

# Compression of Women's Reproductive Spans In Andhra Pradesh, India

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**CONTEXT:** The total fertility rate in Andhra Pradesh, India, has recently decreased to near-replacement level; however, the reasons for the fertility decline are unknown.

**METHODS:** Data from the second round of the National Family Health Survey were used to examine the reproductive span—the duration between first marriage and menopause or sterilization—among 4,032 ever-married women aged 15–49 living in Andhra Pradesh in 1998–1999.

**RESULTS:** Between 1992–1993 and 1998–1999, the median age at which women married remained at 15.1, whereas the age at which they adopted sterilization decreased from 24.5 to 23.6. In life-table analyses, reproductive spans of successive cohorts of women decreased—from 22 years among those who married during the 1960s to 15 years among those who married in the 1970s, 10 years among those who married in the 1980s and five years among those who married in 1990–1996. Proportional hazards regression analyses that controlled for demographic and social characteristics, as well as reproductive attitudes, confirmed this cohort effect (hazard ratios, 1.5–2.6).

**CONCLUSIONS:** These findings suggest that women are making the decision to end childbearing faster than older generations did. The gradual compression in reproductive spans is attributable mainly to sterilization acceptance among younger women.

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A woman's reproductive span is important in understanding not only the fertility levels of a society but also a woman's or couple's reproductive planning, allocation of time for childbearing and decision to end reproduction. These reproductive decisions are socially and culturally influenced. In many developing countries, sexual relationships are initiated only after marriage, and childbearing out of wedlock is socially forbidden. In India, for example, childbearing is expected to begin soon after marriage. And because marriage used to coincide with the onset of menarche, Indian women had long intervals between marriage and menopause or sterilization, during which they bore an average of 6–7 children, and the country's total fertility rate (TFR) was high.<sup>1</sup> However, from 1971 to 1997, the TFR decreased from 5.2 children per woman to 3.3.<sup>2</sup> During this period, the Child Marriage Restraint Act, which was implemented in 1978 to increase the minimum legal age at marriage from 15 to 18 years for women and from 18 to 21 for men, led to a modest and gradual delay in the age at marriage.<sup>3</sup>

In 1997, the TFR was lowest in the southern states, ranging from 1.8 in Kerala to 2.5 in Andhra Pradesh, which is near replacement level. Among the southern states, Kerala and Tamil Nadu attained TFRs below replacement level by 1988 and 1993, respectively.\*<sup>4</sup> By comparison, the TFR in the north-

ern states of Uttar Pradesh, Bihar, Rajasthan and Madhya Pradesh still exceeded 4.0 in 1997.<sup>5</sup> Much of India's fertility decline, especially that in the southern states, is attributable to an increased acceptance of sterilization—particularly female sterilization, which is one of the most popular methods of contraception in the country.<sup>6</sup> Many couples in India consider female sterilization the safest and most effective method, and it is often the sole method that couples use to control their family size.<sup>7</sup> According to the first round of the National Family Health Survey (NFHS) in 1992–1993, some 27% of currently married women had been sterilized; by the second round of the survey (NFHS-2), in 1998–1999, the proportion had increased to 34%.<sup>8</sup> By contrast, the proportion of women relying on male sterilization declined slightly, from 3% to 2%, during the same periods.

The gradual increase in the age at which Indian women marry and the decrease in the age at which they seek sterilization indicate that reproductive spans may be narrowing. The reproductive span represents a useful fertility indicator, because it is more closely related to a woman's life course than are conventional fertility indicators. Studies have found intervals between marriage and last birth ranging from nine years in Kerala to 17–20 years in Uttar Pradesh,<sup>9</sup> but these studies did not focus on women's reproductive age spans per se, and very little information exists regarding reproductive spans in the Indian context. This article analyzes the time that women spend in their reproductive lives, changes in reproductive spans across suc-

\*In addition, a below-replacement level of fertility was first noticed in the western state of Goa in the mid-1980s.

cessive cohorts of women, and factors associated with the completion of a reproductive span. We focus on Andhra Pradesh because its fertility rate is approaching replacement level, despite the lack of substantial improvement in female literacy and social development.<sup>10</sup> Understanding the factors behind the falling fertility rate in this state may help policymakers and program planners initiate strategies to improve the uptake of a wide range of modern reversible contraceptive methods and to enable women and couples to adequately space births before adopting sterilization.

