Title: Parity Progression and Birth Interval Analysis: An Implication for Under-Five Mortality in Ekiti Communities, Southwestern Nigeria

Adebowale S.A, Akinyemi J.O

Adebowale Stephen Ayo (Ph.D) Department of Epidemiology, Medical Statistics and Environmental health, Faculty of Public Health, college of medicine, University of Ibadan, Ibadan, Nigeria.

Email: Adesteve2006@yahoo.com

Phone: +23408033565210

ABSTRACT

In the past, different factors have been examined on under-five mortality. However, in Ekiti, such studies failed to include parity progression and birth interval as part of their key variables, hence this study. The study was a cross-sectional house-hold survey, where a stratified multi-stage sampling technique was used to select 982 respondents who were women of childbearing age and have given birth irrespective of the survival status of the child. Data analyses showed that the higher the level of education, the lower the risk of under-five mortality (p<0.001), Also, significant association existed between place of residence (p<0.001), religion (p<0.001), birth interval (p<0.001) and under-five mortality. However, gender preference shows insignificant association with under-five mortality. The probability of progressing from lower parity to the next higher parity was consistently greater among women who experienced under-five mortality than their counterparts who did not. Cox-proportional hazard multivariate model revealed that, increased under-five mortality risks were found to be associated with birth intervals; of less than 24 months (RR=3.6, p<0.01), 24-35 months (RR=1.87, p<0.01) and above 60 months (RR=1.27, p>0.05) relative to birth intervals of three to five years, thus justifying the U-shaped interval effect. The effect persists when potentially confounding variables were used as control. In conclusion, spacing births for at least three years and reducing childbearing progression probability through constant use of contraceptive will reduce substantially under-five mortality in the study area.

Keywords: Under-five mortality, Parity Progression, Birth-interval, Childbearing, Ekiti

Introduction

One of the millennium development goals is to reduce childhood mortality since level of childhood mortality is an important index in measuring health status of any nation, most especially developing countries. Every year nearly 11 million children die before their fifth birthday; 99 percent of these deaths occur in developing countries (UNICEF, 2003). In Nigeria, the Demographic Health Surveys conducted across the country in 2003 and 2008 put the figure at 201 and 157 per 1,000 live births respectively (NDHS, 2003; NDHS, 2008). This shows a reduction in under-five mortality in Nigeria, but the present rate is still high.

In the past, numerous factors such as; maternal's place of residence, education, place of delivery, environmental pollution, cultural e.t.c have been investigated on their influence on under-five mortality. However, in recent times, researchers are more curious about the effects of birth spacing and how women progress in parity on under-five children survival because of the availability of family planning programs which tend to have the possibility of affecting the timing of pregnancies. Childspacing and parity progression ratios are two essential aspects of fertility behavior of any population. While childspacing signifies how couples space their children, parity progression measures how women proceed a parity to the next higher parity. Two populations can have the same child spacing pattern, but differential in their limiting patterns can vary their fertility outcome. Thus parity progression probability is a decisive factor in fertility analysis. Among Ekiti women, the prevalence of contraceptive use is low and as such, reducing the childbearing progression through increasing intervals between births might be difficult to achieve. Hence, the survival chances of under-five children are threatened.

Studies have investigated the relationship between short birth intervals and under-five mortality in a wide range of populations through retrospective and empirical approaches (Miller, 1994; Rutstein, 2000, 2003a, 2003b). Most of the findings showed that short (births interval less than 24 months) and very long births interval (births interval of at least five years) have significant effect on under-five mortality (Rutstein, 2005). Therefore, understanding the effects of births spacing and progression in parity will provide useful information for guiding the formulation of effective policies and framework to improve child's health.

In the past, programmers believed that a 24 month births interval was good enough to ensure good health for mothers and their under-five children. However, recent development reveals that spacing of at least 36 months and at most 59 months (optimal birth spacing) will reduce the risks of under-five mortality. This assertion has been tested using empirical results and it yielded the expected outcome (Conde-Agudelo and Belizan, 2000; Rutstein, 2005). In response to this development, communication campaigns in several countries have already begun using a 3-year spacing message and USAID is currently promoting this initiative. The present study was designed to validate the theory in Ekiti setting.

Studying the effects of child-spacing and progression in parity might be a bit cumbersome because of numerous intervening processes through which these variables operate to influence under-five mortality. However, the adverse consequences of a short interval and high progression in parity on under-five mortality may be attributed to the biological effects related to the "maternal depletion syndrome" or more generally the inability of the mother not fully recuperating from one pregnancy before supporting the next one which in most cases lead to anemia and premature rupture of membranes. This was also supported by competition hypothesis, which states that the birth of each successive child generates competition for scarce resources among sibling in the household, thus leads to a lower quality of care and attention to each child and hence their survival endangered (Gribble, 1993; Bicego and Ahmad, 1996; Norton, 2005).

Among other factors influencing under-five mortality is the frequency of births measured by parity progression. Parity progression analyses are important in providing insights into patterns of birth spacing and, subsequently, child's health. Studies have investigated the effect progression in parity on under-five mortality and most of their findings revealed that high birth frequency are associated with an increased hazard of death for mother and under-five children (United Nations, 2000; Davanzo et. al, 2004).

Other mechanisms that have been hypothesized to possibly contribute to a detrimental effect of a short preceding interval on under-five survival are; behavioral effects associated with competition between siblings (e.g., competition for parental time or material resources among closely spaced siblings), the inability (or lack of desire) to give a child adequate attention if his or her birth came sooner than desired and disease transmission among closely spaced siblings (Conde-Agudelo, 2002).

