Utilization of Maternal Health Care Services in India: Understanding the Regional Differences

Sonalde Desai
Lijuan Wu
B.L. Joshi

India Human Development Survey
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Sonalde Desai
University of Maryland College Park
sdesai@socy.umd.edu

Lijuan Wu
University of Maryland College Park
lwu@socy.umd.edu

B.L. Joshi
KARAM, Delhi
bljoshikaram@gmail.com

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Abstract

There is great regional variation on utilization of maternal health care services across India. While regional differences have long been established, why women in some states are more likely to utilize maternity care than in others still remains poorly understood. Research efforts to date have focused on controlling for such individual characteristics as education, age, parity, and household socioeconomic status in order to see if variations in these explain the regional variation. We take a different approach and argue that the observed regional differences in India reflect two major dimensions affecting maternity care utilization: (1) Marriage and kinship patterns which determine the extent to which households are willing to invest in women's health; and (2) Characteristics of the state and civil society which determine the extent to which households are willing to trust medical systems. Using the data from our newly collected India Human Development Survey 2004-2005, we examine these relationships using hierarchical linear models.

Regional Variation on Maternity Care in India:

Although a number of studies document positive associations between prenatal and delivery care and positive maternal and child health outcomes (e.g. (Bhatia 1993; Griffiths, Hindet, and Matthews 2001), the prevalence of maternal health care is still low in India. In 1998-99, only 200 out of 1,000 births received all recommended types of prenatal care[1]; and for every 1,000 births, 336 were delivered in a medical institution (International Insitute for Population Sciences (IIPS) and ORC Macro 2000). However, a remarkable regional variation exists in India on utilization of maternal health care. National Family Health Survey – II documents that Kerala has the highest rate of prenatal care use—649 out of 1,000 births received all recommended types of prenatal care, while the lowest prevalence was found in Uttar Pradesh—only 44 per 1,000 births received the same care (International Insitute for Population Sciences (IIPS) and ORC Macro 2000). Similarly, the use rate of institutional delivery could be as high as 930 per 1,000 births in Kerala and as low as 121 per 1,000 births in Nagaland. The striking differences across regions on prenatal care was also demonstrated even after controlling individual and household characteristics (Sunil, Rajaram, and Zottarelli 2006; Govindasamy and Desai 1999).

However, while these regional differences in maternal care are well recognized, the mechanisms through which they have formed remains unclear and demographic research has not been able to provide clear answers. We attribute this deficiency to two factors: (1) Lack of conceptual clarity; and, (2) Lack of appropriate data.

[1] Recommended types of prenatal care include three or more prenatal check-ups with the first check-up within the first trimester of pregnancy, two or more tetanus toxoid injections, and iron and folic acid tablets or syrup for three or more months.

Theorizing Health Care Utilization and Maternity Care:

Much of the research on health care utilization has been implicitly or explicitly influenced by two major and to some extent overlapping models, Health Belief Model targeting behavior and prevention (Rosenstock 1966) and Socio-Behavioral Model, targeting specifically illness behavior and overall use of medical care (Andersen 1968). The Socio-Behavioral Model, first advanced by Andersen (1968) has been particularly influential since it focuses on three sets of determinants of health service utilization: (1) Characteristics that **predispose** individuals to use formal health care systems such as age, gender, education, ethnicity, social networks, health beliefs etc.; (2) **Enabling resources** which allow individuals to use health care if they so choose, such as money, time, transportation and availability of health services; and, (3) Actual or perceived **need** for health care. In a way, this is a highly comprehensive model. Virtually any precursors to health care utilization can be fit into this structure.

However, it also directs our attention to individuals, rather than social structure. As Anderson (1995) indicates, "The model of health services' use initially focused on family as a unit of analysis because the medical care an individual receives is almost certainly a function of the demographic social and economic characteristics of the family as a unit. However, in the subsequent work I shifted to the individual as the unit of analysis because of difficulties of developing measures at the family level." A similar critique of the focus on individuals in the Health Belief Model has been advanced by Stephenson and Tsui (Stephenson and Tsui 2002).

Research on maternal health care and health care utilization continues to build on this tradition and consequently the focus seems to be on the impact of individuals'

characteristics on utilization of prenatal and maternity care (Elo 1992; Abbas and Walker 1986; Obermeyer and Potter 1991). In areas where substantial regional inequalities have been found, such as in India, attention is also directed at availability of health services to individuals in their communities (Sunil et al. 2006; Stephenson and Tsui 2003). This focus on health services in local areas is a way of moving beyond the focus on individual determinants of health care utilization. However, it still retains the basic assumption that individuals would use health care services if they knew about the services, could afford them and services are available.

In explaining regional variation in maternal care usage, this approach leads us to control for as many individual and service availability variables as possible to see if much of the regional variation disappears. Unfortunately, empirical research focusing on individual characteristics and health service availability has not been sufficient to explain the variation in maternal care utilization across states (Sunil et al. 2006). This leaves us searching for a better conceptual framework for explaining these regional differences.

