UNIVERSAL IMMUNIZATION PROGRAMME IN INDIA: THE DETERMINANTS OF CHILDHOOD IMMUNIZATION

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Abstract: The study analyses the effects of some selected demographic and socioeconomic predictor variables on *likelihood of immunization* of a child for six vaccine-preventable diseases covered under UIP. It focuses on immunization coverage a) in all India, b) in rural and urban areas, c) for DPT, Polio, and partial immunization, d) for three groups of states, namely, *Empowered Action Group*, *North-Eastern* and *other* states, and e) for three states, namely, Bihar, Tamilnadu, and West Bengal. The study applies *logistic regression* model to *National Family Health Survey*-2 (1998-99) data. Excepting a few cases, the results are robust.

[Keywords: Immunization, UIP, NFHS-2, Logit, Unadjusted and Adjusted Likelihood]

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1. INTRODUCTION:

Social, cultural and economic factors continue to inhibit women from gaining adequate access even to the existing public health facilities. This handicap does not merely affect women as individuals; it also has an adverse impact: on the health, general well-being and development of the entire family, particularly children. This area is of grave concern in the public health domain. In the vulnerable sub-category of women and girl child, this has a multiplier effect for the future generations.

Available data for Indian states shows a close correlation between maternal mortality and infant mortality rate (Padhi, 2001). There is global evidence showing that wherever infant mortality is high, fertility is also high (Kulkarni, 1992; Ghosh, 1991; Sai, 1988). 'Any attempt to reduce fertility without reducing mortality would be like putting the cart before the horse' (Kulkarni, 1992). Thus to reduce fertility, child survival rate should be raised first. And this can be best done by universal immunization to all eligible mothers and children. This would in turn raise the overall health standard of the mass; reduce morbidity and mortality and lower fertility.

In India, under Universal Immunization Programme (UIP) vaccines for six vaccine-preventable diseases (tuberculosis, diphtheria, pertussis (whooping cough), tetanus, poliomyelitis, and measles) are available for free of cost to all. UIP was launched in 1985 with much dynamism to attain the target to immunize all eligible children by 1990. Lot of energy and money has been spent on the UIP but it does not reap the much hyped outcome. Unmistakably, various survey results show the glaring gap between the target and achievement even after several years. Given the tight budgetary allocations, one should take care of effectiveness of the Programme. Here lies the necessity of the present study. The study tries to find out the causes of poor immunization coverage rate in India.

There are some bottlenecks from both supply- and demand-side. In a developing country like India, any programme like UIP could be affected by supply-side financial constraints when the overall Central and State budgetary allocations on health care are meagre and availability of supply-side data at disaggregated level is rare. Thus supply-side analysis is beyond the scope of the present study. The study hence concentrates purely in the demand-side assuming the *ceteris paribus* supply-side constraints.

The second section reviews literature relating to universal immunization programme. The data source and methodology are given in the third section. The study uses *National Family Health Survey* (NFHS)-2 (1998-99) data, richness of which is well-acknowledged. Bivariate and multivariate *logit* regression analyses are done. Fourth section summarizes the results of determinants of full immunization in India. Some vaccine-specific and state-specific extensions are presented in section five. Section six concludes the study with some policy implications.

2. UNIVERSAL IMMUNIZATION PROGRAMME AND LITERATURE REVIEW:

2.1: STATE INTERVENTION AND UIP

Kethineni (1991) discusses the political economy of state intervention in health care. He mentioned that in case of vaccination, as the private marginal benefits are less than the social marginal benefits, it would be advantageous for state intervention by bearing the cost. State intervention is considered necessary to reduce inequalities in the access to health care and income distribution in the long run. Disease and poverty form a vicious circle. "Men and women were sick because they were poor; they became poorer because they were sick and sicker because they were poor"[1].

[1] Winslow, 1951, pp-9.

The report of the sub-committee on national health prepared for the consideration of National Planning Committee of the Indian National Congress also had advocated state intervention to preserve and maintain health of the people by organizing and controlling health care to achieve proper integration of curative and preventive services[2]. But Kethineni (1991) argued that in India state intervention in the health care sector overemphasized on curative services largely for the urban elites leaving the majority of the rural population at bay. As a consequence the benefits of health care system accrued mainly to the upper and middle classes while the poor remained beyond the purview of modern health care system.

The Govt. of India (GoI) took steps to strengthen maternal and child health services as early as in the *First* and *Second Five-Year Plans* (1951-56 and 1956-61). As part of the *Minimum Needs Programme* initiated during the *Fifth Five-Year Plan* (1974-78), maternal health, child health, and nutrition services were integrated with family planning services. The primary aim at that time was to provide at least a minimum level of public health services to pregnant women, lactating mothers, and preschool children[3]. As part of *National Health Policy*, the *National Immunization Programme* is being implemented on a priority basis. In the wake of diphtheria, pertussis, tetanus, and poliomyelitis and childhood tuberculosis, the *Expanded Programme on Immunization* (EPI) was initiated in India in 1978 (WHO launched it globally in 1974) with the objective to reduce morbidity, mortality and disabilities by making free vaccination services easily available to all eligible children and pregnant women by 1990[4]. Achievement of self-sufficiency in the production of vaccines was also a part of the programme.

[2] National Planning Committee, 1948, pp-224-5.
[3] Kanitkar, 1979.
[4] Sokhey, 1988.

Universal childhood immunization has been accepted by world public health leaders as both an affordable and cost effective strategy not only for child survival but also for promoting primary health care[5]. In India, the UIP was launched in 1985-86 to extend immunization coverage among the eligible children and to improve the quality of services. The UIP is a carefully planned strategy for systematic district-wise expansion of the immunization programme to cover all the districts by 1989-90[6]. The objective of UIP was to cover at least 85% of all infants against the six vaccine-preventable diseases by 1990 and to achieve self-sufficiency in vaccine production and the manufacture of cold-chain equipment[7]. The target in UIP districts is to achieve universal coverage within one year (1986) and maintain the same in the subsequent years. This scheme has been introduced in every district of the country, and the target now is to achieve 100% immunization coverage although technically 85% coverage levels would ensure *herd immunity*. More than 90 million pregnant women and 83 million infants are to be immunized over a five year period under the UIP[8]. The programme was given the status of a *National Technology Mission* in 1986 (GoI, 1988) to provide a feeling of urgency and commitment to achieve the goals within the specified period. UIP became a part of the *Child Survival and State Motherhood* (CSSM) Programme in 1992 and *Reproductive and Child Health* (RCH) Programme in 1997[9]. The GoI constituted a *National Technical Committee on Child Health* on 11th June, 2000 and launched *Immunization Strengthening Project* on recommendation of the Committee[10]. The *Department of Family Welfare* established a *National Technical Advisory Group on Immunization*

[5] The Task Force for Child Survival, *Protecting the World's Children*, Bellagio II, Colombia, Oct, 1985.
[6] GoI, MoHFW, 1985; Sokhey, 1985
[7] GoI, MoHFW, 1991
[8] Sokhey, 1988.
[9] Annual Report, 2002-03, MoHFW, pp-176.
[10] Annual Report, 2002-03, MoHFW, pp-173.

on 28th August, 2001 to assist GoI in developing a nationwide policy framework for vaccines and immunization[11].

According to *United Nations Children's Fund*[12] (UNICEF) vaccine-preventable diseases (VPDs) cause an estimated 2 million deaths or more every year, of which approximately 1.5 million deaths occur among children below five year age (EXHIBIT-A). These 1.5 million deaths represent approximately 15 percent of under-five deaths. Reducing child mortality by two thirds between 1990 and 2015 is the fourth of eight *Millennium Development Goals* endorsed by world leaders in the *Millennium Declaration* in 2000.

2.2: *A CRITICAL REVIEW OF UIP EXPERIENCE IN INDIA*

Various survey results bear the testimony to the glaring gap between the goals aspired for and the targets reached. To quote, "…achievement of the target of protecting 100% of pregnant women with TT and 85% of infants with vaccines …remains a distant dream"[13]. This *National Review* mentioned some *supply side bottlenecks* that may hinder the UIP to achieve its goals. But Padmanabha (1992) argues that '…the Programme suffers not so much from lack of funds as from functional isolation'. Public health should not be treated as the sole responsibility of the health sector. Policies and programmes in other sectors such as environment, education, welfare, industry, labour, information, etc, have also be informed and influenced by public health considerations (Gopalan, 1994).

No matter how noble the idea of UIP, a 'non-controversial' programme of GoI, it faces severe criticism from many scholars. As Banerjee (1986, 1993) pointed out that it is a part of 'ill conceived and unimaginative global venture' and '… revealed many serious flaws in the programme itself. The most outstanding among them was that a massive,

[11] Annual Report, 2002-03, MoHFW, pp-174.
[12] UNICEF, 2005, pp-vii.
[13] Gupta, J.P. and Murali, Indira, 1989, National Review of Immunization Programme in India, pp-160.

expensive and a very complicated programme had been recommended for launching without even finding out what the problem was, leave alone the other important epidemiological considerations, such as incidence rates under different ecological conditions and time trends of the chosen diseases'. Banerjee (1993) mentioned that the programme is an 'onslaught' of the totalitarian approach of the developed *North* to 'sell' their 'social' products in the vast 'market' of developing *South* deviating from the *Alma Ata Declaration* (WHO, 1978). Banerjee (1992) mentions that 'the *Union Department of Family Welfare* did not have most basic epidemiological data concerning the extent of the problems, leave aside their significance in relation to other health problems of the country'. It hits the UIP as 'a nation-wide evaluation of UIP in 1990[14] revealed shocking acts of omission and commission by the bureaucrats'. Banerjee (1990) dubs UIP as 'an unholy alliance of national and international power brokers (who) could impose their will on hundreds of millions of human beings living in the poor countries of the world and make them forget all that happened at *Alma Ata* (*USSR*) in 1978'. Madhavi (2003) also noted strong indications of immunization policy in India, instead of being determined by disease burden and demand, is increasingly driven by supply push, generated by industry and mediated by international organizations.

