proportion of deaths was due to enteritis in all provinces, compared to nationwide.

Tetanus: The proportion of deaths was over two times as great in all provinces compared to nationwide.

Measles: 8% to 10% of female deaths in L.. .o del Sur and del Norte were caused by measles, about four to fi: times the national figure.

Beri-Beri, Malnutrition: Generally there was a lower proportion of deaths due to these than compared to nationwide. However, since this region had a large number of deaths listed as "others", (some deaths may be in that category). The proportion may be longer.

Bronchitis, Pneumonia: Generally, there was a slightly lower proportion of deaths compared to nationwide.

Problems of Newborns: All provinces showed a lower proportion of deaths from these causes.

d. Summary: Enteritis and tetanus caused greater proportions of deaths compared to nationwide. Measles accounted for an important proportion of deaths among females in two provinces. No gradient with IMR was seen.

14. Overall Summary

Except for enteritis in Region V, the IMR was not associated with any specific cause of death within a region. Pneumonia-bronchitis was consistently the cause of the greatest proportion of deaths. Enteritis accounted for proportionately fewer deaths in the Northern Regions

Table 8: Sex Specific Infant Mortality Rates for Malnutrition and Beri-Beri, Philippines 1976

Area	Number of Live Births		Number of deaths from Malnutrition & Beri-Beri		Malnutrition, Beri-Beri Mortality rate (10^3)	
	Male	Female	M	F	M	F
Region						
I	56,396	51,349	344	321	6.10	6.25
II	35,372	32,222	366	284	10.35	8.81
III	77,970	72,275	493	382	6.32	5.29
IV	91,110	83,433	477	411	5.24	4.93
V	56,009	51,692	251	255	4.48	4.93
VI	55,886	51,136	406	334	7.26	6.53
VII	56,587	51,808	433	400	7.65	7.72
VIII	28,490	26,546	398	360	13.97	13.56
IX	20,751	19,067	144	124	6.94	6.50
X	39,960	36,885	226	173	5.66	4.69
XI	52,307	48,639	160	163	3.06	3.35
XII	19,448	17,932	67	53	3.45	2.96
Philippine Total	684,791	630,069	4267	3785	6.23	6.01

Source: Vital Statistics, 1976, NCSO, 1980 tables 10 and 37.

Table 8A: Correlation of the Proportionate Mortality Ratio for Causes of Death With Infant Mortality Ratio in 67 Provinces, Philippines.

Cause of Death	Correlation Coefficient	Partial Correlation Coefficient
Enteritis	0.0997	0.1133
Tetanus	0.0845	0.2442
Malnutrition	-0.0399	-0.1150
Bronchitis/Pneumonia	0.0996	-0.1150
Abnormalities of Newborn	-0.3063	-0.5009

(I and II), was similar to the nationwide figure in many mid-regions (III, IV, V and VIII), and accounted for more deaths in Mindanao (IX, X, XI and XII). Western, Southern and Central Mindanao showed a greater proportion of deaths due to tetanus, although, in general, provinces with high IMR's had a greater proportion of deaths due to tetanus.

Females generally had a greater proportion of deaths from beri-beri and malnutrition. Whether this represented a true increased risk of death or was the result of less mortality from other causes can be discerned only from examining malnutrition mortality rates (presuming the figure is not the result of inaccurate data). The question is crucial, as differential feeding practices, between sexes are not considered as prevalent in the Philippines as elsewhere. While the added problem of introducing number of births in the denominator for mortality rates was discussed, for this analyses, sex-specific mortality rates were calculated by region (Table *). The results suggested no increased risk of death from malnutrition for female infants. Thus, their higher proportionate mortality ratio more likely reflected less mortality from other causes.

In summary, there appeared to be no clear intra-regional trends in causes of infant mortality. Some regions fluctuated in the proportion of deaths due to various causes, but no clear differences were apparent. Therefore, the next section presents some correlational analyses by provinces ignoring regions.

Provinces

All provinces with an estimated IMR were examined for the proportion of deaths due to any of the specific causes correlated with the IMR. The results are shown in Table 8A. With the exception of abnormalities of the newborn, none of the causes of death showed a significant correlation with the IMR. Abnormalities of the newborn showed a negative correlation, suggesting these causes of infant mortality were less important as infant mortality rates increased.

This pattern of causes of death is compatible with a picture of fewer deaths in later infancy due to enteritis, malnutrition, bonchitis, etc., in low IMR provinces, such that abnormalities of the newborn play a proportionately greater role; in high IMR provinces, more deaths occur beyond the newborn period from all the other causes.

Conclusions

Several good reasons for skepticism in using data on cause of death among infants have been presented. Nevertheless, marked differences correlated with infant mortality rates were considered of interest in suggesting possible preventive strategies in specific regions or provinces.

The results of provincial and regional analyses did not support the concept of proportionately more mortality from any cause of death accounting

for differences in the infant mortality rate. The bronchitis-pneumonia category was consistently an important cause of death, more so than other infectious diseases or the malnutrition category.

These data did support the general impression that in high IMR provinces more infants die, but in similar proportions, from the major causes of death. Looked at another way, it appeared that more infants in high IMR regions are at risk of dying, and they die of all the important causes of death.

CORRELATION OF IMR WITH SOCIO ECONOMIC, FERTILITY, AND HEALTH VARIABLES.

The main objective of the analyses in this section was to determine if specific socio-economic, fertility, or health variables correlated with IMR such that some of the large variation in the IMR in the Philippines could be explained. Several data sources were investigated that might yield such information at the regional and provincial levels. Interesting data were available at the regional level from the National Health Survey, World Fertility Survey, and Census publications. However, very little information was consistently available for the provinces. Isolated detailed analyses of some provinces existed, but uniform data on the items of interest from each province that could be used in correlation analyses were available only from the census. Therefore, published data from the 1970 and 1975 censuses were abstracted for each province that existed in 1970.

The rest of this section is organized as follows: first, problems with the use and interpretation of the data from each source is presented; second, the analytical methods used in this section are discussed; third, the results of the analyses are discussed by region and by province; and fourth, the conclusions and implications are presented.

Problems with data sources

There are aspects of each data source that should be mentioned so that a reasonable interpretation of the findings can be made.

National Health Survey

This survey covered a sample of 14,725 households in the Philippines over the two week period, October 1-15, 1978. The sampling frame was designed to permit estimation of population parameters for each region and of the Philippines total. The overall response rate was 93%, and it varied from 91% in Region IV to 74% in Region XI. The variation in response rates makes population inferences difficult unless one assumes that non-responders are similar to responders, a questionable assumption in health surveys. The large variation in response rates to individual questions is evident from the published tables on projected number of respondents (National Health Survey, Republic of the Philippines Ministry of Health, October, 1978). Without actual figures on the estimation procedures, the

projected number of households by region, and the non-response rates, it is difficult to assess the response bias.

Data from the National Health Survey on maternal and child health were obtained from female respondents who had given birth within three years of the survey. This criterion for limiting the respondents insured results reflective of the current situation; however, it may have biased the results by preferentially including women who were more likely to have given birth. Since the sampling procedure and hence the weighting procedure for population estimates did not consider women who had recently given birth, the published tables showing projected estimates should be interpreted with caution.

Some results of the survey also guided the selection of data items for analyses, and these are discussed below.

Maternal and Child health:

Most women who participated did not seek medical consultation for pregnancy until the last trimester (National Health Survey, October, 1978, table 21_A). Therefore, the variable of interest became the first person seen during the third trimester. Secondly, breastfeeding was reportedly very common, from 82% to 94%, making the tabulation of reasons why breastfeeding was not done unhelpful. It should be noted that health personnel advised not breastfeeding for 8% to 32% of the women who did not breastfeed (Ibid, table 27 A-C). Thirdly, over 50% did not respond to the question on child food supplements, so conclusions cannot be drawn from those data. Lastly, questions on family planning were not broken out by region and so could not be used.

Morbidity:

The survey editors noted the serious problems associated with self-reporting diseases as the basis for prevalence surveys. They attempted to improve the quality of the data by including only those diseases with diagnoses known as the result of medical attention. This limitation effectively excluded 81% of the reported cases. In addition, it also ensured that the highest prevalence rate of disease would occur where access to medical care was the easiest. Thus, for example, the highest prevalence rates of high blood pressure and diabetes occured in Metro-Manila. None of the diseases were free from this bias, or the problem that the age structures of the regions may confound comparisons of prevalence rates. For these reasons, correlations of IMR with prevalence rates of disease were not attempted.

