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Title

Understanding the Factors Associated with Slow Progress in Childhood Immunisation in India

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Understanding the Factors Associated with Slow Progress in Childhood Immunisation in India

Abstract

This paper attempts to understand the factors associated with slow progress in coverage of basic childhood immunization in India and states of Gujarat, Andhra Pradesh and Bihar using three rounds of National Family Health Survey data. States are selected on the basis of changes in full immunization coverage during 1992-2005. Bivariate, multivariate and dropout rates are used to understand the differentials and changes in immunization coverage. The result reveals that there has been substantial improvement in partial immunization in most of the states. However the increase in full immunization coverage is relatively slow in India and states. Along with other factors, availability of health card, ANC visits of mother are found two crucial determinants in explaining the full immunization coverage in selected states irrespective of time. Finding further reveals that higher drop out of DPT3 and Measles are responsible for slow increase in full immunization coverage in selected states.

1. Introduction

In developing country, the vaccine preventable diseases (VPDs) is the leading cause of under five mortality (Anand, S. and Barnighausen, T. 2007). To prevent the VPDs, the basic childhood vaccinations have been integrated in the public health programme of many developed and developing countries. In developed countries, the child immunisation programmes have been most successful and cost effective public health tools in preventing infectious diseases during childhood. The vaccine not only protects the children from potentially serious illness but also interrupt the diseases transmission in a community (Mark & Darden, 1999). However, in developing countries including India, a large proportion of children are either not immunized at all or partially immunized resulting in higher infant and child mortality. The UN Millennium declaration had outlined reduction of under five mortality as one of the eighth goals with proportion of 1-year old children immunized against measles as one of the monitoring indicators (UN, 2003).The basic childhood vaccinations have been advocated as the most important medical intervention in preventing childhood morbidity and mortality.

The World Health Organization launched the Expanded Immunisation Programme in 1974 to prevent six major preventable childhood diseases namely, the measles, tuberculosis, pertussis (whooping cough), diphtheria, tetanus and poliomyelitis. Under the EIP, children receive one dose of BCG for protection against tuberculosis, three doses of the triple vaccine DPT (diphtheria, pertusis and tetanus), three doses of either IPV (inject able) or OPV (oral) for poliomyelitis protection and one dose of the measles vaccine by their first birthday. These combinations are also known as basic childhood immunisation or full immunisation in various countries and used interchangeably.

In India, the basic childhood immunisation services are part of essential health services and accorded top priority in its health delivery system. Following the Alma Ata Declaration in 1978, the country had adopted Expanded Immunisation Programme (EIP) under the National Health Policy. It introduced six childhood vaccines (Bacillus Calmette-Guerin, DPT, Polio and typhoid) in its EIP in 1978 and measles vaccine was added in 1985. These services are delivered at all public health centers and sub-centers at free of cost, and private sectors do provide these services to some extent. To accelerate the implementation of the immunisation programme, the Government of India launched Universal Immunisation Programme (UIP) in 1985-86 with the objective of achieving universal immunisation of all children and pregnant women by the 1990s. The UIP became a part of the Child Survival and Safe Motherhood Programme in 1992 and Reproductive and Child Health (RCH) Programme in 1997 (MOHFW, 2002-03:176). However, the targets of universal immunisation were revised in subsequent National Population Policy and the National Rural Health Mission (MOHFW, 2000; 2008).

Despite the importance, the coverage of all basic child hood immunisation in the country had never reached to majority of the children. In addition, there is wide variation in coverage of immunisation among states of India. Moreover, the differentials in immunisation services continued to be large by economic and social status of household. For example, in 2005-06, the full immunisation of children aged 12-23 months belonging to lowest wealth quintile was 24.4% compared to 71.0% among wealthiest quintile (IIPS and Macro International, 2007). Studies indicate that wealth and regional inequalities in India are correlated with overall level of immunisation in a non-linear fashion (Pande and Yazebeck 2003). Realizing the need, the National Population Policy and the National Rural Health Mission reiterated in achieving the universal immunisation by 2010 (NRHM, 2008 and NPP 2000).

However, evidences from large scale population based surveys revealed that there is a large gap between target and achievement of child immunisation in the country. Moreover, the trends in immunisation services seem to be slowed down in recent years as compared to other reproductive and child health services. For example, the coverage of full immunisation had increased by 4 percent during 1992 to 1998 and 5 percent during 1998 to 2005. Further a number of states (8 out of 29) had shown decline in full immunisation during 1998-2005. It may be mentioned that while the demographically backward states such as Bihar, Uttar Pradesh and Orissa had shown the sign of improvement in coverage of child immunisation it had deteriorated in the economically progressive states like Gujarat and Maharashtra. Though the coverage of immunisation varies largely across the states of India, little is known on the trends, pattern and the cause of such changes.