The programme monitors its performance not by measuring the impact on morbidity and mortality rates but by assessing percentage coverage of the target population. But this criterion of assessing performance cannot be acceptable because the objective is to reduce morbidity and mortality due to the six vaccine-preventable diseases and not to merely increase coverage of vaccination, since the latter is important only as far as it helps in achieving the former objective[15].

[14] Gupta and Murali, 1989.
[15] Sathyamala, Immunization, The Technology Missions, Seminar 354—Feb, 1989, pp-28.

There are no studies to show the general pattern of morbidity among under-five children in India. According to the *Survey of Causes of Death in Infants* (*Rural*) conducted by the *Registrar General* and quoted in the booklet on the *National Mission on Immunization* (GoI, 1988), prematurity, respiratory infection of the new-born, followed by diarrhea, none of which is a vaccine-preventable disease, account for approximately 65% of deaths among 'causes peculiar to infancy'. The selection of the six vaccine-preventable diseases which account for barely 10-12% of the total deaths in under-five children as the most important set of diseases tackled at the national level cannot be justified epidemiologically.

Another route of attack on UIP is the basis on which immunization was chosen as the most effective way to tackle the diseases. For instance, measles in a healthy child is a negligible disease but mortality due to measles is 400 times greater in an undernourished population and the spread and severity of the epidemic is directly linked to overcrowding. Similarly, if an adequate amount of safe drinking water is made available, poliomyelitis will cease to be a problem[16]. Thus provision of basic survival needs could have been an alternative to universal immunization.

Ghosh (1991) also argues that the goals of '*Health for All*' can be 'achieved partly by immunization and partly by better nutrition. Preventive health care, therefore, requires immunization as well as good sanitation, proper nutrition, and availability of safe drinking water as the *minimum* of social needs that must be met before we embark on an ambitious plan of government outlay for *development*'. He also asks for 'convergence of services' instead of several projects with similar goals to make effective and efficient use of the funds.

2.3: *PULSE POLIO IMMUNIZATION*

[16] *Ibid*, pp-27

Pulse Polio Immunization Programme began in December, 1995 as part of a major national effort to eradicate polio. In the context of Polio eradication, George, *et al* (2004) argued for reassessing eradication strategy in view of the prevailing epidemiological situation in the country. Almost all of the 91 polio cases reported in India as on November 20, 2004, are from Bihar and UP[17]. It is also important to concede that, compared to 1995 (year of launch of *Pulse Polio Immunization*), drinking water and sanitation in the country has improved. In India, the risk of getting vaccine-associated polio is much higher than contracting the wild poliovirus infection[18]. Thus George, *et al* (2004) argued that Pulse Polio Immunization in India, as a whole, should be replaced by a regional approach in conducting sub-national immunization days (SNIDs) (as the risk is 6.26 times higher).

Proponents of *Polio Eradication* in India are in favour of 'multiple doses' protection. But there is no clear cut number of this 'multiple doses'. As a consequence, a substantial proportion of Indian children have received up to 25 doses (Sathyamala *et al*, 2005). George, *et al* (2004) termed this 'flooding' of the 'intestines of our child population with live, attenuated polio vaccine'. In Rajasthan, between January 1 and July 31, 1999, 24 children, some of whom had been administered a high number of OPV doses had died owing to polio (Paul, 2004). Numerous doses of OPV have changed the epidemiological behavior of wild poliovirus in the Indian environment. Confusion is going on among the programme managers about the introduction of more expensive and injectable inactivated polio virus (IPV) to counter vaccine-associated paralytic poliomyelitis.

2.4: *FACTORS AFFECTING IMMUNIZATION*

George *et al* (1993) highlights the health indicators of Indian states that follow two broad patterns of growth. One classified by Maharashtra

[17] http://www.childinfo.org
[18] http://www.childinfo.org

and Punjab which have attained relatively high health indicators against the backdrop of a high per capita income (PCI) and high CMIE index of economic development. The other is characterized by Kerala with a very good development of health indicators against the background of a low PCI, low level of industrialization, but relatively good infrastructural indicators. 'The first pattern could be attributed to the *trickle down effect* of capitalist modernization of an industrial-cum-agrarian variety in Maharashtra and of a predominantly agrarian variety in Punjab (Duggal, 1992); the second pattern is rooted in certain social, political, geographic and demographic particularities of Kerala (Tharakan, 1984; Nag, 1989)'.

Decentralization is also a highly popular component in policy reform. Within the health sector, decentralization of finances and responsibilities is one of the essential topics that has emerged in the agenda of national governments and international organizations. Devolving some of the centralized responsibilities to local levels is likely to improve both *technical efficiency* and *allocative efficiency* (Peabody, 1999). Robalino *et al* (2001) shows that higher fiscal decentralization is consistently associated with lower mortality rate and the benefits of fiscal decentralization is predominantly important for poor countries. Khaleghian (2003) finds that decentralization has a positive impact on immunization in low-income countries but the reverse happens for middle-income countries.

'Efforts to augment demand generation and community participation for immunization must focus on the consumers of the programme with due regard to their problems, needs, biases and aspirations. Highest level of political commitment to the programme can have a maximal translation into action by appropriate health education and dissemination of information in a language people can understand and with a cultural bias familiar to them'[19]. Mass communication for UIP

[19] GoI (1985), pp-40.

has no doubt helped to create claim for immunization services. In some states, notably in Punjab, the *Song and Drama* division of the *Ministry of Information and Broadcasting* has trained folk artists to spread messages on immunization and child health[20].

Education is an important determinant of immunization coverage. It also affects mortality and fertility inversely (Ghosh, 1991). 'The evidence from Kerala and Punjab shows that the effect of education on the proximate variables of both fertility and mortality can explain more than anything else the relatively higher decline of vital rates in these states' (Nag, 1989). Ghosh (1991) also argues for enhancing female education. 'There is a vast amount of demographic literature indicating that female literacy exerts greater influence on fertility and child mortality than male literacy' (Bhat *et al*, 1992). Role of education/ literacy/ female literacy is also agreed by many other researchers (Gupta *et al*, 1992; Dreze, 1993; George *et al*, 1993; Rajan *et al*, 1993; Rajan *et al*, 1993a; Pebley *et al*, 1996; Gage *et al*, 1997; Desai *et al*, 1998; Gauri *et al*, 2002) in making people more health conscious. Padmanabha (1992) also agrees to the importance of literacy and argues that 'because of low literacy levels in a large part of the country, communication with masses, particularly at the community level is only effective through political and local leadership'.

Infrastructural indicators such as electrification, all weather roads are also important factors (George *et al*, 1993).

3. DATA SOURCE AND METHODOLOGY:

All data is sourced from *National Family Health Survey* (NFHS)-*2*, undertaken in 1998-99. NFHS-2 covers a representative sample of more than 90,000 ever-married women of age 15-49 years from 26 states of India that comprise more than 99% of India's population. The survey provides state-level estimates of demographic and health parameters as

[20] Kulkarni (1992), pp-1335.

well as data on various socioeconomic factors that are critical for bringing about desired changes in India's demographic and health situation. Though it has some limitations, it is regarded as 'storehouse of demographic and health data in India'[21].

NFHS-2 data on immunization is based on vaccination card for each child born since January 1995 (or since January 1996 in states in which the survey began in 1999) or on mother's report in case of non availability of the card. EXHIBIT-B shows the percentages of rural and urban children age 12-23 months who received specific vaccinations at any time before the interview and before 12 months of age. The 12-23 month age group was taken for analysis because both international and GoI guidelines specify that children should be fully immunized by the time they complete their first year of life.

In NFHS-2, children who received BCG, measles, and three doses each of DPT and Polio (excluding Polio 0) are considered to be fully vaccinated. Based on information obtained from 'either source', 42% of children are fully vaccinated and 14% have not received any vaccinations. Coverage for BCG, DPT, and Polio (except Polio 0) vaccinations is much higher than the percentage fully vaccinated. According to the immunization schedule, all primary vaccinations, including measles, should be completed by the time a child is 12 months old. EXHIBIT-B shows that only 35% of all children were fully vaccinated by age 12 months. The analysis of vaccine specific data indicates much higher coverage of all vaccines in urban areas (61%) than rural areas (37%) for children age 12-23 months. The proportion fully vaccinated during the first year of life is also much higher in urban areas (52%) than rural areas (29%). Dropout rates for both DPT and Polio are lower in urban areas than in rural areas. Immunization coverage in India has improved since the time of NFHS-1 (1992-93) when the proportion of

[21] Rajan *et al* (2004).

children fully vaccinated was 36% (six percentage points increase in six years!) and the proportion who received none was 30%. But these marginal improvements indicate that achievement is lagging far behind than the goal of universal immunization programme in India.

An immunization coverage model is used in this study to estimate the effects of the selected background variables on immunization coverage. The measure of a child's immunization is a binary variable that indicates whether a child has had all six vaccinations or not. The analyses use *bivariate* (*unadjusted*) and *multivariate* (*adjusted*) *binary logit regression* analysis. The logit model is based on *cumulative logistic probability function* and it closely resembles the t distribution with 7 degrees of freedom. Logistic regression results are presented in *multiple classification analysis* (MCA) form. Unlike OLS regression, logistic regression does not assume *linearity* of relationship between the dependent and independent variables, does not require *normally* distributed variables, does not assume *homoscedasticity*, and in general has less stringent requirements.