There has been little or no research on the effect of parity progression and birth interval on under-five mortality in Ekiti. This research effort therefore will test the validity of previous findings on relationship between child spacing, parity progression and under-five mortality in Ekiti community. Also, birth spacing as a concept is at the heart of reproductive health, few countries have policies and norms on it (DaVanzo, et al, 2004). This is relevant in societies like Ekiti which are characterized by low levels of contraceptive use and where the interval between successive births may be a key indicator of completed family size.

Research Questions

Establishing the linkages between parity progression, birth spacing and under-five mortality were possible based on the following research questions:

1. Does the parity progression probability influence under-five mortality?
2. To what extent does the interval between births affect the risks of under-five mortality?
3. Are the interval effects U-shaped?

DATA AND METHODS

The study area

The Ekitis, whose ancestors migrated from Ile-Ife form one of the largest ethnic groups in Yoruba land. Ekitis are generally homogenous and they speak a dialect of Yoruba language known as Ekiti. People from different ethnic backgrounds like Ebiras, Igbos, and Hausas live within the community. The people of Ekiti are predominantly agrarian. There are professionals, artisans, traders and sparsely located cottage industries like sawmilling, rice and other grain processing facilities, printing and publishing, auto mechanics e.t.c. in the community. Ekiti-land had, as of 2008, over 160 secondary schools with a student population of over 81,000 located. There are about 600 primary schools with an enrolment of approximately 190,000 pupils and five tertiary institutions. There are 252 and 14, Primary and secondary Health-Care Institutions respectively in the community. Also located within the state are 95 registered private hospitals. These health facilities are distributed equally among the three geopolitical zones in the state.

Although, there are evidences that modern family planning methods are utilized in Ekiti, but the prevalence is low. Ekiti is part of southwestern Nigeria which had TFR of 4.5, under-five mortality rate of 89 per 1,000 live birth and 31.7% of women of childbearing age are currently using contraception (NDHS, 2008). The population figure reported for Ekiti in 2006 census was 2,398,957 out of which 1,183,470 were females and 641,144 were women of childbearing age (NPC, 2006).

Data collection procedures

The study was a cross-sectional house-hold survey. A stratified multi-stage sampling technique was used to select the eligible mothers. At the first stage, one Local Government Area (LGA) was randomly selected from each of the three senatorial districts in Ekiti-State. Based on the 2008 projected population of women of childbearing age in the selected LGAs, the sample size was proportionately allocated to each LGA. The Enumeration Areas (EAs) in each LGA were stratified into rural and urban EAs and the study sizes were further proportionately allocated. Twenty Households were systematically selected in each EAs and women who had their last birth within the last seven years were selected from each household. A pre-tested questionnaire was administered on selected respondents. The data were collected by teams of interviewers who have university degree and could speak the local dialect fluently.

Estimation of Cumulative Survival Probabilities

The life table approach was adopted for the analysis of cumulative survival probabilities. The analysis was done using the number of births at year of childbearing which was grouped in three years interval by selected background characteristics. Retrospective information on fertility history was sought from the respondents to ascertain timing of births of specific order. Timing in this regard is the survival time and the event is birth. Also, censoring may occur in this study for if a woman does not remember her fertility history and if she refuses to respond to questions on childbearing (births and dates). In this regard, $\boldsymbol{\omega}$ is used to represent random variable (0, 1) indicating either failure or censorship. That is $\boldsymbol{\omega} = 1$ for failure if the event birth occurs between a starting point (year) and 2008 and $\boldsymbol{\omega} = 0$ for censors.

The quantitative term used in the analysis is survivorship function S(t) which is the probability that a woman survives longer than some specified time t without given birth to a child of a particular order. S(t) is the cumulative survival probabilities or simply survival rates which are the estimated probabilities of surviving from entry into the study through t years. Since survival to this time requires survival through all prior time points, the probability of surviving to the end of a given time interval is estimated by the product of survival probabilities for that interval and all previous time periods after the initial birth.

Mathematically S(t) represents the probability of surviving from the initial event (time zero) until time t (units) later.

$$\text{Then, } S(t) = P_0 \times P_1 \times P_2 \times \ldots \times P_t = \underset{j=0}{\overset{t}{\pi}} P_j$$

Parity Progression Probability (PPP)

Childbearing level is measured in terms of PPP. The PPP for parity j (p_j) is the probability of women at parity *i* proceeding to higher order parity. Value of a PPP varies from zero to one. If PPP is zero, it means no women of the specified parity had an additional birth and is directly related to the births of the next higher order. The computation of cohort specific parity increments denoted by P_j for the progression from parity j to parity j+1 is shown below;

$$N_j = n_j - (A_{j+1} - A_j),$$

$$N_j = n_j + A_j - A_{j+1},\ j = 0, 1, 2, \ldots,$$

where n_j is the number of women with j children at time t, N_j are women with j children at time t+s, and A_j is the number of j-th births during the period, $A_0 = 0$.

