

CONFIDENCE IN MEDICAL SERVICES AND IMMUNIZATION AGAINST TUBERCULOSIS IN INDIA

A Thesis
submitted to the Faculty of the
Graduate School of Arts and Sciences
of Georgetown University
in partial fulfillment of the requirements for the
degree of
Master of Public Policy
in Public Policy

By

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Washington, DC
April 15, 2011

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ABSTRACT

Despite the various international and national efforts behind reaching universal coverage of child immunization rates against tuberculosis in India, coverage rates remain between 70% and 80%. This study attempts to gain insight into the reasons behind India's tuberculosis immunization rate by analyzing whether a mother's attitude and experience with medical services is a significant factor in whether or not children receive the Bacille Calmette-Guerin (BCG) vaccine against tuberculosis. Using the 2005 Indian Human Development Survey, a logistic regression model was used to examine the extent to which four key variables—mother's confidence in medical services, treatment from medical staff, usual wait time for medical treatment and confidence in government services—are associated with whether mothers immunized their children with the BCG vaccine. The results indicate that mothers with high confidence in medical services and mothers who have received positive treatment from medical staff are more likely to have their child vaccinated from tuberculosis. Given these results, policy implications include building trust and a positive impression of medical clinics within households by focusing on creating and developing a sustainable long-term patient-staff relationship and concentrating on improving the quality of delivered health services. Additionally, the results indicate that initiatives to improve child immunization rates against tuberculosis should be approached in conjunction with other social and economic development

initiatives such as improving mother's education and her means to access information about vaccination campaigns.

ACKNOWLEDGEMENTS

Thank you to my thesis advisor Harriet Komisar for her insight and guidance and to classmates and friends for their support.

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INTRODUCTION

Tuberculosis (TB) remains a leading cause of death in India. According to the World Health Organization (WHO), India has an estimated two million new cases of TB a year and is ranked fifth in the WHO top 22 highest-burden countries in terms of estimated TB cases and TB incident rates (WHO, 2009). Anti-TB strategies in India can be broadly divided into two approaches: Directly Observed Treatment Short-course, a global strategy that targets adult TB, and India's Universal Immunization Program which uses the Bacille Calmette-Guerin (BCG) vaccine to immunize children against TB.

Despite the long history of the BCG vaccination in India as well as international and national efforts and funding behind immunization policies, BCG vaccination rates have yet to reach universal coverage. Several studies have looked at mother's education, household income, gender of child, birth order and access to vaccinations as important determinants explaining India's vaccination rates. Other studies have analyzed parents' attitude and perception about vaccination to better understand the lack of parental demand for child vaccination within the context of India and other developing countries. Building upon these findings, this study measures the extent to which a mother's attitude and experience with medical services, particularly her confidence in medical services, influences her decision to immunize her child against TB. Holding other demographic, access to information and access to BCG vaccination factors constant, this study hypothesizes that higher confidence levels in medical services will be associated with a higher likelihood of a child receiving the BCG vaccination against TB. The analysis is conducted using data from the 2005 Indian Human Development Survey, a nationally representative household survey.

BACKGROUND

Currently, the policy for TB vaccinations for infants is part of the government-run Universal Immunization Program that provides vaccinations free of charge for six vaccine-preventable diseases: tuberculosis, diphtheria, pertussis (whooping cough), tetanus, polio and measles.

India's TB policy for child immunization is based on the distribution of the BCG vaccine through various levels of public health services. India's BCG vaccine campaign began in 1948 with funding from the United Nations Children Fund (UNICEF) and training and support from a Scandinavian vaccination initiative called "The International Tuberculosis Campaign" (Brimnes, 2011). In 1985, the BCG campaign became linked to the global Expanded Program of Immunization¹ and within India became part of India's Universal Immunization Program.

The preventive health system in India is managed by the Central and State authorities with 73% of the funding from government sources (World Bank, 1997). The preventive health system is particularly focused on providing services to territorial areas with one Community Health Center for every 100,000 Primary Health Care Centers for every 30,000 people (20,000 for remote or rural areas) (Das and Das, 2003; Radwan, 2005). For every 5000 people (3000 in mountainous areas) an Auxiliary Nurse Midwife is posted who uses the Primary Health Center as her base (Government of India, 1985). In 1992, the Universal Immunization Program was augmented with India's Child Survival and Safe Motherhood Program (Das and Das, 2003).

¹ The Expanded Program of Immunization was established in 1974 by the World Health Assembly with a goal that all children would be able to receive life-saving vaccines. Targeted diseases include: diphtheria, whooping cough, tetanus, measles, poliomyelitis and tuberculosis.

With this change, Auxiliary Nurse Midwives became the main providers for maternal services and child vaccination in their placement communities.

In terms of immunization coverage, the Universal Immunization Program has had mixed results with discrepancies across states and households (Das and Das, 2003). Furthermore, studies show there has been little improvement in services between 1987-1996 and that the poorest households remain marginalized, only capturing 10% of government subsidies (Radwan, 2005). According to Radwan (2005), the bureaucratic Primary Health Care Center structure, focus on inputs rather than results, lack of capacity and accountability of services, poor infrastructure and incoherent budgeting are all reasons behind the government's failure to meet its immunization target of 85% coverage of all infants.

Aside from public health care services, there has been a rapid increase in private health care services.² Private sector medical institutions broadly comprise rural medical providers, who are usually unqualified medical practitioners, not-for profit sector providers, usually religious based organizations funded by international organizations and for-profit sector providers, who generally have better quality services than public sector providers (Radwan, 2005). Though the magnitude of the influence of the private sector is unknown, private-for profit medical institutions are usually small facilities (clinics and nursing homes) that are individually owned (Radwan, 2005). Particularly, in the poorest states where the public sector is ineffective, private sector medical institutions provide the majority of health care. Cost of treatment differs depending on the type of private clinic, generally city clinics have higher rates and rural and remote clinics have lower fees (Radwan, 2005). However, many private for-profit hospitals

² After Indian independence in 1947 about 8% of all medical centers were privately owned. By 1990, private health clinics constituted 60% of all medical institutions (Radwan, 2005).

often provide concessionary or free services to the poor (Radwan, 2005). Though private sector clinics are frequented more than public sector services, the private sector provided only 10% of all immunizations in India in 1995-1996 (Radwan, 2005). However, this number is rapidly increasing as the private sector is becoming heavily involved with delivering primary and preventive health care in maternal and child care (Radwan, 2005).

