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Early, Shorter and Fewer?

Convergence of reproductive biographies and pathways to accelerated childbearing among Indian women

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Abstract

Reproductive trajectories in India demonstrate an exceptional pattern not seen elsewhere in other low and middle income countries. Births are increasingly compressed in shorter intervals and many Indian women complete childbearing at very young ages. This is particularly the case in Andhra Pradesh where an intensive sterilization-driven family planning program brought down fertility rate way below replacement level in a relatively short period. The Andhra model, although successful in reducing fertility rates, is certainly extreme in India. The critical question is: to what extent other large, high fertility states follow the Andhra model? Using birth history data from three successive rounds of the National Family Health Surveys, this paper uses multi-state life table analysis to investigate the age-period-cohort variations determining the sequencing and timing of reproductive events in Indian states. The accelerated childbearing pattern depicted in Andhra is converging rapidly in other medium/high fertility states even among young educated women.

***Keywords**: Reproductive career; Multistate life tables; India; Age cohort; National Family Health Surveys*

1. Introduction

India's population has been growing at an unprecedented rate of 2% each year since 1950s, which then dropped from 1.73% in the mid-1990s to 1.39% in the last decade (United Nations 2013; RGI 2011). Despite the reduction in growth rate, the absolute population in India currently at 1.25 billion is projected to increase further to 1.52 billion by 2035 (United Nations 2013). This is attributed to the inbuilt population momentum and future fertility of large cohorts of women already entering reproductive ages (Bongaarts 1994; Frejka 1973). Another explanation for the increase in population size is the pattern of persistent early marriage and childbearing across India, which have implications in determining the future population size. Matthews et al. (2009) have shown that India would have 52 million people less by 2050 had it adopted a policy encouraging later marriage and birth spacing.

There is considerable variation in the pace of fertility decline in Indian states with a total fertility ranging from 3.9 children per woman in Bihar to 1.7 in Kerala and Tamil Nadu (RGI 2013). The heterogeneity in the pace of Indian fertility decline at the state and district levels have been reported elsewhere (Guilmoto & Rajan 2013; Kumar & Sathyanarayana 2012). Recent data show that 14 out of 35 states in India have a total fertility rate below replacement level (RGI 2013). In particular, the fertility trajectories in the state of Andhra Pradesh demonstrate an exceptional pattern not seen elsewhere in Asia. Andhra Pradesh achieved significant reductions in total fertility rates from 2.6 children per woman in 1992-93 to a low level of 1.7 within a decade – mostly attributed to a sterilization-driven family planning program (Matthews et al. 2009; Padmadas, Hutter & Willekens 2004). Many women in Andhra Pradesh complete childbearing relatively at younger ages. The so called compression of reproductive spans continues to dominate this state where about one-half of women marry as early as 17 years, have births in shorter intervals and undergo sterilization around age 24 (Padmadas, Hutter & Willekens 2004). These trends unequivocally augment future population growth in the state where each generation is being replaced faster and earlier.

The Andhra model, although successful in reducing fertility rates, is certainly extreme in India. The critical overarching question is: whether the Andhra pattern of family formation (*Andhraization* hereafter) is emerging in other Indian states? A multistate life table approach is adopted in this study emphasizing the age-period-cohort changes in the sequencing of events. The analyses, using data from the three

consecutive rounds of the Indian National Family Health Surveys (NFHS) will systematically examine the structure and pathways of reproductive life course of women in India, with a focus on the timing and sequencing of critical events. The results of this study will feed into the ongoing population stabilization policies and programmes of the Government of India which are currently discussed at the national and state levels.

We hypothesize that the sequencing and timing of reproductive events in high and low fertility states of India are rapidly converging to those observed in Andhra Pradesh. The underlying arguments that substantiate this hypothesis are: (a) the increasing demand for small families, especially in southern India; (b) the continuing influence of female sterilization in the family planning programmes and (c) the rise in average household income especially among middle class families in India as a precursor for below replacement or low fertility. The reductions in fertility gained considerable momentum across different states in India especially during the late 1990s, irrespective of significant improvement in social indicators.

Three inter-related research questions are addressed in this study: (i) how are events scheduled within a woman's reproductive career and how do they vary across cohorts in different states/regions of India? (ii) whether the larger states in the northern and central India exhibit similar patterns of childbearing trends seen in southern India? and (iii) how does education, in particular, mediate the timing and sequencing of events within the reproductive life course and how do these vary across low, medium and high fertility states in India? There has not been any systematic examination of events sequencing and transitions of states within a woman's reproductive career in the Asian context, particularly in India where childbearing tends to concentrate increasingly towards young ages.

2. Methodology

We used the retrospective cross-sectional data from the three successive rounds of the Indian National Family and Health Surveys (NFHS), conducted during 1992-93, 1998-99 and 2005-06 respectively, which collected detailed birth histories of 257,345 married women born between 1942 and 1991 (IIPS and Macro International 2007). NFHS are nationally representative surveys equivalent to the standard Demographic and Health Surveys in terms of questionnaire and survey design. NFHS-1 interviewed 89,777 married women from 88,562 households; NFHS-2 interviewed 90,303 married

women from 91,196 households whereas NFHS-3 interviewed 124,385 women aged 15-19, both married and single, from 109,041 households (IIPS and Macro International 2007; IIPS and ORC Macro 2000; IIPS 1995). NFHS-3 collected data from Chattisgarh, Uttaranchal and Jharkhand – newly formed states in 2000 reconstituting Madhya Pradesh, Uttar Pradesh and Bihar respectively (IIPS and Macro International 2007). To ensure consistency with NFHS-1 and NFHS-2, data on these new states from NFHS-3 were regrouped to its original sources. The women interviewed were in the reproductive age between 15 and 49 years, except for NFHS-1 which included women aged 13-49 years.

The analyses considered events in the reproductive life course of currently married women aged between 15-49 years (marriage/ sexual union, births and sterility). The cohort variations are determined by considering different age cohorts. For consistency, the analyses excluded 272 women aged below 15 years in NFHS-1; 335 who got married in the year of NFHS-3 (2006) and 532 women from all the surveys who reported a first or second birth before marriage or those who had a sterilization before age 10. This yielded a large sample of 256,206 women for the analysis, born between 1942 and 1986 with detailed birth histories. This paper reports the findings from only selected states in India, comparing high (Bihar, Uttar Pradesh), medium (Maharashtra) and low (Andhra Pradesh, Kerala, Karnataka) fertility states. The total fertility rates range between as high as around 3 children per woman in Bihar and Uttar Pradesh to about 2 in Maharashtra and as low as 1.6 in Andhra Pradesh and Kerala (IIPS and Macro International 2007). Modern contraceptive use ranges between 40% in Bihar and 67% in Andhra Pradesh, with a substantial proportion relying on female sterilization as the main method of contraception.