Environmental Sanitation:

Some of these questions were not worded well, and only those which were considered non-judgemental were chosen for analyses (for example, 96% of respondents indicated they washed their hands before eating, although only 12% have a water tap inside the house, and 30% indicated unsanitary sources of water such as surface water, undeveloped spring, shallow wells, etc.). Questions on sanitation were excluded because no data were published on households without toilets.

The list of variables selected for study is presented below:

1. Distance from a government hospital.
2. Distance from a private hospital.
3. Distance from a community hospital or health center.
4. Distance from a rural health unit.
5. Distance from a barangay health station.
6. Proportion of persons seeking no help when reported sick.
7. The person who is consulted for pregnancy in third trimester.
8. Birth attendant.
9. Practice of withholding food when child has diarrhea.
10. Availability of trash can.
11. Refuse disposal system.
12. Source of water.
13. Income: The responses to this variable are notoriously low estimates, and do not consider true purchasing power through the exchange of goods and services.

1979 Area Fertility Survey

The University of the Philippines Population Institute has done extensive, good, quality work on studying fertility in the Philippines. The researchers are also using the data to investigate the level of infant mortality in their fertility survey. Several publications have described their methods and results, so the details need not be reiterated here (Concepcion, 1980, Cabigon, unpublished).

The data from the 1979 Area Fertility Survey has not yet been published, but Dr. Mercedes Concepcion kindly permitted the use of the computer tables. These data were selected because they were the most recent and the tabulations correlated the seven areas with the vital statistics regions.

The limitations of the data for the purposes of this report are as follows: Data are available only at the regional level because the sample design was based on a regional division of the country (provincial data gathering was never an aim of the survey). Moreover, 1979, seven regions were studied, of which six have tabulated data available. Thus, data in this report are presented for only six regions, and conclusions must be considered tentative at best. It would be highly desirable to correlate reliable estimates of fertility measures with the IMR at the provincial level, and the absence of such estimates has been unfortunate.

UPPI investigators are currently exploring the data for the best estimates of IMR for each region, as noted previously, so it would be premature to simply select an estimate for each region at this time. In addition, the investigators have found evidence of under-reporting of infant deaths in

their survey, so that IMR estimates are liable to be low (Cabigon, personal correspondence, 1981). The extent to which under-reporting varies by region is not known, so that estimates of regional bias are not possible. For these reasons, the six regions are simply ranked from high to low IMR for analyses with fertility items.

Other researchers have criticized the area fertility surveys for an apparent over-reporting of fertility in the last calendar year (Herrin, 1981). Moreover, the sampling errors are large despite the sample size due to the cluster sampling method chosen; thus, estimations of fertility rates and other fertility measures by region may appear to differ but actually be within sampling variation.

The variables selected for analyses are as follows:

1. Socio-economic status (SES): This composite variable assumes the existence of a "low, middle, and upper" status based on responses to 9 indicators; occupation of household head, household income, highest grade attained by household head, appliances owned, wall construction material, floor construction material, total number of rooms in the household, the type of toilet, and the type of lighting (Madigan, 1979).

2. Highest grade attained by ever married woman.

3. The age at first birth of ever married woman.

4. If ever married women worked between ending school and marriage.

Census Data

The 1970 and 1975 censuses were designed to be a complete enumeration of the population of the Philippines. In addition, questions were asked on fertility, education, occupation and characteristics of households.

Use of these data caused some misgivings because they may be out of date and not applicable. However, there is no other uniform, comprehensive source of data at the provincial level. Moreover, the estimates of infant mortality used in this study were created from the 1970 and 1975 census, so the correlation analyses would be done on comparable data. In any case, the focus of analyses is not on the absolute value of each variable, but on the variation in value from one province to the next in relation to the infant mortality rate. For these reasons, several variables were selected from the census data; they are described in table 9.

There are caveats with use of these data that require further explanation.

1. The definition of urban is based on population density, or physical structures in the town, or non-farming or fishing occupation of the households. It is likely, therefore, that areas considered semi-urban are classified as urban. Thus, urban-rural differences may be obscured in some provinces. For this reason, and the relatively smaller population in urban areas outside Manila, some variables were limited to results from the rural areas only.

2. Some data were the result of a 5% sample of the population (see table 9). The sample was a systematic selection of every 20th household. The published data are, therefore, estimates based on the sample, and hence, may differ from tabulations based on 100% samples. Rare events may not be detected. For example, although the 1975 vital statistics for Batanes showed 14 of 340 births occurred to women age 15-19, the 1975 census recorded no births in their sample.

3. The data on number of children refer to the number of children born alive. Thus, it does not reflect number of pregnancies, since the woman may miscarry or suffer stillbirth. Moreover, there is a reluctance to report dead children, particularly in Mindanao, so the figure may be low (Madigan, 1977).

4. Literacy is defined as able to read and write a "simple message" in some language or dialect. Illiterate, by this definition, are those unable to read or write at all; those considered functionally illiterate by other standards are probably classified as literate in these data.

5. Much of the occupational data refer to persons 10 years old and over. Data selected for use were age-specific so that a more realistic appraisal of work patterns among women and men in child-bearing years could be attained. Occupation was defined in the 1975 census as the kind of work performed at least 10 hours per week for not less than 26 weeks (if unemployed, the kind of work that used to be done). Not gainfully employed is not equivalent to unemployed, but is a category for students, housekeepers, disabled, prisoners, etch.

6. A household was defined as a group of people who sleep in the same dwelling unit and have common arrangement for the preparation and consumption of food. Thus, more than one household may exist in one dwelling unit.

7. The census reports indicated a post-enumeration survey was done to detect biases in data collection and reporting. However, no published data could be located on the post-enumeration surveys. Therefore, the completeness and accuracy of the census was difficult to determine other than as noted.

Analytic Methods

The data for regional and provincial analyses were first graphed, IMR versus the variables of interest. For regional data, trends were noted. Correlation coefficients of regression coefficients were not calculated because the sample size is small, n-12, and the correlations can be quite variable. Even high correlation coefficients can be non-significant if n is small (Snedecor and Cochran, 1967), so that if n=15, even a finding of r=0.50 would not result in rejecting the hypothesis that p=o.

For provincial data, a correlation matrix was created with IMR and the census variables. Variables correlated with IMR were selected for a linear regression model, with IMR as the dependent variable. The model was created using SEREG, a program designed to perform linear regression using

Table 9: List of Variables Selected from the Census According to Year of Ascertainment and Population Source.

Variable	Year	Population
Education		
1. Proportion of 20 year olds with no grade completed, with elementary school completed, and with high school completed	1975	Total
2. Number of persons age 10+ who had any elementary education, by sex and urban-rural.	1975	Total
3. Proportion of illiterate age 15+ by urban-rural	1970	5%
Fertility		
1. Proportion of females age $\leq$ 24 who never married	1975	Total
2. Number of ever married women age 15-19, 10-24, and 25-29 with no children, 1-3 children, 4-6 children and 7+ children by urban and rural.	1970	5%
3. Number of women age $\leq$ 40 who were ever married whose age at first marriage was 15, 16-20, or 21-25.	1970	5%
Occupation		
1. Proportion of male age 20+ who were farmers, fishermen, or not gainfully employed.	1975	Total
2. Proportion of females age 15-49 who are not gainfully employed, and who are housekeepers.	1975	Total
Socio Economic/Environmental		
1. Proportion of household with a radio, T.V. and refrigerator.	1970	Total
2. Proportion of dwelling units with electricity or kerosene.	1970	Total
3. Proportion of households whose source of water is piped, artesian well, pump, open well, or other (spring, lake, river, or rain)	1970	Total
4. Proportion of households with a flush toilet, antipolo, open pit, public toilet or no access to a toilet.	1970	Total
5. Population density (person/sq. km.)	1975	Total
6. Proportion rural.	1975	Total

least squares estimates of the β coefficients (SEREG was developed by the School of Economics, University of the Philippines).

