Center for Demography and Ecology

University of Wisconsin-Madison

Child Mortality and Reproductive Patters In Urban Bolivia

Guido Pinto Aguirre

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CHILD MORTALITY AND REPRODUCTIVE PATTERNS

IN URBAN BOLIVIA

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1. Introduction

In spite of improvements in the health and well-being of populations globally over the last few decades, factors such as infectious and parasitic diseases, malnutrition, and adverse reproductive and demographic characteristics (e.g. adolescent child bearing, short inter-birth intervals, etc.) persist as major obstacles to improvements in infant and child mortality in many developing countries. In an effort to clarify relationships among the various causes of infant and child mortality and to provide a comprehensive framework for research and policy making, Mosley and Chen (1984) proposed a two level analytical model. The model organizes factors associated with infant mortality into either proximate or distal determinant categories. The proximate level includes biomedical and biodemographic factors which are directly associated with infant and child deaths. Proximate determinants typically involve the interaction of malnutrition and infectious diseases and adverse reproductive characteristics of mothers (maternal factors). The distal level includes social, cultural, and economic conditions, such as the association between infant mortality and maternal education and family occupation, which have been found to affect child survival in many developing countries.

The Mosley-Chen model has served as a useful starting point for theory, research, and policy making over the last decade. One of the strengths of the framework lies in its focus on women's disproportionate poverty, lack of education, lack of economic opportunity, low social status, and women's unique reproductive role as major factors affecting child health and survival.

The Mosley-Chen model situates reproductive patterns under the proximate category of maternal factors which include maternal age, parity, and duration of inter-birth interval components. It is important to bear in mind, however, that reproductive patterns as such should not be considered as the immediate mechanism and/or cause of death, in the sense that a specific disease or a combination of diseases are thought of and often recorded as such on a death certificate. Instead they are proximate determinants in the sense that they are associated directly with particular conditions that may lead to child morbidity, impaired intrauterine growth, poor postnatal growth, and subsequently to child death. A large number studies from around the world have consistently demonstrated that children are exposed to much higher levels of mortality when births are spaced too close to one another, when families are large, when children are born to very young or to older mothers, and when children are weaned early in the postpartum period (Cantrelle and Leridon, 1971; Wolfers and Scrimshaw, 1975; Clark, 1981; Rutstein, 1983; Da Vanzo et al.,1984; Hobcraft et al., 1985; Palloni and Millman, 1986; Hobcraft, 1987; Pebley and Stupp, 1987; Palloni et al., 1994; United Nations, 1994). While not meant to diminish in any way the importance of the non-maternal proximate category determinants in the Mosley-Chen hierarchy, it does appear from the weight of accumulated evidence that a combination maternal category factors has a particularly strong and universally negative impact on child health and survival.

In the study which is considered in this paper, we are only able to focus attention on the maternal factor proximate determinant category due to the limitations in the data. In spite of the circumscribed nature of the data, a focus on a single proximate determinate category seems justified for several reasons. First, it appears that a combination of adverse demographic or reproductive factors (that is to say, a combination of high parity, early supplementation and weaning, and short inter-birth intervals) has a particularly strong and negative impact on child survival net of all other proximate determinant factors. Reproductive pattern variables along with knowledge about the use of modern contraception would be expected to account for much of the overall variability in infant mortality in an urban setting.

Secondly, the maternal proximate determinant category would appear to encompass a number of important mechanisms, both direct and indirect, which account for much of the observed variability in child survival. Although we might not have measures of some of these mechanisms, maternal category variables would be expected to closely proxy their effects. For instance, every time a woman becomes pregnant she is put at some risk of experiencing pregnancy complications. Often, these complications are more severe in developing country settings where women living in conditions of urban poverty have limited access to appropriate preventive and curative medical care, especially modern prenatal, delivery, and antenatal care services. Birth related complications can include, among others, obstructed labor, hemorrhage, and obstetric fistulae associated with the delivery process, uterine prolapse, anemia, diabetes, cardiovascular diseases, hypertension, and cervical cancer.