LITERATURE REVIEW

To my knowledge, there are no studies that examine the relationship between mother's confidence in medical services and child vaccination rates against TB in India. Several related studies, however, analyze the relationship between parents' confidence in medical services and child vaccination rates against various diseases in developing countries, including one study that looks particularly at India (Das and Das, 2003). A second set of related studies analyze parents' attitude and belief about vaccination and child vaccination rates. Other studies of immunization rates in India test mother, child and household demographic factors as well as household accessibility to vaccinations and their affect on child immunization rates.

Confidence in Medical Services and Vaccination Rates

Das and Das (2003) conducted an ordered probit regression using data they collected in the Garhwal region of India to examine whether households do not actively demand immunization for their child on the basis of costs and benefits but rather on the basis of how much trust they have in the immunization provider. The authors found trust to be a particularly important factor under the conditions of incomplete information about the benefits of vaccinations.

Streefland and colleagues (1999) argue that trust or "confidence in reliability of a person or system..." is particularly important in modern society in the absence of traditional security systems of kinship. Within medical systems, each access point with health facilitators becomes an opportunity to build trust or mistrust. Jheeta and Newell (2008) further corroborate the findings by Streefland and colleagues, illustrating that if parents believe the vaccine or

organization administering the vaccine will cause harm to their child, they will resist vaccination regardless of their knowledge about the vaccination benefits. For example, in the early 1990s at the height of Hindu-Muslim conflict, Muslim parents sought vaccinations for their children from private clinics rather than government medical staff because fear that the Hindi government-sponsored vaccinations were linked to sterilization (Nichter, 1995).

Parental Attitudes toward Vaccination and Vaccination Rates

Akmotov and colleagues (2009) conducted a multivariable logistic regression using survey data collected from 934 families living in Bishkek, Kyrgyzstan to find that parents with lower education, with rural residency and limited information about vaccinations had a negative attitude and belief toward child vaccinations, resulting in lower vaccination rates, compared to that of parents with positive attitudes about vaccinations.

Despite the lack of quantitative studies regarding parents' confidence in medical services and child vaccination, health care providers recognize that parents' attitude and experience with medical services is an important factor in whether parents seek vaccination for their children (WHO, 1998). WHO policy recommendations identify the need to change parents' negative experiences with medical services through compensation and through changing staff behavior toward clients (Jheeta and Newell, 2008; WHO, 1998).

Other Studies of Child Immunization in India

Most quantitative studies about child immunization in India analyze how demographic factors of the mother, child or household affect whether children receive vaccinations or not.

A common determinant is mother's education level, which indicates her level of knowledge about the benefits of vaccination. Parasher (2005) conducted four different hierarchical linear models in a logistic regression using data from the 1994 Human Development Profile Index (HDPI) and 1991 Indian Census to find that literate mothers are more likely to seek preventive health care for their children than non-literate mothers. Parasher's study goes beyond the individual level of mother's education but also looks at district level influences: non-literate mothers who live in villages where other mothers have access to higher education benefit from the positive externalities created by other mothers' education. In another study, using data from the National Family Health Survey 1992-1993, Govindasamy and Ramesh (1997) ran a logistic regression model with the following variables: mother's education, residency, employment status, caste, religion, child's sex, birth order and child's age. The results indicate that even after controlling for a mother's social-economic status, mother's education level remains the most significant indicator of a mother's likelihood to access preventive child health care, particularly child immunization.

Other studies analyze the effect of religion on child immunization. Using the National Family Health Survey 2005-2006, Yadav and Guruswamy (2010) conduct a multilevel logistic regression across different Indian states to find that in certain states, being Muslim negatively affected a child's odds of being immunized. The study also found that family structure, gender of child, access to immunization were statistically significant in some states, but not in others.

Gender of child is an important determinant in the Indian context. Choi and Lee (2006) use the National Family Health Survey 1992-1993 on a probit and bivariate probit model to show that gender of child has a significant influence on whether parents participate in immunization

programs. Parents place more value on infant boys than girls and subsequently are more likely to vaccinate and provide better nutrition to boys than girls.

Aside from mother and child demographic determinants, there are several quantitative studies on household determinants such as residency and wealth, and their affect on child immunization rates. Yazbeck and Pande (2003) and Yazbeck and Gaudin (2006) use data from the Indian National Family and Health Survey of 1992-1993 and 1998-1999 respectively, to test the correlation between household wealth, gender, regional inequality and immunization rates. Both studies found that wealthier states have better immunization coverage than poorer states. Yazbeck and Pande (2003) found that rural households had lower immunization rates than urban households. But amongst the rural and urban households, poorer households had lower immunization rates than richer households. Mohanty and Pathak (2009) further corroborate these results indicating a large disparity in utilization of health care services, with the poor being at a disadvantage.³

Other studies look at access to immunization (distance to clinic and cost), distribution and supply of immunization in relation to immunization rates in India. Ghei and colleagues (2010) use data collected from the U.S. Agency for International Development Environmental Health Project in 2005 from Agra slums to find that distance to health centers matters in whether or not a child receives immunization. Using a multinomial logit regression, the authors show that if an urban health center was located within 2 kilometers in a slum, it was twice as likely for a child to be immunized than if the health center was located further than 2 kilometers. In the case of rural India, Datar and colleagues (2007) conclude that expanding fixed health infrastructure

³ Their study used data from the National Family and Health Survey conducted during 1992–2005 for the states of Uttar Pradesh and Maharashtra.

would have modest immunization coverage but not lead to universal coverage. Using a logistic regression on data from the National Family Health Survey conducted in 1993-1998, Datar and colleagues also find that expanding community health workers does little to increase vaccination rates. However, the study found that availability of a nearby well staffed and well stocked primary health clinic or hospital had a positive effect on immunization rates in comparison to lower level health clinics. From these studies, it seems distance and quality of health clinics matter.

