HNP DISCUSSION PAPER

Immunization in India

An Equity-Adjusted Assessment

Sylvestre Gaudin and Abdo S. Yazbeck

March 2006

HNP
HEALTH, NUTRITION, AND POPULATION
THE WORLD BANK

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Health, Nutrition and Population (HNP) Discussion Paper

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Health, Nutrition and Population (HNP) Discussion Paper

Immunization in India:
An Equity-Adjusted Assessment

Sylvestre Gaudin[a] and Abdo S. Yazbeck[b]

[a] Assistant Professor of Economics, Oberlin College, USA
[b] Lead Economist, Health Nutrition and Population, The World Bank Institute

While this paper was in press, a different but closely related article was submitted to Social Science and Medicine and was published in February 2006 under the title "Immunization in India 1993-1999: Wealth, gender, and regional inequalities revisited." (Vol. 62, issue 3, pp. 694-706)

Abstract: An analysis of the 1992-93 National Family and Health Survey (NFHS) revealed wide differences in levels and distribution of childhood immunization between and within Indian states. Evidence of total system failure (no immunization for all) in some low performance areas suggested that improvements in immunization levels may come with a worsening of the distribution of immunization based on wealth. Using the latest NFHS data (1998-99), we take a new snapshot of the situation and compare it to 1992-93, focusing on heterogeneities between states, rural-urban differentials, gender differentials, and more specifically on wealth-related inequalities. In order to assess whether improvements in levels were accompanied by distributional improvements (or whether inequalities were reduced at the expense of overall achievement), we use recently developed methodology to calculate an extended achievement index that captures performance both in terms of efficiency (change in overall immunization rates) and equity (distribution by wealth quintiles) for each of the seventeen largest states. Comparing 1992-93 to 1998-99 levels using different degrees of "inequality aversion" provides no evidence that distributional improvements come at the expense of overall performance.

Keywords: immunization, India, inequality.

Disclaimer: The findings, interpretations and conclusions expressed in the paper are entirely those of the authors, and do not represent the views of the World Bank, its Executive Directors, or the countries they represent.

Correspondence Details: Abdo S. Yazbeck, Lead Economist (Health), The World Bank, 1818 H Street NW, Washington, DC 20433, USA. Tel: 202-473-0847. Ayazbeck@worldbank.org.

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ACKNOWLEDGEMENTS

Support for this research was provided by the Global Alliance for Vaccines and Immunization (GAVI). The authors thank Amie Batson, Davidson Gwatkin, G. N. V. Ramana, Thomas Uthup, Kenneth Kuttner, Jayati Datta-Mitra and participants of the 2003 “Reaching the Poor” conference in Washington D.C. for comments, suggestions, and support. David Kwakye and Laura Wallerstein provided research assistance. All analyses, views and any remaining errors in this paper are the responsibility of the authors.

The authors are grateful to the World Bank for publishing this report as an HNP Discussion Paper.

I. INTRODUCTION

Wealth-based inequalities in health care provision and utilization are endemic to the developing world; India is no exception. A good indicator of accessibility and outreach in the health care sector is the state of childhood immunization. Immunization is a simple preventive service; it is independent of need and is normally provided free of charge at all public health care facilities in India.[1] Although immunization is but one element of public health services, differential achievements between states, rural/urban areas, and socioeconomic groups give important information about where overall health sector policies are likely to have worked or failed, and where improvements are still needed. In other words, immunization can be used as an important tracer function for overall sector performance.

An earlier HNP discussion paper, subsequently published in *Social Science and Medicine* (Pande & Yazbeck, 2002, 2003) described the state of immunization in India "beyond national averages". That study, subsequently referenced as P&Y, used data from the Indian National Family and Health Survey (NFHS) conducted in 1992-93. Emphasis was placed on urban/rural, regional differences, wealth-based inequalities, and gender inequalities. The situation described in P&Y was mostly dismal with 70 percent of children aged 12-60 months in rural areas still not fully immunized, and close to 40 percent with no immunization at all. Even in urban areas, only about half of the children were fully immunized and close to 20 percent had not received any immunization. Performance was found to be very uneven across locations (rural/urban; north/south), wealth quintiles, and gender. Bihar was the worst performing state in both rural and urban areas with only 10 percent of children fully immunized and two-thirds who had not received any vaccination in rural areas. In comparison, more than 98 percent of children in urban areas of Tamil Nadu had received at least partial immunization. Inequalities based on wealth were found to be less pronounced in areas with higher immunization rates, but wealth did not help children in areas where a larger proportion of children had not received any vaccination.

Since the P&Y study, complete data from the second wave of the NFHS conducted in 1998-99 became available. The questionnaires and survey methodology remained mostly unchanged, allowing us to take a new snapshot of the situation and compare it to the earlier figures. Two main themes were highlighted in P&Y: gender inequalities and wealth-related inequalities. While gender inequalities in immunization persist in some parts of India, and understanding this phenomenon is important in the context of economic development, policy implications from evidence of gender inequalities are not directly related to the health care system. Wealth-based inequalities, however, are economic in nature and differences among and within states can provide important information about where health care investments are most needed.

When one cares about the distribution of immunization across different groups and in particular whether immunization efforts have reached the poor, it is important to report concentration ratios (a measure of inequality) in addition to overall immunization rates (a measure of efficiency). However, it is difficult to get a sense of overall achievement looking at each measure separately. Indeed, some states may have done well in increasing overall immunization but become more inequitable if most improvements were in the richer segments of the population. Other states may have become more equitable but less efficient in reaching the greatest number; yet others

[1] Contrary to most clinical and some preventive services that are dominated by the private sector in India–mostly unqualified private providers– more than 90 percent of immunization services are delivered by the public sector (Peters et al, 2002).

may have improved on both grounds. Recently developed methodology allows us to create an achievement index that combines performance on efficiency and equity grounds (Wagstaff, 2002). Comparing changes in this inequality-adjusted measure across time and across states is especially useful in identifying whether efforts to reach lower-income groups are necessarily made at the expense of improvement in overall performance.

Although our intention is not to evaluate the effectiveness of different government programs, it is useful to understand the policy context that prevailed in the mid 1990's when the Government of India and its development partners in the health sector introduced a range of projects and programs intended to improve maternal and child health.[2] In addition to the national effort and with support from development agencies, a selected set of states in India embarked on state level projects to strengthen service delivery, notably Andhra Pradesh, Maharashtra, West Bengal, Punjab, Orissa, and Karnataka (Peters et. al, 2002). Policy makers can use the stylized facts presented in this paper to assess whether state-specific public commitment through expenditures have contributed to improve the state and distribution of immunization beyond levels expected by automatic technology diffusion mechanisms. Of special interest is to gauge whether the conscious effort made by the Government of India to target groups with lowest immunization levels -- particularly children in the bottom income group and children in rural areas -- has produced tangible results such as improved immunization coverage for socially vulnerable groups and whether it did so at the expense of overall immunization performance.[3]

The rest of the paper is organized as follows. Section II briefly describes the data and methods. In section III, we present overall and inequality adjusted performance and trends at the national levels and by states. In section IV, we explore the tradeoff between efficiency and equity in immunization outcomes. Section V summarizes our findings. Overall, we find no evidence that equity improvements have been achieved at the cost of slowing down overall performance.

II. OVERVIEW OF DATA AND METHODS

NFHS-1 and NFHS-2 Samples

NFHS is the Indian version of the Demographic and Health Survey. With financing from USAID, the two waves of the survey (1992-93 and 1998-99) were conducted under the supervision of the International Institute for Population Sciences (IIPS) and ORC MACRO. Approximately 90,000 ever-married women 15 to 49 years old were interviewed. The survey designed was stratified and sample weights assigned to allow representative analysis at the state level and within urban and rural areas of each state (IIPS,1995 and IIPS, 2000). Two

[2] Some of these programs are national and implemented with support of the federal government and include: A national program on nutrition (ICDS), a national program for malaria, a national program for Tuberculosis, and a national program for reproductive and child health (Peters et al, 2002).

[3] The Indian government has traditionally assigned a high priority to promoting equity in health whether measured in outcomes, or access to subsidized inputs – in health policy statements, as a recommendation of government policy committees such as the Bhore Committee of 1946, or in various Plan documents. The government's use of population based norms in setting up primary health facilities is one indicator of its efforts to ensure equitable access to ambulatory care for the Indian population. Moreover, its provision of subsidized health services is often viewed as a means of providing insurance to those unable to afford the high costs of hospitalizations, and health care in general (Mahal *et al*, 2000).

questionnaires were combined for this study: the household's questionnaire and the Women's questionnaire. A line was created for each child included in the questions on immunization in the Women's questionnaire so the analysis could be conducted at the level of the child. The NFHS-1 asked the interviewees detailed questions about the immunization of children aged 12-59 months. The NFHS-2 limited the questions to children under 36 months. Although standard statistics report immunization for children 12-23 months only, including all children for whom the mother was asked about immunization (whether the immunization was received before or after 23 months) has the advantage of doubling the sample size for immunization statistics, thereby reducing sampling errors. Sampling standard errors were calculated for full immunization rates in the 1998-99 children sample. For full immunization rates the standard errors were 0.3 percentage points for the combined sample, 0.4 for rural India, and 0.7 for urban India. [4] The NFHS-2 sample includes a total of 20,157 children with data on immunization (14,732 in rural areas and 5,425 in urban areas), the 1992-93 sample was slightly larger with the same proportion of cases in rural areas. Although we do not expect the effect to be large (few children receive shots after the age of 3, the difference in base between the two samples slightly increases the likelihood of no-immunization and reduces the likelihood of full immunization.

Immunization Measures

Children age 12-60 months (NFHS-1) or 12-36 months (NFHS-2) at the time of the interview with the mother were classified into three categories: not immunized, partially immunized, and fully immunized. Fully immunized children were those children who had received one dose of BCG, three doses each of DPT and OPV, and one dose of measles vaccine. If the child received any of these doses but not all, the child is considered partially immunized. It is important to look at statistics on both full-immunization and no-immunization (or equivalently "some immunization", which includes children partially and fully immunized) as differential changes in these ratios can identify whether under-provision is linked to system failure (supply based) or to demand problems (families fail to return to the health facility to complete shots).

Measuring Household Wealth

As in P&Y, we use principal components analysis to construct the wealth indexes (see also Gwatkin et al, 2000). Sample weights and household sizes are used in the calculation of scores and the creation of wealth quintiles. The methodology has been widely used to approximate levels of income in developing countries where consumption or expenditure data is not available, not reliable, or simply not representative of standards of living (Montgommery et al, 2000; Filmer & Pritchett, 2001). All assets included in the analysis in 1992-93 are used in the 1998-99 calculation. Each observation is assigned 4 principal components scores based on the area of reference. For example, a household in rural Punjab is assigned a score based on principal components analysis using all observations in India, another score based on observation in rural India only, another based on the state of Punjab, and the fourth score based exclusively on rural Punjab. Four sets of quintiles are created from each of these scores, taking account of relevant sample weights and household sizes. The level of analysis for the calculation of immunization rates determines which quintile is used in the distribution analysis. For example when reporting immunization rates for all-India, we use all India quintiles; when reporting immunization rates

[4] While sampling standard errors were not reported in P&Y for the 1993 data, the survey methodology as the same and the sample size larger so standard errors would not have been higher.

for rural Punjab, we use the quintile created using observations in rural Punjab only. For comparison with P&Y results published in the 2002 HNP discussion paper, we provide 1998-99 asset scores obtained using the all-India urban sample and the all-India rural sample as well as quintiles descriptions for each subgroup in Annex A.