## METHODS

### Data

NFHS-2 is a nationally representative, cross-sectional survey that collected individual-level information on 90,303 ever-married women aged 15–49 from 92,486 households in 1998–1999. The survey covered 25 Indian states and the sample represented more than 99% of the country's total population.<sup>11</sup> In Andhra Pradesh, data were collected between November 1998 and March 1999 from 4,032 ever-married women in 3,872 households. The household response rate was 99%, and women's response rate was 98%. The median age of participants at the time of the survey was 30 years. The survey asked for background characteristics of women and their households, as well as the month and year of first marriage, first cohabitation (as a proxy for consummation of first marriage), each birth, and sterilization of the woman or her husband. Although the survey did not ask for the age at menarche or menopause—this information is usually difficult to collect because many women may not accurately remember when they experienced these events—it asked women whether they had experienced menopause at the time of the survey. NFHS-2 classified women as having reached the menopausal state if they were currently neither pregnant nor amenorrheic, and had reportedly experienced menopause, had had a hysterectomy, or had had their last menstrual period six or more months before the survey.<sup>12</sup>

The reproductive span was defined as the duration between first marriage and menopause or sterilization of the woman or her spouse.\* For women who reported having reached menopause but had not undergone sterilization at the time of the survey, we assumed that the age at menopause was 44 years—the average age at menopause among Indian women.<sup>13</sup> NFHS-2 data from Andhra Pradesh show that about 13% of women had reached menopause at the time of survey, 66% of whom had already undergone sterilization or had a spouse who had already done so. Hence, roughly 175 women had reached menopause without undergoing sterilization; 72% of these women were older than 40 at the time of survey.

A quarter of the 1,412 nonsterilized, premenopausal women expressed their intention to stop childbearing at the time of the survey; the reproductive span (although incomplete) for these women, as well as for those who did not express such an intention, was taken to be the duration from first marriage to the date of the survey (right-censored).

**TABLE 1. Total fertility rate and median ages at first marriage and at sterilization among Indian women aged 25–49, by region and state, National Family Health Surveys, 1992–1993 and 1998–1999**

Region and state	TFR†		First marriage‡		Sterilization§	
	1992–1993	1998–1999	1992–1993	1998–1999	1992–1993	1998–1999
<b>India</b>	<b>3.39</b>	<b>2.85</b>	<b>16.1</b>	<b>16.4</b>	<b>26.6</b>	<b>25.7</b>
<b>North</b>						
Delhi	3.02	2.40	18.3	19.0	28.2	27.8
Haryana	3.99	2.88	16.0	16.9	27.3	26.5
Himachal Pradesh	2.97	2.14	17.7	18.6	26.9	26.2
Jammu and Kashmir	u	2.71	17.8	18.2	28.6	28.2
Punjab	2.92	2.21	19.0	20.0	27.9	27.1
Rajasthan	3.63	3.78	15.0	15.1	27.7	27.0
<b>Central</b>						
Madhya Pradesh	3.90	3.31	14.5	14.7	27.3	26.4
Uttar Pradesh	4.82	3.99	15.1	15.0	29.6	28.3
<b>East</b>						
Bihar	4.00	3.49	14.7	14.9	28.1	27.7
Orissa	2.92	2.46	16.6	17.5	26.8	26.3
West Bengal	2.92	2.29	16.0	16.8	26.0	25.1
<b>Northeast</b>						
Arunachal Pradesh	4.25	2.52	18.2	18.7	28.0	26.2
Assam	3.53	2.31	16.9	18.1	27.1	26.7
Manipur	2.76	3.04	20.8	21.7	29.7	30.5
Meghalaya	3.73	4.57	19.0	19.1	27.9	28.6
Mizoram	2.30	2.89	21.0	22.0	28.8	29.3
Nagaland	3.26	3.77	20.1	20.1	29.3	29.0
<b>West</b>						
Goa	1.90	1.77	21.7	23.2	28.5	28.5
Gujarat	2.99	2.72	17.9	17.6	27.5	26.5
Maharashtra	2.86	2.52	16.1	16.4	25.6	25.0
<b>South</b>						
Andhra Pradesh	2.59	2.25	15.1	15.1	24.5	23.6
Karnataka	2.85	2.13	16.6	16.8	25.2	24.2
Kerala	2.00	1.96	19.8	20.2	26.5	26.4
Tamil Nadu	2.48	2.19	18.1	18.7	26.2	25.3

†Total fertility rates are for the three years preceding the survey date. ‡Based on ever-married women. §Based on currently married women who were sterilized or whose husbands were sterilized. Note: Analysis is restricted to 25–49-year-olds to avoid censoring data. u=unavailable.

### Statistical Analysis

To account for right-censoring, we used life tables to estimate the probability of infecundity at various times after first marriage and hence expected reproductive spans.<sup>14</sup> To study trends in reproductive spans, we divided women into cohorts on the basis of their year of marriage.<sup>15</sup> Although the NFHS-2 included women who had married between 1960 and 1999, we excluded from analysis 281 women who married after 1996, because they were unlikely to have completed their reproductive span during the short interval between marriage and the interview. We also excluded two women who said they had been sterilized before marriage. A total of 3,749 women were divided into the following four

\*Of the three types of reproductive span—potential or biological (the interval between menarche and sterility), effective or behavioral (the interval between marriage and sterility), and social (the interval between marriage and separation, divorce or widowhood)—this article refers only to the effective reproductive span. We assumed that a woman was not exposed to the risk of reproduction if her spouse had undergone sterilization. Although we cannot rule out the possibility of extramarital sexual relationships, evidence of such behavior in India is scarce. Furthermore, the rates of divorce, separation and desertion are negligible (source: International Institute for Population Sciences, 2000, reference 8).

