Global Trends in Birth Intervals 1975-2013

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Abstract

Birth spacing patterns are a fundamental feature of any reproductive regime, and changes in these patterns can be one source of fertility change. It is surprising, therefore, to discover in the literature of the past decade no comprehensive analysis of trends in birth spacing patterns outside the West. Our principal goal is filling this substantial gap. A secondary goal is to consider, in settings outside Sub-Saharan Africa, Moultrie's and Timæus' provocative arguments about "postponement" as a third form (with spacing and stopping) of birth avoidance. We analyze birth history data from four major survey programs -- WFS, DHS, RHS, and PAP –, confined to countries with at least two surveys (288 surveys in 69 countries, conducted from 1975 to 2013). We perform both descriptive analysis (Kaplan-Meier) and hazard regression modeling. To our knowledge, there is no comparable effort to analyze trends in birth spacing patterns spanning the past four decades.

Background and Goals

Birth spacing patterns are a fundamental feature of any reproductive regime, and changes in birth spacing patterns can be a source of fertility change. Indeed, Caldwell *et al* (1992) posited that changes in birth spacing would make a major contribution to fertility decline in Sub-Saharan Africa. This possibility reverberates in the research by Bledsoe *et al* (1998) on fertility in Gambia and Johnson-Hanks (2004) on Cameroon, and it is addressed explicitly in recent provocative work by Moultrie and Timaeus (2008, 2012). Moultrie and Timaeus argue that a particular form of pregnancy avoidance which they term "postponement" – a third form in addition to spacing and stopping, and heretofore not recognized – accounts for a substantial fraction of the recent observed fertility decline in Sub-Saharan Africa, especially in the southern African countries. A major motivation for this research is to pursue Moultrie's and Timaeus' theory and methods in some depth; in particular, to ascertain (by casting a broader net with regard to countries examined) whether the pattern of birth interval lengthening which they identify is, as they claim, indeed a uniquely African phenomenon.

It is surprising to discover that the literature of the past decade contains no comprehensive analysis of trends in birth spacing patterns in mid- and low-income countries outside the West. The first and overarching goal of this research is to fill this substantial gap in the existing literature. We should note that Casterline *et al*'s 2011 conference paper makes a limited effort to examine global trends in birth spacing, but the analysis is confined to eight countries, six of which are non-African. This research will be far more comprehensive.

A second goal – really, a corollary of the first – is to examine trends in birth spacing both with and without taking account of parity progression. Without adjusting for parity progression when analyzing data containing censored observations, estimates of trends in the median birth interval – the duration at which fifty percent of women have progressed to another birth –will be affected by both trends in the inter-birth interval and trends in parity progression. This is of interest for some purposes. Adjusting the survival function for parity progression yields estimates of the inter-birth interval distribution alone. This, too, can be of interest, especially because it bears directly on the health risks of short, or long, intervals. Therefore, in this research we shall examine distributions – survival functions – both without and with adjustment for parity progression.

A third goal of this research is to test for Moultrie and Timaeus's "postponement" in regions other than sub-Saharan Africa, using the diagnostics presented in Timeaus and Moultrie (2008) and Tiimaeus *et al.* (2013). At issue is the shape of the birth interval hazard function, easily generated from birth history data. We are less confident that Timeaus' and Moultrie's diagnostics will prove illuminating in analysis of empirical data from a diversity of settings, and hence cannot by fully confide that this third goal will be achieved.

Data and Methods

We will analyze birth intervals using birth history data from four major survey programs spanning the past four decades, namely: the World Fertility Survey (1975-1980), the Demographic and Health Survey (1987-present), Reproductive and Health Survey (1992-2008), and the Pan-Arab Project for Family Health (1990-2004).[1] These surveys collected birth histories from women of reproductive age (usually defined as ages 15-49). Because our goal is to analyze trends in birth spacing patterns, we select only countries in which at least two surveys are available: 288 surveys in 69 countries (see Table 1).

