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RELATIONSHIP OF INFANT MORTALITY AND COMMUNITY DEVELOPMENT

Socorro D. Abejo

ABSTRACT

This study is aimed at examining the influence of community factors on infant and child mortality in rural areas of the Philippines. It uses as its data set the rural portion of the data from the 1978 Republic of the Philippines Fertility Survey (RPFS).

Among the health variables considered in the analysis, the accessibility of a dispensary and a midwife or nurse appear to have the greatest influence on a child's chances of survival between birth and fourth birthday. Their effects are particularly noted among the children of the least educated parents.

The general development of the barangay, measured by the proximity of a newspaper outlet and the availability of electricity, also shows an inverse relation with mortality in the first four years of life. General improvements in living conditions appear to benefit mostly the children of the poor and the least educated.

The results of this analysis also show that it is in the less developed barangays that accessibility of health services has greater impacts upon the mortality of children. The results likewise highlight the fact that medical interventions have a limited efficacy in reducing mortality.

INTRODUCTION

Within the boundaries of social demography, the idea that the characteristics of a community or social unit affect individual demographic behavior is well accepted. In studies of infant and child mortality, an important rationale for considering community variables can be illustrated as follows. Proximate determinants of morbidity and mortality during the first five years of life, such as maternal age, parity and birth interval; nutritional intake of both child and mother; and utilization of medical care are usually the result of household decisions (Da Vanzo, 1985). For example, corresponding to the above-mentioned risk factors are decisions regarding the timing and pace of childbearing; the preparation, storage and allocation of food; and when and where, if at all, to seek medical care. These decisions are often made in response to the following: (l) the availability and price of family planning methods, food and medical care; and (2) whether the couple or the family decision- maker wants fewer, better nourished and healthier children (Da Vanzo, 1985). Studies that examine the association between mortality and such community-level variables described in (l) above are particularly useful for policy purposes. These factors are beyond the control of individual couples or families but may be amenable to influence by government policies and programs. For instance, according to Rosenzweig and Schultz (1982), public health programs may affect health and health behavior by reducing the prices of health inputs directly through subsidies or indirectly, by making the services more accessible especially in remote areas. The reduced costs of health inputs may then lead to greater investments in health, and hence in greater survival chances.

The present study is an attempt to analyze the influence of community factors, namely, accessibility of selected health services and community amenities on mortality in rural Philippines. The focus is on the mortality of children below 5 years of age for the following reasons. First, the data set utilized in this study provides information about infant and child mortality only. Second, and more importantly, because of the relatively young age structure of the Philippine population and the relatively high mortality among children under 5 years of age; the deaths of children constitute a very large proportion of the total annual deaths in the country. Death registration data for the years 1978 and 1982 show that infant deaths accounted for about 25 per cent of total deaths in 1978, and around 20 per cent in 1982. The corresponding percentages of deaths at ages 1-4 years for these years were 12 and 13 per cent (Philippine Statistical Yearbook, 1985). Thus,

a marked reduction in infant and child mortality will contribute to further rapid improvement in the life expectancy at birth in the country.

The present study posits that infant and child mortality rates are lower in communities which have better access to health services and in communities which are more developed socio-economically. Using data from the 1978 Republic of the Philippines Fertility Survey (RPFS), this study attempts to meet the following specific objectives: (1) To examine whether mortality rate during the first four years of life varies among children of rural ever-married women (EMW) classified by selected characteristics of these women; and (2) To examine whether mortality rate is higher among children of rural EMW who reside in less developed barangays particularly those which have poor access to health services.

DATA, METHODOLOGY AND LIMITATIONS

Source of Data

This study uses as its data set responses from the rural respondents of the 1978 Republic of the Philipppines Fertility Survey (RPFS). This data set was generated from two data files, one containing information collected in the Individual Survey and the other containing data gathered in the Community Survey. The 1978 RPFS covered 718 sample barangays of which 359 were classified as rural. Seven of these rural barangays had no responses to the community-level questionnaire, thus leaving a total of 352 rural barangays for which community information was available. These 352 rural barangays included 1,623 interviewed women.

The Variables Included in the Analysis

The Dependent Variable

In this study, the dependent variable is $_4q_0$, the probability of dying before age 5. The probability of dying at infancy, $_1q_0$, and before age 4, $_3q_1$, are likewise estimated to ascertain their relative contributions to the variation in the probability of dying before age 5.

The Independent Variable

The community-level variables considered in the present analysis are grouped into two broad types: (1) accessibility of health services; and (2) indicators of levels of community development. Included in the first group are the health services of doctors, midwives or nurses, barangay health workers, hospitals, primary health care centers and dispensaries. Falling under the second type are such variables as presence of newspaper outlet, secondary school, and electricity.

Information about the types of water supply in the barangay was also gathered in the 1978 RPFS. However, this was not included among the data contained in the computer data tape used and thus is not considered in the analysis. Other health-related services like traditional birth attendant (TBA), pharmacy or drug store, and family planning services are likewise not included in the present analysis.

Among the development-related community variables, only newspaper outlet, secondary school and electricity are included in the analysis. However, these variables indirectly influence health behavior in that mass media facilitates the diffusion of information pertaining to health and sanitation and so do educational institutions.

Other Variables

Empirical evidence shows that survival chances of children during the first five years of life are associated with the personal attributes of the mother as well as of the father. In this regard, the effects of the individual level variables - (1) mother's education; (2) father's education; (3) father's occupation; and (4) region of residence on infant and child mortality are also examined. These individual-level variables are later used as control variables in the assessment of the effects of the community-level variables.