Measuring Wealth-based Inequality Independent of Levels: Concentration Ratios

P&Y reported concentration ratios for full and no immunization at the rural/urban India level and for rural and urban areas of each state. A concentration ratio is similar to the more familiar Gini coefficient. It takes values between zero and 1 for a "good" outcome such as full immunization and between 0 and -1 for a "bad" outcome such as no-immunization. The value is based on the area between the concentration curve and the line of perfect equality. The concentration curve (equivalent to a Lorenz curve) measures the relationship between cumulative percentage of the immunized population (y-axis) and cumulative wealth (x-axis). For full immunization the concentration ratio would coincide with the perfect equality line (45 degree line) if the share of eligible children in each quintile relative to the total number of eligible children in the population is equal to the share of children immunized in that quintile relative to the total number of eligible children immunized in the total population. For example, if 30 percent of all children in the sample are in the bottom wealth quintile and 30 percent of children fully immunized are in the bottom health quintile then the concentration curve coincides with the line of perfect equality up to the first quintile. If only 15 percent of the total number of eligible children immunized are in the bottom health quintile, the concentration curve lies below the line of perfect equality. The closer a concentration ratio is to 0, the more equitable the distribution of immunization by wealth quintiles (Wagstaff *et al*, 1991; Kakwani *et al*, 1997). While concentration ratios give an idea of the degree of inequality and is useful in representing distribution of outcomes both in full-immunization and no-immunization, it is difficult to look at inequality results without considering achievements in levels. For example, P&Y find that high levels of no immunizations are typically accompanied with "good" concentration ratios, everyone being equal in the face of system failure. One could hardly consider a worsening of the distribution a bad outcome if more children are being immunized at all levels of the wealth distribution. In order to get a better picture of achievement, we need a measure that combines achievement in levels and distributional considerations.

Measuring Performance Incorporating Inequality Aversion: the Wagstaff Index

Following the methodology presented in Wagstaff (2002), an achievement index is created that incorporates different levels of inequality aversion into measures of full immunization. In effect, the index takes immunization rates in each wealth quintiles and aggregates them by assigning different weights to each quintile. The weights vary depending on the degree of inequality aversion (v). Higher levels of v decrease the weight on higher income groups and increase the weight on lower income groups. When v=1, the adjusted immunization score gives a number equal to the average immunization rate where all children are assigned equal weight regardless of income – we also refer to this statistic as "level"; when v=2, the weights assigned to each quintiles are equivalent to the implicit weights of a Gini coefficient or concentration ratio; when

v=8, most of the weight falls on the lowest income quintile and performance in higher income has no perceptible impact on the index.[5]

III. NATIONAL TRENDS AND STATE VARIATIONS: URBAN AND RURAL AREAS

Performance in Levels: Full and No-immunization

The news is mixed at the national level. Although full immunization rates are still low and improvements have been small on average --from 30 to 35 percent in rural areas and 53 to 57 percent in urban areas--[6] efforts have paid off in reaching a much larger part of the population. The percentage of children who received no immunization at all significantly decreased in both rural and urban areas. In 1992-93, 38 percent of rural children and 17 percent of urban children had not received any vaccine. In 1998-99, the percentages were reduced to 18 and 6 percent respectively.[7]

Coefficient of variations --calculated as the standard deviation of state level statistics divided by the Indian average-- indicate that differences among states are strongest when looking at full immunization, especially in rural areas (cv=0.70 in rural areas and 0.34 in urban areas) with no sign of convergence since 1993. When including children who are partially immunized, however, there are clear signs of convergence and little dispersion remains -- both the rural and urban coefficients of variation were more than halved to reach 0.12 in rural areas and 0.05 in urban areas. Figure 1 represents the trends in full immunization by states, clearly showing the increased dispersion between states in rural areas. The North-South division is still strong and a wider gap has formed between the worse performing states and the rest of the country. Five states are clearly lagging, including Assam and the four "Bimaru" states (Bihar, Madhya Pradesh, Rajasthan, and Uttar Pradesh); Madhya Pradesh even lowering its performance. Orissa and West Bengal, two states that were in the group of worse performing states in 1993 separated themselves from the bottom with significant increases in full immunization. At the top, Punjab saw little improvement, slipping from the number 1 rank to number 4 as Tamil Nadu, Himachal Pradesh, and Maharashtra leaped past. In urban areas, relative patterns are less clear. We note the same dominance of Tamil Nadu, the only state where more than 90 percent of the urban population is fully immunized. The most striking improvement occurred in urban West Bengal where the immunized population went from 30 to 67 percent, going from the worst performing state after Bihar in 1993 to the top half of the 18th largest states, outperforming 9 of them.[8]

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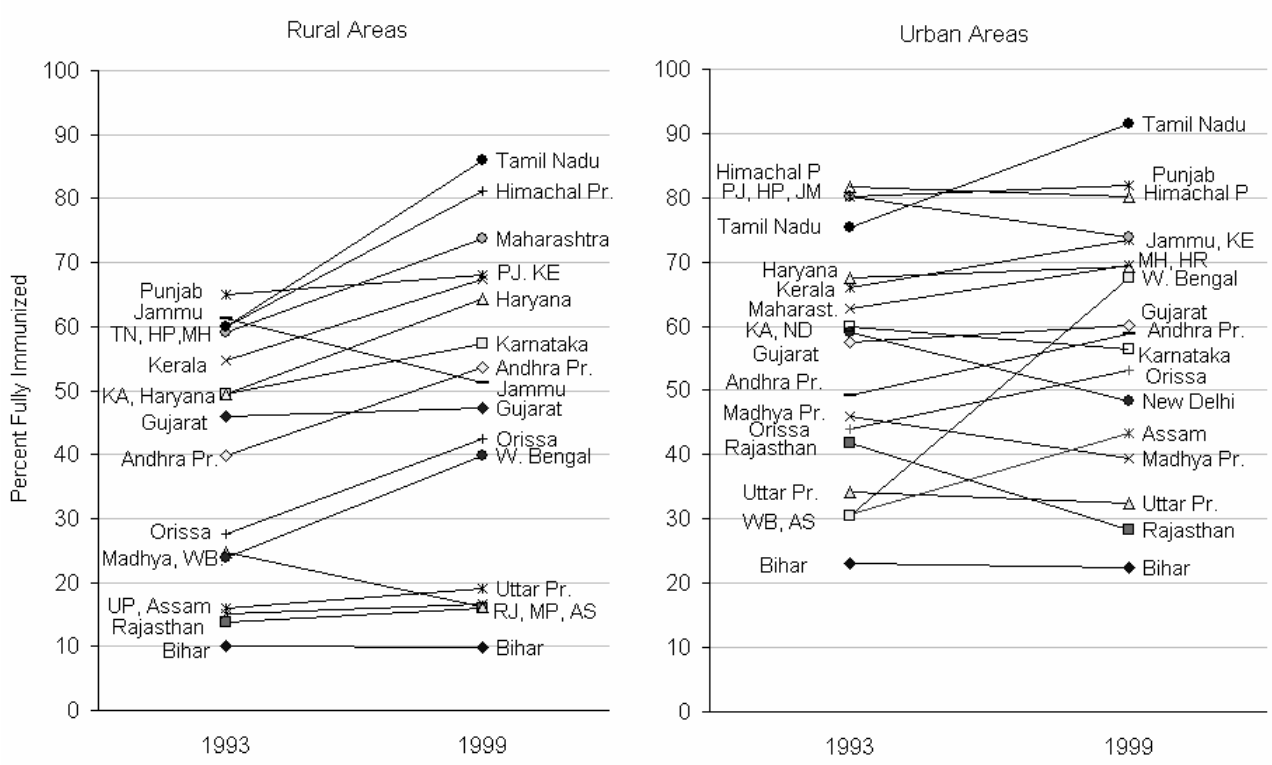
[5] Wagstaff (2002) provides a very useful graphical representation that helps visualize these weights for values of v between 1 and 8.

[6] Standard errors for full-immunization in the 1998-99 data are 0.39 percentage points for rural areas and 0.67 for rural areas (they are smaller than the reported standard errors in NFHS-2 as we are using a larger sample of children—12-35 instead of the reported 12-23 in the NFHS report). Considering the lower standard errors in the 1992-93 data due to a larger sample size, differences greater than 1.5 percentage points for rural areas and 2.5 for urban areas are significant at the 95 percent confidence level.

[7] For no-immunization, the standard errors are 0.31 and 0.33 percentage points for rural and urban areas respectively so a difference greater than 1.3 is significant at the 5% level.

[8] A complete list of statistics in full and no immunization by state is presented in the tables of Annex B; the 1992-93 statistics were also given in Annex B of the Pande &Yazbeck s HNP 2002 paper. For ease of comparison, we updated all the tables with the same table numbers.

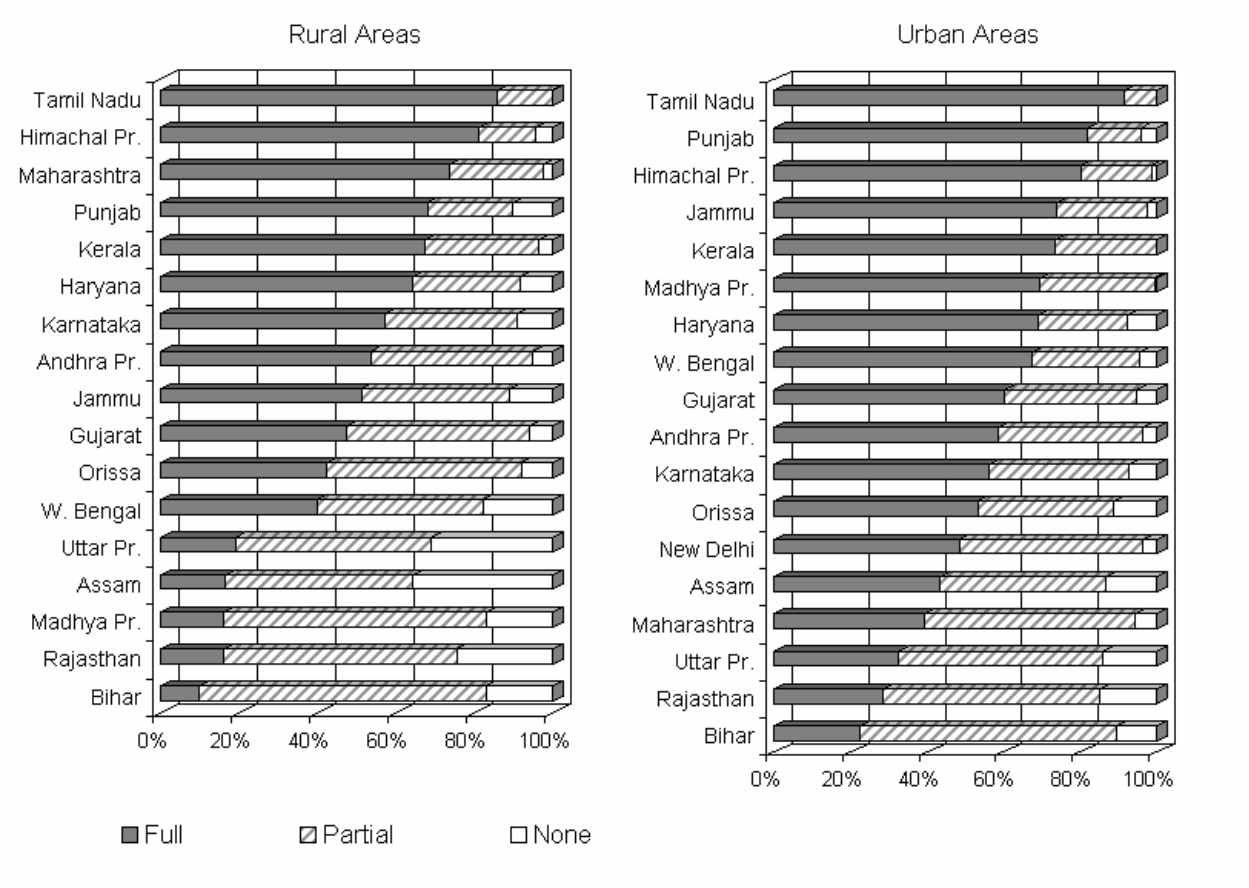
Figure 1. Full Immunization 1993 to 1999, Urban and Rural Areas



The picture looks very different when we include partial immunizations. All states have significantly increased the percentage of children with some immunization and states that worsened or improved the least in full immunization were among the most improved in partial immunization. In Rural Bihar, for example, while the rate of full immunization is still below 10 percent and has not improved since 1993, the percentage of children that received partial immunization more than doubled to 83 percent. Consequently, while the gap between the worst and best performing state significantly increased in full immunization in both rural and urban areas, it decreased considerably when we take account of partial immunization (from 56 to 35 percentage points in rural India and from 40 to 15 in urban India).

