PROGRESSION TO FEMALE STERILIZATION OR TO THE NEXT PARITY:

RESULTS OF A COMPETING RISK MODEL

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Abstract

Female sterilization is the most common contraceptive method used in India; one third of all married women use it and close to 80 percent of sterilized women did not use a previous method. The prevalence of female sterilization has increased rapidly in recent years, especially with the introduction of the simplified laparoscopic procedure (Basu, 1985). This increase, however, has occurred differentially across the country and is associated with individual characteristics and family formation preferences (Jayaraman, Mishra, & Arnold, 2009; Thind, 2005) and household influences (Char, Saavala, & Kulmala, 2010; Säävälä, 1999).

Female sterilization has played an important role in fertility decline in India. Due to its irreversible and permanent nature, large proportions of older women at higher parities who wanted to end childbearing selected sterilization in the 1970s and 1980s. For example, the average number of children born to a sterilized woman was 4.0 in 1992/1993 (International Institute for Population (IIPS), 1995), while the total fertility rate was 3.9 births per woman, down from 6 births in the 1960s. Rates of sterilization use continue to rise especially among younger women of lower parities (International Institute for Population (IIPS) & Macro International, 2007) and therefore, sterilization use continues to significantly contribute to the fertility transition.

This study is distinguished from past research on sterilization because it focuses on the timing of sterilization, as opposed to sterilization prevalence. In this study I explore the complex relationship between marital fertility and female sterilization by modeling the competing risks of progression to parity $x+1$ and female sterilization among women at parity x born from 1945 to 1985. I use the birth history data of the National Family and Health Surveys (NFHS), and examine patterns of female sterilization and parity progression risks by birth cohort, urban-rural

residence and residential region. I then employ multivariate models of the cause-specific hazard to explore the progression to female sterilization among women at parity *x* born from 1956 to 1985.

Background

In low-income countries, the total fertility rate (TFR) has declined significantly over the past several decades from 6 births per woman in the 1950s to 2.7 births in 2005-2010 (United Nations, Department of Economic and Social Affairs, Population Division, 2011). India is an important case in the discussion of fertility decline because of its current population size of 1.2 billion individuals (Chandramouli, 2011) that is projected to surpass China's population to 1.5 billion people in 2045 (United Nations, Department of Economic and Social Affairs, Population Division, 2011). This projected population prevails despite significant declines in the total fertility rate where TFR decreased from 6 births per woman in the early 1950s to about 2.6 in 2009 (Central Intelligence Agency, 2009). The TFR is projected to fall below replacement level by 2045 at 1.92 births (United Nations, Department of Economic and Social Affairs, Population Division, 2011).

The fertility decline observed over the past several decades in India has been attributed to a number of different factors including increases in female education (Basu, 2002; Drèze & Murthi, 2001; A. K. Jain & Nag, 1986b; Murthi, Guio, & Dreze, 1995), age at marriage (Dommaraju & Agadjanian, 2009), changes in norms around ideal family size and sex preferences (Arnold, Choe, & Roy, 1998; Clark, 2000; Jayaraman, Mishra, & Arnold, 2009; Pande & Astone, 2007; Rajaretnam & Deshpande, 1994), increases in urbanization (Angeles, 2009; Robinson, 1961), and reductions in infant mortality (Angeles, 2009; Kolenda, 1998; Pal &

Makepeace, 2003; Puri & Jain, 2001). Increase in access to contraceptive methods is also an important component of fertility decline. According to Bongaart's proximate determinants framework, contraceptive use is a direct influence on fertility (Bongaarts, 1978). Jain extends this framework to include public policies and social development as distal determinants to fertility decline in India (A. K. Jain, 1985b). The author concludes that public policies related to family planning programs increased contraceptive use (primarily female sterilization and condoms), and increased social developments in female education and infant mortality influenced the fertility decline observed in the 1970s. Using the NFHS-I (1992/93) survey data, it has been argued that while sterilization was effective in reducing fertility levels to 3.4 births, if the characteristics of sterilization users remain unchanged (i.e. those at higher parities), fertility decline would likely stall (Pathak, Feeney, & Luther, 1998). The authors conclude that in order for fertility to decline past 3.4 births, increase in the availability of temporary methods is warranted especially since many women rely on temporary methods to limit childbearing and prefer to use them in the future.

The Indian Census, however, indicates that the total fertility rate has declined past 3.4 births to 2.6 births per woman (Chandramouli, 2011). Furthermore, results from the three NFHS surveys suggest a change in female sterilization user profiles where the median age[1] at the time of sterilization has decreased from 26.6 percent to 25.5 percent in 1992/93 and 2005/06, respectively (International Institute for Population (IIPS) & Macro International, 2007). The gap between urban and rural sterilization use decreased over time where in 1992 the urban use was 4.2 percentage points more, which decreased to 0.7 percentage points in 2005. In a hospital-based study in New Delhi researchers looked at characteristics of women accepting female sterilization in 1981-1982 to women accepting it in 1991-1992 (Gupta, Kumar, Bansal, & Sood,

[1] Median age of sterilization is calculated for women whose sterilization took place before the age of 40 years old.

1996). Their results showed a shift in sterilization user profiles; a greater proportion of women who opted for sterilization in the 1990's were younger and had fewer living children.

Regional variations

The states in the south are primarily responsible for much of India's decline in fertility where childbearing is occurring at earlier ages and female sterilization use is high. A compression of women's reproductive years has been shown in Andhra Pradesh where women are marrying at slightly older ages, bearing children soon after marriage and selecting sterilization after achieving their desired number of children (Padmadas, Hutter, & Willekens, 2004). In Kerala, the first state in India to reach replacement level, across socioeconomic groups like education, religion, and wealth status disparities in fertility levels are declining (Irudaya Rajan & Aliyar, 2005).

This regional fertility distinction between north and south India has been shown extensively in the literature (Drèze & Murthi, 2001; Gans, 2000; Guilmoto & Irudaya Rajan, 2001; Spoorenberg & Dommaraju, 2012), and is most commonly attributed to a difference in gender equity. Dyson and Moore argued that endogamous kinship structures in the south allow women greater female autonomy and thus greater decision making ability over their reproductive health (Dyson & Moore, 1983). Several economists have theorized that gender equity disparities arise from differences in female agricultural participation. Women are valued more economically in the south where they have a significant role in cultivating and harvesting wet-rice. Wheat cultivation that occurs primarily in the north on the other hand, requires more strength and the labor force is therefore dominated by men (Bardhan, 1974; Foster & Rosenzweig, 1996). State policies have also been designed to promote gender equity (Das Gupta et al., 2000; Jeffrey, 1992) such as the increase in access to safe maternal and child health services (Bardhan, 1974).

The majority of studies that assessed regional fertility variations have used district-level data collected in the census (Drèze & Murthi, 2001; Gans, 2000; Guilmoto & Irudaya Rajan, 2001; Malhotra, Vanneman, & Kishor, 1995; Murthi, Guio, & Dreze, 1995). Four states have consistently comprised the south – Andhra Pradesh, Karnataka, Kerala, and Tamil Nadu. The states included in the north have varied, however. Some studies have followed the administrative boundaries used in the NFHS surveys (Spoorenberg & Dommaraju, 2012), while others have grouped the "Bimaru" (Gans, 2000; U. Kumar, 2010) states of Uttar Pradesh, Bihar, Rajasthan, and Madhya Pradesh as the north. In this analysis, my main interests are in observing differences in risk between northern and southern states. As such, I develop three state groupings based on their homogeneity in kinship structure, and economic and development indicators. The three groups consist of two regional groups -- southern states (Tamil Nadu, Kerala, Karnataka, and Andhra Pradesh) and northern states (Uttar Pradesh, Madhya Pradesh, Rajasthan, and Bihar). A third group contains all other states. I recognize that there is great heterogeneity within each regional group formed for these analyses but the combinations are consistent with the literature.

Urban-rural difference

As in many low-income countries, India is experiencing increased urbanization and urban growth through three main factors: natural increase, rural to urban migration both intra- and interstate, and the reclassification of rural enclaves into urban centers. The increase in the size of the urban population and increased urbanization are important influences in India's fertility transition. Theories of rural to urban migration and its influence on fertility include: selectivity, disruption, and adaption (Brockerhoff & Yang, 1994). Selectivity is based on the idea that certain characteristics (e.g. education levels, economic status, or unobserved factors) that propel an individual to migrate also influence their decisions around fertility. These characteristics already existed before an individual migrates so therefore, individuals who have a higher propensity to migrate may also have different propensities for fertility, specifically a higher propensity for smaller families.

The theory of disruption is based on the idea that couples are temporarily separated when one spouse pioneers the migration leaving their partner behind. This separation delay births by reducing the frequency of sex, and thereby influences the tempo of fertility but not necessarily quantum.

Finally, adaptation theory suggests that influences on fertility decision-making occur after migration to urban areas. That is, factors like mass media exposure or "modern" ideas related to smaller family size and increased value of the girl child, and greater access to healthcare services including family planning are thought to influence attitudes of fertility such that couples have a lower demand for children and therefore have smaller family sizes.

While it beyond the scope of the present analysis to differentiate among these three theories, I hypothesize that for any or all of the reasons suggested by the theories, fertility is decreasing at a faster rate among women residing in urban areas. The analysis for urban-rural differences is conducted by cohort to account for the fact that in older cohorts, urban residents were a smaller percentage of the population and even more selected than urban residents in younger cohorts. If selectivity is at work in the analysis, then I expect to see an increase in "traditional" childbearing patterns (i.e. higher proportions of women progressing to the next birth) in rural areas over time. If however, adaption is occurring then I would expect to see younger urban women progressing slowly to the next parity and accessing female sterilization in greater proportions when compared to older urban women and rural women.

In sum the contributions of this study are to understand the complex relationship between marital fertility and female sterilization use by birth cohort, residential residence, and region of residence. I use the competing risks model to determine the time (in months) to parity $x+1$ and the time to female sterilization among women at parity x born from 1945 to 1985. I examine whether differences in female sterilization risk by birth cohort, urbanicity, and residential region persist after accounting for differences in individual-level socioeconomic characteristics. I also hypothesize that if differences in residence, region and birth cohort exist in the multivariate models, they are not due to differences in religion or female educational attainment. I use the birth history data of the NFHS surveys, and extend the analysis by examining patterns in parity progression and female sterilization risks by residence and residential region.

