INCAP Publication I-1044

Fertility Desires and Child Mortality Experience Among Guatemalan Women

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In the past 15 years the tremendous success of public health programs in reducing mortality in developing countries has been clouded by the lack of an offsetting fertility decline. For those in the public health community who must deal with this phenomenon, the belief that the reduction of child mortality is a necessary and perhaps sufficient condition for fertility decline is particularly appealing. Despite only limited empirical support, this hypothesis has been embraced by policymakers at many levels.[1] The appeal of continued child mortality reduction as a fertility reduction policy stems primarily from the political and social attractiveness of child mortality reduction itself and from the fact that it requires little change in current policy and institutional structure.

Proposing further child mortality reduction as a means to reduce fertility, however, poses a special type of risk. As Retherford (1975) cautions:

> As a proposed fertility reduction policy for developing countries, child mortality reduction deserves particularly careful scientific scrutiny, not only because its political attractiveness colors policymakers' perceptions of its potential effectiveness, but also because if not pursued as part of a balanced modernization policy, it may render society worse off than before. Unlike most other proposed fertility reduction policies, the failure of this one to obtain the desired fertility response would further increase population growth rates. This in turn might impede modernization, particularly economic development . . . itself the fundamental force underlying fertility transition.

Of course, there is no question that the continued lowering of child mortality must continue to be a priority concern of policymakers, along with other goals related to fostering economic development and decreasing population growth.

[1]See Preston (1975 and 1978) and Retherford (1975) for further discussion of this issue.

Fertility and Child Mortality Relationships

Theoretically, the effects of child mortality on fertility can be divided into three types: (1) individual-level biological effects; (2) individual-level behavioral effects; and (3) community-level effects, which are both biological and behavioral. (The effects of fertility changes on child mortality are important and interesting but are only of secondary concern when studying the impact of child mortality reductions and therefore will not be examined in this paper.)

Individual-level biological effects of decreased mortality may reduce fertility as a result of increased pregnancy intervals. Because the death of a breastfed child cuts short lactation and may thus reduce the length of the postpartum anovulatory period, improved infant survival should prolong lactation and increase average pregnancy interval length.

Behavioral reaction by individuals to child mortality may involve replacement of a child who has died, adjustment of fertility to ensure the survival of at least some children to adulthood, or both. If couples merely replace children who have died, a decline in child mortality should have little impact on completed family size. The impact might be significant, however, if parents overcompensate for a child death, that is, have more than the number of births needed to replace a child who has died. If couples adjust their fertility behavior to ensure a certain number of surviving children, a reduction in child mortality might change desired fertility but not necessarily desired completed family size.

Adjustment of fertility desires is usually assumed to be a conscious process in which couples accurately perceive child survival conditions. However, fertility desires also may be shaped by perceptions of the mortality experiences of family and friends both during childhood and as an adult instead of by a conscious assessment of current and expected child survival chances (Taylor, Newman, Kelly, 1976).

On the community level, child mortality declines may reduce fertility by altering community fertility norms and disrupting social and economic structures designed for low levels of child survivorship (Freedman, 1963; Beaver, 1975). For example, housing that accommodated the survivors of three generations may barely suffice for two after child mortality decline. Community effects undoubtedly would require a considerably longer time to change fertility levels than would individual effects.

Previous Empirical Evidence

Analyses of aggregate data have often shown a relationship between infant or child mortality and fertility rates on a regional level (Heer, 1966; Schultz, 1966; Nerlove and Schultz, 1970; Beaver, 1975; and Taylor, Newman, and Kelly, 1976). Because possible causal direction and the mechanisms involved in the relationship are particularly difficult to determine at the aggregate level, many studies have analyzed micro-level data instead. Preston (1975) and Taylor, Newman, and Kelly (1976) provide critical reviews of more recent work. Schultz and DaVanzo (1970) found both a biological and a behavioral effect, while Harman (1970) concluded that families adjust their fertility behavior to both their own experience with child mortality and to the mortality risks they perceive in the community. Heer and Wu (1978) provide support for the operation of community effects but find little evidence of fertility behavior being influenced by perceptions of child survival. They attribute this to the lack of a good measure for perceived child survival. Rutstein and Medica (1978) found only a very weak relationship between child mortality experience and fertility response. They conclude that any additional fertility is much less than what is necessary for the replacement of the children who have died. Chowdhury, Khan, and Chen (1976) report no significant behavioral effect of child death experience on birth interval length, excluding those intervals in which it was the last child who died.