Figure 2 shows the situation in 1999, taking account of partial immunization (the numbers on which this figure is based are given in Annex B). The picture is good when looking at full and partial immunization combined. Eighty percent of all children 12-35 months received some immunization in all states except Uttar Pradesh, Assam, and Rajasthan --Assam ranking the lowest with 63 percent, still much beyond its full immunization rate of less than 17 percent. The majority of children, however, do not complete immunization shots in at least half the states represented. The graph highlights the need to focus on the demand side; indeed, these statistics clearly show that the health system is capable of reaching most children (the infrastructure is present) but many of them are not brought back to the health facility to complete the shots.

Figure 2. Full and Partial Immunization by State in 1998-99



Wealth-based Inequalities: Full and No-immunization

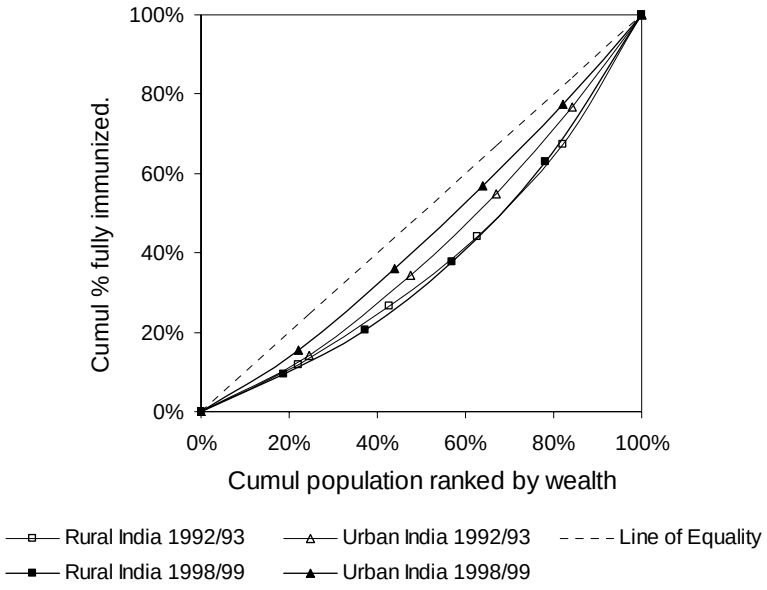
Wealth-based inequalities were reduced in urban areas where the concentration ratio for full-immunization went from 0.18 to 0.10 (se=0.03), but did not decrease overall in rural areas where the concentration ratio stayed at 0.24 (se=0.04).[9] Figure 3 reveals that the improvement is unambiguous in urban areas (the concentration curves do not cross) whereas there is some indication that poorer segments of the population faired slightly worse relative to richer segments in rural areas.[10] When considering no-immunization results instead of full-immunization, we do not find that wealth-related inequalities have decreased. The concentration ratio went from -0.37 to -0.43 (se=0.11) in urban areas and from -0.18 to -0.26 (se=0.09) in rural areas. While the change is likely due to sampling errors in urban areas with half of the states going in one direction and half in the other, one could argue for evidence of a shift in the distribution for rural areas where all but two states exhibit more inequality in 1998-99. Immunization rates by quintiles, concentration ratios, and Poor Rich ratios for full and no-immunization in urban and rural areas are given Annex B. Concentration ratios vary significantly among states although

[9] The concentration ratio and 1998-99 standard errors given in parenthesis are calculated following the methodology in Kakwani *et al* (1997).

[10] The 1998-99 rural areas concentration curve is below the 1992/93 one for lower quintiles and above for higher quintiles, leaving the area between the equality line and the concentration curve unchanged; the concentration ratio stays constant, but the divide between the poorest and the middle class has increased.

significantly less in full immunization than no-immunization. For full-immunization twelve out of the 17 largest states have concentration ratios significantly different from zero in rural areas and 9 out of 18 states in urban areas. For no-immunization the figures are 14 out of 17 in rural areas and 12 out of 18 in urban areas. The variation is much wider in full immunization than no immunization. While the highest concentration index in full immunization is 0.38 in rural Bihar eight states have concentration ratios above 0.50 in absolute value for no-immunization with the highest in urban areas of Punjab and Jammu (CI=-0.68).

Figure 3. Concentration Curves for Full Immunization, Rural and Urban India



Increased inequality, however, does not indicate that immunization efforts did not reach the poor. As mentioned earlier, high level of no-immunization accompanied with a low concentration ratio indicates total system failure, i.e. the infrastructure to provide immunization is not in place, affecting all groups. Evidence of total system failure was highlighted in P&Y who also noted that the provision of immunization in an area previously not serviced would likely increase wealth-related inequalities in usage. The new statistics presented above are consistent with a reduction of total system failure accompanied with increased inequality.

Inequality Adjusted Achievement

Since reducing inequalities by denying access would not be considered a positive result by most, it is important to consider both equity and efficiency results to assess performance. Using the methodology developed by Wagstaff (2002) and outlined in section II, we can now present performance in levels and incorporate distributional considerations using a single

Table 1. Inequality-Adjusted Achievement in Immunization by State - Rural India

	Percent with some immunization		Percent fully immunized		Inequality-adjusted full-immunization achievement index degrees of risk aversion [b/]							
					v=2		*v=4*		*v=6*		*v=8*	
	1999 [a/]	*change*	*1999* [a/]	*change*	*1999*	*change*	*1999*	*change*	*1999*	*change*	*1999*	*change*
Andhra Pr.	94.95 (0.99)	+20.48	53.54 (2.24)	+13.62	50.81	+15.31	49.31	+17.90	48.29	+19.40	46.78	+20.11
Assam	64.34 (2.06)	+13.5	16.53 (1.59)	+1.54	13.38	+3.43	11.42	+3.85	10.37	+3.69	9.38	+3.40
Bihar	82.92 (0.93)	+45.48	9.8 (0.74)	-0.19	6.09	-0.69	4.21	-1.06	3.62	-1.26	3.24	-1.34
Gujarat	94.13 (1.04)	+18.15	47.36 (2.21)	+1.49	40.88	+2.19	33.85	+1.45	29.44	+0.36	26.3	-0.21
Haryana	91.83 (1.22)	+15.41	64.35 (2.14)	+14.95	58.49	+15.65	50.84	+14.22	46.14	+12.82	42.33	+11.61
Himachal Pr.	95.53 (1.03)	+8.59	81.14 (1.95)	+21.17	74	+23.64	63.46	+21.98	56.7	+19.58	51.73	+17.81
Jammu	88.89 (1.40)	+11.56	51.19 (2.23)	-10.15	44.39	-4.68	38.76	+1.99	35.43	+3.91	32.43	+3.94
Karnataka	91.04 (1.21)	+14.33	57.35 (2.10)	+7.96	51.69	+8.99	46.38	+8.35	43.06	+7.79	40.11	+7.64
Kerala	96.32 (1.00)	+9.89	67.42 (2.50)	+12.65	65.78	+15.70	62.21	+17.07	59	+16.97	55.36	+16.36
Maharashtra	97.5 (0.71)	+10.71	73.75 (2.01)	+14.74	68.46	+17.06	61.75	+16.93	56.87	+15.67	52.37	+14.31
Madhya Pr.	83.24 (1.04)	+23.43	16.14 (1.03)	-8.65	10.83	-9.21	7.43	-9.09	6.14	-8.49	5.35	-7.78
Orissa	91.96 (1.00)	+26.99	42.36 (1.81)	+14.69	36.52	+14.39	30.91	+12.60	27.97	+11.37	25.55	+10.27
Punjab	89.67 (1.53)	+6.32	68.01 (2.34)	+3.05	57.05	+1.48	45.51	-1.02	39.11	-2.59	34.52	-3.19
Rajasthan	75.51 (1.12)	+34.84	16.04 (0.95)	+2.26	11.15	-0.23	8.31	-1.76	7.17	-2.37	6.39	-2.64
Tamil Nadu	99.79 (0.21)	+5.92	85.96 (1.60)	+25.98	82.35	+27.30	76.84	+26.38	72.3	+25.21	67.93	+24.45
Uttar Pr.	69.05 (0.99)	+19.35	19.00 (0.84)	+3.08	15.71	+3.48	13.77	+3.81	13.02	+4.06	12.34	+4.15
W. Bengal	82.11 (1.71)	+14.85	39.76 (2.18)	+15.98	33.77	+13.33	28.29	+10.16	24.94	+8.16	22.29	+6.82
All-India	82.4 (0.31)	+20.4	35.51 (0.39)	+ 5.52	26.93	+ 4.10	20.83	+ 2.54	18.64	+ 2.19	17.26	+ 2.18
Coeff. of Variation [c/]	0.12	-0.15	0.70	+0.04	0.90	+0.11	1.08	+0.23	1.13	+0.27	1.15	+0.28

[a/] Standard errors in parenthesis below the mean immunization rate are in percentage points. Standard errors for the inequality adjusted measures are similar and therefore not repeated.

[b/] v =1 gives an equal weight on all individuals and correspond to the percentages given for full immunization; v=2 uses the implicit weight of the standard concentration ratio; v=8 gives most of the weight to immunization in the lowest wealth quintile (methodology from Wagstaff, 2002). Quintiles are calculated on the basis of asset-based wealth scores estimated using the specific area of reference (here: urban areas of the state).

[c/] Calculated as the standard deviation of state level indices divided by the all-India average.