In standard linear regression, the assumption is made that the variance of the dependent variable is constant, i.e. that E is a random variable $\mathcal{N}$ (0, $\sigma_{y.x}$). However, the IMR is a rate, with the variance proportional to its mean (V(p)=pq/n, p=IMR). In order to see if the use of a rate for the dependent variable was a serious violation of the regression assumption, the residuals were plotted and analyzed. In addition, the IMR was subjected to a logarithmic transformation (to stabilize the variance) and the residuals were analyzed. In both instances, it was apparent that the basic assumption was not violated. Therefore, the results are presented for the untransformed data.

Re regression coefficient and the linear model were tested by means of the t-test and F-test.

The following provinces were not included in the regression model because they did not have IMR estimates; Quirino, Siquijor, Tawi-Tawi, Basilan, Maguindanao, and Sultan Kudarat. In addition, Batanes had such a small population that most of their data were considered sufficiently unstable to warrant inclusion. Lastly, Metro Manila was excluded because it was 100% urban and thus had no values for several rural variables.

It should be noted that the OPS estimate for Nueva Vizcaya includes Quirino, the estimate for Negros Oriental contains Siquijor, the estimate for Sulu contains Tawi-Tawi and Basilan, the estimate for N. Cotabato contains Maguindanao, and the estimate for S. Cotabato contains Sultan Kudarat. Except for Maguindanao, these inclusions represent small populations.

In addition, OPS estimates were not available for Region XII; estimates included Surigao del Sur, Lanao del Norte and Lanao del Sur in Region X; N.Cotabato was included in Region XI. For regional analyses, an estimate for Region XII was created using OPS life table values on population and deaths for Lanao del Norte, Lanal del Sur, and N. Cotabato; since Maguindanao was part of N. Cotabato in 1970, the estimate is deficient only in as much as Sultan Kudarat is not included. These provinces were also excluded from Region X, an estimate was recreated based on the remaining provinces. Likewise, Surigao del Sur was included in Region XI and . Cotabato excluded, and a new estimate created. Thus, the provincial structure of Regions X, XI and XII were made to approximate the current structure, so census IMR estimates could be correlated with data from the regions as they currently exist.

Results

Region

The data from the 1979 Area Fertility Survey will be presented first, followed by the National Health Survey data.

1. Age at First Birth

There appeared to be no trend in the proportion of women whose age at first birth was less than 20 among regions ranked by IMR (table 10). This was true regardless of rural or semi-urban status, and true when analyzed by age 15 and age 15-19. For each province except Metro Manila, a greater proportion of rural women experience their first birth before age 20.

2. Work

Likewise, no trend was apparent in the proportion of women who did not work between finishing school and marriage (table 11). This result may have been confounded by the educational attainment of women; for example, if more women in a region went through high school and college, then more women would have been of marriageable age while in school, and potentially more would have married while in school or shortly thereafter. Tables 12 and 13 show the educational attainment of women in semi-urban and rural areas. In Central Luzon and Southern Tagalog, a relatively high proportion of women did not work, regardless of locale. In the rural areas, Central Luzon and Southern Tagalog also had the greatest proportion of women attaining high school and college; in semi-urban areas, the same pattern is not seen. At the extreme, semi-urban Manila and rural Mindanao, the supposition did not hold since Manila had the lowest proportion not working and yet high proportions in high school and college, while Mindanao had the highest proportion not working and low proportions in high school and college. Thus, there was no clear evidence of educational attainment confounding the proportion of women who work between school and marriage.

3. Education

Tables 12 and 13 also show that with one exception, there was no clear trend in the educational attainment of women in regions ranked by IMR. In rural areas, proportionately more women have no schooling as the rank of the IMR increases from low to high. Conversely, proportionately fewer women in the greater IMR regions of Bicol, W. Visayas and N. Mindanao attained high school and college. This finding is similar to Concepcion's finding in the 1973 MDS and 1978 RPFS of a decrease in the proportion of children dead as the women's educational attainment increases (Concepcion, 1980). In sum, in the rural areas, a possible trend in educational attainment was observed among regions ranked by IMR.

4. SES

A trend of increasing proportions of women of low SES by regions ranked according to IMR is seen in table 14. In part, this may reflect the trend in educational attainment, in rural areas at least, because 21% of the SES scale is a weighted measure of educational attainment. However, as noted, other factors are also components and together the measure of SES appears to differentiate among greater and lesser IMR regions. It was not possible in this study to do factor analyses of which component was the more important, and researchers at UPPI may

Table 10: Proportion of Ever Married Women Whose Age at First Birth < 20 by Region. (Ranked according to IMR)

Area (low to high)	Semi-Urban	Rural
Metro Manila	29.5	-*
Luzon	32.4	33.2
Southern Tagalog	33.2	40.5
Bicol	25.9	42.1
Western Visayas	24.5	37.2
Northern Mindanao	31.0	41.2

* no rural women

Source: 1979 AFS (weighted data)

Table 11: Proportion of Women Who Did Not Work Between Finishing School and Marriage by Region (Ranked According to IMR)

Area (low to high)	Semi-Urban	Rural
Metro Manila	44.9	-*
Central Luzon	67.1	65.3
Southern Tagalog	66.9	69.1
Bicol	55.2	65.4
Western Visayas	51.4	50.2
Northern Mindanao	70.5	82.0

* no rural women

Source: 1979 AFS (weighted data)

Table 12: Educational Attainment of Ever Married Women In Rural Areas by Regions
Ranked according to IMR

Area	No School	Elementary	High School	College
Central Luzon	2.4	62.6	22.9	11.7
Southern Tagalog	3.8	62.4	23.7	10.2
Bicol	3.4	74.4	15.9	3.3
Western Visayas	5.7	69.7	15.7	7.1
Northern Mindanao	8.8	65.5	19.5	5.8

Source: 1979 AFS (Weighted table)

Table 13: Educational Attainment of Ever Married Women in Semi-Urban Areas Ranked according to IMR.

Area	No School	Elementary	High School	College
Metro Manila	1.4	38.1	36.2	23.2
Central Luzon	1.2	52.7	28.0	18.1
Southern Tagalog	2.2	48.1	28.7	20.9
Bicol	1.8	50.6	23.9	20.5
Western Visayas	1.8	45.3	22.4	28.5
Northern Mindanao	2.4	45.8	33.0	18.3

Source: 1979 AFS (weighted table)

Table 14: Socioeconomic Status of Women by Region Ranked according to IMR

AREA	LOW	MIDDLE	HIGH
Metro Manila	51.6	44.3	4.0
Central Luzon	56.4	40.2	3.4
Southern Tagalog	67.5	28.6	4.0
Bicol	84.6	14.0	1.4
Western Visayas	82.0	15.8	2.2
Northern Mindanao	83.6	15.4	1.0

Source: 1979 AFS (weighted table)

wish to further examine this finding in their data set.

5. Income

No association was observed between IMR and income as reported in the National Health Survey or as reported in the integrated Census of Population and Economic Activities (NCSO, 1975) Income, as noted previously, was not a reliable variable, and for each region the reported average expenditures exceeded the average income by anywhere from P104 to P1730, where the average income for the Philippines as a whole was only P5840 (NCSO, 1975). With biases in reporting of this magnitude, it is difficult to conclude anything about the relationship of IMR and income.

6. Sanitation

A trend was seen of increasing IMR associated with an increasing proportion of people who dispose of garbage in an open dump (as opposed to pits, garbage collection, or other forms). A seeming exception to the trend was Region VIII, where 27% of persons reported use of open dumps, but where the IMR was not as high as would have been expected. There was no obvious explanation for the outlier, as response to the question on disposal did not indicate basic confusion with the question (Figure 5).

Questions were asked about water supply. One household may have had more than one source of water, so each source was counted. Therefore, the proportion of households reporting only one source, for example tap water, would be spuriously low in a region where most households had multiple sources(a). Since multiple sources are liable to be characteristic of disadvantaged provinces, the possibility of an artificial relationship of high IMR and low proportion of household using tap water, public faucet or other single source should be considered. With this caveat in mind, a trend was observed between increasing IMR and increasing proportion of households in each region whose water supply was an undeveloped spring (Figure 6) and surface water (Figure 7), both considered unsanitary sources by the Ministry of Health. No trend was seen with use of private, shallow wells or open, dug wells, also unsanitary sources.