Since, the report is retrospective and cross-sectional, both migration and mortality are zero.

$$\therefore\ A_{j+1} = n_j + A_j - N_j$$

Then, the parity progression rate (PPP_j) can be defined by

$$PPP_j = \frac{A_{j+1}}{n_j + A_j} = \frac{n_j + A_j - N_j}{n_j + A_j} = 1 - \frac{N_j}{n_j + A_j}$$

Measuring child-spacing

For this study spacing of childbearing was measured as the inter-birth interval. This is the time in months between the delivery of the previous child irrespective of the surviving status of the child and the index child. Women who gave birth in the last seven years preceding the survey were considered for child spacing analysis. Extending the interval to seven years was necessary because report on child mortality are always small relative to the number of respondents and hence require large number of cases to provide representative information for analysis. Thereafter, a sequential birth history of the index child during arrival and death time was constructed for each woman. The index child was the most recent delivery by the woman and she has not had any other pregnancy since his/her delivery. Selected socio-demographic variables were then considered in relation to surviving status of the index child. For each child in the study, time (t) starts with a value of zero at birth and is right censored at the first 60 months of life. Meanwhile, a child who is alive and has not reached the age of 60 months as at the time of the study is said to be censored for under-five mortality. Also those who are dead or alive after five years are censored. Then, the cases are those who died between ages zero and five years.

The indicator of child survival in the analysis is the time (t) to death of the i^{th} (index) child, t depends on a characteristics vector, X_i ($X_1, X_2, \ldots, X_n$). Hazard rate was used to specify the relationship between time to death and the vector of characteristics. The hazard rate $h_i(t)$ shows the rate at which individuals die at age t given that they have lived to be t-years old. Cox-proportional hazard model was used so that the hazard rate for t is $h_i(t) = \exp(X_i\beta)h_o(t)$. The hazard has "baseline" component, $h_o(t)$, which is common to all individuals with a value that depends only on t.

Results

Table 1 shows the percentage distribution of respondents by under-five children survival (index child), according to selected background characteristics. The table shows that across the births categories, prevalence of under-five mortality was least (11.2%) among women who spaced their index birth for an interval between 36 and 59 months, whereas, it was highest among their counterparts who left less than 24 months before the birth of their index child (38.6%). In Table, 28.9% of the rural compared to 17.6% of the urban mothers had lost their most recent under-five children. The level education of mother shows an inverse relationship with under-five mortality as the percentage of women who lost their most recent under-five children ranges from 9.0% among higher educated women through 43.5% among women with no education.

Among the religious groups, Christian mothers experienced the least under-five mortality with 17.6% having reported to have lost their most recent under-five children. It is striking that a higher proportion (68.4%) of women who were traditional sect lost their most recent under-five children. It is interesting to know that no significant association existed between child preference and under-five mortality ($p>0.05$), both women who claimed that they have preference for a particular gender (male or female) (20.3%) and those who did not (20.4%) exhibited similar pattern of under-five mortality in the study area. Significant association also existed between; births interval ($p<0.001$), place of residence ($p<0.001$), levels of education ($p<0.001$), religion ($p<0.001$) and under-five mortality.

TABLE 1: Percentage Distribution of Under-Five Mortality Experience of the Index Child By Selected Background Characteristics

Backgroud Characteristics	Under-five Mortality No (79.6%, n=782)	Under-five Mortality Yes (20.4%, n=200)	TOTAL (100.0%, n=982)
Birth Interval (Months) (Chi-Square value = 59.735)*			
Less than 24	61.4(121)	38.6(76)	100.0(197)
24-35	79.3(264)	20.7(69)	100.0(333)
36-59	88.8(293)	11.2(37)	100.0(330)
60+	85.2(104)	14.8(18)	100.0(122)
Place of Residence (Chi-Square value =14.084)*			
Rural	71.1(170)	28.9(69)	100.0(239)
Urban	82.4(612)	17.6(131)	100.0(743)
Levels of Education (Chi-Square value = 62.711)*			
None	56.5(52)	43.5(40)	100.0(92)
Primary	71.1(172)	28.9(70)	100.0(242)
Secondary	83.7(365)	16.3(71)	100.0(436)
Higher	91.0(193)	9.0(19)	100.0(212)
Religion (Chi-Square value =36.233)*			
Christian	82.4(675)	17.6(149)	100.0(824)
Islam	72.3(99)	27.7(38)	100.0(137)
Traditional	31.6(6)	68.4(13)	100.0(19)
Others	n.a(2)	n.a(0)	100.0(2)
Gender Preference (Chi-Square value = 0.003)$^{n.s}$			
Yes	79.7(224)	20.3(57)	100.0(281)
No	79.6(557)	20.4(143)	100.0(700)

Source: Fieldwork 2008 ***Significant at 0.1% (p<0.001)** **$^{n.s}$ Not significant**

Socio-Demographic Differences in Parity Progression Probabilities (PPP)

Table 2 shows the survivorship and parity progression probabilities by background characteristics. In the table, the incidence of first births i.e. transition from parity zero to parity 1 represented by P_0 is 947 births per 1,000 women in the sample. The data revealed that the percentage of women who progress from parity 0 to 1 is higher in urban than rural areas. The lower value of P_0 recorded in rural area mainly reflects fewer first births among rural teenagers than their urban counterparts. For example, the P_0 in rural was 0.932 whereas the urban is 952 births per 1,000 women. As seen by comparing the level of P_1 with P_0, urban women progress at lower rate ($P_1 = 0.796$) than rural women ($P_1 = 0.811$). There is consistency in lower rate of progression among urban women than rural between parities P_1 to P_5. Higher PPP exhibited by higher parity women (P_6 and above) in urban area than rural was not significant since few births were recorded at these births order.

