

**UTILIZATION OF MATERNAL HEALTH CARE
SERVICES IN SOUTH INDIA**

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ABSTRACT

In this study we examine the patterns and determinants of maternal health care use across different social setting in south India: in the states of Andhra Pradesh, Karnataka and Tamil Nadu. We use data from the National Family Health Survey (NFHS) carried out during 1992-93 across most states in India. The study focuses on most recent births to ever-married women that took place during the four years prior to the date of the survey. We have used logistic regression models to estimate the effect of covariates on the utilization of maternal health services viz., antenatal care, tetanus toxoid vaccine, place of delivery and assistance during delivery. The study indicates that determinants of maternal health care services are not same across states and for different maternal health care indicators. Although illiterate women were less likely to use maternal health care services; there was no difference among the educated. The level of utilization of maternal health care services was found to be highest in Tamil Nadu, followed by Andhra Pradesh and Karnataka. Part of the interstate differences in utilization is likely to be due to differences in availability and accessibility among the three south Indian states. It is argued that the differential in access to health care facilities between rural-urban areas is an important factor for lower utilization of maternal health care services, particularly for institutional delivery and delivery assistance by health personnel in the rural areas of the three states. Results from this study indicate that health workers might play a pivotal role in providing antenatal care in the rural areas.

JEL Classification: I 10, I 11, I 19

Key words: Utilization, Maternal health care, Reproductive health, Regional differential, India

INTRODUCTION

Over half a million women from the developing world die each year of causes related to pregnancy and childbirth. There are about 500 maternal deaths for every 100,000 live births, and around 10 per cent of the pregnancies are at high-risk (UNFPA, 1995). An important proximate determinant of maternal mortality is access to and use of quality health care services (Fauveau et al., 1991; McCarthy and Maine, 1992; Bhatia, 1993). Access to quality reproductive health services is also crucial for improved child survival and increased contraceptive use and consequent fertility decline in the developing countries (Ramachandran, 1989; United Nations, 1994; Phillips et al., 1998). Utilization of reproductive health services is in turn related to their availability and socio-economic, demographic and cultural factors such as women's age, education, employment, caste and autonomy (Obermeyer, 1991; Stewart and Sommerfelt, 1991; Elo, 1992; Obermeyer, 1993; Becker et al., 1993; Bhatia and Cleland, 1995; Pebley et al., 1996; Raghupathy, 1996; Dharmalingam et al., 1999; Addai, 2000; Acharya and Cleland, 2000). In this paper we explore the patterns and correlates of utilization of reproductive services in three southern states of India. We use the data from the 1992-93 National Family Health Survey of India (NFHS) (IIPS, 1995).

Past comparative research on demographic behaviour in India have in general tended to contrast south India with north India (Dyson and Moore, 1983; Miller, 1981; Basu, 1997). This comparison is based on the assumption that south India as a whole has a similar social, economic

and cultural history (Karve, 1965; Sopher, 1980). However, there are variations between the four south Indian states of Kerala, Tamil Nadu, Andhra Pradesh and Karnataka. Kerala has traditionally been more advanced in social and cultural development compared to the rest of south India. Over the last two decades Tamil Nadu has also progressed substantially in economic, social and demographic arenas (Krishnan, 1976; Mencher, 1981; Zachariah, 1984; Caldwell et al., 1985; Caldwell, 1986; Bhat and Rajan, 1990; Kishor, 1994; Srinivasan, 1995; Ramasundram, 1995). For instance, according to the National Family Health Survey of 1992-93, while 7 in 10 women were illiterate in Andhra Pradesh, it was 1 in 10 in Kerala and 1 in 2 in Tamil Nadu; less than 5 per cent of women in Kerala belonged to socially backward castes (scheduled castes and scheduled tribes), but it was about 20 per cent in the other 3 south Indian states; and 52 per cent of respondents from Kerala were non-Hindus, against 10-15 per cent in the other three states. There are differences with respect to women's employment status, women's autonomy, level of poverty, and contraceptive use among the southern states (IIPS, 1995; Srinivasan et al., 1997). The per capita income was highest in Tamil Nadu (Rs. 2363) and lowest in Karnataka (Rs. 1736) in 1992-93 (at 1980-81 prices). However, the per capita expenditure on health (medical and public health) was highest in Kerala (Rs. 36.44) and lowest in Andhra Pradesh (Rs. 21.54) during 1995-96 (at 1980-81 prices). It can thus be expected that there would be marked variations between the four states in the level of utilization of maternal and child health services and the influence of socio-economic factors on utilization. An earlier study that used NFHS data and focused on the role of maternal education on the utilization of maternal care services did not examine state level variations; the study also did not control for confounding effects of important correlates (eg. childhood background) (Govindasamy and Ramesh, 1997).

In this paper we examine the patterns and determinants of maternal health care use in three south Indian states. We explore whether the correlates of use of maternal health care services vary across different social settings. In the following section we describe the data source and variables used. This is followed by results and discussion and conclusion.