Selectivity and biases in birth history data are a concern (Brass & Juarez 1983; Schoumaker 2009,2010,2011). Therefore, we restrict our analyses to birth intervals initiated in the period 13-132 months preceding the interview. We make use of both uncensored and censored intervals, but in all cases begin with the second interval (from first to second birth), that is, we exclude the interval from union to first birth. Multiple births such as twins, triples, etc. are treated as a single birth outcome, but each birth in a multiple birth increments the birth order.

While we will examine birth intervals of all orders, we will place most emphasis on lower-order birth intervals, especially the second and third interval. There are two reasons for this emphasis. First, most women who have a first birth progress to a second until fertility declines to post-transition levels. Second, higher-order intervals are increasingly selective on fecundability and volitional factors as fertility declines, which greatly

[1] We also make use of a few surveys not part of one of these four programs, in particular national surveys in Brazil and Mexico.

complicates the task of assessing changes in deliberate birth-spacing behavior (Van Bavel 2004).

The analysis comprises two stages. First, we will perform a simple descriptive analysis of trends in order-specific median birth intervals by country, without and with adjustment for parity progression. As noted, we are aware of no equivalent descriptive exercise during the past decade, and therefore this alone fills a noticeable gap. This analysis will use conventional life-table methodology (Kaplan-Meier estimates).

Second, we will extend the descriptive analysis via regression modeling of the birth hazard. This permits us to control confounding factors, most notably woman's age and continuous historical time. The duration-pattern of the hazard will also be represented, as is the usual practice. A simplified statement of the regression model is

$$\ln(h) = f(D, P, A, T) \qquad (1)$$

where h is the hazard of the next birth, D denotes duration (including various parameterizations), P denotes parity at the beginning of the birth interval, A is age at each time-segment, and T is historical time at each time-segment. This is a log –hazard model, and will be estimated via conventional techniques (Box-Steffensmeier and Jones 2004).

Equation (1) will be estimated country-by-country, on data pooled across surveys within country. Coefficients on T will serve as evidence of the presence or absence of trends in birth-spacing patterns, net of changes over time in age (and, depending on the specification, changes in duration patterns as well).

As noted above, because equation (1) includes the duration pattern of the hazard, the hazard regression modeling will also yield an opportunity to explore Moultrie and Timaeus's "postponement" concept in a broader context. Our investigation, which will include dozens of countries outside Africa, with ample representation of Latin America, the Arab Region, and South and Southeast Asia, represents a significantly improved test of Moultrie and Timaeus' claim of African exceptionalism (which is based on comparison to four non-African countries: Peru, Egypt, Philippines, Vietnam),.

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Table 1. Surveys, by country, year and survey program.