Accordingly, the objective of this paper is to understand the levels, trends and changes in childhood immunisation in India and states, differentials in coverage of full immunisation by socio-economic and demographic characteristics in the states of Bihar, Andhra Pradesh and Gujarat. Finally this paper tries to explore the factors associated with the use and change in the immunisation services in Bihar, Andhra Pradesh and Gujarat.

2. Data and Methods

This study uses the data from three successive rounds of National Family Health Surveys conducted during 1992-2005. The first round of NFHS was conducted in 1992-93, the second round in 1998-99 and the third round in 2005-06. For convenience, we refer the periods between 1992-93 and 1998-99 as 1992-98, between 1998-99 and 2005-06 as 1998-05 and between 1992-93 and 2005-06 as 1992-05. All these rounds of survey are nationally representative and covered more than 99% of country's population. These population based surveys are in similar line with other Demographic and Health Surveys (DHS) and covers a wide range of topics such as fertility, mortality, family planning, immunisation coverage of children, nutritional status, and other issues. It may be mentioned that there are improvement in the coverage of topics, geographical areas, from one round to another round of the survey.

With regard to vaccination coverage, all the three rounds of NFHS collected information on all childhood vaccination for the surviving child aged 12 months or and born in the reference period. The reference period and the number of last birth is different in all three rounds. The NFHS-1 taken into account of last three births in four years time, it was last two births in last three years time in NFHS-2. In NFHS-3, the last five births in past five years were considered. To make the estimates comparable, the study estimates the vaccination coverage of children 12-23 months for the last two births. Children are the unit of analysis, and so the KID's files of three rounds are used. For the state of Bihar, the estimates are for new Bihar excluding Jharkhand for all the three period.

Dependent Variable: This study uses basic childhood Immunisation of surviving child aged 12-23 months prior to survey date and it is classified as:

No Immunisation: Surviving children age 12-23 months who did not receive any vaccination

Partial Immunisation: Surviving children age 12-23 who received at least any one of the vaccination

Full Immunisation: Surviving children age 12-23 who received all doses of each vaccine namely *(BCG+ 3 doses of DPT + 3 doses of Polio + Measles.)*

Independent Variables: The study uses selected socio-economic and demographic variables to understand the differentials in immunisation coverage. The *socioeconomic variables* are: mother's education, place of residence, religion of household, caste of household, standard of living index. The *demographic variables* are: sex of the child, birth order of child, age of mother. *Others variables* are antenatal care (ANC) visits, availability of health card.

Bivariate analysis has been carried out to understand the differentials and changes in immunisation coverage. The dropout rate, which is compliment of rate of progression, is used to understand the sequential progression of child from one vaccine to another vaccine. To understand the statistical significance of factors affecting the immunisation, a binary logistic regression is attempted for 1998-99 and 2005-06.

3. Results and Discussion

A. Trends and changes in Immunisation coverage in India and states

The levels and trends in the coverage of none, partial and full immunisation in the states of India is shown in table 1. The no immunisation has significantly declined from 30 percent in 1992-93 to 14 percent in 1998-99 and further to 5 percent in 2005-06. On the other hand, the partial immunisation has increased from 35 to 46 percent and further to 51 percent during the period. However, the increase in full immunisation was slower (increase from 36 to 44 percent) during last 14 years. The coverage of full immunisation varies largely across the states over the period. Among the major states, the coverage of immunisation (2005-06) is highest in Tamil Nadu followed by Kerala, Himachal Pradesh etc. On the other hand, the coverage is lower in the state of Uttar Pradesh followed by Rajasthan, Assam and Bihar. The overall pattern in the coverage of immunisation has remained similar over the years in the states of India. The states such as Bihar, West Bengal, Orissa and Assam, have witnessed a substantial increase in vaccination coverage in last 14 years. For example, the full vaccination in Bihar had increased from 10 percent during 1992-93 to 32 percent in 2005-06.

The changes in the coverage in none, partial and full immunisation during three point of time (1992-98 to 1998-05 and, 1992-05) are shown in table 2. The states are arranged in ascending order of overall changes in full immunisation during 1992-2005. In case of changes in none immunisation during 1992-05 each states are showing declining figure, where Tamil Nadu is on the top with maximum changes followed by Uttar Pradesh, Rajasthan and Kerala. On the other hand, minimum changes are found in states of Punjab, Maharashtra and Karnataka. With regard to changes in partial immunisation during 1992-05, Rajasthan is on the top position followed by Uttar Pradesh, Bihar and Punjab. While those states, which have noticed lower changes, are West Bengal, Kerala, Tamil Nadu and Himachal Pradesh. ***Based on changes in coverage of full immunisation during 1992-2005, the states are classified into following three groups*** (figure 1.)