Two developments in social sciences offer interesting possibilities. First, research from scholars working within traditions of feminist sociology, economics and anthropology suggests that the gender is an integral component of all decisions including health care utilization decision, particularly in the arena of reproductive health (Obermeyer 2001) and that gender is not reducible to such easily observable characteristics as education and employment (Presser and Sen 2000; Mason 1986). Second, a little farther a field from demography, medical sociology and medical anthropology have begun to question the way in which individuals begin to define need

for medical services and interact with health care systems (Pescosolido and Kronenfeld 1995; Clarke, Mamo, Fishman, Shim, and Fosket 2003; Yoder 1997).

This paper argues that in the Indian context, these two forces are key to understanding regional differences in women's utilization of maternity care.

Gender Systems and Health Care Utilization:

The "empowerment" factor is highly relevant in the Indian context. Research on intra-household gender inequality suggests that due to the gender inequality, the wealth of the nation or a household would not necessarily trickle down to women (Dwyer and Bruce 1988; Blumberg 1991; Visaria and Visaria Leela 1985; Anker 1998; Sen 1999) and be translated into utilization of maternal care. Data suggested that the main reasons reported by women for not using maternal health care services are the lack of the perceived need to use such services. Among the births without a prenatal check-up, about 60 percent was attributed to the reason of "not necessary" (International Insitute for Population Sciences (IIPS) and ORC Macro 2000). It should be acknowledged that the perceived need to a large extent is socially constructed (Andersen 1995). In a society where women are in a subordinate position, it is very likely that women's health are not considered as important as men's, resulting in a low demand on health care even among women themselves. On the other hand, at the societal level the investment in maternal health care may be insufficient due to the lack of interest in women's health.

It would be gross exaggeration to say that research on health care utilization has ignored gender inequality. It is increasingly believed that gender inequalities in society are likely to play an important role, and numerous empirical studies have examined the association between women's education, employment, bargaining power within the

household or the closeness to their natal family and their use of maternal health care services in India and other developing countries (Beegle, Frankenberg, and Thomas 2001; Bloom, Wypij, and das Gupta 2001; Miles-Doan and Brewster 1998; Obermeyer and Potter 1991) (Tomlinson 1979). Nevertheless, these studies have tended to see empowerment as a property of individuals and focused on such factors as control over resources and freedom of movement (Bloom et al. 2001; Griffiths and Stephenson 2001).

Research that explicitly focuses on women's empowerment has increasingly begun to suggest that instead of seeing empowerment solely as characteristics of the individuals, we need to see social contexts as empowering or disempowering women (Presser and Sen 2000). This argument is bolstered by the fact there are far greater differences in women's empowerment across different cultural contexts than between women within the same context (Mason 1995; Jejeebhoy and Sathar 2001; Basu and Amin 2000). This then suggests that models which include gender related variables in analysis at an individual level are misspecified (Smith 1989).

In the Indian context, some of the earliest research examining differences in gender relations across regions began with a focus on differences between the Dravidian kinship system in southern India and the rest of India (Dumont 1953; Karve 1965; Oberoi 1998). Following this line of research, a seminal article by Dyson and Moore recognized that regional differences on demographic outcomes such as fertility, age at first marriage, infant and child mortality, sex ratio, and utilization of maternal health care correspond with the north-south contrast on women's status resulting from the differences on marriage pattern (exogamy vs. endogamy) and the consequential kinship structure (Dyson and Moore 1983). In north India, exogamy is practiced. That is, spouses must be

unrelated in terms of their kinship and residence. In many North Indian villages, custom dictates that women may not marry within their own or neighboring villages because all men in these areas are like their brothers or uncles. In contrast, endogamous marriage is preferred in south India. There is virtually no prohibition to women marrying within their own village and often they tend to marry cross-cousins or even maternal uncles (Bittles 1994). Different marriage patterns have different implications for married women and their social interactions. Exogamous marriage generally uproots women from their natal home after the marriage, while under endogamous marriage, women remain contacts with their natal home and other social networks developed before the marriage. Consanguinous marriage is even more supportive of women because of the long term ties of kinship and affection between the two families. Therefore, women under endogamous marriage may have more social and moral support than their counterparts under exogamous marriage. Consequently, exogamy may result in less motivation on the part of the husband's family to invest in women's health and more restrictions on married women's ability to utilize health care services.

However, findings from empirical studies aiming to directly test the relationship between gender inequality and the regional variation on the use of maternal care services in India are inconclusive. The common practice in previous studies was to take the residual regional effects as the evidence of cultural differences on gender norms after controlling individual and household characteristics by statistics or by research design in multiregional analysis (Basu 1990; Jejeebhoy and Sathar 2001; De Janvry 1986). The residual approach leaves a lot of questions unanswered. First, accompanying the regional difference on gender relations, there are broad socioeconomic differences separating parts

of India from others (Govindasamy and Desai 1999). Similarly, although most studies attempt to control for some socioeconomic differences, there are still a lot of unmeasured differences with regard to the quality, amount, convenience, and cost of health care across regions as well as quality of infrastructure such as roads. Consequently, the residual effects of region in a large extent have mixed all the three factors emphasized by Shiffman (Shiffman 2000)—wealth, health, and empowerment. Direct measures of kinship structures will help to unravel the relative strength of empowerment perspective in explaining the regional differences on prevalence of maternal health care across the country.