Methods

National Family Health Surveys

The National Family Health Surveys (NFHS) are cross sectional surveys that are representative at the national and state levels, and implemented in all states of India by the International Institute for Population Sciences and Macro International. The NFHS is equivalent to the Demographic and Health Survey (DHS) that is conducted in over 80 developing countries. In the current study, I combined NFHS-I (collected from April 1992 to September 1993) with the NFHS-III (collected from November 2005 to August 2006) data sets. The NFHS surveys estimate population rates of fertility, and infant and child mortality, and measures maternal and child health.

Analytical Sample

The present analysis is restricted to currently married women of reproductive age (15-49 years old) because the overwhelming majority of Indian women begin childbearing after marriage. Birth years are constructed using the century month calendar of the respondent's date of birth. The NFHS-III (2005/06) survey provides data on women born between 1956 and 1991. I restrict the data from this survey to women born from 1956 to 1985 because women born in 1991 are 14 years old at the time of the survey and would not contribute adequate reproductive years to this analysis. In the bivariate analysis, I add data on women born in earlier years from the NFHS-I (1992/93) survey to the analysis to obtain a broader picture of fertility changes, and include women born between 1946 and 1955. Eight 5-year birth cohorts are constructed: 1946-1950; 1951-1955; 1956-1960, 1961-1965, 1966-1970; 1971-1975; 1976-80; and 1981-1985 consisting of 8,218 women, 10,657 women, 7,556 women, 10,910 women, 13,911 women,15,712 women, 17,876 women, and 16,372 women, respectively.

For the multivariate analysis, I restrict the data from the 2005 NFHS to singleton births and to women born from 1956 to 1985. Six 5-year birth cohorts are constructed: 1956-1960, 1961-1965, 1966-1970; 1971-1975; 1976-80; and 1981-1985 consisting of 7,556 women, 10,910 women, 13,911 women,15,712 women, 17,876 women, and 16,372 women, respectively.

Statistical methods

I employ survival analysis techniques to model competing risks of time to the next birth ($x+1$) and time to female sterilization within 60 months of a reference birth (x). The advantage of using survival analysis[2] is that it accounts for right censoring, which can occur in this study if (1) the respondent did not have another birth ($x+1$) and was not sterilized within 60 months of the previous birth (x), or (2) the respondent did not have another birth and was not sterilized before the date of interview, which occurred less than 60 months after the previous birth. Parity progression is useful indicator of fertility behavior because the decision to have a next child is often based on the number of surviving children, the sex of the children, and the time between the last births.

While both cause-specific hazards and cumulative incidence functions (CIF) are commonly used in competing risk analysis, I estimate cumulative incidence function (CIF) because of my interest in understanding the probability of event *k* in the presence of a competing event. The cause-specific hazard measures the instantaneous failure rate of one event at a time and treats the time to event from competing events as censored (Cleves, Gould, & Gutierrez, 2004; Kalbfleisch & Prentice, 2002; Prentice, Kalbfleisch, & Peterson, 1978). The CIF on the other hand, is the probability of the occurrence of event *k* in the presence of a competing event. As stated by Chappell, the CIF provides the "real world" (Chappell, 2012) chance of an event. I compared differences in CIFs between birth cohort groups, urban-rural residence, and regional residence using the Pepe and Mori test (Pepe & Mori, 1993). The study period is limited to 5 years after previous birth, analyzed in one month blocks of time because the majority of respondents transition to the next parity or to female sterilization within this period.

In order to estimate the CIF, I install the Stata add-on *stcompet* developed by Coviello and Boggess (V. Coviello & Boggess, 2004), and *stpepemori* developed by to test equality of the CIF curves between groups Coviello (E. Coviello, 2010).

[2] Right censoring typically occurs when: (1) the study period has ended before a participant has experienced the event of interest; (2) a participant is lost-to-follow-up and it is unknown if the event occurred; or (3) a participant voluntarily withdraws from a study.

For the multivariate analysis, I model the cause-specific hazard on the relative instantaneous failure rate of female sterilization, and treat the time to event from competing events as censored. I choose to regress covariates on the cause-specific hazard of sterilization versus the cumulative incidence function (as proposed by Fine and Gray (Fine & Gray, 1999)) because of my interest in yielding a direct estimate of association (Lau, Cole, & Gange, 2009). The Fine and Gray model yields a subhazard function by modeling the CIF, which may be difficult to interpret (Hinchliffe, 2012; Rodrıguez, 2012). By examining log-log plots and Schoenfeld residuals, I found that the hazards lacked proportionality across the full study period of five years (analyzed in one month time blocks) after reference birth (parity *x*) (analysis not shown). Therefore, the piecewise constant hazard model is employed and the models are estimated with *stpiece* module (Sorensen, 1999). To determine the time intervals at risk, I ran *stpiece* models for each covariate with 12 month time intervals. Using the *lincom* command, I compared each time coefficient to determine if the covariate behaved differently in the time interval. At parity 2 the established time intervals are 0-12, 13-24, and 25-60 months while at parity 3 and parity 4, the time intervals are 0-12, 13-24, 25-36, and 37-60 months.

Finally, Cox proportional hazard are modeled (Table 1A in the Appendix) and the AIC and BIC of the piecewise constant hazards and the Cox proportional hazards are compared (Table 2A in the Appendix) to confirm the model choice. All analyses are conducted in STATA.SE, Version 12 (StataCorp, 2011).

Outcome variables

A birth history is collected in the NFHS surveys, beginning with the most recent birth and ending with the first birth. Respondents are asked a series of questions related to each birth including the date of birth, gender, survival status, date of death if applicable and singleton, twin, or triplet. A century month calendar (CMC) is calculated based on the reported month and year for the date of birth. The CMC is also calculated for the month and year of interview, the start date of the current contraceptive method being used, respondent date of birth, and date of first marriage. Durations in months are calculated for second to third birth, third to fourth birth, and fourth to fifth birth intervals. Duration in months is also calculated between parity *x* and female sterilization.

Main Predictor

In the first part of this analysis, I am interested in describing the differences in the probability of sterilization by cohort, urbanicity, and region. In the second part, I look at the extent to which these very large differences by cohort, urbanicity or region are explained by religion or education when socioeconomic status is held constant. I include respondent birth year that is constructed using the century month calendar of the respondent's date of birth (as described in the analytic sample section. I add a regional variable consisting of states that form the southern region (Tamil Nadu, Kerala, Karnataka, and Andhra Pradesh), northern region (Uttar Pradesh, Madhya Pradesh, Rajasthan, and Bihar), and other regions, as well as an urban - rural bivariate.

Control Variables

<u>Religion</u>

Muslims have a higher fertility rate than Hindus, who are an overwhelming majority of the Indian population at 81%. Muslims are the second largest religious group at13% and other groups make up the remaining 6% (General, 2001). Religious differentials in fertility are often due to differences across religious groups in socioeconomic status (Goldscheider, 1971). McQuillan argues that if religious differences persist after socioeconomic status is taken into account it may be due to reproductive health behaviors being prescribed or proscribed by religion (McQuillan, 2004). He goes on to argue that adherence to the norms regarding these behaviors are particularly salient when the religion in question has an important and valued institutional role for a given group above and beyond the usual, such as Catholicism in 19th century Ireland or Islam in many dictatorships today. It is beyond the scope of the present study to explore McQuillan's proposals but, scholars have shown a persisting effect of religion on fertility that is not fully explained by differences in socioeconomic factors, educational attainment, or urban-rural residence (Bhagat & Praharaj, 2005; Bhat & Zavier, 2005; Kulkarni & Alagarajan, 2005). Therefore, I include it as a control variable in our analysis.

Education

Studies in India and elsewhere have shown the effect of female education on declining fertility (Abbasi-Shavazi, Lutz, Hosseini-Chavoshi, KC, & Nilsson, 2008; Bhat & Zavier, 2005; Drèze & Murthi, 2001; Ezeh, Mberu, & Emina, 2009; A. K. Jain & Nag, 1986a; R. A. LeVine, LeVine, & Schnell, 2001). Several intermediate factors have been proposed in this association including a postponement or delay in the age at marriage (Dommaraju, Agadjanian, & Yabiku, 2008; Rindfuss, Morgan, & Offutt, 1996; Westoff, 1990), increases in women's autonomy (J. Cleland, Kamal, & Sloggett, 1996; Dyson & Moore, 1983; Jejeebhoy, 1995), reductions in infant and child mortality (J. G. Cleland & Van Ginneken, 1988; A. K. Jain, 1985a), and contraceptive use (Hazarika, 2010; A. S. Kumar, 2006). I also control for education in our multivariate models.

Results

Table 1 presents social and demographic characteristics of respondents by birth cohort. For respondents born in 1946-1950 and 1951-1955, the median age at interview, which occurred between 1992 and 1993, is 44.3 years and 39.3 years, respectively. For the remaining birth cohorts the median age at interview, which occurred between 2005 and 2006 decreases by roughly 5-year increments moving from the oldest to the youngest birth cohort. The median age is 47.2 years among respondents born in 1955-1960 and 22.9 years for respondents in 1981-1985. Median marriage duration is calculated only for birth cohorts obtained from NFHS-III (2005/06) survey because the date of marriage was not collected in NFHS-I (1992/93) survey. The median marriage duration decreases by roughly 5 years for every succeeding birth cohort group. Women born in 1956-1960 are married for 29.2 years while women born in 1981-1985 are married for 4.9 years.

Women born in later years have fewer children compared to the women born in earlier years. It is important to remember that the younger birth cohorts have only experienced a portion of their reproductive life spans and therefore these results do not provide a complete picture of their reproductive histories.

Birth Cohort Comparisons

I calculate the median time to parity $x+1$ and the median time to female sterilization for each birth cohort (Table 2). Spacing between births is virtually constant across the birth cohorts. Older women tend to wait slightly longer to have their next child than younger women. For instance, the median time to parity 3 is 27 months among women born in 1946-1950 compared to 25 months among women born in 1981-1985. Across all birth cohorts the median time to female sterilization is usually within 1 month of the last birth. At parity 4, younger cohorts wait somewhat longer than the earlier cohorts to be sterilized. I also calculate the 75% duration time to parity *x+1* and female sterilization (Table 3).