Figure 8 shows the relationship of IMR with the proportion of households using safe water wells (the low proportion which is circled in Metro Manila, where more than 50% have an inside tap). The variation is large, but generally, those regions with a high IMR had a lower proportion of households using this safe water source.

(a) In a community of two households, one has tap water and one uses surface water, rain water, and a public faucet The table would read: 25% tap, 25% surface water, 25% rain water and 25% public faucet.

Figure 5: Proportion of Households Using Open Dumping for Refuse Disposal and IMR by Region

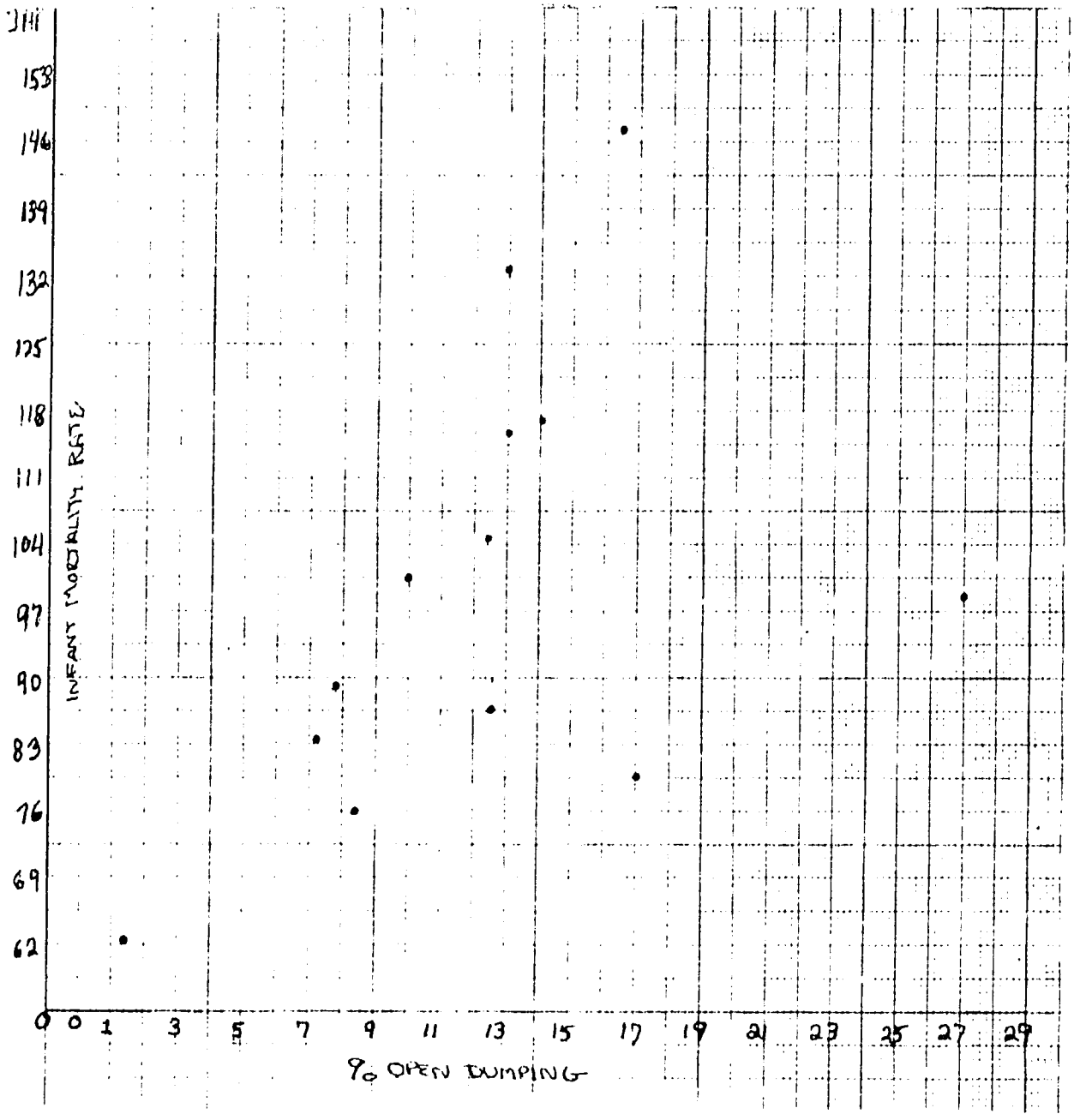


Figure 6: Proportion of Households Using Undeveloped Spring as a Source of Water and IMR by Region.

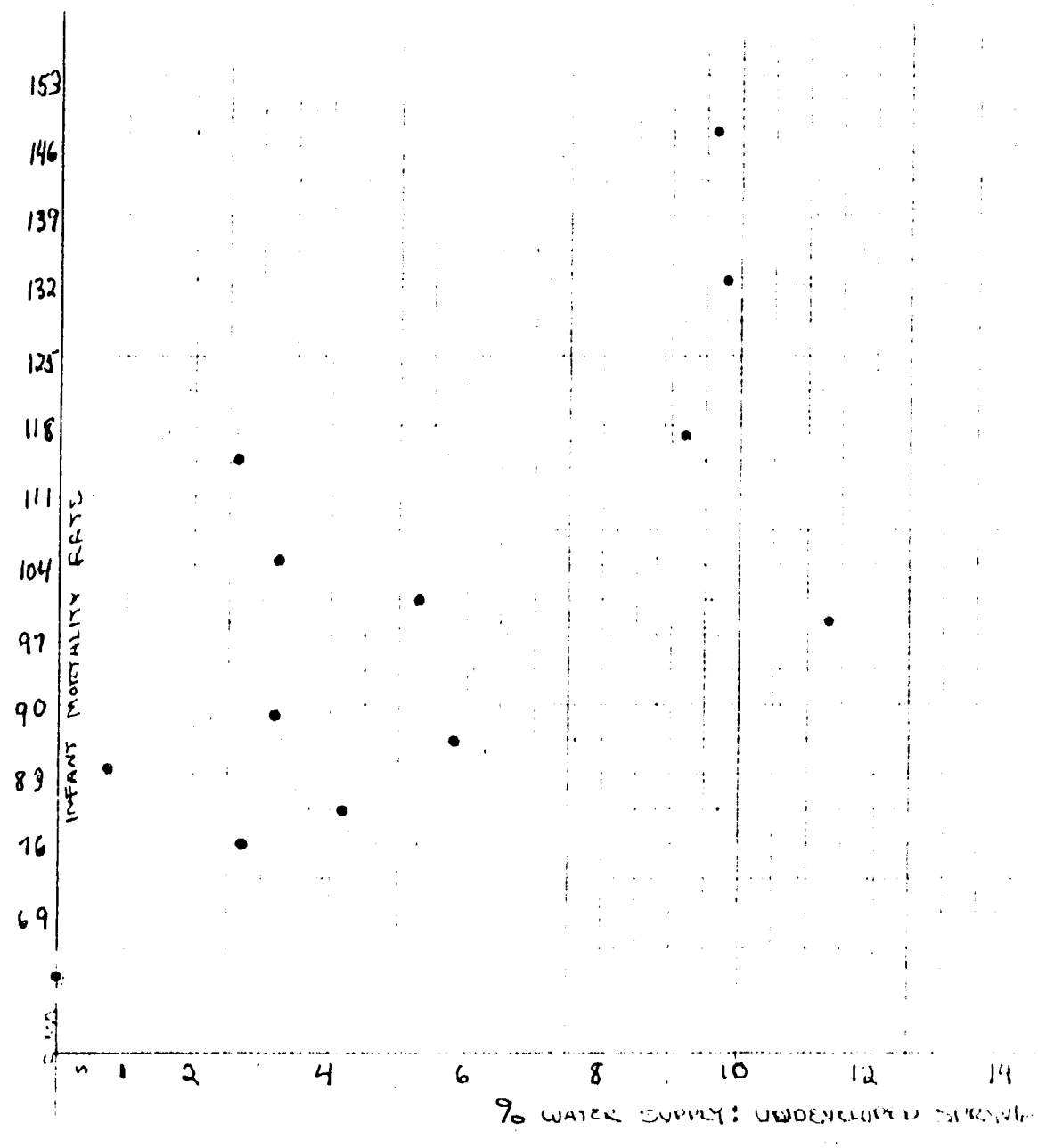


Figure 7: Proportion of Persons Using Surface Water as a Source of Water and IMR by Region.