Second, as advocates of women's empowerment perspective have argued, the concept is multidimensional (Mason 1986; Presser and Sen 2000; Das 2002). It is often observed that certain dimensions of women's autonomy might have stronger influence over some others, depending on the outcome concerning the researchers (Bloom et al. 2001). Furthermore, the regional difference on women's empowerment across India is not always consistent on all the dimensions and does not follow a clean north/south divide (Rahman and Rao 2004). For instance, while women in Punjab may suffer from strong limitations on their labor force participation, they don't experience much gender inequality on education. Hence, it is necessary to disentangle which aspects of the gender system are most crucial for understanding the regional variation in utilization of maternal health care services. From that perspective, more direct examination on the impact of marriage pattern and kinship structure, which has long been argued as one of the fundamental institutions affecting gender inequality across India, is of great merit.

Third, the inconclusiveness of the empirical studies may be at least partially explained by the disconnection between the theoretical argument and the empirical studies which did try to directly test the effect of marriage pattern and kinship structure. In theory, it is been suggested that the preference on endogamy versus exogamy has strongly affected the gender norms in different regions of India (Dyson and Moore 1983) which affect ***all*** women, regardless of their own marital relationships. In other words, it is the prevalence of certain pattern of marriage that is expected to display the contextual effects. In the empirical studies, nevertheless, usually it was just the individual level practice on endogamy versus exogamy that was included in the analyses. To solve the problem, a distinction needs to be made between contextual and individual effects of marriage pattern and kinship structure on maternal care.

Focusing on specific institutions—marriage and kinship—by directly measuring them at community as well as individual levels, our research aim to produce a more precise understanding on the contextual and individual influences of gender relations on regional variation of utilization of maternal health care service in India.

Health Systems and State Structures:

Although recent research has tried to incorporate availability of health services in the utilization model, conceptually it is assumed that health services form a constraint to health care utilization, where services are available, utilization will increase. Yet, empirical research in the Indian context and elsewhere often fails to find that availability of services automatically increases utilization or health outcomes (Stephenson and Tsui 2003; Sunil et al. 2006). This has led to calls for a deeper understanding of health systems and how they interact with people's lives.

Following recent thinking in medical anthropology (Yoder 1997) and medical sociology (Pescosolido and Kronenfeld 1995), we suggest that there is a need to take a broader look at the way in which state structures – of which health systems usually form a part – shape individuals' perceptions about the need for and utilization of medical services, particularly preventive health care. Most families anticipate that a pregnant woman will need care during delivery. However, moving from a traditional *dai* or midwife to seeking care from formally trained nurse or doctor requires a leap of faith which assumes that these providers are competent will provide useful service. It also requires finding good providers, having faith that they will be available at the time of the delivery (often in the middle of the night or during monsoon) and making connections in advance of the delivery.

This reflects a process of incorporation into formal systems which is similar for many different facets of life. Borrowing from banks instead of the local moneylender, using a bank account for savings instead of buying gold, complaining to the police to solve local crime issues instead of setting up citizen's vigilante committees, registering marriages instead of relying on common-law all reflect different dimensions of this integration into formal systems. To students of political science it would be obvious that we arguing that some states function well, and many different aspects of life in these states function well. Other states fail, often fail spectacularly, and health systems in these states are also less than confidence inspiring. Of course, health systems can be both private and public and in areas where public systems do not function, private systems can still function well and individuals could use private health care systems even if they do not have confidence in the public systems. Thus, whether state functioning – and

confidence in public medical system – has an impact on maternal care utilization remains an empirical question. However, our preliminary expectation is that government medical systems set a floor with respect to the quality of care and patient-doctor interaction. In states where public systems function well, private systems will also function well. In states where public systems do not function, private systems may or may not function.

We argue that differences in the way various Indian states function may help explain at least part of the difference in health care utilization. States that are generally better able to provide one type of service are also better able to provide another type of service. Thus, states which have better electricity provision, better functioning banks and development programs, will also have better functioning health systems with higher utilization rates.

Data and Measurement

In 2004-2005, University of Maryland and National Council of Applied Economic Research designed and fielded a survey of 41,000 households. This survey, India Human Development Survey 2004-2005, contained questions about health, education, employment and income and gender empowerment. The survey was conducted all over India – in 25 states and Union Territories (with the exception of Andaman Nicobar) – and included urban as well rural areas. In this paper, we have combined some of the smaller states and union territories, giving us a total of 23 states. This data collection was funded by grants from National Institute of Health to University of Maryland.

The survey collected detailed information on prenatal care, delivery, and postnatal care for the last birth and the birth next to the last one among women aged 15 to 49 and

had at least one live birth since January 2000. The sample for this analysis consists of 10,363 last births in the five year preceding the survey. Information on marriage norms on endogamy and exogamy in the community (caste or *jati*) was collected, as well as the actual marriage practice of the women themselves. In addition, one interesting question in the survey was about the location of the women just prior to their delivery: whether they stayed at their marital home, moved back to their natal home, or moved to other locations. The survey also collected a variety of household socioeconomic information including participation in government programs and infrastructure.