Multi-state life table (MSLT) models are used to estimate, for each cohort, rates and probabilities of transition between reproductive stages, expected timing of events, and expected sojourn times in the stages of the reproductive career. The details of the methodology and application in fertility and family formation analysis are available elsewhere (Willekens 2013; Bonetti, Piccarreta & Salford 2013; Yi et al. 2012; Thompson et al. 2012; Willekens 2008; Andersen & Keiding 2002; Schoen & Standish 2001; Willekens et al. 1982; Espenshade & Braun 1982). These indicators of reproductive life are used to investigate the changes between cohorts and between states. Intra-cohort differences are analysed by using hazard regressions considering selected covariates and micro-simulation. Micro-simulation uses empirical transition

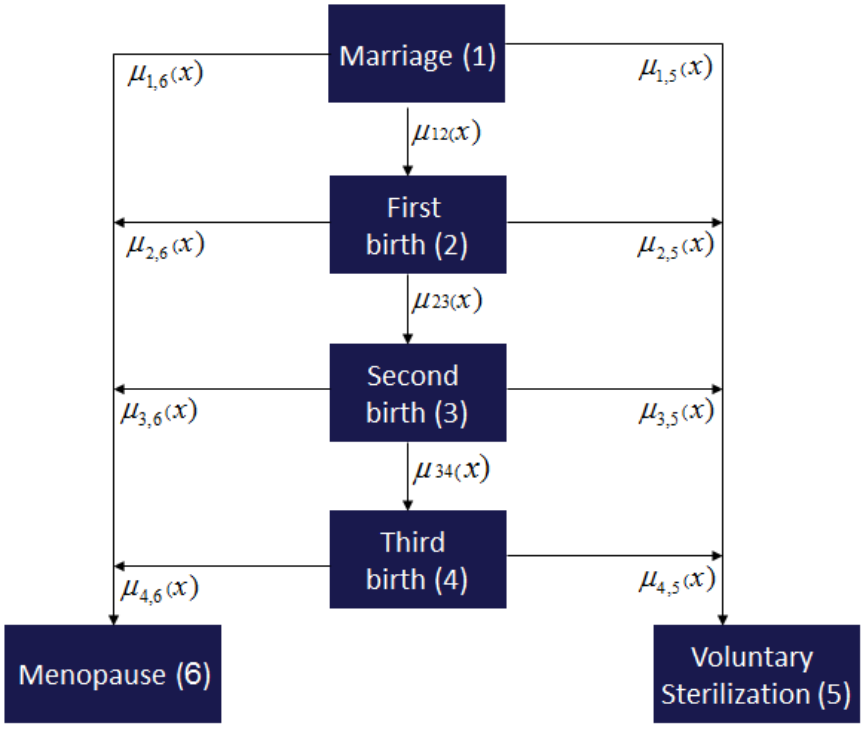
rates to generate individual life histories that account for individual differences that are consistent with life histories exhibited by cohorts. The software program *Biograph*, recently developed in R, is used (Willekens 2013; 2008). Reproductive spans measure the length of time spent between the onset of menarche or marriage and the onset of sterility (voluntary/involuntary). The length of actual or potential reproductive span is an indicator of fertility exposure in terms of determining the timing and sequencing of significant event outcomes such as marriage, births and sterility.

For each woman in the NFHS sample, compete birth histories are collected which include the timing of events such as marriage, first birth, second birth and so on and their attributes (gender, survival status), and sterilization. The time at each event is recorded in century months (CMC). The event histories provide the basis for understanding the dynamics of fertility careers of women and individual or collective reproductive behaviour at a given age or point in time, and the way they respond to external stimuli such as policy measures, interventions or treatments. In order to take full advantage of the information embedded in event histories, methods of analysis must be geared towards the study of change and the influence of past experiences in life on current behaviour. Historical causation is an important aspect of life history analysis (Baltes and Nesselroade 1979).

Two methods may be distinguished to record fertility careers. The first records information on the events, in particular type and timing. Birth histories are an example: dates of births are recorded. The second method records information on the states occupied at each age or point in time. The life history calendar is an example of this method: over a period of time, the state occupied at each month is recorded. The first method focuses on events and is referred to as the *event-based* approach. The second focuses on state occupancies and is referred to as the *status-based* approach. In the second approach, an event is often referred to as a transition (from one state to another) and some authors refer to transition data rather than event history data analysis (Lancaster 1990). The status-based approach is conditional in nature since a transition of the previous event introduces a new state in the life course. However, the two methods are complementary. From either type of data, the history of state occupancies and times of change may be derived. The history of state occupancies and times of change is referred to as a sample path (Tuma and Hannan 1984).

A multistate framework illustrating the sequencing and transition of reproductive events is illustrated in Figure 1. The figure shows the initial state (marriage) and possible absorbing states (sterility) within the reproductive career. The transition, for example, $\mu_{3,5}(x)$ denotes a woman making a transition from the third birth (state 3) to voluntary sterilization (state 5) at age x. If a woman remains childless after her third birth, then she will have further exposure for reproduction until the natural cessation of her menstrual cycle.

FIGURE 1 Sequencing and transitions of reproductive events: a multistate framework