METHODOLOGY

The present study utilizes the indirect method of eatimating mortality levels developed by Preston and Palloni (1978). Like the indirect techniques of Brass (1964), Sullivan (1972), Trussel (1975) and Feeney1 (1980), the Preston and Palloni approach

converts the proportions dead among children ever born (CEB) reported by women in the standard five-year age groups (15-19, 20-24,..., 45-49) into estimates of probabilities of dying between birth and certain exact childhood ages. The main advantage of the Preston and Palloni method over the other methods is that the former uses the age distribution of the surviving children to obtain the age distribution of children ever born to the reporting women without recourse to model fertility schedules. The proportion dead among the CEB to a group of women depends upon the distribution of the children by length of exposure to the risk of dying (that is, upon the time distribution of the births), and upon the mortality risks themselves. The proportions of children dead classified by the mother's five-year age group or marital duration can provide estimates of the probabilities of dying between birth and various childhood ages. Brass discovered that the relation between the proportion of children dead, D(i), and a life-table mortality measure, q(I), is primarily influenced by the age pattern of fertility because it is this pattern that determines the distribution of children of a group of women by length of exposure to the risk of dying (United Nations, 1983).

Estimating Equation, Data Requirements and Assumptions

The Preston and Palloni method uses data on CEB and children still living (CSL) or dead by age of mother. Information about the age distribution of the surviving children is also required. Given an age pattern of mortality obtained from model life tables, the combination of the proportion of children dead and the age distribution of the surviving children of women from some particular age group uniquely determines a level of mortality. In the present study, the required data inputs were obtained from the birth histories reported by rural EMW who were in the age group 25-29. The preference for this group in the present analysis will be discussed later in this section. The estimating equation used in this study is as follows:

$$4q0 = D/B \times 0.9147 - 0.00469 \times Am + 0.4624 \times C(2)$$

where B - total children ever born to the respondent group, that is, ever married women aged 25-29 years

D - number of children dead reported by EMW aged 25-29 years

Am - mean age at last birthday of surviving children of EMW aged 25-29 years

C(2) - the proportion of surviving children of EMW aged 25-29 years whose age at last birthday was 0, 1 or 2

The Preston and Palloni approach uses Am and C(2) as mortality indices. Am serves to identify the mean duration of exposure of children to mortality, whereas C(2) serves to distinguish between children in their early years, when cumulative mortality risks rise rapidly, and children who have passed through this stage.

The above equation is based on the assumptions that mortality has remained constant in the recent past and that the age pattern of mortality follows that of the Coale-Demeny "West" Model Life Tables. The assumption on age-specific mortality pattern is of minor importance here since the results of using the equation are less sensitive to error in the choice of mortality pattern (Preston and Palloni, 1978:80). Nonetheless, the "West" Model was preferred because it is the mortality pattern deemed most appropriate to the Philippines. Thus, one would expect that it will give the least error in the estimates when the age pattern of mortality actually prevailing in the study population does not closely conform to the "West" Model Life Tables. This expectation was confirmed by Preston and Palloni (1978: Table 2).

The Choice of EMW Aged 25-29 Years as Respondent Group

For the present analysis, the age group 25-29 was chosen as the reference group mainly because, relative to the proportions of children dead reported by younger age groups, the proportion reported by this group yields child mortality estimates which are more stable and more representative of the child mortality of the general population. Preliminary estimates based on women aged 20-24 years (not shown) were ob-

served to be more affected by random fluctuations. This is because of the smaller number of CEB and children dead reported by women in this age group. This problem of chance fluctuations due to small numbers is compounded when women are further sub-classified by community characteristics. Similarly, estimates based on women 15-19 years of age are greatly affected by sampling variability. Apart from this, infant mortality among children born to these women is higher than that of the general population (Brass and Coale, 1968:111). In a recent analysis of infant mortality in the Philippines, Esclamad, et al., (1982) noted that infant mortality rate (IMR) estimates derived by Feeney's method were also higher than average infant mortality when based upon the reports of women aged 20-24 years. On the other hand, relative to the estimates derived from the proportion of children dead reported by women aged 30-34, estimates based on reports of women aged 25-29 pertain to the mortality situation for a period closer to the survey date. It can be shown by the Trussel method that mortality estimates of $_3q_0$, which are based on information supplied by women 25-29 years old, describe the mortality situation prevalent approximately four years before the survey. In this case, it can be safely assumed that community characteristics remained constant from the period to which the mortality estimates refer up to the time of the survey. It may be noted that the above equation uses the reports of women 25-29 years of age to estimate $_4q_0$ instead of $_3q_0$. Preston and Palloni were able to demonstrate that the 25-29 age group best identifies probabilities of dying, $_4q_0$, in the West Model, and $_5q_0$ in the South Model, rather than $_3q_0$. For this reason, the present study uses $_4q_0$ as the dependent variable. The values of $_1q_0$ and $_3q_1$ are estimated from the levels implied by the estimates on $_4q_0$ using the "West" Model Life Tables.

Estimation of Confidence Intervals of Mortality Estimates

The observed differences in mortality before age five may be simply due to chance fluctuations. For this reason, the differences of the $_4q_0$ estimates between subgroups are tested for statistical significance. The approach employed to test the significance of the differences is by an inspection of the values of $_4q_0$ and of the standard errors of these estimates. The estimated $_4q_0$ can be interpreted as the proportion who died before reaching the fourth birthday of the total births that occurred in the same period (Shryock and Siegel, 1971). Accordingly, 95 per cent confidence limits can be calculated from the estimated proportions (that is estimates of $_4q_0$ expressed per unit birth) plus or minus about twice (1.96) their standard errors. The estimated $_4q_0$ of two subgroups are considered to be significantly different if the 95 per cent confidence limits of each do not overlap. In the following analysis, an independent variable is assumed to be of little relevance if the differences in the estimated probabilities of dying due to this variable are not statistically significant.

The calculation of confidence limits requires the magnitude of the exposures to risks of dying in the relevant childhood ages. This information was not available for the $_1q_0$ and $_3q_1$ estimates since their values are simply imputed from the "West" levels of mortality corresponding the $_4q_0$ estimates. For this reason, the significance of the differences in $_1q_0$ and $_3q_1$ were not ascertained.