The dependent variable for this analysis is whether the last birth was professionally attended. This variable is constructed from two sets of questions, described in Table 1. First question provides a set of mutually exclusive categories, where did the delivery take place, with about 56 percent of the deliveries taking place at home. The next question asked, who attended the delivery and the respondent was allowed to check as many answers as she liked. We create an attended delivery variable by combining the two questions. Individuals who delivered in a hospital or nursing home are automatically coded one on attended delivery. Those who delivered at home but were attended by a trained nurse/midwife or doctor are also coded 1 on attended delivery. By this definition, 5,878 of the 10,363 births were attended by a professional.

Our key independent variables can be divided in two categories: individual level variables and state level variables. Individual level variables both control variables and substantive interesting variables. Control variables are age, education, whether this is the first birth, caste, religion, urban residence, and a household asset index as a measure of socioeconomic status. At individual level, the two most interesting variables of

substantive interest are endogamy (defined as whether the woman is married to her cousin, uncle or other relatives and/or married into her natal village/town) and residence just before delivery (marital home, natal home, or other). Additionally we control for two measures of medical service availability. The survey collected facility information for the nearest government facility which had at least an outpatient clinic. We asked these facilities whether they provided maternal and delivery services and asked them whether they had a list of medicines in their stock at the time of the interview. We have included availability of maternity services in this facility and number of medicines available in our analysis at the individual level.

Substantively, endogamy is the most interesting variable at an individual level. The role endogamy in shaping gender relations has been discussed above but it should be noted that there are two components to endogamy, the interest of husband's family in investing in woman's health and closeness to her natal family which can fill the gaps left by husband's family. However, since women often return to their natal families for delivery, even exogamous women may benefit from their parents' desire to invest in their daughters. Hence, we control for the location of delivery.

At community level, we are interested in two sets of variables: marriage and kinship patterns as markers of gender relations in a community and measures of state functioning. We used proportion of women in the state who are in endogamous marriage as a marker of kinship pattern and proportion of households which receive government housing assistance in the form of loans, grants, and land as a marker of state functioning. This latter deserves some justification. We were looking to find markers of state functioning which are unrelated to health facilities since we argue that states which

function in one arena also function in another. Housing assistance is a program set up by the central government but administered by the state and local governments. This assistance is given to rich and poor households through a variety of schemes. Wealthy households can get highly subsidized loans and a large number of urban cooperative housing societies are doing thriving business. Private sector mortgages in the housing sector are very low since commercial banks have not tended to provide housing loans. By many accounts, mortgage to GDP ratio in India is only 2 percent as opposed to 51 percent for the United States and 15-20 percent for Southeast Asian countries. Where financing is used, the government sector plays a far greater role than the private sector and although private financing is increasing, as of 2004, government housing finance corporations provided more than 56 percent of all loans (Karnad 2004). Poor households can get outright grants and land, particularly for additions like toilet construction. However, substantial red tape is involved in program administration with local officials receiving large kickbacks. Hence, whether these programs function well or not is an interesting marker of the state functioning.[2] Given that the economic development and quality of health care services are suggested by the literature as contributing factors to the utilization of maternal health care, the average household assets index of a state and the average number of medicines in stock in the public medical facilities in a state are also included in the analysis. The definitions and means of all the variables are listed in Table A1 in the Appendix.

[2] We see both marriage/kinship patterns and state functioning as latent concepts that can be measured by a variety of variables. Unfortunately, given a small number of states, we are unable to control for more than one variable for each concept. However, we have tried this analysis with other measures of marriage/kinship patterns such as practice of ghunghat/purdah and other measures of state functioning such as availability and regularity of electricity and the results were very similar to the ones presented in this paper.

Statistical Methods

First, we estimate four nested logistic regression models to see if some of the regional variations on the utilization of professionally attended delivery can be explained away by the individual and household characteristics.[3] Model 1 includes only the dummy variables on region and controlled for urban residence. Model 2 adds more individual and household level control variables—age, education, caste and religion, household asset index, whether the household is receiving housing assistance, and whether this is the first birth. In Model 3, endogamy and the residence just prior to the delivery are included in the model. The availability of maternity services and the number of medicines available are added in Model 4.

Next, to take into account the non-independence of the observations within state and to examine the impact of macro level characteristics on state level differences, we estimate two-level hierarchical models using HLM 6.0 (Raudenbush, Bryk and Congdon 2000) to analyze the regional differences on the use of professionally attended delivery. The individual level (level-1) equation is as follows:

(1) $\log[P_{ij}/(1-P_{ij})] = B_{0j} + \Sigma B_{kj}X_{kij} + r_{ij}$

where: P_{ij} = probability of using professionally attended delivery for individual i in state j

B_{0j} = the intercept (average use rate of professionally attended delivery) of state j

B_{kj} = the slopes for k individual-level variables

X_{kij} = individual-level variables (centered at their means)

r_{ij} = the individual-level error term

[3] The same models were estimated using dummy variables for states with 22 categories instead of 7 categories for regions but the results were very similar. For presentational simplicity, we only present the regional models here.