**TABLE 2. Median ages and percentages of ever-married women aged 25–49 living in urban and rural Andhra Pradesh, by key life and reproductive events, 1998–1999**

Event	Total	Urban	Rural
<b>First marriage</b>			
No.	2,839	793	2,046
Median age	15.0	16.0	15.0
% marrying before age 18	79.3	63.8	85.3
<b>Consummation†</b>			
No.	2,839	793	2,046
Median age	15.0	16.0	15.0
% consummating before age 18	79.3	63.8	85.3
<b>First birth‡</b>			
No.	2,695	757	1,938
Median age	17.0	18.0	17.0
% with first birth before age 18	53.9	41.6	58.7
<b>Last birth‡</b>			
No.	2,686	754	1,932
Median age	24.0	24.0	24.0
% with last birth before age 25	55.9	55.4	56.1
<b>Female sterilization</b>			
No.	1,650	442	1,208
Median age	24.0	24.0	24.0
% sterilized before age 25	58.0	56.1	58.7
<b>Male sterilization</b>			
No. of women relying on method	162	47	115
Median age of women at time of husband's sterilization	25.0	25.0	25.0
% of women relying on method before age 25	45.1	48.9	43.5
<b>Menopause§</b>			
No.	2,033	578	1,455
% menopausal	23.0	19.0	24.6

†Consummation of first marriage, referred to as cohabitation in the survey. ‡Based on women who gave birth at least once. §Based on 30–49-year-olds because data were available only for this age-group. Note: Analysis is restricted to 25–49-year-olds to avoid censoring data.

cohorts: those married in 1960–1969 (12%), in 1970–1979 (27%), in 1980–1989 (34%) and in 1990–1996 (28%). We used Cox proportional hazards regression analysis to examine the association between timing of marriage (and other covariables) and the risk of menopause or sterilization use after first marriage. Cox proportional hazards models require hardly any assumptions about the hazard rate, which varies with the duration since marriage.<sup>16</sup>

By studying different marriage cohorts, we also examined the effects of historic events on women's reproductive spans. For example, through the Child Marriage Restraint Act of 1978, the government attempted to improve the health and welfare of Indian women. And in 1976, the National Population Policy was drafted to promote sterilization as the major means of effective population control.<sup>17</sup> Using sterilization camps and monetary and other incentives, the government imposed sterilization (initially only vasectomy) on couples with three or more children. As a consequence, 75% of sterilizations performed in the mid-1970s were vasectomies; however, the proportion later de-

\*We made no distinction between induced and spontaneous abortion, because many women who report having had a spontaneous abortion probably had an induced abortion and were unwilling to report it as such.

clined to 20%, while that of female sterilizations increased.<sup>18</sup>

We also explored the effects of women's demographic and social characteristics and reproductive attitudes. Demographic characteristics include current age, the number of children ever born, ever-use of modern contraceptive methods as means of spacing births, experience of fetal loss (abortions or stillbirths)\* or child loss, the length of the preceding birth interval for women with at least two children, and sex composition of children. Social characteristics include the educational level of women and their spouses, religion and place of residence (urban or rural). Reproductive attitudes related to couples' current ideal number of sons and current interspousal communication about family planning; these variables were proxies for women's attitudes and values regarding time allocation for childbearing and family planning. We tested variables for multicollinearity by using correlation matrices; highly correlated variables were not considered in the same model.

## RESULTS

### Descriptive Analyses

We restricted descriptive analyses to 25–49-year-olds to avoid censoring the data. The overall median age at first marriage among Indian women in this age-group did not change considerably between the early and the late 1990s (16.1 and 16.4 years, respectively—Table 1, page 13). During the same period, the median age at which women (or their husbands) became sterilized declined from 26.6 to 25.7, and the TFR from 3.4 to 2.9 births per woman.

