Original article

Breastfeeding, birth intervals and child survival: analysis of the 1997 community and family survey data in southern Ethiopia

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Abstract

Background: This paper uses the 1997 community and family survey data to primarily address the question of whether or not short birth intervals are a problem in a population that typically breastfeeds for more than two years.

Objective: To investigate the strength of the effect of birth interval on child survival in the context of communities, that are characterized by high fertility, prolonged breast-feeding and poor living conditions.

Method: Anthropometry of children and recent morbidity of children are examined in addition to child survival data for children born in the six years before the survey.

Results: The results show that short birth intervals are not crucial problems in populations that typically breastfeed for more than two years. Nonetheless, it was clear from the analysis that short birth intervals are associated with increased mortality rates in the ages 1-12 months, and to a much lesser extent at ages 1-4 years.

Conclusion: Population policies need to have components that encourage mothers to prolong birth intervals. [*Ethiop. J. Health Dev.* 2002;16(1):41-51]

Introduction

Many studies have shown the importance of the length of preceding birth intervals for the survival chances of young children. In particular, anlysis of data from the World Fertility survey (WFS) have made a strong case for increased mortality risks among children born after short birth intervals (1, 2, 3, 4, 5, 6, 7, 8). Not much is known, however, about the actual biological and behavioral mechanisms responsible for the relationship between child spacing and child survival. The evidence for the most frequently suggested explanations of poverty, sibling competition, and inceased infectious disease transmission is fragmentary and sometime contradictory (9). Resource competition is the commonly used hypothesis for linking infant and child mortality to the length of the preceding birth interval and the occurrence of a subsequent conception or birth.

There is little research on the patterns of determinants of infants and child mortality in Ethiopia. Existing studies are limited to small-scale regional surveys (10, 11, 12, 13, 14, 15), with the exception of a brief summary of infant and under five mortality rates by Kidane (16) based on 1970 and 1981 national demographic surveys. Lindstrom and Berhanu (17) have also used the 1990 Family and Fertility survey to study the relationship between breastfeeding and child survival.

Ethiopia has one of the lowest per capita incomes in the world and scores low on all commonly used indicators of social and economic development. Fertility remains very high at around 7 children per woman in 1994 (18). Contraceptive use is very low and almost absent from rural

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areas; contraceptive prevalence in 1990 was 4.3% for the country as whole (19). Government efforts to improve access to modern contraceptive methods increased during the 1980s, but remained very limited by international standards (20, 21).

Breastfeeding is almost universal and pro-longed in Ethiopia, available evidence indicates that close to 97 of every 100 Ethiopian children born are ever breasted, and that slightly over 25% of children are still being breasted at two years of age (22). Infant and early childhood mortality in Ethiopia is high. Using data from the 1984 and 1994 population censuses, Hassen and Strong (18) estimated male and female infant mortality rates of 117 and 103 deaths per 1,000 births, respectively, for 1984; and 123 and 106 for 1994.

In this article, we investigate the effects of preceding birth intervals on infant and child survival in the context of communities with high fertility and prolonged breast-feeding practices as well as poor living conditions. The major question is, however, to examine whether or not short birth intervals are a problem in a population that typically breast-feeds for more than two years. The 1997 Community and Family Survey in the Southern Region of Ethiopia which includes anthro-pometric, health, morbidity, and mortality data for births that occurred six years before the survey (1991-1997) is used for the analysis. The specific objectives of this paper are: (1) to examine whether or not short birth intervals are a problem in a population that typically breast-feeds for more than two years; (2) to estimate the relative effects of preceding birth intervals on infant and child mortality controlling for factors related to demographic, maternal background and economic status of the household; and (3) to investigate how prolonging birth intervals could improve infant and child health.