The effect of education on the PPP was observed by calculating life tables by birth order separately for two broad educational groups: “None or primary” and “secondary or higher education”. Overall, women with at least a secondary education show much lower PPPs than women with no education or primary education. This differential emerges in the transition from parity 0 to 1 and becomes fully fledged in the transition from parity 1 to higher order parties.

A similar pattern obtained for women’s education is also seen for survival of children that were born alive in 5 years preceding the survey. Among women who reported that their under-five children are alive, the PPP are consistently lower down the parity than those women who had lost their under-five children. For instance, the probability of progressing to parity 2 among women who lost their under-five was 1, whereas that with under-five children alive was 0.999. The differential in parity progression probability among women who lost their under-five children and those who have theirs’ alive at the time of the survey became pronounced at higher births order.

Table 2: Cumulative Survival Probabilities, Parity progression probabilities by Birth Order according to date of childbearing and selected background characteristics

Year of Birth	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
PLACE OF RESIDENCE											
Rural											
1976-1978	0.997										
1979-1981	0.984	0.985	0.995								
1982-1984	0.948	0.959	0.970	0.964							
1985-1987	0.870	0.909	0.927	0.923	0.952	0.982					
1988-1990	0.726	0.806	0.844	0.856	0.884	0.912	0.952				
1991-1993	0.556	0.639	0.672	0.733	0.758	0.798	0.862	0.800	0.500		
1994-1996	0.368	0.435	0.468	0.538	0.578	0.642	0.698	0.640	0.250		
1997-1999	0.186	0.235	0.270	0.317	0.364	0.424	0.432	0.512	0.125		
2000-2002	0.064	0.082	0.095	0.124	0.165	0.189	0.185	0.307	0.000		
2003-2005	0.011	0.016	0.018	0.026	0.037	0.145	0.053	0.123	0.000		
2006-2008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		
PPP	**0.932**	**0.811**	**0.756**	**0.692**	**0.604**	**0.667**	**0.375**	**0.238**	**0.400**		
Urban											
1976-1978	0.990	0.998									
1979-1981	0.967	0.981	0.993	0.997							
1982-1984	0.913	0.946	0.965	0.984	0.986						
1985-1987	0.828	0.881	0.921	0.934	0.963	0.992					
1988-1990	0.680	0.756	0.820	0.855	0.880	0.942	0.977				
1991-1993	0.500	0.582	0.660	0.731	0.747	0.826	0.841	0.977			
1994-1996	0.321	0.384	0.461	0.530	0.562	0.621	0.607	0.771	0.75		
1997-1999	0.165	0.213	0.263	0.315	0.359	0.400	0.352	0.514	0.563	0.500	
2000-2002	0.060	0.084	0.108	0.128	0.144	0.172	0.131	0.245	0.298	0.250	0.500
2003-2005	0.012	0.018	0.024	0.029	0.024	0.038	0.015	0.023	0.098	0.000	0.250
2006-2008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PPP	**0.952**	**0.796**	**0.730**	**0.639**	**0.564**	**0.553**	**0.355**	**0.488**	**0.571**	**0.333**	**0.500**
EDUCATION											
None and Primary											
1976-1978	0.979	0.995									
1979-1981	0.935	0.964	0.984	0.996							
1982-1984	0.841	0.899	0.938	0.964	0.981						