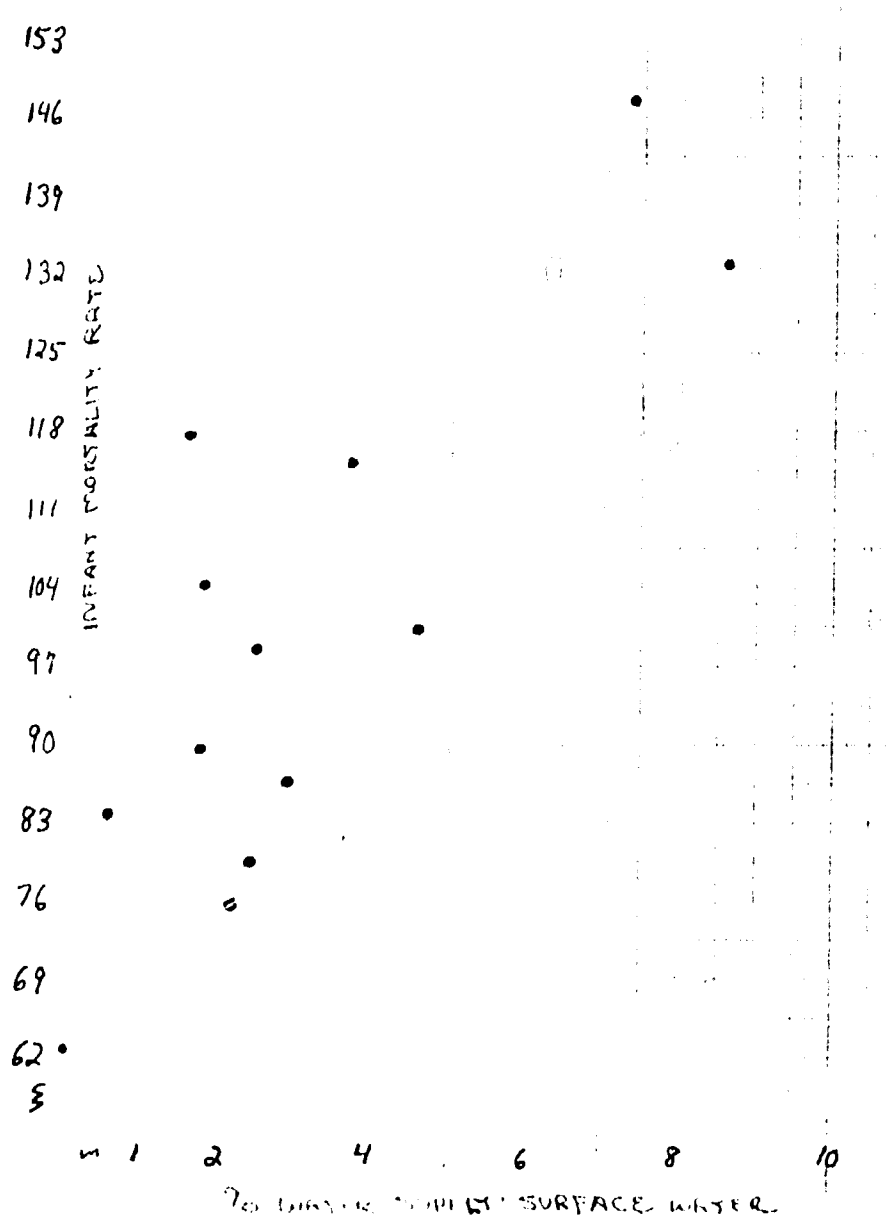
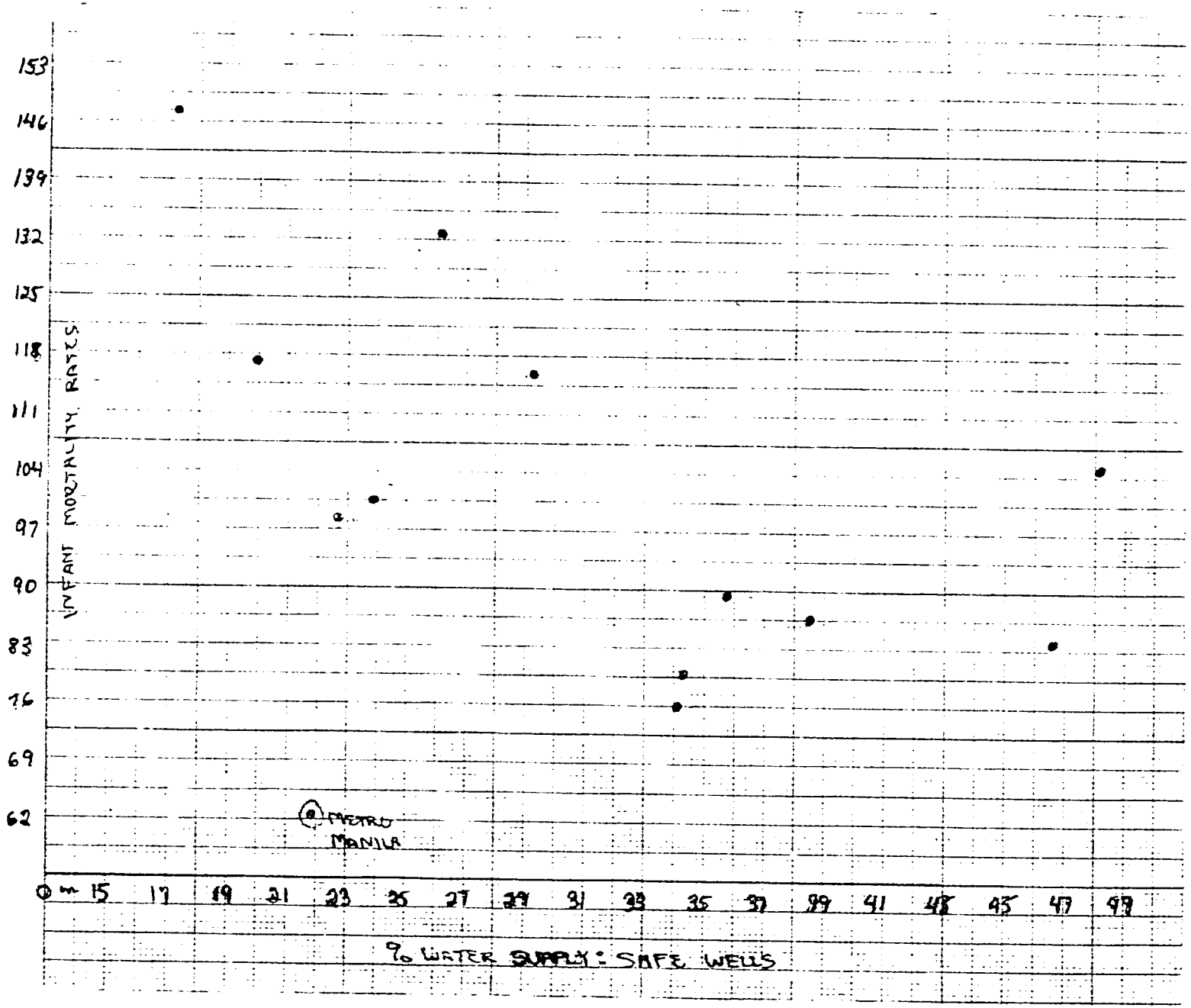


Figure 8: Proportion of Households Using Public, Improved Dug or Private Dug Well by IMR by Region.



In summary, the data are suggestive of an association between increasing IMR and the proportion of households reporting open dumping, and use of unsanitary spring and surface water sources. These variables are probably highly correlated, and the effects of each need to be separated, but such an analyses was not possible from the published data from the National Health Survey.

Health Attendants

Although the variation was great, the data were suggestive of an association between high IMR and the proportion of women in each region who were attended to by "hilots" at birth (Figure 9). Without more data points, the nature of the possible association was difficult to determine; it should be noted that only one region out of six with an IMR less than 90 had more than 30% of women using "hilots".