The *multivariate binary* logit model is specified as:

$$P = F(z) = \frac{1}{1+e^{-z}} \qquad \ldots\ldots\ldots\ldots (1)$$

where $z = \alpha + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots + \beta_k X_k$. Here e represents the base of natural logarithms, which is approximately equal to 2.718 and P is the estimated probability of vaccination given X_i's. It is noteworthy that z is not the response variable but a linear function of a set of predictor variables.

$$(1) \Rightarrow \frac{P}{1-P} = e^{z} = \Omega = Odds$$

$$\text{and, } \log itP = \log\frac{P}{1-P} = z = \log\Omega = LogOdds \qquad \ldots\ldots\ldots\ldots (2)$$

$$\text{Hence, } \log\Omega = \alpha + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots + \beta_k X_k \qquad \ldots\ldots\ldots\ldots (3)$$

Thus $\log\Omega$ is calculated first, then $\Omega = e^{\log\Omega}$ and then $P = \frac{\Omega}{1+\Omega}$. P is presented in percentage form (multiplying P by 100).

Unadjusted values are calculated from logit regressions incorporating only one predictor variable. Adjusted values are calculated from logit regressions incorporating all predictor variables simultaneously. When calculating the adjusted values for a particular predictor variable, all other predictor variables are controlled by setting them to their mean values in the underlying regression[22].

Here each individual observation has a probability, and the overall likelihood is the product of these individual probabilities. Hence, *a very small likelihood does not necessarily mean a poor fit.* The *binary dependent-variable model is not likely to yield a* R^2 *close to* 1[23]. If one assumes that the true probabilities of an event occurring were uniformly distributed across a given interval, it would be possible to show an upper bound for R^2 of 1/3. Thus it is not surprising that in estimating a linear probability model one is likely to obtain a low R^2.

4. DETERMINANTS OF FULL IMMUNIZATION IN INDIA:

Children are the units of the analysis. A child data file is created by merging selected household and mother's characteristics from household and women's data files respectively. Thus, the child data file contains selected characteristics of children aged 12-23 months, selected characteristics of their mothers and selected characteristics of the households in which the mother and child reside. The analysis of immunization coverage focuses on the 10,076 children of 12-23 months of age during the Survey.

The analysis of immunization coverage uses a number of demographic and socioeconomic variables. The dependent variable is full immunization that says whether a particular child is fully immunized or

[22] For detail, see Retherford and Choe (1993).
[23] See Morrison (1972); Pindyck and Rubinfeld (1998), pp-317.

not. The selected predictor variables are sex of the child (male, female), birth order of the child (1, 2, 3, 4 and above), residence (rural, urban), mother's education (illiterate, < middle school complete, middle school complete, high school complete and above), mother's age (15-19, 20-24, 25-29, 30-49), antenatal care (yes, no), religion (Hindu, Muslim, Christian and other minorities), caste/ tribe (general, scheduled caste, scheduled tribe, other backward class[24]), standard of living index (low, medium, high), media exposure (yes, no), mother's awareness (yes, no), sex of household head (male, female), mother's empowerment index (low, medium, high), zone of states (Central, North, East, Northeast, West, South) and electricity (yes, no).

An attempt has been made to construct an indicator (*Mother's Empowerment Index* or *mindex*) to see how mother's decision-making power in the household affects the likelihood of immunization. Such an index could vary widely with changes in its components or their weights. The following six recoded variables are chosen for its construction: who decides on obtaining health care, permission needed to go to market, permission needed to visit relatives or friends, allowed to have money set aside, contribution to total family earnings and who decides how the money will be spent. Some other variables (*e.g.*, form of payment, current type of employment, *etc.*) could also have been included but these were dropped, so that the sample size is not reduced abysmally. The *method of unweighted aggregation* is followed by which the scores of the above-mentioned six recoded variables are simply added to get the scores of *mindex*. The *mindex* is then categorized as: low (0) if score ≤ 2, medium (1) if score = 3, and high (2) if score ≥ 4. Percentage distribution of *mindex* by states is shown in EXHIBIT-C. From EXHIBIT-C, it is evident that excluding Bihar, the other *Empowerment Action Group* (EAG) of states are among the bottom eight states, but the three *Northeastern* (NE)

[24] SC, ST and OBCs are those castes and tribes identified by GoI as socially and economically backward and in need of protection from social injustice and exploitation.

states (Arunachal Pradesh, Mizoram and Meghalaya) are among the top six states in terms of *mindex*.

For the variable zone of states, *Central* includes Madhya Pradesh and Uttar Pradesh; *North* includes Delhi, Haryana, Himachal Pradesh, Jammu and Kashmir, Punjab and Rajasthan; *East* includes Bihar, Orissa and West Bengal; *Northeast* includes Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Sikkim; *West* includes Goa, Gujarat and Maharashtra; *South* includes Andhra Pradesh, Karnataka, Kerala and Tamilnadu. Media exposure includes whether a children's mother reads newspaper once a week or watches TV every week or listens to radio every day or every week. Mother's awareness includes whether discussed immunization with family planning workers or whether discussed immunization during health facility visits.

The hypothesized direction of relationship between dependent variable and each of the predictor variables are presented in EXHIBIT-D.

Before going to the regression results, it is important to look at the possible collinearities among the predictor variables to avoid the problems of *multicollinearity*. In most real life observational research (as opposed to experimental research, where treatments can be randomized), a certain amount of multicollinearity is inevitable, because most of the predictor variables (such as mother's age and birth order of children) are correlated to some extent. As a rule of thumb, when two predictor variables are correlated but both are relevant to explanation from a theoretical point of view, one should not eliminate one of the variables to reduce multicollinearity, unless the correlations are higher in absolute magnitude than about 0.8[25]. But the *Pearson Correlation Matrix* (not shown) shows the maximum correlation coefficient is 0.6 which is much less than the threshold magnitude. Also given the huge observations in

[25] Retherford and Choe (1993), pp-39-40. Hill and Adkins (2001) suggest this threshold to be 0.9 (pp-264).

the data, the present analysis enjoys the luxury of keeping all the predictor variables.

- *EFFECT ON FULL IMMUNIZATION COVERAGE IN INDIA*

There is slight gender discrimination of being vaccinated in India (see EXHIBIT-E). Chance of being fully vaccinated is 41 percent for girls and 43 percent for boys. The adjusted results indicate more poor position. Here the percentages are 39 and 43 respectively. This gender discrimination is statistically significant also. Some researchers also noted such behavior of families to neglect and discriminate female children (Das Gupta, 1987; Rajeshwari, 1996; Islam *et al*, 1996). However, Hill *et al* (1995) noted that although there are substantial mixed variations in immunization coverage by sex, the median difference across all countries is very close to zero.

There is a consistently inverse relationship between immunization coverage and birth order of a child. Majority of first-order births occur to younger women who are more likely than older women to utilize maternal and child health care services. The different likelihoods of immunization for different birth orders are also strongly significant.

One can think of two countervailing effects of increasing birth-order on likelihood of vaccination. The positive one could be some kind of *learning effect* about immunization which almost does not vary with higher birth-order. The negative one could be some kind of *negligence effect* to the higher order births and this effect perhaps increasingly increases with higher birth-order. Thus for higher order births, it seems that the *negligence effect* more than offset the *learning effect*.

Another variable namely, sex-wise birth-order is constructed to see whether likelihood of vaccination decreases with increase in birth-order for girls only or not. Likelihood (unadjusted) of vaccination decreases with increase in birth-order irrespective of sex of a child, and

surprisingly, the rate of decrease is lower for girl children except third birth-order (see EXHIBIT-E†).

Urban children are much more likely to be fully vaccinated than rural ones. The chance of being fully immunized is 37 percent for rural children whereas it is 60 percent for urban children. But the adjusted effects are almost same (41 and 42 respectively) and the rural/ urban difference is not significant. It suggests that the unadjusted effect of rural/ urban residence is actually due to the other predictor variables correlated with residence. High immunization coverage in urban areas is however supported by many researchers (Pebley *et al*, 1996; Padhi, 2001).

There is a strong positive relationship between mother's education and children's immunization coverage. The chance is almost three times higher for the children of mothers with high school or above education than the children of illiterate mothers. The adjusted effects are lower than unadjusted ones but still strongly significant and the effect levels off at higher level of education. Such positive effect of maternal education is also hypothesized by Padhi (2001), Dasai *et al* (1998), Islam *et al* (1996), Gage *et al* (1997), Pebley *et al* (1996) and Mosley *et al* (1984) though Gauri *et al* (2002) finds a spurious effect.

The variable father's education is also tried to see how likelihood of vaccination affected by it as around 60% of Indian mothers are illiterate. Effect of father's education (unadjusted) is significantly positive but its extent is less than that of mother's education (see EXHIBIT-E†).

Chance of immunization of children increases with their mother's age only up to the age group of 25-29 and then decreases. A positive relationship is also noted by Steele *et al* (1996). In the context of rural Bangladesh, Islam *et al* (1996) shows that likelihood of vaccination decreases for the mothers' older than 28 years.

Antenatal care during pregnancy has a strong positive direct effect on vaccination. The chances of immunization are a mere 18 percent for the children of mothers with no antenatal care during pregnancy and 57 percent for the children of mothers with some antenatal care. The adjusted chances are 30 percent and 48 percent respectively. Such a positive relationship is also noted by Islam *et al* (1996).

Chance of immunization varies with religion also. The likelihood of being fully immunized is 42 percent for children from Hindu household, 33 percent for children from Muslim household and 64 percent for children from Christian and other minority community household. The adjusted chances are 42, 32 and 56 percent respectively.

Caste/ tribe also affect full immunization. The chance of being fully vaccinated is 47 percent for children from general category household, 40 percent for children from SC household, 26 percent for children from ST household and 43 percent for children from OBC household. The result is also consistent with the relative order of socioeconomic status of different categories of caste/ tribe. But the adjusted chance does not mark the relative order of socioeconomic status of SCs and they are 42 percent, 44 percent, 31 percent (only significant) and 41 percent respectively. This implies that the adjusted effect ignores some important effects of other variables correlated with caste/ tribe and the unadjusted differences by caste/ tribe stem mainly from the relatively lower socioeconomic status of families belong to backward classes.