The data used for this study (the 1997 Community and Family Survey in the Southern Region) are collected in a manner that is commensurate to DHS surveys. It includes data on child anthropometry, child morbidity, and health-service utilization. Using DHS surveys, various methodological approaches have been applied to investigate the relative importance of the various pre-and post-natal factors linking birth intervals and child survival (23, 24, 25). These approaches include analysis of age-specific mortality patterns, assessment of the effects of controlling for the survival status of the preceding birth and for Breastfeeding duration, and, perhaps most interestingly, a multivariate analysis of the effects of birth intervals on child health indicators, health-service utilization, and Breastfeeding practices. The analysis in this paper uses similar methodological approaches.

Methods

In the summer of 1997, the Demographic Training and Research Center of Addis Ababa University, Ethiopia, and population Studies and Training Center of Brown University, USA conducted a Community and Family Survey in the Southern Region. The Southern Region which is one of the constituencies of the Federal Republic of Ethiopia has a land area of 117,506 square kilometers (10.4% of Ethiopia's total land) and a population of about 11.1 million (about 20% of Ethiopia's population in mid-1997). The Region has the highest population density in all of Ethiopia with about 95 persons per km^2 (the national population density is about 50 persons per km^2).

According to the 1994 population and Housing Census, the region had an estimated infant mortality rate of 128 per 1000 live births and an under-five mortality (Childhood mortality) rate of 189 per 1000 live births. Total fertility rate was estimated at 7 children per woman and current contraceptive use at 4 percent (26).

The Community and Family Survey on which, the present study is based, was an integrated multi-level survey of communities, households and women in their reproductive ages. The survey was carried out with the intention of gathering data useful for analyzing family structures, marriage patterns, household well-being, access and quality of social services, nutrition, education, and reproductive health.

Structured questionnaires were used to collect data on personal attributes such as age, marital status, education, occupation, household com-position and living standards. The individual women questionnaire gathered relevant information from women aged 15-49 on: marriage history, fertility, breastfeeding, child health, child mortality, immunization and prenatal as well as delivery care services, and knowledge, attitude and practices of family planning services. This rich data set has anthropometric, health, morbidity, and mortality data for births that occurred six years before the survey data (1991-1997). Completed questionnaires were obtained from a sample of 2,315 households, and 2,550 women of reproductive age.

Information obtained from 2,428 births that occurred six years prior to the survey date in all the survey sites have been used for the present analysis. Although the survey included full birth history data, our analysis will be limited to births that occurred in the six years preceding the survey. Analysis in limited to births that occurred in the six years prior to the survey date because earlier births cannot be linked with important information on birth interval length, breastfeeding patterns, health service utilization, anthropometry, and morbidity, which were collected only for children born in the last six years. We presume the short recall period have the advantage of providing better data quality. Adequately trained interviewers with the help of field supervisors administered the data collection procedure.

In the survey, breastfeeding was collected for the last birth, next to last birth, second to last birth and third to last birth. The length of the birth interval is classified as: (1) less than 18 months (short); (2) less than 24 months, (3) 24-35 months (reference category); and (4) more than 35 months (long). First births were excluded from the analysis because they do not involve birth intervals. All the dependent
variables were treated as dichotomous, and hence, logistic regression models are used to analyze causal relationships. In cross-sectional studies such as the DHS, it is quit common to use logistic regression models to perform probabilistic estimation (9), which is based upon the maximum likelihood coefficients predicting the occurrence of the event (27). We used SPSS to perform our data analysis. The following are the dependent variables used in the analysis:

- Mortality : this is our outcome variable used to predict child survival. There are two categories for this variable: (1) infant mortality, and (2) childhood mortality. Each category is treated as a dichotomous variable coded as 1 if infant or child died and 0 otherwise.
- Stunting: This is an outcome variable used to measure the effects of birth interval and breastfeeding on child health. It is coded as a dichotomous variable where 1 indicates a z-score of below -2 standard deviations from the median of the NCHS/WHO reference population, for height-for-age, and zero otherwise.
- Underweight: This is an outcome variable coded the same way using weight-for-age data and it was collected for children aged 3-36 months.
- Morbidity: This is an outcome variable used to look at the effect of birth spacing and child care. Specifically, it looked at the prevalence of diarrhea in the two weeks preceding the interview. It is coded 1 if child had diarrhea and 0 otherwise.