A question was also asked about what health worker is consulted if a household member gets sick. No pattern was seen of increasing IMR and reported use of indigenous health workers. In addition, no association was observed with IMR and the proportion of household consulting no one.

Any possible effect on IMR of using indigenous health workers appeared to be confined to birth attendance.

8. Distance from Health Facility

The data were analyzed by the proportion of persons reporting a distance of greater than 5 kms. to a health facility. No association of IMR was seen with proportion of persons reporting such a distance from a barangay health station, rural health unit, or community health center.

The distance to either a private or government hospital was reportedly greater, except in Metro Manila (Figure 10). Even disregarding Metro Manila there appeared to be a greater proportion of persons over five kms. distance from a hospital in regions where the IMR was high.

These results should not be construed to mean that the primary health care units are ineffective in lowering IMR. Although a long distance from a health unit may be tantamount to non-use, a short distance is no guarantee of effective use. The fact that the majority of respondents reported being close (< 5 kms.) to a Barangay Health Station or a Rural Health Unit does not indicate use (note that less than 2% of respondents reported consulting a barangay health worker when someone was ill). One could postulate that infants become gravely ill from the variety of severe illnesses discussed previously, and their requirements surpass the capability of the primary health care facility; then, access to hospital care may become critical.

By the same token, these results do not necessarily indicate that reducing the distance to a hospital is associated with reducing the IMR in a region. Access to hospital care is often accompanied by other improvements in the development of an area, such as improved water

Figure 9: Proportion of Women In Each Region Who Were Attended To at Birth by "Hilots", by IMR (Women had given birth within three years of the survey).

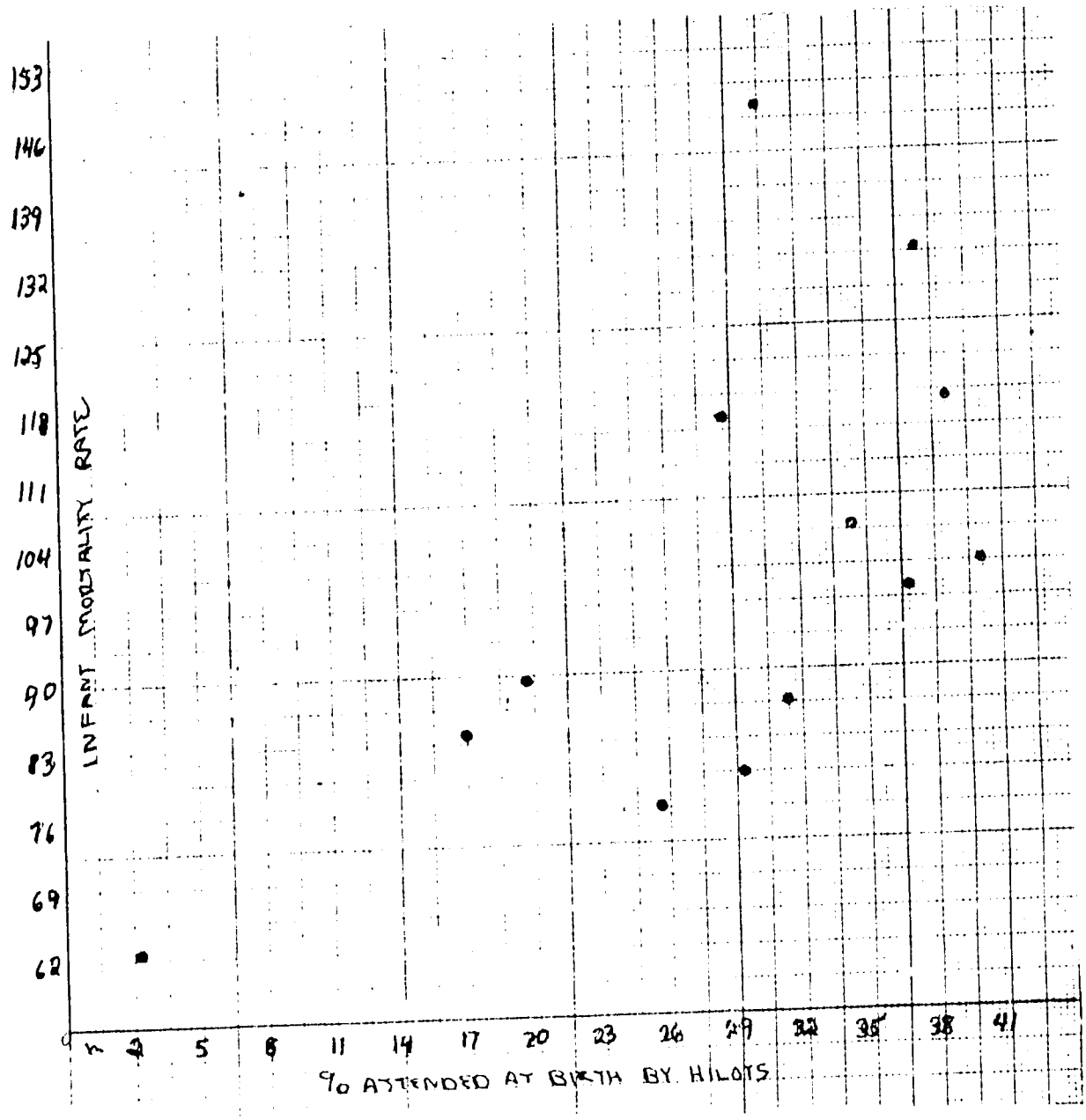
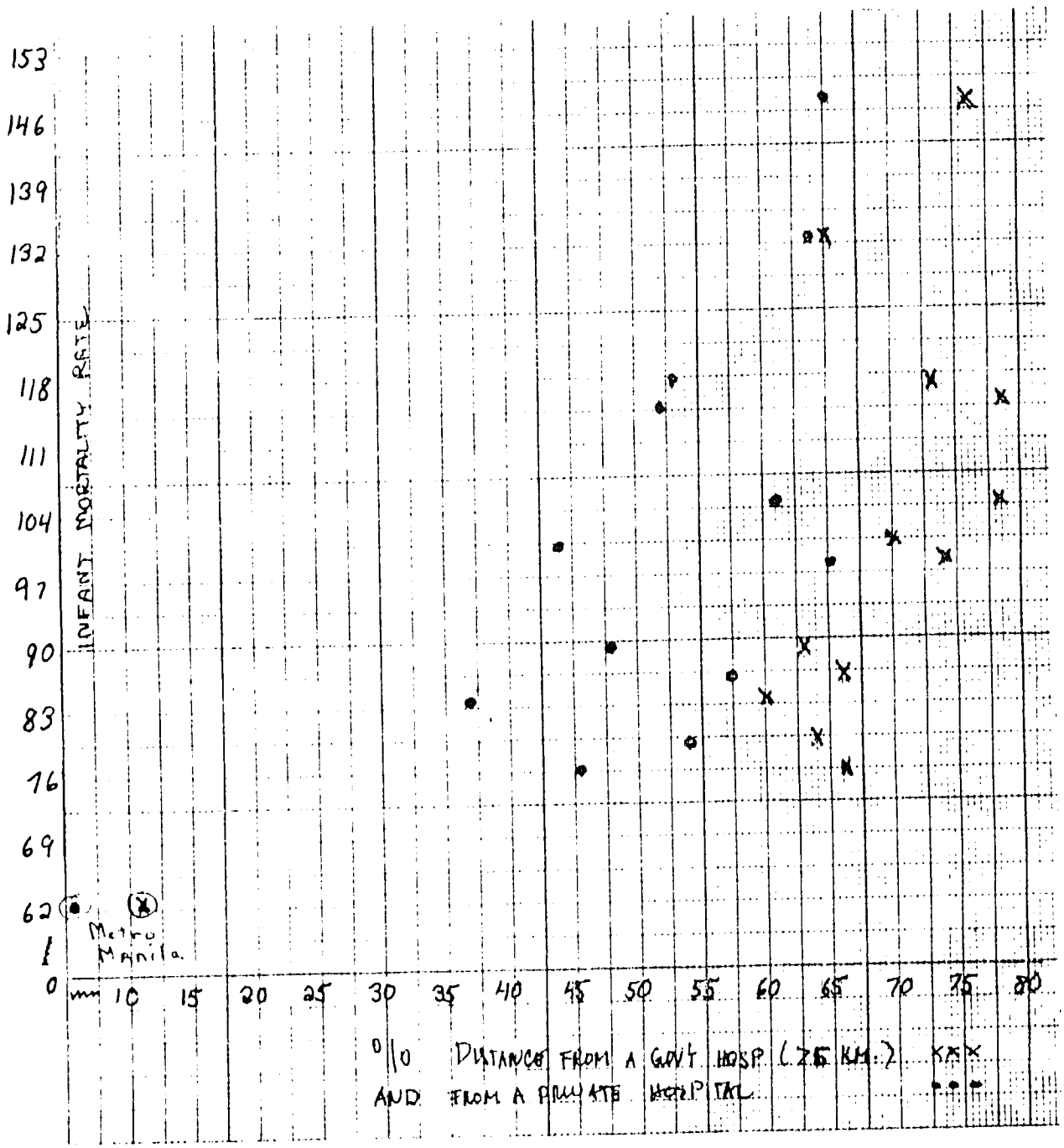