Between 1992–1993 and 1998–1999, the median age at marriage in Andhra Pradesh remained at 15.1 years—among the lowest in India. Thus, Andhra Pradesh, which has a TFR that is near replacement level (2.3), has a median age at marriage similar to that among women in high-fertility states such as Uttar Pradesh, where the TFR in 1998–1999 was 4.0 lifetime births per woman. Between 1992–1993 and 1998–1999, the already low median age at sterilization in Andhra Pradesh declined further, from 24.5 to 23.6 years. By comparison, the median age at sterilization in Uttar Pradesh fell from 29.6 to 28.3 during the same period. These findings suggest that reproductive spans are narrowing in both states, and that the younger age at sterilization in Andhra Pradesh is contributing to this state's lower fertility. As a result, childbearing in Andhra Pradesh is increasingly concentrated among young age-groups: In 1996, more than three-fifths of births were among women younger than 25—up from two-fifths in 1971.<sup>19</sup>

Table 2 shows the timing of key events during the reproductive span among women aged 25–49 in Andhra Pradesh in 1998–1999. A larger proportion of rural women than of urban women had married before age 18 (85% vs. 64%); overall, 79% of women had married before this age. Typically, consummation had occurred very soon after marriage, and the first birth two years later. Most women had given birth at least once, and more than half (54%) of them had had their first child before they were 18. The median age at which women adopted sterilization (male or female)

indicates that the procedure was obtained soon after the birth of the last child. Although urban women married later than their rural counterparts, both groups had had their last birth and become sterilized at a median age of 24, suggesting that urban women had somewhat shorter reproductive spans than did rural women. Finally, 23% of women aged 30–49 were menopausal at the time of the survey; a larger proportion of rural women than of urban women reported that they had reached menopause (25% vs. 19%).

In all, roughly one-half (51%) of women aged 15–49 had been sterilized, and of the 1,946 who gave a reason, 49% reported that it had been their own decision to obtain the procedure (not shown). A further 21% said that the decision had been influenced by their husbands; 16% by auxiliary nurses, midwives and local health volunteers; 4% by mothers-in-law; and 2% by friends. In addition, about 48% of respondents reported that they had not been informed of other method options when they sought sterilization.

Because the results in Table 2 masked cohort effects and the data were right-censored, we calculated mean and median reproductive spans for each marriage cohort according to women's sterility status (Table 3). Mean reproductive spans of women aged 25–49 clearly narrowed across successive marriage cohorts, regardless of sterility status or residence. However, reproductive spans were much shorter if women were sterile than if they were not (overall mean, 10.4 vs. 18.3 years). The interval was much shorter among women who married between 1990 and 1996 (partly because of data censoring, particularly among nonsterile women). On average, women who were not sterile had fewer children than those who were, particularly in the 1980–1989 marriage cohort; however, these women were still at risk of further childbearing.

### Life-Table Analyses

In life-table analyses of data from women aged 15–49 (corrected for right-censoring), longer reproductive spans were more common than shorter ones in each marriage cohort (Table 4). However, short reproductive spans became more common across cohorts: For example, 8% of women who married during the 1960s had a reproductive span of seven years or less, compared with 21% of those who married during the 1970s, 40% of those who married during the 1980s and 56% of those who married between 1990 and 1996. Similarly, reproductive spans of five years or less became substantially more common among women who married in 1980 or later. The changes in reproductive spans across cohorts were particularly evident among urban women. The probability that a woman who married in the 1980s did not use sterilization for five years but did so before reaching the seventh year is about 21% in urban areas and 19% in rural areas (not shown).\*

The distribution of women remaining fecund by duration since marriage shows that the reproductive span is decreasing across successive cohorts of married women

\*The probability is calculated as (probability of not ending childbearing at time 1 – probability of not ending childbearing at time 2)/(probability of not ending childbearing at time 1) x 100.

**TABLE 3. Mean and median durations of reproductive spans and mean number of children ever born among ever-married women aged 25–49 years, according to sterility status, by residence and marriage cohort, Andhra Pradesh, 1998–1999**

Residence and marriage cohort	Nonsterile				Sterile†			
	N	Mean	Median	Mean no. of children	N	Mean	Median	Mean no. of children
<b>All</b>	<b>855</b>	<b>18.3</b>	<b>17.0</b>	<b>2.1</b>	<b>1,975</b>	<b>10.4</b>	<b>9.0</b>	<b>3.4</b>
1960–1969	134	31.2	32.0	4.0	303	17.0	15.0	4.6
1970–1979	255	23.2	23.0	3.4	746	11.9	10.0	3.8
1980–1989	362	13.4	13.0	2.2	806	7.4	7.0	3.1
1990–1996	104	5.9	6.0	na	120	3.5	3.0	2.3
<b>Urban</b>	<b>257</b>	<b>17.5</b>	<b>16.0</b>	<b>2.1</b>	<b>530</b>	<b>9.1</b>	<b>7.0</b>	<b>3.2</b>
1960–1969	46	32.0	32.0	3.8	66	16.2	14.0	4.2
1970–1979	63	22.9	22.0	3.4	185	11.3	10.0	3.8
1980–1989	99	13.0	13.0	1.9	225	6.5	6.0	3.0
1990–1996	49	5.9	6.0	na	54	3.6	3.5	2.2
<b>Rural</b>	<b>598</b>	<b>18.7</b>	<b>18.0</b>	<b>2.1</b>	<b>1,445</b>	<b>10.8</b>	<b>9.0</b>	<b>3.4</b>
1960–1969	88	31.9	32.0	4.2	237	17.2	15.0	4.7
1970–1979	192	23.3	23.0	3.4	561	12.2	10.0	3.8
1980–1989	263	13.6	14.0	2.4	581	7.8	7.0	3.1
1990–1996	55	5.9	6.0	na	66	3.4	3.0	2.3

†Women who had reached menopause or been sterilized and women whose husbands had been sterilized. Note: Analysis is restricted to 25–49-year-olds to avoid censoring data. na=not applicable because of cohort censoring.

