

## **Towards Andhraization? A Multistate Analysis of Reproductive Biographies in High and Low Fertility States of India**

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### ***Short abstract***

Fertility trajectories in India show an exceptional pattern not seen elsewhere in Asia. Births are increasingly becoming compressed in shorter reproductive spans and many women complete childbearing at very young ages, particularly in southern India where fertility rates have fallen below replacement levels. For example, in Andhra Pradesh women enter childbearing early and accept sterilization at relatively young ages as low as 23 years. The Andhra model, although successful in reducing fertility rates, is certainly extreme in India. The critical question is: to what extent other large and high fertility states follow the Andhra pattern and if they do, what are the implications for future population growth in these states? Using cross-sectional data from the three successive rounds of the nationally representative Indian National Family Health Surveys, this paper adopts a multi-state life table approach to investigate the intra-cohort variations in the sequencing and timing of major events in the reproductive life course. Additionally, a micro-simulation is carried out to examine the extent of intra-cohort heterogeneity. The analyses show that most high and low fertility states in India are rapidly converging to the Andhra model. The potential impact of the ‘Andhraization’ effect on individual reproductive biographies and its implications on the health and economic wellbeing of women are discussed.

*Word count: 209*

## ***Extended abstract***

### *Context*

Fertility trajectories in India show an exceptional pattern not seen elsewhere in Asia. Despite the recent decline in fertility levels, many Indian women still enter childbearing early, give births in relatively short birth intervals and complete reproduction by resorting to permanent methods of contraception. The so-called compression of reproductive spans is seen not only in southern states such as Andhra Pradesh<sup>1</sup> but also recently in other larger states.

### *Rationale*

Reproductive spans measure the length of time spent between the onset of menarche or marriage and the onset of sterility (natural or induced). The length of reproductive life (actual and/or potential) is an interesting indicator of fertility, particularly in relation to the structure of reproductive life. The structure is determined by the timing and sequence of significant events such as marriage/ sexual union, births and sterility. An assessment of the timing and sequence of reproductive events adds considerable value in designing appropriate family planning and reproductive health policies and programmes. There has not been any systematic analysis of reproductive careers in the Asian context, particularly in India where childbearing increasingly concentrate towards young ages.

### *Aims*

The aims of this research are three-fold:

1. To determine the structure of the reproductive life course (pathway, career) on the basis of the sequence of timing of events
2. To examine the changes in sequencing and timing of major events across cohorts and to assess the associated determinants
3. To understand whether the larger states in India are following the unique childbearing patterns seen in Andhra Pradesh

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<sup>1</sup> Padmadas SS, Hutter I & Willekens F. 2004. Compression of women's reproductive spans in Andhra Pradesh, India. *International Family Planning Perspectives*. 30(1):12-19.

### *Research questions*

- How are events scheduled within a woman's reproductive career and how do they vary across cohorts in different states/regions of India? What factors explain the regional differentials and intercohort variations?
- Whether the larger states especially in the northern and central India exhibit similar patterns of childbearing trends in southern India?

### *Data*

We used the retrospective cross-sectional data from the three successive rounds of the Indian National Family and Health Surveys (NFHS)<sup>2</sup>, conducted during 1992-93, 1998-99 and 2005-06 respectively. The analyses considered events in the reproductive life course of currently married women aged between 15-49 years (marriage/ sexual union, births and sterility).

### *Methods*

Different (marriage) cohorts are distinguished and 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. These indicators of reproductive life are used to investigate the changes between cohorts and between states. Intra-cohort differences are studied using 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 *SurveyLife*, recently developed in R, is used<sup>3</sup>.

### *Operationalisation of reproductive histories*

For each woman in the NFHS sample, complete birth histories are collected. In addition, other information on the fertility career is collected, such as the time at first union (cohabitation; consummation of marriage) and time at sterilisation. The time at event is generally measured in century months (CMC). The information provides the

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<sup>2</sup> International Institute for Population Sciences (IIPS) and Macro International. 2007. *National Family Health Survey (NFHS-3) 2005-06: India: Volume 1*. Mumbai: IIPS.

<sup>3</sup> Willekens F. 2008. An introduction to *SurveyLife*: Multi state life table analysis. *Netherlands Interdisciplinary Demographic Institute*. The Hague.

basis for most of the fertility measures reported by the NFHS. The event histories provide the basis for the study of the fertility careers of women. They also provide the basis for the assessment of the effect of past experiences on current behaviour and attitudes. The behaviour of people at a given age and/or point in time, and the way they respond to external stimuli such as policy measures, interventions or treatments, are influenced by their collective and individual histories. 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 (for a discussion, see 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 of multistate 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 analysis 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. 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, p. 48).