Table 2. Inequality-Adjusted Achievement in Immunization by State -Urban India

	Percent with some immunization		Percent fully immunized		Inequality-Adjusted Full-Immunization Scores [b/]							
					v=2		v=4		v=6		v=8	
	1999 [a/]	*change*	*1999* [a/]	*change*	*1999*	*change*	*1999*	*change*	*1999*	*change*	*1999*	*change*
Andhra Pr.	96.39 (1.34)	+11.77	58.76 (3.54)	+9.53	57.9	+12.94	55.14	+14.67	51.56	+14.87	47.77	+15.20
Assam	86.73 (3.20)	+8.34	43.36 (4.68)	+12.65	44.05	+21.01	43.64	+26.08	41.68	+26.88	38.46	+25.85
Bihar	89.44 (2.59)	+31.54	22.54 (3.52)	-0.45	19.42	+4.45	15.51	+6.63	12.73	+6.20	10.76	+5.51
Gujarat	94.85 (1.30)	+15.72	60.14 (2.88)	+2.61	51.65	+5.47	44.19	+7.59	39.67	+7.40	35.68	+6.74
Haryana	92.45 (2.10)	+5.14	69.18 (3.67)	+1.56	63.96	+6.46	55.62	+8.63	49.31	+8.61	43.35	+7.33
Himachal Pr.	98.58 (1.00)	+1.89	80.14 (3.37)	-1.64	76.61	-0.42	70.92	+2.62	66.75	+5.03	62.85	+6.67
Jammu	97.52 (1.23)	+1.21	73.91 (3.47)	-6.29	67.27	-4.36	60.04	-1.68	55.25	-0.08	50.97	+1.38
Karnataka	92.65 (1.67)	+9.58	56.33 (3.18)	-2.90	46.19	-1.80	38.43	+1.87	34.45	+3.85	31.07	+4.28
Kerala	100 (0)	+5.49	73.39 (4.25)	+7.46	73.91	+14.05	71.69	+18.35	67.96	+17.90	62.69	+15.12
Maharashtra	99.37 (0.31)	+8.33	69.59 (1.82)	+6.74	65.08	+9.35	58.27	+9.02	53.1	+8.12	48.91	+8.09
Madhya Pr.	94.5 (1.14)	+18.17	39.5 (2.45)	-6.50	28.49	-8.22	19.87	-8.99	15.88	-9.37	13.44	-9.20
Orissa	88.76 (2.44)	+12.41	53.25 (3.85)	+9.16	43.28	+7.18	32.88	+1.85	27.02	-1.54	22.94	-3.22
Punjab	95.78 (1.56)	+3.59	81.93 (2.30)	+1.85	76.88	+4.76	68.9	+7.35	62.73	+7.58	56.97	+6.84
Rajasthan	85.14 (1.85)	+14.61	28.38 (2.35)	-13.44	19.01	-11.36	12.41	-8.56	9.95	-7.43	8.54	-6.76
Tamil Nadu	100 (0)	+1.68	91.48 (1.40)	+16.00	91	+19.72	88.32	+22.64	84.8	+22.73	79.91	+21.33
Uttar Pr.	85.78 (1.67)	+16.39	32.57 (2.25)	-1.67	25.72	-0.33	20.29	-0.73	17.8	-1.28	15.98	-1.74
W. Bengal	95.45 (1.23)	+16.51	67.48 (2.77)	+37.03	61.87	+42.72	54.45	+44.17	49.39	+42.33	44.95	+39.48
New Delhi	96.39 (0.94)	+11.77	48.36 (2.26)	-10.68	46.42	-3.85	42.26	-0.45	38.61	+0.30	34.7	+0.31
All-India	93.66 (0.33)	+3.69	56.85 (0.67)	+ 3.69	50.89	+ 7.06	44.41	+ 8.81	40.36	+ 9.01	36.98	+ 8.87
Coeff. of Variation [c/]	0.05	-0.08	0.34	-0.01	0.41	-0.03	0.48	-0.05	0.52	-0.05	0.54	-0.05

[a/] Standard errors in parenthesis below the mean immunization rate are in percentage points. Standard errors for the inequality adjusted measures are similar and therefore not repeated.

[b/] *v* =1 gives an equal weight on all individuals and correspond to the percentages given for full immunization; v=2 uses the implicit weight of the standard concentration ratio; v=8 gives most of the weight to immunization in the lowest wealth quintile (methodology from Wagstaff, 2002). Quintiles are calculated on the basis of asset-based wealth scores estimated using the specific area of reference (here: urban areas of the state).

[c/] Calculated as the standard deviation of state level indices divided by the all-India average.

measure. Table 1 and 2 report the inequality-adjusted immunization scores for rural and urban India in 1998-99 and the change from 1992-93 for all of India and by state. Four degrees of inequality aversion are reported from v=2 to v=8. The unadjusted levels (v=1) are included in the table for comparison. Coefficients of variation are calculated for each measure.

Adjusted immunization scores that increase more for lower values of v are evidence that richer sections of the population benefited most from the change and vice-versa. In rural areas, although immunization rates increased across the board, most of the improvement occurred in richer segments of the population. In urban areas, however, performance looks better at higher degrees of inequality aversion, indicating that more of the benefit of increased coverage went to lower wealth children.

The best performing state in urban and rural areas and most improved for full immunization in rural areas, Tamil Nadu, touched all income groups evenly in rural areas and decreased inequality in urban areas. Himachal Pradesh shows substantial improvement in rural areas but the lower income groups contributed less to the overall increase in immunization. The same state shows a different pattern for urban areas where the unadjusted immunization rate went down, but adjusted scores indicate improvement in low-income groups. Jammu, a state in political turmoil that saw a large decrease in overall immunization rates in both rural and urban areas improved in reaching the poorer segments of the population primarily in rural areas.

Coefficients of variation were calculated for each degree of inequality aversion to gauge the level of heterogeneity among states. We note that dispersion increases as the level of inequality aversion is increased, indicating that most of the dispersion occurs when comparing immunization rates in the lowest wealth quintiles.

Finally, there were significant movements in state rankings between 1993 and 1999. Table 3 gives 1998/99 rankings in raw immunization rates (percent of children fully immunized by the age of three) and changes in state rankings for inequality-adjusted measures relative to 1992/3 ranks (for full immunization by the age of five). A positive sign indicates that the state slipped in the rankings whereas a negative sign reflects a better relative position. Changes in rankings at different levels of risk aversion give an indication of the distribution of efforts across wealth quintiles. Since higher degrees of inequality-aversion increase the relative weight of poorer children in the achievement index, a state that passes other states in unadjusted levels (v=1) while losing rank in inequality-adjusted achievement (v>1), owes its relatively good position in immunization rates to improvements in the richer segments of the population but has been relatively less successful than other states at reaching the poorer. Larger increases in inequality-adjusted scores indicate that even larger improvements were recorded in poorer families. Tamil Nadu now leads all states in overall performance (v=1) and all adjusted measures in both rural and urban areas. Urban West Bengal jumped nine places up (from second to last place in 1992-93) by doubling immunization rates in six years. Unlike urban areas of the state, rural areas of West Bengal did not improve their ranking for all degrees of inequality aversion. In rural areas, it is Andhra Pradesh that showed the most striking improvement in ranking at all levels of inequality aversion. Punjab, Jammu, and Maharashtra performed worst in rural areas, although the situation in rural Jammu and Maharashtra looks better using inequality-adjusted measures. Karnataka, New Delhi, and Rajasthan, performed worst in urban areas for all degree of inequality aversion. Madhya Pradesh's bad relative performance can be attributed to increasing inequality only. Looking at rank changes and differences in performance at various degrees of inequality aversion is useful in order to get at the notion of tradeoff between efficiency and equity. We explore this relationship in the next section.

Table 3. Changes in State Rankings for Inequality-Adjusted Achievement in Full Immunization

Percent children fully immunized			Rank Change for Inequality-Adjusted Immunization Scores, 1992/3 to 1998/9				
			v=1	*v=2*	*v=4*	*v=6*	*v=8*
		Inequality aversion: [a/]					
State rank 1998/9							
	Rural Areas						
1		Tamil Nadu	- 4	- 1	0	0	0
2		Himachal Pr.	- 1	- 2	- 4	- 2	- 2
3		Madhya Pr.	- 3	+ 3	+ 3	+ 3	+ 3
4		Punjab	+ 3	+ 5	+ 6	+ 5	+ 4
5		Kerala	- 2	- 2	0	0	0
6		Haryana	+ 2	0	0	+ 1	+ 1
7		Karnataka	- 1	- 1	0	0	0
8		Andhra Pr.	- 2	- 2	- 4	- 5	- 4
9		Jammu	+ 7	+ 2	+ 1	+ 1	+ 1
10		Gujarat	+ 1	+ 1	+ 1	+ 1	0
11		Orissa	0	0	0	- 1	- 1
12		W. Bengal	- 1	0	0	+ 1	+ 1
13		Uttar Pr.	- 1	- 1	- 2	- 2	- 2
14		Assam	- 1	- 2	- 2	- 2	- 2
15		Maharashtra	+ 3	0	0	- 1	0
16		Rajasthan	0	0	+ 1	+ 1	+ 1
17		Bihar	0	0	0	0	0
	Urban Areas						
1		Tamil Nadu	- 3	- 3	- 1	0	0
2		Punjab	- 1	0	0	0	+ 1
3		Himachal Pr.	+ 2	+ 2	+ 2	+ 1	0
4		Jammu	+ 2	+ 2	+ 2	+ 2	+ 1
5		Kerala	- 1	- 1	- 3	- 3	- 2
6		Madhya Pr.	- 1	+ 3	+ 3	+ 3	+ 3
7		Haryana	+ 2	+ 1	0	+ 2	+ 2
8		W. Bengal	- 9	- 9	- 8	- 9	- 9
9		Gujarat	- 1	0	0	+ 1	+ 1
10		Andhra Pr.	- 1	- 2	- 1	- 2	- 2
11		Karnataka	+ 3	+ 3	+ 2	+ 2	+ 2
12		Orissa	- 1	+ 1	+ 2	+ 2	+ 2
13		New Delhi	+ 4	+ 3	+ 4	+ 4	+ 4
14		Assam	- 2	- 3	- 5	- 6	- 6
15		Maharashtra	+ 3	- 1	0	0	0
16		Uttar Pr.	+ 1	+ 1	+ 1	+ 1	+ 1
17		Rajasthan	+ 3	+ 4	+ 3	+ 3	+ 3
18		Bihar	0	- 1	- 1	- 1	- 1

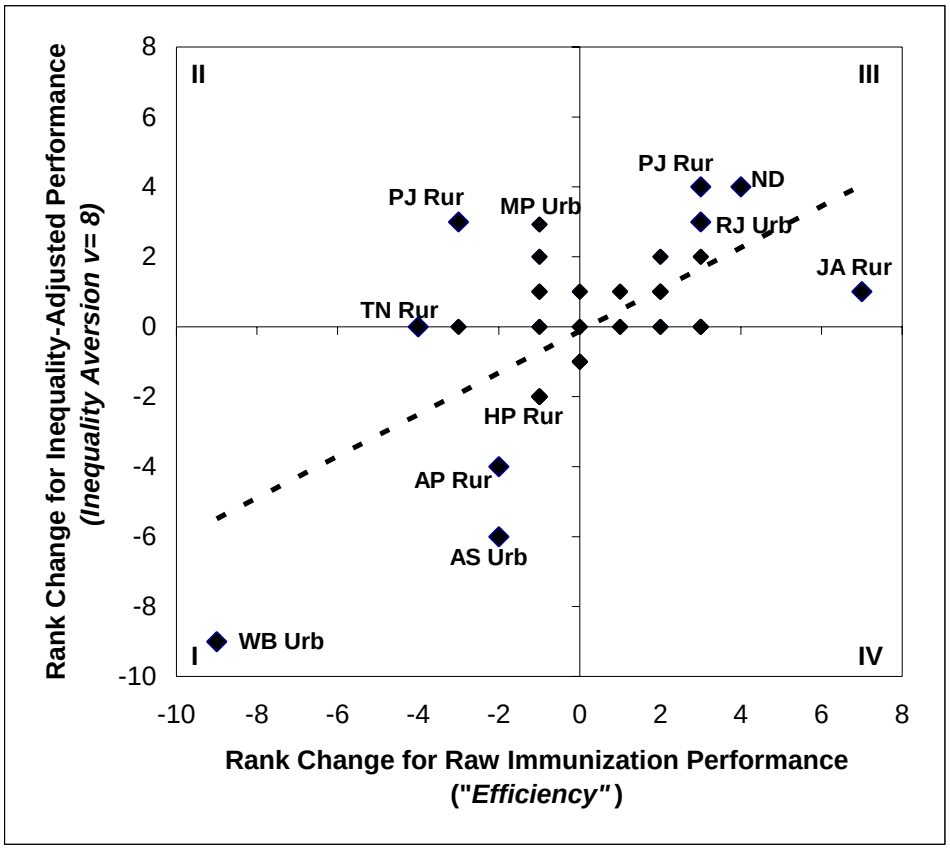
[a/] v =1 corresponds to an equal weight on all individuals so the score is the percentage of population immunized; v=2 uses the implicit weight of the standard concentration ratio; v=8 gives most of the weight to immunization in the lowest wealth quintile. Methodology from Wagstaff (2002)

IV. PERFORMANCE IN LEVELS AND DISTRIBUTIONAL IMPROVEMENTS: SUBSTITUTES OR COMPLEMENTS

Analysis of Rank Changes

A graphical representation of changes in rankings helps classify states into efficiency achievers and/or equality achievers. Figure 4 represents movements in rankings of each state's immunization performance in urban and rural areas along dimensions of efficiency (measured by the overall mean immunization level, or v=1 of the Wagstaff index) and equality (measured by the Wagstaff index with the highest level of inequality aversion, v=8). Urban areas are ranked against other urban areas and rural areas against other rural areas in each of the 1992/93 and 1998/99 surveys. Quadrant I represent areas that improved their rankings in both efficiency and equity while quadrant III includes areas that dropped on both efficiency and equity rankings. Quadrants II and IV include states that improved in one dimension but lost ground in the other.