A third reason is that maternal category variables are closely related to breastfeeding and weaning effects on infant mortality. In developing countries, the availability of adequate breastfeeding alternatives is often limited. If appropriate supplements are available they are frequently too expensive for families to purchase on a regular basis. Thus children who are either never breastfed or weaned early in infancy are at a much higher risk of becoming ill and of being malnourished. Because of the synergism between illness/disease and malnutrition as underlying causes of infant mortality, children experiencing both are at a much higher risk of dying. With the onset of supplementation, even after a prolonged period of full breastfeeding, children become increasingly more dependent on traditional foods eaten by the entire family. Often times foods which make up the regular diet are contaminated during the storage and/or cooking process. They may also be inadequate to meet the nutritional needs of small children. Thus, in under developed countries like Bolivia, one would expect to see the age pattern of malnutrition and mortality depend to a certain extent on the prevailing patterns of breastfeeding, supplementation, and weaning.

Finally, a large number of demographic studies have consistently demonstrated significant negative effects of reproductive and demographic factors on child survival. Although demographic variables may only proxy some of the specific underlying causes there is nonetheless a strong link between these levels of determinants.

With these considerations in mind, the overall objective of the present study is to examine the effects of several reproductive and demographic factors on child survival in the three largest cities in Bolivia, one of the most impoverished nations in all of Latin America. The three urban areas for which data are available are La Paz, Cochabamba, and Santa Cruz. We will model the joint effects of maternal age, parity, pace of childbearing, duration of breastfeeding, and use of modern contraception on child mortality. Mother's educational status, a socioeconomic and distal determinant of child survival in the Mosley-Chen hierarchy, will also be introduced as an efficient control variable for confounding factors. In this study we apply conventional multivariate statistical techniques for event history analysis (i.e., proportional hazard models) to estimate the simultaneous effects of reproductive pattern variables as well as other controls on child survival.

The article is divided into five sections, this introduction being the first. The second section presents a brief description of the infant and child mortality conditions present in Bolivia at the time of the study. This is followed by a brief description of the data and methods used in the study. The final two sections contain the analysis of child mortality in the three largest Bolivian urban settings, and the study conclusions and the policy recommendations that can be derived from the study.

2. Infant and child mortality in Bolivia

Despite improvements in medical technology and increased availability of modern health services in Latin America in recent decades, Bolivia, along with Haiti and Guatemala, has one of the highest rates of infant and child mortality in the region. Bolivia reported infant deaths per thousand live births of 109.2 and 90.2 for the periods 1980-85 and 1985-90, respectively. This is in contrast to Argentina and Cuba who reported 32.2 and 27.1 and 17.0 and 12.9 infant deaths per thousand live births, respectively, for the same time periods (CELADE, 1994).

The high levels of mortality in Bolivia, evident both in rural and urban areas, reflect the high risk of exposure to both disease and malnutrition for infants and children. These high levels are also a reflection of limited access to appropriate medical and health care facilities, limited supply of health related services especially in rural areas, and limited socioeconomic prospects for an improved standard of living. Furthermore, it has been repeatedly showed that children living in conditions of poverty are likely to be exposed to a combination of illnesses and diseases. These illnesses and diseases tend to increase the severity of morbidity which in turn increases the risk of child death. For instance, an infant may die from a specific cause, such as measles, but only after a complicated infectious pattern involving severe spells of both diarrhea and pneumonia. Malnutrition is a common denominator in this process. Poor nutritional status has been shown to have a potentiating effect on infant and child morbidity and subsequent mortality (Pelletier, 1994). Thus, the physiological synergism between malnutrition and infection increases the child's vulnerability to illness and his/her likelihood of dying.