Increasing supply-side determinants is a common issue faced by local, national and international organizations working toward increasing coverage of child immunization as many countries lack the basic infrastructure, supplies and technologies and medical expertise and personnel to provide widespread and easily accessible immunization services (Ryman et al., 2008). As this literature review indicates, both supply and demand-side determinants are important in determining child vaccination rates. Pegurri and colleagues (2005) surveyed a literature review of 680 studies analyzing the cost-effectiveness of demand, supply and demand-supply interventions to improve immunization services in developing countries. They found that both demand and supply interventions are equally cost-effective, yet it is difficult to find concrete results as interventions are contextually different. Thus interventions to increase immunization coverage requires a contextual understanding of both demand and supply factors.

CONCEPTUAL FRAMEWORK AND HYPOTHESIS

There are several determinants that influence whether or not a mother seeks immunization for her child. Various global health initiatives and national policies to increase child immunization as one method to decrease child mortality rates in developing countries have used different approaches to provide incentives for mothers to immunize their children. Largely, the focus is to either increase the supply or the demand for immunization. A growing number of campaigns with enough capacity often attempt to increase a combination of both. Supply of immunization in developing countries, particularly India, depends on international and domestic funding for immunizations, domestic immunization policies and distribution of supply. Whether mother's can access the supply is largely determined by various constraints: availability of and distance to clinic or immunization campaign, funding to travel and in the case of a private clinic, price of immunization and permission from her husband, older male or female in the family to visit a health clinic.

Demand for immunization in India is expected to differ by mother and household characteristics such as financial status, education level, knowledge about the benefits of immunization, knowledge and experience with TB, perception of quality of immunization and health care and experience with as well as trust of government policies and medical services. Confidence that medical services will provide good treatment is a vital factor because mothers who believe medical staff is competent, medical technology and medicine is effective and that medical services exist for their benefit are likely to have a higher demand for immunization than mothers who do not have the same level of confidence.

Other social and economic barriers are caste and religion. The Indian caste system is a system of social stratification and restriction by endogamous hereditary groups largely within the Hindi population. The Indian Constitution outlawed caste-based discrimination in 1950, however, social and economic discrimination continue today.⁴ Similarly, given the minority status of Muslim and other religions, it is expected that mothers belonging to certain castes and religions face additional social and economic barriers to seeking vaccination for their children.

Also particular to the Indian context is the large role that gender plays in the mother's decision to immunize her child or not. Indian society is patriarchal and studies have shown that boys are more likely to be vaccinated than girls (Bonu et al., 2003). This is particularly the case, if the youngest child is a girl in a family of all daughters.

This paper examines the extent to which mother's attitude and experience with medical services are determining factors in whether a mother immunizes her child or not. More specifically, this paper tests the hypothesis that the higher a mother's level of confidence is in medical services, the higher the likelihood that she will vaccinate her child, controlling for demographic factors, factors associated with access and information about vaccination campaigns as well as access to the BCG vaccination and other health care factors.

⁴ To counter the discrimination, the Indian government has identified people belonging to certain oppressed castes and tribes under the official titles of Scheduled Caste and Scheduled Tribe. Those identified under the Scheduled Caste or Scheduled Tribe can benefit from protective arrangements, affirmative action and certain social and economic provisions. Other Backward Classes is another group of people who do not fall into either the Scheduled Caste or Scheduled Tribe category, but still experience the same discriminations and subsequently, also receive similar governmental benefits as Scheduled Caste or Scheduled Tribe.

DATA AND METHODS

DATA

This paper uses data from the Indian Human Development Survey (IHDS) collected during November 2004-October 2005. The survey was organized by researchers at the University of Maryland and the National Council of Applied Economic Research, New Delhi, and funded by the National Institutes of Health. The database is a nationally representative, multi-topic survey covering 41,554 households in 1,503 villages and 971 urban neighborhoods in 383 districts in India. Data collected at the household and individual level cover the following topics: health, education, employment, economic status, marriage, fertility, gender relations and social capital. IHDS also has data collected at the medical facility, village and school levels that describe the characteristics of each entity. The household data were collected through two one-hour interviews.

The IHDS sample design is a combination of two separate samples: 27,654 households first contacted in 1994-1995 and a re-interview sample of 13,900 households. Of the re-interviewed households, roughly half were interviewed by IHDS in 2004-2005. The remaining half was randomly selected from the stratified 1994 sample design. Split households that remained in the village were re-interviewed.

This paper is an individual-level analysis using the household and education file for the women and household characteristics. This study also uses the medical file which includes the characteristics of village clinics and the village file which includes data about village immunization programs. The household and education file has a sample size of 41,544

households while the medical file and village file respectively have 3,777 clinics and 1,501 villages. Additionally, a design weight is provided in the data for national population estimates.

ANALYSIS PLAN

Study Population

Given the global and national efforts behind increasing coverage of immunization against vaccine preventable diseases among children in India, this paper aims to better understand the factors that determine a mother's likelihood to vaccinate her child against TB. An approximate population of mothers who have the option of having their child vaccinated with the BCG vaccine or not was determined using the information provided from the data.

This paper uses a subsample from the IHDS Household data file consisting of women ages fifteen to forty-nine who have been married. Using child identifying variables from the data, the study population was restricted to identify women who gave birth between January 2000 and October 2005 to a surviving child. The study focuses only on the youngest child born to the mother within this timeframe. If there was missing information about the child's BCG immunization status, the observation was excluded from the study. The restrictions changed the study population to women ages sixteen to forty-nine.

The identified study population from the IHDS Household data file was merged with the IHDS Medical Facility file at the village level. The IHDS Medical Facility file is survey data of the basic characteristics, supplies and services of 3,777 randomly chosen clinics in India. Due to a discrepancy in the number of surveyed villages in the Household data file and the number of surveyed villages in the Medical Facility file, the study population was restricted to the number of matched observations in the Medical Facility file to retain variables of interest. The final study population consists of 7,778 mothers of young children.