LIMITATIONS OF THE STUDY

There are five important limitations that need to be considered when interpreting the results of this study. First, the major drawback of the methodology adopted is that it relies on the assumption of constant mortality. Palloni (1978) explains that when the population is exposed to declining mortality and the estimation assumes constant mortality, the resulting estimates will be upwardly biased. The magnitude of the biases will depend on the speed of the decline and the duration of exposure to mortality risks of the CEB to women of a particular age group. For some population subgroups of interest in the present analysis, the assumption of constant mortality may be seriously violated and thus biases may be introduced into the estimates.

Second, the present study is concerned with "geographical accessibility" only inasmuch as this is the only information available in the data set. It therefore cannot address the issue of whether or

not rural people make use of the health services. Surely, actual use of such facilities is below what geographical accessibility implies. Other factors enter as well, such as the cost of health services, the quality of services, the daily or weekly schedule of the provision of services, the cost of travel to reach the services, even the perceived attitudes of health service personnel. Furthermore, the use of these facilities is conditioned by people's beliefs and knowledge about disease causation and by their attitudes and practices regarding treatment of diseases.

Third, in the present analysis, it is assumed that all sample women residing in the same barangay have the same travel time to the services not present in the barangay. This results in some flaws in the measurement of proximity of services for some women in the sample because travel time may differ among barangay residents depending on their location in the barangay. Similarly, the same problem arises with the assumption that facilities located in the barangay are closer than those outside the barangay. For residents near the boundaries of the barangay, this assumption may not hold.

Fourth, individual and community variables included in the analysis are associated with each other. For instance, better educated respondents live relatively closer to health services, and barangays remote from one type of service are likely to be remote from others as well (Casterline, 1984). In the present analysis, the independent effect of each variable on infant and child mortality cannot be estimated. This requires the use of multivariate techniques.

Fifth, the Preston and Palloni method of estimating infant and child mortality is particularly sensitive to omission of births and misstatement of ages of children. However, it is felt that the bias that may be introduced by this problem will not greatly affect the estimates of mortality in the study since the quality of the reporting of births and dating of such births and deaths of children in the 1978 RPFS was generally good (Reyes, 1981).

FINDINGS

Differentials by Selected Socio-economic Characteristics of the Respondents

Several empirical investigations have shown the importance of the socio-economic characteristics of the mother in influencing the child's chances of survival. This paper examines the associations between mortality in the first four years of life and each of the following individual level variables - education of the mother, her region of residence, education of her husband and occupation of her husband.

In rural Philippines, increasing the level of education of the mother is important in reducing the risk of a child dying during the first four years of life. This is reflected by the data in Table 1 which shows infant and child mortality as highest among children whose mothers did not receive any formal education at all, and lowest among those whose mothers attained college or high level of education.

The level of education of the father also appears to have an inverse effect on mortality before exact age four but not as marked as the influence of the mother's education. This is to be expected since it is the mother who takes greater responsibility for child care. The observed mortality differences by level of education of the father are more of a reflection of the socio-economic status of the family than the quality of child care (Hobcraft et al., 1984).

Substantial differences in infant and child mortality by father's occupation also exist. Children whose fathers work in agricultural jobs have the highest mortality in the first four years of life, while those whose fathers belong to the professional category have the lowest (Table 1).

Infant and child mortality vary by region as well. The probability of dying before age four among children in rural Visayas is significantly higher than that for the children in rural Luzon. Between rural Luzon and rural Mindanao, and between the latter and rural Visayas, the difference in mortality during the first four years of life is not significant.

Table 1. Estimates of Probabilities of Dying at Infancy and in Early Childhood, and 95 Percent Confidence of 4q0 by Selected Characteristics of Ever-Married Women: Rural Philippines, 1978 RPFS

Characteristics of Women	Infant and child mortality (per 1000)				Number of CEB
	4q0 (1)	Confidence Limits	1q0 (2)	3q1 (3)	
Total	94	(85,103)	71	25	3690
Education of the Woman					
None	203	(127, 279)	141	72	109
Primary	120	(101, 139)	88	35	1102
Intermediate	84	(70, 98)	64	21	1571
Secondary	72	(52, 92)	56	17	667
College and over	42	(17, 67)	35	7	243
Education of the Husband					
None	132	(75, 189)	95	41	135
Primary	111	(93, 129)	82	32	1178
Intermediate	95	(79, 111)	71	26	1351
Secondary	73	(55, 91)	57	17	778
College and over	48	(21, 75)	39	9	248
Occupation of the Husband					
Prof., clerical etc.	28	(9, 47)	24	4	288
Service-related	74	(57, 91)	57	18	917
Farmers	111	(95, 127)	82	32	1496
Other Agricultural	103	(84, 122)	76	29	977
Region of Residence					
Luzon	72	(59, 85)	56	17	1565
Visayas	116	(97, 135)	85	34	1101
Mindanao	103	(84, 122)	76	29	1024

NOTES: Estimates of 4q0 are obtained using Preston and Palloni Method, and assuming the age-specific mortality pattern of the "West" Coale-Demeny Model Life Tables.

Values of 1q0 are estimated from the "West" levels of mortality implied by the 4q0 estimates.

Values of 3q1 are estimated by applying the formula:

$$(3) = [(1) - (2)] / [1000 - (2)] * 1000$$

Figures in parentheses refer to the 95 percent confidence limits of 4q0.

The number of CEB refers to those borne by ever-married women (EMW) aged 25-29 years

Differentials by Travel Time to Health Services

Travel cost, as a composite of both cash outlay and a valuation of the amount of time spent in transit, is generally viewed as a deterrent to using health services (Akin et al., 1985). Accordingly, it is hypothesized that early childhood mortality increases with travel time to health services. The mortality estimates presented in Table 2 indicate an association between infant and child mortality and travel time to health services in the hypothesized direction. High infant and child mortality in rural Philippines tends to be related to poor access to such health services as dispensaries, primary health care centers, midwives, barangay health workers and doctors. The accessibility of a dispensary emerges as the most significant health variable affecting mortality during the first four years of life.