The cumulative incidence functions (CIFs) for birth *x+1* or female sterilization among women at parity 2, parity 3 and parity 4 by the earliest (1945 to 1950) and latest (1981-1985) birth year cohorts are presented in Figure 1. I graphed the CIFs for all cohorts and the results show that CIF lines progress sequentially from the oldest to the youngest cohort. For the sake of simplicity, I only present results of the youngest and oldest birth cohort. At each parity (*x*), the estimates of progression to the next birth (*x+1*) indicate that they are faster for the 1945-1950 cohort compared to the 1980-1985 cohort as seen by the steeper rise in the 1945-1950 parity lines. The differences in the estimates are statistically significant. The corresponding CIF numbers are available in Table 4 and presented for all birth cohorts. Within 60 months of the last birth, the CIFs for the 1945-1950 cohort is 0.81 at parity 2, 0.75 at parity 3, and 0.70 at parity 4. In comparison, the probability of progressing to the next birth for the 1980-1985 cohort is lower at 0.69 at parity 2, 0.64 at parity 3, and 0.65 at parity 4 (Table 4).

Younger women are choosing sterilization more so than older women and soon after the birth of a child. In Figure 1, the female sterilization lines for 1980-1985 cohort rise sharply after time 0 and then increase more gradually after 20 months. The probability of female sterilization increases for each succeeding birth cohort. At parity 2, the CIF is 0.02 for the oldest birth cohort. This increases to 0.13 among women born in 1965-1970 and reaches 0.17 among the youngest cohort.

Regional Comparisons

Similar to the birth cohort analysis, the estimates of the median duration to parity *x+1* (Table 5) suggest no significant regional differences. While 50 percent of all women in the analysis select female sterilization within the first eight months after the last birth, the median time to sterilization is comparatively lower among women living in southern states. At each parity, 50 percent of women residing in southern states select female sterilization at the time of delivery.

Figures 2, 3 and 4 show the comparative cumulative incidence functions of progressing to parity *x+1* and female sterilization among women at parity *x* by region, and Table 8 shows the results of the Pepe and Mori tests. As expected across all parities women in the northern regions progress to higher parities at a faster pace compared to women in the south and women in other regions. At parity 2, women in the south progress to female sterilization significantly faster than women in the north or other regions. As parity increases sterilization use also increases among women in the north and other regions but never reaches the same level of use among women living in the south. One in 4 women in the south select sterilization after parity 2, and 1 in 3 select it after parity 3 and parity 4. In contrast only 1 in 20 women in the north select sterilization after parity 2, about 1 in 10 select it after parity 3, and 1.5 in 10 select it after parity 4 (Table 5).

Residential Comparisons

I explore residential differences in the timing to parity *x+1* or female sterilization within 5 years of the last birth (*x*). The median number of months to the next parity by residential status does not differ across all birth cohorts (Table 6). Women residing in urban areas generally progress to parity *x+1* sooner or select female sterilization sooner than women residing in rural areas and these differences are statistically significant. Across many birth cohorts of women residing in urban areas the median time to female sterilization is 0. Women at parity 4 appear to wait longer to sterilize than women at lower parities.

Figures 5, 6 and 7 show the comparative cumulative incidence functions for parity *x+1* or female sterilization by residence at parity 2, parity 3, and parity 4, and Table 9 shows the results of the Pepe and Mori tests. I graphed all the birth cohorts and limited the presentation of CIFs to the oldest and youngest birth cohorts for interpretation ease. The CIFs of the remaining birth cohorts fell between the youngest and oldest birth cohort lines. At parity 2 the 1946-1950 rural cohort progresses the fastest to parity 3. The 1946-1950 urban cohort and the 1981-1985 rural cohort progress to parity 3 at the same pace, while the 1981-1985 urban cohort progresses the slowest to parity 3. The probability of female sterilization is greatest among 1981-1985 cohort where the urban women progress slightly faster than rural women. The cumulative incidence of female sterilization use is greater among women living in urban areas at every parity *x* and across each birth cohort (Table 7).

Multivariate Models

It is important to assess whether the differences in sterilization use by urban-rural residence, birth cohort, and region of residence hold after adjusting for religion and education for the reasons explained above. The results of the multivariate piecewise constant regression models at parities 2, 3 and 4 are presented in Table 10. Beginning with urban-rural residence, the hazard of female sterilization use among urban women is 5% less than rural women at parity 2 (HR: 0.95; 95% CI: 0.90-1.00). This switches direction at parity 3 when the hazard is 6% greater among urban women relative to rural women (HR: 1.06; 95% CI: 1.01-1.11). At parity 4, there is no statistically significant difference in the hazard ratio for women living in urban versus rural areas. It should be noted that the confidence intervals at parity 2 contains 1.00 and at parity 3 is 1% away from including 1.00 suggesting that this might not be a meaningful difference even though the hazard ratio is statistically significant.

The inverse association between birth cohort and the timing of sterilization is linear. For example at parity 2 women born in 1961-1965 have a hazard of female sterilization that is 1.5 times greater than women born in 1956-1960 (95% CI: 1.34-165). This hazard increases to 4.68 among women born in 1981-1985 (95% CI: 4.19-5.22). Moving to higher parities while remaining within the same birth cohort, the strength of the hazard ratio decreases. For instance among women born in 1976-1980 at parity 2 the risk of using female sterilization is 3.7 times more than women born in 1956-1960 (95% CI: 3.34-4.05). This decreases to 2.4 at parity 3 (95% CI: 2.21-2.60) and 1.7 at parity 4 (95% CI: 1.56-1.92).

In the multivariate models women residing in the south Indian states have a significantly greater hazard of female sterilization than women residing in the north Indian states. The hazards remain statistically significant across parity 3 and parity 4.

My second hypothesis is to examine I also checked whether or not the observed differences in female sterilization risk across urban-rural residence, birth cohort, and region are moderated by religion and female education. I ran multivariate piecewise constant hazard models stratified on key predictors and found that these differences are not due to differences in religion and female education.

Discussion

From the birth cohort analysis it is evident that there is no change in birth spacing patterns across birth cohorts and across parities. At least 50% of women are transitioning to the next child within 27 months of their last birth. When factoring in pregnancy duration (9 months) and breastfeeding duration, spacing of births is at a minimum. The World Health Organization recommends an interval of at least 24 months after a live birth to the next pregnancy to reduce the risk of harmful maternal, perinatal, and infant health outcomes (World Health Organization, 2006). The relative risk of female sterilization among younger birth cohorts is greater than their older counterparts and this increase over time is linear and not due to increasing education, wealth or changes in religion over time. Several factors may give rise to such a scenario. A cultural shift in the ideal family size may have occurred where younger women deem fewer children more desirable, and after achieving their desired family size they opt for sterilization. The Indian government introduced a communication campaign depicting a four-member family consisting of a son, a daughter, a wife and a husband were broadly advertised with the accompanying slogan "have only two or three children – that's enough" (Harkavy & Roy, 2007) . While no evaluation has been conducted to demonstrate the impact of this communications campaign on changes in contraceptive use and desired family size, over time this message may have effectively permeated the mindsets of younger generations. Other factors such as female labor force participation, weakened sex preferences, child survival, and the lack of available temporary methods may also contribute to increased sterilization use among younger women.

The results of this study are in line with previous findings related to spatial variations in fertility transition (Drèze & Murthi, 2001; Gans, 2000; Guilmoto & Irudaya Rajan, 2001; U. Kumar, 2010; Spoorenberg & Dommaraju, 2012). I find that women residing in southern states transition to the next parity at a slower pace than women residing in other regions. The risk of sterilization is greater among women residing in south Indian versus north Indian states where for example, the hazard ratio at parity 2 is 7.9 for women residing in south Indian. Some of the proposed explanations for this difference are changes in social and economic conditions that decrease the value of child labor in the south (Guilmoto, 2011), higher female literacy rates like those observed in Kerala and Tamil Nadu, and the kinship structures that allow women living in the south greater autonomy and thus greater control over their reproductive behaviors (Dyson & Moore, 1983; Malhotra, Vanneman, & Kishor, 1995). The analysis also shows an overwhelming probability of sterilization within five years after the last birth among women in the south. The probability ranges from 0.28 to 0.37 for parity 2 and parity 3. In a study researchers found that close to 46.6% of couples living in Kerala were sterilization within the first ten years of marriage, which increased to 70.0% by twenty years of marriage (Rajaram & Sunil, 2004).

Another explanation for the increase use of sterilization acceptance in the south could be that women may be delivering at healthcare facilities where they are offered the procedure. Figure 8 is a map of institutional deliveries by state from the NFHS-III (2005/06) survey. Institutional deliveries are over 75% in Tamil Nadu and Kerala and between 50-74.99% in Andhra Pradesh and Karnataka. In the analyses I find that the majority sterilization procedures occur at the time of delivery in the south. This does not hold true in other regions. For instance, 67.4% of sterilizations among women at parity 2 who reside in the south are at the time of delivery. In the north by comparison, only 19.6% of sterilization occur at the time of delivery. This study did not test this hypothesis however, or factors that drive the decision-making around sterilization selection like couple communication or healthcare provider motivation.

India is experiencing increased urbanization that is encouraging a fertility transition as in other developing countries. Early research on rural-urban fertility differentials in India suggests that differences in fertility rates are decreasing, and two contributing factors were identified: faster decrease in infant mortality rates in urban areas coupled with rural to urban migration (Robinson, 1961). More recent evidence of the effects of urbanization on fertility decline, however, has been inconclusive and depends on the analysis methods used and definition of urbanization (Angeles, 2009; Drèze & Murthi, 2001). In this study I find no difference in birth spacing between married women residing in urban compared to rural areas. Urban women however, are selecting sterilization at the time of delivery while rural women wait slightly longer.

Overall, younger rural and urban women are progressing more slowly to the next parity than their older counterparts. It is interesting to see that shape of the CIF curves for rural women born in 1981-1985 is similar to older urban women (born 1946-1950) for parity progression. This suggests that selectivity is not the influence of fertility reduction because the probability of progression to parity $x+1$ among rural women decreases with each successive cohort. Fertility reduction is more likely due to adaptation because younger urban women progress slowly to the next parity and access female sterilization in greater proportions when compared to older urban women and rural women. The multivariate results show that there is no difference in urban and rural risk of female sterilization. This suggests that what appear to be very strong differences in the timing of sterilization by urbanicity are spurious and due to differences between rural and urban women on other factors in the multivariate model. In light of my very large sample size, the marginal significance of urbanicity is particularly notable.