***Group A States*:** These are the states which are experiencing negative changes in the coverage of full immunisation. This group includes states of **Gujarat,** Maharashtra, Punjab and Mizoram.

Group B States: Those states are experiencing increase in full immunisation coverage during the periods but less than national coverage of immunisation. This group includes **Andhra Pradesh**, Jammu & Kashmir, Karnataka, Himachal Pradesh, Uttar Pradesh, Haryana, Arunachal Pradesh, New Delhi and Goa.

Group C States: These Sates are experiencing increase in immunisation coverage more than national coverage of immunisation. This group includes Tamil Nadu, Rajasthan, Kerala, Madhya Pradesh, Orissa, Assam, West Bengal, **Bihar**, Uttaranchal, Chhattisgarh, Manipur, Tripura, Meghalaya, Jharkhand, and Nagaland.

Based on changes in coverage of full immunisation, one state from each group namely, Gujarat from group A, Andhra Pradesh from group B, and Bihar from group C is selected for further analysis. Gujarat and Bihar represents the extreme condition of their group, like Gujarat had experienced maximum decline (9 percent) in full vaccination coverage among its group whereas Bihar noticed maximum increase in coverage of full vaccination during 1992-2005. The state of Andhra Pradesh has noticed a fluctuating trend. This is taken as illustration to explore the factors influencing the levels and change in coverage of immunisation in India.

B. Differentials in coverage of immunisation in states of Bihar, Andhra Pradesh and Gujarat

The differentials in coverage of full immunisation by socio-economic and demographic characteristic for the states of Bihar, Andhra Pradesh, and Gujarat are shown in table 3. Among demographic factors, the variables considered are, sex of child, and birth order of child, age of mother and place of residence. Similarly the socio-economic variables are, standard of living index, education of mother, working status of mother, caste of household, religion of household. In addition, two other variables namely, health card of the child and the coverage of ANC are included in the analysis.

In Bihar the coverage of full immunisation has increased 10 percent from 1992-93 to 11 percent in 1998-99 and 32 percent in 2005-06. The increased in later period has been noticed for both male and female child, for all birth orders, and for all age groups of mother. However, the differential by sex of child shows that female are in disadvantages to male in coverage of immunisation but the situation is improving. Coverage of full immunisation is higher in urban areas than that of rural areas for all the periods. The coverage of full immunisation by mothers aged 35 and above is minimum. Education levels of mothers and economic status of household are directly related to coverage of full immunisation in all the three periods.

One of the interesting finding in level and changes in the coverage of full immunisation is by ANC visits and health card record of child. For example, the coverage of full immunisation is 57 percent for mothers who have received three or more ANC visits as compare to 27 percent of those who have received less than three visits in 2005-06. Similarly, the differentials in coverage of immunisation by health card of child shows that, the immunisation coverage of children having a health card and seen by investigators is 61 percent as compared to 36 percent for those having health card but not seen by investigator and 5 percent, without health card. The estimated coverage of full immunisation has increased significantly over the years.

In case of Andhra Pradesh, the coverage of full immunisation has increased for the male child but declined for female child, for younger mothers and in rural as well as urban areas during 1998-2005. With respect to education level of mother, there has been a sharp decline for less educated mother. However, those children have health card and verified by investigators have reported higher coverage and sharp increasing in all the period. With respect to caste, the substantial increase is observed in coverage of full immunisation among others (general) caste.

In case of Gujarat, there has been a continuous decline in coverage of full immunisation during the 1992-2005. The decline is sharper for female children as compare to male, for younger mother as compare to elder and largely in rural areas. With respect to education, decline is noticeable among illiterate mothers. With respect to standard of living, there is a sharp decline among people with low and medium SLI during the period. However, the coverage of full immunisation has increased among those children who have health card and seen by investigators during the period.

From the analysis, it had shown that the coverage of immunisation has consistently increased among those children having a health card and seen in all the three states during last 14 years. The same is true for those children whose mothers had received 3 and more ANC visits during pregnancy. However, this is not true for other groups.

C. Rate of progression in the vaccination coverage in state of Bihar, Andhra Pradesh and Gujarat

Table 4 shows the rate of progression from one vaccine to another for all three states for three point of time. In Bihar, coverage of BCG is very less for all the periods. Apart from this, drop out rate (complement to rate of progression) in 2005-06 is lower for Polio 1, 2, 3 followed by DPT 1, 2 and 3. But drop out is maximum for Measles followed by DPT 3. More than half of the children, those received Polio 3 had not received the measles vaccination in Bihar in 2005-06. Similarly, about one-third children had not even given the BCG. On comparing the coverage over the years, it may be mentioned that there has been substantial improvement in BCG, DPT 3 and Polio 3 but not so for measles. The coverage of BCG was very low during the periods. Therefore, considering as a primary vaccine, it is a major obstacle to achieving the goal of full immunisation.