Figure 10: Proportion of Persons Reporting Distance from Hospital is > 5 kms. versus IMR by Region.



supply, roads, etc., any of which may also be associated with lower IMR.

Summary

Analyses of several variables for an association with IMR by region was performed. Data from the demographic and fertility surveys, National Health Survey, and census were used. The results suggested that increasing IMR was associated with the following: 1) low educational attainment by women; 2) low SES; 3) greater proportion of people in the region who dispose of garbage by open dumping; 4) lower proportion of persons using safe water wells; 5) increasing proportion of persons using undeveloped springs and surface water as water supply; 6) women attended to by "hilots" at birth; and 7) proportion of persons more than 5 kms. from a hospital.

Clearly, many of these factors are highly correlated and the effects of each should be evaluated for their independent contribution to explaining infant mortality. However, with only 13 data points, the small sample and variation obscures any possible association; further sub-classification should not be attempted. Therefore, the next step is to evaluate the findings using the province as the unit of analysis.

Unfortunately, some variables were not available at the provincial level. Specifically, SES, garbage disposal, "hilot" as birth attendant, and distance from hospital were available only at the regional level. Therefore, these associations with IMR should be considered tentative at best until further, refined analyses can be performed.

Provinces

Several variables were selected for study at the provincial level in order to explore the association with IMR. These variables are shown in table 15, as is their correlation with IMR. As noted, many of these variables were also highly correlated with one another; a linear model employing all variables simultaneously resulted in a singular matrix which would not invert. Therefore, several equations were constructed and significant variables selected for a final model.

The best model, in terms of maximum amount of variance explained with fewest variables, is shown in table 16. Four variables did not have individually significant t-tests, but the F-test for them together as a contribution to the regression equation was significant, so they are displayed. Each variable is discussed further below.

1. Education

   The most significant variable appeared to be the proportion of rural females aged 10+ who had at least some elementary education (as opposed to no grade completed). As the IMR increased by province, the proportion of rural females with some elementary education decreased; the lowest proportions were in the provinces with the highest IMR. This finding is similar to the finding of no schooling among women associated with increasing rank of IMR in the regional analyses.

Table 15: Variable Used in Regression Analyses, and Correlation Coefficient with Infant Mortality. Provincial Analyses, Philippines

Variable	Correlation Coefficient
Population Density	-0.413
% rural	0.399
Proportion of women age 24 who never married	-0.093
Proportion of 20 year olds with no grade completed	0.609
Proportion of 20 year olds with High School completed	-0.429
Proportion of males aged 20+ who are farmers	0.46E
Proportion of males aged 20+ not gainfully employed	-0.241
Proportion of women aged 15-49 who are housekeeper	0.0059
Proportion of rural males aged 10+ who completed only elementary	-0.313
Proportion of rural females aged 10+ who completed only elementary	-0.484
Proportion of rural illiterates aged 15+	0.511
Proportion of women age 15-19 with no children	0.167
Proportion of women aged 20-24 with four or more children	0.254
Proportion of women age 25-29 with four or more children	0.224
Proportion of women ever married whose age at first marriage 15 (respondent age 40)	0.414
Proportion of women ever married whose age at first marriage 20 (respondent age 40)	0.287
Proportion of households with a radio	-0.583
Proportion of dwelling units with electricity	-0.469
Proportion of households with piped water	0.001
Proportion of households with pumped water	-0.371
Proportion of households with other water sources	0.548
Proportion of households with unsanitary toilets	0.223
Proportion of households with no toilets	0.087

Table 16: Linear Regression Model of Infant Mortality In the Philippines.

Variable	Regression Coefficient	t-test	P	R^2	F-test
% Rural female with elemetary education	-1.975	5.62	<.05		
% Rural illiterates	-1.436	3.54	<.05		
% Radio	- .857	3.46	<.05		
% Male farmers	0.621	2.60	<.05		
% Water supply: other	0.350	1.72	>.05		
% Water supply: pump	-0.179	1.36	>.05		
% Women married at age $\leq$ 15	1.586	1.53	>.05		
% Male not gainfully employed	2.088	1.59	>.05		
				0.691	15.65 ($p<.05$)

There was also a significant negative association with the proportion of the rural population age 15+ who were illiterates. This association was puzzling especially since the initial correlation was distinctly positive. Closer inspection of the data revealed that a few of the highest IMR regions were all in Mindanao "peace and order" problem areas, and these reported abnormally low illiteracy rates. This suggests that either the literacy test was misused in these populations, or the population canvassed was highly select. The latter is a less likely explanation, since reported schooling was low for males and females, and other variables were indicative of a disadvantaged area.

The variable on illiteracy was highly negatively correlated with the proportion of females with elementary education. When confounding by this variable was controlled in the regression model, the outliers with high IMR's and low illiteracy rates reversed the initial positive direction of the association of IMR and illiteracy. Therefore, illiteracy rates should not be accorded much attention in the regression model (a).

2. Radio

A significant association was seen with increasing IMR and decreasing proportions of households who own radios. This is obviously an indirect association, and the primary variable could be several factors: i) an index of better income; ii) access to radio-transmitted education; or iii) an index of community development in the province. Whatever the primary factor, ownership of a radio is an important marker for IMR.

3. Male Employment

The proportion of males aged 20+ who were farmers was significantly associated with IMR, independent of female education, early age at marriage, and water supply. The proportion of male farmers explained an initial association of IMR and proportion of the province which was rural, suggesting that the IMR is more specifically related to farming families. Unfortunately, the data were not presented in such a way as to distinguish land owners from tenants or landless farmers, so gradations could not be studied. Jimeno (1980) also found that women married to farmers showed an increased risk for one or more child deaths.

Data on several aspects of farming which may be associated with IMR were not available, but data from the regional analyses suggest they may be important explanatory variables. For example, distance from a hospital

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(a) Postcript: the model was re-run after the report was completed deleting the variable on illiteracy. The R^2 dropped to only 0.62 and F-test on the remaining variables was 13.38, still highly significant.

may be far for most farmers. Moreover, most may use "hilots" as birth attendants. Also, the disposal of garbage, and living conditions in general, may not be very sanitary. These factors, and others may help explain the association of IMR and farming.

An association was noted between IMR and the proportion of males aged 20+ not gainfully employed. The regression coefficient was not significant, although this variable, taken together with water supply and young at age at marriage, did contribute significantly to the regression equation. As explained earlier, this variable was not a measure of unemployment; it included the disabled, retirees, students, and others not listing a usual occupation. In practice, the age limitations reduce the number of students, and retirees in rural areas are fairly rare. Thus, it should be considered a measure of those males with no identifiable occupation and uncertain income.

4. Water Supply

The variables on water supply were initially significantly associated with IMR, until the variable on proportion of male farmers was entered into the equation. Then, the t-test for the regression coefficient became non-significant, although the F-test indicated that taken together with young age at marriage and not gainfully employed, they added significantly to the regression equation. Together, the variables on water supply explain about 5% of the variation in IMR.