Figure 4. Rank Changes by State and Urban/Rural Areas: Equity versus Efficiency



Inequality adjusted performance confirms the superior performance of West Bengal highlighted in the previous section for efficiency alone. [11] Other good performers are urban Assam, rural

[11] The state of West Bengal appears to have gained from having a variety of health sector projects related to immunization occurring in urban areas during the 6 year period between the two surveys. Examples include a project on integrated population activities that address health and population services in the urban setting. It is likely

Andhra Pradesh, and rural Himachal Pradesh. Each of these areas was able to improve their national position in terms of the level of immunization and the degree to which it is reaching the poor. Notable among states that lost ground in both efficiency and equity are the capital New Delhi, rural Punjab, and urban Rajasthan. The absence of states in quadrant IV of Figure 3 indicates that no states have improved their equity rankings while losing ground in overall immunization performance. This deserves a closer look as we often assume the existence of an equity-efficiency tradeoff. We use the word *tradeoff* loosely to indicate a negative or positive relationship between efficiency and equality improvements recognizing that different states used different amounts of resources to improve immunization outcomes and health care in general. A trend-line fitted to the data in Figure 3 indicates that relative efficiency and equality achievements are positively correlated. The correlation coefficient (ρ) between changes in efficiency rankings and changes in equality rankings by states is 0.61 (p-value=0.0001), combining rural and urban areas. The strongest relationship is in urban areas with a correlation coefficient of 0.77 (p-value=0.0002), while the correlation is not statistically significant in rural areas (ρ=0.31, p-value=0.22).

Correlation Coefficient Analysis

When looking at changes in achievement rather than rankings, a few states show sign of a tradeoff but the pattern is by no means prevalent. Jammu is the only state in rural India where improvement in lower wealth quintiles was accompanied by lower overall performance (Table 1). In urban areas, five states show that pattern (Bihar, Himachal Pradesh, Jammu, Karnakata, and New Delhi (Table 2).

To better quantify the relationship between efficiency and equality improvements, we calculate correlation coefficients between different measures of efficiency and equity using Wagstaff indices (Table 4). Let W_a be the Wagstaff index for immunization with inequality aversion coefficient v=a, and let dW_a be the six-year change in W_a. To get a measure of inequality using the Wagstaff index we can look at the ratio of the adjusted measures to the unadjusted levels (W_a/W_1). A positive correlation between W_1 and (W_a/W_1) indicates that states with higher immunization rates are also relatively less unequal; this is the case in India, although the correlation decreases with the degree of inequality aversion in rural India. Next, we look at the six-year improvement in the non-adjusted immunization rates (dW_1) and the change in the Wagstaff index with highest degree of inequality aversion (dW_8). We find a positive and significant correlation both for rural and urban areas (0.85 and 0.89 respectively). Finally, to better get at the notion of tradeoff, we look at the correlation between changes in levels (dW_1) and gaps between inequality-adjusted changes and the non-adjusted change (dW_a-dW_1). A large negative gap indicates that higher income groups benefited most; a large positive difference indicates higher income groups benefited less; and a small or no difference indicates that improvements were evenly distributed among wealth quintiles. A positive correlation therefore indicates that higher efficiency improvements are accompanied by improvements in equity whereas a negative correlation indicates a tradeoff. While most correlations are negative, there are not significant except for the highest degree of inequality aversion in rural areas for which we note some evidence of a tradeoff at the 90 percent confidence level. None of the coefficients are significant for urban areas, indicating the absence of tradeoff.

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that this specific project contributed to the jump in efficiency and equity that is documented in this paper, but detailed evaluation of all possible contributing factors is needed to help other states learn from the success in West Bengal.

Table 4. Efficiency-Equity Relationship in Immunization

	Correlation Coefficients [a/]	
	1999 W_1	
With[(b)]	Rural Areas	Urban Areas
W_2/W_1	0.84*** (0.000)	0.63*** (0.005)
W_4/W_1	0.77*** (0.000)	0.63*** (0.005)
W_6/W_1	0.72*** (0.001)	0.65*** (0.004)
W_8/W_1	0.69*** (0.002)	0.67*** (0.003)
	dW_1	
With[(c)]	Rural Areas	Urban Areas
dW_8	0.85*** (0.000)	0.89*** (0.000)
$dW_2 - dW_1$	-0.01 (0.97)	0.32 (0.19)
$dW_4 - dW_1$	-0.26 (0.31)	-0.15 (0.56)
$dW_6 - dW_1$	-0.36 (0.16)	-0.02 (0.99)
$dW_8 - dW_1$	-0.42* (0.09)	-0.16 (0.53)

[a/] *** significant with >99% confidence, * significant with 90% confidence. P-values in parentheses.
[b/] W_a is the 1999 Wagstaff index where the immunization level is adjusted with inequality aversion parameter v = a.
[c/] dW_a is the change in W_a between 1993 and 1999

Regression Analysis

The rural and urban state level data is pooled to run ordinary least square regressions on the 35 state level averages (17 states divided into rural and urban areas plus New Delhi). In model one, the six-year change in immunization levels is regressed on initial conditions (level and equality gap) and the change in the fully adjusted achievement index (dW_8). In model two, we use change in the inequality adjusted measure as the dependant variable and change in levels as a dependent variable. Such regressions are not able to explain the factors that lead to changes in immunization since state specific factors such as average income, educational attainment, health expenditures and other factors are likely to influence immunization, as well as changes in these factors are imbedded in the right-hand side variables. We can however use it to gauge whether improvements in levels and improvements in distribution have been substitutes or complements overall. We obtain the following relationships:

(1) $Dln(W_1)=$ 0.76 (0.16) -0.14 $ln(W93)$ (0.037) + 0.39 $GAP93$ (0.074) + 0.48 $dln(W_8)$ (0.04) + e_1

(2) $Dln(W_8)=$ -1.47 (0.30) + 0.27 $ln(W93)$ (0.069) - 0.82 $GAP93$ (0.12) + 1.70 $dln(W_1)$ (0.14) + e_2

where $dln(W_a)$ is the six-year percentage change in W_a, $W93$ is the initial unadjusted immunization level, $GAP93$ is the initial difference between $ln(W_8)$ and $ln(W_1)$, and e_1 and e_2 are the OLS residuals. Standard errors are given in parentheses below the estimated coefficient. All coefficients are statistically significant with p-values of 0.001 or less. Adjusted R-squared are 0.80 and 0.84 respectively. The negative coefficient on $ln(W93)$ in (1) indicates overall convergence in levels whereas the positive coefficient in (2) indicates that the higher the initial immunization level, the easier it is to reach lower income groups. The signs of the coefficients on

the initial equity gap reveal that states with higher initial wealth-based immunization inequality have least improved in lower income groups but most improved overall. This finding indicates divergence between states on the equality front. Such a phenomenon –i.e. less equitable states in 1993 show least improvements in low income groups and conversely, more equitable states in 1993 show greater improvement in low income groups-- could be explained by self reinforcing diffusion mechanisms or by persistent state-specific preferences. Finally, the positive coefficients on $dln(W_8)$ in (1) and $dln(W_1)$ in (2) indicate that the higher the overall improvement, the more lower income groups benefit and vice versa. The analysis overall tends to support the hypothesis of complementarity between efficiency and equality. At least, the data does not provide any strong evidence of a tradeoff. We conclude that efforts directed toward the poor are not necessarily made at the expense of overall performance in immunization rates and are likely to contribute positively to overall outcomes.

V. SUMMARY AND CONCLUSIONS

The availability of nationally representative household surveys with almost identical sets of questions completed six years apart offers a wonderful opportunity to measure and evaluate the performance of the health sector in India. Samples sizes in NFHS are large enough and clusters are selected in such a way that one can go beyond the national picture to construct measures of performance (equality and efficiency) at the sub-national level. Immunization is used as a health system output marker for the public effort and commitment to improving the health of the population. Several authors have highlighted the phenomenon that leads immunization to spread in a manner similar to technological diffusion processes (Gwatkin et al. (2000), Victora et al., 2000 and 2001). However, when looking at the data disaggregated at the state level, the diffusion hypothesis would lead us to expect a narrowing of differences between states. Evidence of leapfrogging (changes in state rankings) between states as well as increasing heterogeneity in rural areas, however, indicate that the diffusion hypothesis is not sufficient to explain changes in immunization. Indeed, there is no obvious reason to believe that the diffusion mechanism is significantly different between Indian states, especially when looking at urban and rural areas separately. Differential policy efforts between states are therefore likely to have played an important role in promoting immunization. Further research is necessary to specifically sort out the respective role of policy and diffusion processes.

At the national level, we find major improvements in outreach in urban and rural areas with a clear drop in the percentage of children that received no immunization, but full immunization rates are almost stagnant. The data seem to indicate a successful effort in addressing the complete system failure that is captured by the no immunization variable. There is, however, no success in addressing the partial failure of continuity of services, which is reflected in the increasing number of children with only partial immunization.[12] The distributional analysis using concentration indices shows a decrease in wealth-related inequality in urban but not in rural areas. More revealing than the concentration index, Wagstaff's extended achievement index applied to immunization allows us to pinpoint whether the gains over the six-year period were more or less equally distributed across wealth quintiles. The numbers at the national level

[12] Continuity in this context refers to demand and supply failures where children that get some of the immunization package fail to complete the set of immunization available from the public sector; for a discussion of continuity of health services failure see Claeson et al., 2001.

show that the consideration of inequality in a single achievement index makes immunization achievements look worse in rural areas and more so when using higher degrees of inequality aversion. Urban areas, on the other hand look better with inequality adjusted measures. Looking at gender inequality, the issue of continuity emerges again. Indeed, we find that the gender gap decreases, disappears, or even reverses when looking at cases of complete system failure but holds steady or increases for full immunization.

Pande and Yazbeck (2003) showed the importance of looking beyond national averages in the case of India. The state level findings summarized here confirm a strong and continuing heterogeneity between states in rural areas and the persistence of a North/South divide, especially when looking at full immunization. All Indian states have greatly reduced or eliminated cases of total system failure and efforts need now be directed to encouraging families to complete the immunization schedule for all of their children. The analysis of change over the six-year period at the state level was particularly useful in assessing whether efforts in improving the distribution of immunization outcomes, and in particular to reach the poorest income groups, were made at the expense of overall improvement in immunization rates. We found no evidence of such a tradeoff in India.