In Andhra Pradesh the drop out is also highest for measles followed by DPT 3 & DPT 2. There has been substantial fall in the coverage of DPT 2 and DPT 3 in the state resulting in drop out in the coverage of full immunisation. In Gujarat, the dropout rate in 2005-06 is highest for DPT 3 followed by DPT 2, Polio 3 and Measles during 1998-2006.

From the analysis, it may be said that the dropout rate in coverage of DPT 2, DPT 3 and Measles in Bihar continued to be cause of lower full immunisation in the state. In case of Andhra Pradesh, the drop out in DPT 3,DPT 2, Polio3 and measles while, in Gujarat the higher drop out for DPT 3,DPT 2 and Polio 3 may be attributed as the causes of lower as well as consistent decline in coverage of full immunisation in the state.

D. Factors affecting the coverage of full immunisation

To understand the statistical significance of factors affecting the immunisation, a binary logistic regression is attempted for 1998-99 and 2005-06. The results are shown in table 5. The dependent

variables are dichotomous, 1 for full immunisation and 0 for otherwise (including no & partial immunisation). The independent variables are sex of child, birth order of child, age of mother, education of mother, place of residence, caste of household, availability of health card, standard of living index, and religion of household, ANC visits and exposure to mass media.

It may be mentioned that the significant predictors of full immunisation in all the three states in both the periods are three ANC visits of mother, availability of health card of the child and exposure to mass media. For example, the odds of being fully immunized for children who had received 3 or more ANC visit was 2.09 in 1998-99 and 6.0 in 2005-06 for Andhra Pradesh. Similarly, the odds of being full immunized for a child with a health card is 25.6 in 1998-99 and 12.92 in 2005-06 for Bihar. The other proximate determinants such as education of mother, birth order, standard of living index are not uniformly significant for all the states over the period. For example, in case of Bihar, the significant predictors for full immunisation are sex of the child, availability of health card, medium standard of living index, three and more ANC visits, and exposure to mass media during 2005-06. However, rural area and religion are significant during1998-99 but not in 2005-06.

In Andhra Pradesh, availability of health card, exposure to mass media and three and more ANC visits are found as a significant predictor of full immunisation during1998-05. However, the variables like education of mother, standard of living are not significant predictor in both the period. In Gujarat, full immunisation coverage is significantly higher among those children who have health card, belongs to educated mother, and whose mother has gone for 3 and more ANC visits. While the coverage of full immunisation is significantly, lower in female child and children from other backward categories during 2005-06.

From the analysis, it may be said that the availability of health card, full ANC visits of mother and exposure to mass media of mother are found as a common factor among all three states, which are affecting the coverage of full immunisation throughout the period.

4. Summary and Conclusions

This study attempts to understand the trends, differentials and changes in the coverage of immunisation in India and selected states. The coverage of immunisation is classified as *no*, *partial* and *full immunisation* and the analysis are carried out for all states of India. Based on the trends in coverage of full immunisation, the states are classified into three categories, namely, states experiencing negative growth rate in coverage of full immunisation, states experiencing positive but less than national average and, states experiencing more than national average in the coverage of full immunisation. For further analysis, one sate from each group has been selected.
The main findings of this study are:

1) The economically progressive states such as Gujarat, Maharashtra and Punjab had shown decline in immunisation coverage during 1992-2005.

2) While backward states such as Bihar, Uttar Pradesh and Orissa had shown the sign of improvement in coverage of child immunisation during 1992-05 though the level of immunisation coverage is lower in these states.
3) ANC visit is positively and significantly associated with the coverage of full immunisation. Those mothers receiving three or more ANC visits are more likely to immunize their children irrespective of the states and time period.
4) The immunisation coverage of children has consistently increased for those children with a health card and seen by investigator irrespective of space and time.
5) The lower coverage of full immunisation in Bihar is due to lower coverage of BCG and higher drop out in DPT 2, DPT3 and measles. In case of Andhra Pradesh, the decline is largely due to drop out for DPT 2, Polio 3 and measles. In case of Gujarat, the consistent decline in coverage of full immunisation is due to higher drop out in DPT 3 and measles.
6) The results of the binary logistic analysis confirmed the bivariate analysis. Immunisation of female child, higher birth order, women of higher age group are less likely to be immunized their children. Other hand, the health card, exposure to mass media and ANC visits are critical and significant predictors for full immunisation coverage.