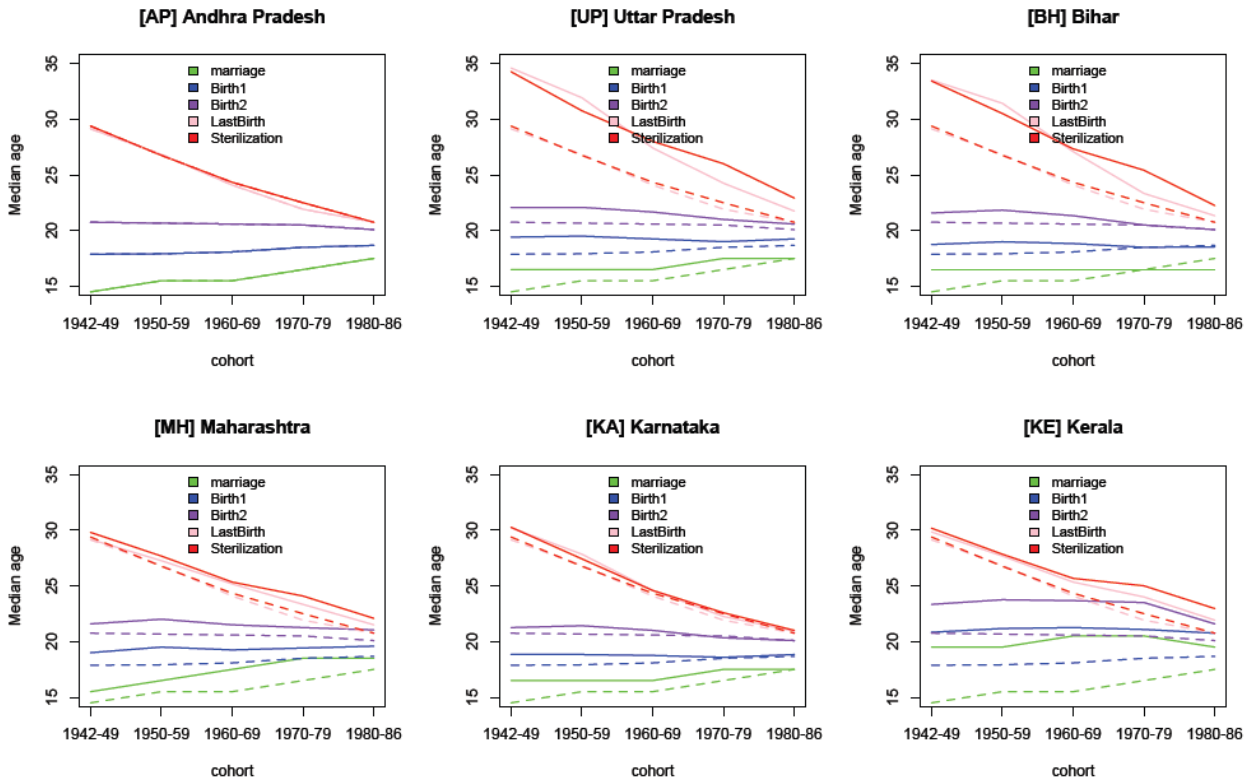


3. Results

3.1. Timing of events within the reproductive career

The median age at events for women born in different cohorts in Andhra Pradesh comparing other major Indian states is illustrated in Figure 2. Although there is a steady improvement in the age at marriage for those born since 1960, the median age of about 17 years for the most recent birth cohort suggests that over 50% of girls in Andhra marry before the legal age of marriage which is 18 years for females. The timing of first and second births did not vary considerably by birth cohorts whereas that of the last birth coincides with post-partum sterilization. An interesting observation is the compressed sequencing of births and sterilization among Andhra women. The median age at sterilization in Andhra Pradesh has fallen from about 30 years for the cohort born during 1942-49 to about 23 years for the most recent cohort. Similar patterns are observed in other high, medium and low fertility states of India. The convergence to Andhra pattern is clearly illustrated in Figure 2 which shows the difference in the median ages at various events with Andhra as the baseline.

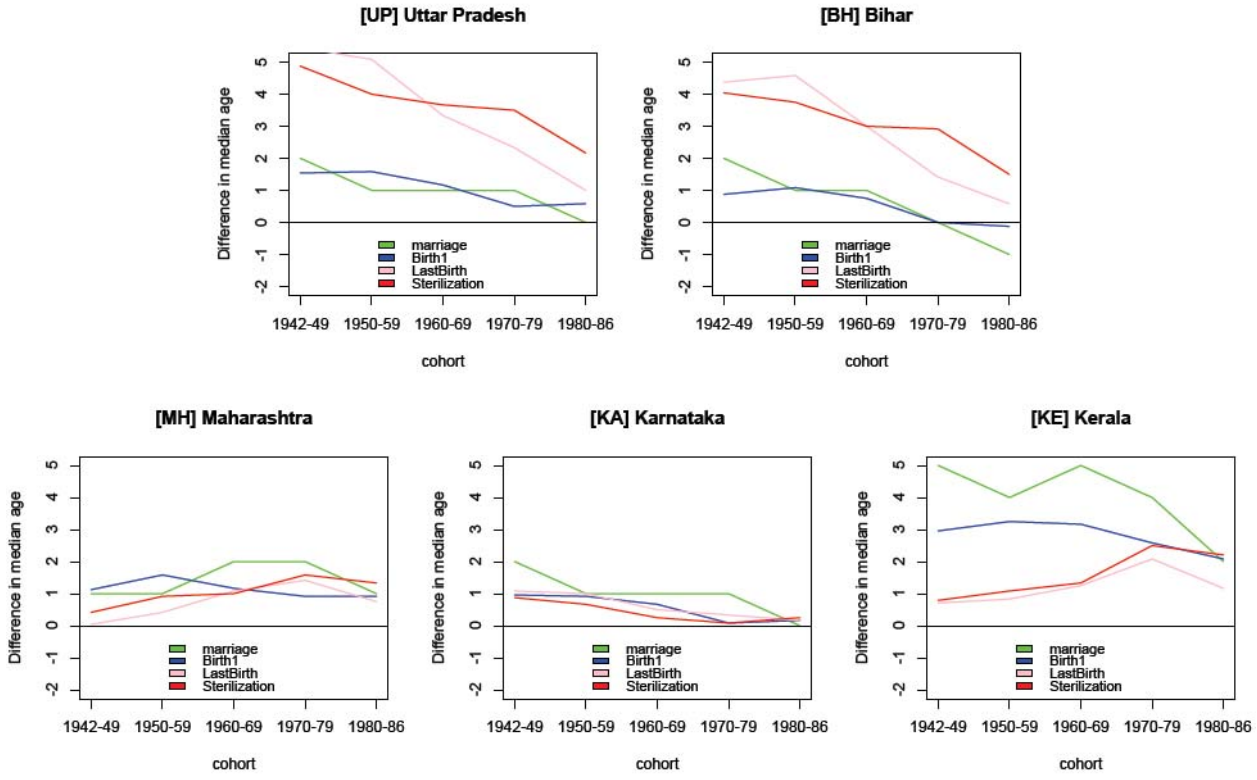
FIGURE 2 Median age at events by cohorts of women born between 1942 and 1986



Notes: dotted line refers to data from Andhra Pradesh. To avoid censoring problems, the descriptive results are shown for only women aged 20-49 years.

The trends especially among recent birth cohorts converge to the reference line but the patterns vary by states. The median ages at marriage and first birth are below the reference in Bihar for the recent two cohorts. However, the timing of other events converges closely to the Andhra pattern across birth cohorts. Similarly, the patterns in Karnataka resemble close to those in Andhra. Kerala and Maharashtra stand as outliers, yet there is evidence of compression of event sequences for the recent birth cohort.