The percentage of deaths for children under five years of age by various disease categories reported for Bolivia between 1980-1983 are presented in Table 1, panel 1 (Toro et al., 1984). The distribution by causes of death for children aged one and four shows that intestinal and acute respiratory infections accounted for slightly over two-thirds of all infant deaths and 55 percent of all child deaths. Intestinal and acute respiratory diseases are also important causes of child death in the urban setting accounting for 53.2 percent and 15.3 percent of deaths respectively. Furthermore, Table 1, panel 2 shows that in urban areas 14.3 percent of children under four also suffer from severe malnutrition while an additional 30.2 percent were considered at risk of malnutrition. Only 55.5 percent of urban Bolivian children are considered to be without any nutritional deficiency.

3. Data and Methods

The urban Bolivian data

The data for this research come from the "Woman's Economic Activity and Human Reproduction Survey" (WEAHR) carried out during November and December of 1986 by the National Population Council of Bolivia (CONAPO), with financial assistance from the Pathfinder

Fund.

The survey covers the three largest cities of Bolivia: La Paz, Cochabamba, and Santa Cruz de la Sierra. Together, these three cities make up 57 percent of the urban population and about one fourth of the total population of the nation.

A two-stage sample design was used to select 2,600 households in these three cities. The sample size by cities totals 1,000 households in La Paz, 850 in Santa Cruz, and 750 in Cochabamba. 3,011 women aged 15-49 were included, regardless of their marital status. In La Paz City 1,132 women were interviewed, in Santa Cruz City 1,024, and in Cochabamba City 855. The survey in those places was carried out on a house-by-house interview and the average rate of response was about 96 percent.

The main objective of the survey was to obtain more reliable information on the relationship between fertility and working patterns among Bolivian urban women. Demographic and socioeconomic factors which might account for this relation were also included in the core questionnaire.

The questionnaire is made up of three sections: (1) a household schedule, used to list the members of the household, and their basic demographic and socioeconomic characteristics; (2) an individual questionnaire for detailed interviews to females aged 15-49 years who were previously identified in the household schedule. This section contains the following information: respondent's demographic and social background, marriage history, current economic activity, maternity history, and contraceptive knowledge and use; and (3) a second individual questionnaire for detailed interviews with women between 20 and 39 years old about occupational and reproductive histories.

The maternity history section includes retrospective information on variables related to the woman's reproductive history, such as the age of the mother at the time of each birth, timing of occurrence of births, number of live births, still births, infant and child mortality, and timing of postpartum variables. This section also includes a number of socio-economic characteristics of the mother. However, the survey provides incomplete and truncated histories for some of these characteristics. The basic questions about breastfeeding, amenorrhea, and contraception were restricted to the last two children.

Births which occurred during the period 1976-1986 are considered in this study; that is, the analysis covers 10 complete years preceding the survey. This restriction allows us to include both breastfeeding and contraception covariates in the analysis. According to an evaluation done by CONAPO, this survey is a reliable source of information. In the final report released by CONAPO (1989), it has been found no significant divergences between this survey and other sources of information.

The dependent variable is defined as follows: First, the time elapsed between the birth of the child and the death of the child, if the child died on or before his/her second birthday. Thus, infant mortality is measured by the interval between the date of birth and the date of death (i.e., age at death). These observations are usually known as failure cases. Second, the time elapsed between the birth of the child and the time of the survey, if the child was still alive when the survey ended. Third, the time elapsed between the birth of the child and date of his/her death, if the child died after his/her second birthday and before the time of the survey. The second and third cases are also known as censored observations.

The reproductive pattern covariates taken into consideration in the analysis are the age of the mother at the time of each birth, the order of the birth, the length of the previous birth interval, the duration of breastfeeding, and contraception. All of these are considered fixed covariates in the analysis. Maternal age at birth is considered as continuous variable (in years), and since the effect of maternal age in child mortality tends to be U-shaped, maternal age squared is also included in the analysis. The order of the birth is defined by three dummy variables. PAR1: 1 if the child is of order one, and 0 otherwise, PAR2: 1 if the child is of order two, three, or four, and 0 otherwise. The reference category includes all those children born order five or more.