Finally, the stratified multivariate models show that the observed differences in female sterilization use by birth cohort and region are not moderated by religious composition or differences in female educational attainment.

There are several limitations that need to be considered when interpreting the results of this study. These analyses are based on retrospective reports of the date of child birth and date of marriage. While these are salient events, a mother may omit a child as a live birth if that child passed away soon after birth. In addition, age heaping may occur when respondents have preferences for specific digits. Finally, extensive health and immunization information is collected on children born within 5 years preceding the survey. Therefore respondents may age births more than 5 years preceding the survey in order to avoid the lengthy questionnaire.

In the bivariate analysis I combined respondents from the NFHS-I (1993/94) survey and the NFHS-III (2005/06) survey, which may lead to a survey effect on sterilization use. I conducted a sensitivity test to determine if the rise in sterilization use among the 1956-1960 cohort is a survey affect by comparing the CIFs of the 1956-1960 cohort from the NFHS-I (1992/93) data set to the CIFs of the 1956-1960 cohort from the NFHS-III (2005/06) data set. The CIFs are similar for data obtained from both data sets (Table 4) therefore suggesting that the rise in sterilization use is not due to a survey affect.

A limitation of using the 1981 to 1985 birth cohort is that this analysis only captures their fertility behaviors at the median age of 22.9 and misses over twenty years of their reproductive lifespan. While this picture presented is therefore limited in scope, the trends presented for the youngest birth cohort are unique and show that one in four women in this age group are sterilized. Another limitation is that *stpiece* hazard models assume that the competing risk is independent of the event of interest. While parity progression and female sterilization appear to be independent events there may be some unobserved factors that are correlated with both events.

Finally, many of the covariates used in these analyses are time invariant and therefore may not reflect a respondent's characteristics at the time of sterilization. For example, urban and rural residence or region of residence may have changed during the course of a women's life such that where she lived at the time of the survey is different than where she lived when she selected sterilization. Wealth is another covariate that was collected only at the time of the survey and therefore may not represent a respondent's wealth status at the time of the sterilization. Covariates like education and religion however, are less likely to change over time.

Conclusion

In this study I show the pace of parity progression ($x+1$) and the pace of female sterilization from reference parity x using a competing risk model, and differences in risk of female sterilization by birth cohort and region persist after adjusting for socio-economic characteristics. The advantage of estimating competing incidence probabilities is that it takes the competing risk into account and provides a "real world" estimate of event chance. To my knowledge these analyses on parity progression and female sterilization research has not been done previously.

The findings demonstrate that an overwhelmingly number of Indian women are being sterilized suggesting that couples are choosing the contraceptive method even though India has had a tainted and controversial history of providing it. Women are undergoing sterilization at the time of or soon after the reference birth. This study also indicates that Indian women are not spacing their births suggesting that the Government of India could focus efforts to increase information, availability and promote the use of spacing methods. Younger women are using sterilization at much higher rates than older women and at lower parities indicating a shift towards a smaller family size. Women living in South India are much more likely to use sterilization than women in North India. While Dyson and Moore argued that endogamous kinship structures in the south allow women greater female autonomy and thus greater decision making ability over their reproductive health (Dyson & Moore, 1983). Säävälä argued that by opting for sterilization, daughter-in-laws in Andhra Pradesh decreased their mother-in-laws power over decision-making within the household because sterilization reflected an older category of a woman, thereby advancing her stage in the life course (Säävälä, 1999). Further research is required to fully understand why women in the south India are using sterilization.

Table 1: Weighted Frequencies and Distribution of Respondents by Social and Demographic Characteristics

	1946-50		1951-55		1956-60		1961-65		1966-70		1971-75		1976-80		1981-85	
	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N
Median age @ interview	44.3		39.3		47.2		42.4		37.5		32.6		27.8		22.9	
Median marriage duration	-		-		29.2		24.6		19.6		14.3		9.3		4.9	
Parity																
0	2.1	172	2.5	263	2.0	149	2.0	215	2.3	318	3.0	483	6.4	1136	17.5	2861
1	3.3	274	3.6	382	4.4	335	4.7	509	5.3	736	8.2	1281	15.1	2705	32.2	5271
2	8.2	672	11.4	1220	15.7	1184	19.0	2074	22.8	3175	27.3	4285	32.4	5801	31.3	5122
3	14.2	1170	18.0	1919	20.6	1558	21.7	2371	23.6	3279	24.7	3880	23.2	4140	13.6	2238
4+	72.2	5930	64.5	6873	57.3	4330	52.6	5741	46.0	6403	36.8	5783	22.9	4094	5.4	880
Total	8218		10657		7556		10910		13911		15712		17876		16372	

Table 2: Median Duration (months) to Parity *x+1* and Female Sterilization from Parity *x* by Birth Cohort

	1946-50	1951-55	1956-60	1961-65	1966-70	1971-75	1976-80	1981-85
At parity 2								
Parity 3	27	27	27	26	27	26	26	25
Sterilization	0	1	1	1	1	1	1	1
At parity 3								
Parity 4	27	27	26	26	26	25.5	26	25
Sterilization	1	1	1	1	1	2	2	2
At parity 4								
Parity 5	26	27	25	26	25	25	26	23
Sterilization	1	1.5	2	2	3	3	3	2

Table 3: 75% Duration (months) to Parity *x+1* and Female Sterilization from Parity *x* by Birth Cohort

	1946-50	1951-55	1956-60	1961-65	1966-70	1971-75	1976-80	1981-85
At parity 2								
Parity 3	37	36	36	36	36	36	35	32
Sterilization	13.5	18	17	14	12	11	9	6
At parity 3								
Parity 4	37	36	35	36	35	35	35	32
Sterilization	12	13	9	9	9	9	8	6
At parity 4								
Parity 5	36	36	35	35	34	35	34	29
Sterilization	13	12	10	10	12	12	10	7

Table 4: Cumulative Incidence to Parity *x+1* and Female Sterilization from Parity *x* by Birth Cohort

	NFHS-I (1992/93)			NFHS-III (2005/06)					
	1946-50	**1951-55**	**1956-60**	**1956-60**	**1961-65**	**1966-70**	**1971-75**	**1976-80**	**1981-85**
At parity 2									
Parity 3	0.81	0.79	0.78	0.72	0.69	0.66	0.63	0.65	0.69
Sterilization	0.02	0.03	0.06	0.08	0.10	0.13	0.16	0.17	0.17 @ 55 months
At parity 3									
Parity 4	0.75	0.72	0.69	0.64	0.61	0.59	0.58	0.61	0.64
Sterilization	0.06 @ 59 months	0.10	0.16	0.18	0.20	0.23	0.25	0.25 @ 58 months	0.25 @ 55 months
At parity 4									
Parity 5	0.70	0.66	0.64	0.59	0.57	0.59	0.58	0.59	0.65
Sterilization	0.10	0.15	0.20	0.22	0.24	0.24	0.24	0.25 @ 59	0.24 @ 42 months

Table 5: Median Duration and Cumulative Incidence to Parity *x+1* and Female Sterilization from Parity *x* by Region

	Median Duration			Cumulative Incidence		
	Southern Region	Northern Region	Other Regions	Southern Region	Northern Region	Other Regions
At parity 2						
Parity 3	27	26	27	0.56	0.80	0.68
Sterilization	0	8	5	0.28	0.05	0.09
At parity 3						
Parity 4	26	26	26	0.50	0.74	0.61
Sterilization	0	5	2	0.37	0.12	0.18
At parity 4						
Parity 5	26	26	26	0.49	0.69	0.58
Sterilization	0	6	3	0.35	0.15	0.21

Table 6: Median Duration (months) to Parity *x+1* and Female Sterilization from Parity *x* by Birth Cohort and Residence

1946-50	1946-50		1951-55		1956-60		1961-65		1966-70		1971-75		1976-80		1981-85	
	U	**R**	**U**	**R**	**U**	**R**	**U**	**R**	**U**	**R**	**U**	**R**	**U**	**R**	**U**	**R**
At parity 2																
Parity 3	27	27	27	27	26	27	26	27	27	27	26	26	26	26	24	25
Sterilization	0	0	1	2	0	1	1	2	0	2	0	2	0	2	0	2
At parity 3																
Parity 4	26	27	27	27	26	26	26	26	25	26	25	26	25	26	23	25
Sterilization	0	1	0	2	0	2	0	2	0	2	0	3	1	3	1	2
At parity 4																
Parity 5	26	27	26	27	24	26	26	26	25	26	24	26	25	26	24	22.5
Sterilization	0	2.5	0	3	2	3	1	3	1	4	2	4	2	3.5	1	3

U = urban
R = rural

Table 7: Cumulative incidence of Parity *x+1* and Female Sterilization from Parity *x* by Birth Cohort and Residence

	1946-50		1951-55		1956-60		1961-65		1966-70		1971-75		1976-80		1981-85	
	U	**R**	**U**	**R**	**U**	**R**	**U**	**R**	**U**	**R**	**U**	**R**	**U**	**R**	**U**	**R**
At parity 2																
Parity 3	0.74	0.86	0.74	0.84	0.67	0.77	0.62	0.76	0.58	0.73	0.55	0.70	0.58	0.69	0.64	0.73
Sterilization	0.03 @ 51	0.01	0.05	0.03 @ 59	0.09 @ 59	0.07	0.12 @ 59	0.09	0.14 @ 59	0.11	0.19	0.14	0.20	0.16	0.20 @ 55	0.15 @ 45
At parity 3																
Parity 4	0.67	0.79	0.65	0.75	0.58	0.69	0.56	0.65	0.52	0.64	0.52	0.64	0.50	0.62	0.60 @ 59	0.65
Sterilization	0.09 @ 59	0.05 @ 59	0.14	0.09 @ 57	0.22	0.15	0.23 @ 58	0.18	0.27	0.20	0.29	0.23	0.30 @ 58	0.23 @ 57	0.27 @ 49	0.25 @ 55
At parity 4																
Parity 5	0.62	0.72	0.59	0.69	0.54 @ 59	0.62	0.50	0.62	0.53	0.61	0.51	0.62	0.53 @ 58	0.62	0.55 @ 40	0.67
Sterilization	0.16	0.08	0.20 @ 57	0.14	0.27	0.20	0.30	0.21	0.28	0.22	0.28 @ 57	0.22	0.29 @ 59	0.23 @ 59	0.29 @ 42	0.23 @ 31