1985-1987	0.706	0.801	0.858	0.894	0.939	0.982					
1988-1990	0.502	0.646	0.723	0.792	0.835	0.920	0.955				
1991-1993	0.310	0.443	0.528	0.634	0.670	0.796	0.846	0.882	0.889		
1994-1996	0.157	0.247	0.313	0.420	0.471	0.595	0.635	0.727	0.593		
1997-1999	0.058	0.107	0.146	0.222	0.276	0.376	0.361	0.513	0396	0.500	
2000-2002	0.012	0.031	0.045	0.071	0.102	0.169	0.123	0.242	0.132	0.250	0.500
2003-2005	0.001	0.005	0.007	0.011	0.017	0.040	0.028	0.043	0.015	0.000	0.000
2006-2008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PPP	**0.962**	**0.903**	**0.823**	**0.778**	**0.659**	**0.685**	**0.396**	**0.386**	**0.529**	**0.444**	**0.500**
Secondary and Higher											
1976-1978	0.997										
1979-1981	0.988	0.992									
1982-1984	0.960	0.978	0.986	0.993							
1985-1987	0.904	0.939	0.966	0.965	0.986						
1988-1990	0.792	0.841	0.900	0.914	0.937	0.955					
1991-1993	0.633	0.693	0.763	0.826	0.852	0.856	0.850				
1994-1996	0.449	0.503	0.585	0.648	0.696	0.690	0.638	0.778	0.800		
1997-1999	0.252	0.308	0.375	0.422	0.485	0.474	0.414	0.519	0.640		
2000-2002	0.111	0.133	0.169	0.199	0.229	0.198	0.207	0.289	0.384		
2003-2005	0.026	0.032	0.044	0.057	0.047	0.041	0.010	0.032	0.230		
2006-2008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		
PPP	**0.943**	**0.754**	**0.690**	**0.571**	**0.504**	**0.472**	**0.299**	**0.450**	**0.556**		
					UNDER-FIVE MORTALITY						
Baby Alive (Yes)											
1976-1978	0.996										
1979-1981	0.988	0.995									
1982-1984	0.968	0.986	0.992								
1985-1987	0.930	0.968	0.981	0.986							
1988-1990	0.832	0.927	0.953	0.969	0.993						
1991-1993	0.670	0.822	0.890	0.930	0.965						
1994-1996	0.455	0.654	0.758	0.829	0.899	0.956	0.909				
1997-1999	0.223	0.438	0.549	0.632	0.737	0.830	0.744				
2000-2002	0.061	0.208	0.278	0.333	0.394	0.525	0.406				
2003-2005	0.003	0.053	0.081	0.093	0.099	0.170	0.074	0.333			
2006-2008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		
PPP	**1.00**	**0.990**	**0.680**	**0.559**	**0.490**	**0.472**	**0.162**	**0.273**	**0.333**		
Baby Alive (No)											
1976-1978	0.985										
1979-1981	0.940	0.985	0.994								
1982-1984	0.864	0.931	0.959	0.993							
1985-1987	0.729	0.847	0.908	0.940	0.982	0.986					
1988-1990	0.509	0.690	0.801	0.871	0.910	0.934	0.977				
1991-1993	0.299	0.492	0.592	0.749	0.794	0.860	0.863	0.909	0.923		
1994-1996	0.135	0.270	0.368	0.539	0.635	0.699	0.743	0.702	0.639		
1997-1999	0.041	0.114	0.170	0.313	0.421	0.506	0.501	0.479	0.442	0.500	
2000-2002	0.007	0.029	0.052	0.115	0.184	0.220	0.221	0.218	0.170	0.250	0.500
2003-2005	0.001	0.004	0.006	0.028	0.032	0.049	0.046	0.030	0.039	0.000	0.000
2006-2008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PPP	**1.00**	**1.00**	**0.849**	**0.888**	**0.733**	**0.691**	**0.566**	**0.512**	**0.591**	**0.308**	**0.500**
TOTAL											
1976-1978	0.991	0.998									
1979-1981	0.971	0.982	0.994	0.998							
1982-1984	0.922	0.949	0.967	0.979	0.986						
1985-1987	0.839	0.887	0.923	0.931	0.963	0.989					
1988-1990	0.692	0.767	0.827	0.855	0.880	0.934	0.969				
1991-1993	0.514	0.595	0.663	0.732	0.747	0.818	0.848	0.923	0.929		
1994-1996	0.332	0.396	0.463	0.532	0.562	0.628	0.636	0.746	0.663		
1997-1999	0.170	0.218	0.265	0.316	0.359	0.408	0.378	0.516	0.474	0.500	
2000-2002	0.061	0.083	0.105	0.127	0.144	0.178	0.148	0.258	0.203	0.250	0.500
2003-2005	0.011	0.017	0.023	0.029	0.024	0.039	0.025	0.040	0.058	0.000	0.000
2006-2008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PPP	**0.947**	**0.800**	**0.736**	**0.652**	**0.416**	**0.808**	**0.362**	**0.406**	**0.539**	**0.286**	**0.500**

Source: Field work, 2008.
PPP: Parity progression probability

Multivariate Analysis of the Effect of Child-Spacing on Under-Five Mortality

In this section, analyses of the effects of birth intervals were examined on under-five mortality. Results were compared before and after controlling for confounding factors. Table 3 shows the Cox-proportional hazard models for under-five mortality and birth interval. In the table, births occurring after an interval of less than 24 months have higher relative risk ($p<0.01$) for under-five mortality, when compared with an interval of 36-60 months. Both intervals between 24-35 months and above 60 months also exhibited the same pattern when compared with births spaced for less than 24 months. Adding confounding variables such as maternal's education, place of residence, immunization; ante-natal and post-natal clinic visit to the model reduced the size of the effect of short intervals but to a relatively small extent.

In order to facilitate clear understanding and interactive effect between an interval 36-60 months and other low-risk birth intervals, the variable was disaggregated into two groups as seen in Table 4. However, increased under-five mortality risks was observed to be associated with birth intervals of 24-35 months 1.87 ($p<0.001$) and above 60 months 1.4 ($p<0.05$) relative to birth intervals of three to five years as shown in Table 4. Controlling for confounding variables also reduced the strength of the risk for 24-35 months and increased the strength for above 60 months birth intervals (Table 5).

It is obvious that birth intervals of 24-35 months (significant) and above 60 months (not significant) have higher relative risk of under-five mortality when compared to an interval of 36-60 months. The risk patterns remained the same even when the confounding variables were controlled. Although, non-significant association exists between the interaction of birth interval 24-35 months and above 60 months, but birth intervals 24-35 months have higher relative risks than intervals above 60 months for under-five mortality, with and without controlling for confounding factors.

The graphs in Figures 1–3 were drawn to show the survival patterns of the under-five children through different age intervals. The graphs appear in layers with respect to variable indicators. The graph of an indicator appearing at the top-most layer has higher survival rates than any other indicators. For example, in figure 1, women who spaced their children within an interval of 36-59 months survive under-five deaths than any other birth interval. This means that least under-five mortality was experienced by women who left an interval of 36-59 months between births. Obviously in figure 1 clear differentials in under-five mortality occur among women who left an interval of 36-59 months and those who left less than 24 months. The survival pattern of under-five mortality show direct relationship with levels of education. Although, slight rural-urban differential in survival pattern was observed, but urban mothers have higher survival chances of under-five children than their rural counterparts.