Implications

Based on the findings, the implications are as follows:

1) Programme should be focus on improving the BCG and Measles coverage in Bihar while it should be focus to improve the coverage of DPT 2, Polio 3 and measles in AP. In case of Gujarat, there is a need of improving the coverage of DPT 2, DPT 3 AND Polio 3 to achieve the high level of coverage of full immunisation.
2) Health cards may be made compulsory for all newborn babies.
3) Research need to be taken to understand the reporting bias if any in explaining the changing immunisation in India.

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Table 1: Trends in coverage of basic childhood immunisation in states of India, 1992-2005

States	NFHS-1 (1992-1993)			NFHS-2 (1998-1999)			NFHS-3 (2005-2006)		
	None	Partial	Full	None	Partial	Full	None	Partial	Full
Major States									
Andhra Pradesh	17.34	37.39	45.27	4.55	43.43	52.02	3.79	50.17	46.03
Assam	43.43	37.14	19.43	33.19	50.64	16.17	15.51	53.06	31.43
Bihar	52.64	36.57	10.79	14.17	74.78	11.05	7.07	60.10	32.83
Gujarat	18.67	31.42	49.91	6.65	45.18	48.17	4.50	50.29	45.21
Haryana	17.54	29.12	53.33	10.10	29.80	60.10	8.02	26.74	65.24
Himachal Pradesh	7.69	29.23	63.08	2.00	16.00	82.00	2.13	23.40	74.47
Jammu	16.67	18.52	64.81	10.47	34.88	54.65	4.30	29.03	66.67
Karnataka	15.20	32.60	52.20	7.61	36.36	56.03	6.86	38.04	55.10
Kerala	11.43	34.29	54.29	2.25	25.84	71.91	1.83	22.83	75.34
Madhya Pradesh	35.11	36.71	28.18	15.37	64.42	20.20	5.02	54.65	40.32
Maharashtra	7.42	28.45	64.13	1.99	25.31	72.70	2.80	38.45	58.74
Orissa	28.00	36.00	36.00	9.31	50.15	40.54	11.57	36.64	51.79
Punjab	17.46	20.63	61.90	8.38	20.11	71.51	6.37	33.33	60.29
Rajasthan	48.47	30.44	21.09	22.42	61.45	16.13	6.15	67.35	26.50
Tamil Nadu	3.03	31.90	65.07	0.35	11.71	87.94	0.00	19.20	80.80
Uttar Pradesh	43.88	37.10	19.01	30.35	50.49	19.16	3.49	73.46	23.06
West Bengal	22.38	43.43	34.18	13.64	42.73	43.64	5.95	29.76	64.29
Smaller states									
Arunachal Pradesh	47.06	29.41	23.53	30.00	50.00	20.00	25.00	50.00	25.00
Chhattisgarh	31.31	35.35	33.33	7.14	70.78	22.08	2.42	48.79	48.79
Goa	9.09	18.18	72.73	0.00	20.00	80.00	0.00	18.18	81.82
Jharkhand	59.63	30.43	9.94	27.47	63.95	8.58	4.27	61.59	34.15
Manipur	33.33	37.04	29.63	16.67	41.67	41.67	4.76	47.62	47.62
Meghalaya	54.17	37.50	8.33	41.94	45.16	12.90	17.65	50.00	32.35
Mizoram	14.29	28.57	57.14	10.00	30.00	60.00	11.11	44.44	44.44
Nagaland	73.68	21.05	5.26	31.82	54.55	13.64	20.00	60.00	20.00
New Delhi	6.43	35.71	57.86	4.84	45.16	50.00	10.00	26.67	63.33
Sikkim	***	***	***	20.00	40.00	40.00	0.00	25.00	75.00
Tripura	42.42	39.39	18.18	22.22	37.04	40.74	16.13	35.48	48.39
Uttaranchal	25.77	32.99	41.24	11.11	49.49	39.39	9.33	30.67	60.00
India	**29.92**	**34.62**	**35.47**	**14.40**	**46.21**	**39.39**	**5.31**	**51.14**	**43.55**
Total Number	**3,551**	**4,095**	**4,199**	**1,468**	**4,710**	**4,013**	**552**	**5.324**	**4,535**