U = urban
R = rural

Table 8: Regional Comparisons using Pepe and Mori Tests by Parity

	Parity *x*					
	Parity 2		Parity 3		Parity 4	
	χ^2	p-value	χ^2	p-value	χ^2	p-value
Parity *x+1*						
South vs. North	1739.2	0.00	971.9	0.00	415.1	0.00
South vs. Other	459.8	0.00	208.6	0.00	78.0	0.00
North vs. Other	762.7	0.00	539.3	0.00	285.1	0.00
Sterilization						
South vs. North	4071.0	0.00	2347.7	0.00	980.0	0.00
South vs. Other	2858.1	0.00	1459.1	0.00	513.9	0.00
North vs. Other	475.2	0.00	353.0	0.00	266.1	0.00

Table 9: Residential and Birth Cohort Comparisons using Pepe and Mori Tests by Parity

	Parity *x*					
	Parity 2		Parity 3		Parity 4	
	χ^2	p-value	χ^2	p-value	χ^2	p-value
Parity *x+1*						
1946-55 urban vs. 1946-55 rural	74.5	0.00	47.1	0.00	24.3	0.00
1981-85 urban vs. 1981-85 rural	15.4	0.00	0.51	0.48	0.06	0.81
1946-55 urban vs. 1981-85 rural	4.2	0.04	9.6	0.00	0.24	0.62
Sterilization						
1946-55 urban vs. 1946-55 rural	20.1	0.00	29.0	0.00	55.3	0.00
1981-85 urban vs. 1981-85 rural	18.2	0.00	1.3	0.25	1.35	0.25

Table 10: Adjusted Piecewise Constant Hazard Models and 95% Confidence Intervals						
	@ Parity 2		@ Parity 3		@ Parity 4	
	HR	95% CI	HR	95% CI	HR	95% CI
Education						
None/ missing	ref		ref		ref	
Primary	1.52	(1.42- 1.62)	1.37	(1.29- 1.45)	1.24	(1.16- 1.33)
Secondary/ higher	1.69	(1.59- 1.80)	1.48	(1.40- 1.56)	1.22	(1.14- 1.32)
Religion						
Hindu	ref		ref		ref	
Muslim	0.28	(0.25- 0.31)	0.30	(0.28- 0.33)	0.33	(0.30- 0.36)
Christian	0.45	(0.41- 0.50)	0.39	(0.35- 0.43)	0.34	(0.30- 0.39)
Other	0.81	(0.73- 0.90)	0.80	(0.72- 0.88)	0.76	(0.67- 0.86)
Residence						
Rural	ref		ref		ref	
Urban	0.95	(0.90- 1.00)	1.06	(1.01- 1.11)	1.06	(0.99- 1.13)
Wealth Index						
Lowest	ref		ref		ref	
Second	1.35	(1.21- 1.51)	1.27	(1.17- 1.39)	1.23	(1.12- 1.36)
Middle	1.47	(1.32- 1.63)	1.46	(1.34- 1.58)	1.50	(1.37- 1.65)
Fourth	1.83	(1.65- 2.03)	1.79	(1.64- 1.94)	1.90	(1.72- 2.10)
Highest	1.85	(1.65- 2.06)	2.11	(1.92- 2.32)	2.41	(2.16- 2.70)
Birth cohort						
1956-1960	ref		ref		ref	
1961-1965	1.49	(1.34- 1.65)	1.28	(1.19- 1.39)	1.21	(1.11- 1.32)
1966-1970	1.97	(1.79- 2.17)	1.67	(1.55- 1.80)	1.37	(1.26- 1.50)
1971-1975	2.84	(2.58- 3.12)	2.10	(1.95- 2.27)	1.50	(1.37- 1.64)
1976-1980	3.68	(3.34- 4.05)	2.40	(2.21- 2.60)	1.73	(1.56- 1.92)
1981-1985	4.68	(4.19- 5.22)	2.88	(2.58- 3.22)	2.11	(1.75- 2.56)
Region						
North	ref		ref		ref	
South	7.90	(7.39- 8.44)	5.29	(4.99- 5.60)	4.56	(4.23- 4.91)
Other	1.67	(1.56- 1.79)	1.50	(1.42- 1.59)	1.57	(1.47- 1.67)
Age at 1st birth	1.09	(1.08- 1.09)	1.04	(1.03- 1.04)	1.01	(1.00- 1.02)

Figure 1: Comparative Cumulative Incidence 1946-1950 and 1981-1985 Birth Cohorts, Currently Married Women of Reproductive Age

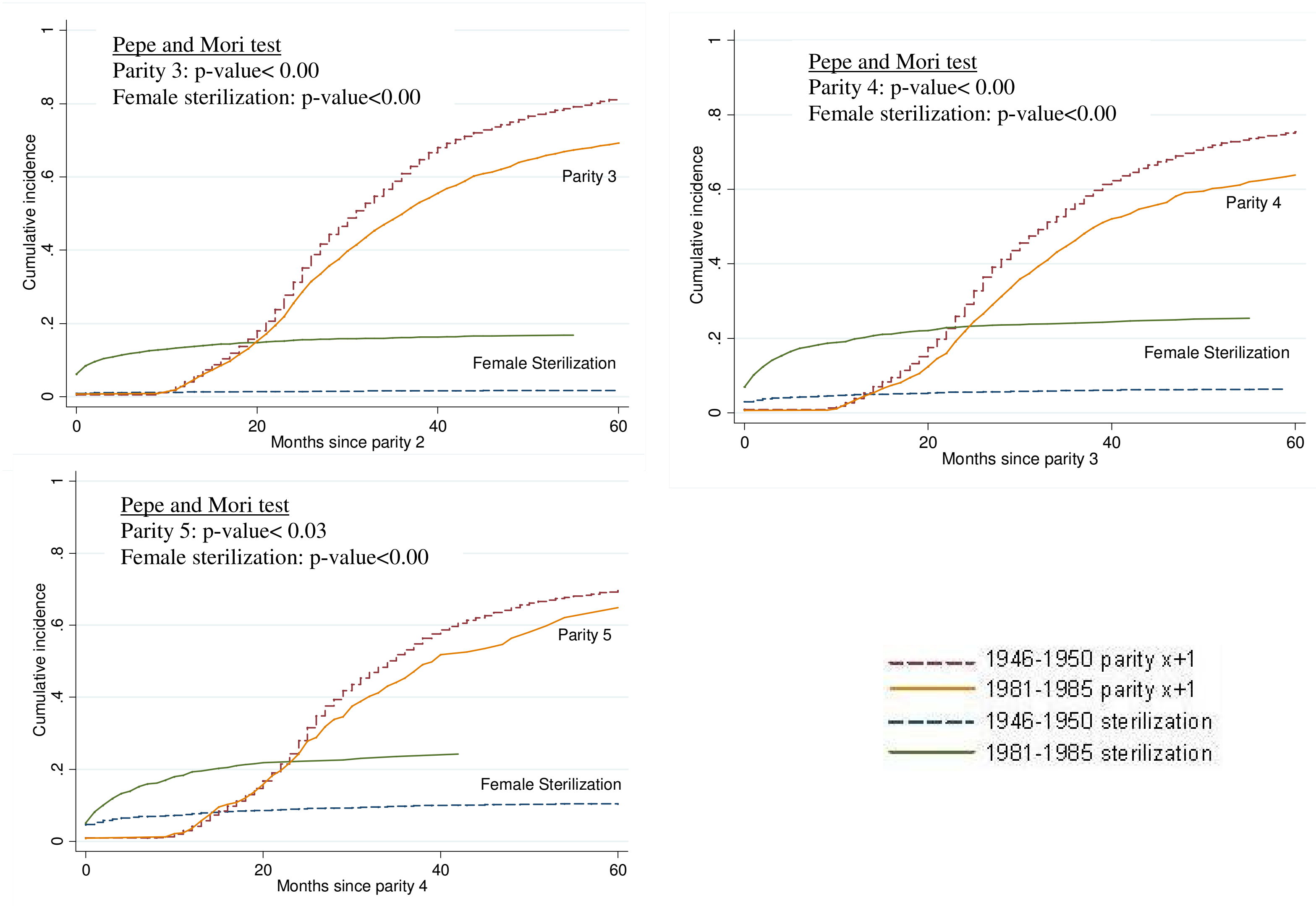


Figure 2: Comparative Cumulative Incidence at Parity 2 of South, North, and All Other Regions, Currently Married Women of Reproductive Age