The state level (level-2) equation takes the form:

(2) $B_{0j} = \gamma_{00} + \Sigma\, \gamma_{0m} Z_{jm} + \mu_{0j}$

(3) $B_{kj} = \gamma_{k0}$

where: γ_{00} = the intercept of the state-level model

γ_{0m} = state-level coefficients for m state level variables Z_{jm}

μ_{0j} = the error term for the state-level random effect on the intercept

γ_{k0} = constant coefficients of B_{kj} across all states

At level-1, all but the region variables in the full model of the logistic regression are used to predict the probability of using professionally attended delivery. At level-2, each of the 23 states' intercept is modeled by four state-level variables of interest: the marriage and kinship pattern of the state, the government functioning of the state, the wealth of the state, and the quality of public medical facilities of the state. Six nested HLM models are developed. The first model includes only level-1 covariates and does not include any level-2 covariate. The next four models add the level-2 variables of interest one by one to see the independent explanatory power of each variable. The final model (full model) has all the level-1 and level-2 covariates. The nested structure allows us to examine the change of the variance components of those models systematically.

Results

Table 2 reports the coefficients of the nested logistic regression models for using professionally attended delivery. In Model 1, it is clear that there are significant regional differences on the utilization of professional delivery care. Compared to women from the central states (UP, Bihar, and Jharkhand), women from the other regions have higher probability of using delivery services. In Model 2, after controlling for individual and

household demographic characteristics such as women's age, education, caste and religion, household assets index, whether the household is the recipient of government housing support, and whether it is the delivery of first birth, the magnitudes of region coefficients decrease for most regions. However, the region effects on the use of professionally attended delivery remain large and statistically strong. For example, women in Western states of Gujarat, Maharashtra and Goa are nearly 3.5 times as likely to have an attended delivery as those in the central states. The addition of endogamous marriage and women's residence prior to the delivery in Model 3 does not modify the regional differences substantially, nor does the further control of the availability of delivery care services and the number of medicines available at a nearby public facility. In sum, the regional differences are strong and persistent from Model 2 to Model 4. It indicates that the individual and household covariates cannot effectively explain away the regional variations on the utilization of professionally attended delivery.

Practicing endogamy does not have statistically significant effect on the use of professionally attended delivery after controlling individual and household demographic and socioeconomic characteristics (see Model 3 and Model 4). However, the place where a woman stays just prior to the delivery matters. Relative to women going back to the natal home before the delivery, those who stay at the marital home are disadvantaged in using the delivery care service. As for the control variables, we see that urban women are better off in using the professionally attended delivery service. Education also makes a difference. Better educated women are more likely to use the service than illiterate women. Compared to high caste Hindu women, women from other caste and religion are disadvantaged, although the difference is not statistically significant for Scheduled Caste

women. The economic status of the family matters as well. The wealthier the family is, the more likely for a woman to deliver her baby with professional assistance. The likelihood of using the professionally attended delivery service increases if it is the first birth of a woman. All these effects are consistent with previous empirical studies on the utilization of maternal care services. The availability of public medical facility providing delivery service and the number of medicines available in the facilities do not affect the women's chances of using the delivery service in these logistic models, but as we will see later, living near a public facility with well stocked medicine closet is conducive to getting professional delivery care in hierarchical models.

From these logistic regressions, we move on to trying to explain the differences in maternal care utilization across different states within a hierarchical model. All variables from Model 5 of the logistic regressions, with the exception of regional dummy variables, are included in the individual level (level-1) regression of the HLM Model. In order to look at the impact of macro level variables on variation across states we add one macro level characteristic at a time in the level-2 model.[4]

The summary statistics of the nested HLM models are presented in Table 3. For the baseline model in which only level-1 predictors are included, the variance component on level-2 is 1.365. After introducing the state-level endogamy variable in the level-2 model, 23% of the state variations on the use of professionally attended delivery is diminished. Similarly, the state-level variable of government housing assistance alone diminishes about 21% of the state variations on the use of professional birth delivery service after it is added to the level-2 model. However, the average household assets index per state does not help in explaining the state variations on the use of delivery care.

[4] All variables are centered around the grand mean.

The average number of medicines available in the public medical facility per state only explains away less than 2% of the state variations on the outcome. The change of the variance component across the models shows that the marriage patterns and the functioning of state government are more effective in explaining the regional differences on the use of delivery care than are the economic development and the availability of public medical services. In the final model with all four components, about 35 percent of the variance across states is explained.

Furthermore, Table 3 presents the effects of the state-level variables on the individual-level intercept across states, that is, the between-state differences on the utilization of professional attended delivery care. The effect of endogamy is positive and statistically significant ($p < .05$): for states where the practice of endogamy is more pervasive, the use rate of professionally attended delivery is higher. The coefficient of government housing assistance is also significantly positive ($p < .05$). That is, the use rate of professionally attended delivery is higher in the states with better-functioning government. Nevertheless, the effects of the state-level asset index and average number of medicines are not statistically significant. The significant effects of endogamy and government housing assistance on the between-state differences decrease a bit but do not diminish after controlling asset and medicines in the level-2 model.