The Study

In this paper we examine the importance of individual-level behavior effects of child mortality in shaping fertility desires in two areas of Guatemala. Unlike many previous studies, we are concerned with the variables that are related to fertility desires rather than fertility behavior.

Analytical Framework

Focusing on fertility desires has two important advantages. First, behavioral relationships between fertility desires and child mortality are not confounded by biological effects as is the case when actual fertility is used. Second, if differential child mortality experience does have a behavioral effect, the relationship with fertility desires may be stronger than with fertility itself, because a variety of unrelated factors, such as the impracticality or inaccessibility of contraceptive services, may prevent the accomplishment of desires.

It sometimes is assumed that couples decide on family size early in marriage and then implement the decision throughout the rest of their lives. This assumption leaves no room for changes in tastes or correction of judgmental errors later in life. To avoid these rigidities, our analysis assumes that fertility decisions may be made sequentially and that decisions may be qualitatively different at various life-cycle stages. This concept has been discussed at length by Namboodiri (1972 and 1974) and Khan and Sirageldin (1977).

Two hypotheses about the relationship between child mortality and fertility are tested: (1) that fertility desires are shaped by familial and personal experiences with child mortality, that is, the deaths of siblings and one's own children; and (2) that fertility desires are based on a conscious assessment of current child mortality conditions. These two hypotheses are not mutually exclusive, and fertility desires are likely to be shaped to varying degrees by both experiences with and expectations about child mortality. No attempt is made in this analysis to distinguish between strategies to replace children who have died and strategies to ensure achievement of desired number of children. A third hypothesis crucial to the second is also tested: that individuals accurately perceive changes in child mortality and current mortality conditions. If parents do not perceive survival chances with a reasonable degree of

accuracy, they are unlikely to respond appropriately to child mortality reductions; however, previous research (Stycos, 1963; CELADE and CFSC, 1972; Heer and Wu, 1978) has cast doubt on the accuracy of perceptions both of current conditions and changes over time.

Setting

The study settings are particularly appropriate for examining the impact of exogenously induced mortality declines. The primary data collection area was four isolated rural villages in the Guatemalan department of El Progreso, in which the Nutritional Institute of Central America and Panama (INCAP) has conducted an intensive nutrition and health program. In four El Progreso villages mortality declined substantially between 1968, when the intervention began, and 1975, when the data were collected (Teller et al., 1975). The second area studied was comprised of two semiurban communities in the municipality of Petapa, located close to Guatemala City.

Sample

The data used in this study are taken from a 1975 INCAP survey of 847 women aged 15 and over on attitudes toward and expectations related to children. We have used a subsample of 716 women aged 15–49, which includes most of the women of childbearing age in the El Progreso villages and approximately 15 percent of women of these ages in the Petapa communities. On average, women in the subsample in El Progreso had 4.1 living children and in Petapa, 3.5. The average number of additional children desired was 1.0 and 0.6, respectively. This subsample was reduced considerably, however, by the exclusion of women who gave nonnumeric responses to the question concerning desired additional children and of women for whom there were missing values for several of the variables. The final sample includes 410 women, of which 44 percent were from Petapa and 56 percent from El Progreso.[2]

[2]A major reason for case exclusion was a nonnumeric answer to the question on the number of additional children desired. Because we felt that the large number of women who gave nonnumeric responses to this question might be substantially different from the rest of the sample, we compared the means for the two groups on the other variables. The only variables not significantly different between the two groups are: experience with sibling deaths, age, and number of living children. Women responding "don't know" or "whatever God sends" are, on average, of lower socioeconomic status and have experienced substantially more child deaths, yet they feel the probability of child survival is better than women giving a numerical response. Of those giving a nonnumeric response, 92 percent are from the El Progreso villages, compared with 63 percent of the total sample.

Perceptions of Child Survival

Prior to discussing the methodology and results of our analysis, our third hypothesis, that perceptions of child survival are reasonably accurate, must be tested. According to our findings, the majority of the respondents perceived changes in child mortality with a reasonable degree of accuracy. When asked whether there were more, less, or the same proportions of child deaths in the area as five years ago, an overwhelming majority (90 percent) in El Progreso felt that there were fewer. In Petapa, where a more gradual decline in child mortality has occurred, respondents were more evenly split: 42 percent felt that there were fewer child deaths, but 30 percent felt there were more.