(Figure 1, page 16). The difference in distribution for the 1960–1969 and 1970–1979 cohorts is particularly large, reflecting the introduction of sterilization camps across the country in the mid-1970s.

Table 5 (page 16) shows married women's mean expected reproductive span, by marriage cohort. On average, the reproductive span of a woman who married during the 1960s was about 22 years; this interval decreased to 15 years in the 1970–1979 cohort, 10 years in the 1980–1989 cohort and five years in the most recent cohort. Our findings suggest that couples who married in 1990–1996 may have two children (with a birth interval of 2–3 years) and then opt for sterilization—all within a total period of five years. Urban and rural women had similar declines in expected reproductive spans.

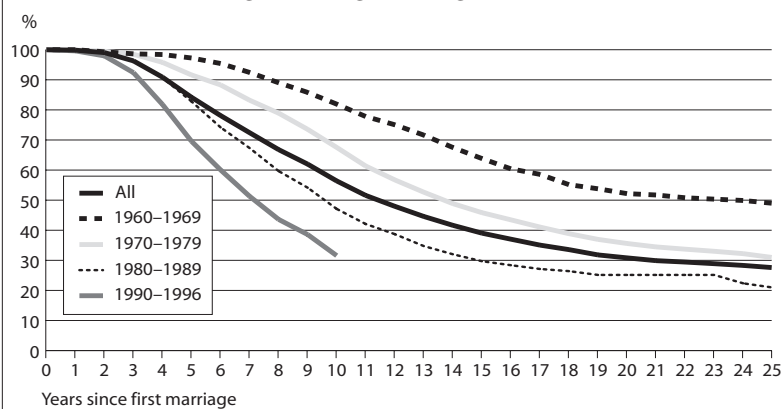
**TABLE 4. Cumulative percentages of ever-married women aged 15–49 completing reproductive spans, according to selected durations since marriage, by residence and marriage cohort, Andhra Pradesh, 1998–1999**

Residence and marriage cohort	N	Years since marriage						
		3	5	7	9	11	13	15
<b>All</b>	<b>3,749</b>	<b>9.1</b>	<b>21.9</b>	<b>33.2</b>	<b>43.6</b>	<b>52.0</b>	<b>58.8</b>	<b>63.0</b>
1960–1969	437	1.4	2.7	7.6	14.2	22.2	28.4	36.2
1970–1979	1,001	4.2	11.7	21.1	32.5	43.3	51.1	56.5
1980–1989	1,279	9.3	25.8	40.3	52.9	61.3	68.0	71.6
1990–1996	1,032	18.2	39.9	56.4	na	na	na	na
<b>Urban</b>	<b>986</b>	<b>12.2</b>	<b>27.7</b>	<b>38.3</b>	<b>49.0</b>	<b>56.4</b>	<b>61.7</b>	<b>65.0</b>
1960–1969	112	1.8	3.6	8.0	15.2	22.3	28.6	33.9
1970–1979	248	6.0	13.7	22.6	35.9	46.0	53.6	58.5
1980–1989	342	10.8	32.5	46.8	59.6	66.9	71.2	73.0
1990–1996	284	24.8	49.2	62.6	na	na	na	na
<b>Rural</b>	<b>2,763</b>	<b>8.0</b>	<b>19.8</b>	<b>31.4</b>	<b>41.7</b>	<b>50.5</b>	<b>57.7</b>	<b>62.2</b>
1960–1969	325	1.2	2.5	7.4	13.8	22.1	28.8	36.9
1970–1979	753	3.6	11.0	20.6	31.3	42.4	50.3	55.9
1980–1989	937	8.7	23.4	38.0	50.5	59.2	66.7	71.0
1990–1996	748	15.6	36.3	54.0	na	na	na	na

Notes: Data based on life-table analyses. na=not applicable because of cohort censoring.



**FIGURE 1. Percentages of ever-married women aged 15–49 remaining fecund, by duration since first marriage, according to marriage cohort**



Note: Data based on life-table analyses.

**Hazards Analyses**

To control for respondents' demographic and social characteristics and reproductive attitudes, we performed hazards analyses to assess cohort effects on the rate at which women exited their reproductive span through menopause or through sterilization of the woman or her spouse. We performed two analyses, the results of which are shown in Table 6. The first included women who had only one child or were pregnant for the first time during the survey and therefore omitted the preceding birth interval as a variable. The second excluded these women and therefore omitted sex composition, birth order and number of children ever born. It analyzed the interactive effect of marriage cohort and residence on the completion of the reproductive span. The interaction term was intended to capture the impact of national sterilization programs on different cohorts, especially in rural areas, where the implementation of family planning programs was particularly vigorous.