The timing between births only refers to the time since the preceding birth. Thus, the previous interval is defined as a dummy variable: 1 if births occurred less than 24 months apart each other, and 0 otherwise. Those who were firstborn are considered as if they had the longest interval, thus, they are included in the reference category.

Breastfeeding is defined through three dummy variables. BR1: 1 if the child did not breastfeed, and 0 otherwise, BR2: 1 if the child breastfed between 12 and 18 months, and 0 otherwise, and BR3: 1 if the child breastfed more than 18 months, and 0 otherwise. The reference category includes all those children with a duration of breastfeeding equal or less than 11 months.

The variable 'use of contraceptive methods' captures whether the woman did or did not use any contraceptive method before the birth of the last child, and it is represented by a dummy variable: 1 if the mother did not use any contraceptive method before her last child was born, and 0 otherwise.

Finally, mother's education is considered a proxy for socio-economic factors. Three dummy variables are defined. EDUC1: 1 if the mother has no education, and 0 otherwise, EDUC2: 1 if the mother only has elementary education, and 0 otherwise, and EDUC3: 1 if the mother only has secondary education, and 0 otherwise. The reference category contains all women with higher education (i.e., more than secondary).

The statistical technique

Empirical work about infant and child mortality is based on logit models, in which the probability of dying in a certain time interval, conditional on being alive at beginning of the interval, is specified as a function of a set of explanatory variables. However, this approach has two shortcomings. First, the selection of the intervals and their lengths is arbitrary; second, the information on the timing of the death is not used within the intervals being considered.

The so-called Cox proportional hazard model (Lawless, 1982; Palloni and Sorensen, 1990) is a statistical procedure not subject to these sort of problems. The attention of this device is posed on the 'survival time;' that is, the time between birth and death of the child. The hazard in the Cox-proportional specification has the following functional form:

$$h(t,\mathbf{z}) = h_0(t)\, e^{\boldsymbol{\beta}'\mathbf{z}},$$

where $h_0(t)$ is an unspecified time-dependent function, $\mathbf{z}$ is a vector of covariates, and $\boldsymbol{\beta}$ is a vector of unknown coefficients. Thus, the risk of dying is allowed to vary with time and a set of exogenous variables.

The interpretation of the coefficients is rather simple. A positive $\boldsymbol{\beta}$ implies that when $\mathbf{z}$ increases, the probability of dying at each duration (time) also increases and vice versa. Since most explanatory variables are specified as binary variables, a positive $\boldsymbol{\beta}$ implies that when $\mathbf{z}$ takes the value one, the likelihood of dying increases.

The parameters of the proportional Cox models were fitted by using their joint partial likelihood. The fitting of the models was carried out utilizing the statistical software package BMDP on data files derived for this purpose. The implicit numerical procedure calculates the risk of dying at each point of time for every risk set defined by the fixed covariates.

4. The results

To examine the independent effects of reproductive factors and maternal education on child mortality, three different hazard models are fitted. These bio-demographic models are concerned with the interplay among the pace of childbearing, breastfeeding, birth order, the age of the mother at birth, contraceptive use, and mother's education.

Model 1—the full model—includes all the reproductive-pattern covariates and mother's education. Model 2 removes the effects of contraception in order to explore the existence of a possible correlation with mother's education. Finally, Model 3 only estimates the net effects of the reproductive-pattern covariates.

Table 2 shows the estimated effects of the reproductive patterns on child mortality. Each parameter estimate represents the effects of every covariate on the instantaneous risk of dying. Table 3 presents the estimated effects of the reproductive patterns as relative risks of dying during the first two years of life (the estimated effects are exponentiated.) A value of 1.00 indicates no greater or lesser risk than the average, while a value greater than 1.00 represents a higher risk in relation to the reference category, and a value less than 1.00 represents a lower risk. For example, Model 1 shows a relative risk of 1.85 for those children born into short birth intervals (less than two years), meaning that the risk of dying at any given month, controlling for all other covariates in the model, is 85 percent greater than the risk for those born in longer intervals (reference category). In other words, the risk of dying for children born into short intervals is about 1.85 times higher than the risk for children born into longer intervals. All the findings described in the following paragraphs refer solely to the risks presented in Table 3.