- Immunization: A variable used to look at the relationship between access to health services and child mortality. It is coded 1 if child was never immunized, and 0 if immunized. The survey collected information on specific vaccinations only if mothers could present a health card. But most mothers were unable to present a vaccination card and data on specific vaccination were incomplete. Hence, information on specific vaccination is not available in the analysis.

The following independent variables are used in the analysis:
- Demographic variables: age of the child; age of mother; and birth order.
- Breastfeeding: From the information on breastfeeding duration (collected for each child born in the six years before the survey), a dichotomous variable was constructed to indicate whether the child is ever breasted or not. It is coded as 1 if the child had never been breasted, and 0 if otherwise.
- Mother's level of education: classified as illiterate, if none; primary, if 1-6 years of schooling; and secondary if 7+years of education.
- Economic status: coded as 1 if low, 2 if medium, and 3 if high. Medium is the reference category. Classification is based on assessment of household assets.
- Medical treatment: coded as 1 if the child with diarrhea in the two weeks before the survey was not taken to a medical person for assistance, and 0 if otherwise.

There are three data quality problems that necessitate caution when interpreting the impact of breastfeeding controls on the birth interval-child survival relationship. First, there are many missing values for breastfeeding duration, especially for deceased children. Even in large data sets such as those of WFS and DHS, in many countries, more than 10 percent of the post-neonatal deaths have no data on breastfeeding duration (9). Second, a large proportion of deceased children were reportedly breasted until they died. Third, the recalled duration of breastfeeding is rather imprecise, as evidenced by the massive heaping on multiples of six and by the unlikely high level of overlap between gestation and breastfeeding. These problems were clearly reflected in the present data.

Results and Discussion

Pace of childbearing and Length of Birth Intervals: Table 1 presents descriptive statistics of relevant variables that explain the background and context of study population. All data unless specified are weighted. Short birth intervals (<18 months) are much less common in Ethiopia as in many other Sub-Saharan Africa. The data shows that only 11% of all births with preceding birth intervals belong to the less than 18 months birth interval. The mean length of birth interval for all births is 31.7 months. Birth intervals shorter than 24 months account for a quarter of all births. However, more than a third of all births are born within preceding birth intervals of more than three years long.

Of the 2, 428 births in the six years before the survey, only 1,022 were found to have preceding birth intervals. The remaining 1,406 births are reported to have no preceding birth intervals. This is possible either because they are first order births or births whose preceding birth orders have been deceased. Hence, our analysis of birth intervals and child survival is based on the 1,022 births, whose preceding birth intervals were correctly recorded.

The infant and childhood mortality levels shown in Table 1 are consistent with the Region's mortality estimates based on the 1994 census (26). We estimated these levels using the North Level Coale-Demeny Model Life Tables (28). The estimated values for the year 1996 are based on children ever born by women in the age group 15-19. Mortality estimation made on the basis of children ever born to women in the age group 15-19 is not reliable because there is high degree

of under reporting of births by this age group. Hence, we have taken the estimated values for the 1995, which are based on children ever born to women in the age group 20-24. This is consistent with the procedure recommended by the indirect techniques for mortality estimation (29).

Birth interval, Breastfeeding and Child Survival: An interesting aspect of this kind of study is to look at the effects of overlap of pregnancy and breastfeeding. A high prevalence of overlap of pregnancy and breast-