The significance of access to a dispensary for child survival does not come as a surprise. The cost advantage that rural health clinics have over public hospitals, private hospitals and private clinics may explain the significant positive effect of accessibility of a dispensary upon the survival chances of a child in the first four years of life. Rural health units, at least in principle, are expected to provide free services and medicines to patients.

The importance of the accessibility of a midwife or nurse, a barangay health worker and a primary health care center to survival at exact age four is also to be expected. The bulk of primary health care extended to the rural areas is made through the rural health units and the primary health care centers or barangay health stations (World Bank, 1984). These facilities provide, among others, services related to maternal and child health care, family planning and nutrition. At the primary health care centers, it is the midwife who mainly carries out such functions, being the person in charge of the center.

Differentials by Accessibility of Other Community Amenities

Studies on mortality differentials have highlighted the fact that the level of mortality is strongly correlated with community-level development. The present analysis attempts to examine if this is true for rural Philippines. The proximity of a newspaper outlet, the accessibility of a secondary school and the availability of electricity in the barangay were used as indicators of the level of general development of the barangay.

The accessibility of a newspaper outlet shows an inverse effect on mortality before exact age four. The effect of the variable on presence of secondary school in the community appears to be spurious. The difference in child mortality is not significant between children in barangays where a secondary school is present and those living in barangays where such amenities are not present or where these are located at least an hour away.

The presence of electricity does not appear to make any difference at all in the survival of children (Table 2). However, its significance becomes evident once the education of the mother, occupation of the father, and region of residence are introduced as control variables (Table 3, 5 and 6).

Differential by Travel Time to Community Services Controlling for Socio-economic Characteristics of the Respondents

The data reveal that well educated women, women whose husbands have relatively high educational attainment and women whose husbands work in non-agricultural occupations tend to be located in or near barangays where health services are available. Moreover, the present study shows the importance of the selected socio-economic characteristics of the mother in influencing the child's chances of survival (see "Differentials by Selceted Socio-economic Characteristics"). This raises the possibility that the differentials observed by travel time to community services are reflective of differentials in socio- economic characteristics of the respondents. To take account of this possibility, the effects of proximity to the services are evaluated after controlling for the selected individual socio- economic variables.

Education of the Mother

The differences in mortality during the first four years of life due to the varying accessibility of

Table 2. Estimates of Probabilities of Dying at Infancy and in Early Childhood, and 95 Percent Confidence Limits of 4q0 by Travel Time to Community Services: Rural Philippines, 1978 RPFS

Service / Travel time (in hours)	Infant and child mortality (per 1000)				Number of CEB
	4q0	Confidence Limits	1q0	3q1	
Doctor					
present	82	(62, 102)	63	20	689
less than 0.5	77	(61, 93)	59	19	1102
0.5 - 1	92	(69, 115)	69	25	626
1 and over	113	(96, 130)	83	33	1271
Midwife or Nurse					
present	75	(62, 88)	58	18	1668
less than 0.5	87	(66, 108)	66	22	705
0.5 - 1	114	(87, 141)	84	33	532
1 and over	124	(101, 147)	90	37	782
Health Worker					
present	69	(51, 87)	54	16	727
less than 0.5	84	(68, 100)	64	21	1090
0.5 - 1	90	(67, 113)	68	24	596
1 and over	116	(98, 134)	85	34	1261
Hospital					
present	70	(31, 109)	55	16	164
less than 0.5	77	(61, 93)	59	19	1118
0.5 - 1	91	(70, 112)	69	24	743
1 and over	108	(93, 123)	80	30	1663
Primary Care Center					
present	66	(51, 81)	52	15	1040
less than 0.5	96	(78, 114)	72	26	1012
0.5 -1	100	(76, 125)	74	28	542
1 and over	116	(97, 135)	85	34	1082

Table 2. Estimates of Probabilities of Dying at Infancy and in Early Childhood, and 95 Percent Confidence Limits of 4q0 by Travel Time to Community Services: Rural Philippines, 1978 RPFS(continued)

Service / Travel time (in hours)	Infant and child mortality (per 1000)				Number of CEB
	4q0	Confidence Limits	1q0	3q1	
Dispensary					
present	50	(32, 68)	41	9	566
less than 0.5	84	(68, 100)	64	21	1160
0.5 - 1	99	(77, 121)	74	27	682
1 and over	117	(99, 135)	86	34	1272
Newspaper Outlet					
present	61	(36, 86)	49	13	345
less than 0.5	78	(63, 93)	60	19	1206
0.5 -1	97	(74, 120)	73	26	645
1 and over	112	(96, 128)	82	33	1491
Secondary School					
present	88	(66, 110)	67	23	639
less than 0.5	74	(60, 88)	57	18	1406
0.5 - 1	102	(77, 127)	76	28	583
1 and over	118	(98, 138)	86	35	1050
Electricity					
present	64	(43, 72)	51	14	1010
absent	104	(83, 106)	90	15	2542

NOTES: same as in Table 1

Table 3. Estimates of Probabilities of Dying at Infancy and in Early Childhood, and 95 Percent ConfidenceLimits of 4q0 by Travel Time to Community Services and by Mother's Education: Rural Philippines, 1978 RPFS