Chance of immunization increases with standard of living index of children's household. The unadjusted chances are 30 percent for children from low SLI household, 43 percent for children from medium SLI household and 65 percent for children from high SLI household. When all other predictor variables are controlled, these percentages become 39, 40 and 46 (only significant) respectively. It indicates that the effect of SLI on full immunization largely disappears, suggesting that the

unadjusted likelihoods actually reflect the effects of other variables (*e.g.*, education) that are correlated with SLI. The result is consistent with expectation as under UIP, vaccines are available free of cost. Mosley *et al* (1984) also argues for household income as a proximate determinant of immunization coverage. Islam *et al* (1996) also noted such positive relationship with household income.

Unadjusted chances of being fully vaccinated are 25 percent for children whose mothers are not exposed to mass media and 56 percent for children whose mothers have some media exposure. The adjusted likelihood is 38 percent and 43 percent respectively. This indicates that media exposure has significantly positive effect on immunization. But Gauri *et al* (2002) does not find any significant effect of media.

Mother's awareness about immunization also has significantly strong positive effect on vaccination. The unadjusted chances are 33 percent for children of unaware mothers and 58 percent for children of mothers with some awareness. Adjusted chances are 36 percent and 51 percent respectively.

Unadjusted chance of being fully immunized is 48 percent for children from households with female headship and 42 percent for children from households with male headship. But the adjusted chances are 40 percent and 41 percent (not significant) respectively. It implies that sex of household headship affects immunization mainly through other predictor variables correlated with sex of household headship. However, in the context of rural Orissa, Panda (1997) shows that children from male headship households are more likely to be immunized than those from female headship households. Moreover, he shows that the gender inequality (boys are more likely than girls) in preventive health care persists regardless of the gender of the household headship.

Both unadjusted and adjusted effects of mother's empowerment index are almost positively related to immunization coverage. The chances of being immunized are 39 percent for children of mothers with

low empowerment index, 51 percent for children of mothers with medium empowerment index and 58 percent (all significant) for children of mothers with high empowerment index for unadjusted and 41, 40 and 43 (none significant) percent respectively for adjusted. It indicates that the effect of MEI on full immunization largely disappears, suggesting that the unadjusted likelihoods actually reflect the effects of other variables (*e.g.*, mother's employment type) that are correlated with MEI.

The variable mother's employment type is also tried to see how likelihood of vaccination affected by it as most Indian mothers does not contribute to total family earnings. Likelihood (unadjusted) decreases for children whose mother is non-wage employee but increases (not significant) for children whose mother is wage employee compared to non-working mothers (see EXHIBIT-E†).

There is strong effect of zone of states on immunization. The immunization rate varies widely across different zones as well as within the same zone. Low likelihood in Northeast is mainly due to high weight given to Assam (with 233 observations out of a total of 332 observations for Northeast or 70% of the total observations) that has only 17% coverage rate of full vaccination.

Electricity also has significant effect on full immunization in India. It shows that electricity has significantly strong positive effect on immunization possibly through electronic mass media. Islam *et al* (1996) also noted such a positive relationship.

- *EFFECT ON FULL IMMUNIZATION COVERAGE IN RURAL INDIA*

Separate regressions for rural and urban areas are tried to see clearly how the effects vary due to change in place of residence in lieu of a residence dummy. These regression results are compared with the all-India 'reference' regressions. Unadjusted and adjusted effects on full immunization coverage in rural India (sample size 7795) are presented in EXHIBIT-E.

The relationship between child's birth order and likelihood of immunization becomes strictly negative here. This result indicates strong negative effect on immunization. Mother's education has a strictly positive impact on immunization. The relationship between mother's age and immunization coverage also remains same except for the last age group in adjusted case supporting that vaccination chance increases with mother's age only up to 25-29 year age group. Caste/ tribe have similar effects as before except the fact that SC children are more likely to be vaccinated. Effects of other variables remain same as the baseline regression.

- *EFFECT ON FULL IMMUNIZATION COVERAGE IN URBAN INDIA*

Unadjusted and adjusted effects on full immunization coverage in urban India (sample size 2281) are also presented in EXHIBIT-E. Gender discrimination of being fully immunized is slightly favourable to girls in urban India in contrast to the earlier results.

The positive relationship between mother's education and immunization coverage holds well in case of unadjusted case but it becomes inverted-U shaped after controls. The relationship between mother's age and immunization coverage remains inverted-U shaped as before for unadjusted case but it becomes strictly increasing after controls. Effect of caste/ tribe is consistent with the relative order of socioeconomic status of different categories of caste/ tribe except OBCs (not significant). Though the relationship between SLI of children's household and chance of immunization remains upward sloping in unadjusted case, it becomes U-shaped (not significant) after controls. Children from female-headed households are more likely to be fully immunized even after the controls. Though the relationship between mother's empowerment index and chance of immunization remains upward sloping in unadjusted case, it becomes U-shaped (not significant) after controls. Effect of zone of states remains same as before except Northeast and South zones. Electricity also affects immunization in the

same way but in higher extent. Effects of other variables remain same as the reference regression.

- *ADJUSTED EFFECT OF DEMOGRAPHIC FACTORS ON FULL IMMUNIZATION IN INDIA*

Here a separate regression is tried incorporating only the demographic factors to see their independent effect. The adjusted effects of demographic factors on full immunization coverage in India are shown in EXHIBIT-F.

Urban children are significantly more likely to be vaccinated even if rural/ urban differential vanished after controls in all-India regression. It implies that the unadjusted likelihoods for residence in all-India regression capture mainly the effects of the selected socioeconomic variables. Hence it can be assumed that the rural-urban disparity is not due to the demographic factors but the socioeconomic factors. Likelihood of immunization decreases for backward caste children according to their relative social status except SCs. Children from female-headed households are more likely to be vaccinated (not significant). Other variables have similar effects as in the all-India case.

- *ADJUSTED EFFECT OF SOCIOECONOMIC FACTORS ON FULL IMMUNIZATION IN INDIA*

Here another regression is tried incorporating only the socioeconomic factors to see their independent effect. The adjusted effects of socioeconomic factors on full immunization coverage in India are shown in EXHIBIT-G.

The relationship between mother's education and immunization becomes strictly positive here. Effect of SLI of children's family is U-shaped as in case of urban India. Mother's empowerment index affects immunization strictly positively. It implies that the unadjusted likelihoods for MEI in all-India regression capture mainly the effects of the selected demographic variables. Other variables have analogous effects as in the reference regression.

5. VACCINE-SPECIFIC AND STATE-SPECIFIC PATTERN: VARIANTS AND EXTENSIONS

- *ADJUSTED EFFECT ON DPT IMMUNIZATION COVERAGE IN INDIA*

As coverage rate is generally lower for DPT vaccine than Polio, the study attempts to explore the effects on DPT and Polio immunization separately. Here a child is immunized against DPT means that the child completed all three doses of DPT. The adjusted effects on DPT immunization coverage in India are presented in EXHIBIT-H.

The effect of mother's education becomes strictly positive here. Immunization chance increases with mother's age only up to 25-29 years age group of mothers and then decreases for children of more aged mothers. The relationship between mother's empowerment index and immunization becomes inverted-U shaped (though not significant). Other variables have similar effects as in the reference regression.

- *ADJUSTED EFFECT ON POLIO IMMUNIZATION COVERAGE IN INDIA*

Here a child is immunized against Polio means that the child completed all three doses of Polio (excluding Polio 0). The adjusted effects on Polio immunization coverage in India are presented in EXHIBIT-H.

Effect of mother's education is strictly positive. Immunization chance increases with mother's age only up to 25-29 years age group of mothers and then decreases for children of more aged mothers. Excluding SC and OBC, likelihood of immunization decreases for ST children. Other variables have analogous effects as in the reference regression.

- *ADJUSTED EFFECT ON PARTIAL IMMUNIZATION COVERAGE IN INDIA*

Partially immunization means that whether a child received any of the above-mentioned six vaccines or not. The adjusted effects on partial immunization coverage in India are shown also in EXHIBIT-H.

Likelihood increases for second birth order and then decreases (not significant) for higher birth order children. Effect of mother's education is strictly positive. Immunization chance increases with mother's age only up to 20-24 years age group of mothers and then decreases (not significant) for children of more aged mothers. Excluding OBCs,

likelihood of partial immunization decreases for ST children. The relationship between mother's empowerment index and immunization becomes inverted-U shaped. Other variables have similar effects as in the baseline regression.

- *ADJUSTED EFFECT ON FULL IMMUNIZATION IN THREE STATES OF INDIA*

Three states of India, namely Bihar, Tamilnadu and West Bengal are selected for state-level analysis. These states are selected because Bihar (11%) and Tamilnadu (89%) are two extreme cases and West Bengal (44%) is one with just above the national average (42%) in terms of coverage of full vaccination.

- *ADJUSTED EFFECT ON FULL IMMUNIZATION IN BIHAR*

The adjusted effects on full immunization coverage in Bihar are presented in EXHIBIT-I for 879 children. Higher birth order children are less likely to be vaccinated excluding second order (not significant) births. Residence has a significantly positive effect favouring urban children. Relationship between mother's education and immunization becomes inverted-U shaped. Immunization chance does not affected significantly by mother's age or antenatal care or caste/ tribe or media exposure or mother's awareness or mother's empowerment index or electricity. Chance of immunization significantly decreases for children from male-headed households compared to those from female-headed households.

- *ADJUSTED EFFECT ON FULL IMMUNIZATION IN TAMILNADU*

The likelihood of immunization is not significantly much affected by almost all the predictor variables. Chance of vaccination is almost certain for the children of Tamilnadu. Herd immunity is already achieved by Tamilnadu and in near future hopefully it will achieve *universal immunization*. The Programme managers of UIP could cite Tamilnadu as a model as far as the performance of vaccination is concerned.

The adjusted effects on full immunization coverage in Tamilnadu are presented in EXHIBIT-I for 430 children. Gender discrimination on

immunization is not significant. Residence has significantly positive impact favouring urban children. Immunization chance does not affected significantly by birth order or mother's education or religion or caste/ tribe or SLI or media exposure or mother's awareness or sex of household head or mother's empowerment index.