Table 1: **Descriptive statistics of selected variables used in the analysis**

Variable	Rural	Urban	Total
Number of women aged 15-49	1524	407	1931
Births in last six years	2011	417	2428
Births with preceding birth intervals	856	166	1022
Mean Length of birth intervals	31.9	30.8	31.7
Percent births with interval <18 months	10.3	14.4	11.1
Percent births with interval <24 months	25.0	29.4	25.9
Percent births with interval 24-35 months	35.2	36.6	35.4
Percent birth with interval >35 months	39.8	34.0	38.7
Percent children who are breastfed for: <1 year 1-2 years 2+	14.5 58.5 27.0	15.9 65.2 18.8	14.8 60.2 25.0
Mean length of breastfeeding	23.3	20.7	22.6
Infant mortality (1q0) per 1,000 births	122	107	121
Child mortality (4q1) per 1,000 births	93	79	92
Number of pregnant women at time of interview	183	28	211
Number of pregnant women still breastfeeding	16	2	18
Mother's education: % literate	29.5	71.9	37.9
Economic status: Low Medium High	39.5 47.5 13.0	47.1 36.2 16.7	43.1 42.1 14.9
Child's birth weight: % below normal	44.5	34.1	42.3
Immunization: % immunized	35.0	85.6	45.0
Stunting: % stunted	45.9	40.6	44.8

feeding indicates that many women are exposed to the risks of becoming malnourished (maternal depletion), which may affect the birth weight and breastfeeding of the newborn (30). Our data did not allow us to make analysis of this relationship because of fewer cases in the sample. There were 211 pregnant women at the time of interview and only 18 of them reported that they were breastfeeding. The figures include women who had at least one living child and who were pregnant at the time of the survey. Since current pregnancy status data are based on women's own report than on medical tests and check ups, the likelihood of under reporting is obviously immense.

Table 2 presents the relative risks of mortality for short and long birth intervals, compared with the reference category for birth intervals lasting 24-35 months, for two age segments (i.e. 0-1 and 1-4). The relative risks are estimated net of child's age, mother's age,

Table 2: **Relative risks of infant and childhood mortality associated with short and long birth intervals, compared with birth intervals of 24-35 months, CFS: 1997.**

Place of residence	Infant Mortality				Childhood Mortality			
	<18 months	<24 months		>35 months	<18 months	<24 months		>35 months
		with prech	No Prech			With prech	No Prech	
Rural	2.55*	1.65	1.73	1.04	0.97	0.94	1.48	0.50
Urban	1.27	0.13	0.52	2.19	1.26	0.42	0.23	2.20
Total	2.36*	1.13	1.37	1.16	0.94	0.95	1.51	0.53

* Significant at 0.01 level; Prech = preceding child

birth order, mother's education, household's economic status, and rural-urban residence.

Theoretically, the adverse effects of short birth intervals are greatest in the neonatal period and the first 6 months after birth. Boerma and Bicego (9) in their analysis of DHS data for 17 countries found that during the neonatal period, the relative risks of dying associated with short preceding intervals are substantially higher in African and Asian countries. In the present study, the mortality effects of intervals are measured using the age groups 0-12 months, and 1-4 years. The birth intervals used are:<18 months (short birth interval), <24 months, 18-35 months, 24-35 months, and >35 months (long birth interval). The interval 24-35 is used as a reference category for comparing relative risks of infant and child mortality associated with short and long birth intervals.

The effect of birth interval less than 24 months or more than 35 months on both infant and childhood mortality is weak. But if intervals of <18 months are considered, the relative risk is 2.55 which is significant at a 0.1 level (but, when we control for place of residence, the effect looses its significance for the urban areas). This shows that the risk of infant mortality is significantly associated with short birth intervals of less than 18 months compared with an interval of 24-35 months.

In particular, children born after long birth intervals (lasting three years or more) appear to have better survival chances in all these age periods than do children with shorter preceding birth intervals, even though the relative risks are not significantly lower. In sum, these age-specific mortality patterns indicate that the adverse effects of short intervals are strongest in the infant periods, but appear to weaken in the 1-4 age category.

Birth interval effects on mortality with and without breastfeeding controls are shown in Table 3. There is considerable reduction in mortality risk associated with short preceding birth intervals when control is made for breastfeeding. The values for the category 'urban' are sometimes inconsistent because of the smallness of cell observations (see Table 1). In general, the effects of breastfeeding are found to be strong, except in the urban, where a small reduction in the birth interval effects was observed. In a society where poverty is rampant and prolonged breastfeeding is a norm, this finding can not be surprising at all. Nonetheless, the role breastfeeding plays in reducing mortality risks of children and in prolonging birth intervals, which in turn plays a role of fertility reduction should be emphasized.