DATA AND MEASUREMENT OF VARIABLES

Data used in this paper come from the National Family and Health Survey (NFHS) carried out during April 1992- September 1993 in all Indian States (IIPS, 1995). For each State, separate sample designs were applied and samples were drawn using multi-stage, self-weighted sampling procedure. Information from the individual and household questionnaires has been drawn for analysis. To study the patterns and determinants of use of maternal health care services, we have considered the most recent births to ever married women, which took place during the four years prior to the date of the survey each woman was interviewed. This yielded 1594 births in Andhra Pradesh, 1951 births in Karnataka and 1427 in Tamil Nadu.

In this paper we focus only on Andhra Pradesh, Karnataka and Tamil Nadu. Kerala is excluded from the analysis as there were very few women (compared to the other three states) who did not use maternal health services (see Table 2): 1.6 per cent did not receive antenatal care and less than 10 per cent did not have TT vaccine, were not assisted by a health professional at delivery and gave birth at home.

We focus on the utilization of four maternal health care services during pregnancy and the birth of the reference child. They are:

Antenatal check-up: Information on antenatal care for all children born during the four years prior to the survey included: whether antenatal care was obtained, who provided the antenatal care (eg

health professional or trained/traditional birth attendant), duration of pregnancy at first antenatal check-up, and the number of antenatal check-ups. In this paper we use only one indicator for antenatal care: whether a woman received antenatal care (yes vs no).

Tetanus toxoid (TT) vaccine: Women were asked whether they were given an injection in the arm to prevent them and their babies from getting tetanus; they were also asked how many such injections they had when they were pregnant. Two doses of tetanus toxoid vaccine, one month apart, are usually given during pregnancy to prevent nearly all tetanus infections in both mother and her newborn children. For the purposes of this paper we treat a woman as having taken TT vaccine if she received at least two doses of injection, otherwise she is treated as not having had TT vaccine.

Place of delivery: The place of delivery is an important determinant for reducing the risk of infant and maternal death. Women were asked whether their babies born during the last four years were born at home or at any health institution (public hospitals, private hospitals or other health care institutions).

Assistance during delivery: Assistance during delivery is an important component in the reproductive health care services: it can reduce the risk of obstructed labour during delivery. Although assistance during delivery is highly associated with place of delivery, we have treated it as a separate variable because home deliveries can also be attended by health personnel. We expect that the determinants of assistance at delivery would be different from place of delivery. Information was collected about who assisted during delivery: health personnel (doctor, Auxiliary Nurse

Midwife (ANM), nurse or midwife, trained traditional birth attendant) or non-health personnel (untrained traditional birth attendant, friends or relatives).

The selection of the explanatory variables given below was based on their theoretical and empirical importance, as borne out by the international literature, for the use of maternal and child health services on the one hand, and their availability in the NFHS data set on the other.

Demographic Characteristics: Order of the birth has been used as an explanatory variable. It is generally believed that care during delivery would be higher for first order births and is expected to decline as order of birth increases (Elo, 1992; Bhatia and Cleland, 1995). If a woman ever had a still birth in a previous pregnancy, the use of maternal care services would be higher because of known risk factor (Bhatia and Cleland, 1995). Age of woman, which is also an important predictor for use of maternal health care services, is treated as a control variable.

Socioeconomic characteristics: It is well established that educated and working mothers are more likely than uneducated and nonworking mothers to take advantage of modern health care services (Caldwell et al., 1983; Mosley and Chen, 1984; Cleland and van Ginneken, 1988; Mencher, 1988). Educated and working women are considered to have greater awareness of the existence and value of preventive health care services. We have included exposure to electronic media in the analysis since it is an important source of information regarding the beneficial impact of the preventive care for maternal and child health (Rao et al, 1998; Retherford and Mishra, 1997).

Place of residence has been included in the analysis to capture the degree of availability and accessibility to health care facilities. Caste and religion have also been included as community factors that could facilitate or hinder health-seeking behaviour of members of a community.

The following variables were included in the logistic regression models as controls but their estimated effects have not been presented in the tables: age of woman, age difference between spouses, husband's education and occupation, childhood place of residence, presence of toilet in the household, possession of consumer durables (television, car, scooter, refrigerator, VCR), house type and person per room in the house.

A number of logistic regression models were run to estimate the effect of covariates on the utilization of maternal health care services. The logistic regression analyses were performed for dependent variables with dichotomous outcomes: use of antenatal care (yes vs no), TT vaccination (yes vs no), place of delivery (institution vs home) and assistance during delivery by health professional (yes vs no).

RESULTS

Pattern of Maternal Health Care Use

Table 1 presents the distribution of individual, household and background characteristics of women who had a birth during the four years prior to the survey. Most births were to women aged 20-29 (about 65-70%) in all three states in south India. Around five per cent of the women had at least one still birth in the past. The population was predominantly rural; about 20-30 per cent of the respondents lived in cities or towns. Over two-third of the respondents were illiterates in Andhra Pradesh (71%) and Karnataka (70%); in Tamil Nadu it was about one-half (47%); fewer husbands than wives were illiterates. About one in five respondents belonged to scheduled caste and scheduled tribe communities; the sample was predominantly Hindu (about 85%). The percentage of woman working and earning was highest in Andhra Pradesh (39%) followed by Tamil Nadu and Karnataka. About two-thirds of the respondents reported to have watched Television and/or listened radio

Table 1. Individual and Household characteristics of the woman who gave a birth (last birth) in the four years preceding the survey (NFHS, 1992-93) in three south Indian States