Note: - NFHS (National Family Health Survey); ***--information not collected

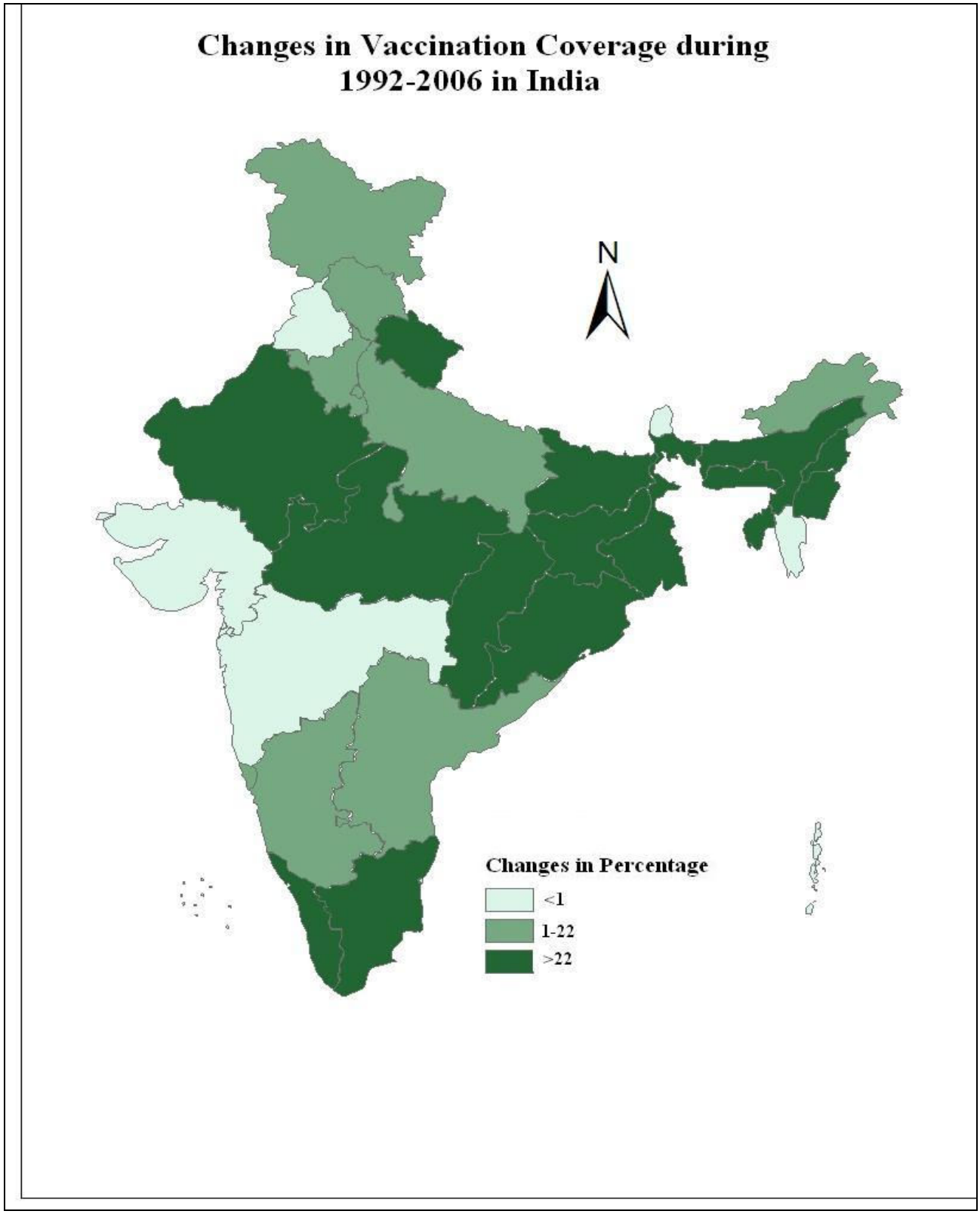
Changes in Vaccination Coverage during
1992-2006 in India
N
Changes in Percentage
<1
1-22
>22

Figure 1

Table 2: Percentage changes in coverage of none, partial and full immunisation in states of India 1992-2005