Some salient facts can be noted in that table. First, the effects of the reproductive patterns are statistically significant and in the expected direction. Second, breastfeeding and the pace of childbearing emerge as the most important factors affecting child mortality. The effects of these covariates are consistently strong and significant across models, after controlling for other covariates. Third, the effects of maternal education also remain strong, significant, and in the expected direction, even when other covariates are controlled for.

In Model 1, the effects of the reproductive factors on child mortality are statistically significant and in the expected direction. This model shows that once other factors are controlled, birth intervals emerge as one of the most important factors affecting child mortality. In fact, the risk of dying for children born into short birth intervals (less than two years after the previous birth) is

1.89 times higher than the risk for children born in long birth intervals (more than two years after the previous birth). That is, being born into poorly-spaced births increases the risk of dying during childhood in about 89 percent when compared with the well-spaced births. However, the effects of the previous birth interval could be somewhat underestimated, because fetal losses are ignored and birth-to-birth not birth-to-conception intervals are considered.

The length of breastfeeding is also one of the most important factors affecting infant mortality. Longer durations of lactation reduce the risk of dying. Infants who did not breastfeed are 3.36 times more likely to die before their second birthday than infants who breastfed less than 12 months; and, infants who breastfed beyond 18 months are less likely to die before their second birthday than infants who breastfed less than 12 months, after controlling for other covariates in the model. Therefore, stopping breastfeeding early in life increases considerably the likelihood of dying.

Since age and parity are strongly correlated, they need to be controlled for simultaneously in order to study their independent effects on the risk of dying. Consistent with other studies, maternal age has a U-shaped relationship with child mortality. In effect, both coefficients age and age squared are statistically significant and have the expected direction. That is, the risk of child mortality for children under age two is higher when women are either too young and too old, once parity and other reproductive factors are controlled for. Parity also follows an expected pattern: low parities (four children or less) reduce mortality when compared to high parities (five children or more). In fact, the risk of dying during childhood is reduced by 43 percent for first-order births, and by 44 percent for second-, third-, and fourth-order births, when compared with higher-order births, once maternal age and all other factors are controlled for.

Use of contraception improves children's chances of surviving during their first two years of life. Infants whose mothers did not use any contraception are 1.48 times more likely to die than infants whose mothers did use contraception. However, contraception appears to have no substantial effect on child mortality once education has been introduced as a control. The lack of significance is due to the presence of a correlation with mother's education.

Finally, mother's education is the most important factor that directly affects child mortality. There is a strong association between the instantaneous risk of dying and education in the face of other controls. Net of the other factors considered in the model, infants whose mothers had no education (0 years of schooling) are 13.8 times more likely to die before their second birthday than those whose mothers had received more than 12 years of schooling (reference group). This relative risk decreases to 4.6 when mothers have primary education and to 2.4 when they have secondary education, if all of the maternal education differentials were a direct result of schooling.

From Model 1 we can conclude that the effects of the reproductive patterns are consistent with other findings. First, the pace of childbearing and breastfeeding independently affect child mortality: long interbirth intervals and long durations of breastfeeding reduce mortality significantly. Second, maternal age increases child mortality when the mother is very young or very old; and high parity (more than five children per woman) tends to increase mortality, once maternal age and other covariates are controlled for. Third, contraception has the weakest effect on child survival once education is introduced as a control. And fourth, mother's education is one of the most important covariates that directly affects the risk of mortality during childhood. However, the effects of mother's education are independent of the effects of breastfeeding, preceding birth interval, maternal age, and birth order. Thus, this effect may be related to other non-maternal determinants of child mortality, such as attendance at birth, access to health services, birth weight, children's nutritional status, water supply, toilet facilities, vaccination, and medical care, not accounted for in the model.