Characteristics	Andhra Pradesh	Karnataka	Tamil Nadu
Age group			
15-19	18.3	14.8	8.8
20-29	66.5	64.4	70.4
30 +	15.2	21.8	20.7
Order of birth			
1	27.1	25.0	31.9
2	26.0	26.9	31.9
3	22.0	19.3	19.7
4+	24.9	28.8	14.5
Ever had a still birth			
Yes	5.4	4.1	5.7
No	94.6	95.9	94.3
Childhood place of residence			
City/Town	20.0	24.5	30.6
Village	80.0	75.5	69.4
Place of residence			
Rural	75.0	69.7	64.5
Urban	25.0	30.3	35.5
Level of education of women			
Illiterate	71.0	62.4	46.7
Literate-primary complete	10.9	18.1	24.5
Middle complete	7.1	6.2	12.5
High school +	11.0	13.3	16.1
Caste			
Schedule caste/tribe (SC/ST)	22.2	17.3	20.4
Non-SC/ST	77.6	82.7	79.6
Religion			
Hindu	87.9	84.0	86.8
Muslim	9.5	14.0	7.2
Christians	2.6	2.0	6.0
Husband's education			
Illiterate	51.4	40.6	24.4
Literate-primary complete	16.5	20.1	26.7

Table 1 cont'd.....

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Characteristics	Andhra Pradesh	Karnataka	Tamil Nadu
Middle complete	10.6	15.5	21.4
High school +	21.5	23.8	27.4
Husband's Occupation			
Primary sector	50.3	50.0	39.7
Secondary sector	24.6	27.1	31.1
Tertiary sector	25.1	22.9	29.3
Work Status of Women			
Not working	49.2	58.9	62.5
Working but not earning	12.3	14.5	6.6
Working and earning	38.5	27.6	30.1
Media Exposure			
Watch TV and listen radio	36.5	35.6	28.5
Watch TV or listen radio	35.2	32.6	31.1
Neither watch TV nor listen radio	29.3	31.8	40.4
Age difference between husband and wife			
10 years and over	21.7	29.1	21.5
5-9 years	50.0	52.1	45.7
<5 years	28.3	18.8	32.8
Type of house			
Katcha	41.5	33.9	38.8
Semi pucca	30.4	51.9	38.6
Pucca	28.1	14.2	22.6
Durable goods			
No TV	85.0	79.8	78.5
TV alone	8.7	10.3	12.9
TV+car/fridge/scooter/VCR	6.3	9.9	8.6
Presence of toilet			
No	78.7	72.1	70.6
Yes	21.3	27.8	29.4
Number of persons per room in a household			
Mean	3.76	3.62	3.27

at least once a week. In all three states, around 80 per cent of the households did not possess television. The proportion of households with a toilet varied from 21 per cent in Andhra Pradesh to 29 per cent in Tamil Nadu. On average there were 3-4 persons per room in a house in all three states.

Table 2 shows the pattern of maternal health care utilization in three south Indian states: Andhra Pradesh, Karnataka and Tamil Nadu. It is clear that almost all mothers in Tamil Nadu (95%) received antenatal care. The corresponding percentages of women having received antenatal care for the last child born during the 4 years prior to the survey were 88 per cent in Andhra Pradesh and 85 per cent in Karnataka. About one in five women received antenatal care at home from the health workers alone against about 2 out of 3 women receiving by visiting a provider.

It is interesting to note that while 51 per cent of women in Karnataka went for antenatal check ups in the first trimester, the corresponding figures for Tamil Nadu and Andhra Pradesh were 43 per cent and 38 per cent respectively. It was found that more than 50 per cent of the women had their first antenatal check-up only after 5 months of pregnancy in Tamil Nadu and Andhra Pradesh. The number of visits for antenatal check up during pregnancy was highest in Tamil Nadu (5 visits). The average number of visits made by women was 4.62 in Karnataka and 4.15 in Andhra Pradesh.

Institutional delivery reduces the risk of maternal and child mortality. As regards the place of delivery, over 60 per cent of the deliveries were at home in both Andhra Pradesh and Karnataka. This percentage was only 36 in Tamil Nadu. About three quarters of the deliveries were assisted by medical personnel (doctor, nurse or midwife, ANM/LHV, trained birth attendant) in Tamil Nadu, but in Karnataka and Andhra Pradesh the proportion was only one-half.

Table 2. Pattern of Maternal Health Care Utilization in South India (per cent)

Maternal care Services	Andhra Pradesh	Karnataka	Kerala	Tamil Nadu
Received antenatal care				
Yes, received	88.5	85.3	98.4	94.8
Visiting to provider and provider visiting home	21.0	23.5	26.8	24.7
Visiting to provider	47.1	43.0	70.8	53.8
Provider visiting home	20.4	18.8	0.8	16.3
Not received	11.6	14.7	1.6	5.2
TT Vaccine				
2 doses and more	75.4	70.6	91.0	90.1
Not taken or single dose	24.6	29.4	9.0	9.9
Place of delivery				
Home	66.6	61.7	11.1	36.3
Institution (Public or private hospital)	44.4	38.3	88.9	63.7
Assistance during delivery				
Health professional (Doctor, nurse/midwife, ANM/LHV, TTBA)	60.7	57.4	92.8	77.2
Non-health professional (TBA, relatives or friends)	39.3	42.6	7.2	22.8
Total number of births	1594	1951	1550	1427

Note: Missing cases are excluded for computing percentages. TT- Tetanus Toxioid; ANM - Auxiliary Nurse Midwife; LHV- Lady Health Visitor; TTBA- Trained Traditional Birth Attendant; TBA- Traditional Birth Attendant.