The first analysis showed that women who married after the 1960s ended childbearing at a quicker pace than those who married in the 1960s (hazard ratios, 1.5–2.6); more

recent cohorts had shorter reproductive spans than earlier cohorts. Furthermore, each child that a woman had increased the pace at which she completed her reproductive span by 10%. However, the pace of exit from the reproductive span decreased by 3% with each year of age. In addition, the pace of exit among women who had used a modern contraceptive method as a means of spacing births and those who had experienced any child or fetal loss was 17–36% lower than among other women. Sex composition and birth order of children were also associated with the length of a woman's reproductive span: Women whose first two children were sons or a son and a daughter ended childbearing at an elevated pace, indicating the inclination of couples to continue having children until a son is born.

We included the educational status of both spouses because the two variables were not significantly correlated. Compared with uneducated women, those with a primary-education ended childbearing 38% more quickly and those with a secondary-level education did so 64% more quickly. However, more than one half (58%) of sterilized women had received no schooling, compared with 20% with primary schooling, 19% with secondary schooling and 3% with an education beyond this level (not shown). The rate of exit from the reproductive span rose with the husband's educational level (hazard ratios, 1.3–1.4). Compared with Hindus, Christians and Muslims ended their reproductive spans at a slower pace (0.5–0.8).

Although women's desired number of sons was not associated with the length of their reproductive span, women who were not sure of their preferred number of sons ended childbearing at a significantly slower pace than did those who wanted no sons (hazards ratio, 0.9).

The second analysis found similar results in regard to age, use of modern contraceptives to space births, child and fetal loss, education and religion. Longer birth intervals were associated with longer reproductive spans. Women who wanted at least two sons or who did not know how many sons to have ended childbearing at a slower pace than those who wanted no sons (hazard ratios, 0.8 each). In addition, the lack of interspousal communication about family planning was associated with ending reproduction at a quicker pace (1.2).

Compared with rural women in the 1970–1979 marriage cohort (the period in which sterilization camps were introduced), women who married in the 1960s—especially those in urban areas—exited their reproductive spans at a slower pace. By contrast, urban women who married during the 1980s and women who married later—especially those in urban areas—tended to have shorter reproductive spans. These findings suggest that the sterilization camps of the mid-1970s helped to increase the acceptance rates of sterilization, particularly in urban areas of India.

**DISCUSSION AND CONCLUSIONS**

This study investigated the reduction in fertility to a near-replacement level in Andhra Pradesh in terms of women's reproductive spans. Our findings indicate that women are

**TABLE 5. Expected mean reproductive spans among ever-married women aged 15–49, by residence and marriage cohort, Andhra Pradesh, 1998–1999**

Residence and cohort	Mean reproductive span (yrs.)
<b>All</b>	<b>11.1</b>
1960–1969	21.5
1970–1979	15.2
1980–1989	9.5
1990–1996	4.5
<b>Urban</b>	<b>10.5</b>
1960–1969	22.3
1970–1979	14.7
1980–1989	8.8
1990–1996	4.4
<b>Rural</b>	<b>11.2</b>
1960–1969	21.2
1970–1979	15.4
1980–1989	9.8
1990–1996	4.5

Note: Data are based on life-table analyses.

**TABLE 6. Hazard ratios (and 95% confidence intervals) from regression analyses examining the associations between selected characteristics and the rate at which women ended childbearing, according to sample**