Regression Model

This paper uses the logistic regression model:

Log (odds of child received the BCG vaccine) = $\beta_0 + \beta_1$ *Demographic Variables + β_2 *Confidence level in medical services + β_3 *Treatment by medical staff + β_4 *General wait time to receive medical services + β_5 *Confidence in Government + β_6 *Access to Information about Vaccination Campaigns + β_7 *Access to BCG Vaccination and Health Care

Dependent Variable

Child Received BCG Vaccine: This is a binary variable indicating whether a child has received the BCG immunization against TB or not. The answer was identified by the recording of BCG vaccination on the child's immunization card or by verbal verification if immunization card was missing. This dependent variable refers to the BCG immunization status of the youngest child born to the mother between January 2000 and October 2005.

Demographic Variables

Age: This set of binary variables indicates a mother's age (reference group, 16-25): 26-35 and 26-49. This variable was included in the analysis because mothers are expected to have different attitudes and perceptions about immunization depending on their age. Older mothers are more likely to have their child vaccinated than younger mothers because they are likely to have more knowledge and experience.

Number of Children: This set of binary variables indicates the number of children a mother has (reference group, one child): two, three and four or more. The number of children a mother has could influence her decision on whether to vaccinate her youngest child, given her past experiences with raising children.

Caste: This group of binary variables specifies the mother's caste (reference group, Other Backward Classes): High Caste, Scheduled Caste, Scheduled Tribe and other. Those in the Other Backward Classes, Scheduled Caste and Scheduled Tribe are likely to face additional social and economic restraints to health services. It is expected that mothers in these Castes are less likely to have their child immunized.

Religion: This set of binary variables identifies a mother's religion (reference group, Muslim): Hindi and Christian, Sikh, Jain, Buddhist and Other. India has a long history of Hindu-Muslim conflict which has carried through to contemporary society and is expressed in the form of ongoing religious riots (Brass, 2003). There is particularly a strong distrust among the Muslim minority population of Hindu majority led government policies. At the height of Hindu-Muslim conflict in the 1990s, the Muslim population believed the Hindu government's immunization program as a mechanism of Muslim control (Nichter, 1995). Given this history of distrust, it is expected that Muslim mothers are less likely to have their children immunized than Hindu mothers.

Education: This group of binary variables indicates the mother's education level (reference group, no school): grade 1-6, grade 7-9 and grade 10 or higher. It is expected that mothers with higher education will have a higher likelihood of having their children immunized.

Household Poverty: This group of binary variables indicates a household's poverty level based on monthly consumption per capita and the official poverty line (reference group, poor (0-100%)): near poor (100%-150% of the poverty level), low income (150%-200% of the poverty level), middle income (200%-300% of the poverty level) and high income (300% and above the poverty level). It is expected that children of poor and near poor households are less likely to be immunized from TB.

Residency: This binary variable indicates whether the mother has rural or urban residency. Households with rural residency are likely to have less access to information about vaccination and vaccination campaigns as well as less access to medical clinics with vaccination programs.

Attitude and Experience with Medical Services and Government Variables

Confidence Level in Medical Services: This set of binary variables indicates a mother's level of confidence in medical services (hospitals and doctors) to provide good treatment (reference group: hardly any): a great deal, only some and unknown. It is expected that a mother with a great deal of confidence in medical services is likely to have her child immunized because she trusts the medical institution. This is a key factor in assessing the demand a mother has for her child's immunization.

Treatment by Medical Staff: This set of binary variables indicates the mother's type of experience with medical staff (reference group, mothers who describe their treatment from medical staff as "somewhat nicely"): nicely, not nicely and unknown. Mothers who have had a positive experience with medical staff are likely to be more responsive to medical services.

Usual Wait Time to Receive Medical Services: The following binary variables indicate a mother's usual wait time before receiving medical assistance (reference group, over 30 minutes): 0-15, 16-30 minutes and unknown. It is expected that mothers who have experienced long wait times before receiving medical services are less likely to seek immunization for their child because they have a higher opportunity cost of seeking care than that of mothers with a shorter wait time.

Confidence Level in Government: This set of binary variables assesses the mother's level of confidence in government services to look after the people. The categories range from a great deal, only some, hardly any (reference group) and unknown. Because India's child immunization programs are government funded and promoted, it is likely that a mother's perception of the government could influence her decision to seek vaccination for her child.

Access to Information about Vaccination Campaigns Variables

Watches TV: This group of binary variables indicates whether a mother never watches television (reference group), sometimes watches television, regularly watches television or unknown.

Information about immunization campaigns is often announced on television. Mothers who regularly watch television are expected to have more information about vaccination campaigns and subsequently more likely to have their child vaccinated.

Public Campaign to Promote Anganwadi Immunization Program: This binary variable indicates whether there is a public campaign to promote an Anganwadi immunization program in the village or not. Anganwadi workers are frontline health care workers who are integrated into the local community and have a direct and close relationship with parents and children as well as with government health service providers. Implementing and monitoring child vaccination falls under the responsibility of Angandwadi workers. It is predicted that mothers living in villages with a public campaign are more likely to seek vaccination for their children. This variable has a large number of missing data because not all villages are in the data.

Access to BCG Vaccination and Health Care Variables

Type of Medical Facility in Village: Public (reference group), private, public and private and other medical clinics are the categories for this set of binary variables. This variable provides insight into the type of services that are accessible to a mother. Public clinics that provide immunization programs are free of charge to mothers, whereas private clinics charge a fee. It is possible that the type of clinic available influences a mother's likelihood to get her child vaccinated. Given that public clinics are free of charge, it is expected that mothers who live in villages with public clinics or public and private clinics are more likely to have their children vaccinated than mothers with access to only private or other medical clinics.

Village Clinic has Child Immunization Program: This set of binary variables is categorized by clinic has immunization program, clinic does not have immunization program (reference group) and unknown. The availability of a child immunization program is likely to influence whether a child is immunized or not. Mothers living in a village with a child immunization program are expected to be more likely to have their child immunized.