- *ADJUSTED EFFECT ON FULL IMMUNIZATION IN WEST BENGAL*

The adjusted effects on full immunization coverage in West Bengal are presented in EXHIBIT-I for 398 children. Gender discrimination on immunization is also not significant here. Higher birth order children are less likely to be vaccinated except the last category. Immunization chance does not affected significantly by residence or antenatal care or SLI or sex of household head. Chance of immunization skyrocketed significantly for children of at least middle school educated mothers. Likelihood increases with mother's age up to 25-29 year age group and then decreases. OBC children are least likely to be vaccinated.

- *ADJUSTED EFFECTS ON FULL IMMUNIZATION IN THREE STATE-WISE AREAS*

A backward group of states with weak socio-demographic indicators is formed as *Empowered Action Group* (EAG) consists of Bihar (including Jharkhand), MP (including Chattisgarh), Orissa, Rajasthan, and UP (including Uttaranchal). The group was formed in 2001 under the *Ministry of Health and Family Welfare* (MoHFW) to design and implement area specific programmes to strengthen the primary health care infrastructure. The group of *North-Eastern* states consists of seven states namely, Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, and Sikkim (excluding Tripura). The remaining thirteen states (AP, Goa, Gujarat, Haryana, HP, J&K, Karnataka, Kerala, Maharashtra, Punjab, TN, WB, and Delhi) are clubbed as *other* states. Immunization coverage rates are 20.1%, 20.2% and 65.7% and the sample sizes are 4244, 332 and 4359 for EAG, NE, and other group of states respectively.

Effects on full immunization for EAG, North-Eastern and other states are given in EXHIBIT-I and these are compared with the national

level effects. Male children are more likely to be vaccinated in each case. Children of higher birth-order are less likely to be vaccinated except the North-eastern children of fourth or higher birth-order (not significant). Urban children are more likely to be immunized (not significant) in each case. Children of more educated mothers are more likely to be immunized except the children of mothers with at least high school education in EAG states. The likelihood of immunization increases with mother's age up to 25-29 year age group everywhere except North-Eastern states (not significant). Children of mothers with some antenatal care are more likely to be vaccinated. Muslim children are least likely to be immunized and Christian and other minority community children are most likely to be vaccinated in each case. ST children are least likely to be vaccinated in each case except North-Eastern states (not significant). The effect of household SLI is almost positive everywhere but the North-Eastern states (not significant). Effects of media and mother's awareness are both positive. Likelihood decreases for children from male household headship in only EAG and North-eastern states (none significant). Likelihood increases with mother's empowerment index in North-eastern states and other states but the relationship becomes U-shaped for EAG states and India as a whole. Electricity has a positive effect in each case.

6. CONCLUSION AND POLICY IMPLICATIONS:

Six vaccine-preventable diseases are covered under UIP, and vaccination is given free of cost to every child in India. Though vaccines are available for free, the goals of UIP are far from being achieved after almost one and a half decades since its inception. The present study made an attempt to investigate the demographic and socio-economic determinants of immunization in India. It is possible to give a *big push* to the immunization uptake, only when one understands the demand-side factors well, to achieve the chartered goals of UIP.

- *FINDINGS OF THE STUDY*:

The study analyses the effects of some selected demographic and socioeconomic predictor variables on the chance of immunization of a child. It focuses on immunization coverage for children (a) in all India, (b) in rural and urban areas in India, (c) for DPT, Polio and partial immunization for all India, (d) for three groups of states, namely, *Empowered Action Group*, *North-eastern* and *other* states, and (e) for three states namely, Bihar, Tamilnadu (two extremes in immunization coverage performance) and West Bengal (national average). The study applies *binary bivariate* and *multivariate logit* model to *National Family Health Survey-2* (1998-99) data. Excepting a few cases, the results are very much consistent across the different models.

ROBUST RESULTS:

- Boys are more likely to be immunized than girl children.
- Children of higher-order births are less likely to be vaccinated. This is true irrespective of the sex of a child, but the rate of decrease is higher for girl children, except third birth-order. It seems that the *negligence effect* more than offset the *learning effect*. The result perhaps shows the apathy on part of the parents to immunize their children of higher-order births.
- The likelihood of immunization is higher for children from urban areas.
- Likelihood of vaccination increases with mother's education level, mother's age up to 29 years, mother's exposure to mass media and mother's awareness about immunization.
- Some antenatal care during pregnancy raises immunization chances significantly. This increases possibility to meet health personnel who help mothers to raise awareness by disseminating information regarding immunization.

- Among the religious groups, Muslim children are least likely to be immunized whereas children from Christian and other religious minority communities are most likely to be immunized.
- Immunization chance increases with the standard of living index of children's household.
- Children from the West zone are most likely to be immunized, followed by South, North, East, Central and Northeast respectively.
- Children from households with electricity are more likely to be immunized.

TENTATIVE[26] *RESULTS*:

- Compared to general caste children, OBCs are less likely to be immunized, followed by the SCs and STs. Likelihood is least for ST children in India as a whole, eight EAG and thirteen *other* states, and for OBC children in seven North-eastern states.
- Possibility of immunization is higher for children in female-headed households.
- Likelihood of immunization increases with mother's empowerment index. In North-eastern and other states, the relationship between mother's empowerment index and likelihood of immunization is upward sloping but it becomes U-shaped for EAG states and India as a whole.

- *BROAD POLICY AREAS*:

The need of the hour is an equitable, participatory and intersectoral approach to health and health care (Bose, 2001). Provision of vaccination should not be treated as the sole responsibility of the health sector. Policies and programmes in other sectors such as education, welfare, industry, labour, information, environment, etc. have also to be informed and influenced by public health considerations

[26]: These results are not consistent across different models.

(Gopalan, 1994). To reach the goal of UIP in India, the policy managers should also try to:

- Enhance (female) education through *Education for All* and incorporate primary health information in the curricula.
- Generate enough employment opportunity supported by the Government (*e.g.*, some kind of *Employment Guarantee Programme*).
- Increase infrastructure to provide antenatal care universally.
- Spread more and more basic information regarding vaccination through electronic mass media.
- Enhance coverage in EAG and North-eastern states by organizing more sub-national immunization days (SNIDs).
- Spread news to break religious misbeliefs against vaccination.
- Raise number of health personnel to improve mother's awareness.
- Provide urban facilities in rural areas if possible with the help of corporate social responsibility.
- Provide electricity to every village if possible through non-conventional energy resources.
- Promote small family norm and discourage early marriage.

Some supply-side facility enhancement can also improve demand for vaccination. For example, physician and clinic hours might be increased to reduce waiting time of the parents to immunize their children or introduction of mobile units in thinly populated rural areas to minimize travel time of parents to curtail their economic disincentives.

Higher budgetary allocation for preventive care might improve immunization coverage but only in the short run. But as immunization is a long term process, one should give thrust to improve its demand given the meagre Central as well as State budgetary allocation on health sector as a whole for decades and evaporating *aids* and *soft loans* from international organizations.

REFERENCE:

Annual Report (2002-03), Ministry of Health and Family Welfare (MoHFW), Govt. of India.

Annual Report (1986-87), MoHFW.

Annual Report (1985-86), MoHFW.

Banerjee, Debabar (1993): 'Crash of the Immunization Programme: Consequences of a Totalitarian Approach', *International Journal of Health services*, Vol-20, No-3, pp-501-10.

Banerjee, Debabar (1992): 'Family Planning in the Nineties: More of the Same?', *Economic and Political Weekly*, Apr 25, pp-883-7.

Banerjee, Debabar (1990): 'Politics of Immunization Programme', *Economic and Political Weekly*, Apr 7, pp-715-8.

Banerjee, Debabar (1986): 'Technocratic Approach to Health: Western Response to Alma Ata', *Economic and Political Weekly*, Vol-21, No.-28, July 12, pp-1233-4.

Bhat, P.N. Mari and Rajan, S. Irudaya (1992): 'Demographic Transition in Kerala: A Reply', *Economic and Political Weekly*, June 6, pp-1213-5.

Bose, Ashish (2001): 'Health for All by 2000: Broken Promises', *Economic and Political Weekly*, Mar 17, pp-905-7.

Das Gupta, M. (1987): 'Selective Discrimination against Female Children in Rural Punjab, India', *Population Development Review*, Vol-13, No.-1, pp-77-100.

Desai, S. and Alva, S. (1998): 'Maternal Education and Child Health: Is There a Strong Causal Relationship?', *Demography*, Vol-35, No.-1, pp-71-81.

Dreze, Jean (1993): 'Nutrition and Health in Rural India' (review article), *Economic and Political Weekly*, Feb 13, pp-276-7.

Duggal, Ravi (1992): 'Regional Disparities in Health Care Development: A Comparative Analysis of Maharashtra and other States', NCAER, *Harvard University Workshop on Health and Development in India*, New Delhi, January 2-4.

Gage, A.J., Sommerfelt, E. and Piani, A. (1997): 'Household Structure and Childhood Immunization in Niger and Nigeria', Demography, Vol-34, No.-2, pp-295-309.

Gauri, V. and Khaleghian, P. (2002): 'Immunization in Developing Countries: Its Political and Organizational Determinants', Policy Research Working Paper No.-2769, *The World Bank*.

George, B. and Vijaykumar, K. (2004): 'Polio Eradication: A Misplaced Approach?', *Economic and Political Weekly*, December 25, pp-5571-3.

George, A. and Nandraj, S. (1993): 'State of Health Care in Maharashtra: A Comparative Analysis', *Economic and Political Weekly*, Aug 7, pp-1671-83.

Ghosh, Arun (1991): 'Eighth Plan: Challenges and Opportunities—XII, Health, Maternity and Child Care: Key to Restraining population Growth', *Economic and Political Weekly*, Apr 20, pp-1017-22.