Table 3: **Relative risks of infant and childhood mortality associated with short preceding birth intervals, with and without controls for breastfeeding, CFS: 1997**

Place of Residence	Infant Mortality			Child Mortality		
	without Breastfeeding	with Breastfeeding	Breastfeeding effect	without Breastfeeding	with Breastfeeding	Breastfeeding
Rural	1.69	1.90	35.17***	2.07	2.15	19.44***
Urban	0.35	0.35	0.00	0.34	0.35	0.00
Total	1.26	1.34	18.40***	2.04	2.11	12.44**

** Significant at 0.05 level; *** Significant at 0.01 level

Child Health Status, Morbidity and Immunization: Table 4 presents the relative risks of stunting and under-weight (poor growth) associated with children of short and long birth intervals using the interval 24-35 months as a reference category. Children of less than 36 months of age at the time of the survey are considered for this analysis. The pattern is that poor nutritional status is slightly more common among children with short birth intervals than among those with longer birth intervals.

Table 4: **Relative risks of stunting and underweight (under 36 months of age); Morbidity (two weeks before interview); and immunization (born in the six years prior to the survey)Associated with short and long birth intervals, (reference category is the interval 24-35 months), CFS: 1997**

Place of Residence	Stunting			Underweight			Morbidity			Immunization		
	N	Short	Long	N	Short	Long	N	Short	Long	N	Short	Long
Rural	378	0.88	0.58**	391	0.74	0.59**	597	1.12	1.16	635	1.07	1.12
Urban	91	1.01	1.00	96	1.67	0.69	149	3.54*	5.30	151	3.08	0.78
Total	467	0.93	0.66*	487	0.88	0.62**	746	1.31	1.42	786	1.13	1.08

* Significant at 0.10 level; ** Significant at 0.05 level

The relative risk of stunting associated with long birth intervals is reduced by more than 30% in the rural areas. The relative risks of being underweight are significantly lower (0.59) for children of longer birth intervals. The general trend is that children with long birth interval are less likely to face the problem of stunting and underweight. Those with short birth interval did not reveal any meaningful pattern of relationship.

The estimated relative risks of morbidity (having diarrhea in the two weeks before the survey) among children born in the six years prior to the survey date are also summarized in Table 4. Control was made for birth interval length but no major effect was observed. There is little or no effect of shot or long birth intervals on morbidity (diarrhea prevalence) among the rural areas. For the urban areas, the relative risks of morbidity show strong positive association with short birth intervals. Nevertheless, the conclusion to be drawn is that the relationship between birth interval and morbidity is not consistent. Regarding the relationship between immunization and birth interval, it can be stated that the likelihood of not receiving immunization is higher among children with short birth intervals in urban areas. In the rural areas, the relationship is weak.

Mother's Age and Child Mortality: Mother's age is strongly related to child mortality. In particular, neonatal mortality and infant mortality are very much influenced by the age

Table 5: **Relative risks of infant and childhood mortality associated with age of mother (15-24, and 35-49 age categories are compared with those in the age category 25-34, CFS: 1997**

Place of Reticence	Infant mortality				Child mortality			
	15-24 years old		>35 years old		15-24 years old		>35 years old	
	No prech	With Prech	No prech	With prech	No prech	With prech	No prech	With prech
Rural	2.20	2.12*	0.55	0.67*	1.72	1.76	0.42	0.52*
Urban	1.05	1.12	2.36	1.86	1.05	1.12	2.36	1.86
Total	1.90	1.80**	0.83	0.97*	1.57	1.55*	0.65	0.77

* Significant at 0.10 level; ** Significant at 0.05 level

of the mother (31). Births to mothers in the age group 15-19 face higher mortality risks than births to mothers in the age groups 25-29 or 30-34. Table 5 summarizes the relative risks of infant and childhood mortality associated with children born to women in the youngest (15-24) and oldest (35-49) age categories, compared with those born to women in the age category (25-34). All effects are controlled for age of child, birth interval, birth order, mother's education and economic status of household.