	Changes in none vaccination			Changes in partial vaccination			Changes in full vaccination		
	1992-98	**1998-05**	**1992-05**	**1992-98**	**1999-05**	**1992-05**	**1992-98**	**1998-05**	**1992-05**
Major States									
Gujarat	-64.4	-32.3	-75.9	43.8	11.3	60.0	-3.5	-6.1	-9.4
Maharashtra	-73.2	41.0	-62.2	-11.0	51.9	35.1	13.4	-19.2	-8.4
Punjab	-52.0	-24.0	-63.5	-2.5	65.7	61.5	15.5	-15.7	-2.6
Andhra Pradesh	-73.7	-16.7	-78.1	16.2	15.5	34.1	14.9	-11.5	1.7
Jammu	-37.2	-58.9	-74.2	88.4	-16.7	56.7	-15.7	22.0	2.9
Karnataka	-49.9	-9.8	-54.9	11.5	4.6	16.6	7.3	-1.7	5.6
Himachal Pradesh	-74.0	6.4	-72.3	-45.3	46.2	-19.3	30.0	-9.2	18.1
Uttar Pradesh	-30.8	-88.5	-92.0	36.1	45.4	97.9	0.8	20.4	21.3
Haryana	-42.4	-20.6	-54.3	2.3	-10.2	-8.2	12.7	8.6	22.3
Tamil Nadu	-88.5	-100.0	-100.0	-63.2	63.9	-39.8	35.1	-8.1	24.2
Rajasthan	-53.7	-72.6	-87.3	101.8	9.6	121.2	-23.5	64.3	25.7
Kerala	-80.3	-18.7	-84.0	-24.6	-11.6	-33.4	32.5	4.8	38.8
Madhya Pradesh	-56.2	-67.3	-85.7	75.4	-15.1	48.8	-28.3	99.6	43.1
Orissa	-66.8	24.3	-58.7	39.3	-26.9	1.7	12.6	27.8	43.9
Assam	-23.6	-53.3	-64.3	36.3	4.7	42.6	-16.8	94.4	61.8
West Bengal	-39.1	-56.3	-73.4	-1.6	-30.3	-31.4	27.6	47.3	88.1
Bihar	-73.1	-50.1	-86.6	104.4	-19.6	64.3	2.4	197.1	204.1
Smaller states									
Mizoram	-30.0	11.1	-22.2	5.0	48.1	55.5	5.0	-25.9	-22.2
Arunachal Pradesh	-36.3	-16.7	-46.9	70.0	0.0	70.0	-15.0	25.0	6.2
New Delhi	-24.7	106.7	55.6	26.4	-40.9	-25.3	-13.6	26.7	9.5
Goa	-100.0	-100.0	-100.0	10.0	-9.0	0.0	10.0	2.3	12.5
Uttaranchal	-56.9	-16.0	-63.8	50.0	-38.0	-7.0	-4.5	52.3	45.5
Chhattisgarh	-77.2	-66.2	-92.3	100.2	-31.0	38.0	-33.8	121.0	46.4
Manipur	-50.0	-71.4	-85.7	12.5	14.2	28.5	40.6	14.3	60.7
Tripura	-47.6	-27.4	-62.0	-5.9	-4.1	-9.9	124.1	18.8	166.1
Jharkhand	-53.9	-84.5	-92.8	110.1	-3.7	102.3	-13.6	297.8	243.6
Nagaland	-56.8	-37.1	-72.9	159.0	10.0	185.0	159.1	46.7	280.0
Meghalaya	-22.6	-57.9	-67.4	20.4	10.7	33.3	54.8	150.7	288.2
Sikkim	***	-100.0	***	***	-37.5	***	***	87.5	***
India	**-51.9**	**-63.1**	**-82.3**	**33.4**	**10.6**	**47.7**	**11.1**	**10.6**	**22.8**

***--information not collected

Table 3: Differentials in coverage of immunisation by selected demographic and socioeconomic characteristics in Bihar, Andhra Pradesh and Gujarat, 1992-2005

	Bihar			Andhra Pradesh			Gujarat		
Background characteristics	**1992-93**	**1998-99**	**2005-06**	**1992-93**	**1998-99**	**2005-06**	**1992-93**	**1998-99**	**2005-06**
Sex of child									
Male	12.43	12.91	38.00	46.92	47.84	52.70	51.48	49.55	48.46
Female	9.07	8.89	26.66	43.57	55.91	38.86	48.33	46.94	41.83
Birth order of child									
1	5.47	13.72	44.36	52.17	60.49	57.67	59.55	55.03	50.32
2	9.16	14.97	38.58	48.51	53.62	43.27	50.72	46.15	48.52
3	9.21	12.5	35.18	36.84	48.93	31.52	48.48	45.34	33.67
4+	4.69	5.38	20.23	37.17	28.57	40.98	36.22	44.66	43.01
Age of mother									
15-24	12.34	11.60	35.00	44.34	54.77	45.68	48.50	44.39	44.52
25-34	9.72	12.04	33.71	46.41	47.43	45.72	52.20	53.92	45.29
35+	6.03	1.51	11.90	44.44	36.36	52.38	43.47	30.76	58.33
Place of residence									
Urban	19.33	22.03	45.65	58.00	60.80	51.38	57.22	54.54	54.74
Rural	9.56	10.26	31.14	40.00	48.86	42.97	46.26	45.03	40.06
Mother's education									
No education	5.39	6.96	21.81	36.61	44.41	29.57	35.88	35.71	27.58
Primary	21.27	17.64	49.59	47.77	61.15	51.40	47.67	49.20	38.80
Secondary & higher	34.00	25.14	64.31	74.80	59.16	57.14	74.85	64.59	61.66
Standard of living									
Low	5.50	6.38	16.66	34.25	46.41	46.03	37.74	34.14	31.25
Medium	12.41	15.66	41.42	48.04	51.45	41.70	48.16	45.04	37.83
High	26.20	24.35	62.50	73.68	65.32	54.28	68.70	69.64	59.11
Caste									
SC & ST	4.44	9.56	24.48	35.48	48.80	38.56	40.38	41.29	46.09
OBC	***	10.73	35.33	***	52.90	43.43	***	45.04	42.28
Others	12.23	14.61	36.41	47.97	53.7.0	58.16	52.06	56.72	48.52
Religion									
Hindu	10.38	12.61	35.86	45.13	52.56	45.07	49.78	47.94	45.96
Muslims	11.81	4.37	18.48	41.79	50.79	48.00	45.28	50.00	40.00
ANC check up									
Less than 3 visits	7.28	9.26	26.72	28.57	32.64	22.06	25.41	29.48	24.29
3 and more visits	25.21	20.71	57.07	50.47	56.48	49.47	62.64	60.69	57.11
Availability of health card									
No health card	0.71	2.05	4.91	30.86	43.15	29.13	21.59	18.75	15.60
Have health but not seen	20.98	18.71	36.45	54.84	37.50	23.35	60.53	48.39	36.22
Have health card &seen	31.07	37.34	60.49	59.68	67.19	81.48	67.63	71.94	76.88
Total Number	**1,195**	**896**	**1,188**	**700**	**769**	**580**	**542**	**436**	**511**