Perceptions of child survival chances at the time of the interview were surprisingly accurate. Respondents were asked how many children they thought would survive out of five births and ten births. Each of the two responses was divided by the number of total births and multiplied by 100. The two rates were then averaged to produce a mean rate for each individual. Community perceived rates were determined by averaging individual rates for each community. We have estimated that the *actual* survival rate from birth to age 15 is approximately 79 percent in the El Progreso villages and 76 percent in Petapa.[3] The average *perceived* survival rate for children is 84 percent in El Progreso and 77 percent in Petapa.

Variables

The measure of fertility desires, which is the dependent variable in our analysis, is taken from responses to the question: "How many children (other than those you already have) do you want to have?" If the respondent wanted no additional children, this variable takes the value 0, and if she wanted one or more, its value is 1.

The independent variables come from our hypotheses about the behavioral effects of child mortality on fertility desires. If parents' fertility desires are shaped principally by their *expectations* about child survival chances, the major factor affecting the desire for another child would be the perception of current child survival conditions. For this variable

[3]This estimate was made using Coale and Demeny (1966) south model life tables at levels 14 and 15. Model life tables are used because of the difficulty of obtaining accurate life table values for such small populations.

we have used the perceived child survival rate calculated for each individual as described in the last section. If fertility desires are shaped primarily by parents' *experience*, we would expect that personal experience with child death and the experience of one's family directly affect fertility desires. These variables are represented by: (1) the number of the respondent's own children who have died; and (2) mortality of siblings (the number of the respondent's siblings who had died was divided by the total number of births the respondent's mother had, to control for the increasing risk of child mortality associated with increasing parity; both figures were provided by the respondent).

Socioeconomic control variables included are: (1) residence; (2) education (the number of years of school completed by the respondent); (3) housing quality index (a composite measure of the quality of building materials used in the respondent's house was designed by INCAP researchers for these data); and (4) occupational ranking of the respondent's husband (a scale of occupational prestige was developed for the study communities by Edmonston and Teller, 1976). If the major factor shaping fertility desires is expectations of child survival chances, the perceived child survival rate should have a negative relationship with the dependent variable. If experience is the important factor, both the number of child deaths and familial experience with child death should be positively related to the dependent variable.

Methodology

If fertility decisions are made sequentially and change qualitatively during the life cycle, the relationship between the dependent and independent variables may differ at various life-cycle stages. In this analysis, these stages are represented by the number of live births[4] women had at the time of interview. To examine the differing influences of the independent variables, a separate analysis was performed for each parity group: women with 0–2 children; with 3–4; and 5+. (The small sample size necessitated combining adjacent parities.)

[4]Using the number of live births as a measure of life-cycle stage is preferable to using the number of surviving children, since the latter is confounded by the effects of infant and child mortality.

The use of a dichotomous dependent variable, as required by our model, makes the estimation of its relationship with the independent variables more complex. Although multiple regression could be performed in this case, the results are likely to be biased and inconsistent (Nerlove and Press, 1973; Namboodiri, 1975). We have used logit analysis, which employs a nonlinear transformation to estimate the probabilities of the occurrence of an event rather than attempting to estimate a linear function to fit the 0 or 1 outcome.[5] The likelihood ratio test will be used to assess the goodness-of-fit of each equation, and a t-statistic is used to test the statistical significance of individual coefficients within the equation.

Results

The means of the independent variables are given in Table 1 by parity group and whether or not additional children were desired. As might be expected, the means for age, number of child deaths, and family mortality increase with parity, while the number of grades of school completed declines. The perceived child survival rate does not vary significantly by parity.

Within each parity group, women who do desire additional children are likely to be younger and more educated that women who do not. They have also had more experience with child deaths, both those of their own children and those of their siblings. Despite this, they are slightly more optimistic about child survival chances than women who do not want another child. For all three groups, women desiring additional children are more likely to come from rural El Progreso than from semiurban Petapa.

Table 2 presents logit coefficients for each of the three parity groups. In the equation for women with 0–2 live births, the number of children who have died is excluded since only a few of the women desiring additional children and none of the women who

[5]Using maximum likelihood estimation, coefficients for the equation are chosen so as to maximize the function:

$$\pounds = \prod_{t=1}^{T} P_t^{Y_t} (1-P_t)^{1-Y_t}$$

where £ is the likelihood function, there are T cases, and P and 1-P are the sample probabilities that Y, the dependent variable, is 1 and 0, respectively. More detailed discussions of the use of logits with individual data can be found in Nerlove and Press (1973) and Hanushek and Jackson (1977).