Determinants of Utilization of Maternal Health Care Services

Antenatal care

Results from multivariate logistic regression models are given in Table 3 for the states of Andhra Pradesh and Karnataka. The state of Tamil Nadu was excluded from this part of the analysis as antenatal care was almost universal in Tamil Nadu. A woman was assumed to have received antenatal care if she was provided antenatal care at home or/and at a hospital. In Table 3 we provide estimated odds ratios only for those covariates in which we are particularly interested. However, the effects of a number of other covariates were statistically controlled for in the models (given below in each table).

What is clear from the table is that: i) not all variables are equally important discriminating factors for the use of antenatal care, and ii) the variables which are important in one state may not necessarily be relevant for the other state, and if they are important, not necessarily to the same extent or in the same direction as in the other state.

The order of birth was found to be an important predictor of receiving antenatal care in Andhra Pradesh but not in Karnataka. If the order of birth was 4 and above, the probability of a woman receiving antenatal care was reduced by 60 per cent compared to births of second order. There was no difference in the likelihood of obtaining antenatal care between first and second order births. Having had a still birth did not affect women's likelihood of receiving antenatal care in both Andhra Pradesh and Karnataka.

As access to and availability of health care services is expected to be greater in the urban areas, we would anticipate higher use among women in urban areas than among those in rural areas. However, surprisingly we found that women in urban areas were about 50 per cent

Table 3. Determinants of receiving antenatal care in two South Indian States (estimated odds ratios from logistic regression models; 1 if received from provider at home or elsewhere, 0 if not received)

Characteristics\$	Andhra Pradesh	Karnataka
Order of birth		
1 st order	1.19	1.47
2 nd order ®	1.00	1.00
3 rd order	0.63 *	1.45
4 th order and above	0.41 ***	0.70
Ever had a still birth		
No ®	1.00	1.00
Yes	1.39	0.97
Place of residence		
Rural ®	1.00	1.00
Urban	0.49 **	0.52 **
Education of women		
Illiterate	0.74	0.46 ***
Literate-primary Complete ®	1.00	1.00
Middle complete	0.79	0.91
High school +	1.80	3.36
Caste		
Other caste ®	1.00	1.00
SC and ST	0.76	0.94
Religion		
Hindu ®	1.00	1.00
Muslim	0.99	0.81
Christians	1.73	2.03
Work Status of Women		
Not working	1.82 ***	1.17
Working but not earning	0.61 **	0.93
Working and earning ®	1.00	1.00
Watch TV/ listen radio		
Low ®	1.00	1.00
Medium	1.44*	1.33 *
High	1.92*	1.63 *
Log likelihood	-446.58	-632.61
Chi square	184.70	237.95
N	1505	1842

® - reference category; *** significant at 1 per cent level; ** significant at 5 per cent level; * significant at 10 per cent level.

Note: \$ —Control variables included in the model are: age of the mother, husband's education and occupation, age difference between spouses, presence of toilet, possession of consumer durable, house type, and persons per room in the house.

less likely to have received antenatal care than those living in rural areas in both states. The analysis carried out by Govindasamy and Ramesh (1997) for south India as a whole showed that there was no significant difference between rural and urban woman in receiving antenatal check up even without controlling for other important confounding variables (eg. childhood place of residence).

It is generally believed that the demographic behaviour of members of 'socially backward' communities such as scheduled caste and scheduled tribes are different from that of other communities. But our results show that caste is not a differentiating factor for the use of antenatal services; similarly religion did not turn out to be a significant factor for the two south Indian states.

As expected, use of antenatal services was less likely among the illiterate women than among the literates. However, this was statistically significant only among women in Karnataka, not among those in Andhra Pradesh. Moreover, in Karnataka there was no difference between women of different educational levels (see Table 3).

The pattern of relationship between women's work status and antenatal care was not uniform across the states. Those women who were working but not earning (eg working in family business) were about 40 per cent less likely to use antenatal services than those working and earning in Andhra Pradesh. But, there was no significant difference in the use of antenatal care between earning and non-earning women in Karnataka. It was found that non-working women in Andhra Pradesh were about 82 per cent more likely to go for antenatal check-up compared to earning women.

Exposure to mass media (watching TV and listening to radio) was the only variable that was significant in both Andhra Pradesh and Karnataka for the use of antenatal care. Women with medium to high

degree of exposure to mass media were more likely to have received antenatal care in Andhra Pradesh and Karnataka than those with no or low degree exposure.

Tetanus Toxoid (TT) vaccine

Table 4 shows the estimated odds ratios from logistic regression models for TT vaccination (yes if received 2 or more doses; no if received none or 1 dose) for the states of Andhra Pradesh, Karnataka and Tamil Nadu. The factors that were significant for receiving antenatal care came out as being important for TT vaccination as well, although the existence, strength and direction varied by state. Higher order births, particularly over 4, were associated with reduced likelihood of obtaining TT vaccination in all three states. There is no differential in the use of TT vaccine between rural and urban areas in Andhra Pradesh and Tamil Nadu. It was found in Karnataka that urban women were less likely (odds ratio=0.72, $p<.10$) to obtain TT vaccine during pregnancy.