***--information not collected

Table 4: Progression rate of two successive vaccinations in states of Bihar, Andhra Pradesh and Gujarat, 1992-2005

Types of Vaccines	Bihar			Andhra Pradesh			Gujarat		
	1992-93	1998-99	2005-06	1992-93	1998-99	2005-06	1992-93	1998-99	2005-06
BCG	0.34	0.36	0.65	0.74	0.90	0.93	0.77	0.85	0.87
DPT1	0.94	0.92	0.94	0.96	0.96	0.98	0.97	0.95	0.92
Polio 1	0.98	0.97	0.97	0.99	1.00	1.00	0.98	0.98	0.99
DPT2	0.82	0.39	0.61	0.92	0.92	0.81	0.91	0.83	0.79
Polio 2	0.99	0.96	1.00	0.98	0.98	1.00	0.97	0.97	0.97
DPT3	0.71	0.33	0.52	0.88	0.89	0.66	0.88	0.77	0.73
Polio 3	0.98	0.90	0.97	0.97	0.87	0.89	0.97	0.89	0.84
Measles	0.41	0.32	0.45	0.72	0.74	0.79	0.81	0.81	0.82

Table 5: Correlates of full immunisation in Bihar, Andhra Pradesh, and Gujarat, 1998-2005

Background characteristics	India		Bihar		Andhra Pradesh		Gujarat	
	Exp (β)		Exp (β)		Exp (β)		Exp (β)	
	1998-99	2005-06	1998-99	2005-06	1998-99	2005-06	1998-99	2005-06
Sex of child								
Male ®								
Female	0.92*	0.84*	0.81	0.21***	1.32	0.92	0.96	0.19**
Birth order of child								
1®								
2	0.87**	0.87	1.37	1.2	0.77	1.03	0.89	0.78
3	0.67***	0.60***	0.84	0.38	0.77	1.7	0.88	0.34
4+	0.52***	0.51***	0.58	0.19*	0.35**	2.78	0.93	0.32
Age of mother								
15-24®								
25-34	1.39***	1.38***	1.57	1.27	0.95	0.49	1.71*	1.67
35+	1.26**	1.12	0.21	0.79	1.17	0.16	0.48	0.49
Mother education								
No education®								
Primary and more	1.61***	1.51***	1.39	1.23	1.37	1.25	1.32	12.22***
Place of residence								
Urban®								
Rural	0.91*	0.99	0.41**	0.51	0.67	0.7	1.32	0.54
Caste								
SC & ST®								
OBC	1.12*	1.02	0.92	0.68	0.71	0.29	0.91	0.16**
Others	1.06	1.12	1.02	1.31	0.58*	1.33	1.17	0.29
Availability of health card								
No health card®								
Have health card	8.45***	8.67***	25.26***	12.9***	2.38***	32.04***	5.94***	41.94***
Standard of Living Index								
Low ®								
Medium	1.20***	1.50***	1.6	5.10***	0.98	0.10**	1.08	1.66
High	1.32***	2.18***	1.32	2.63	1.42	0.29	2.05*	0.88
Religion								
Hindu®								
Muslim & other	0.85***	0.67***	0.42*	0.56	0.84	0.93	0.68	0.54
Mass media exposure								
No®								
Yes	1.17***	1.35**	1.79*	2.07*	1.70*	1.67**	1.27*	1.17**
ANC visits								
Less than 3®								
3 and more	2.35***	2.02***	1.41	2.82*	2.09**	6.00*	2.34***	5.85**

® Reference category Level of significance: *p<0.1 **p<0.05 ***p<0.01