The equation indicated that the IMR increased with the increasing proportion of persons in the province using other water sources (i.e., spring, lake, rain, and river) and decreasing proportions of persons who have pumped water. The relatively small regression coefficients suggested that a relatively large proportion of persons must stop using other sources of water in order to affect the IMR. Likewise, large numbers of persons would need pumped water before the IMR would be affected.

Other sources of water studied were piped water, artesian wells and open wells. None of these sources was associated with IMR.

5. Marriage and Fertility

Only one variable showed a relationship with IMR that approached significance. This was the proportion of women aged $\leq$40 whose age at first marriage was 15 or under. While the t-test for the regression coefficient was not significant, this variable taken together with water supply did add significantly to the regression equation.

The variable on young age at marriage acted independently of education and having children between 15-19, because both of these variables were held constant and an independent effect was seen. However, it is known that reporting births at young ages, especially if the infants died, can be very poor, so the association with child bearing should not be excluded altogether. One could postulate that, all other things being

equal, a very young, inexperienced mother, who may not be well nourished herself, is less capable of caring for an infant than even older adolescents or women in their early twenties.

Other variables studied on marriage and fertility did not show much of an association with IMR. Even the variable "proportion of women aged 20-24 who have > four children", while highly correlated with young age at marriage, did not show an association with IMR once young age at marriage was controlled.

6. Other

None of the other variables, as shown in table 15, were significantly associated with IMR. The presence of electricity and of unsanitary toilets (or no toilet) were not significant when the presence of a radio and association with piped and pumped water were controlled.

None of the variables related to numbers of children showed any association with IMR once the confounding variables were controlled. This is somewhat puzzling as infant mortality is felt to be higher among very young mothers and elderly mothers, and mothers with frequent childbearing. These variables as used here may have been constructed so crudely that the association was missed.

Summary

A linear regression model of IMR was developed, using data from the census, to construct several dependent variables on socioeconomic status, sanitation, marriage and fertility.

Several variables were associated with IMR, and together they explained over 60% the variation in IMR by province. The variables which were negatively associated were: (1) proportion of rural females with elementary education; (2) presence of a radio; (3) water supply by pump. The variable which were positively associated with IMR were: (1) male employment as a farmer, or not gainfully employed; (2) age at marriage $\leq$ 15 for women; (3) water supplied by spring, lake, river or rain.

Conclusion

The problems of ecologic fallacy, and predicting IMR as developed by OPS, need to be addressed before the conclusions are stated.

The ecologic fallacy is a problem when observed relationships are based on group characteristics, rather than individual characteristics. Thus, for example, although we observe a high IMR in regions where men are farmers, we do not know specifically that farmers as a group have high IMR's. Our association is an ecologic one, and can only suggest possible leads for further studies.

The other problem is that the linear model is only as good as the data producing it. The six or seven variables can predict fairly closely the IMR for a province, but the IMR's are based on OPS estimates from 1970. Therefore,

the absolute values of the regression coefficients should not be considered as anything other than suggesting trends. With such reservations, the findings of this section, using multiple data sources and analyses at the regional and provincial level, point to several potentially important correlates of infant mortality.

One of the most important associations with lower IMR was education of women, especially in rural areas. Even elementary school education seemed to be better than none. This finding has appeared in virtually all work in the Philippines on infant and child mortality, and this study reinforces those findings for the infant mortality rate in particular.

The finding in the provincial analyses of a significant association of lower IMR with owning a radio should probably be thought of in the larger context of improved socioeconomic status or more income. Others may argue to the acquisition of material goods also reflects certain family planning practices. Further research on the nature of the IMR association with a radio would be in order.

The association of increasing IMR with use of unsafe water supplies, such as spring and rivers, makes intuitive sense. However, the size of the regression estimate suggests that a fairly large proportion of the population must decrease their use of these sources in order to reduce the IMR.

An intriguing finding in this study, and also in that by Jimeno (1980), was the association of IMR with males employed as farmers. Perhaps there is a unique feature of farming, such as exposure to insecticides, that needs to be identified. As noted, however, such factors as distance from a hospital and "hilots" as birth attendants need to be considered in evaluating any risk associated with farming.

The association of IMR with young age at marriage was not significant but, taken together with other variables, did explain some of the variation in IMR. Other works has also suggested an independent effect on childhood deaths of young age at marriage (Jimeno, 1980). It would be interesting to explore this relationship in some depth, as it may be independent of childbearing. However, with the trend of increasing age at marriage, it may be difficult to pursue.

DISCUSSION AND RECOMMENDATIONS

A study of infant mortality in the Philippines was carried out using 1970 estimates of infant mortality rates and data from a variety of sources on socioeconomic factors. The findings can be summarized as follows:

1. No particular cause of death could be associated with high rates of infant mortality as compared to lower rates;

2. An association of high IMR in regions and provinces was seen with low educational attainment of women, use of unsanitary water supply and dumping, low SES, proportion of males employed as farmers, young age at marriage, and distance from a hospital.

Several recommendations follow from this report, and these are discussed in more detail below:

1. There is an urgent need for better quality data on births, deaths and causes of death among infants in the Philippines.

   The best estimates available are based on data over ten years old, but substantial adjustment and the acceptance of uncertain assumptions are required even to use these. The attempt to improve the amount and quality of vital registration by using a dual-record system was innovative, but does not appear practical in the long run.

   The burden of reporting vital events might be removed from tne Local Civil Registrars, who have very little motivation to perform a good job. Instead, a full-time person, perhaps in the municipal health office, whose sole job would be to record and verify vital events might be employed.

   Another suggestion would be to utilize the parish priests in some areas to keep track of births and deaths. Many families feel that a baptism is synonymous with registering a birth, so the additional information required of the parents would be simple to collect.

2. Programs aimed at lowering infant mortality through preventive strategies are laudable, but are difficult to design, take a long time to implement, and are hard to evaluate. In the meantime, effective curative programs should be considered. For example, pneumonias, and lower respiratory disease, are the most significant causes of death, regardless of the IMR in a region. A primary health care system could be designed with the ability to administer penicillin injections whenever a mother complains that her child has fever, cough, and difficulty in breathing. Another simple focus would be the administration of tetanus toxoid to pregnant women in order to prevent neonatal tetanus.

   The current practice of training barangay health workers or midwives who are not allowed to prescribe or dispense selected drugs should be reconsidered. Not doing so is often the result of a tedious argument advanced by threatened physicians; perhaps more of them should be subjected to the acute frustration of chronic lack of resources in the

rural communities.

3. The association of high IMR with unsanitary water supplies suggests superficially that water projects should be undertaken for health goals. However, if the relationship is as noted, a large proportion of the population would have to abandon this water source for a modest improvement in the IMR. According to Walsh and Warren (1979), a community water supply and sanitation intervention is the most costly per capita strategy, and costly in terms of per infant or child death averted. Therefore, at this time, water supply projects whose goal is to reduce infant mortality, do not appear to be cost-effective interventions.

4. Education of women in the rural areas should be a high priority in programs designed to reduce IMR. The educational system in the Philippines is riddled with problems, including lack of physical structures, teachers, books, teaching aids, and others. Perhaps pilot projects, involving mobile teaching units, radio time, educational cooperatives and other approaches could be attempted. Tackling this problem calls for long-term strategies, and potential benefits would not be seen for some years.

5. The results of this preliminary foray into the causes of infant mortality suggest that further research in the following areas would be desirable:

   a. The data should be updated, using 1980 census figures and data. The linear regression model can then be updated and refined to reflect the current situation.

   b. The intriguing associations with ownership of a radio, and male employment as a farmer should be more thoroughly investigated as to the precise nature of the relationship with IMR. Perhaps some of the Bohol data could be re-analyzed in this regard. The value of such research lies in the potential for discovering true risk factors for infant mortality which could be modified.

   c. Because of the limitations of published data, this study was not able to address the relationship of fertility patterns with IMR in an in-depth way. The lack of association observed might change if more refined measures were employed using better data sets. In addition, further exploration of the association with young age at marriage would be interesting, although perhaps of less practical importance if the age at marriage is steadily increasing. In sum, with the heavy emphasis in the Philippines on projects controlling fertility, a research project specifically aimed at the likely effect of such control on infant mortality could be beneficial.

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