Table 3: Results of Cox proportional hazard model of the effect of birth spacing on under-five mortality without and with control for confounding variables

Birth Intervals (Months)	**β**	**S.E**	**SIG.**	**EXP(β)**	**95.0% C.I for Exp(β)**	
					Lower	**Upper**
<24 (Ref.)	R.C	R.C	R.C	1.000	R.C	R.C
24-35	-0.643	0.166	0.000*	0.526	0.379	0.728
36-59	-1.282	0.196	0.000*	0.277	0.189	0.407
60+	-1.050	0.283	0.000*	0.350	0.201	0.609
Controlling For Confounding Variables						
<24 (Ref.)	R.C	R.C	R.C	1.000	R.C	R.C
24-35	-0.579	0.198	0.004**	0.560	0.380	0.827
36-59	-1.311	0.235	0.000*	0.270	0.170	0.428
60+	-0.787	0.313	0.012***	0.455	0.247	0.841

Source: Field work, 2008. * Significant at 0.1% (P<0.001) **Significant at 1.0%(P<0.01) *** Significant at 5% (P<0.05) R.C Reference category.

Table 4: Results of Cox proportional hazard model of the effect of birth spacing on under-five mortality (*Interaction effects*)

Birth Intervals (Months)	**β**	**S.E**	**SIG.**	**EXP(β)**	**95.0% C.I for Exp(β)**	
					Lower	**Upper**
Birth intervals 24-35 & 36-59						
24-35	0.628	0.199	0.002**	1.873	1.268	2.766
36-59 *(Ref.)*	R.C	R.C	R.C	1.000	R.C	R.C
Birth intervals 36-59 & 60+						
36-59 *(Ref.)*	R.C	R.C	R.C	1.000	R.C	R.C
60+	0.236	0.303	0.436	1.266	0.699	2.292
Birth Intervals 24-35 & 60+						
24-35 *(Ref.)*	R.C	R.C	R.C	1.000	R.C	R.C
60+	-0.369	0.285	0.195	0.691	0.395	1.209

Source: Field work, 2008. **Significant at 1.0%(P<0.01, R.C Reference category

Table 5: Results of Cox proportional hazard model of the effect of birth spacing on under-five mortality with control for confounding variables *(interaction)*

Birth Intervals (Months)	**B**	**S.E**	**SIG.**	**EXP(β)**	**95.0% C.I for Exp(β)**	
					Lower	**Upper**
Birth Intervals 24-35 & 36- 59						
24-35	0.723	0.230	0.002**	2.061	1.312	3.237
36-59 *(Ref.)*	R.C	R.C	R.C	1.000	R.C	R.C
Birth Intervals 36-59 & 60+						
36-59 *(Ref.)*	R.C	R.C	R.C	1.000	R.C	R.C
60+	0.525	0.334	0.116	1.690	0.878	3.252
Birth Intervals 24-35 & 60+						
24-35 *(Ref.)*	R.C	R.C	R.C	1.000	R.C	R.C
60+	-0.172	0.309	0.579	0.842	0.460	1.544

Source: Field work, 2008. * Significant at 0.1% (P<0.001) **Significant at 1.0%(P<0.01) *** Significant at 5% (P<0.05) **** Significant at 10% (P<0.10) RC Reference category.