Service / Travel time (in hours)	Education of Mother														
	None or Primary					Intermediate					Secondary or over				
	4q0	Confindence Limits		1q0	3q1	No. of CEB	4q0	Confidence Limits		1q0	3q1	No. of CEB	4q0	Confidence Limits		1q0	3q1	No. of CEB
Doctor																		
present or <0.5	109	(77, | 141)	80	32	360	81	(62, | 100)	62	20	799	64	(45, | 83)	51	14	634
0.5 and over	132	(109, | 155)	95	41	848	88	(68, | 108)	67	23	772	72	(42, | 102)	56	17	276
Midwife or Nurse																		
present or <0.5	96	(73, | 119)	72	26	614	78	(62, | 94)	60	19	1046	62	(44, | 80)	49	14	714
0.5 and over	154	(125, | 183)	110	49	594	94	(69, | 119)	71	25	525	77	(40, | 114)	59	19	195
Health Worker																		
present or <0.5	103	(72, | 134)	76	29	379	75	(57, | 93)	58	18	819	67	(47, | 87)	53	15	619
.05 and over	135	(112, | 158)	97	42	829	94	(73, | 115)	71	25	742	65	(36, | 94)	51	15	287
Hospital																		
present or <0.5	84	(49, | 119)	64	21	245	84	(61, | 107)	64	21	558	56	(35, | 77)	45	12	478
0.5 and over	134	(112 | 156)	97	41	962	84	(67, | 101)	64	21	1012	75	(50, | 100)	58	18	431
Primary Care Center																		
present or <0.5	99	(74, | 124)	74	27	531	84	(66, | 102)	64	21	904	58	(40, | 76)	47	12	617
0.5 and over	145	(118, | 172)	104	46	677	86	(65, | 107)	65	22	658	80	(49, | 111)	61	20	289
Dispensary																		
present or <0.5	79	(54, | 104)	61	19	444	80	(60, | 100)	61	20	717	62	(42, | 82)	49	14	566
0.5 and over	152	(127, | 177)	109	48	764	89	(70, | 108)	67	24	851	71	(44, | 98)	55	17	340
Secondary School																		
present or <0.5	109	(80, | 138)	80	32	443	79	(62, | 96)	61	19	942	58	(40, | 76)	47	12	661
0.5 and over	134	(110, | 158)	97	41	765	94	(71, | 117)	71	25	626	91	(55, | 127)	69	24	243
Newspaper Outlet																		
present or <0.5	103	(69, | 137)	76	29	306	74	(55, | 93)	57	18	714	57	(37, | 77)	46	12	531
0.5 and over	131	(109, | 153)	95	40	901	92	(73, | 111)	69	25	857	77	(50, | 104)	59	19	377
Electricity																		
present	75	(41, | 109)	58	18	233	58	(36, | 80)	47	12	425	63	(38, | 88)	50	14	352
absent	142	(120, | 164)	102	45	934	87	(70, | 104)	66	22	1091	71	(49, | 93)	55	17	517

NOTES: same as in Table 1

community services are marked among children of women with no schooling or with primary education (Table 3). The largest differences are those due to differential access to a dispensary. The effects of accessibility to health workers, primary health care center and newspaper outlet are not manifest, even after the mother's education was controlled.

Rosenzweig and Schultz (1982) had a similar finding in urban Colombia. The authors gave two possible reasons as to why it is the less educated who tend to benefit most from public health programs. Firstly, if the informational roles of both the health programs and the education of the mother are predominant in improving child survival, then such programs are likely to have greater impact on the health of the children of the less educated mothers. This difference, according to them, reflects the fact that the availability of information is only of value to those who have not yet acquired the information.

Secondly, education tends to increase the value of the mother's time so that a higher-educated woman will more likely prefer to go to a private doctor rather than wait at a public health facility. On the other hand, a mother with a low opportunity cost would consider waiting at a government clinic in order to get a cheaper, if not free, consultation for her ailing child. Under this situation, it is again the least educated who tend to be the major beneficiaries of public health programs.

Education of the Father

Accessibility to a doctor, a midwife or nurse, a hospital, a dispensary and a newspaper outlet show inverse effects on the mortality of children whose fathers are least educated. But these factors have no significant effect when fathers have intermediate or higher education (Table 4). This result more likely reflects the underlying effect of income and suggests that travel time is a strong deterrent to the use of modern health facilities among poor families but not among those with higher incomes.

Occupation of the Father

The occupation of the father appears to be a poor control variable (Table 5). The non-agricultural group is socio-economically heterogeneous since it includes both white and blue-collar workers. A further refinement of this category is no longer possible due to the small number of cases involved. This explains the seemingly inverse relationship of a number of health services variables with infant and child mortality among children of the non-agricultural workers.

Region of Residence

The effects of the community variables tend to differ by region. In rural Luzon, where the levels of infant and child mortality are lowest, the variables measuring development, namely, newspaper outlet and electricity, are significant factors of mortality risks in the ages 0-3 years (Table 6). In rural Mindanao, where infant and child mortality are at intermediate levels relative to those in rural Luzon and rural Visayas, the health variables on access to midwife or nurse and access to a dispensary emerge as important. In rural Visayas where infant and child mortality are at the highest, none of the community variables shows an effect on the mortality of children.

The result for rural Luzon seems to lend support to the view that there is a limit to the decline in probabilities of dying that can be achieved by medical techniques. The proponents of this view claim that public health programs can be extremely successful in bringing about rapid short-term declines in mortality, but social and economic factors are much more important in achieving long- term effects (United Nations, 1973).

Differentials by Travel Time to Health Services Controlling for the Level of Development

The apparent differences in probabilities of dying attributed to the variables used as proxies for levels of development may be capturing the effects of the health services variables. Conversely, the observed differences by travel time to health services might also be reflecting the effects of the proxy variables for development. The relative contributions of the levels of development and the accessibility of health services in the improvement of a child's chances of survival between birth and the fourth birthday can-

Table 4. Estimates of Probabilities of Dying at Infancy and in Early Childhood, and 95 Percent Confidence Limits of 4q0 by Travel Time to Community Services and by Father's Education: Rural Philippines, 1978 RPFS