FIGURE 3 Difference in median ages at events with reference to Andhra Pradesh



Notes: To avoid censoring problems, the descriptive results are shown for only women aged 20-49 years.

3.2. State occupancies

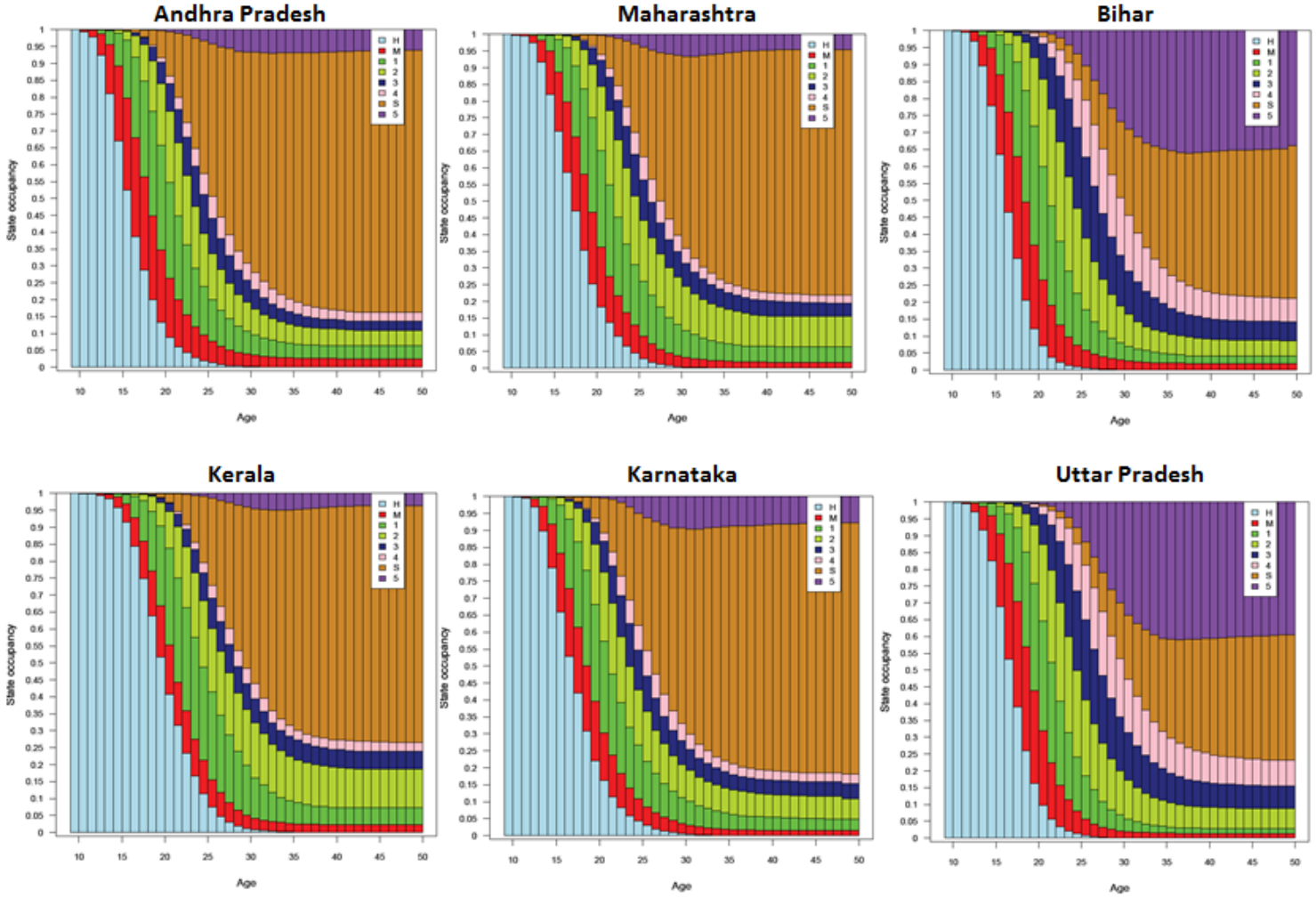
Figure 5 present the multistate lifetable state occupancies of women's reproductive career comparing Andhra Pradesh with selected major Indian states. In Andhra Pradesh, overall, about 75% of women are married by age 18 which increased further to 90% by age 20. About 55% of married women had a first birth at age 18, and another 50% with a second birth at age 21. More than a half of all married women are

sterilized by age 25 and about three-fourth by age 30. Within the reproductive career, women in Andhra spend a significant proportion of their time in the sterilized state. The Andhra pattern is visible in Maharashtra, Karnataka and to some extent in Kerala where marriage and birth events are relatively delayed when compared to other states. The results confirm the high, medium and low fertility trends observed in these states. In Maharashtra, about 55% of women had a second birth at age 25 and about 37% sterilized by age 25. In contrast, about 50% of women in Bihar had a second birth at age 21 and only 20% sterilized by age 25 suggesting rapid progression to higher parities and low use of sterilization at young ages. Although women in Uttar Pradesh and Bihar delay sterilization, the trends among recent cohorts suggest, with gradual reduction in total fertility, a clear convergence towards the Andhra pattern (results not shown separately).

We constructed multistate life tables disaggregated by women's level of education, categorized as no education, primary school drop-out, primary completed, secondary drop-out, secondary completed and those with high school and above. The differences in state occupancies by women's level of education are illustrated for Andhra Pradesh and Maharashtra. Three general observations are worth noting which apply in the case of both Andhra Pradesh and Maharashtra. As the level of education increases, women tend to delay marriage and first birth, stay longer in the first birth state before progressing to the second birth, and regress progressing to higher parities and postpone sterilization.