(GoI), MoHFW, 1991.

GoI (1988), National Mission on Immunization, MoHFW, New Delhi.

GoI, MoHFW (1985): Towards Universal Immunization by 1990. New Delhi.

Gopalan, C. (1994): 'Challenges to Public Health Systems', *Economic and Political Weekly*, May 14, pp-1204-9.

Gupta, N., Pal, P., Bhargava, M. and Daga, M. (1992): 'Health of Women and Children in Rajasthan', *Economic and Political Weekly*, pp-2323-32.

Gupta, J.P. and Murali, Indira (1989), National Review of Immunization Programme in India, MoHFW, National Institute of Health and Family Welfare, New Delhi.

Hill, Kenneth and Upchurch, D.M. (1995): 'Gender Differences in Child Health: Evidence from the Demographic and Health Survey', *Population and Development Review*, Vol-21, No.-1, pp-127-51.

Hill, R. Carter and Adkins, Lee C. (2001): 'Collinearity' in Baltagi (ed.) A Companion to Theoretical Econometrics, Ch-12, Blackwell.

IIPS, Measure DHS+ and ORC Macro (2000): National Family Health Survey (NFHS-2), 1998-99: India, International Institute of Population Sciences, Mumbai.

Indian Academy of Pediatrics (www.iapindia.org/immunization.cfm)

Islam, S.M.S. and Islam, M.M. (1996): 'Influences of Selected Socio-economic and Demographic Factors on Child Immunization in a Rural Area of Bangladesh', *Demography India*, Vol-25, No.-2, pp-275-83.

Kethineni, V. (1991): 'Political Economy of State Intervention in Health Care', *Economic and Political Weekly*, October 19, pp-2427-33.

Khaleghian, Peyvand (2003): 'Decentralization and Public Services: The Case of Immunization', Policy Research Working Paper No.-2989, *The World Bank*.

Kulkarni, Manu N. (1992): 'Universal Immunization Programme in India: Issues of Sustainability', *Economic and Political Weekly,* July 4, pp-1431-7.

Madhavi, Y. (2003): 'Manufacture of Consent?: Hepatitis B Vaccination', *Economic and Political Weekly,* June 14, pp-2417-24.

Morrison, D.G. (1972): 'Upper Bounds for Correlations between Binary Outcomes and Probabilistic Predictions', *Journal of American Statistical Association*, Vol-67.

Mosley, W.H. and Chen, L.C. (1984): 'Child Survival: Strategies for Research', Supplement to *Population and Development Review*, Vol-10.

Nag, Moni (1989): 'Alternative Routes of Fertility and Mortality Decline: A Study of Kerala and Punjab' in S.N.Singh (ed.) Population Transition in India, Vol-1, BR Publishing Corp., Delhi.

Nag, Moni (1989): 'Political Awareness as a Factor in Accessibility of Health services: A Case Study of Rural Kerala and West Bengal', *Economic and Political Weekly*, Feb 25.

National Planning Committee (1948), Report of the Sub-Committee on National Health, Vora & Co, Bombay, pp-224-5.

National Polio Surveillance Project (http://www.npspindia.org)

Padhi, Sakti (2001): 'Infant and Child Survival in Orissa: An Analysis with NFHS Data', *Economic and Political Weekly*, Aug 25, pp-3316-26.

Padmanabha (1992): 'Integrating Family Welfare and development Programmes: Some Organizational Considerations', *Economic and Political Weekly*, Jan 18, pp-89-91.

Panda, Pradeep K. (1997): 'Female Headship, Poverty and Child Welfare: A Study of Rural Orissa', *Economic and Political Weekly*, Oct 25, pp-WS-73-WS-82.

Paul, Y. (2004): Letter to the Editor, Vaccine 23, 280 available on July 22, 2004, at www.sciencedirect.com, Elsevier.

Peabody, J. (1999): Policy and Health: Implications for Development in Asia, Cambridge University Press.

Pebley, A.R., Goldman, N. and Rodriguez, G. (1996): 'Prenatal and Delivery Care and Childhood Immunization in Guatemala: Do Family and Community Matter?', *Demography*, Vol-33, No.-2, pp-231-47.

Pindyck, R.S. and Rubinfeld, D.L. (1998): Econometric Models and Economic Forecasts, 4th Edition, Irwin McGraw-Hill.

Rajan, S.I. and James, K.S. (2004): 'Second National Family Health Survey: Emerging Issues', *Economic and Political Weekly*, Feb 14, pp-647-51.

Rajan, S.I. and James, K.S. (1993a): 'State's Dwindling Role in Health Sector', *Economic and Political Weekly*, Feb 13, pp-269.

Rajan, S.I. and James, K.S. (1993): 'Kerala's Health Status: Some Issues', *Economic and Political Weekly*, Sep 4, pp-1889-92.

Rajeshwari (1996): 'Gender Bias in Utilization of Health Care Facilities in Rural Haryana', *Economic and Political Weekly,* Feb 24, pp-489-94.

Retherford, Robert D. and Minja Kim Choe (1993): Statistical Methods for Causal Analysis, New York: John Wiley and Sons.

Robalino, D.A, Picazo, O.F. and Voetberg, A. (2001): 'Does Fiscal Decentralization Improve Health Outcomes?: Evidence from a Cross-Country Analysis', Policy Research Working Paper No.-2565, *The World Bank*.

Sai, Fred (1988): '*Protecting the World's Children—An Agenda for the 1990s*', The Task Force for Child Survival, Tufts University European Centre, Talloires, France, March 10-12.

Sathyamala, C., Priya, R., Dasgupta, R. and Mittal, O. (2005): 'Polio Eradication: Some Concerns', *Economic and Political Weekly*, Apr 2, pp-1474-5.

Sathyamala, C. (1989): Immunization, *The Technology Missions*, Seminar 354, New Delhi, February.

Sokhey, Jotna (1988): National Immunization Programme (National Health Programme Series 1), MoHFW, National Institute of Health and Family Welfare, New Delhi.

Sokhey, Jotna, 1985: Universal Immunization Programme 1985-86: Data at a Glance, MoHFW, GoI.

Steele, F., Diamod, I. and Amin, S. (1996): 'Immunization Uptake in Rural Bangladesh: A Multilevel Analysis', *Journal of Royal Statistical Society*, Vol-159, Part-2, pp-289-99.

The Task Force for Child Survival, *Protecting the World's Children*, Bellagio II, Colombia, October, 1985.

Tharakan, P.K. (1984): 'Socio Economic Factors in Educational Development, Case of 19th Century in Travancore', *Economic and Political Weekly*, Nov 10.

UNICEF (http://www.childinfo.org/eddb/polio/country.htm)

UNICEF (2005): Immunization Summary-2005: A Statistical Reference.

Visaria, P. and Rajan, S.I. (1999): 'National Family Health Survey: A Landmark in Indian Surveys', *Economic and Political Weekly*, Oct 16, pp-3002-7.

Winslow, P.H. (1951): 'The Cost of Sickness and the Price of Health', *WHO*, Geneva, pp-9.

World Health Organization (http://www.who.int).

WHO (2004): 'Economics of Immunization: A Guide to the Literature and other Resources', Dept. of Vaccines and Biologicals, (http://www.who.int/vaccines-documents/).

WHO (1986): 'The Expanded Programme on Immunization in South-East Asia', *SEARO Regional Health Papers 12*: India, New Delhi.

WHO (1978): *Primary Health Care: A joint Report* by director general of WHO and executive director of UNICEF, Geneva.

APPENDIX:

EXHIBIT-A: CHILD DEATHS CAUSED BY SELECTED VIPS, 2002

Cause of Death	Children under five	Children five and older
Diphtheria	4,000	1,000
Measles	540,000	71,000
Neonatal Tetanus	180,000	—
Pertussis	294,000	—
Tetanus (excluding neonatal tetanus)	18,000	15,000

Source: UNICEF, 2005, pp-vii.

EXHIBIT-B: CHILDHOOD IMMUNIZATION BY SOURCE OF INFORMATION

Percentage of children age 12-23 months who received specific vaccinations at any time before the interview and before 12 months of age by source of information on vaccination history and residence, India, 1998-99

Source information	Percentage vaccinated											Number of children
	BCG	Polio 0	DPT 1	DPT 2	DPT 3	Polio 1	Polio 2	Polio 3	Measles	All[1]	None	
A	**URBAN**											
Vaccination Card	96.6	33.0	98.9	96.4	91.1	98.5	96.0	90.8	81.0	77.5	0.1	1048
Mother's report	78.4	14.9	75.3	69.5	58.3	86.9	83.7	67.5	59.2	46.0	11.7	1233
Either source	86.8	23.3	86.1	81.9	73.4	92.2	89.4	78.2	69.2	**60.5**	6.4	2282
B	85.1	23.3	83.6	79.1	70.6	89.4	86.1	74.9	59.7	**51.9**	8.6	2282
A	**RURAL**											
Vaccination Card	94.5	19.8	98.4	91.4	83.0	97.9	91.1	83.0	69.7	65.4	0.1	2344
Mother's report	55.3	5.9	53.7	46.6	35.5	73.8	68.0	47.7	34.8	24.3	23.9	5450
Either source	67.1	10.1	67.1	60.1	49.8	81.1	75.0	58.3	45.3	**36.6**	16.7	7795
B	64.3	10.1	64.4	57.0	46.6	77.5	71.1	54.4	36.2	**29.3**	20.2	7795
A	**TOTAL**											
Vaccination Card	95.2	23.9	98.6	92.9	85.5	98.1	92.6	85.4	73.2	69.1	0.1	3393
Mother's report	59.6	7.6	57.6	50.8	39.7	76.2	70.9	51.3	39.3	28.3	21.6	6684
Either source	**71.6**	**13.1**	71.1	65.0	**55.1**	83.6	78.2	**62.8**	**50.7**	**42.0**	**14.4**	10076
B	69.1	13.1	68.8	62.1	52.1	80.3	74.6	59.2	41.7	**34.5**	17.5	10076

Note: Table includes only surviving children from among the two most recent births in the three years preceding the survey. [1]: BCG, measles, and three doses each of DPT and Polio vaccines (excluding Polio-0).**A: Vaccinated any time before the interview, B: Vaccinated by 12 months of age** (for children whose information was based on the mother's report, the proportion of vaccinations given by 12 months of age is assumed to be the same age for children with a written record of vaccination).