Service / Travel time (in hours)	Education of Father														
	None or Primary					Intermediate					Secondary or over				
	4q0	Confindence Limits	1q0	3q1	No. of CEB	4q0	Confidence Limits	1q0	3q1	No. of CEB	4q0	Confidence Limits	1q0	3q1	No. of CEB
Doctor															
present or <0.5	80	(54, 106)	61	20	434	98	(75, 121)	73	27	670	62	(44, 80)	49	14	688
0.5 and over	129	(107, 151)	94	39	879	91	(69, 113)	69	24	679	80	(51, 109)	61	20	339
Midwife or Nurse															
present or <0.5	82	(62, 102)	63	20	713	90	(71, 109)	68	24	861	60	(44, 76)	48	13	799
0.5 and over	146	(118, 174)	105	46	599	101	(74, 128)	75	28	487	93	(55, 131)	70	25	228
Health Worker															
present or <0.5	88	(62, 114)	67	23	470	97	(75, 119)	73	26	686	52	(35, 69)	42	10	661
0.5 and over	127	(105, 149)	92	39	843	92	(70, 114)	69	25	653	90	(60, 120)	68	24	361
Hospital															
present or <0.5	64	(36, 92)	51	14	289	93	(67, 119)	70	25	487	62	(41, 83)	49	14	506
0.5 and over	125	(105, 145)	91	37	1023	94	(75, 113)	71	25	861	71	(49, 93)	55	17	521
Primary Care Center															
present or <0.5	90	(67, 113)	68	24	580	92	(72, 112)	69	25	786	58	(40, 76)	47	12	685
0.5 and over	131	(106, 156)	95	40	726	96	(72, 120)	72	26	559	84	(54, 114)	64	21	338
Dispensary															
present or <0.5	64	(42, 86)	51	14	488	90	(68, 112)	68	24	624	64	(45, 83)	51	14	614
0.5 and over	142	(118, 166)	102	45	825	98	(76, 120)	73	27	721	72	(47, 97)	56	17	409
Secondary School															
present or <0.5	88	(64, 112)	67	23	547	88	(68, 108)	67	23	776	60	(43, 77)	48	13	722
0.5 and over	131	(107, 155)	95	40	766	104	(79, 129)	77	29	567	79	(48, 110)	61	19	300
Newspaper Outlet															
present or <0.5	75	(48, 102)	58	18	378	98	(74, 122)	73	27	614	47	(29, 65)	39	8	559
0.5 and over	128	(107, 149)	93	39	935	91	(70, 112)	69	24	735	88	(62, 114)	67	23	466
Electricity															
present	73	(40, 106)	57	17	246	67	(40, 94)	53	15	320	55	(34, 76)	44	12	443
absent	121	(101, 141)	88	36	1018	100	(81, 119)	74	28	976	78	(56, 100)	60	19	548

NOTES: same as in Table 1

Table 5. Estimates of Probabilities of Dying at Infancy and in Early Childhood, and 95 Percent Confidence Limits of 4q0 by Travel Time to Community Services and by Father's Occupation: Rural Philippines, 1978 RPFS

Service/ Travel time (in hours)	Occupation of the Father									
	Agricultural					Non-Agricultural				
	4q0	Confidence Limits	1q0	3q1	No. of CEB	4q0	Confidence Limits	1q0	3q1	No. of CEB
Doctor										
present or <0.5	92	(73, 111)	69	25	893	66	(50, 82)	52	15	887
0.5 and over	115	(99, 131)	84	34	1577	60	(34, 86)	48	13	319
Midwife or Nurse										
present or <0.5	88	(73, 103)	67	23	1382	63	(48, 78)	50	14	980
0.5 and over	131	(111, 151)	95	40	1088	68	(35, 101)	53	16	226
Health Worker										
present or <0.5	88	(70, 106)	67	23	929	66	(50, 82)	52	15	876
0.5 and over	118	(102, 134)	86	35	1537	56	(31, 81)	45	12	319
Hospital										
present or <0.5	83	(62, 104)	63	21	633	67	(48, 86)	53	15	644
0.5 and over	116	(101, 131)	85	34	1838	60	(40, 60)	48	13	561
Primary Care Center										
present or <0.5	96	(79, 113)	72	26	1112	62	(46, 78)	49	14	928
0.5 and over	118	(101, 135)	86	35	1349	73	(42, 104)	57	17	274
Dispensary										
present or <0.5	80	(62, 98)	61	20	914	64	(47, 81)	51	14	806
0.5 and over	123	(107, 139)	90	36	1552	65	(40, 90)	51	15	396
Secondary School										
present or <0.5	89	(72, 106)	67	24	1097	66	(50, 82)	52	15	943
0.5 and over	122	(105, 139)	89	36	1368	56	(28, 84)	45	12	259
Newspaper Outlet										
present or <0.5	81	(62, 100)	62	20	820	64	(46, 82)	51	14	726
0.5 and over	119	(103, 135)	87	35	1649	61	(40, 82)	49	13	479
Electricity										
present	67	(43, 91)	53	15	407	59	(40, 78)	47	13	592
absent	114	(100, 128)	84	33	1964	73	(52, 94)	57	17	578

NOTES: same as in Table 1

Table 6. Estimates of Probabilities of Dying at Infancy and in Early Childhood, and 95 Percent Confidence Limits of 4q0 by Travel Time to Community Services and by Major Island Group: Rural Philippines, 1978 RPFS