Learning from failure in some parts of India is as important as learning from the success in other parts. Having the outcome data summarized in this paper provides policymakers in India and elsewhere both the ability to focus their policy research agenda and establish benchmarks that they can use in defining realistic objectives and targets for the future. In particular the paper provides evidence that on average, as immunization rates improve, wealth-based inequalities decrease.

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ANNEX A: ASSET FACTOR SCORES AND HOUSEHOLD WEALTH QUINTILE, ALL-INDIA

Table A1. Assets and Factor Scores, Rural India 1998/9

	Asset ownership		Principal Components Results		
	Unweighted			Household score if:	
	Mean	Std. Dev.	Asset Factor scores	Owns Asset	Does not own asset
Electricity	0.481	0.500	0.4604	0.4778	-0.4436
Telephone	0.025	0.158	0.3203	1.9805	-0.0518
Fan	0.315	0.464	0.2535	0.3742	-0.1718
TV	0.202	0.401	0.2399	0.4772	-0.1206
Pressure cooker	0.159	0.366	0.2280	0.5235	-0.0993
Table	0.301	0.459	0.2247	0.3421	-0.1476
Chair	0.357	0.479	0.2220	0.2977	-0.1656
Mattress	0.382	0.486	0.2074	0.2638	-0.1630
Clock	0.575	0.494	0.2006	0.1725	-0.2333
Pucca house	0.190	0.392	0.1891	0.3911	-0.0915
Gas as cooking fuel source	0.051	0.219	0.1820	0.7872	-0.0421
Fridge	0.037	0.188	0.1741	0.8931	-0.0339
Motorcycle	0.060	0.237	0.1736	0.6892	-0.0437
Own flush toilet	0.078	0.268	0.1705	0.5876	-0.0495
Sewing machine	0.118	0.323	0.1617	0.4415	-0.0592
Radio	0.321	0.467	0.1569	0.2280	-0.1079
Separate room used as kitchen	0.447	0.497	0.1540	0.1715	-0.1383
Drinking water piped into residence	0.093	0.290	0.1308	0.4089	-0.0418
Water pump	0.081	0.273	0.1211	0.4070	-0.0360
Own pit latrine	0.092	0.289	0.0990	0.3103	-0.0316
Bicycle	0.457	0.498	0.0982	0.1071	-0.0900
Cot	0.794	0.405	0.0906	0.0462	-0.1777
Acres of cultivated land	25.862	70.951	0.0835	**	**
Tactor	0.020	0.139	0.0833	0.5888	-0.0118
Acres of irrigated land under cultivation	13.315	50.790	0.0824	**	**
Car	0.006	0.077	0.0774	0.9990	-0.0060
Kerosene as cooking fuel source	0.027	0.161	0.0556	0.3360	-0.0092
Thresher	0.025	0.157	0.0544	0.3377	-0.0088
Bullock cart	0.094	0.291	0.0512	0.1592	-0.0165
Biogas as cooking fuel source	0.005	0.067	0.0476	0.7054	-0.0032
Owns agricultural land	0.613	0.487	0.0452	0.0359	-0.0569
Drinking water hand pump in residence	0.175	0.380	0.0341	0.0738	-0.0157
Shared flush toilet	0.006	0.080	0.0317	0.3917	-0.0026
Drinking water from own well	0.014	0.116	0.0243	0.2064	-0.0029
Electricity as cooking fuel source	0.002	0.049	0.0214	0.4346	-0.0010
Coke as cooking fuel source	0.016	0.125	0.0190	0.1493	-0.0024
Public flush toilet	0.004	0.061	0.0151	0.2483	-0.0009
Shared pit latrine	0.006	0.080	0.0121	0.1505	-0.0010
Owns Livestock	0.593	0.491	0.0090	0.0075	-0.0109
Semi-Pucca house	0.393	0.488	0.0072	0.0090	-0.0058
Coal as cooking fuel source	0.002	0.040	0.0068	0.1714	-0.0003
Drinking water from rainwater	0.001	0.023	0.0053	0.2307	-0.0001

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Table A1, cont'd.

	Asset ownership		Principal Components Results		
	Unweighted		Asset Factor scores	Household score if: Owns Asset	Does not own asset
	Mean	Std. Dev.			
Drinking water from a public tap	0.157	0.364	0.0042	0.0097	-0.0018
Public pit latrine	0.004	0.064	0.0030	0.0463	-0.0002
Gas as main source of lighting	0.001	0.026	0.0016	0.0613	0.0000
Drinking water from a spring	0.007	0.084	0.0004	0.0044	0.0000
Other toilet facility	0.001	0.037	-0.0007	-0.0184	0.0000
Drinking water from a dam	0.001	0.029	-0.0009	-0.0297	0.0000
Other source of lighting	0.001	0.035	-0.0009	-0.0253	0.0000
Drinking water from a tanker truck	0.001	0.035	-0.0014	-0.0394	0.0000
Drinking water from a pond/lake	0.010	0.102	-0.0030	-0.0290	0.0003
Other source of drinking water	0.005	0.071	-0.0062	-0.0872	0.0004
Owns House	0.948	0.222	-0.0072	-0.0017	0.0307
Oil as main source of lighting	0.002	0.041	-0.0072	-0.1751	0.0003
Other source of cooking fuel	0.002	0.043	-0.0077	-0.1785	0.0003
Drinking water from public well	0.222	0.416	-0.0187	-0.0349	0.0100
Drinking water from a river/stream	0.016	0.127	-0.0193	-0.1504	0.0025
Dung as cooking fuel source	0.084	0.277	-0.0306	-0.1010	0.0092
Crop residue as main fuel source	0.080	0.272	-0.0605	-0.2048	0.0179
Wood as main fuel source	0.732	0.443	-0.0690	-0.0417	0.1141
Drinking water from public pump	0.297	0.457	-0.0970	-0.1490	0.0631
Number of members per sleeping room	2.883	1.906	-0.1124	0.1110	0.1700
Kachha House	0.416	0.493	-0.1572	-0.1864	0.1326
Bush or no toilet facility	0.808	0.394	-0.2001	-0.0976	0.4101
Kerosene as main source of lighting	0.514	0.500	-0.2294	-0.2229	0.2360

** Household scores for numbers of people per sleeping room are calculated as follows: {#people per room - unweighted mean)/unweighted std. Deviation}*asset factor score

Table A2. Household Wealth Quintiles, Rural India 1998/9

Wealth Quintile	Unweighted Sample Size	Asset Index Score			
		Mean	Std. Deviation	Lowest	Highest
Poorest	11164	-2.558	0.781	-7.978	-0.785
Second	11119	-1.833	1.037	-7.248	0.700
Middle	11889	-0.917	1.252	-6.567	2.466
Fourth	13347	0.521	1.599	-4.826	5.247
Richest	14281	3.826	2.871	-3.952	20.405

Table A3. Assets and Factor Scores, Urban India 1998/9

	Asset ownership		Principal Components Results		
	Unweighted			Household score if:	
	Mean	Std. Dev.	Asset Factor scores	Owns Asset	Does not own asset
Telephone	0.200779	0.40059	0.37724	0.7526	-0.1891
Electricity	0.913414	0.281231	0.36861	0.1135	-1.1972
Drinking water piped into residence	0.516465	0.499737	0.34132	0.3303	-0.3527
Gas as cooking fuel source	0.469225	0.49906	0.23835	0.2535	-0.2241
Pressure cooker	0.651115	0.476625	0.22689	0.1661	-0.3100
TV	0.691886	0.461722	0.21653	0.1445	-0.3245
Table	0.650028	0.476969	0.21134	0.1551	-0.2880
Mattress	0.717068	0.450431	0.21035	0.1321	-0.3349
Fan	0.821625	0.382835	0.20831	0.0971	-0.4471
Chair	0.712985	0.452376	0.20715	0.1314	-0.3265
Fridge	0.288169	0.452918	0.20569	0.3233	-0.1309
Own flush toilet	0.476212	0.499442	0.19831	0.2080	-0.1891
Pucca house	0.659038	0.47404	0.19745	0.1420	-0.2745
Motorcycle	0.249616	0.432798	0.17942	0.3111	-0.1035
Separate room used as kitchen	0.640107	0.479977	0.1786	0.1339	-0.2382
Clock	0.901052	0.298597	0.17326	0.0574	-0.5228
Sewing machine	0.354115	0.478252	0.15611	0.2108	-0.1156
Radio	0.531636	0.499006	0.14276	0.1340	-0.1521
Cot	0.860961	0.345993	0.13144	0.0528	-0.3271
Drinking water hand pump in residence	0.098885	0.298512	0.09571	0.2889	-0.0317
Water pump	0.09306	0.290521	0.09516	0.2971	-0.0305
Car	0.043687	0.204401	0.09285	0.4344	-0.0198
Bicycle	0.534437	0.498821	0.08182	0.0764	-0.0877
Owns House	0.781849	0.412997	0.03294	0.0174	-0.0624
Drinking water from own well	0.006852	0.082492	0.03098	0.3730	-0.0026
Acres of irrigated land under cultivation	6.104229	40.47415	0.02754	**	**
Tactor	0.007606	0.086882	0.02725	0.3113	-0.0024
Drinking water from public well	0.053566	0.225162	0.0267	0.1122	-0.0064
Acres of cultivated land	10.72356	55.83063	0.02571	**	**
Drinking water from public pump	0.082524	0.275166	0.01817	0.0606	-0.0054
Drinking water from a tanker truck	0.00325	0.056913	0.01499	0.2625	-0.0009
Biogas as cooking fuel source	0.005655	0.074988	0.01452	0.1925	-0.0011
Thresher	0.006838	0.082408	0.01288	0.1552	-0.0011
Other source of drinking water	0.006644	0.081243	0.01247	0.1525	-0.0010
Owns agricultural land	0.199163	0.399378	0.01068	0.0214	-0.0053
Bullock cart	0.014233	0.118453	0.0039	0.0325	-0.0005
Drinking water from a spring	0.000855	0.029222	0.00375	0.1282	-0.0001
Drinking water from a pond/lake	0.002775	0.052608	0.00308	0.0584	-0.0002
Electricity as cooking fuel source	0.008261	0.090516	0.00233	0.0255	-0.0002
Drinking water from a river/stream	0.000767	0.027689	0.00215	0.0776	-0.0001
Drinking water from rainwater	4.63E-05	0.006801	0.00192	0.2823	0.0000
Own pit latrine	0.133841	0.340487	0.0016	0.0041	-0.0006
Drinking water from a dam	8.64E-06	0.002939	0.00064	0.2178	0.0000

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Table A3: cont'd.