Village Clinic has BCG Vaccination Stock: The binary variable of whether a clinic has a BCG stock or not, indicates the supply of vaccinations. Mothers accessing clinics with a BCG vaccination stock are more likely to have their child vaccinated.

Annual Number of Immunization Campaigns in Village: The number of immunization campaigns ranges from zero, one, two or more (reference group) and an unknown number in this set of binary variables. It is expected that the higher the number of immunization campaigns in a village, the more likely mothers in the village will seek vaccination for their children. The unknown category is a result of missing data from villages that were randomly not surveyed.

Needs Permission to Visit Health Facility: This binary variable specifies whether a mother needs to ask for permission from her husband, elder male relative or elder female relative to visit a health facility. This is an important variable because it indicates the level of access a mother has to a health clinic and also the gender dynamics within a household in terms of health

decisions regarding children. It is expected that women who need permission to visit health facilities are less likely to have their child immunized.

RESULTS

DESCRIPTIVE RESULTS

The study's sample of 7,778 people consists of women between age sixteen and forty-nine who gave birth to a surviving child between January 2000 and October 2005. The study focuses on the last child born to the mother as of the date of the survey (which was conducted between November 2004-October 2005). The sample represents approximately 38 million women in India. Of these women, 28% did not have their child immunized with the Bacillus Calmette-Guerin (BCG) vaccine against TB and 72% of the women did (see Table 1).

Ninety percent of the women were within the age range of 16-35 and 10% of the women were between the ages 36-49. Of the surveyed women, 22% have one child, 29% have two children and 50% have three or more children. Most of the women belong to the Other Backward Classes (45%), while 4% belong to the High Caste. Eighty percent of the women follow the Hindu religion, 14% are Muslim and the remaining 5% are Christian, Sikh, Jain, Buddhist or another religion. Of these women, about half of the women have received no education (51%), 17% have received primary education and roughly 30% have received secondary education from grade 7-15. Correspondingly, a little over 60% live in poor or near poor households while 8% of the women are from high-income households. Most of the households have rural residency (80%) but 21% live in urban areas.

This study looks specifically at mother's attitude and experience with medical services using four key variables: confidence of medical services, treatment from medical staff, wait time to receive medical treatment and confidence in government services.

Table 1. Characteristics of Study Population

Variable	Unweighted		Weighted	
	Number	Percent	Number (in millions)	Percent
Total	7,778	100.0%	38.9	100.0%
Dependent Variable				
Child has received Bacillus Calmette-Guérin (BCG) vaccination				
No	1,756	22.6%	10.9	28.0%
Yes	6,022	77.4%	28.0	72.0%
Demographic Variables				
Age				
16-25	3,132	40.3%	15.6	40.2%
26-35	3,836	49.3%	19.0	48.9%
36-49	810	10.4%	4.2	10.9%
Number of Children				
1	1,790	23.0%	8.4	21.7%
2	2,342	30.1%	11.3	29.0%
3	1,672	21.5%	8.4	21.7%
4 or more	1,974	25.4%	11.0	27.6%
Caste				
High castes	340	4.4%	2.0	4.3%
Other Backward Classes	3,315	42.6%	17.4	44.7%
Scheduled Caste	1,727	22.2%	9.1	23.3%
Scheduled Tribe	707	9.1%	3.3	8.5%
Other	1,689	21.7%	7.4	19.2%
Religion				
Hindu	6,166	79.3%	31.5	80.9%
Muslim	1,122	14.4%	5.6	14.2%
Christian, Sikh, Jain, Buddhist, Other	490	6.3%	2.0	4.9%
Education				
No school	3,711	47.7%	20.0	51.4%
Grade 1-6	1,331	17.1%	6.5	16.8%
Grade 7-9	1,190	15.3%	5.7	14.6%
Grade 10-15	1,410	18.1%	5.8	15.0%
Unknown	136	1.8%	0.9	2.3%

Table 1 Continued

Variable	Unweighted		Weighted	
	Number	Percent	Number (in millions)	Percent
Household Poverty				
0-100% of poverty level	2,389	30.7%	12.3	31.7%
100%-150% of poverty level	2,232	28.7%	12.0	30.6%
150%-200% of poverty level	1,294	16.6%	6.4	16.5%
200%-300% of poverty level	1,130	14.5%	5.0	12.9%
300% and above poverty level	733	9.4%	3.2	8.2%
Residency (2001 Census)				
Rural	5,755	74.0%	30.7	78.9%
Urban	2,023	26.0%	8.2	21.1%
Attitude and Experience with Medical Services and Government				
Confidence level in medical services				
A great deal	5,019	64.5%	24.4	62.9%
Only some	2,001	25.7%	10.1	26.0%
Hardly any	710	9.1%	4.1	10.6%
Unknown	48	0.6%	0.2	54.0%
Treatment by medical staff				
Nicely	4,853	62.4%	22.8	58.6%
Somewhat Nicely	2,224	28.6%	12.2	31.4%
Not nicely	69	0.9%	0.3	0.8%
Unknown	632	8.1%	3.6	9.3%
Usual wait time to receive medical services				
0-15 minutes	4,146	53.3%	20.2	52.0%
16-30 minutes	2,090	26.9%	10.3	26.5%
over 30 minutes	860	11.1%	4.4	11.4%
Unknown	682	8.8%	4.0	10.1%
Confidence in Government				
A great deal	2,149	27.4%	11.2	28.7%
Only some	3,767	48.4%	18.9	48.7%
Hardly any	1,730	22.2%	8.1	20.8%
Unknown	132	1.7%	0.7	1.8%