Service / Travel time (in hours)	Region of Residence														
	Luzon					Visayas					Mindanao				
	4q0	Confidence Limits	1q0	3q1	No. of CEB	4q0	Confidence Limits	1q0	3q1	No. of CEB	4q0	Confidence Limits	1q0	3q1	No. of CEB
Doctor															
present or <0.5	64	(48, 80)	51	14	849	106	(78, 134)	78	30	462	82	(57, 107)	63	20	481
0.5 and over	84	(64, 104)	64	21	717	122	(97, 147)	89	36	639	119	(92, 146)	87	35	541
Midwife or Nurse															
present or <0.5	64	(49, 79)	51	14	1052	111	(87, 135)	82	32	651	68	(49, 87)	53	16	670
0.5 and over	90	(65, 115)	68	24	513	123	(93, 153)	90	36	450	163	(124, 202)	116	53	351
Health Worker															
present or <0.5	57	(41, 73)	46	12	834	110	(82, 138)	81	32	491	88	(63, 113)	67	23	493
0.5 and over	90	(69, 111)	68	24	724	122	(96, 148)	89	36	604	115	(88, 142)	84	34	529
Hospital															
present or <0.5	68	(49, 87)	53	16	655	93	(60, 126)	70	25	296	77	(48, 106)	59	19	332
0.5 and over	76	(59, 93)	59	18	911	126	(103, 149)	92	37	806	113	(89, 137)	83	33	690
Primary Care Center															
present or <0.5	62	(46, 78)	49	14	884	110	(86, 134)	81	32	647	77	(54, 100)	59	19	520
0.5 and over	88	(67, 109)	67	23	668	127	(96, 158)	92	39	455	123	(94, 152)	90	36	501
Dispensary															
present or <0.5	58	(42, 74)	47	12	815	100	(71, 129)	74	28	420	76	(53, 99)	59	18	491
0.5 and over	89	(69, 109)	67	24	743	126	(101, 151)	92	37	681	126	(98, 154)	92	37	531
Secondary School															
present or <0.5	66	(51, 81)	52	15	1033	106	(78, 134)	78	30	477	78	(55, 101)	60	19	535
0.5 and over	84	(60, 108)	64	21	525	124	(98, 150)	90	37	624	126	(96, 156)	92	37	484
Newspaper Outlet															
present or <0.5	52	(36, 68)	42	10	787	120	(87, 153)	88	35	382	75	(49, 101)	58	18	382
0.5 and over	92	(72, 112)	69	25	778	114	(91, 137)	84	33	719	116	(91, 141)	85	34	638
Electricity															
present	51	(34, 68)	42	9	639	83	(42, 124)	63	21	174	89	(49, 129)	67	24	197
absent	88	(69, 107)	67	23	887	117	(95, 139)	86	34	854	109	(87, 131)	80	32	801

NOTES: same as in Table 1

not be estimated in the present analysis. However, one important issue that can be addressed is whether the effects of the accessibility of health services vary according to the level of development of the barangay.

In less developed barangays access to health services exerts relatively greater influence on the survival chances between birth and the fourth birthday (Table 7). The accessibility of a dispensary undoubtedly is the most important health services variable affecting a child's chances of survival before exact age four in these barangays. Accessibility of a midwife or nurse also emerges as significant health services variables in these barangays.

The relatively weaker influence of the health services variables in more developed barangays might be due to the relatively higher socio-economic characteristics of the population (Table 8). The quality of the transport system plays an important role as well. The relationship between transportation cost and distance is not linear where transportation facilities are not uniformly good (Akin et al.,1985). In more developed barangays where the transport system is likely to be relatively better, the monetary cost of travel is expected to be lower. Thus, it is more likely that in more developed barangays, distance is not as much a deterrent to using health facilities as in less developed barangays.

CONCLUSION

In rural areas of the Philippines, the children of the poor and least educated are the ones most exposed to the highest mortality risks (Table 1). These children can be a major target group for a substantial reduction in overall levels of infant and child mortality. This study shows that low-cost health services such as dispensaries and midwives are most influential in the marked decreases in probabilities of dying between birth and the fourth birthday among children with poor and less educated parents. Thus, the government should continue to focus on expanding health care services, both preventive and curative, to the extent that these are affordable by the rural population.

The primary health care services should be extended in coverage to reach the doorsteps of the poor rural households. In rural areas where travel can be difficult and expensive, distance or travel time appears to be a major impediment to the use of modern medical services. The government's move to assign trained midwives to rural barangays and recruit indigenous barangay health workers are good policy options. Of equal importance to the improvement of health, and hence of the survival chances of rural children, are strategies that will promote the optimum use of public health services. The relative unimportance of access to the health services variables for the survival of children in rural Visayas might be due to the under-utilization of the available health services. Possibly, the services offered are not appropriate to the social setting of the region.

This study highlights the importance of improving the general standard of living to ensure the health and survival of children, particularly those belonging to socio-economically disadvantaged rural families. The study underscores the fact that access to the other basic necessities of life - adequate nutrition, better housing conditions, education, safe water and sanitation - are equally important for the reduction of mortality. Government planners should therefore integrate the health component in social and economic development programs. These are premised on policies aimed at uplifting the living conditions of the rural population.

The present study poses as many questions as it provides answers. For instance, the underlying reasons for the different community factors emerging as important to the survival of children in the three regions are not clear and this calls for further investigation. Another issue which could be important from the policy-maker's perspective, but which this study failed to resolve, is the identification of the threshold beyond which travel time becomes a major impediment to using modern health services. The small sample size available for the study, unfortunately, as mortality is a rare event, did not permit a more refined grouping of travel time. Despite the limitations of the present analysis, it is hoped that this study serves as a basis for future research in this area.

Table 7. Estimates of Probabilities of Dying at Infancy and in Early Childhood, and 95 Percent Confidence Limits of 4q0 for Children of EMW Living in More Developed Barangays According to Travel Time to Health Services: Rural Philippines, 1978 RPFS

