

Birth-spacing, Infant Mortality, and the Use of Contraceptives:

Evidence from Longitudinal Data

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Abstract

Using longitudinal data from rural Bangladesh, this study investigates the effects of contraceptive use after a birth on birth intervals and fertility, as well as the effects of infant death and other factors (such as socio-economic status or gender composition of the household) on subsequent contraceptive use. Our analysis is based upon a model with three parts: an equation explaining infant mortality, a model part explaining whether contraceptives are used after a child is born (and if so, for how long), and an equation explaining birth intervals. Infant mortality is determined by covariates reflecting socio-economic status, etc., but also by the length of the preceding birth interval. The decisions about contraceptives are driven by similar covariates, but also by survival status of the previous child and the family's gender composition. Birth spacing is driven by contraceptive use and other factors. Each part of the model incorporates unobserved mother specific heterogeneity.

Extended Abstract

While Bangladesh has experienced a sharp decline in child mortality and total fertility during the past decades, further reducing both child mortality and total fertility remains an important concern, with the aim to achieve the United Nations Millennium Development Goals 4 and 5. This study analyzes the role of using contraceptives in birth spacing, total fertility, and infant mortality in Bangladesh. The existing literature emphasizes the many mechanisms that link child mortality, birth spacing, and total fertility. Child mortality affects fertility through physiological and biological changes (e.g., breastfeeding) as well as behavioral replacement effects. On the other hand, it is well established that short birth intervals reduce survival chances of the next born child, particularly during the infancy (the first twelve months),

because of, for example, maternal depletion or competition for scarce resources. Estimating the optimum birth interval has been the goal of many existing studies and is policy relevant in guiding mothers with their future reproductive planning.

The evidence of adverse effects of short birth intervals is widely regarded in the demographic literature. In response to recent research that suggests birth intervals of at least three years may be associated with better health outcomes for children (Rutstein, 2005). USAID is currently supporting the Optimal Birth Spacing Initiative (OBSI), which seeks to provide advice on how programs can best promote optimal spacing, and WHO defines family planning as “the ability of individuals and couples to anticipate and attain their desired number of children and the spacing and timing of their births. It is achieved through use of contraceptive methods (WHO, 2008). The use of contraceptives is an important instrument to control birth intervals and fertility. A recent review (Marissa et al., *Studies in Family Planning*, 2009) emphasizes the policy relevance of studying the effect of contraceptives on birth spacing. It scrutinized fourteen studies, which all find that the use of contraceptives is protective against short birth intervals. But this review points out methodological flaws of the existing studies that could undermine the accepted rationale for expanding family planning programs to help deliver the maternal and child health benefits of birth spacing. Existing studies typically used retrospective birth-history data collected in cross-sectional surveys, potentially introducing recall bias and heaping at six-month intervals. The review concludes that more rigorous modeling is needed, preferably on the basis of longitudinal prospective data. This is exactly the contribution of this study.

Using longitudinal data from rural Bangladesh known to be of exceptional accuracy and completeness, this study investigates first, the effects of contraceptive use after a birth on birth intervals and fertility, and second, the effects of infant death and other factors (such as socio-economic status or gender composition of the household) on subsequent contraceptive use. Our main analysis is based upon a model with three parts: an equation explaining infant mortality, a model part that explains whether contraceptives are used after a child is born (and if so, for how long), and an equation explaining birth intervals. Infant mortality is determined by covariates reflecting socio-economic status, age of the mother, gender of the child, etc., but also by the length of the preceding birth interval. The decision to use contraceptives and, if so, for how long, is driven by similar covariates, but also by survival status of the previous child and the family’s gender composition. Birth spacing is driven by contraceptive use and other factors. Each part of the model also incorporates

unobserved mother specific heterogeneity, and the various unobserved heterogeneity terms are allowed to be correlated, so that the estimates of the parameters reflecting the causal effects remain consistent under general assumptions about the nature of heterogeneity. This makes the model similar in spirit to a recently developed model for birth spacing, fertility, and neonatal mortality in Bhalotra and van Soest (*Journal of Econometrics*, 2008). We also look at extensions of this model in which various types of contraceptives are distinguished.

Our data are collected by the International Centre for Diarrheal Disease Research, Bangladesh (ICDDR,B). ICDDR,B started the Maternal Child Health and Family Planning Programme (MCH-FP) project in October 1977 in half of the health and demographic surveillance system (HDSS) area in Matlab, formerly known as MCH-FP area and currently as ICDDR,B area, which provided additional health services and collected additional data on a range of health indicators. HDSS data have been collected systematically through regular household visits (every two weeks until January 1998, and once every month since then). Covering the period July 1982 to December 2005, this study analyses a sample of 31,968 children and 13,232 mothers who continuously lived and gave all their births in the ICDDR,B area.

The dependent variables in our models are the length of each time interval between births, a dummy for using contraceptives and the length of the time interval during which contraceptives are used (possibly censored), and a dummy for infant mortality. The covariates include birth order of the child, gender of the child, and age of mother at the time of birth of the child; education of the mother is captured by dummy variables; it may proxy the mother's ability to take good care of her children but may also proxy the family's socio-economic status. Education and occupation of the father also reflect the family's socioeconomic status. Another family level covariate is religion. To control for environmental factors, we include a dummy for access to running drinking water (a dummy for piped drinking water / tube well), and the distance to the nearest health facility (defined as a sub-centre or ICDDR,B hospital).

The average number of children born per mother is 2.42 and 82.7 per cent of all mothers in the sample are Muslims. The mean age of mothers at birth is respectively 24.7 years, and the average birth interval is about 48 months with standard deviation 23 months, and about 11 per cent birth intervals are shorter than 24 months. 48 per cent of all mothers never attended school. Mothers residing in this area are much nearer to a health facility (2 kilometres on average), and 88 per cent of all mothers have access to running water (tube well/pipe water).

About 86 per cent of mothers use any type of contraceptive method after giving a birth. Among users, 21.28 per cent use *pill*, 47.28 per cent use *injection*, 4.80 per cent use *IUD*, 11.40 per cent use *condom*, 0.44 per cent use *sterilization* and 0.82 per cent use *traditional* method. The average log birth interval is about 9% longer if a mother continuously uses a method for more than three years, compared to seven months to three years. Surprisingly a short span of continuation (six months) is also associated with a longer birth interval.

Preliminary estimates suggest that an infant death has a substantial negative effect on the probability to use contraceptives, in the line with replacement hypothesis. A mother is more likely to use contraceptives if her last born child is male and less likely to if she comes from a Muslim family or has higher educational achievement. A strong positive relationship exists between the father's education level and contraceptive use.

Using contraceptives after giving a birth increases the subsequent interval between two births, as expected. Birth interval length also increases with the mother's education. The father's socio-economic status indicators also have the expected positive effect on birth intervals. Unobserved time persistent heterogeneity among mothers captures 31 per cent of the total unsystematic variation in contraceptive use and 12 per cent in birth intervals equation.