Fig.1 SURVIVAL FUNCTION FOR UNDER-FIVE MORTALITY PATTERNS BY BIRTH INTERVALS

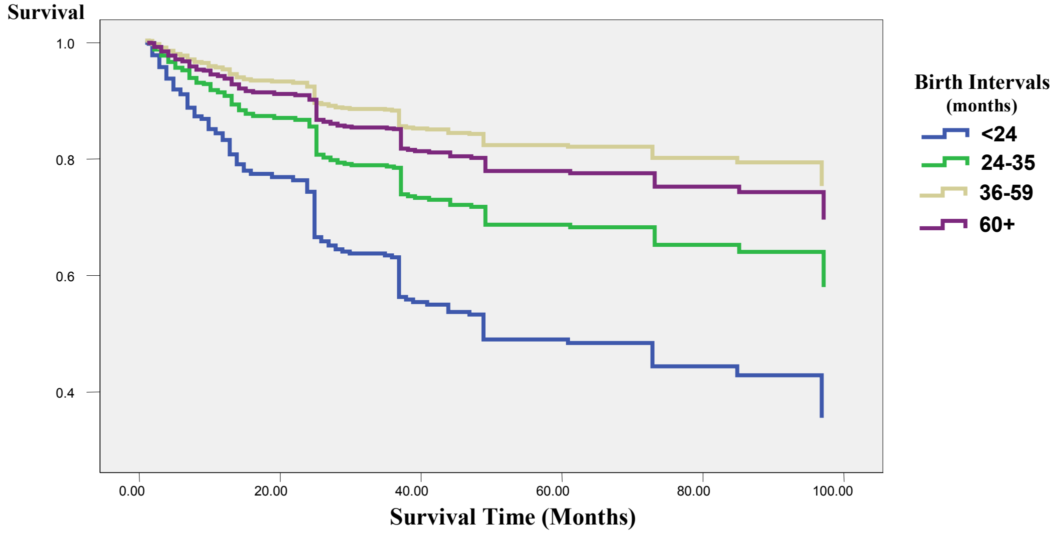


Fig. 2 SURVIVAL FUNCTION FOR UNDER-FIVE MORTALITY PATTERNS BY LEVELS OF EDUCATION

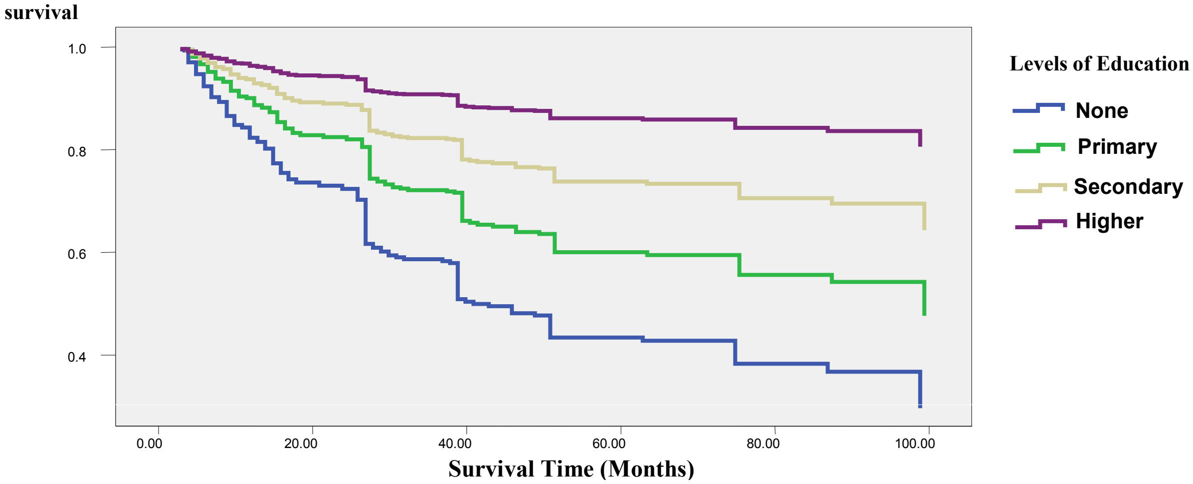
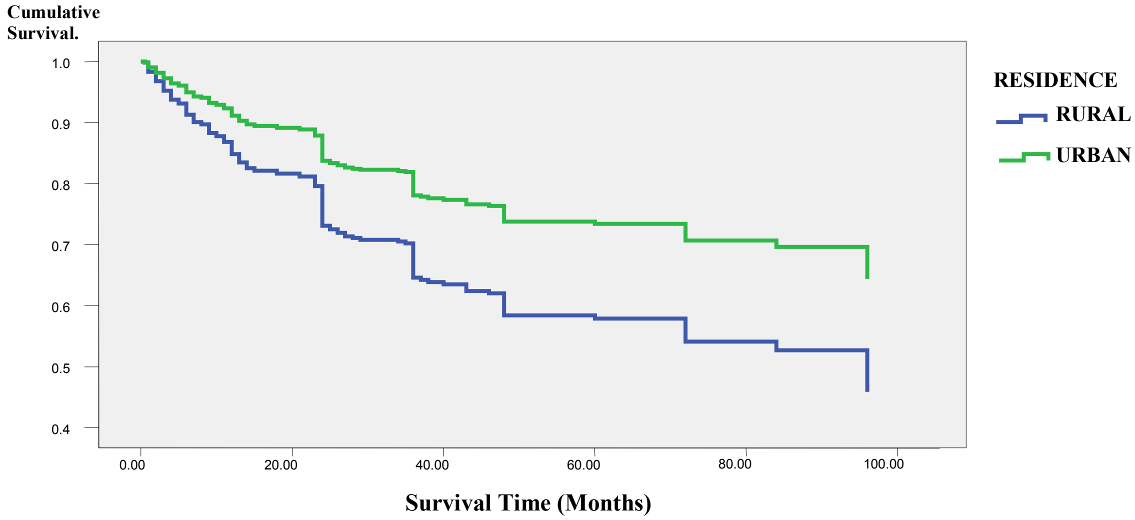


Fig. 3 SURVIVAL FUNCTION FOR UNDER-FIVE MORTALITY PATTERNS BY PLACE OF RESIDENCE



Discussion

Birth spacing and parity progression (PP) are well known but underutilized child's health intervention, particularly in Nigeria. In recent years, more attention is being focused on the study of PP because of its relevance in assessing the impact of contraceptive practices in populations. Researches on factors influencing under-five mortality have been conducted at different times in Ekiti and other locations in Nigeria, but very few have used parity progression and child spacing as part of their key variables. This gap informed the choice of these variables in the present study.

The study was cross-sectional where retrospective information were sought from women of childbearing age using pre-tested and well designed questionnaire on births history of the respondents. The data analysis revealed that across the births categories, prevalence of under-five mortality was least (11.2%) among women who spaced their index birth for an interval between 36 and 59 months, whereas, it was highest among their counterparts who left less than 24 months before the birth of their index child (38.6%). Also, rural women lost more of their under-five children than their urban counterparts. Exposure to modern health facilities by urban women can explain the difference. Education in the literature has been known as a major contributing factor to improving maternal and child health. As shown in the present study, the higher the level of education of the mother, the lower the risks of under-five mortality. This is because higher educated women have better behavioral attitudes and are more knowledgeable of underlying mechanisms that can improve health of their children and hence, their survival chances.

Among the religious groups, Christian mothers experienced the least under-five mortality. It is striking that a higher proportion (68.4%) of women who were traditional sect lost their most recent under-five children. Low patronage of modern health facilities in terms of acceptability and use of local herbs that have not been scientifically tested can be a reason for the large number. It is interesting to know that no significant association existed between child preference and under-five mortality in the study area. In Ekiti, the believe of the people is that equal attention should be given to a child with disregard for gender when the child is sick and the public campaign on gender equality has eroded the preferential treatment accorded to male child in the past.