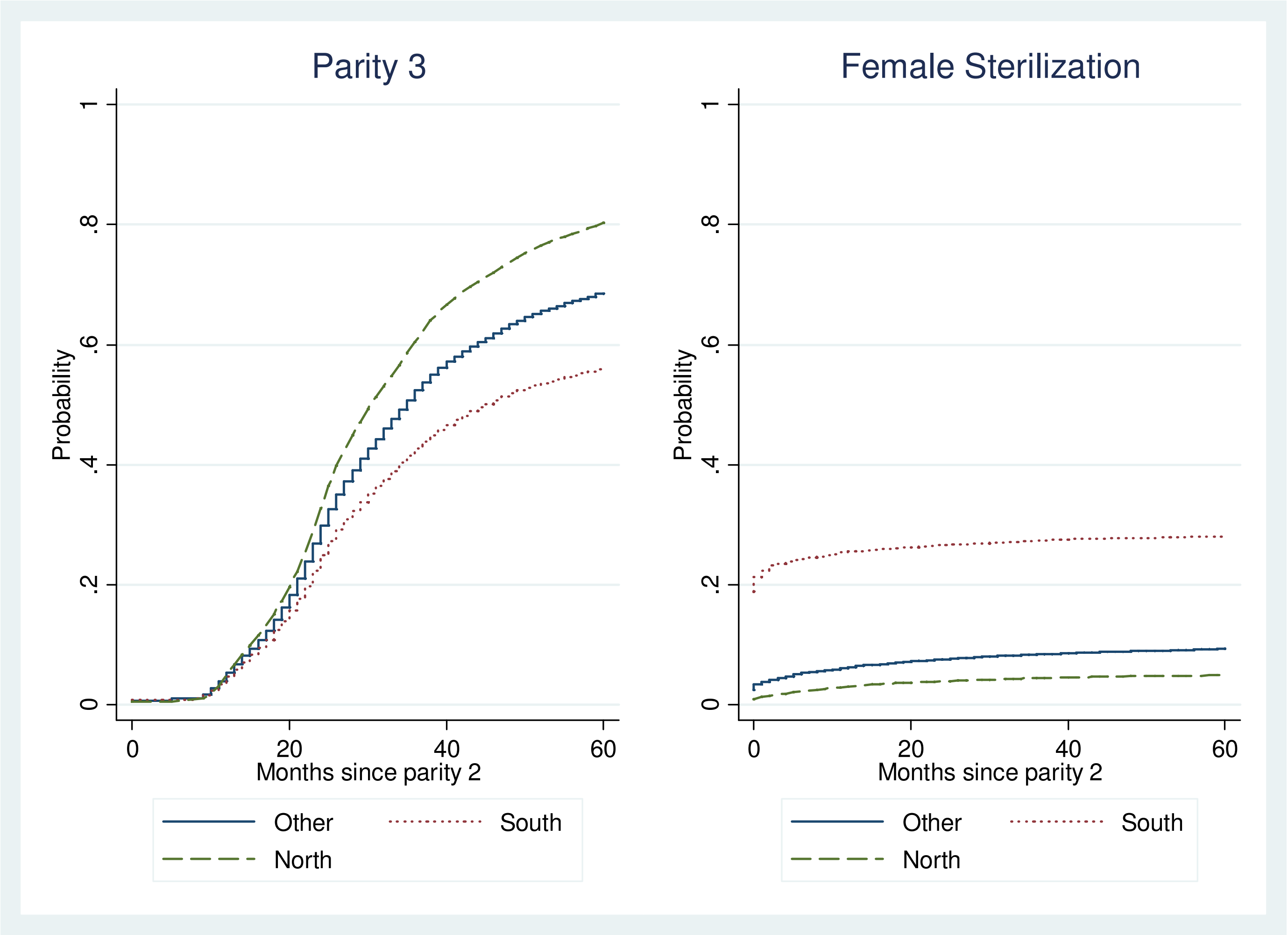


Figure 3: Comparative Cumulative Incidence at Parity 3 of South, North, and All Other Regions, Currently Married Women of Reproductive Age

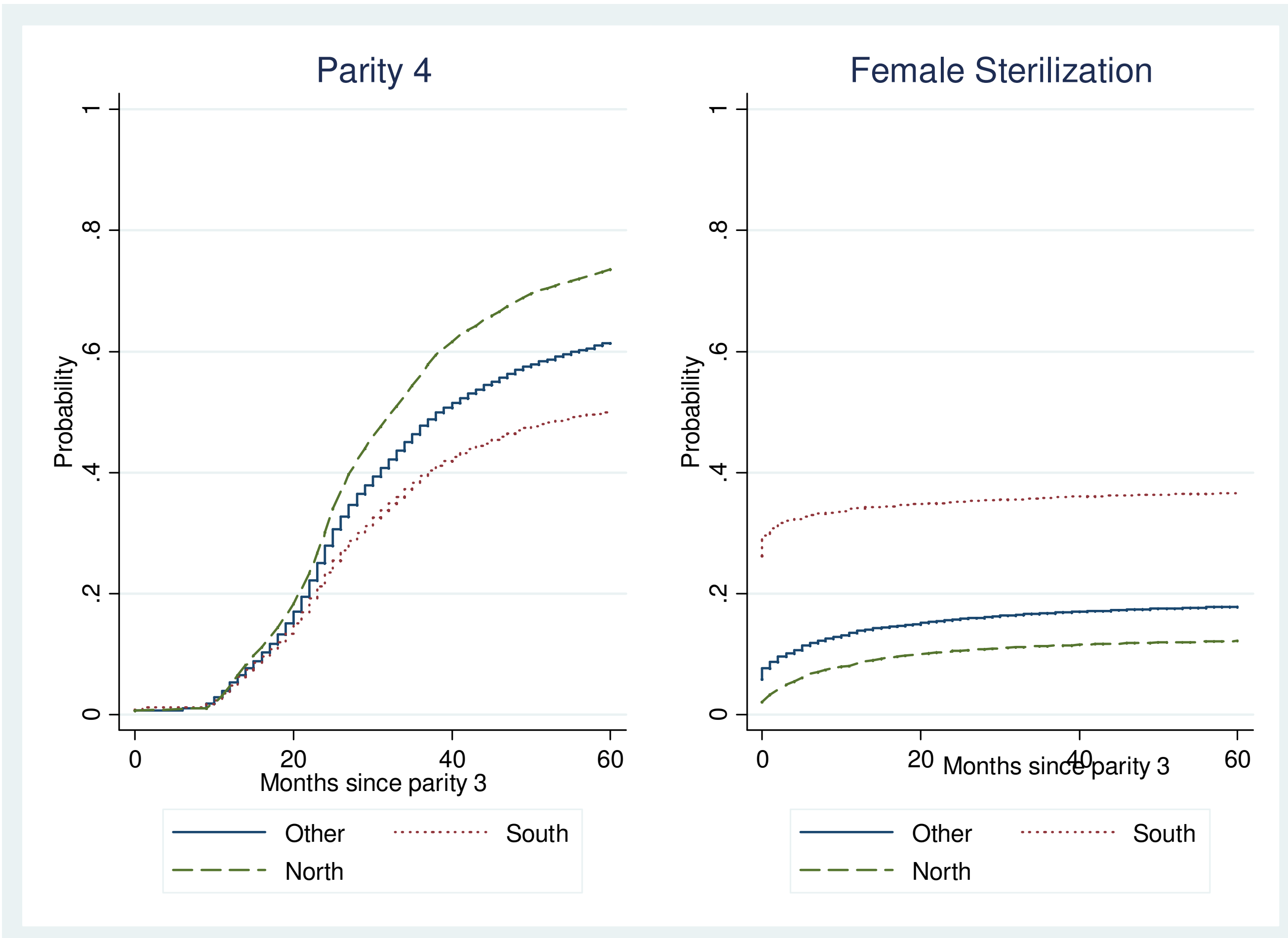


Figure 4: Comparative Cumulative Incidence at Parity 4 of South, North, and All Other Regions, Currently Married Women of Reproductive Age

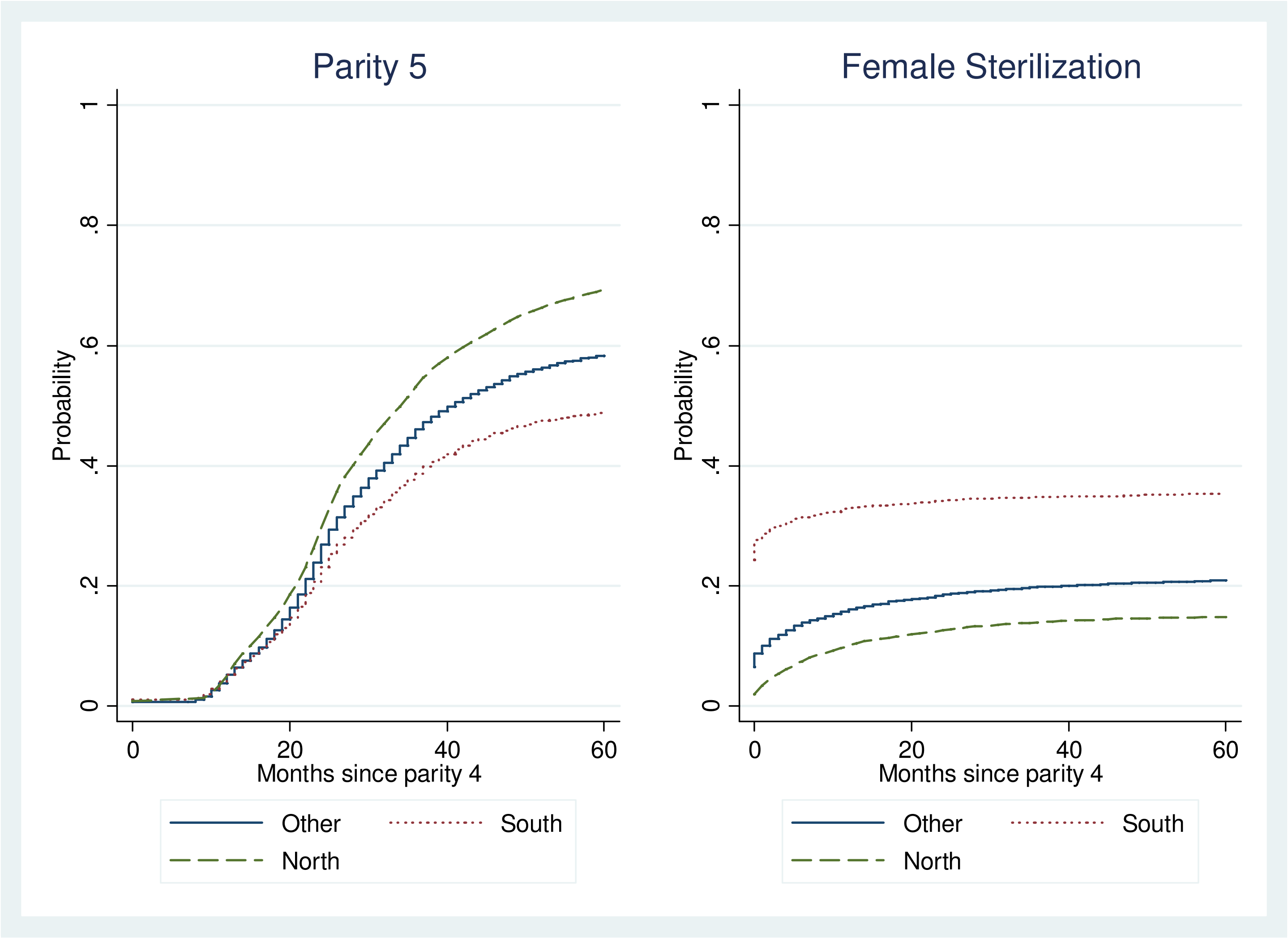


Figure 5: Comparative Cumulative Incidence at Parity 2 of Urban and Rural, Currently Married Women of Reproductive Age