In the full HLM model with all level-1 and level-2 variables (Table 4), we see interesting contrasts on the individual and state level effects of endogamy, government housing assistance, household assets index and number of medicines. For endogamy, its sole effect at the state level is significant ($p < .05$) and the effect remains in the full model. However, at the individual level, the effect of endogamy is not significant. It is similar for

government housing assistance: its effect is significant at the state level but insignificant at the individual level. On the contrary, the effects of household assets index – a marker of household wealth-- and number of medicines – a marker of local facilities -- are significant at the individual level but insignificant at the state level. These findings imply that endogamy mostly works as contextual factor that facilitate the use of maternity care for *all* women, not as the individual factors that help only a fraction of women who are in endogamous marriage. As for wealth and the availability of medical facility, they are more effective at the individual level in improving women's use of maternity care. In addition, a well-functioned local government is also inductive to better utilization of maternal health care services.

There are some differences in findings between individual-level hierarchical models and logistic regression models since HLM adds more precision at the individuals level by removing the state level error term from the individual equation and allowing us, in effect, to look at within state differences. The caste/ethnicity differences are far stronger and consistently statistically significant in these models as is our marker for the quality of public health services, number of medicines current in stock at the public facility we visited. The quality of medical facilities is interesting, within a particular state context it is important and women who live near a highly stocked medical facility are more likely to use maternity care than those who don't. But it is not enough to explain the inter-state differences.

Table 1 Distribution (%) of Place of Delivery and by Whom the Delivery was Assisted

	Total	Professionally attended delivery[b]	
		Yes	No
Place of delivery			
Government hospital or clinic	21.5	41.0	0.0
Private nursing home	21.3	40.6	0.0
Home	56.3	18.0	98.4
Other	0.9	0.0	1.6
Who assisted with the delivery[a]			
A doctor	41.8	79.5	0.0
A nurse/ANM	38.8	73.7	0.0
A traditional midwife/Dai	44.6	20.2	71.0
A friend/relative	31.8	16.5	48.1
Other	12.6	8.2	17.2
Number of observations	10,363	5,878	4,485

Notes: Percentages are weighted, and frequencies are unweighted.

[a] Categories are not mutually exclusive.

[b] A birth delivered at government hospital/clinic or private nursing home, or was assisted by a doctor or a nurse/ANM is considered as professionally attended delivery; otherwise, it is not.

Table 2 Logistic Regression of Utilization of Professionally Attended Delivery

	Model 1	Model 2	Model 3	Model 4
Region (UP, Bihar, Jharkhand Omitted)				
Jammu & Kashmir, Himachal Pradesh & Uttaranchal	0.779***	0.413**	0.441***	0.466***
	(0.115)	(0.137)	(0.139)	(0.140)
Punjab, Haryana, Delhi & Chandighar	1.143***	0.413***	0.413***	0.453***
	(0.093)	(0.107)	(0.109)	(0.110)
Rajasthan, Madhya Pradesh, Orissa & Chhattisghar	0.289***	0.305***	0.310***	0.312***
	(0.070)	(0.081)	(0.081)	(0.082)
West Bengal, Assam, Sikkim & North East	0.664***	0.631***	0.669***	0.683***
	(0.092)	(0.104)	(0.105)	(0.107)
Gujarat, Maharshtra, Goa, Diu, Daman, Dadra & Nagar Haveli	1.595***	1.227***	1.241***	1.197***
	(0.081)	(0.092)	(0.094)	(0.096)
Karnataka, Andhra, Tamil Nadu & Kerala	2.502***	2.359***	2.398***	2.362***
	(0.092)	(0.100)	(0.102)	(0.104)
Urban	1.451***	0.972***	0.926***	1.048***
	(0.062)	(0.070)	(0.070)	(0.079)
Age		-0.003	-0.001	-0.001
		(0.005)	(0.006)	(0.006)
Education (illiterate omitted)				
Grade 1 to 6		0.455***	0.436***	0.435***
		(0.073)	(0.074)	(0.074)
Grade 7 to 9		0.781***	0.773***	0.776***
		(0.081)	(0.081)	(0.080)
Grade 10 to 11		1.111***	1.092***	1.093***
		(0.117)	(0.115)	(0.115)
Grade 12 to 15		1.552***	1.508***	1.502***
		(0.166)	(0.162)	(0.163)
Grade 15+ (College)		3.079***	3.039***	3.065***
		(0.332)	(0.332)	(0.332)
Social group (high caste Hindu omitted)				
OBC		-0.240**	-0.225**	-0.226**
		(0.086)	(0.086)	(0.086)
SC		-0.171*	-0.137	-0.134
		(0.092)	(0.092)	(0.092)
ST		-0.791***	-0.761***	-0.755***
		(0.117)	(0.118)	(0.118)
Muslim		-0.544***	-0.535***	-0.531***
		(0.100)	(0.102)	(0.102)
Chirstian, Jain, Sikh & Others		0.501*	0.517*	0.519**
		(0.224)	(0.223)	(0.224)

(Table 2 cont'd)