Source: NFHS-2, India, table-6.9, pp-204

EXHIBIT-C: PERCENTAGE DISTRIBUTION OF MOTHER'S EMPOWERMENT INDEX BY STATES

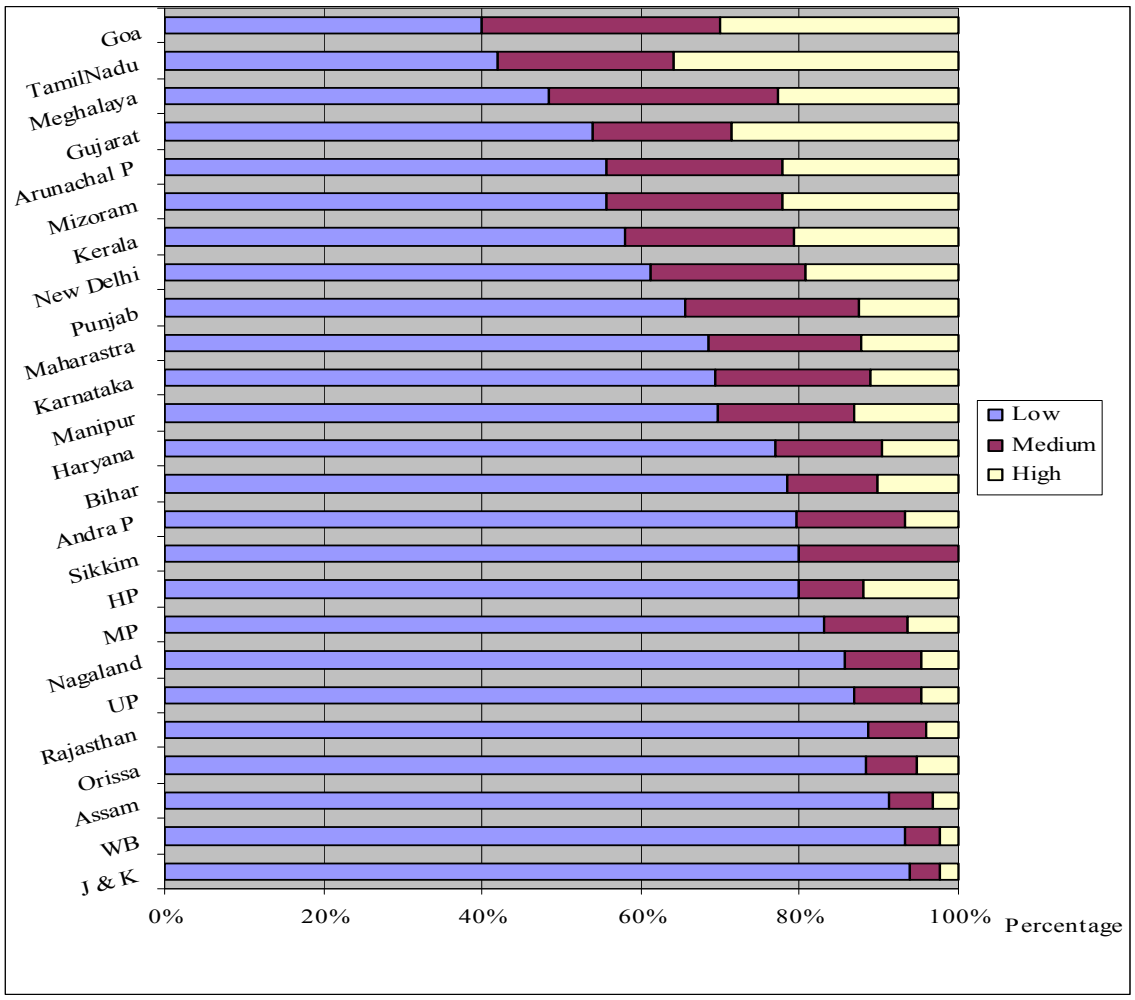

EXHIBIT-D: HYPOTHETICAL RELATIONSHIP OF VARIABLES WITH FULL IMMUNIZATION

Variable	Variable Name	Hypothesized Sign
Sex of child	sexchi	+
Birth order	border	+
Residence	res	+
Mother's education	medu	+
Mother's age	mage	+
Antenatal care	antcare	+
Religion	religion	+/-
Caste/ Tribe	cast	+/-
Std. of Living Index	stdliv	+
Media Exposure	media	+
Mother's awareness	maware	+
Sex of HH-Head	sexhead	-
Mother's Empowerment Index	mindex	+
Zone	zone	+/-
Electricity	elect	+

EXHIBIT-E: SUMMARY OF EFFECTS (P IN %) ON FULL IMMUNIZATION COVERAGE

Background Variables		India		Rural		Urban	
		Unadjusted	**Adjusted**	**Unadjusted**	**Adjusted**	**Unadjusted**	**Adjusted**
Sex of child	Female[#]	**41***	**39**	**35***	**31**	**61***	**64**
	Male	**43****	**43****	**38***	**34***	**60**	**63**
Birth order	1[#]	**54***	**49**	**48*****	**42**	**69***	**71**
	2	**49***	**43***	**44***	**36***	**65****	**64****
	3	**39***	**35***	**34***	**29***	**58***	**59***
	4+	**24***	**35***	**22***	**24***	**38***	**49***
Residence	Rural[#]	**37***	**41**	—	—	—	—
	Urban	**60***	**42**	—	—	—	—
Mother's Education	Illiterate[#]	**28***	**36**	**26***	**29**	**39***	**51**
	Lit, <mid	**52***	**45***	**48***	**36***	**65***	**67***
	Mid sch.	**63***	**52***	**59***	**43***	**71***	**71***
	High sc+	**73***	**52***	**69***	**44***	**76***	**69***
Mother's age	15-19[#]	**37***	**28**	**35***	**22**	**47**	**45**
	20-24	**45***	**38***	**40***	**30***	**61***	**58***
	25-29	**46****	**47***	**40***	**39***	**64***	**66***
	30-49	**33***	**47***	**25***	**36***	**60***	**74***
Antenatal care	No[#]	**18***	**30**	**17***	**23**	**28***	**52**
	Yes	**57***	**48***	**53***	**41***	**66***	**65***
Religion	Hindu[#]	**42***	**42**	**37***	**33**	**63***	**65**
	Muslim	**33***	**32***	**25***	**25***	**49***	**55***
	Christ &	**64***	**56***	**59***	**49***	**77***	**69**
Caste/ Tribe	General[#]	**47***	**42**	**40***	**34**	**63***	**64**
	SC	**40***	**44**	**37*****	**37*****	**53***	**62**
	ST	**26***	**31***	**24***	**23***	**46***	**51*****
	OBC	**43***	**41**	**38**	**32**	**63**	**65**
Standard of Living Index	Low[#]	**30***	**39**	**29***	**31**	**43***	**65**
	Medium	**43***	**40**	**39***	**33**	**57***	**60**
	High	**65***	**46***	**58***	**37****	**72***	**66**
Media Exposure	No[#]	**25***	**38**	**24***	**30**	**38***	**61**
	Yes	**56***	**43***	**52***	**35***	**65***	**64**
Mother's Awareness	No[#]	**33***	**36**	**28***	**28**	**52**	**56**
	Yes	**58***	**51***	**53***	**42***	**72***	**71***
Sex of HH-Head	Female[#]	**48**	**40**	**40***	**32**	**65***	**64**
	Male	**42***	**41**	**36*****	**33**	**60**	**63**
Mother's Empowerment Index	Low[#]	**39***	**41**	**34***	**32**	**56***	**63**
	Medium	**51***	**40**	**44***	**32**	**68***	**62**
	High	**58***	**43**	**50***	**34**	**72***	**65**
Zone	Central[#]	**22***	**28**	**19***	**23**	**36***	**42**
	North	**43***	**39***	**36***	**31***	**58***	**58***
	East	**27***	**31*****	**25***	**25**	**44****	**46**
	Northeast	**20**	**21****	**17**	**15***	**46**	**45**
	West	**71***	**66***	**68***	**61***	**75***	**76***
	South	**70***	**60***	**66***	**52***	**79***	**77***
Electricity	No[#]	**24***	**37**	**24***	**30**	**32***	**46**
	Yes	**57***	**44***	**52***	**36***	**63***	**65***

[#]: Reference category; Significance level: ***10%, **5%, *1%.