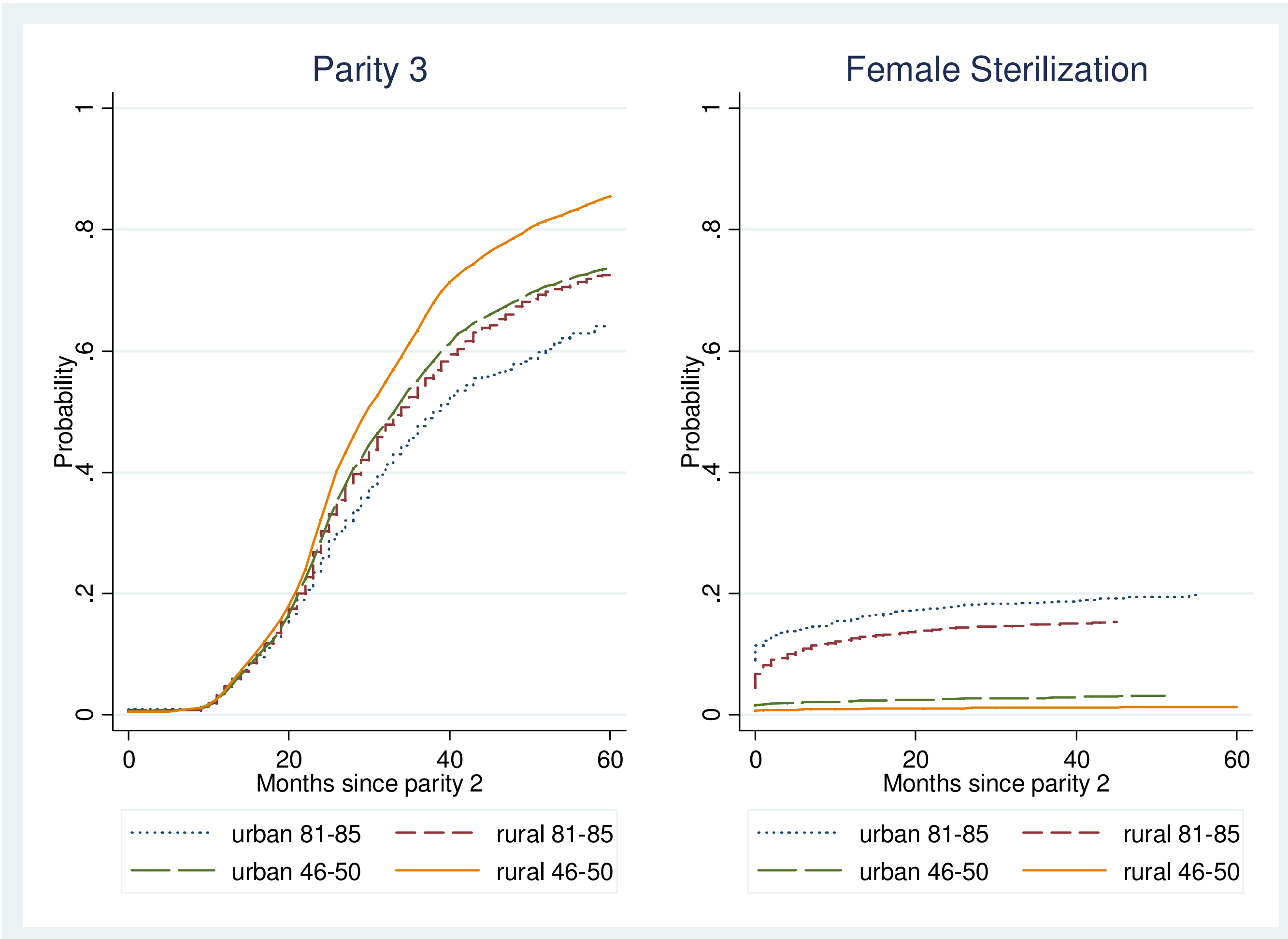


Figure 6: Comparative Cumulative Incidence at Parity 3 of Urban and Rural, Currently Married Women of Reproductive Age

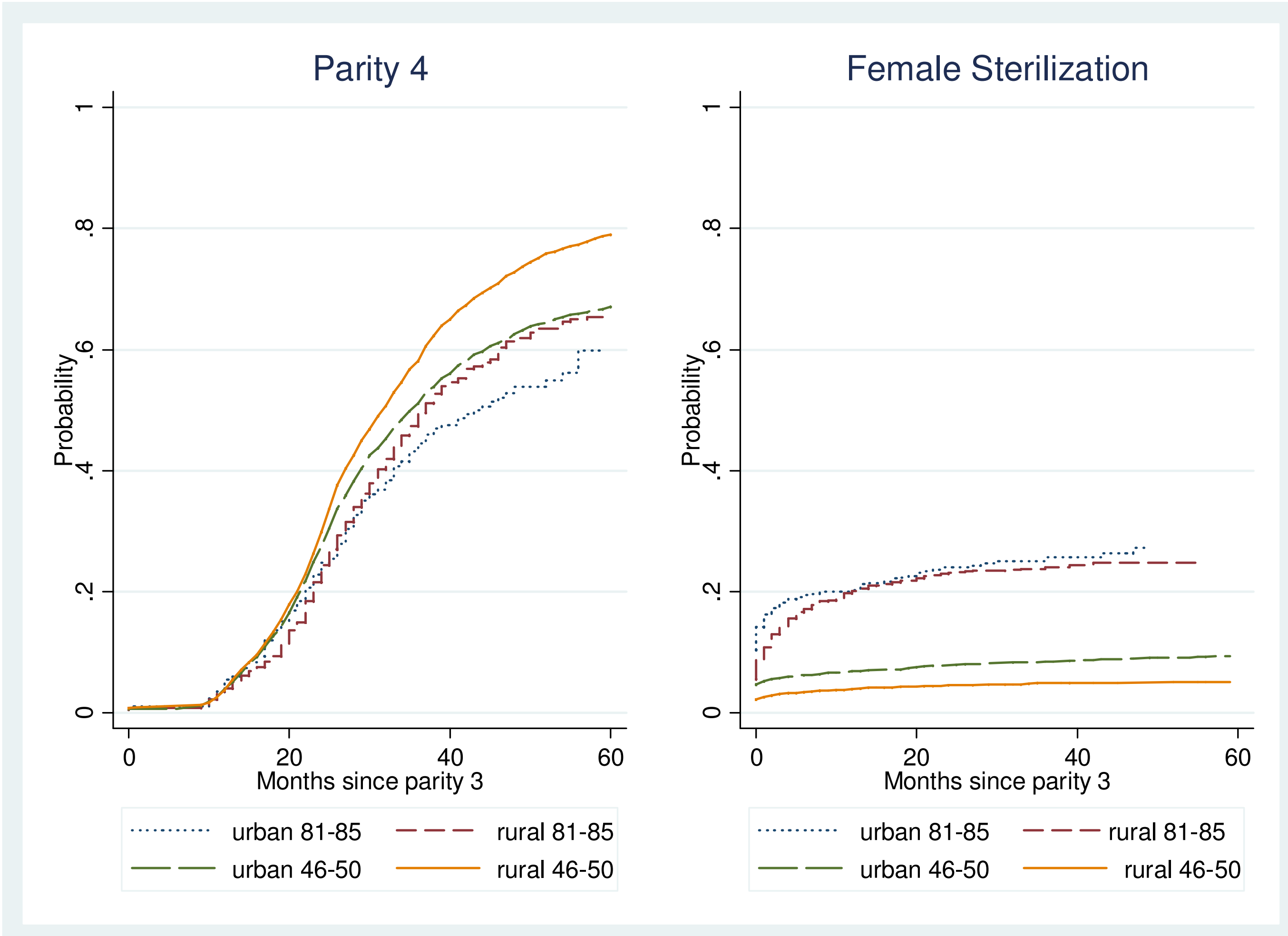


Figure 7: Comparative Cumulative Incidence at Parity 4 of Urban and Rural, Currently Married Women of Reproductive Age