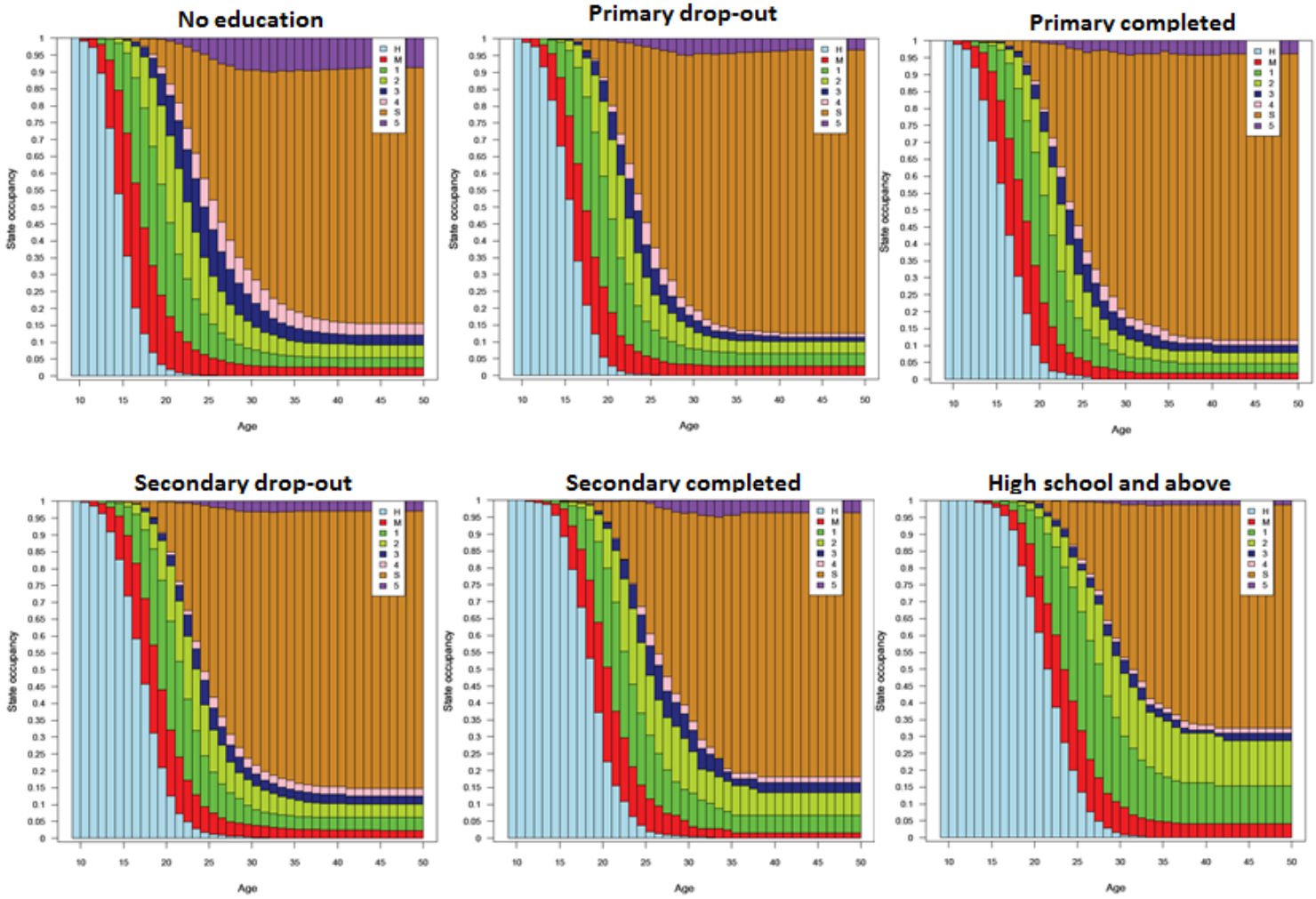
For example, in Andhra Pradesh, by age 25 about 70% of women with no formal education had a third birth and 50% had sterilization (Figure 5). In contrast, among those with high school education and above, only 16% progressed to a second birth and 12% had sterilization by age 25. In the case of women who completed secondary school level education, 32% had a second birth and 25% had sterilization by age 25. Similar patterns can be observed in Maharashtra (Figure 6). It should be noted that the percentage of women who reach high school level or above is very low at 7% and 12% and those with no education constitutes about 53% and 31% in Andhra Pradesh (n=11,423) and Maharashtra (n=14,019) respectively.

FIGURE 4 State occupancies by age based on multistate life table analysis, comparing Andhra Pradesh with selected Indian states



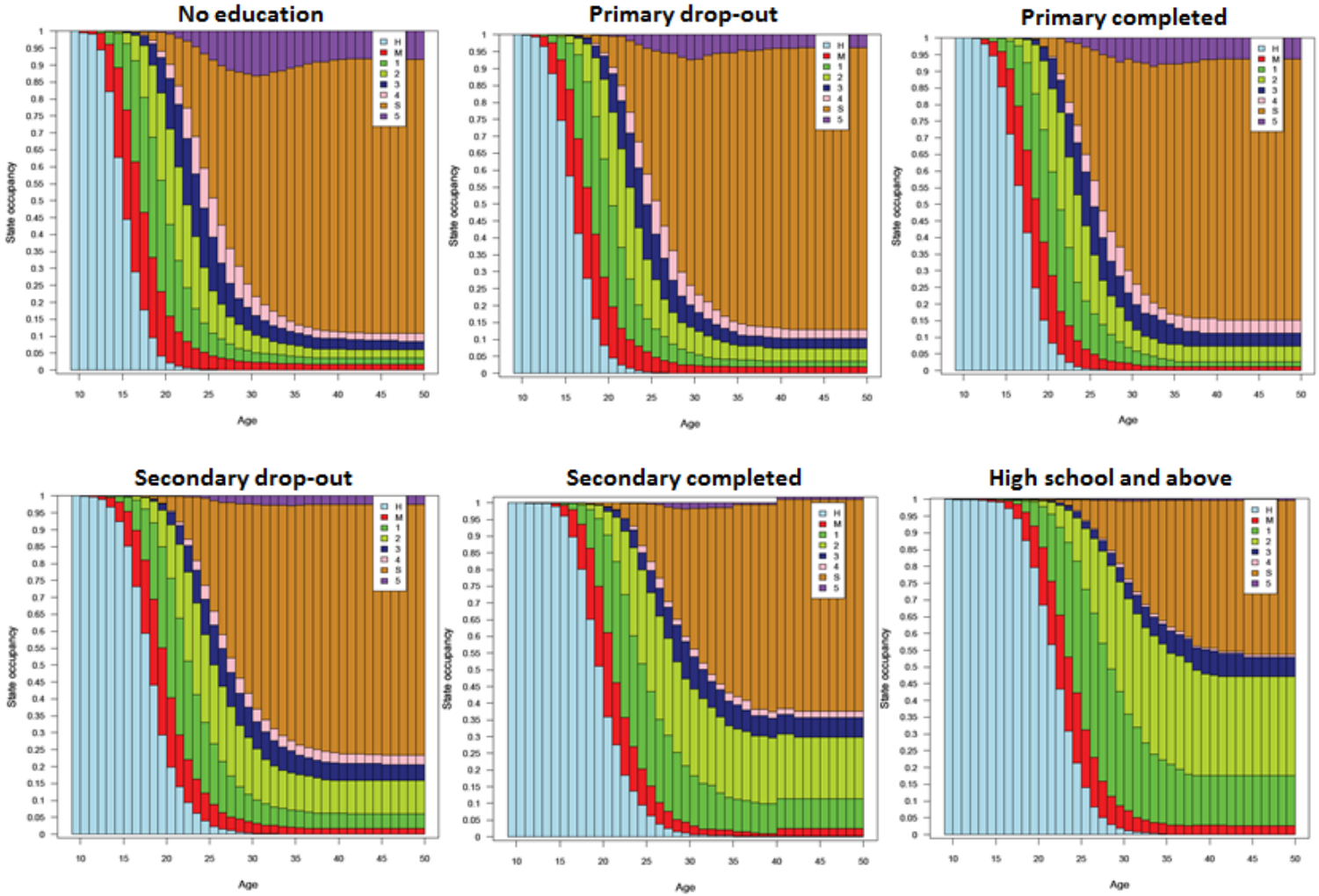
H: Never-married; M: Married; 1-5: Births 1-5; S: Sterilization