Country	Year (Survey Program)
Algeria	1992, 2002(PAP)
Armenia	2000, 2005, 2010(DHS)
Bangladesh	1975(WFS), 1994, 1997, 2000, 2004, 2007, 2011(DHS)
Benin	1981(WFS), 1996, 2001, 2006, 2012(DHS)
Bolivia	1989(DHS), 1993, 1998, 2003, 2008(DHS)
Brazil	1986, 1991, 1996(DHS), 2006(other)
Burkina Faso	1992, 1998, 2003, 2010(DHS)
Burundi	1987, 2010(DHS)
Cambodia	2000, 2005, 2010(DHS)
Cameroon	1978(WFS), 1991, 1998, 2004, 2011(DHS),
Chad	1996, 2004(DHS)
Colombia	1976(WFS), 1986, 1990, 1995, 2000, 2005, 2010(DHS)
Comoros	1996, 2012(DHS)
Congo (Brazzaville)	2005, 2011(DHS)
Costa_Rica	1976(WFS), 1993(RHS)
Cote d'Ivoire	1980(WFS), 1994, 1998, 2012(DHS),
Dominican_Republic	1975, 1980(WFS), 1986, 1991, 1996, 1999, 2002, 2007(DHS)
Ecuador	1979(WFS), 1987(DHS), 1994, 1999, 2004(RHS)
Egypt	1980(WFS), 1991(PAP), 1988,1992, 1995, 2000, 2003, 2005, 2008(DHS)
El Salvador	1985(DHS), 1993, 1998, 2003, 2008(RHS)
Ethiopia	2000, 2005, 2011(DHS)
Gabon	2000, 2012(DHS)
Ghana	1979(WFS), 1988, 1993, 1998, 2003, 2008(DHS)
Guatemala	1987, 1995, 1998(DHS), 2002, 2008(RHS)
Guinea	1999, 2005, 2012(DHS)
Guyana	1975(WFS), 2009(DHS)
Haiti	1977(WFS), 1994, 2000, 2005, 2012(DHS)
Honduras	1996, 2001(RHS), 2005, 2012(DHS)
India	1993, 1999, 2006(DHS)
Indonesia	1976(WFS), 1987, 1991, 1994, 1997, 2002, 2007, 2012(DHS)
Jordan	1975(WFS), 1990, 1997, 2002, 2007, 2009, 2012(DHS)
Kazakhstan	1995, 1999(DHS)
Kenya	1978(WFS), 1989, 1993, 1998, 2003, 2008(DHS)
Kyrgyz Republic	1997, 2012(DHS)
Lebanon	1996, 2004(PAP)
Lesotho	1977(WFS), 2004, 2009(DHS)
Liberia	1986, 2007, 2013(DHS)
Madagascar	1992, 1997, 2003, 2008(DHS)

Malawi	1992, 2000, 2004, 2010(DHS)
Mali	1987, 1995, 2001, 2006, 2012(DHS)
Mauritania	1981(WFS), 1990(PAP), 2000(DHS)
Mexico	1976(WFS), 1987(DHS), 1997, 2003, 2009(other)
Morocco	1980(WFS), 1987, 1992, 2003(DHS), 1997(PAP)
Mozambique	1997, 2003, 2011(DHS)
Namibia	1992, 2000, 2006(DHS)
Nepal	1976(WFS), 1996, 2000, 2006, 2011(DHS)
Nicaragua	1992, 2006(RHS), 1997, 2001(DHS)
Niger	1992, 1998, 2006, 2012(DHS)
Nigeria	1982(WFS), 1987, 1990, 1999, 2003, 2008, 2013(DHS)
Pakistan	1975(WFS), 1991, 2006, 2012(DHS)
Paraguay	1979(WFS), 1990(DHS), 1995, 1998, 2004, 2008(RHS)
Peru	1977(WFS), 1986, 1991, 1996, 2000, 2008, 2012(DHS)
Philippines	1978(WFS), 1988(other), 1993, 1998, 2003, 2008, 2013(DHS)
Rwanda	1983(WFS), 1992, 2000, 2005, 2008, 2010(DHS)
Senegal	1978(WFS), 1986, 1992, 1997, 2005, 2011, 2013(DHS)
Sri Lanka	1975(WFS), 1987(DHS)
Sudan	1978(WFS), 1989(DHS), 1993(PAP)
Syria	1978(WFS), 2001(PAP)
Tanzania	1991, 1996, 1999, 2004, 2010(DHS)
Thailand	1975(WFS), 1987(DHS)
Togo	1988, 1998(DHS)
Trinidad	1977(WFS), 1987(DHS)
Tunisia	1978(WFS), 1988(DHS), 1994, 2001(PAP)
Turkey	1978(WFS), 1993, 1998, 2003, 2008(DHS)
Uganda	1988(DHS), 1995, 2000, 2006, 2011(DHS)
Vietnam	1997, 2002(DHS)
Yemen	1979(WFS), 1991(DHS), 2003(PAP)
Zambia	1996, 2001, 2007(DHS)
Zimbabwe	1988, 1994, 1999, 2005, 2010(DHS)