*MSLT analysis:*

*Illustration of input data (Andhra Pradesh)*

Illustration 1: NUMBER OF EVENTS (DIRECT TRANSITIONS) OBSERVED IN NFHS-2, ANDHRA PRADESH DATA

Origin States	Destination states															Total
	FM	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	S	
NM	3969	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3969
FM	0	3504	0	0	0	0	0	0	0	0	0	0	0	0	1	3505
C1	0	0	2943	0	0	0	0	0	0	0	0	0	0	0	26	2969
C2	0	0	0	1935	0	0	0	0	0	0	0	0	0	0	636	2571
C3	0	0	0	0	1097	0	0	0	0	0	0	0	0	0	646	1743
C4	0	0	0	0	0	607	0	0	0	0	0	0	0	0	371	978
C5	0	0	0	0	0	0	322	0	0	0	0	0	0	0	214	536
C6	0	0	0	0	0	0	0	159	0	0	0	0	0	0	104	263
C7	0	0	0	0	0	0	0	0	82	0	0	0	0	0	35	117
C8	0	0	0	0	0	0	0	0	0	41	0	0	0	0	19	60
C9	0	0	0	0	0	0	0	0	0	0	18	0	0	0	6	24
C10	0	0	0	0	0	0	0	0	0	0	0	9	0	0	1	10
C11	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
C12	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
C13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	3969	3504	2943	1935	1097	607	322	159	82	41	18	9	2	1	2059	16748
EC	464	535	372	192	119	71	59	42	22	17	8	7	1	1	0	

NM: Never Married; FM: First Marriage; C1: Child 1 and so on; EC: Events Censored; S: Sterilised

Illustration 2: OBSERVED NUMBER OF EVENTS (DIRECT TRANSITIONS) BY AGE OF WOMEN, ANDHRA PRADESH

Age of women	Destination states															
	FM	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	S	EC
12	298	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	681	138	9	0	0	0	0	0	0	0	0	0	0	0	0	0
14	612	290	37	3	0	0	0	0	0	0	0	0	0	0	3	0
15	664	411	112	14	0	0	0	0	0	0	0	0	0	0	8	31
16	563	510	199	43	5	0	0	0	0	0	0	0	0	0	21	58
17	323	471	290	77	14	2	0	0	0	0	0	0	0	0	56	74
18	363	447	378	145	33	5	0	0	0	0	0	0	0	0	110	121
19	144	368	376	168	44	12	3	0	0	0	0	0	0	0	130	110
20	132	265	366	217	86	17	6	2	0	0	0	0	0	0	176	140
21	60	179	314	244	98	30	8	2	1	0	0	0	0	0	198	96
22	45	106	234	224	106	47	11	2	2	1	0	0	0	0	192	112
23	22	92	190	198	132	59	19	7	1	0	0	0	0	0	199	74
24	22	56	124	168	124	59	31	5	1	2	0	0	0	0	186	69
25	13	38	83	109	102	77	17	6	4	1	0	0	0	0	137	77
26	13	27	62	84	96	55	44	16	4	2	0	0	0	0	138	60
27	2	23	50	71	68	45	29	18	5	1	1	0	0	0	120	40
28	4	15	38	49	50	48	28	12	9	0	0	0	0	0	83	60
29	1	9	28	33	36	34	28	14	8	3	2	0	0	0	64	46
30	0	10	17	28	28	30	26	11	5	3	1	1	0	0	65	57
31	2	6	10	15	24	25	16	18	5	8	1	1	0	0	44	40
32	2	3	7	16	19	18	14	7	8	3	2	0	0	0	32	42
33	2	0	4	10	13	8	11	14	8	5	2	1	0	0	25	29
34	1	2	5	7	4	12	9	6	6	0	4	0	1	0	19	39
35	0	3	4	4	4	6	7	3	6	0	2	2	0	0	15	35
36	0	0	3	3	6	8	2	3	3	6	0	1	0	1	14	34
37	0	0	2	2	3	4	3	2	1	2	0	2	1	0	7	23
38	0	1	1	2	1	2	7	3	3	1	2	0	0	0	6	43
39	0	0	0	0	1	2	2	4	1	0	1	1	0	0	4	34
40	0	1	0	0	0	1	0	1	1	0	0	0	0	0	2	46
41	0	0	0	0	0	1	1	1	0	0	0	0	0	0	3	30
42	0	0	0	1	0	0	0	1	0	2	0	0	0	0	1	29
43	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	31
44	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	25
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	56
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	55
Total	3969	3504	2943	1935	1097	607	322	159	82	41	18	9	2	1	2059	1910

FM: First Marriage; C1: Child 1 and so on; EC: Events Censored; S: Sterilised