EXHIBIT-E[†]: UNADJUSTED EFFECTS ON FULL IMMUNIZATION COVERAGE IN INDIA

Background Variables		P (in%)
Sex-wise Birth-order	Female, Birth-1[#]	**53****
	Female, Birth-2	**49****
	Female, Birth-3	**36***
	Female, Birth-4	**23***
	Male, Birth-1	**55**
	Male, Birth-2	**49*****
	Male, Birth-3	**42***
	Male, Birth-4	**25***
Father's Education	Illiterate[#]	**27***
	Lit, < mid. sch.	**40***
	Middle sch. comp.	**47***
	High sch. & +	**56***
Mother's Employment	Not working[#]	**43***
	Work, non-wage	**36***
	Work, wage	**44**

EXHIBIT-F: ADJUSTED EFFECTS OF DEMOGRAPHIC FACTORS IN INDIA

Background Variables		β	$SE.$	$\log\Omega$	Ω	P (in %)
Sex of child	Female[#]			-0.494	0.610	**38**
	Male	0.122**	0.048	-0.372	0.689	**41****
Birth order	1[#]			0.116	1.123	**53**
	2	-0.338*	0.066	-0.222	0.801	**44***
	3	-0.771*	0.079	-0.655	0.519	**34***
	4+	-1.219*	0.087	-1.103	0.332	**25***
Residence	Rural[#]			-0.511	0.600	**38**
	Urban	0.349*	0.059	-0.162	0.851	**46***
Mother's age	15-19[#]			-1.185	0.306	**23**
	20-24	0.604*	0.082	-0.581	0.559	**36***
	25-29	1.063*	0.094	-0.122	0.885	**47***
	30-49	1.073*	0.111	-0.112	0.894	**47***
Antenatal care	No[#]			-1.103	0.332	**25**
	Yes	1.077*	0.057	-0.026	0.975	**49***
Religion	Hindu[#]			-0.388	0.679	**40**
	Muslim	-0.512*	0.074	-0.900	0.407	**29***
	Christ and minorities	0.702*	0.116	0.314	1.370	**58***
Caste/ Tribe	General[#]			-0.271	0.763	**43**
	SC	-0.140**	0.070	-0.411	0.663	**40****
	ST	-0.746*	0.098	-1.017	0.362	**27***
	OBC	-0.192*	0.061	-0.463	0.629	**39***
Sex of HH-Head	Female[#]			-0.406	0.667	**40**
	Male	-0.028	0.097	-0.434	0.648	**39**
Zone	Central[#]			-1.082	0.339	**25**
	North	0.617*	0.081	-0.465	0.628	**39***
	East	0.116	0.072	-0.966	0.381	**28**
	Northeast	-0.353**	0.160	-1.435	0.238	**19****
	West	1.771*	0.082	0.689	1.991	**67***
	South	1.540*	0.075	0.458	1.581	**61***
Constant		-1.869*	0.137	-1.869	0.154	13
N	**10017**			**Cox & Snell** R^2		**0.270**
Model χ^2	**3127.49***			**Nagelkerke** R^2		**0.363**

[#:] Reference category; Significance level: **5%, *1%.

EXHIBIT-G: ADJUSTED EFFECTS OF SOCIOECONOMIC FACTORS IN INDIA

Background Variables		β	*S.E.*	$\log\Omega$	Ω	P **(in %)**
Mother's Education	Illiterate[#]			-0.786	0.456	**31**
	Lit, < mid. sch. com.	0.677*	0.063	-0.109	0.897	**47***
	Middle sch. comp.	0.994*	0.083	0.208	1.232	**55***
	High sch. comp. & +	1.240*	0.082	0.454	1.575	**61***
Standard of Living Index	Low[#]			-0.265	0.767	**43**
	Medium	-0.205*	0.058	-0.470	0.625	**38***
	High	-0.177**	0.087	-0.442	0.643	**39****
Media Exposure	No[#]			-0.678	0.508	**34**
	Yes	0.524*	0.056	-0.154	0.857	**46***
Mother's Awareness	No[#]			-0.699	0.497	**33**
	Yes	0.864*	0.048	0.165	1.179	**54***
Mother's Empowerment Index	Low[#]			-0.465	0.628	**39**
	Medium	0.265*	0.070	-0.200	0.819	**45***
	High	0.407*	0.077	-0.058	0.944	**49***
Electricity	No[#]			-0.893	0.409	**29**
	Yes	0.907*	0.055	0.014	1.014	**50***
Constant		-1.833*	0.051	-1.833	0.160	14
N	**9951**			**Cox & Snell** R^2		**0.206**
Model χ^2	**2295.86***			**Nagelkerke** R^2		**0.277**

[#]: Reference category; Significance level: ***10%, **5%, *1%.

EXHIBIT-H: ADJUSTED EFFECTS (P IN %) ON DPT, POLIO AND PARTIAL IMMUNIZATION COVERAGE IN INDIA

Background Variables		DPT	Polio	Partial
Sex of child	Female[#]	**58**	**67**	**93**
	Male	**61****	**68**	**94***
Birth order	1[#]	**66**	**73**	**93**
	2	**62****	**70*****	**94*****
	3	**54***	**64***	**93**
	4+	**51***	**61***	**92**
Residence	Rural[#]	**59**	**67**	**93**
	Urban	**61**	**69**	**93**
Mother's Education	Illiterate[#]	**52**	**63**	**90**
	Lit, < mid. sch. com.	**62***	**70***	**93***
	Middle sch. comp.	**71***	**74***	**95***
	High sch. comp. & +	**73***	**77***	**98***
Mother's age	15-19[#]	**49**	**60**	**92**
	20-24	**57***	**67***	**94****
	25-29	**64***	**71***	**93**
	30-49	**62***	**69***	**92**
Antenatal care	No[#]	**47**	**57**	**89**
	Yes	**66***	**73***	**95***
Religion	Hindu[#]	**60**	**68**	**94**
	Muslim	**49***	**60***	**90***
	Christ and minorities	**74***	**78***	**94**
Caste/ Tribe	General[#]	**61**	**67**	**93**
	SC	**62**	**70*****	**93**
	ST	**45***	**59***	**90***
	OBC	**60**	**70****	**94***
Standard of Living Index	Low[#]	**56**	**65**	**92**
	Medium	**59*****	**68****	**93****
	High	**65***	**72***	**95***
Media Exposure	No[#]	**55**	**66**	**92**
	Yes	**62***	**69*****	**94***
Mother's Awareness	No[#]	**53**	**63**	**89**
	Yes	**70***	**76***	**97***
Sex of HH-Head	Female[#]	**57**	**68**	**93**
	Male	**59**	**68**	**93**
Mother's Empowerment Index	Low[#]	**59**	**67**	**93**
	Medium	**60**	**68**	**94**
	High	**57**	**69**	**92**
Zone	Central[#]	**45**	**58**	**89**
	North	**50****	**62****	**91**
	East	**47**	**59**	**93***
	Northeast	**42**	**46***	**84***
	West	**79***	**81***	**97***
	South	**79***	**81***	**96***
Electricity	No[#]	**57**	**64**	**92**
	Yes	**61****	**70***	**94***

[#]: Reference category; Significance level: **5%, *1%.

EXHIBIT-I: ADJUSTED EFFECTS (P IN %) ON FULL IMMUNIZATION COVERAGE

Variables		Bihar	TN	WB	India	EAG States	N-E States	Other States
Sex of child	Female[#]	**6**	**93**	**40**	**39**	**15**	**11**	**68**
	Male	**9****	**94**	**44**	**43****	**18***	**19*****	**69**
Birth order	1[#]	**10**	**95**	**52**	**49**	**21**	**18**	**76**
	2	**11**	**92**	**44**	**43***	**20**	**15**	**69***
	3	**9**	**95**	**30***	**35***	**17****	**8**	**63***
	4+	**4****	**88**	**32****	**35***	**12***	**17**	**57***
Residence	Rural[#]	**7**	**90**	**43**	**41**	**16**	**14**	**68**
	Urban	**13****	**97****	**35**	**42**	**19**	**22**	**69**
Mother's Education	Illiterate[#]	**7**	**92**	**37**	**36**	**15**	**11**	**62**
	Lit, < mid. sch. com.	**11**	**93**	**37**	**45***	**19****	**16**	**71***
	Middle sch. comp.	**13*****	**89**	**63***	**52***	**28***	**19**	**74***
	High sch. comp. & +	**12*****	**97**	**65***	**52***	**25***	**39***	**76***
Mother's age	15-19[#]	**7**	**86**	**36**	**28**	**11**	**23**	**56**
	20-24	**6**	**93*****	**45**	**38***	**14*****	**15**	**67***
	25-29	**9**	**95****	**50*****	**47***	**20***	**16**	**73***
	30-49	**10**	**93**	**25**	**47***	**21***	**11**	**71***
Antenatal care	No[#]	**7**	**85**	**34**	**30**	**14**	**9**	**56**
	Yes	**9**	**94*****	**43**	**48***	**23***	**20****	**70***
Religion	Hindu[#]	**9**	**93**	**48**	**42**	**18**	**16**	**70**
	Muslim	**3***	**97**	**29***	**32***	**11***	**10**	**59***
	Christ and minorities	**50*****	**84**	**56**	**56***	**39***	**21**	**75*****
Caste/ Tribe	General[#]	**8**	**99**	**41**	**42**	**18**	**19**	**67**
	SC	**9**	**92**	**46**	**44**	**19**	**15**	**69**
	ST	**2**	**93**	**51**	**31***	**12****	**12**	**60****
	OBC	**8**	**94**	**16***	**41**	**16**	**10**	**73***
Standard of Living Index	Low[#]	**6**	**95**	**43**	**39**	**14**	**17**	**69**
	Medium	**11****	**91**	**41**	**40**	**18***	**14**	**66**
	High	**11**	**96**	**41**	**46***	**19****	**13**	**74*****
Media Exposure	No[#]	**7**	**92**	**37**	**38**	**16**	**12**	**67**
	Yes	**9**	**94**	**46*****	**43***	**18**	**19**	**69**
Mother's Awareness	No[#]	**7**	**91**	**27**	**36**	**15**	**14**	**62**
	Yes	**10**	**94**	**52***	**51***	**22***	**20**	**74***
Sex of HH-Head	Female[#]	**15**	**97**	**43**	**40**	**19**	**19**	**65**
	Male	**7*****	**93**	**42**	**41**	**17**	**15**	**69**
Mother's Empowerment Index	Low[#]	**8**	**93**	**42**	**41**	**17**	**14**	**67**
	Medium	**5**	**96**	**26*****	**40**	**13****	**16**	**72****
	High	**7**	**92**	**55**	**43**	**15**	**28**	**73***
Electricity	No[#]	**8**	**88**	**39**	**37**	**15**	**14**	**59**
	Yes	**7**	**94****	**51****	**44***	**20***	**16**	**72***

[#]: Reference category; Significance level: ***10%, **5%, *1%.