The pattern of relationship between level of education and use of TT vaccination during pregnancy was not uniform across the states. While illiterate women in Karnataka and Tamil Nadu were over 50 per cent less likely to have had TT vaccination than those with primary school level education, there was no difference between these two groups of women in Andhra Pradesh. Similarly while women with at least a high school diploma were over three times more likely to have had TT vaccination in Karnataka, this was not true in Tamil Nadu and Andhra Pradesh. In general, working and earning women were more likely to have obtained TT vaccination than others, particularly in the states of Andhra Pradesh and Tamil Nadu. While high degree of exposure to mass media increased the likelihood of having had TT vaccination in Andhra Pradesh and Karnataka, it was not the case in Tamil Nadu. As in the case

Table 4. Determinants of obtaining TT Vaccine in three South Indian States (estimated odds ratios from logistic regression models; 1 if received 2 or more doses, 0 if 1 dose or none)

Characteristics\$	Andhra Pradesh	Karnataka	Tamil Nadu
Order of birth			
1 st order	0.74	0.97	1.32
2 nd order ®	1.00	1.00	1.00
3 rd order	0.57 ***	0.95	0.47 **
4 th order and above	0.41 ***	0.64 **	0.40 ***
Place of residence			
Rural ®	1.00	1.00	1.00
Urban	0.81	0.72*	0.85
Level of education of women			
Illiterate	0.66	0.43 ***	0.45 **
Literate-primary complete ®	1.00	1.00	1.00
Middle complete	2.62 *	0.91	1.72
High school +	0.96	3.47 **	0.80
Work Status of Women			
Not working	1.08	1.28 *	0.80
Working but not earning	0.66 **	0.94	0.48 **
Working and earning ®	1.00	1.00	1.00
Watch TV/listen radio			
Low ®	1.00	1.00	1.00
Medium	1.24	1.15 *	1.22
High	1.50*	2.41 ***	1.30
Log likelihood	-722.47	-907.51	-345.74
Chi square	216.94	381.72	149.37
N	1495	1832	1344

® -reference category ; *** significant at 1 per cent level; ** significant at 5 per cent level; * significant at 10 per cent level.

Note: \$— Control variables included in the model are: age of the mother, women ever had a still birth, childhood place of residence, husband's education and occupation, caste and religion, age difference between spouses, presence of toilet, possession of consumer durable, house type, and persons per room in the house.

of antenatal care, caste and religion were not important covariates of use of TT vaccine in all three states.

Place of delivery

The estimated parameter values (odds ratios) for the dependent variable place of delivery (home vs health care institution) for the three states are given in Table 5. Women who had first order births were about one-and-a-half times to two-and-a-half times more likely to have delivered their babies at a health care institution (eg. hospital) than women who had their second order births in all three states. On the other hand, women with births of order 4 and above were less likely to do so. In Andhra Pradesh a woman who had a still birth in the past was about 45 per cent less likely to deliver the child in an institution compared to those who had not experienced still births at all.

Although urban residence was not an important differentiating factor for the use of antenatal care and TT vaccine, it increased the likelihood of institutional delivery by over two times compared to rural residence in all three states. Similarly, caste was an important factor for institutional delivery: women belonging to scheduled castes and tribes were less likely to have their babies at hospitals than other caste women particularly in Karnataka and Tamil Nadu. In Andhra Pradesh there was no difference between schedule castes and other caste groups in institutional delivery of births.

Illiterate women were more likely to deliver a baby at home relative to hospital in all three states compared to literates. However, the level of education does not seem to be a significant predictor for delivery at an institution relative to delivering at home in Andhra Pradesh and Tamil Nadu. In the case of Karnataka, women with higher education were more likely to deliver at hospitals (odds ratio=1.71) than delivering at home.

Table 5: Determinants of institutional delivery of birth in three South Indian States (estimated odds ratios from logistic regression models; 1 if delivered at health care institution, 0 if delivered at home).

Characteristics \$	Andhra Pradesh	Karnataka	Tamil Nadu
Order of birth			
1 st order	1.51 **	2.65 ***	1.42 *
2 nd order ®	1.00	1.00	1.00
3 rd order	0.78	0.94	0.77
4 th order and above	0.43 ***	0.70 *	0.53 ***
Women ever had a still birth			
No ®	1.00	1.00	1.00
Yes	0.55 **	0.62	1.21
Place of residence			
Rural ®	1.00	1.00	1.00
Urban	2.13***	2.21***	2.74***
Level of education of women			
Illiterate	0.49 ***	0.68 **	0.69 **
Literate-primary complete ®	1.00	1.00	1.00
Middle complete	0.93	1.31	1.49
High school +	0.88	1.71 **	1.27
Caste			
Other caste ®	1.00	1.00	1.00
SC and ST	1.07	0.56 ***	0.70 **
Religion			
Hindu ®	1.00	1.00	1.00
Muslim	1.20	1.02	0.64
Christians	0.45	1.74	0.86
Work Status of Women			
Not working	1.62 ***	1.16	1.53 ***
Working but not earning	0.68	0.94	1.09
Working and earning ®	1.00	1.00	1.00
Watch TV/listen radio			
Low ®	1.00	1.00	1.00
Medium	2.39 ***	1.41 **	1.08
High	3.11 ***	1.52 **	1.07
Log likelihood	-649.11	-836.00	-644.60
Chi square	599.88	775.22	461.84
N	1498	1833	1343

® -reference category ; *** significant at 1 per cent level; ** significant at 5 per cent level; * significant at 10 per cent level.