TABLE 1 Independent variable means, by whether or not additional children are desired and by number of live births: Guatemala, 1975

Variable[a]	Number of live births					
	Desires no more	Desires more	Desires no more	Desires more	Desires no more	Desires more
Residence[b]	.56	.51	.58	.41	.41	.10
Age	25.7	23.8	28.9	27.7	35.4	34.9
Number of years of school completed	2.4	3.1	2.0	2.3	1.2	1.3
Husband's occupational ranking	5.6	5.4	5.9	6.1	6.2	5.8
Housing quality index	1.5	1.5	1.5	1.2	1.3	1.0
Number of own child deaths	0	.1	.3	.5	1.2	1.8
Sibling mortality rate	16.5	18.1	15.0	21.4	18.5	28.8
Perceived child survival rate	79.9	80.1	79.1	84.2	80.3	81.6
Number of cases	34	83	64	64	135	30

[a]See pages 131–132 for a description of these variables.
[b]Respondents living in El Progreso were coded 0, those living in Petapa were coded 1.

TABLE 2 Logit coefficients, using whether or not additional children are desired as the dependent variable, by parity: Guatemala, 1975

Independent variable	Parity		
	0–2	3–4	5+
Residence[a]	−.77	−.91	1.87
	(1.28)	(1.62)	(2.25)*
Age	−.07	−.04	−.05
	(1.91)*	(1.02)	(1.29)
Number of years of school completed	.16	.11	.22
	(1.60)	(1.30)	(1.59)
Husband's occupational rank	.001	.05	.02
	(.01)	(.66)	(.26)
Housing quality index	.11	.06	−.04
	(.39)	(.25)	(.12)
Number of own child deaths	—	.68	.29
		(2.00)*	(1.73)
Sibling mortality rate	.01	.02	.03
	(.67)	(1.90)*	(2.18)*
Perceived child survival rate	−.003	.02	−.01
	(.23)	(1.69)	(.79)
Grand mean	2.25	1.49	.24
Number of cases	117	128	165
Likelihood ratio[b]	134.1	159.1	133.6
Degrees of freedom	109	119	156

NOTE Numbers in parentheses are t -- statistics for each coefficient.
*t statistic significant at .05 level or lower.
[a]Respondents living in El Progreso were coded 0, those living in Petapa were coded 1
[b]The likelihood ratio is distributed as χ^2. Note that the lower the likelihood ratio divided by degrees of freedom, the better the fit.

did not desire additional children had experienced a child death. The fit for all equations is fairly good and is best for the 5+ group.

The results show several trends for women across parity levels. Residence has a negative and increasing effect as parity rises, although only the coefficient for the 5+ group is significant. As seen in Table 1, women in semiurban Petapa are considerably less likely at the third or fourth parity to want additional children. In fact, 90 percent of those wanting additional children after reaching the fifth parity live in rural El Progreso. Age is an important factor for women who have had 0–2 live births. The coefficients in Table 2, although they are not statistically significant, confirm Table 1 data that suggest that education is positively related to the desire for another child. Thus, higher education appears to increase the probability of wanting additional children. Neither the housing quality index nor the husband's occupational ranking shows much effect. Experience with child mortality—own child deaths and sibling deaths—is strongly and positively related to the desire for additional children at parity 3 and above. Sibling mortality experience becomes more important as parity increases, while both the coefficient for the number of child deaths and its significance decline in the 5+ group. Although the coefficient for the perceived child survival rate approaches significance in the 3–4 parity group, this variable does not appear to make a consistent or important contribu-

tion to the desire to have additional children for any of the three equations.[6]

The coefficients given in Table 2 can be used to estimate the probabilities of desiring additional children under different conditions.[7] To compare the relative importance of sibling deaths and own child deaths for the last two parity groups, we have calculated probabilities separately for El Progreso and Petapa under four different conditions: (1) no child deaths or sibling deaths experienced; (2) one child death but no sibling deaths experienced; (3) no child deaths but one sibling death out of six live births to the respondent's mother; (4) one child death and one sibling death. These probabilities are presented in Table 3. For each parity group, we used a value close to the mean for the remaining variables. Thus the figures given in Table 3 may be thought of as representing the probability of wanting an additional child for an average woman in that parity group, under the conditions listed above. These probabilities were not computed for the 0–2 parity group since very few had experienced a child death and since the coefficient for family mortality in this equation is not significant.