Household assets		1.757***	1.827***	1.842***
		(0.197)	(0.198)	(0.198)
Recipients of government housing support		-0.097	-0.091	-0.092
		(0.110)	(0.109)	(0.109)
First child		0.651***	0.639***	0.641***
		(0.075)	(0.076)	(0.076)
Endogamy			-0.042	-0.045
			(0.074)	(0.075)
Staying place prior to the delivery (natal home omitted)				
Marital home			-0.190*	-0.199**
			(0.075)	(0.075)
Other			1.470***	1.464**
			(0.190)	(0.191)
Access to birth delivery services				-0.077
				(0.083)
Access to medicine				0.024*
				(0.013)
Missing data on public medical facility				-0.292***
				(0.088)
Constant	-1.099***	-1.912***	-1.902***	-2.048***
	(0.059)	(0.218)	(0.226)	(0.251)
Log likelihood	-5833.20	-5157.67	-5081.72	-5072.16
(df)	(8)	(22)	(25)	(28)
Observations	10,363	10,363	10,363	10,363

Notes: Robust standard errors are in parentheses. A dummy variable for panel sample is controlled.

* p < .05, ** p < .01, *** p < .001 (one-tailed test).

Table 3 Summary of State Level Effects on Professionally Attended Delivery: Intercept-As-Outcome HLM Model

Variable	Coefficient	T-Ratio	P	Variance Component
No Level 2 Variables				1.365
Variables added individually				
Endogamy	3.630	2.200	0.020	1.047
Government housing support	8.160	2.387	0.013	1.082
Assets	1.177	0.348	0.366	1.430
Medicines	0.338	1.107	0.140	1.340
All Variables in the Model				
Endogamy	3.230	2.033	0.029	
Government housing support	7.028	2.170	0.022	
Assets	2.673	0.964	0.174	
Medicines	0.118	0.449	0.329	0.888

* Note: The p-value is based on one-tailed test.

Table 4 Full HLM Model on Utilization of Professionally Attended Delivery

Variable	Coefficient		Standard Error
State level			
Endogamy	3.230	*	(1.589)
Government housing support	7.028	*	(3.239)
Assets	2.673		(2.771)
Medicines	0.118		(0.263)
Constant	0.675	**	(0.200)
Individual level			
Urban	0.824	***	(0.070)
OBC	-0.275	***	(0.074)
SC	-0.236	**	(0.078)
ST	-0.832	***	(0.104)
Muslim	-0.436	***	(0.089)
Christian, Jain, Sikh & Others	0.147		(0.204)
Grade 1 to 6	0.393	***	(0.064)
Grade 7 to 9	0.663	***	(0.071)
Grade 10 to 11	0.890	***	(0.096)
Grade 12 to 15	1.353	***	(0.142)
Grade 15+	2.770	***	(0.261)
Age	0.008	*	(0.005)
Assets	2.113	***	(0.168)
Government housing support	-0.093		(0.091)
First child	0.641	***	(0.064)
Endogamy	-0.107		(0.064)
Maternal home	-0.038		(0.063)
Other places	1.334	***	(0.153)
Birth delivery service	0.032		(0.069)
Medicines	0.032	**	(0.011)
Missing data on public medical facility	-0.142	*	(0.075)

Notes: A dummy variable for panel sample is controlled at the individual level model.
Reference categories: social group = high caste hindu; education = illiterate; staying place prior to delivery = natal home.
* $p < .05$, ** $p < .01$, *** $p < .001$ (one-tailed test).

Table A1 Variable Definitions and Sample Means

Variable	Definition	Mean
Professionally attended delivery	Dummy = 1 for births delivered in health-care institutions or assisted by a doctor or a nurses/ANM	0.57
Age (15-49)	Women's age at the time of survey	27.38 (5.58)
Education		
Illiterate	Dummy = 1 for women with no schooling	0.43
Grade 1-6	Dummy = 1 for women with 1 to 6 years of schooling	0.18
Grade 7-9	Dummy = 1 for women with 7 to 9 years of schooling	0.18
Grade 10-11	Dummy = 1 for women with 10 to 11 years of schooling	0.11
Grade 12-15	Dummy = 1 for women with 12 to 15 years of schooling	0.06
Grade 15+	Dummy = 1 for women with 15 or more years of schooling	0.06
Social group--Combination of religion, ethnicity & caste		
High castes	Dummy = 1 for high caste Hindu	0.21
OBC	Dummy = 1 for other backward caste Hindu	0.31
Scheduled castes	Dummy = 1 for scheduled caste of any religion	0.22
Scheduled tribes	Dummy = 1 for scheduled tribe of any religion	0.09
Muslim	Dummy = 1 for non SC & non ST Muslim	0.14
Christian, Jain, Sikh & Others	Dummy = 1 for non SC & non ST Christian, Jain, Sikh and other religions	0.03
First child	Dummy = 1 if it is the delivery of a woman's first child	0.25
Household assets scale (0-1)	proportion of 12 non-electrical assets (clothes, shoes, cycle/bicycle, sewing machine, motor cycle/scooter, clock or watch, chair or table, cot, telephone, pressure cooker, car, and credit card)	0.49 (0.19)
Urban	Dummy = 1 for urban women	0.33
Recipients of government support on housing	Dummy = 1 if the household receives any support from the government for house construction, latrines, or chulha	0.07
Endogamy	Dummy = 1 if a woman is relater to her husband by blood or grew up in the same village/town as her husband	0.20