Note: \$— Control variables included in the model are: age of the mother, childhood place of residence, husband's education and occupation, age difference between spouses, presence of toilet, possession of consumer durable, house type, and persons per room in the house.

Non-working mothers were more likely to deliver their babies in institutions than working mothers in the states of Andhra Pradesh and Tamil Nadu but not in Karnataka. Similarly, those who had greater exposure to mass media were more likely to deliver at institutions than those who had less or no exposure, particularly in the states of Andhra Pradesh and Karnataka. There was no difference in terms of the place of delivery between women of different levels of exposure to mass media in the state of Tamil Nadu.

Assistance during delivery

Results presented in Table 6 show that the pattern of relationship between the covariates and assistance during delivery is broadly similar to that found for place of delivery. Women who had their first baby were more likely, and those with 4 or higher order births were less likely, to have been assisted by health professional at the time of delivery than those who had their second child. Illiterate women were less likely to receive assistance from health professionals than literate women. The relationship between work status and exposure to mass media on the one hand and assistance during delivery on the other was similar to that obtained in the case of place of delivery. But here it was significant only for the state of Andhra Pradesh, not significant for the other two states. The place of residence was significant in the states of Karnataka and Tamil Nadu. Women who resided in urban areas in these states were more likely to be assisted by health personnel during delivery than those who lived in the rural areas. The only result that is different is that Muslim women were about 40 per cent more likely to have been assisted by a health professional than their Hindu counterparts in Karnataka, but there were no religious differences in Andhra Pradesh and Tamil Nadu.

Table 6: Determinants of delivery assistance by health personnel in three South Indian States (estimated odds ratios from logistic regression models; 1 if assisted by health professional, 0 if assisted by untrained birth attendant, friends or relatives)

Characteristics\$	Andhra Pradesh	Karnataka	Tamil Nadu
Order of birth			
1 st order	1.33	1.78 ***	1.73 **
2 nd order ®	1.00	1.00	1.00
3 rd order	1.07	0.83	0.89
4 th order	0.48 ***	0.59 ***	0.66 *
Women ever had a still birth			
No ®	1.00	1.00	1.00
Yes	0.69	0.84	1.19
Place of residence			
Rural®	1.00	1.00	1.00
Urban	1.18	1.71***	1.88**
Level of education of women			
Illiterate	0.55 ***	0.54 ***	0.61 **
Literate-primary complete ®	1.00	1.00	1.00
Middle complete	0.89	0.92	1.63
High school +	2.63 *	0.89	1.62
Caste			
Other caste ®	1.00	1.00	1.00
SC and ST	0.90	0.49 ***	0.79
Religion			
Hindu ®	1.00	1.00	1.00
Muslim	1.34	1.41**	0.58
Christians	0.70	1.28	0.79
Work Status of Women			
Not working	1.28 *	1.07	1.28
Working but not earning	0.48 ***	1.12	0.75
Working and earning ®	1.00	1.00	1.00
Watch TV/listen radio			
Low ®	1.00	1.00	1.00
Medium	1.43 ***	1.04	1.31
High	1.75 ***	0.99	1.21
Log likelihood	-816.41	-990.70	-566.01
Chi square	389.47	527.08	297.13
N	1504	1841	1343

® -reference category ; *** significant at 1 per cent level; ** significant at 5 per cent level; * significant at 10 per cent level.

Note: \$— Control variables included in the model are: age of the mother, childhood place of residence, husband's education and occupation, age difference between spouses, presence of toilet, possession of consumer durable, house type, and persons per room in the house.

DISCUSSION AND CONCLUSIONS

In general, utilization of maternal health care services (antenatal check up, TT vaccine, institutional delivery, assistance of health personal during delivery) was higher in the south Indian states than in the northern ones (IIPS, 1995; Govindasamy and Ramesh, 1997). However, there were differences among the south Indian states: Kerala was the leader in the use of all reproductive health services followed by Tamil Nadu, Andhra Pradesh and then Karnataka. As shown in Table 7, the accessibility and availability of health care services was highest in Kerala followed by Tamil Nadu. Health care facilities were least accessible in the states of Andhra Pradesh and Karnataka. The utilization of maternal health care services in Kerala (receiving antenatal care, institutional delivery and delivery assisted by health professional) was about 2 to 8 times greater than in Andhra Pradesh after controlling for individual and household characteristics (see Table 7). Women in Tamil Nadu were one and a half to three times more likely to use maternal health care services than their counterparts in Andhra Pradesh. But women in Karnataka were about 25 per cent less likely to use maternal health care services than women in Andhra Pradesh. This is likely to be due to differentials in the accessibility and availability of maternal health care services in these states. For instance, in Kerala the population served per hospital (includes both government and private hospitals) was around 14 thousand, whereas in Karnataka it was 156 thousand. Similarly, the road length per 100 sq.km. in Kerala was highest (322) followed by Tamil Nadu (128). On the other hand, it was 60 and 72 in Andhra Pradesh and Karnataka respectively. Moreover, around 98 per cent of villages in Kerala have at least one health facility followed by Tamil Nadu (57%). But in Karnataka and Andhra Pradesh, only one-third of the villages have at least one health facility. We have also found that the magnitude of regional differences is not the same for all the maternal health care indicators