Table 1 Continued

Variable	Unweighted		Weighted	
	Number	Percent	Number (in millions)	Percent
Access to Information about Vaccination Campaigns				
Watches TV				
Never	3,071	39.5%	17.1	43.9%
Sometimes	1,862	23.9%	9.4	24.1%
Regularly	2,710	34.8%	11.8	30.3%
Unknown	135	1.7%	0.7	1.7%
Public Campaign to promote Anganwadi immunization program				
No	757	9.7%	5.2	13.3%
Yes	4,956	63.7%	25.4	65.2%
Unknown	2,065	26.6%	8.4	21.5%
Access to the BCG Vaccination and Health Care				
Type of medical facility in Village				
Public	792	10.2%	3.7	9.5%
Private	1,509	19.4%	6.8	17.5%
Public and Private	5,410	69.6%	28.1	72.2%
Other	67	0.9%	0.3	0.8%
Village clinic has a child immunization program				
No	1,380	17.7%	6.5	16.8%
Yes	6,394	82.2%	32.3	83.2%
Unknown	4	0.1%	--- ^a	0.1%
Village clinic has a stock of the BCG vaccination				
No	2,010	25.8%	10.1	26.1%
Yes	5,768	74.2%	28.8	73.9%
Annual number of immunization campaigns in villages				
0	294	3.8%	1.6	4.0%
1	103	1.3%	0.7	1.9%
2 or more	4,664	60.0%	24.0	61.6%
Unknown	2,717	34.9%	12.6	32.4%
Needs permission to visit health facility				
No	1,453	18.7%	7.4	18.9%
Yes	6,319	81.2%	31.5	80.9%
Unknown	6	0.1%	--- ^b	0.1%

Source: Author's analysis of data from the 2005 Indian Human Development Survey.

^a 18,000.

^b 32,000.

Sixty-three percent of the mothers have a great deal of confidence in medical services, while 26% have only some level of confidence and 11% have hardly any confidence that hospitals and doctors will provide good treatment. In terms of specific experience with medical staff, nearly 90% of the women have had positive experiences: 59% expressed they have been treated nicely and 31% expressed they were treated somewhat nicely by medical staff. Only 1% has had negative experiences. Similarly, most mothers wait less than 30 minutes to receive medical services (78%), but 11% have reported that their general wait time has been over 30 minutes. Compared to mother's confidence in medical services, mother's confidence in government services is low. Only 29% strongly believe that their government will look after them while more than 60% have only some (49%) or hardly any (21%) confidence in government services. Because immunization campaigns are sponsored by the government, the impression mothers have toward government services could influence their attitude toward immunization programs.

This study also analyzes mothers' access to information about vaccination campaigns. Within this category is the mothers' television watching habits and whether or not mothers live in villages that have had public campaigns to promote Anganwadi immunization programs. Information about immunization programs is highly televised. Thirty percent regularly watch television, while 44% of the mothers never watch any television. On the other hand, 65% of the mothers live in villages with public campaigns to promote immunization programs and 13% have no programs at all.

Aside from mothers' access to information, mothers' access to the BCG vaccine and health care was also analyzed. This category examines the type of medical facility available in

the village, whether the village clinic has a child immunization program and a stock of the BCG vaccine. It also observes the annual number of immunization campaigns in the village and whether a mother needs permission to visit a health clinic or not. The study finds that most mothers have access to both public and private clinics (72%), while 10% have access only to a public health facility and 18% have access only to a private clinic. Most mothers also live in villages with clinics that have child immunization programs (83%) and clinics with a stock of the BCC vaccination (74%). Sixty-two percent of the mothers live in villages that have two or more immunization campaigns annually. On the other hand, the study finds that 81% of the mothers need permission from a husband or elder male or female family member to visit a health facility.

REGRESSION RESULTS

This logistic regression estimates the odds of a woman's youngest child receiving the BCG vaccine against TB, among mothers of children between the ages 0-5. The four key variables of interest in this regression model are confidence level in medical services, treatment by medical staff, general wait time to receive medical services and confidence in government. These variables reflect the mothers' attitude and experience of medical and government services. The regression results indicate that mothers with a strong confidence in medical services have a positively statistically significant influence on the likelihood of the youngest child receiving the BCG vaccine against TB compared with mothers with little confidence in medical services. Mothers who have received positive treatment by medical staff also have a positive statistically significant influence on the likelihood of the youngest child receiving the BCG vaccine against TB compared with mothers who felt they received somewhat less positive treatment. The other two key variables are not statistically significant.

The regression results signify that the odds of a child receiving the BCG vaccine are 69% higher if the mother has "a great deal" of confidence in medical services and 33% higher if the mother has "some" level of confidence in medical services compared to mothers with "hardly any" confidence in medical services (see Table 2). Additionally, the odds of a child receiving the BCG vaccine are 41% higher if the mother reports having been treated nicely by medical staff than for children with mothers who experienced "somewhat nice" treatment from medical staff.

Table 2. Logistic Regression Analysis of Child Immunization with Bacille Calmette-Guérin (BCG) Vaccine

Variable (reference group)	Coefficient	Odds Ratio	P Value	95% Confidence Interval of Odds Ratio	
Demographic Variables					
Age (16-25)					
26-35	0.56 ***	1.75	0.000	1.42	2.16
36-49	0.40 **	1.49	0.011	1.10	2.02
Number of Children (1)					
2	-0.15	0.86	0.229	0.67	1.10
3	-0.46 ***	0.63	0.001	0.48	0.83
4 or more	-0.89 ***	0.41	0.000	0.31	0.55
Caste (Other Backward Classes)					
High Castes	0.35	1.41	0.145	0.89	2.25
Scheduled Caste	0.03	1.03	0.800	0.83	1.27
Scheduled Tribe	-0.02	0.98	0.894	0.73	1.31
Other	0.34 ***	1.41	0.003	1.13	1.76
Religion (Muslim)					
Hindi	0.79 ***	2.20	0.000	1.76	2.75
Christian, Sikh, Jain, Buddhist, Other	0.78 ***	2.18	0.000	1.46	3.27
Education (No School)					
Grade 1-6	0.62 ***	1.86	0.000	1.49	2.32
Grade 7-9	1.01 ***	2.73	0.000	2.05	3.64
Grade 10-12	1.05 ***	2.87	0.000	2.08	3.95
Unknown	-0.88 ***	0.41	0.001	0.25	0.68
Household Poverty (0-100% of poverty level)					
100%-150% of poverty level	-0.29 ***	0.75	0.006	0.61	0.92
150%-200% of poverty level	-0.23 *	0.80	0.081	0.62	1.03
200%-300% of poverty level	0.00	1.00	0.993	0.75	1.33
300% and above of poverty level	0.24	1.27	0.207	0.87	1.86
Residency (Rural)					
Urban	-0.80 *	0.45	0.016	0.23	0.86