Service / Travel time (in hours)	Barangays With or Less 0.5 hr.-Travel to: Newspaper Outlet					Barangays With or Less 0.5 hr.-Travel to: Secondary School					Barangays With Electrity				
	4q0	Confindence Limits	1q0	3q1	No. of CEB	4q0	Confidence Limits	1q0	3q1	No. of CEB	4q0	Confidence Limits	1q0	3q1	No. of CEB
Doctor															
present	78	(55, 101)	60	19	527	84	(63, 105)	64	21	644	78	(52, 104)	60	19	421
less 0.5	72	(55, 89)	56	17	938	73	(57, 89)	57	17	1057	53	(32, 74)	43	10	422
0.5 - 1	-	-	-	-	56	84	(47, 121)	64	21	220	-	-	-	-	42
1 and over	-	-	-	-	30	91	(41, 141)	69	24	125	51	(12, 90)	42	9	125
Midwife or Nurse															
present	69	(53, 85)	54	16	926	71	(57, 85)	55	17	1225	73	(53, 93)	57	17	637
less 0.5	78	(56, 100)	60	19	586	81	(60, 102)	62	20	626	68	(37, 99)	53	16	261
0.5 - 1	-	-	-	-	39	144	(86, 202)	103	46	142	-	-	-	-	25
1 and over	-	-	-	-	-	-	-	-	-	52	-	-	-	-	87
Health Worker															
present	62	(40, 84)	49	14	451	61	(41, 81)	49	13	570	65	(39, 91)	51	15	347
less 0.5	82	(65, 99)	63	20	994	82	(65, 99)	63	20	1056	65	(43, 87)	51	15	471
05. - 1	-	-	-	-	42	97	(59, 135)	73	26	233	-	-	-	-	32
1 and over	-	-	-	-	51	92	(50, 134)	69	25	181	60	(23, 97)	48	13	160
Hospital															
present	63	(24, 102)	50	14	147	67	(28, 106)	53	15	154	-	-	-	-	99
less 0.5	71	(55, 87)	55	17	996	75	(59, 91)	58	18	1081	60	(40, 80)	48	13	545
0.5 - 1	103	(63, 143)	76	29	225	75	(49, 101)	58	18	394	65	(27, 103)	51	15	158
1 and over	66	(30, 102)	52	15	183	91	(63, 119)	69	24	415	56	(25, 87)	45	12	207
Primary Care Center															
present	54	(36, 72)	44	10	601	59	(42, 76)	47	13	774	62	(40, 84)	49	14	453
less 0.5	92	(73, 111)	69	25	872	91	(73, 109)	69	24	939	70	(45, 95)	55	16	388
0.5 - 1	-	-	-	-	35	91	(52, 130)	69	24	205	-	-	-	-	39
1 and over	-	-	-	-	31	89	(38, 140)	67	24	121	49	(12, 86)	40	9	130
Dispensary															
present	56	(31, 81)	45	12	319	55	(33, 77)	44	12	426	62	(37, 87)	49	14	356
less 0.5	81	(64, 98)	62	20	1049	83	(67, 99)	63	21	1123	65	(43, 87)	51	15	479
0.5 - 1	-	-	-	-	84	100	(65, 135)	74	28	283	-	-	-	-	96
1 and over	-	-	-	-	91	80	(44, 116)	61	20	214	-	-	-	-	79

NOTES: The level of development of a barangay is here defined according to the proximity of a newspaper outlet or a secondary school, or to the presence of electricity.

Infant and child mortality are not estimated for categories where CEB is less than 100.

Table 8. Estimates of Probabilities of Dying at Infancy and in Early Childhood, and 95 Percent Confidence Limits of 4q0 for Children of EMW Living in Less Developed Barangays According to Travel Time to Health Services: Rural Philippines, 1978 RPFS

Service / Travel time (in hours)	Barangays Which are 0.5 hr. Over-Travel to: Newspaper Outlet 4q0	Confidence Limits	1q0	3q1	No. of CEB	Secondary School 4q0	Confidence Limits	1q0	3q1	No. of CEB	Barangays Without Electrity 4q0	Confidence Limits	1q0	3q1	No. of CEB
Doctor															
present	97	(51, 143)	73	26	162	-	- -	-	38	100		(63, 137)	74	28	247
less 0.5	107	(60, 154)	79	30	163	-	- -	-	46	93		(71, 115)	70	25	651
0.5 - 1	91	(67, 115)	69	24	569	94	(66, 122)	71	25	405	99	(74, 124)	74	27	557
1 and over	115	(97, 133)	84	34	1241	116	(97, 135)	85	34	1144	112	(94, 132)	83	33	1084
Midwife or Nurse															
present	81	(61, 101)	62	20	742	84	(58, 110)	64	21	434	79	(62, 96)	61	19	961
less 0.5	131	(70, 192)	95	40	118	-	- -	-	-	79	98	(70, 126)	73	27	444
0.5 - 1	114	(86, 142)	84	33	493	103	(73, 133)	76	29	390	124	(95, 153)	90	37	481
1 and over	124	(101, 147)	90	37	782	132	(107, 157)	95	41	730	129	(103, 155)	94	39	653
Health Worker															
present	76	(45, 107)	59	18	275	97	(51, 143)	73	26	157	81	(52, 110)	62	20	330
less 0.5	-	- -	-	-	96	-	- -	-	-	35	100	(76, 124)	74	28	619
0.5 - 1	89	(65, 113)	67	24	554	86	(57, 115)	65	22	363	97	(72, 122)	73	26	540
1 and over	120	(102, 138)	88	35	1210	120	(101, 139)	88	35	1078	117	(98, 136)	86	34	1044
Hospital															
present	-	- -	-	-	16	-	- -	-	-	2	-	- -	-	-	41
less 0.5	126	(67, 185)	92	37	121	-	- -	-	-	37	96	(71, 121)	72	26	544
0.5 - 1	85	(61, 109)	65	21	518	108	(75, 141)	80	30	349	101	(76, 126)	75	28	561
1 and over	114	(98, 130)	84	33	1480	113	(95, 131)	83	33	1245	110	(94, 126)	81	32	1394
Primary Care Center															
present	83	(57, 109)	63	21	439	83	(50, 116)	63	21	265	74	(52, 96)	57	18	544
less 0.5	128	(72, 184)	93	39	139	-	- -	-	-	73	111	(86, 136)	82	32	624
0.5 - 1	99	(73, 125)	74	27	507	106	(73, 139)	78	30	337	104	(77, 131)	77	29	478
1 and over	118	(98, 138)	86	35	1051	118	(98, 138)	86	35	958	117	(96, 138)	86	34	888
Dispensary															
present	47	(21, 73)	39	8	247	37	(6, 68)	31	6	140	34	(8, 60)	29	5	191
less 0.5	112	(53, 171)	82	33	109	-	- -	-	-	37	101	(78, 124)	75	28	657
0.5 - 1	100	(76, 124)	74	28	599	104	(74, 134)	77	29	400	109	(83, 135)	80	32	562
1 and over	124	(105, 143)	90	37	1181	125	(105, 145)	91	37	1056	115	(96, 134)	84	34	1130

NOTE: same as in Table 7

NOTE:

[1] The Feeney method provides estimates of infant mortality rates (IMR) only. It also gives estimates of the periods to which the IMR values refer.

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