	Asset ownership		Principal Components Results		
	Unweighted			Household score if:	
	Mean	Std. Dev.	Asset Factor scores	Owns Asset	Does not own asset
Drinking water from a public tap	0.227363	0.419136	0	0.0000	0.0000
Gas as main source of lighting	3.25E-05	0.005699	-0.00057	-0.1000	0.0000
Other source of lighting	0.000393	0.019821	-0.00601	-0.3031	0.0001
Other toilet facility	0.000277	0.01664	-0.00747	-0.4488	0.0001
Other source of cooking fuel	0.002185	0.046689	-0.0112	-0.2394	0.0005
Oil as main source of lighting	0.000412	0.020303	-0.01275	-0.6277	0.0003
Coal as cooking fuel source	0.005534	0.074186	-0.01512	-0.2027	0.0011
Shared flush toilet	0.077278	0.267037	-0.01752	-0.0605	0.0051
Shared pit latrine	0.021864	0.14624	-0.02025	-0.1354	0.0030
Public pit latrine	0.012936	0.112998	-0.02465	-0.2153	0.0028
Crop residue as main fuel source	0.005158	0.071634	-0.03016	-0.4189	0.0022
Dung as cooking fuel source	0.013759	0.116491	-0.0326	-0.2760	0.0039
Coke as cooking fuel source	0.043486	0.203952	-0.03526	-0.1654	0.0075
Owns Livestock	0.137123	0.343982	-0.03618	-0.0908	0.0144
Public flush toilet	0.085579	0.279746	-0.05357	-0.1751	0.0164
Kerosene as cooking fuel source	0.214412	0.410421	-0.07571	-0.1449	0.0396
Semi-Pucca house	0.24381	0.429387	-0.12271	-0.2161	0.0697
Number of members per sleeping room	2.545882	1.870595	-0.13251	**	**
Kachha House	0.09562	0.294075	-0.1391	-0.4278	0.0452
Wood as main fuel source	0.231975	0.4221	-0.1762	-0.3206	0.0968
Kerosene as main source of lighting	0.085372	0.27944	-0.18408	-0.6025	0.0562
Bush or no toilet facility	0.191965	0.393852	-0.18805	-0.3858	0.0917

** Household scores for numbers of people per sleeping room are calculated as follows: {#people per room - unweighted mean)/unweighted std. Deviation}*asset factor score

Table A4. Household Wealth Quintiles, Urban India 1998/9

Wealth Quintile	Unweighted Sample Size	Asset Index Score			
		Mean	Std. Deviation	Lowest	Highest
Poorest	5683	-4.350	1.743	-12.971	-0.363
Second	5987	-1.466	1.166	-7.750	2.057
Middle	6009	0.434	1.097	-5.114	4.342
Fourth	6272	2.097	0.950	-2.192	5.554
Richest	6735	3.735	1.025	0.377	9.240

ANNEX B: LEVELS AND INEQUALITIES IN FULL AND NO IMMUNIZATION

Table B1. Full Immunization, Rural India

State	N	Wealth Quintiles (% immunized)					**State Level (%)**	**C.I.** [a/]	**Poor/Rich Ratio**
		Poorest	Second	Middle	Fourth	Richest			
Andhra Pr.	495	51.65	48.08	49.04	53.85	66.30	**53.54**	0.05 (0.03)	0.78
Assam	544	10.88	13.60	14.91	22.09	29.17	**16.54**	0.19** (0.05)	0.37
Bihar	1622	3.36	5.26	6.93	10.61	24.27	**9.80**	0.38** (0.06)	0.14
Gujarat	511	25.53	44.35	53.70	47.52	67.86	**47.36**	0.14 (0.06)	0.38
Haryana	502	44.95	60.78	70.00	75.79	72.97	**64.34**	0.09* (0.04)	0.62
Himachal Pr.	403	50.00	76.92	92.68	87.78	92.77	**81.14**	0.09 (0.05)	0.54
Jammu	504	36.51	42.11	58.51	49.49	75.56	**51.19**	0.13* (0.04)	0.48
Karnataka	558	43.33	51.40	60.33	57.00	75.45	**57.35**	0.10** (0.03)	0.57
Kerala	353	60.26	70.18	67.12	71.60	68.75	**67.42**	0.02 (0.01)	0.88
Maharashtra	480	58.04	71.68	79.79	78.67	86.05	**73.75**	0.07** (0.07)	0.67
Madhya Pr.	1289	5.04	10.12	12.69	20.07	34.67	**16.14**	0.33** (0.07)	0.15
Orissa	746	27.75	37.18	41.73	54.49	54.92	**42.36**	0.14 (0.03)	0.51
Punjab	397	37.11	63.92	78.08	85.07	92.06	**68.01**	0.16** (0.05)	0.40
Rajasthan	1478	6.59	11.15	13.21	18.53	35.66	**16.04**	0.30** (0.07)	0.18
Tamil Nadu	470	73.40	85.45	88.89	88.37	95.06	**85.96**	0.04* (0.02)	0.77
Uttar Pr.	2168	13.66	13.33	17.23	20.89	31.03	**19.00**	0.18** (0.04)	0.44
W. Bengal	503	23.97	38.60	41.58	42.22	61.04	**39.76**	0.15* (0.06)	0.39
All-India	***14732***	***17.85***	***21.68***	***30.64***	***42.24***	***60.22***	***35.51***	***0.24**** (0.04)	***0.30***

[a/] The Concentration Index and standard error (in parentheses) are calculated using the methodology of Kakwani et al (1997). * and ** indicate that the index is significantly different from zero (there is some degree of inequality) at the 5 percent and 1 percent levels respectively.

Table B2. Full Immunization, Urban India

State	N	Wealth Quintiles (% immunized)					**State Level**	**C.I.** [a/]	**Poor/Rich Ratio**
		Poorest	Second	Middle	Fourth	Richest			
Andhra Pr.	194	50.00	71.43	51.22	58.97	62.50	**58.76**	0.01 (0.03)	0.80
Assam	113	46.88	37.93	52.94	35.71	42.86	**43.36**	-0.02 (0.02)	1.09
Bihar	142	11.11	27.78	24.00	21.43	35.29	**22.54**	0.14 (0.09)	0.31
Gujarat	291	40.00	58.21	52.83	80.00	82.35	**60.14**	0.14** (0.03)	0.49
Haryana	159	52.08	74.29	76.00	85.71	69.57	**69.18**	0.08 (0.04)	0.75
Himachal Pr.	141	68.97	76.47	85.71	87.50	85.19	**80.14**	0.04** (0.01)	0.81
Jammu	161	54.29	70.97	78.57	74.19	91.67	**73.91**	0.09* (0.03)	0.59
Karnataka	245	34.92	48.15	52.17	75.00	85.71	**56.33**	0.18** (0.03)	0.41
Kerala	109	72.41	78.57	75.00	72.41	70.59	**73.39**	-0.01 (0.01)	1.03
Maharashtra	1638	51.61	71.10	72.66	75.49	79.00	**69.59**	0.06 (0.03)	0.65
Madhya Pr.	400	13.54	30.85	46.67	45.33	78.33	**39.50**	0.28* (0.09)	0.17
Orissa	169	24.44	57.50	54.84	71.43	77.78	**53.25**	0.19* (0.07)	0.31
Punjab	166	64.29	85.00	86.67	93.55	86.96	**81.93**	0.06 (0.03)	0.74
Rajasthan	370	9.28	16.87	35.21	36.36	57.81	**28.38**	0.33** (0.08)	0.16
Tamil Nadu	399	90.32	88.46	94.20	94.81	90.24	**91.48**	0.01 (0.01)	1.00
Uttar Pr.	436	17.59	24.73	35.44	40.48	52.78	**32.57**	0.21** (0.03)	0.33
W. Bengal	286	50.70	66.22	74.14	80.85	75.00	**67.48**	0.08* (0.04)	0.68
New Delhi	488	41.01	50.96	48.96	62.34	43.06	**48.36**	0.04 (0.04)	0.95
All-India	***5425***	***39.55***	***54.13***	***59.19***	***64.26***	***71.28***	***56.85***	***0.10**** (0.03)	***0.55***

[a/] The Concentration Index and standard error (in parentheses) are calculated using the methodology of Kakwani et al (1997). * and ** indicate that the index is significantly different from zero (there is some degree of inequality) at the 5 percent and 1 percent levels respectively.

Table B3. No Immunization, Rural India

State	N	Wealth Quintiles (% not immunized)					**State Level**	**C.I.** [a/]	**Poor/Rich Ratio**
		Poorest	Second	Middle	Fourth	Richest			
Andhra Pr.	495	5.49	9.62	3.85	3.85	2.17	**5.05**	-0.20* (0.08)	2.53
Assam	544	55.10	40.00	34.21	20.93	8.33	**35.66**	-0.24* (0.09)	6.61
Bihar	1622	19.89	23.10	17.82	12.86	10.68	**17.08**	-0.13* (0.04)	1.86
Gujarat	511	14.89	4.84	4.63	4.95	0.00	**5.87**	-0.37* (0.15)	-
Haryana	502	18.35	8.82	4.00	4.21	4.17	**8.17**	-0.34** (0.04)	4.40
Himachal Pr.	403	18.57	2.56	2.44	0.00	1.20	**4.47**	-0.61** (0.07)	15.48
Jammu	504	23.02	13.68	5.32	8.08	1.11	**11.11**	-0.38** (0.11)	20.74
Karnataka	558	14.17	14.95	5.79	8.00	1.82	**8.96**	-0.28* (0.10)	7.79
Kerala	353	1.28	3.51	5.48	6.17	1.56	**3.68**	0.09 (0.18)	0.82
Maharashtra	480	7.14	3.54	0.00	0.00	0.00	**2.50**	-0.61** (0.19)	-
Madhya Pr.	1289	21.71	23.74	21.54	11.42	4.44	**16.76**	-0.22 (0.11)	4.89
Orissa	746	10.40	12.82	6.47	5.13	4.10	**8.04**	-0.20** (0.05)	2.54
Punjab	397	25.77	12.37	4.11	1.49	0.00	**10.33**	-0.51** (0.14)	-
Rajasthan	1478	38.32	29.39	24.53	15.03	10.66	**24.49**	-0.23** (0.06)	3.59
Tamil Nadu	470	0.00	0.91	0.00	0.00	0.00	**0.21**	-0.37 (0.36)	-
Uttar Pr.	2168	41.63	40.00	29.98	27.46	14.04	**30.95**	-0.17** (0.06)	2.97
W. Bengal	503	21.49	17.54	22.77	16.67	7.79	**17.89**	-0.11 (0.08)	2.76
All-India	***14732***	***27.15***	***25.57***	***19.72***	***13.05***	***5.12***	***17.59***	***-0.26**** (0.09)	***5.30***

[a/] The Concentration Index and standard error (in parentheses) are calculated using the methodology of Kakwani et al (1997). * and ** indicate that the index is significantly different from zero (there is some degree of inequality) at the 5 percent and 1 percent levels respectively.

Table B4. No Immunization, Urban India

State	N	Wealth Quintiles (% not immunized)					**State Level**	**C.I.** [a/]	**Poor/Rich Ratio**
		Poorest	Second	Middle	Fourth	Richest			
Andhra Pr.	194	10.00	2.38	4.88	0.00	0.00	**3.61**	-0.49* (0.18)	-
Assam	113	21.88	10.34	23.53	7.14	0.00	**13.27**	-0.27 (0.18)	-
Bihar	142	13.89	11.11	8.00	10.71	5.88	**10.56**	-0.12 (0.05)	2.36
Gujarat	291	14.67	2.99	3.77	0.00	0.00	**5.15**	-0.56** (0.14)	-
Haryana	159	18.75	5.71	4.00	0.00	0.00	**7.55**	-0.54** (0.15)	-
Himachal Pr.	141	0.00	0.00	2.86	6.25	0.00	**1.42**	0.32 (0.33)	-
Jammu	161	8.57	3.23	0.00	0.00	0.00	**2.48**	-0.68** (0.18)	-
Karnataka	245	14.29	9.26	6.52	2.50	0.00	**7.35**	-0.39* (0.15)	-
Kerala	109	0.00	0.00	0.00	0.00	0.00	**0.00**	0.00 (0.00)	-
Maharashtra	1638	2.42	0.58	0.00	0.00	0.00	**0.63**	-0.69** (0.15)	-
Madhya Pr.	400	12.50	9.57	0.00	1.33	0.00	**5.50**	-0.51* (0.17)	-
Orissa	169	31.11	7.50	3.23	2.86	0.00	**11.24**	-0.54** (0.10)	-
Punjab	166	14.29	2.50	0.00	0.00	0.00	**4.22**	-0.68** (0.17)	-
Rajasthan	370	27.84	19.28	12.68	1.82	3.13	**14.86**	-0.37* (0.12)	8.89
Tamil Nadu	399	0.00	0.00	0.00	0.00	0.00	**0.00**	0.00 (0.00)	-
Uttar Pr.	436	32.41	11.83	11.39	7.14	1.39	**14.22**	-0.07 (0.06)	23.32
W. Bengal	286	8.45	6.76	3.45	0.00	0.00	**4.55**	-0.41* (0.18)	-
New Delhi	*488*	14.39	0.96	1.04	0.00	0.00	**4.51**	-0.65** (0.16)	-
All-India	***5425***	***14.88***	***7.17***	***4.99***	***2.23***	***0.51***	***6.35***	***-0.43**** (0.11)	***29.18***

[a/] The Concentration Index and standard error (in parentheses) are calculated using the methodology of Kakwani et al (1997). * and ** indicate that the index is significantly different from zero (there is some degree of inequality) at the 5 percent and 1 percent levels respectively.