Table 2 Continued

Variable (reference group)	Coefficient		Odds Ratio	P Value	95% Confidence Interval of Odds Ratio	
Attitude and Experience with Medical Services and Government						
Confidence level in medical services (Hardly any)						
A great deal	0.53 ***		1.69	0.000	1.31	2.18
Only some	0.28 *		1.33	0.044	1.01	1.75
Unknown	0.80		2.23	0.125	0.80	6.22
Treatment by medical staff (Somewhat nicely)						
Nicely	0.35 ***		1.41	0.000	1.19	1.68
Not nicely	0.45		1.56	0.262	0.72	3.41
Unknown	-0.44		0.64	0.300	0.28	1.49
Usual wait time to receive medical services (over 30 minutes)						
0-15 minutes	-0.03		0.97	0.796	0.76	1.24
16-30 minutes	0.16		1.17	0.234	0.90	1.52
Unknown	0.30		1.36	0.495	0.57	3.25
Confidence in Government (Hardly any)						
A great deal	-0.06		0.94	0.611	0.74	1.19
Only some	-0.07		0.93	0.492	0.75	1.15
Unknown	-0.43 *		0.65	0.078	0.41	1.05
Access to Information about Vaccination Campaigns						
Watches TV (Never)						
Sometimes	0.22 *		1.25	0.030	1.02	1.53
Regularly	0.69 ***		1.99	0.000	1.61	2.48
Unknown	0.07		1.07	0.805	0.62	1.84
Public Campaign to promote Anganwadi immunization program (No)						
Yes	0.46 ***		1.59	0.001	1.22	2.07
Unknown	1.37 ***		3.92	0.000	1.88	8.18

Table 2 Continued

Variable (reference group)	Coefficient	Odds Ratio	P Value	95% Confidence Interval of Odds Ratio	
Access to the BCG Vaccination and Health Care					
Type of medical facility in village (Public)					
Private	0.52 ***	1.69	0.005	1.17	2.44
Public and Private	0.20 *	1.23	0.093	0.97	1.56
Other	0.18	1.20	0.597	0.61	2.38
Village clinic has a child immunization program (No)					
Yes	-0.05	0.95	0.738	0.70	1.29
Unknown	-1.05	0.35	0.331	0.04	2.90
Village clinic has a stock of the BCG vaccination (No)					
Yes	0.43 ***	1.54	0.000	1.21	1.96
Annual number of immunization campaigns in villages (0)					
1	-0.62	0.54	0.131	0.24	1.20
2 or more	-0.44 *	0.64	0.017	0.45	0.92
Unknown	-0.18	0.84	0.426	0.54	1.30
Needs permission to visit health facility (Yes)					
No	0.10	1.11	0.325	0.90	1.36
Unknown	1.67	5.29	0.199	0.42	67.23
Constant	-1.21	-----	0.000	-----	-----

Source: Author's analysis of data from 2005 Indian Human Development Survey.

N=7,778

*Indicates statistically significant at the 90% confidence level.

**Indicates statistically significant at the 95% confidence level.

***Indicates statistically significant at the 99% confidence level.

^a People with missing or unknown information were indicated as 'Unknown.'

Contrary to expectation, there is not a statistically significant relationship between the likelihood of the youngest child receiving the BCG vaccination against TB and the variables, usual wait time and confidence in government services.

The results also indicate that a mother's demographic factors are important in determining the probability of the youngest child receiving the BCG vaccine. Older mothers (26-49) are more likely to have their child vaccinated against TB than younger mothers (16-25). More specifically, the odds of a child receiving the BCG vaccine are 75% higher if the mother is between the age range 26-35 and 49% higher if she is between ages 36-49 compared to odds of a child receiving the BCG vaccination if born to a younger mother. Additionally, the more siblings a child has, the less likely the child will receive the BCG vaccination. The regression results show that the odds of a child receiving the BCG vaccine are 37% less if the child has two siblings and 59% less if the child has three or more siblings compared to the odds of a child who has no siblings. The mother's religion is also a statistically significant factor in the odds of a child receiving the BCG vaccine. Compared to children of Muslim mothers, the odds of a child receiving the BCG vaccine is 120% higher if the mother is Hindi and 118% higher if the mother is Christian, Sikh, Jain, Buddhist or another religion. Surprisingly, a mother's caste has no statistical significance in determining whether a child receives the BCG vaccine or not with the exception of mothers that indicated they belong to "other" caste.⁵ The results indicate that a child born to a mother in the "other" category is more likely to receive the BCG vaccination than one born to a mother in the Other Backward Class caste.

⁵ "Other" indicates a person who no longer associates with the Indian Caste system or falls outside the Caste system because they are not Hindi.

Like religion, mother's education level is highly statistically significant and has the strongest relationship, among other demographic variables, with the odds of a child receiving the BCG immunization. The regression results show that the higher a mother's education level, the higher the probability her child receives the BCG immunization. Compared to a child born to a mother with no education, the odds of a child receiving the BCG vaccine are 86% higher if the mother has had grade 1-6 education, 173% higher if she has had grade 7-9 education and 187% higher if the mother has received grade 10-15 education.

The regression results show that household factors also matter. Unexpectedly, households with urban residency are less likely than households with rural residency to have their child vaccinated against TB. The odds of a child receiving the BCG vaccine are 55% lower if the household is located in urban areas compared to if the household is located in rural areas. Equally unexpected are the regression results showing how household poverty levels influence whether a child receives the BCG vaccination or not. It was expected that households with higher income would have a higher probability of ensuring their child was vaccinated against TB. However, the results show that compared to poor households, the odds of a child receiving the BCG vaccine are 25% lower for a child from a near poor (100%-150% of the poverty level) household and 20% lower for a child from a low-income (150%-200% of the poverty level) household. Regression results of other household income levels are not statistically significant.