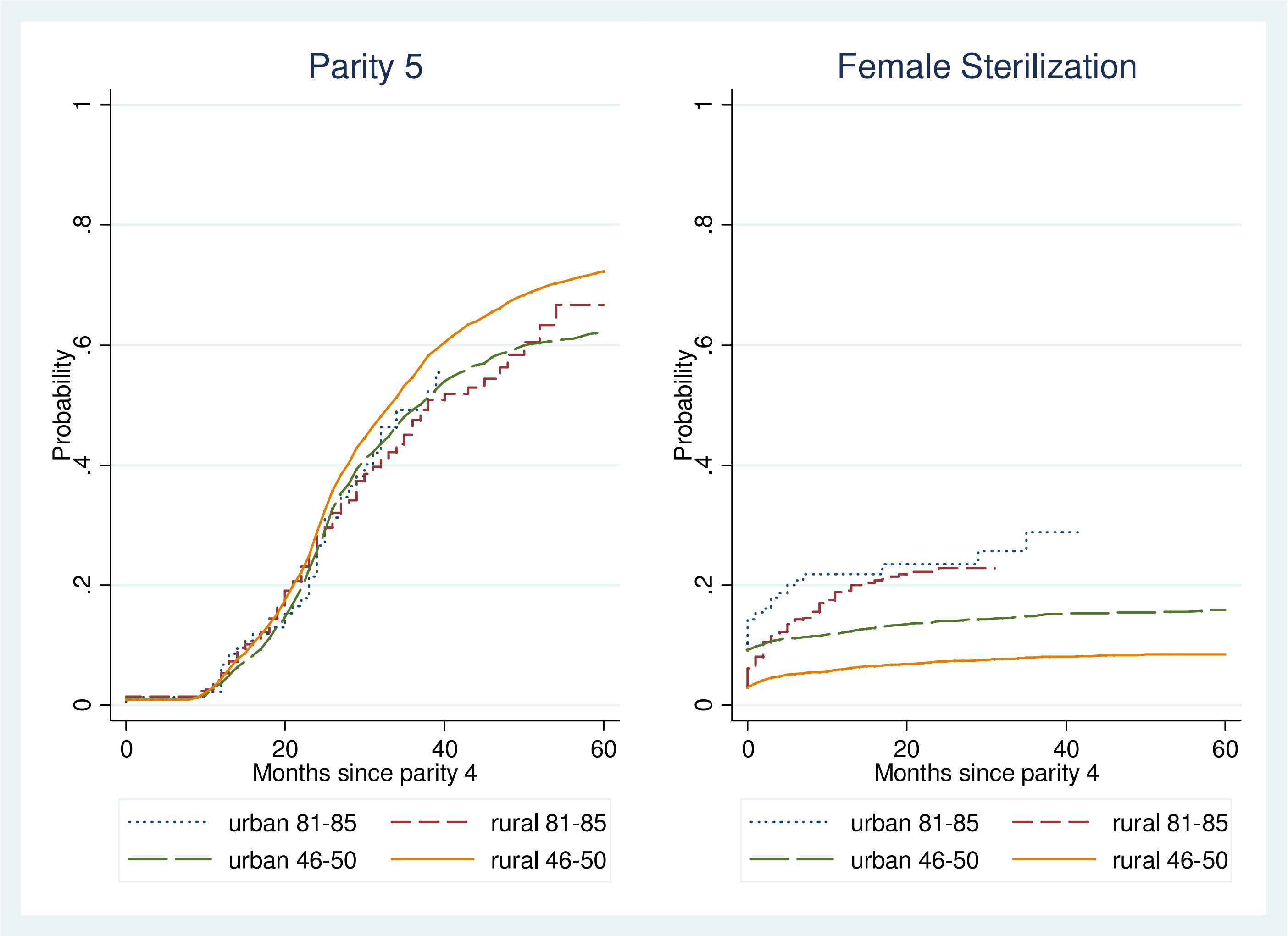
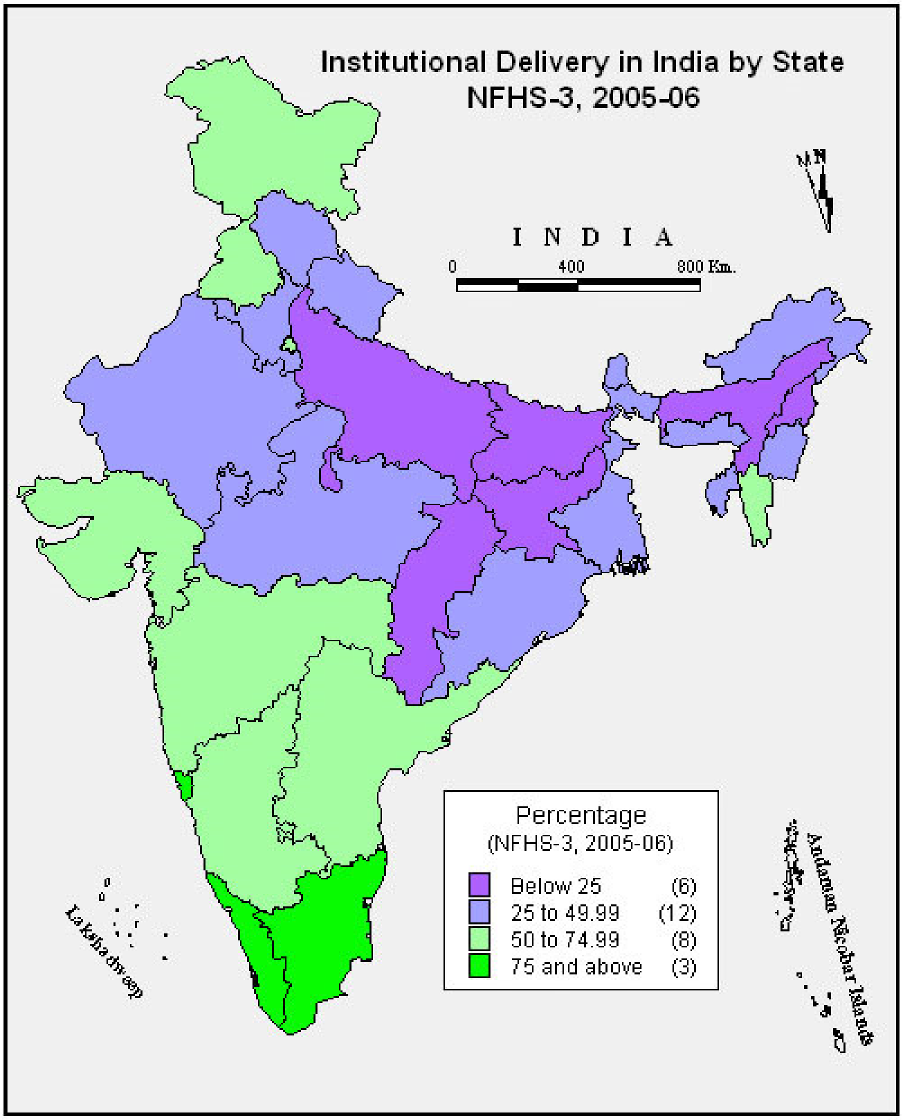


Figure 8: Map of Institutional Deliveries in India by State, NFHS-III (2005/06)



Source: http://populationcommission.nic.in/cont-en3a.htm

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Appendix

Table 1A: Adjusted Cox Proportional Hazard Models and 95% Confidence Intervals						
	@ Parity 2		**@ Parity 3**		**@ Parity 4**	
	HR	95% CI	HR	95% CI	HR	95% CI
Education						
None/ missing	ref		ref		ref	
Primary	1.48	(1.39- 1.59)	1.33	(1.25- 1.40)	1.22	(1.14- 1.32)
Secondary/ higher	1.61	(1.52- 1.72)	1.40	(1.33- 1.48)	1.20	(1.12- 1.29)
Religion						
Hindu	ref		ref		ref	
Muslim	0.31	(0.28- 0.34)	0.34	(0.32- 0.37)	0.35	(0.32- 0.39)
Christian	0.48	(0.44- 0.53)	0.41	(0.37- 0.45)	0.36	(0.32- 0.41)
Other	0.83	(0.74- 0.92)	0.82	(0.74- 0.91)	0.77	(0.68- 0.88)
Residence						
Rural	ref		ref		ref	
Urban	0.94	(0.90- 0.99)	1.05	(1.00- 1.10)	1.05	(0.99- 1.12)
Wealth Index						
Lowest	ref		ref		ref	
Second	1.34	(1.20- 1.49)	1.26	(1.16- 1.38)	1.22	(1.10- 1.34)
Middle	1.45	(1.30- 1.60)	1.43	(1.31- 1.55)	1.47	(1.34- 1.62)
Fourth	1.76	(1.59- 1.95)	1.70	(1.56- 1.85)	1.82	(1.65- 2.02)
Highest	1.80	(1.62- 2.01)	2.00	(1.82- 2.20)	2.28	(2.03- 2.55)
Birth cohort						
1956-1960	ref		ref		ref	
1961-1965	1.44	(1.30- 1.60)	1.24	(1.15- 1.35)	1.19	(1.09- 1.29)
1966-1970	1.86	(1.69- 2.05)	1.57	(1.45- 1.69)	1.32	(1.22- 1.44)
1971-1975	2.54	(2.31- 2.80)	1.90	(1.76- 2.05)	1.43	(1.31- 1.57)
1976-1980	3.12	(2.83- 3.44)	2.09	(1.93- 2.27)	1.59	(1.43- 1.76)
1981-1985	3.67	(3.29- 4.09)	2.27	(2.03- 2.54)	1.76	(1.46- 2.13)
Region						
North	ref		ref		ref	
South	6.40	(5.99- 6.84)	4.11	(3.88- 4.36)	3.78	(3.50- 4.08)
Other	1.65	(1.54- 1.77)	1.47	(1.39- 1.55)	1.52	(1.43- 1.62)
Age at 1st birth	1.07	(1.06- 1.08)	1.03	(1.02- 1.03)	1.01	(1.00- 1.02)

Table 2A: AIC and BIC Estimates					
Model	**Obs**	**ll(model)**	**df**	**AIC**	**BIC**
Parity 2					
Piecewise	152469	-733633.67	21	147309.3	147518.0
Cox PH	63832	-90126.96	18	180289.9	180453.1
Parity 3					
Piecewise	104281	-70909.91	22	141863.8	142074.0
Cox PH	40968	-92620.23	18	185276.5	185431.6
Parity 4					
Piecewise	59858	-38184.41	22	76412.8	76610.8
Cox PH	23675	-53695.64	18	107427.3	107572.6

Table 5.3A(Continued): Adjusted Piecewise Constant Hazard Models and 95% Confidence Intervals at Parity 2 by Birth Cohort						
	1971-75		**1976-80**		**1981-85**	
	HR	95% CI	HR	95% CI	HR	95% CI
Education						
None/ missing	ref		ref		ref	
Primary	1.43	(1.24- 1.64)	1.63	(1.42- 1.86)	1.54	(1.28- 1.84)
Secondary/ higher	1.45	(1.27- 1.64)	1.66	(1.47- 1.88)	1.55	(1.31- 1.83)
Religion						
Hindu	ref		ref		ref	
Muslim	0.28	(0.23- 0.34)	0.23	(0.19- 0.28)	0.30	(0.24- 0.38)
Christian	0.51	(0.42- 0.61)	0.32	(0.25- 0.40)	0.47	(0.34- 0.66)
Other	0.85	(0.69- 1.04)	0.67	(0.52- 0.85)	0.80	(0.55- 1.16)
Residence						
Rural	ref		ref		ref	
Urban	0.91	(0.82- 1.00)	1.05	(0.95- 1.15)	1.03	(0.90- 1.18)
Wealth Index						
Lowest	ref		ref		ref	
Second	1.18	(0.95- 1.48)	1.42	(1.16- 1.73)	1.33	(1.05- 1.69)
Middle	1.46	(1.19- 1.80)	1.57	(1.30- 1.91)	1.45	(1.15- 1.82)
Fourth	2.07	(1.68- 2.54)	1.95	(1.60- 2.36)	1.43	(1.12- 1.82)
Highest	2.13	(1.71- 2.65)	1.71	(1.38- 2.10)	1.32	(0.99- 1.76)
Region						
North	ref		ref		ref	
South	8.06	(7.05- 9.20)	9.59	(8.42- 10.92	11.87	(9.85- 14.29)
Other	1.66	(1.45- 1.90)	1.91	(1.67- 2.19)	2.01	(1.64- 2.45)
Age at 1st birth	1.07	(1.05- 1.08)	1.07	(1.06- 1.09)	1.11	(1.07- 1.14)