In Model 2 contraception has been removed. However, the size and the direction of the estimates remained almost constant, as Table 2 illustrates. This fact is reflected in the small reduction of the global chi-square, from 122.6 in Model 1 to 121.6 in Model 2. The most noticeable change in the relative risks belongs to maternal education; and within this variable, the risk for those children born to mothers with no education (Table 3). In the latter case, the relative risk changed from 13.80 to 14.61. The conclusions that can be obtained from model 2 about the effects of the reproductive-pattern covariates on the child mortality, are similar to those presented for Model 1.

Model 3 only contains the covariates associated with the reproductive patterns. The new estimated effects are still in the expected direction, and the significance of some of them have been notably improved. In effect, when education is removed (from Model 1), parity and contraception become statistically significant. This result confirms the existence of a correlation between contraception and maternal education. The effect of contraception on child mortality is clear; children whose mothers did not use contraceptive methods are 1.48 times more likely to die than those whose mothers used contraception; that is, their risk of dying increased by 48 percent, when other variables are controlled for. Finally, the global chi-square is reduced from 122.6 to 88.2, which means that an important variable has been deleted from the model.

5. Conclusions and policy implications

The main purpose of this paper has been to analyze the effects of the reproductive patterns on child survival. The analysis was carried out using a set of bio-demographic hazard models.

The body of evidence accumulated during the last ten years shows the existence of a relationship between reproductive patterns and child mortality across societies. The results obtained in this paper support the evidence found in other studies: in Bolivian urban areas the reproductive-pattern covariates (pace of childbearing, breastfeeding, maternal age, birth order, and contraception) are important correlates of infant mortality, even after controlling for maternal education.

The results indicate that breastfeeding and the pace of childbearing are the most important reproductive patterns affecting child mortality risks, and their strong, consistent effects tend to persist even after the introduction of education as a control. In this study, short preceding birth intervals and short durations of breastfeeding increase the risk of death during the first two years of life.

Some authors have suggested that the adverse effects of short birth spacing is causally related to three underlying mechanisms: maternal depletion, sibling competition and risk of cross-infection (Boerma and Bicego, 1992; Miller et al., 1992; Palloni and Millman, 1986). However, short birth intervals should be considered as a risk factor with some qualifications. For instance, the detrimental effect of short birth intervals on child mortality may be reduced by favorable socieconomic conditions (Boerma and van Vianen, 1984).

Early weaning may also expose the child to higher risks of morbidity and mortality from contaminated food, especially in less developed countries. Breastfeeding protects children from early exposure to diseases and ill-health in different ways. Breastmilk provides the infant a balanced diet during the first six months of his life, immunological protection against diseases, and hygienic and sterile food free of outside contamination (Palloni and Millman, 1986; Wray, 1978; Puffer and Serrano, 1975).

Net of other factors, child mortality also increases to an important extent with increasing birth order, and with births to very young women or to very old mothers. Once all other factors in the model are controlled for, contraception does not emerge as a strong correlate of child mortality; however, the effect of this covariate is in the expected direction.

The association of child mortality with maternal education also remains strong in the presence of the reproductive patterns in the models. This, it is likely that mother's education in Bolivian urban areas is related to child mortality not only through the reproductive patterns but also through other proximate determinants such as nutrition, illness, medical care, environmental contamination, et cetera.

Since each pregnancy and childbirth carries a risk of child and maternal mortality, avoidance of many poorly-spaced births at young or old ages constitutes an important rationale for health and family planning programs. On the one hand, health policies should encourage breastfeeding to improve children's nutritional status and their survival. At the same time, breastfeeding delays the next pregnancy and thus increases the length of the intervals between births (Jones and Palloni, 1994; Pinto, 1994). On the other hand, family planning programs should provide not only supplies of contraceptives, which are relevant to pace of childbearing, but also information and education about the effects of reproductive patterns on women's and children's health.

In a country like Bolivia where poverty and malnutrition are widespread, future reductions in child mortality are more likely to depend on mother's behavior in regards to lactation, and the pace of childbearing. Therefore, major health policies need to introduce effective contraceptive methods and encourage breastfeeding on the one hand; and promote education among women on the other.