FIGURE 5 State occupancies by age and education in Andhra Pradesh, based on multistate life table analysis



H: Never-married; M: Married; 1-5: Births 1-5; S: Sterilization

FIGURE 6 State occupancies by age and education in Maharashtra, based on multistate life table analysis

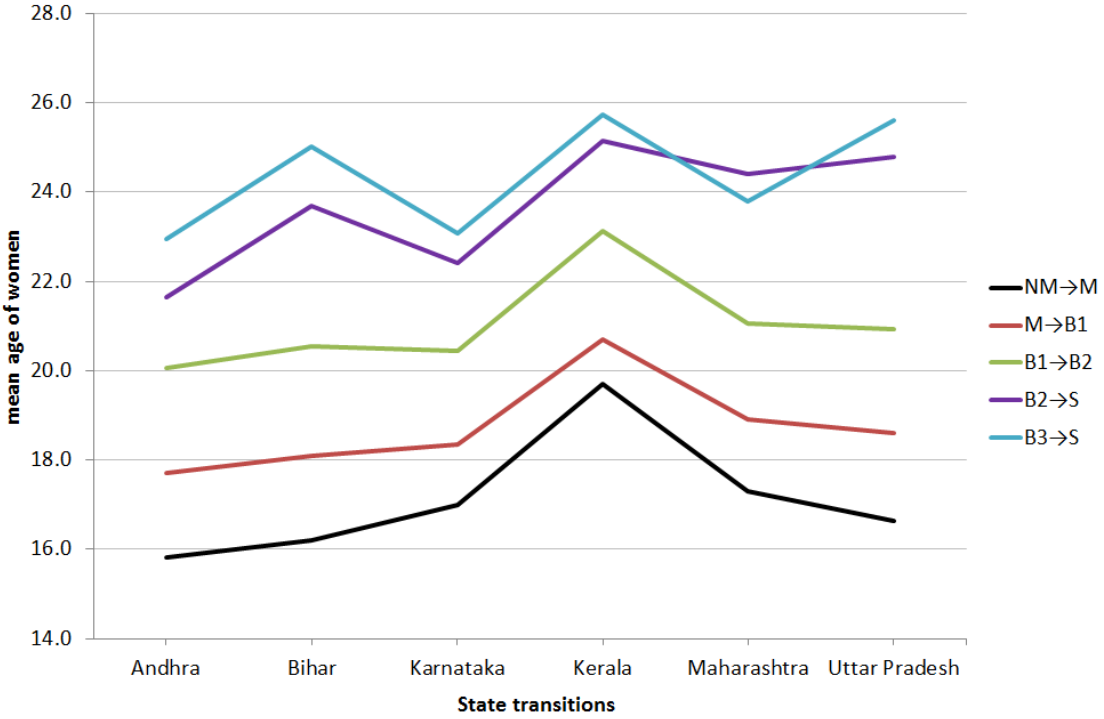


H: Never-married; M: Married; 1-5: Births 1-5; S: Sterilization

3.3. Mean age at state transition

The mean ages at transition for different states, comparing Andhra Pradesh with selected Indian states is illustrated in Figure 7. Andhra lags behind other states in terms of scheduling of events, in particular, the mean age at transition from never-married to married state is about 16 years and in contrast women in Kerala on an average marry about 4 years later than Andhra women. However, the mean age among those who make a transition from second birth to sterilization is below 26 years in all the states, particularly early in Andhra Pradesh and Karnataka around 22 years.

FIGURE 7 Mean age at state transition based on multistate life table analysis



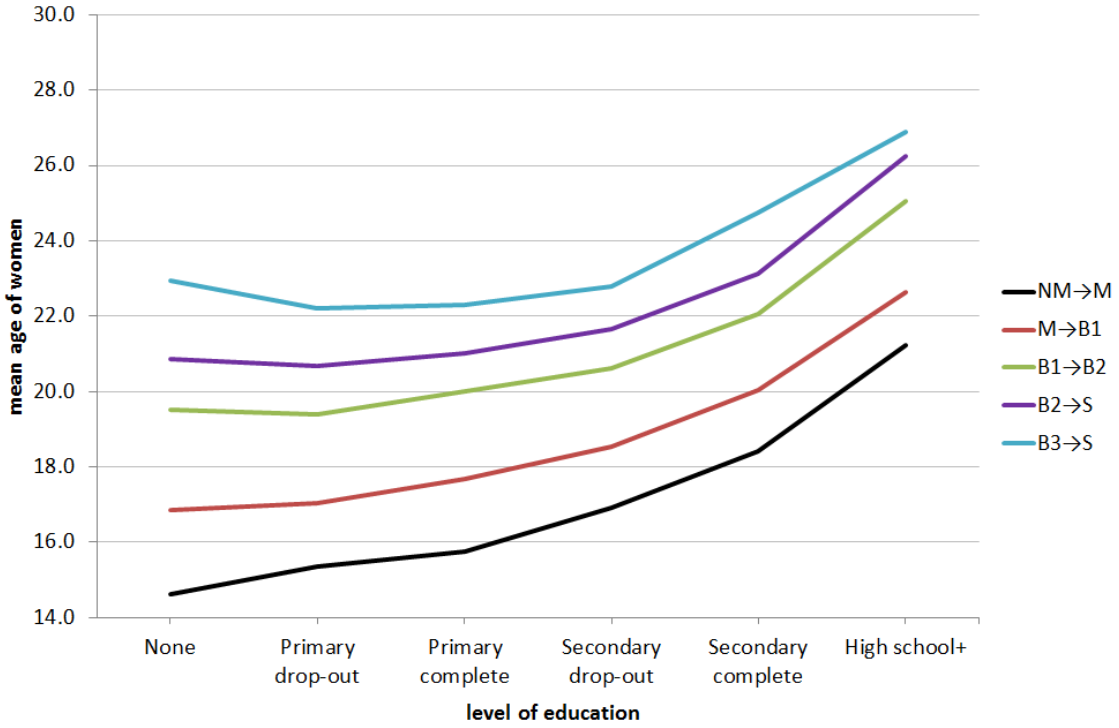
Notes: NM: Never-married; M: Married; B1: Birth 1; B2: Birth 2; B3: Birth 3; S: Sterilization