(Table A1 cont'd)

Staying place just prior to the delivery		
Marital home	Dummy = 1 for women staying at marital home before delivery	0.75
Natal home	Dummy = 1 for women staying at natal home before delivery	0.21
Other	Dummy = 1 for women staying at other places before delivery	0.04
Access to birth delivery services	Dummy = 1 for women living in PSUs with public medical facilities providing birth delivery services	0.48
Access to medicine (0-13)	Total number of medicines in stock in the best public medical facility of the PSU	9.34 (2.40)
Missing data on public medical facility	Dummy = 1 for women living in PSUs with no data on public medical facility	0.31
Region		
Region 1	Dummy = 1 for Jammu & Kashmir, HP, Uttaranchal	0.06
Region 2	Dummy = 1 for Punjab, Haryana, Delhi, Chandigarh	0.09
Region 3	Dummy = 1 for UP, Bihar, Jharkhand	0.21
Region 4	Dummy = 1 for Rajasthan, MP, Orissa, Chhattisgarh	0.22
Region 5	Dummy = 1 for West Bengal, Assam, Sikkim, and NE states	0.09
Region 6	Dummy = 1 for Gujarat, Maharashtra, Daman & Diu, Goa, Dadra & Nagar Haveli	0.14
Region 7	Dummy = 1 for Andhra Pradesh, Tamil Nadu, Karnataka, Kerala, Pondicherry	0.19
Average household assets per state	mean of the scale of household non-electrical assets of a state	0.52 (0.08)
Average stock of medicines per state	mean of the number of medicines stocked in public medical facilities of a state	9.41 (0.81)
Pervasiveness of endogamy per state	proportion of women practicing endogamy in a state	0.26 (0.13)
Accessibility of government housing support	proportion of households receiving government support for house construction, latrines, or chulha in a state	0.08 (0.07)

Notes: Means are unweighted. Standard deviations in parentheses for continuous variables.

Table A2 Use of Professionally Attended Delivery by State, Urban, and Rural

State	Urban (%)	Rural (%)	Total (%)	N
Jammu & Kashmir	80.6	72.3	73.6	119
Himachal Pradesh	85.7	39.7	44.8	317
Punjab, Chandigarh	78.4	64.4	69.5	384
Uttaranchal	67.7	30.4	37.3	149
Haryana	81.7	44.8	53.5	359
Delhi	77.4	86.7	77.9	139
Rajasthan	62.9	32.5	40.8	510
Uttar Pradesh	46.4	20.7	25.3	1,338
Bihar	62.5	35.1	37.3	570
Sikkim, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya	78.8	67.5	69.0	168
Assam	52.4	15.9	20.6	155
West Bengal	88.7	41.1	50.5	570
Jharkhand	73.4	35.9	43.2	308
Orissa	69.4	34.8	39.1	572
Chhatishgarh	62.6	40.1	45.9	408
Madhya Pradesh	62.4	69.4	40.3	833
Gujarat, Daman & Diu, Dadra & Nagar Haveli	92.1	52.9	69.8	564
Maharashtra	91.1	65.6	76.3	888
Andhra Pradesh	93.6	77.5	82.2	510
Karnataka	86.5	68.9	76.2	748
Goa	100.0	96.2	97.9	34
Kerala	100.0	98.1	98.6	343
Tamil Nadu, Pondicherry	99.1	86.8	92.8	377
Total	78.6	43.2	52.4	10,366

Notes: Percentages are weighted, and frequencies are unweighted.

Table A3 State Characteristics on Wealth, Public Medical Facility, Marriage Pattern, and Government Functioning

State	Household assets	Stock of medicines	Endogamy	Housing subsidy
Jammu & Kashmir	0.52	8.54	0.33	0.01
Himachal Pradesh	0.59	8.50	0.22	0.07
Punjab, Chandigarh	0.67	9.55	0.16	0.03
Uttaranchal	0.54	9.35	0.18	0.14
Haryana	0.61	9.76	0.05	0.03
Delhi	0.66	9.00	0.27	0.01
Rajasthan	0.50	9.01	0.21	0.02
Uttar Pradesh	0.50	9.35	0.17	0.04
Bihar	0.43	7.55	0.11	0.10
Sikkim, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya	0.54	9.36	0.57	0.11
Assam	0.51	9.60	0.27	0.02
West Bengal	0.46	9.21	0.46	0.06
Jharkhand	0.52	9.13	0.25	0.08
Orissa	0.42	8.28	0.27	0.13
Chhatishgarh	0.45	9.96	0.09	0.03
Madhya Pradesh	0.42	9.81	0.15	0.06
Gujarat, Daman & Diu, Dadra & Nagar Haveli	0.56	9.80	0.22	0.07
Maharashtra	0.50	10.42	0.36	0.08
Andhra Pradesh	0.49	11.45	0.36	0.23
Karnataka	0.42	10.75	0.34	0.15
Goa	0.67	9.25	0.08	0.27
Kerala	0.58	9.47	0.32	0.16
Tamil Nadu, Pondicherry	0.49	9.37	0.50	0.06
Total	0.52	9.41	0.26	0.08

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