Table 1. Percentage of deaths by various disease categories and nutritional levels in Bolivia, 1980-1983

Causes and nutritional status	Children's age (years)		
	0-1	1-4	0-3
Panel 1. Disease categories			
Bolivia (1980)			
Intestinal diseases	39.0	30.2	
Respiratory diseases	27.6	24.9	
Nutritional deficiency	7.2	6.4	
Measles	-	12.3	
Other causes	26.2	26.2	
All causes	100.0	100.0	
Urban areas (1982-1983)			
Intestinal diseases			53.2
Respiratory diseases			15.3
Other infectious			11.7
Perinatals			6.3
Other causes			13.5
All causes			100.0
Panel 2. Nutritional status in Urban areas (1982-1983)			
Severe malnutrition			14.3
Risk of malnutrition			30.2
Normal nutrition			55.5
All children			100.0

Source: Toro et al., Mortalidad en los tres primeros ..., 1984.

Table 2. Partial likelihood estimates of the effects of reproductive patterns on child mortality. (Standard errors in parentheses).

Covariates	Model 1	Model 2	Model 3
Maternal age			
Age	-0.0744*	-0.0743*	-0.0669
	(.0451)	(.0451)	(.0447)
Age squared	0.0007*	0.0008**	0.0007*
	(.0004)	(.0004)	(.0004)
Parity			
1 child	-0.5685	-0.5328	-1.1220**
	(.4899)	(.4897)	(.4771)
2-3 children	-0.5745*	-0.5745*	-1.0036**
	(.2978)	(.2977)	(.2895)
Previous interval			
Less than 24 mos.	0.6370**	0.6468**	0.6149**
	(.2644)	(.2646)	(.2645)
Breastfeeding			
No	1.2114**	1.2060**	1.2041**
	(.2566)	(.2563)	(.2568)
12-18 mos.	-0.9109**	-0.8996**	-0.7360**
	(.3077)	(.3075)	(.3050)
More than 18 mos.	-2.1549**	-2.1425**	-1.7260**
	(.7317)	(.7317)	(.7270)
Contraception			
No	0.2630		0.3929*
	(.2216)		(.2206)
Maternal education			
No education	2.6248**	2.6815**	
	(.5415)	(.5388)	
Elementary	1.5313**	1.5599**	
	(.4894)	(.4887)	
High school	0.8626*	0.8766*	
	(.4938)	(.4936)	
Log Likelihood	-576.56	-577.26	-578.77
Chi-Square	122.56	121.59	88.23
DF	12	11	9

* significant at 10 percent
** significant at 5 percent

Table 3. Hazard model estimates of the relative risks of the effects of reproductive patterns on child mortality.

Covariates	Model 1	Model 2	Model 3
Maternal age			
Age	0.9283 *	0.9284 *	0.9353
Age squared	1.0007 *	1.0008 **	1.0007*
Parity			
1 child	0.5664	0.5870	0.3256
2-3 children	0.5625 *	0.5630 *	0.3665**
Previous interval			
Less than 24 mos.	1.8907 **	1.9094 **	1.8495**
Breastfeeding			
No	3.3582 **	3.3402 **	3.3337**
12-18 mos.	0.4022 **	0.4067 **	0.4790**
More than 18 mos.	0.1159 **	0.1174 **	0.1780**
Contraception			
Yes	1.3008		1.4813*
Maternal education			
No education	13.8024 **	14.6075**	
Elementary	4.6242 **	4.7583 **	
High school	2.3692 *	2.4026 *	
Log Likelihood	-576.56	-577.26	-578.77
Chi-Square	122.56	121.59	88.23
DF	12	11	9

* significant at 10 percent

** significant at 5 percent

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Center for Demography and Ecology
University of Wisconsin
1180 Observatory Drive Rm. 4412
Madison, WI 53706-1393
U.S.A.
608/262-2182
FAX 608/262-8400
email: name@ssc.wisc.edu