Variables measuring access to information about vaccination campaigns have a positive relationship to the odds of a child receiving the BCG vaccination. As expected, mothers who watch television are more likely to have their child vaccinated against TB than mothers who do not watch television. Similarly, mothers who live in villages with public campaigns promoting

immunization programs are more likely to have their child receive the BCG vaccination compared to mothers with no access to such campaigns.

The study also points to interesting results about how access to the BCG vaccination and health care is related to the likelihood of a child receiving the BCG vaccination. The regression results indicate that the odds of a child receiving the BCC vaccine are 69% higher if the household lives in a village with only private clinics compared to if the household lives in villages with only public clinics. Villages with only private clinics may be an indication of the wealth of the community. Another interesting result indicates that there is a high probability for a child to receive the BCG immunization if the village clinic has a stock of the BCG vaccination, but there is no evidence of a relationship between the odds of the child receiving the immunization and whether the village clinic has a child immunization program. The results also show the odds of a child receiving the BCG vaccination are 36% lower if there are two or more annual village immunization campaigns compared to the odds of having no immunization campaigns, which was unexpected. Also contrary to expectation, whether a mother needs permission to visit a health clinic has no statistical significance on the odds of her child receiving the BCG vaccination.

DISCUSSION

This study used a logistic regression to analyze whether there is a relationship between a mother's attitude and experience with medical services and her decision to immunize her child against TB. Attitude and experience were measured by four key variables: confidence in medical systems, treatment by medical staff, wait time for medical treatment and confidence in government services. The results indicate that mothers who have a high confidence in medical services and have had positive experiences with medical staff are more likely to seek BCG vaccination against TB for their child than mothers with low confidence and negative experiences with medical services. The results are consistent with the hypothesis that there is a relationship between mother's confidence in medical services and whether her child receives the BCG immunization for the two key variables mentioned above, but results were not statistically significant for the other key variables, usual wait time and confidence in government services.

In concurrence with findings from numerous other studies, mother's education proved to be a highly significant determinant in a child receiving the BCG vaccination. Age and number of children were also significant: older mothers and mothers with fewer children have a higher probability of vaccinating their children against TB than younger mother and mothers with three children or more. Also in concurrence with other studies, non-Muslim mothers were more likely to seek vaccination for their children than Muslim mothers. The magnitude for likelihood of child receiving the BCG vaccination for non-Muslim mothers is exceptionally strong (odds of a child receiving the BCG vaccine is 120% higher if the mother is Hindi and 118% higher if the mother is Christian, Sikh, Jain, Buddhist or another religion compared to the odds of a child receiving the BCG if mother is Muslim) indicating that religion is an important factor. It is

unclear as to what extent social memory of past Hindu-Muslim conflict that was played out in prior vaccination campaigns influences the disparity found in vaccination rates today.

Also in accord with the findings in other studies is the importance of mother's knowledge and information about the BCG vaccination in relation to having her child vaccinated. If the mother watches television and therefore is more likely to see information about vaccination campaigns, or is exposed to village vaccination campaigns her child is more likely to receive the BCG vaccination.

In contrast to the findings of past studies, this study found that immunization rates were lower for children of urban households than rural households, after controlling for other factors in the model. This difference in results could be explained by the increasing focus on rural primary health care through private or public health services. This difference could also be an indication that rural residency itself is not as significant a factor as other factors linked to rural residency such as lower levels of education or access to information about immunization campaigns, in relation to the likelihood of a child receiving the BCG vaccination. Also in contrast to previous studies, the results for this study show that poor households are more likely than near poor and low-income households to have their children immunized. Reasons for these results are unclear and require further study.

Limitations of this study include omitted variable bias and other methodological limitations in terms of missing information and reverse causality. The study could have an omitted variable bias because it does not include variables indicating the gender of child or distance from household to health clinic. Within the Indian context, gender seems to be a significant determinant in parents' decision to vaccinate their children (Bonu et al., 2003). In the

context of developing countries, distance also seems to be important. The opportunity cost of a mother seeking vaccinations for her child can be disproportionately high if she lives far away from health clinics and may deter her from receiving care despite her information and knowledge about vaccination benefits. This study also had missing information, particularly for the variable measuring whether or not the village had a public campaign promoting immunization and for the variable indicating number of annual immunization campaigns in villages. Additionally, the results show that the mothers who live in villages with two or more annual village immunization campaigns are less likely to have their child immunized against TB than mothers who live in villages with no immunization campaigns. This could be a situation of reverse causality if villages with low vaccination rates are likely to have more campaigns.

Despite these limitations, this study provides some insight into policy implications for future BCG vaccination campaigns in India. With the key variables of interest in mind, building trust and a positive impression of medical clinics could be a key factor in raising immunization rates. This requires serious initiative to fund and build clinics as well as train personnel with the idea of delivering sustainable care and building long term relationships. Several development initiatives already focus on providing better supply-side factors such as more facilities and more comprehensive training of health care providers to improve immunization rates in India (Ryman et al., 2008). However, few global health advocates seem to recognize that trust building is also an important feature of providing health care in developing countries. Most programs tend to concentrate on supply and delivery, while neglecting quality.

However, there seems to be a growing interest in the importance of health care quality in developing countries. Das and Hammer (2004) recognize that quality of health providers is an

important area that needs improvement in India's medical health system. Focusing on improving quality could additionally lead to better patient-staff relations and subsequently increasing trust and confidence in medical services and staff from patients.

Aside from an added focus on trust building between patient-staff relations, the analysis suggests that raising immunization rates for BCG vaccination cannot be an isolated initiative but must be approached in conjunction with improving other social and economic factors, particularly mother's education level. Besides immunization, global health issues such as HIV/AIDS rates are linked to the education of women. In fact, an increasing number of studies have recognized the relationship between education and health for girls and young women. Baird and colleagues (2009) found that Conditional Cash Transfer (CCT) programs not only raised attendance and enrollment rates for young women in Malawi, but also reduced the rate of early marriage, teen pregnancy and sexual relations. Though the study did not find a causal relationship between increased educational opportunities in young women and a decrease in HIV/AIDS rates, it did indicate that development initiatives to raise education levels can and should be linked to global health initiatives.

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