For women with 3–4 live births, one child death clearly has a greater impact than one sibling death. In both El Progreso and Petapa, the increase in the probability of wanting another child due to experiencing a child death is roughly twice the increase due to experiencing a sibling death. For women with 5+ live births the difference is not as great. In El Progreso, the experience of a sibling death brings about a slightly greater increase in the probability of wanting another child, but the difference is only three percentage points. The probabilities are uniformly small for Petapan women with 5+ living children, and their child mortality experience has no real impact.

TABLE 3 Probabilities of desiring additional children under four conditions, by parity and residence: Guatemala, 1974

Condition	Parity 3–4[a] El Progreso	Parity 3–4[a] Petapa	Parity 5+[b] El Progreso	Parity 5+[b] Petapa
No child or sibling deaths	.39	.20	.12	.02
1 child death, no sibling deaths	.56	.34	.15	.03
No child deaths, 1 sibling death[c]	.47	.26	.18	.03
1 child death, 1 sibling death[c]	.63	.41	.23	.04

NOTE: See footnote 7 on page 134 for discussion of how probabilities were derived.

[a]Calculations assume age is 28, the woman completed 2 years of schooling, occupational ranking equals 6, housing index equals 1, and perceived child survival rate equals 82.

[b]Calculations assume age is 35, the woman completed 1 year of schooling, occupational ranking equals 6, housing index equals 1, and the perceived child survival rate equals 80.5.

[c]One sib death means the death of one sibling out of six live births to the respondent's mother. Thus the family mortality variable in this case is equal to 16.66.

Implications

While conclusions must be drawn cautiously when considering a sample of this size and type, a few points can be made. Our results indicate that even under conditions of an exogenously induced rapid decline in child mortality, women may perceive both the decline and current child survival chances relatively accurately. Despite their accuracy, perceived child survival chances seem to have little influence on whether or not a woman desires additional children at any parity. Experience with the death of one's siblings and own children, however, does appear to be an important factor. This study found that,

[6]Further evidence against the survival expectations hypothesis comes from responses to a direct question about factors influencing fertility. Respondents were asked, "Some couples have said that they want four or five (surviving) children, but they have eight or more. Why do you believe that they have more children than they want?" Only 9 percent in El Progreso and 4 percent in Petapa felt the motivation had to do with the possibility of death of their children. The hypothetical nature of the question, however, may simply have confused the respondents. Twenty-five percent could think of no reason for this behavior. The responses do, however, indicate that a connection between child mortality expectation and fertility behavior is not immediately obvious to the respondents.

[7]It is important to note that, unlike regression coefficients, logit coefficients do not represent the change in the estimated dependent variable, given a one unit change in a particular independent variable holding the other variable constant. Rather, logit coefficients indicate the amount of change in the log of the odds given a unit change in the independent variable. The conditional probabilities in Table 3 were derived by substituting specific mean values into the following equation and solving for P. The values used for each variable are given in Table 3.

$$\log\left(\frac{P}{1-P}\right) = b_0 + b_1(\text{residence}) + b_2(\text{age}) + b_3(\text{school}) + b_4(\text{occupational rank}) + b_5(\text{housing}) + b_6(\text{child deaths}) + b_7(\text{sibling mortality}) + b_8(\text{survival rate}).$$

at the third and fourth parities, the influence of the death of a woman's own children was greater than the death of her siblings and, at the fifth parity, the influence of sibling deaths was greater.

Thus, it appears that the child mortality experiences affecting a woman's fertility decisions are not only those of her own childbearing years but also those of her mother's childbearing years, and that these influences are manifested at different life stages, as represented by parity levels. This suggests that mortality declines must occur over two generations (her mother's and her own) to make a significant impact on a woman's desire for additional children. The sampling techniques, the sample size, and the exclusion of a substantial minority of women who gave nonnumeric responses to the question on desired additional children limit our ability to generalize from these results. However, if the relationship we have found between child mortality experience and fertility desires is a more general phenomenon, reductions in child mortality may have the short-term effect of accelerating population growth, until enough experience with decreased mortality is accumulated to effect a change in fertility desires.

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ACKNOWLEDGMENTS The data upon which this paper is based were collected by INCAP under a grant from the Rockefeller Foundation. The authors are grateful to the INCAP-DDH staff and to several colleagues at Cornell for comments and suggestions on earlier drafts. The suggestions of two anonymous reviewers substantially improved the analysis. An earlier version of this paper was presented at the annual meeting of the Population Association of America in April 1978.