among the South Indian States. For instance, women in Kerala and Tamil Nadu were 8 and 3 times respectively more likely to deliver babies at health care institutions than women in Andhra Pradesh. The state level characteristics such as the availability and accessibility of health care facilities and program factors could also enhance the utilization of maternal health care services even among the illiterate women. For instance, illiterate women in Tamil Nadu and Kerala (results not shown here) had greater utilization of all the maternal health care services than the illiterate women in Andhra Pradesh.

Table 7: Regional differentials of utilization of maternal health care services controlling for socioeconomic characteristics (estimated odd ratios from logistic regression models).

State\$	Antenatal Care	TT vaccine	Place of delivery	Assistance during delivery
Andhra Pradesh ®	1.00	1.00	1.00	1.00
Karnataka	0.73 ***	0.68***	1.05	0.72 ***
Kerala	2.49 ***	0.89***	8.17 ***	2.86 ***
Tamil Nadu	1.55 ***	2.03**	2.94**	1.56***
Log Likelihood	-1405.37	-2413.55	-2523.00	-2707.00
Chi Square	737.97	1019.77	3312.48	1924.41
N	6091	6057	6069	6084

®- reference category; *** Significant at 1 per cent level; ** Significant at 5 per cent level; * Significant at 10 per cent level.

Note: \$—Control variables included in the model are: age of the women, order of birth, place of residence, childhood place of residence, caste, religion, women's education, husband's education, husband occupation, work status of women, media, type of house, owning durable goods, toilet facilities in the household, number of person per room.

Moreover, the role of various socio, economic, cultural and programmatic factors in influencing the pattern of utilization has varied in their effects depending on the state and the type of service. For example while mothers with first order births were more likely to deliver their babies at health care institutions than mothers with second order births, there was no difference between first and second order births for receiving antenatal care; similarly, while women belonging to scheduled castes and scheduled tribes in Karnataka and Tamil Nadu were less likely than others to deliver their babies in a health institution, it was not the case in Andhra Pradesh.

The order of birth was an important determinant for the use of maternal health care services in the south Indian states. It was found that for all indicators of maternal health care services higher order births decreased the likelihood of using the services in all three states. This corresponds to similar findings from elsewhere (Bhatia and Cleland, 1995; Elo, 1992). Lower parity woman tend to give careful attention to seeking antenatal care and delivery assistance due to their inexperience in pregnancy. Also, lower utilization of maternal health care services among higher parity women could be due to time and resource constraints faced by those with larger families (Wong et al., 1987; Elo, 1992; Bhatia and Cleland, 1995).

Urban residence increased the likelihood of institutional delivery and assistance during delivery. The rural-urban differential in the use of maternal health care services is likely to be due to differences in the availability of maternal health care facilities including the distance to the health care centre. Similar findings are also observed elsewhere (Govindasamy and Ramesh, 1997; Bhatia and Cleland, 1995). However, in this study we found that women living in rural areas were more likely to receive antenatal care than those living in urban areas. The analysis of

NFHS data for south India as whole by Govindasamy and Ramesh (1997) showed that rural and urban women did not differ in utilizing antenatal services. A finding similar to Govindasamy and Ramesh was also observed in a study conducted in Karnataka, in which only those women seeking antenatal care from the providers were considered (Bhatia and Cleland 1995).

It would be interesting to know why rural women are more likely to receive antenatal care even though availability and accessibility of health care services are usually low compared to urban areas. In the rural area, the Auxiliary Nurse Midwife (ANM), a multipurpose health worker plays a pivotal role in providing information on and services related to maternal and child health and family planning. The female health workers is expected to visit every household at least once in two months. She enrolls all the pregnant women in her area (consisting of 5000-6000 households) and provides antenatal care, supervise domiciliary services and also provide post-natal services for the mother and the child (Bhatia and Cleland, 1995). The higher likelihood for rural woman receiving antenatal check up after controlling for education, economic status and communication variables could be due to the role of ANM health workers who visit and provide antenatal care at home. In order to check this claim, we carried out a separate analysis of use of antenatal care by provider type (mothers visiting a provider vs provider visiting mothers). Results showed that the likelihood of women receiving antenatal care by visiting a provider (outside the home) was greater in urban areas than in rural areas — a contrast to earlier analysis — in both Andhra Pradesh (odds ratio=2.53, $p<.01$) and Karnataka (odds ratio=2.46, $p<.01$). This implies that health workers (ANMs) are playing a crucial role in providing maternal health care services, particularly providing antenatal care, to pregnant women in the rural areas of the southern states. Studies which evaluated the quality of services provided by health

workers with respect to frequency and regularity of outreach visits, time devoted by workers to outreach activities and duration of time spent with clients during outreach visits have shown significant shortcomings (see Koenig et al., 2000). However, a study conducted in Tamil Nadu and Karnataka indicated that 89 per cent and 93 per cent of women, respectively, reported having been visited by health worker within in the last three months (Roy and Verma, 1999). It is suggested that home visits by health workers could reduce the monetary and opportunity cost of pregnant woman in the rural areas and thereby increasing the utilization of reproductive health services (Arends-Kuenning, 1997).