It should be noted that women in Bihar and Uttar Pradesh who make a transition from second or third birth to sterilization are an exception. These women are more educated who start childbearing late and opt for small families, and represent the small minority of low parity women relying on permanent method of contraception.

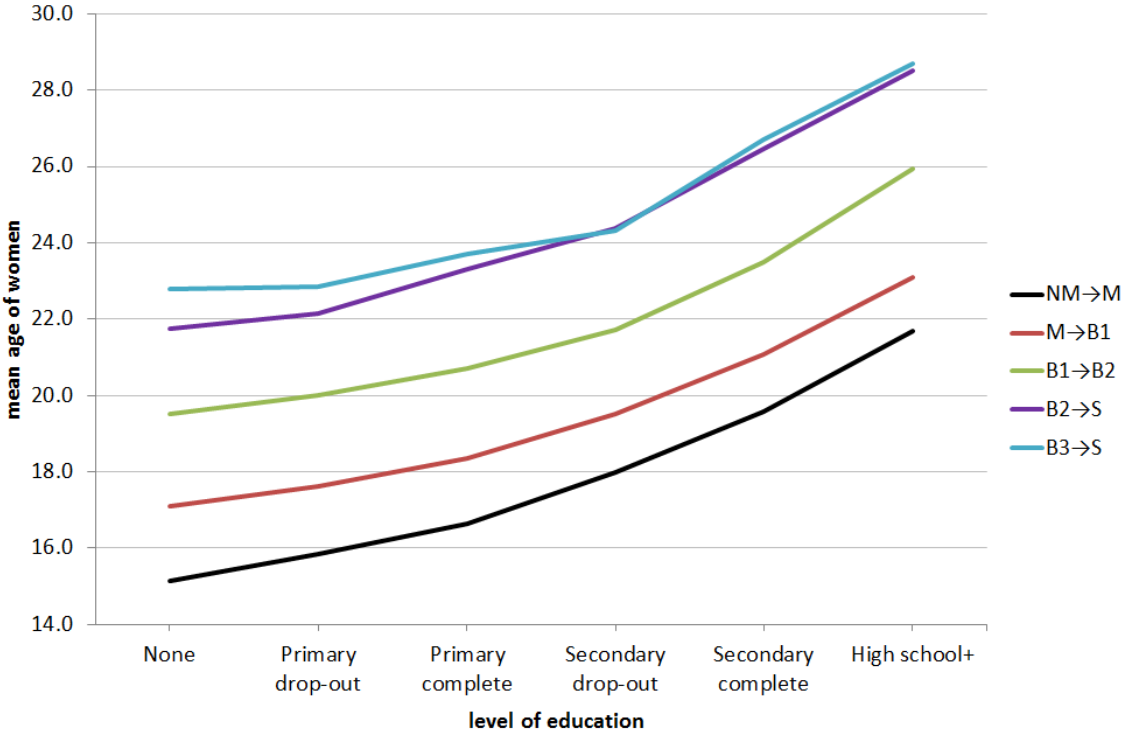
The mean age at transition by women's level of education is presented in Figure 8 for Andhra Pradesh and Maharashtra.

FIGURE 8 Mean age at state transition by education based on multistate life table analysis

(a) Andhra Pradesh



(b) Maharashtra



Notes: NM: Never-married; M: Married; B1: Birth 1; B2: Birth 2; B3: Birth 3; S: Sterilization

The difference in mean age at different transitions is pronounced between women with no education and those with education up to high school and above. An important observation is that, the education gradient is clear but the difference is more accentuated among those who had completed education beyond secondary level. The patterns are similar in Andhra Pradesh and Maharashtra. Between those with no education and high education and above, there is a difference of about 6 years in the mean age at transition from first to second birth. This difference for those making a transition from second birth to sterilization is about 7 years in Maharashtra and 5 years in Andhra Pradesh. The difference in mean age at transition from never-married to married state is about 7 years between the non-educated and highly educated group.

Interestingly, women with education who start late and those without education who start early spend almost equal amount of time between marriage and second birth or sterilization, in both Andhra Pradesh and Maharashtra. This suggests the trend in compression of reproductive spans in Indian states experiencing rapid fertility transition. Women in Andhra Pradesh spent about 19 out of the first 50 years of life in the sterilized state (Table 1). This implies that within the reproductive ages between 15 and 49 years, women in Andhra will have about 56% of time in sterility without any risk to childbearing. In comparison, women in Bihar and Uttar Pradesh will have about 26% and 21% respectively in sterility, suggesting longer exposure in reproduction, as highlighted in the high parity states B5 (birth 5) and S (sterilization).

TABLE 1 Expected years spent in various states since birth till age 50

	States occupied							
	NM	M	B1	B2	B3	B4	S	B5
Andhra Pradesh	16.7	3.1	3.8	3.1	1.7	1.2	18.8	1.7
Bihar	17.1	2.9	3.5	3.7	3.4	3.1	8.6	7.8
Karnataka	17.8	2.2	3.7	3.4	2.0	1.2	17.5	2.2
Kerala	20.5	2.0	4.3	4.3	1.8	0.9	15.3	1.0
Maharashtra	18.2	2.5	3.9	4.2	2.1	1.1	16.7	1.3
Uttar Pradesh	17.5	2.8	3.1	4.0	3.6	3.2	6.9	8.9

Notes: NM: Never-married; M: Married; B1-B5: Birth 1-5; S: Sterilization. The column sum adds to 50 years.

Education does make a significant difference in terms of time spent in various states. For example, the illustration comparing Andhra Pradesh and Maharashtra clearly show that educated women spend over 40% of time in the never-married state between birth and age 50 when compared to their counterparts with no education (Table 2). The influence of education, especially secondary or higher level, is apparent in delaying marriages and enabling a reduction in high parity births with adequate interval between births. These women also spend relatively less time in the sterilized state when compared to their counterparts.