Characteristic	All women	Women with ≥2 children	Characteristic	All women	Women with ≥2 children
<b>Marriage cohort</b>			<b>Social (continued)</b>		
1960–1969 (ref)	1.00	na	Husband's education†		
1970–1979	1.51 (1.26–1.79)***	na	None (ref)	1.00	1.00
1980–1989	1.89 (1.45–2.46)***	na	Primary	1.27 (1.16–1.48)***	1.18 (1.05–1.33)**
1990–1996	2.58 (1.80–3.69)***	na	Secondary	1.31 (1.16–1.48)***	1.23 (1.09–1.39)**
<b>Demographic</b>			≥high school	1.38 (1.16–1.65)***	1.32 (1.10–1.57)**
Age	0.97 (0.96–0.98)***	0.96 (0.95–0.98)***	Religion		
No. of children ever born	1.10 (1.07–1.13)***	na	Hindu (ref)	1.00	1.00
Modern contraceptives used to space births			Muslim	0.52 (0.43–0.64)***	0.51 (0.41–0.61)***
No (ref)	1.00	1.00	Christian	0.82 (0.68–0.98)*	0.83 (0.69–0.99)*
Yes	0.64 (0.53–0.79)***	0.58 (0.47–0.71)***	Residence		
Any child death			Urban (ref)	1.00	na
No (ref)	1.00	1.00	Rural	0.97 (0.87–1.07)	na
Yes	0.80 (0.72–0.90)***	0.83 (0.74–0.93)**	<b>Reproductive attitudes</b>		
Any fetal loss			Desired no. of sons		
No (ref)	1.00	1.00	0 (ref)	1.00	1.00
Yes	0.83 (0.74–0.93)**	0.73 (0.66–0.80)***	1	0.99 (0.88–1.13)	0.93 (0.82–1.06)
Preceding birth interval			2	0.95 (0.82–1.09)	0.83 (0.72–0.96)*
<24 mos. (ref)	na	1.00	Don't know	0.85 (0.74–0.98)*	0.77 (0.67–0.89)***
≥24 mos.	na	0.64 (0.59–0.70)***	Family planning discussed with husband‡		
Sex and birth order of children			Yes (ref)	1.00	1.00
First two male	1.61 (1.37–1.88)***	na	No	1.07 (0.92–1.25)	1.18* (1.01–1.38)
First two female	1.07 (0.86–1.32)	na	<b>Marriage cohort x residence</b>		
First two male and female/female and male	1.54 (1.36–1.74)***	na	1960–1969, urban	na	0.53 (0.39–0.71)***
One male or female (ref)	1.00	na	1960–1969, rural	na	0.81 (0.67–0.99)*
<b>Social</b>			1970–1979, urban	na	0.99 (0.82–1.18)
Education†			1970–1979, rural (ref)	na	1.00
None (ref)	1.00	1.00	1980–1989, urban	na	1.33 (1.08–1.63)**
Primary	1.38 (1.23–1.55)***	1.40 (1.25–1.57)***	1980–1989, rural	na	1.18 (0.99–1.39)
Secondary	1.64 (1.42–1.89)***	1.68 (1.45–1.94)***	1990–1996, urban	na	2.22 (1.65–3.00)***
≥high school	1.06 (0.79–1.42)	1.21 (0.89–1.64)	1990–1996, rural	na	1.97 (1.50–2.57)***
			–2 log likelihood	32484.67	30723.21
			χ <sup>2</sup> for model	807.40***	1058.53***

\*p<.05. \*\*p<.01. \*\*\*p<.001. †Primary, secondary and high school education equate to 5–7, 8–9 and ≥10 years of schooling, respectively. ‡In the previous few months. Notes: The rate at which women ended childbearing is the rate at which they became menopausal or adopted sterilization. na=not applicable. ref=reference category.

making the decision to end childbearing faster than older generations did. Sizable proportions of women in Andhra Pradesh marry before the legal age of 18, have a child soon after marriage, and complete family building and undergo sterilization before age 25. According to the results of life-table analyses, women's reproductive spans are becoming increasingly compressed across successive marriage cohorts—from 22 years among women who married in the 1960s to five years among those who married in the 1990s to five years among those who married in 1990–1996. Despite the effect of right-censoring, the decreasing age at which couples adopt male or female sterilization explains much of this compression.

After adjustment for important demographic and social characteristics and for reproductive attitudes, more recent marriage cohorts ended childbearing at a quicker pace than earlier cohorts. Furthermore, younger age among women in Andhra Pradesh is associated with narrower reproductive spans. These observations might be relevant in other states of India—particularly southern states where sterilization rates have been increasing. After the introduction of sterilization camps nationwide in the 1970s, coercive recruitment practices prevailed because of the government's targeted approach and because of poverty, which influenced

many men and women to accept the financial incentive to end childbearing.<sup>20</sup> In 1996, the government adopted a “target-free” approach to family planning, enabling women and couples to make open and informed contraceptive choices. Although our study could not capture this event, the approach seems to have exerted little influence on sterilization rates, particularly in Andhra Pradesh, where sterilization rates continue to increase.<sup>21</sup> Coercive practices may still exist in state family planning programs.

Roughly one-half of women were influenced by others to adopt sterilization at a young age. Other factors that influence the demand for and supply of sterilization—for example, improvements in infant and child survival, health care accessibility and the frequency of interaction with the antenatal care provider—might also partly explain couples' decisions to accept early sterilization.\* A very small proportion of currently married women in Andhra Pradesh use modern contraceptives to space births (2%), and an even smaller proportion rely on traditional methods (fewer than 1%).<sup>22</sup> Moreover, many couples adopt sterilization as

\*We did not examine the role of health care factors because this information was available only for births occurring in the last few years before the survey.

their first contraceptive method, often in the same month as their last birth.<sup>23</sup>

Our analysis shows that a lack of interspousal communication about family planning is associated with a shorter reproductive span. The lack of partner communication might also explain the low level of use of modern contraceptives to space births. Additionally, fetal loss or child death is associated with a lengthening of the reproductive span. It is likely that such an experience leads couples to continue reproduction until they achieve their desired family size; hence, they have a longer reproductive span than those without such a loss.