We have also found that women's literacy is an important predictor for the use of maternal health care services in all three states. Illiterate women are less likely to use maternal health care services for delivery assistance and place of delivery compared to literate women in all the three states. However, in the case of TT vaccination, this was true only in the states of Karnataka and Tamil Nadu and for antenatal care, it was only in Karnataka. This result holds even after we have controlled for the childhood residence of women. It is often claimed that the relationship between female education and health-seeking behaviour may not be due to education per se, but due to women's childhood background for which education may serve as a proxy (Behrman and Wolfe, 1987). It is argued that analyses that do not control for childhood background may overstate the impact of education on health outcome. In our analysis we have controlled for childhood residence thereby removing the possible confounding of education effect by childhood residence.

Several reasons have been put forward why educated mothers use more maternal health care services than uneducated mothers in the literature. Educated women may have a greater decision making power on health related matters and also attach a higher value to the welfare

and their health. Further, educated mothers will have more confidence in handling the officials and have the ability and willingness to travel outside the home to seek services (Caldwell, 1979; Cleland and van Ginneken, 1988; Caldwell, 1979; Caldwell et al., 1983). It was expected that among the educated women, the decision making power within the household, awareness, knowledge and acceptance of modern medical treatment and health care institutions varies by their level of education. Consequently, number of years of schooling was positively associated with utilization of maternal health care services. However, we have found that utilization of maternal health care services do not differ significantly among the educated women by their level of education for most of the services. Moreover, the relationship is not uniform across states. In contrast to our findings, women with primary schooling did not differ from women with no schooling in receiving delivery assistance in Bangladesh and Thailand (Dharmalingam et al., 1999; Raghupathy., 1996). Also, evidence from several countries shows that the impact of education on utilization of maternal and child health services depends on the type of service and the social setting (Dharmalingam et al., 1999). All these studies including ours clearly demonstrate that illiteracy among women leads to underutilization of maternal health care services.

Non-earning working women were less likely to use maternal health care services compared to earning women in Andhra Pradesh (TT vaccine), Karnataka (antenatal check up) and Tamil Nadu (TT vaccine). This finding suggests that earning capacity could contribute to the use of maternal health care services by empowering women inside and outside the household (Mencher, 1988). It is also possible that earning women have greater exposure to accessing relevant information and knowledge regarding issues related to maternal and child health. It was also found that non-working woman's likelihood of seeking some maternal health care services was higher than among earning women in Andhra Pradesh

(delivery assistance) and Tamil Nadu (antenatal care and institutional delivery). This shows that women's work does not necessarily influence the utilization of some maternal health care services. It is possible that those not working are relatively well off compared to those working. Further, women's work in the developing countries is largely poverty induced and is likely to have a negative impact on the utilization of maternal health care services (Desai and Jain, 1994; Jose, 1999).

Although caste was not a significant determinant of antenatal care, it came out as important for place of delivery and assistance during delivery by health professionals. Women who belonged to scheduled castes and scheduled tribes were less likely to have institutional delivery than home births. This indicates that there could be a lack of access to health care services in these two states for the socially backward communities. In the rural areas, scheduled caste and scheduled tribe groups are usually living in a separate habitation, which is away from the main settlement. Also, in the urban areas, significant proportions of scheduled castes and scheduled tribes are living in slums (Appasamy et al., 1995). The health facilities are usually in close proximity to the main settlement area. The spatial disadvantage combined with social and economic seclusion of these groups, could be the reason for the relative under-utilization of maternal health care services among the members of scheduled caste and scheduled tribe communities.

The electronic media is an important source for information on the availability and importance of maternal health care services. The media could also be used to bring about changes in people's attitudes towards the use of modern medical services. Literature suggests that mass media are effective in information dissemination, which increases awareness about innovations, and fosters inter-personnel communication, which could facilitate behavioural changes allowing for the adoption of

new/different behaviours (Valente et al., 1996). Studies have shown that exposure to mass media promotes health-related behaviour including contraceptive use, and reproductive preferences and treatment for children (Bankole and Westoff, 1996; Retherford and Mishra, 1997; Rao et al., 1998).

We may conclude that determinants of maternal health care services are not same across states and for different maternal health care indicators. Although illiterate women are less likely to use maternal health care services, there was no difference among the educated. The differential in access to health care facilities between rural-urban areas is an important factor for lower utilization of maternal health care services, particularly for institutional delivery and delivery assistance by health personnel in the rural areas of the three states. Also, the health workers in the rural areas are playing a pivotal role in providing antenatal care in south India. It was also found the level of utilization of maternal health care services was highest in Tamil Nadu, followed by Andhra Pradesh and Karnataka. Part of the interstate differences in utilization could be due to differences in availability and accessibility.

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