The index child for whom the mortality risk is estimated has been classified according to age of mother (i.e. <24 years, 25-34 years, or 35+years). The age category 25-34 is the reference category. Children with preceding child are also distinguished from those with no preceding child mortality appears to be higher among children born to young mothers particularly, in the rural areas. The relationship is weak for the urban areas.

Mother's Education, Household Economic Status and Child Mortality: Mother's education and household's economic status are two important control variables in our analysis. Table 6 shows regression results for the analysis of the relationship between child mortality with mother's education and household economic status. In columns 2 and 3, we present the relative risks of infant and childhood mortality associated with mother's

education. Mothers with primary (1-6) and secondary (7+) education are compared with illiterate mothers. All effects are controlled for age of child, mother's age, birth order, birth interval and economic status of the household. The index child is distinguished as to whether he/she is, with or without preceding child mortality. Primary education of mothers has the tendency to increased the risk of infant mortality slightly. On the other hand, children born to mothers with educational levels of secondary school and above have lower risk of mortality.

Economic status of households was assessed based on their assets such as size of farmland, possession of cash crops, size of livestock, ownership of oxen, etc. An index variable was created to conveniently classify households as low, medium and high in terms of their economic status. The estimated relative risks of infant and childhood mortality associated with children born to women in households with low and high economic status compared with those born to women in households that are considered to be of average economic status are presented in columns 4 and 5 of Table 6. All effects are controlled for, age of child, mother's age, birth order, mother's education, and birth interval. The results show that children in poor families have relatively higher risks to infant mortality compared to those belonging to medium or rich families.

Table 6: **Relative risks of infant and childhood mortality associated with mother's education and economic status (illiterate is the reference category for education and medium for economic), CFS: 1997**

Place of residence	Infant mortality				Child mortality			
	Primary		Junior+		Primary		Junior+	
	No Prech	With Prech	No Prech	With Prech	No Prech	With Prech	No Prech	With Prech
Rural	21.06	1.11	0.00	0.00	0.78	0.84	0.00	0.00
Urban	0.53*	0.72	0.63*	0.85	0.53	0.74	0.64	0.85*
Total	1.03	1.04	0.50	0.53	0.78	0.81	0.33**	0.36**

* Significant at 0.10 level;

Infant Mortality				Child mortality			
Poor		Rich		Poor		Rich	
No Prech	With Prech	No Prech	With Prech	No Prech	With Prech	No Prech	With Prech
1.61	1.19*	0.58	0.62	1.04	0.92	0.32*	0.37
1.65*	2.40	0.92	1.21	1.05	2.40	0.92	1.22
1.68	1.22*	0.71*	0.77	1.23	1.15	0.46*	0.52

** Significant at 0.05 level

Conclusion

The evaluation of age patterns of child mortality indicates that the effects of birth intervals are limited to the age of infancy (i.e. 0-12 months). The relationship is very weak in the later ages (i.e. ages 1-4). The absence of strong effects suggests that sibling competition is, at best, of secondary importance in explaining the relationship between interval length and early childhood mortality. The population in question is characterized by a predominance of longer birth intervals and prolonged breastfeeding practices. The mean birth interval is about three years and mean breastfeeding about 24 months.

Clearly, research in several interrelated areas would foster a more complete understanding of the relationship between child spacing and child survival. The relationship between short birth intervals and maternal health and nutrition and the impact is has on the growth and development of a child in the context of impoverished society such as the one under investigation must be better understood and described. Another area that needs to be further clarified is the relationship between short birth intervals and breastfeeding performance. Intervention policies should aim at encouraging longer birth intervals and breast-feeding practices.

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