Detailed examination of the parity progression patterns showed that the progression intensities are higher among women who experienced under-five mortality, rural and less educated. While urban women exhibited slightly less overall levels of births than rural women, education had a substantial impact on the later stages of family-building process. These findings are in accordance with the results of NiBhrolchain and Maire, (1987).

The Cox-proportional hazard model showed that births occurring at an interval of less than 24 months constituted higher health risk than interval of 24-35 months for under-five children. This is in agreement with previous findings of Rutstein, 2003; Adewuyi and Isiugo-Abanihe, 1990. A direct association between birth intervals and risk of under-five mortality in this study shows that children who were born less than 24 months after the previous birth are more likely to die before attaining the age of five than children who were born 36-59 months after the previous birth. It is also important to note that a minimum birth interval of 36 months promotes survival chances of under-five children.

In this study we have shown that preceding short birth interval and high parity progression are associated with higher levels of under-five mortality and that these effects, though reduced somewhat, persist when we controlled for confounding variables. These are variables that have been conjectured to possibly account for the effects of short intervals and find that, while these variables do indeed affect under-five mortality, the sizes of the effects of short intervals barely change when these additional variables were controlled. The effects of preceding birth intervals on under-five mortality as evident in our study are very similar to studies using Demographic and Health Surveys data, such as Rutstein (2003).

As discovered in this study, under-five children born 24-35 months after the previous birth are still at higher risk of dying than children born between 36-60 months after the previous birth. Some of the deaths occurring among under-five children in Ekiti could have been averted if more women had achieved the longer birth intervals they desire. If women in the study area had no births less than 24 months, a reasonable proportion of deaths could have been averted. And if all women had spaced births for at least 36 months apart, additional number of births could have been averted. Therefore, extending the minimum recommended birth interval from two to three years will really make a difference in terms of under-five children survival in Ekiti.

Conclusion

Despite dearth of data in underlying biological mechanisms, longer birth intervals and low rate of progression in parity are associated with reduced risk of mortality among under-five children. They can play significant roles in helping Ekiti people achieving maternal and child health theme of Millennium Development Goals. Birth spacing and low birth frequency can reduce the number of children in the household, thereby resulting into improving health of under-five years' old children. The duo, birth spacing and parity progression might not be the panacea, but when integrated with other activities, it gives under-five children a fighting chance and hence increase their survival chances.

Acknowledgements

The authors are grateful to those who contributed to the success of this study from data collection through report writing. We are particularly grateful to Professor E.A. Bamgboye of EMSEH department, University of Ibadan for his constructive criticisms during the study writes up.

References

Adewuyi, A. A. and Isiugo-Abanihe. U. 1990: "Regional Patterns and Correlates of Birth Interval Length in Nigeria" in Research Note No. 107 Australian National University, Canberra.

Bicego and Ahmad, (1996). Potential Effects on Fertility and Child Health and survival of Birth-Spacing, Preferences in sub-Saharan Africa. *Studies in Family Planning*. 31(2),99-110.

Conde-Agudelo, A, 2002. Association between interpregnancy intervals and Maternal/Patrnal Outcomes in Latin America. OBSI regional Washington D.C

Conde-Agudelo, A and J.M. Belizan. 2000. "Cross sectional study". *British Medical Journal* Maternal Mortality and Morbidity associated with interpregnancy interval: (Clinical Research Ed.), Vol.321(7271):1255-1259.

DaVanzo, et al. 2004. "the effects of birth spacing on infant and childhood mortality, Pregnancy outcomes in Matlab Bangladesh" Rand Working Paper, WR-19, Santa Monica, California:Rand.

Gribble, P.A. (1993). Fertility leves, Trends and Differentials in sub-Saharan Africa in the1980s and 1990s. Population Council. Studies in FP. Vol.29, No.1(Mar,1998), pp.1-22.

Miller, W.B. (1994): "Childbearing motivations, desires and intentions: A theoretical framework",Genetic, Social and General Psychology,vol.47, No.3,pp.291-326.

National Population Commission Nigeria. 2003. Nigeria Demographic and Health Survey 2003. Calverton, Maryland: National Population Commission and ORC/Macro.

National Population Commission Nigeria. 2008. Nigeria Demographic and Health Survey 2008. Calverton, Maryland: National Population Commission and ORC/Macro.

National Population Commission Nigeria. 2006. Nigeria Population Census Report.

NiBhrolchain, Maire. 1987. Period Parity Progression Ratios and birth intervals in England and analysis. Population Studies (London), vol. 41, pp.103-125.

Norton, M (2005). New evidence on birth spacing: Promising findings for improving newborn, infant, child, and maternal health. *International Journal of obstretrics and Gynecology*.89, S1-S6 *Journal Biosocial Science*

Rutstein, S.O. 2003. Effect of birth intervals on mortality and health: Multivariate cross-country analyses. Unpublished presentation to USAID, Washington, D.C.,July.

Rutstein, S.O. 2005. Effects of preceding birth intervals on neonatal, infant and under-five years mortality and nutritional status in developing countries: Evidence from the demographic health surveys. *International Journal of Gyn. and Obst.*.89, pp S7-S24.

United Nations. 1998. World Population Prospects, the 1998 Revision, vol. 1, Comprehensive Tables (United Nations Publication, Sales No.E.00.XIII.9).

United Nations. 2000. World Population Prospects: The 2000 Revision, Vol.1, Comprehensive Tables (United Nations Publication, Sales No. E. 01. XVIII.8).