Knowledge of and reliance on sterilization have increased over time, especially in southern India, mainly because of the gains made in female literacy and social development.<sup>24</sup> This is, however, not the situation in Andhra Pradesh, where couples relying on sterilization generally have moderate levels of schooling. Son preference is an influential factor in early sterilization in this state, because women who have reached their desired number of sons are more likely than those who have not to adopt sterilization.<sup>25</sup> In addition, cultural factors seem to play an important role. A qualitative study published in 1999 reported that young rural mothers in Andhra Pradesh accept sterilization so that they can work, advance their social goals and attain a culturally defined prestige so as to retain their individual identities in kinship and social networks.<sup>26</sup>

These interlinked factors suggest that the position of women solely as mothers is undergoing a major transition in Andhra Pradesh, which might also be the case elsewhere in India. The compression of reproductive spans suggests that women could increasingly allocate time for their careers once they reach their desired family size. It remains to be seen if compression of reproductive spans among women in India will lead to changing lifestyles, empowerment and modernization.

Also unknown is if women (or couples) make their own choices about early sterilization, or if they are merely responding to governmental population-control measures or societal pressure. These issues need to be evaluated using in-depth studies so that we can better understand couples' decisions on early sterilization. Policymakers and program planners can then formulate ways of encouraging women and couples to postpone childbearing and adequately space births with modern reversible contraceptives, especially in high-fertility states.

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## RESUMEN

**Contexto:** La tasa global de fecundidad en el estado de Andhra Pradesh, India, recientemente ha disminuido a cerca del nivel de reemplazo; sin embargo, no se conocen las razones por las cuales se registra esta reducción de la fecundidad.

**Métodos:** Se utilizaron datos de la segunda ronda de la Encuesta Nacional de Salud de la Familia para examinar la duración del período reproductivo—el tiempo transcurrido entre el primer matrimonio y la menopausia o la esterilización—entre 4.032 mujeres casadas alguna vez, de 15–49 años y que residían en Andhra Pradesh en 1998–1999.

**Resultados:** Entre 1992–1993 y 1998–1999, se mantuvo en 15,1 años la edad mediana en la cual las mujeres se casaban, al tiempo que la edad en la cual se sometían a la esterilización disminuyó de 24,5 años a 23,6. Según análisis de tablas de vida, disminuyó la duración del período reproductivo de cohortes sucesivos—desde 22 años entre las que se habían casado durante la década de los sesenta a 15 años entre aquellas que lo hicieron durante los años setenta, a 10 años entre las que se casaron en los años ochenta, y a cinco años entre aquellas que lo hicieron en 1990–1996. Los análisis de regresión de riesgo proporcionales, que controlaron las características demográficas y sociales, así como las actitudes con respecto a la reproducción, confirmaron este efecto de cohorte (razones de riesgos, 1,5–2,6).

**Conclusiones:** Estos resultados sugieren que las mujeres están tomando la decisión de no tener más hijos antes que sus pares de generaciones anteriores. Esta reducción gradual de la duración del período reproductivo se atribuye principalmente a la

adopción de la esterilización por las mujeres jóvenes.

## RÉSUMÉ

**Contexte:** L'indice synthétique de fécondité de l'Andhra Pradesh, en Inde, est, depuis peu, presque réduit au niveau de remplacement. Les raisons du déclin ne sont cependant pas connues.

**Méthodes:** Les données du second tour de l'Enquête nationale sur la santé familiale ont servi à l'examen de la période génésique (durée courante entre le premier mariage et la ménopause ou la stérilisation) de 4.032 femmes jamais mariées de 15 à 49 ans en Andhra Pradesh, de 1998 à 1999.

**Résultats:** Entre 1992–1993 et 1998–1999, l'âge médian du mariage des femmes est resté de 15,1 ans, tandis que l'âge auquel elles adoptent la stérilisation est passé de 24,5 à 23,6 ans. Dans les analyses de tables de survie, les périodes génésiques de cohortes féminines successives diminuent—de 22 ans parmi celles mariées durant les années 1960 à 15 ans parmi celles mariées dans les années 1970, 10 ans pour les années 1980 et cinq ans pour celles mariées entre 1990 et 1996. Modèles de risques proportionnels, sous contrôle des caractéristiques démographiques et sociales, ainsi que des attitudes en matière de reproduction, confirment cet effet de cohorte (rapports de probabilités, 1,5–2,6).

**Conclusions:** Ces observations laissent entendre que les femmes prennent la décision de ne plus avoir d'enfants plus rapidement que les générations précédentes. La compression graduelle des périodes génésiques est imputable, principalement, à l'acceptation de la stérilisation parmi les femmes plus jeunes.

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