TABLE 2 Expected years spent in various states by education since birth till age 50

	States occupied							
	NM	M	B1	B2	B3	B4	Ster	B5
Andhra Pradesh								
None	15.5	3.4	3.8	3.2	2.2	1.6	18.1	2.3
Primary drop-out	16.2	2.9	3.7	2.7	1.3	0.7	21.5	1.0
Primary complete	16.7	2.8	3.4	2.5	1.3	0.7	21.7	1.0
Secondary drop-out	17.8	2.8	3.5	2.5	1.1	0.7	20.8	0.7
Secondary complete	19.4	2.6	3.8	3.4	1.4	0.5	18.1	0.9
High school+	22.2	3.0	5.7	4.1	0.7	0.4	13.8	0.3
Maharashtra								
None	16.0	2.8	3.2	2.9	2.3	1.5	18.8	2.6
Primary drop-out	16.7	2.6	3.1	3.2	2.1	1.3	19.8	1.3
Primary complete	17.6	2.3	3.2	3.3	2.2	1.4	18.4	1.7
Secondary drop-out	18.9	2.4	3.9	4.5	2.0	0.9	16.9	0.6
Secondary complete	20.6	2.2	5.1	6.3	1.9	0.5	13.2	0.2
High school+	22.6	2.5	6.8	7.8	1.4	0.2	8.6	0.1

Notes: NM: Never-married; M: Married; B1-B5: Birth 1-5; S: Sterilization. The column sum adds to 50 years.

4. Preliminary conclusions and discussion

Reproductive trajectories in India demonstrate an exceptional pattern not seen elsewhere in other low and middle income countries. The state of Andhra Pradesh in particular has shown consistent decline in fertility way below replacement level in a relatively short period of time. Through an intensive sterilization-oriented family planning programme, the state managed to achieve faster reduction in fertility levels uniformly across different population sub-groups especially among middle-class families. The vast majority of women in Andhra marry early, have few children in short intervals and accept sterilization before age 25.

The foregoing analyses of three consecutive rounds of the Indian NFHS data confirm the research hypothesis and demonstrate evidence of convergence of Andhra pattern of compressed sequencing of reproductive events in other low, medium and high fertility states in India. The pattern in Andhra suggests that although highly educated women start late they soon catch up with their counterparts and spend the same amount of time in the effective reproductive span. Although contraceptive use among currently married women has increased during the last decade, female sterilization constitutes about three-fourth of overall modern method use. This suggests that women in India have limited contraceptive options other than (post-partum) sterilization.

The so-called *Andhraization* effect in India is not a phenomenon confined in below replacement or low fertility states but equally in other medium and high fertility states which are experiencing rapid fertility transition in response to economic development (James 2011). Ironically, economic growth in India has not benefitted all section of the society but has widened the gap between the rich and the poor (Bloom 2011). Moreover, there is little or no parallel social change in terms of female education especially in rural India where enrolment in both primary and secondary level education remains low. The vast majority of Indians still live in rural India including those in poor large states such as Uttar Pradesh, Madhya Pradesh, Bihar, Rajasthan and Orissa. Girls in these states drop out of school in their early years and surrender to marriage and family formation. The median age at first marriage among Indian women is as low as 17 years suggesting that over 50% of girls marry below the legal age at marriage which is 18 years for females and 21 years for males. This trend is also seen in southern Indian states particularly in Andhra Pradesh where the median age at first marriage has been persistently low at the national level for over the last

three decades. Early marriage without adequate contraceptive use other than sterilization increases the exposure to high fertility, as clearly illustrated in the case of Bihar and Andhra Pradesh where the use of sterilization is relatively low when compared to other south Indian states. In Andhra Pradesh, women enter marriage early and complete childbearing much earlier when compared to Kerala where women enter marriage late and complete childbearing earlier – hence the exposure to reproduction is almost the same in both states, even amongst educated groups. The share of female sterilization to overall modern method use is 92% and 78% in Andhra Pradesh and Kerala respectively. About half of all sterilized women in Andhra Pradesh had the procedure by age 25 and they remain in the sterile state for longer period within their reproductive careers.

There are social explanations for the practice of early marriage in most parts of India and in particular Andhra Pradesh. Girls especially in rural India are generally disadvantaged and discriminated in terms of rights to education and many drop-out of school at early ages for a range of reasons including poverty, access to schools and vulnerability to gender-based violence. Their parents often regard early marriage as a strategy to overcome the social and economic pressure on girls. Moreover, the wide practice of dowry system perpetuates early marriages especially among poor families (Rao 1993). The number of female years spent in education is often directly proportional to the bride price. The gender inequalities in educational attainment further suggests that the marriage squeeze increasingly seen against girls will affect also boys (Bhat & Halli 1999). The increasing marriage squeeze is visible more widely across India, including in Kerala where girls marry later than their counterparts from other states.

The sequence of early and compressed events within the reproductive careers of Indian women has social, demographic and economic implications. Early childbearing fuel population growth in the long run and contributes to an increase in absolute number of people (Matthews et al. 2009). The early entry into reproduction would mean that girls skip adolescence, have little opportunities for education and employment, and remain disempowered in later life. More importantly, the accelerated childbearing in short intervals can adversely affect the health and wellbeing of both mothers and children, especially through maternal depletion and sibling competition.

The multistate life table analyses of NFHS data undertaken in this study is the first of its kind which examined the structure and pathways of reproductive life course of women in India, with a systematic analysis of timing and sequencing of reproductive events. The present analysis is based on the reconstruction of birth history data collected retrospectively from mothers born as early as early 1940s to mid-1980s. The NFHS data obviously have limitations as any other population surveys, especially in terms of recall biases, omission and displacement of births to older women. Nevertheless, the NFHS employ standard methodology of survey design and data collection similar to the Demographic and Health Surveys, which ensures better quality data in terms of vigorous field editing and validating consistency in recording major events. Although panel data would be ideal, such data are expensive and difficult to gather at the national level.

The conclusions drawn from this study enable a better understanding of transitions and exposure to fertility and sterility in various states within the reproductive career. Investing on women's education can increase social and capital returns. There is evidence that fertility transition underway in India can accelerate school enrolment rates (Bhat 2002). This is critical for policy development and targeted reproductive health interventions in India where couples increasingly desire for small families, yet they have limited opportunities for delaying and spacing between births. The 'later, longer and fewer' policy adopted in China during the early 1970s (Kane 1987) could be pertinent in contemporary India which is heading to overtake China's population towards the beginning of the next decade.

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