Table B5. Full Immunization, Rural India - Male Children

State	N	Wealth Quintiles (% immunized)					**State Level**	**C.I.** [a/]	**Poor/Rich Ratio**
		Poorest	Second	Middle	Fourth	Richest			
Andhra Pr.	239	38.10	49.09	45.28	52.94	71.05	**50.63**	0.10* (0.04)	0.54
Assam	299	12.50	17.24	19.72	23.91	31.82	**19.73**	0.17** (0.04)	0.39
Bihar	839	4.84	5.75	9.21	13.92	27.27	**11.98**	0.35** (0.05)	0.18
Gujarat	266	27.78	40.00	51.85	50.88	63.27	**47.37**	0.12* (0.04)	0.44
Haryana	270	42.11	60.78	67.27	74.07	75.47	**63.70**	0.10* (0.04)	0.56
Himachal Pr.	230	57.50	76.74	91.30	86.27	92.00	**81.74**	0.07 (0.04)	0.63
Jammu	281	37.50	46.94	54.39	53.23	80.70	**54.80**	0.14* (0.04)	0.46
Karnataka	281	45.00	57.14	56.45	55.81	83.33	**59.79**	0.11* (0.04)	0.54
Kerala	192	56.00	66.67	65.12	69.77	68.97	**64.58**	0.04* (0.02)	0.81
Maharashtra	263	56.90	72.58	73.33	85.37	85.96	**74.14**	0.08** (0.02)	0.66
Madhya Pr.	648	6.30	12.40	15.45	22.82	42.50	**19.75**	0.33**** (0.07)	0.15
Orissa	402	21.95	32.93	44.87	56.70	57.14	**42.54**	0.18 (0.05)	0.38
Punjab	204	43.48	70.21	85.00	85.00	93.55	**73.53**	0.13* (0.05)	0.46
Rajasthan	811	6.38	11.32	11.59	16.98	37.59	**15.91**	0.32** (0.08)	0.17
Tamil Nadu	234	71.43	87.50	95.12	87.80	97.87	**87.61**	0.05 (0.02)	0.73
Uttar Pr.	1118	17.75	14.35	20.17	23.61	31.63	**21.38**	0.14** (0.04)	0.56
W. Bengal	252	22.39	42.37	41.46	51.11	65.00	**42.06**	0.18* (0.06)	0.34
All-India	***7720***	***17.08***	***24.03***	***31.57***	***42.72***	***61.47***	***36.85***	***0.24**** (0.05)	***0.28***

[a/] The Concentration Index and standard error (in parentheses) are calculated using the methodology of Kakwani et al (1997). * and ** indicate that the index is significantly different from zero (there is some degree of inequality) at the 5 percent and 1 percent levels respectively.

Table B6. Full Immunization, Rural India - Female Children

State	N	Wealth Quintiles (% immunized)					**State Level**	**C.I.** [a/]	**Poor/Rich Ratio**
		Poorest	Second	Middle	Fourth	Richest			
Andhra Pr.	256	63.27	46.94	52.94	54.72	62.96	**56.25**	0.01 (0.04)	1.00
Assam	245	8.96	10.45	6.98	20.00	25.00	**12.65**	0.20* (0.07)	0.36
Bihar	787	1.75	4.76	4.64	7.19	20.83	**7.50**	0.42** (0.09)	0.08
Gujarat	245	24.14	50.00	55.56	43.18	74.29	**47.35**	0.38 (0.19)	0.32
Haryana	232	48.08	60.78	73.33	78.05	69.77	**65.09**	0.08* (0.03)	0.69
Himachal Pr.	173	40.00	77.14	94.44	89.74	93.94	**80.35**	0.11 (0.07)	0.43
Jammu	223	35.71	36.96	64.86	43.24	66.67	**46.64**	0.12* (0.04)	0.54
Karnataka	277	41.67	45.10	64.41	57.89	66.00	**54.87**	0.09** (0.03)	0.63
Kerala	161	67.86	73.33	70.00	73.68	68.57	**70.81**	0.00 (0.01)	0.99
Maharashtra	217	59.26	70.59	85.71	70.59	86.21	**73.27**	0.06* (0.03)	0.69
Madhya Pr.	641	3.82	7.81	10.22	17.14	25.71	**12.48**	0.32**** (0.07)	0.15
Orissa	399	32.97	41.89	37.70	50.85	52.54	**42.15**	0.09** (0.02)	0.63
Punjab	193	31.37	58.00	69.70	85.19	90.63	**62.18**	0.20** (0.06)	0.35
Rajasthan	667	6.85	10.95	14.94	20.47	33.01	**16.19**	0.28** (0.06)	0.21
Tamil Nadu	236	75.56	83.33	84.48	88.89	91.18	**84.32**	0.03* (0.01)	0.83
Uttar Pr.	1050	9.42	12.26	14.02	18.10	30.37	**16.48**	0.22** (0.05)	0.31
W. Bengal	251	25.93	34.55	41.67	33.33	56.76	**37.45**	0.12 (0.06)	0.46
All-India	***7012***	***18.67***	***19.20***	***29.66***	***41.73***	***58.63***	***34.04***	***0.24**** (0.04)	***0.32***

[a/] The Concentration Index and standard error (in parentheses) are calculated using the methodology of Kakwani et al (1997). * and ** indicatehat the index is significantly different from zero (there is some degree of inequality) at the 5 percent and 1 percent levels respectively.

Table B7. Full Immunization, Urban India - Male Children

State	N	Wealth Quintiles (% immunized)					**State Level**	**C.I.** [a/]	**Poor/Rich Ratio**
		Poorest	Second	Middle	Fourth	Richest			
Andhra Pr.	86	66.67	56.25	55.00	63.16	56.25	**59.30**	-0.01 (0.02)	1.19
Assam	59	42.86	25.00	60.00	28.57	41.67	**38.98**	-0.43 (0.13)	1.03
Bihar	63	5.00	29.41	20.00	9.09	40.00	**17.46**	0.18 (0.19)	0.13
Gujarat	146	50.00	65.63	73.08	80.95	81.48	**67.81**	0.10** (0.02)	0.61
Haryana	100	46.15	80.00	76.47	83.33	68.42	**69.00**	0.07 (0.06)	0.67
Himachal Pr.	79	82.35	70.00	81.82	85.71	100.00	**82.28**	0.04 (0.03)	0.82
Jammu	20	52.63	80.00	88.89	68.75	95.00	**77.27**	0.08 (0.05)	0.55
Karnataka	127	34.48	51.61	58.33	73.91	90.00	**59.06**	0.17** (0.04)	0.38
Kerala	52	75.00	66.67	72.73	76.47	100.00	**76.92**	0.04** (0.03)	0.75
Maharashtra	312	57.41	75.00	70.97	75.00	81.25	**72.44**	0.05 (0.03)	0.71
Madhya Pr.	195	17.39	33.33	50.00	46.15	80.00	**43.59**	0.25 (0.08)	0.22
Orissa	85	30.43	72.22	46.67	75.00	77.78	**57.65**	0.15 (0.07)	0.39
Punjab	86	66.67	80.00	87.50	94.12	83.33	**81.40**	0.06* (0.02)	0.80
Rajasthan	181	13.95	21.43	21.21	40.63	48.39	**27.62**	0.25** (0.04)	0.29
Tamil Nadu	218	91.30	94.00	92.68	92.68	92.50	**92.66**	0.00 (0.00)	0.99
Uttar Pr.	236	14.63	25.00	34.04	45.61	46.51	**33.90**	0.19** (0.06)	0.31
W. Bengal	150	52.50	63.33	81.08	82.61	65.00	**68.00**	0.07 (0.04)	0.81
New Delhi	*281*	44.87	50.85	50.00	70.83	43.18	**51.25**	0.04 (0.05)	1.04
All-India	***2817***	***42.26***	***55.50***	***62.39***	***62.89***	***72.13***	***58.79***	***0.09**** (0.03)	***0.59***

[a/] The Concentration Index and standard error (in parentheses) are calculated using the methodology of Kakwani et al (1997). * and ** indicate that the index is significantly different from zero (there is some degree of inequality) at the 5 percent and 1 percent levels respectively.

Table B8. Full Immunization, Urban India - Female Children

State	N	Wealth Quintiles (% immunized)					**State Level**	**C.I.** [a/]	**Poor/Rich Ratio**
		Poorest	Second	Middle	Fourth	Richest			
Andhra Pr.	108	40.00	80.77	47.62	55.00	68.75	**58.33**	0.04 (0.07)	0.58
Assam	54	50.00	53.85	42.86	42.86	44.44	**48.15**	-0.03 (0.01)	1.13
Bihar	79	18.75	26.32	26.67	29.41	33.33	**26.58**	0.09* (0.03)	0.56
Gujarat	145	28.57	51.43	33.33	79.17	83.33	**52.41**	0.20** (0.05)	0.34
Haryana	59	59.09	66.67	75.00	90.00	75.00	**69.49**	0.08** (0.02)	0.79
Himachal Pr.	62	50.00	85.71	92.31	88.89	71.43	**77.42**	0.04 (0.07)	0.70
Jammu	73	56.25	62.50	60.00	80.00	87.50	**68.86**	0.09** (0.07)	0.64
Karnataka	118	35.29	43.48	45.45	76.47	81.82	**53.39**	0.18** (0.02)	0.43
Kerala	57	70.59	87.50	77.78	66.67	54.55	**70.18**	-0.05 (0.04)	1.29
Maharashtra	326	47.14	67.42	74.03	75.93	75.00	**66.87**	0.08 (0.04)	0.63
Madhya Pr.	205	10.00	29.09	43.59	44.44	76.00	**35.61**	0.30* (0.10)	0.13
Orissa	84	18.18	45.45	62.50	66.67	77.78	**48.81**	0.23* (0.08)	0.23
Punjab	80	61.90	90.00	85.71	92.86	90.91	**82.50**	0.07 (0.03)	0.68
Rajasthan	189	5.56	12.20	47.37	30.43	66.67	**29.10**	0.41** (0.12)	0.08
Tamil Nadu	181	89.36	78.57	96.43	97.22	88.10	**90.06**	0.01 (0.01)	1.01
Uttar Pr.	200	19.40	24.44	37.50	29.63	62.07	**31.00**	0.22 (0.07)	0.31
W. Bengal	136	48.39	68.18	61.90	79.17	87.50	**66.91**	0.10* (0.04)	0.55
New Delhi	*207*	36.07	51.11	47.73	42.28	42.86	**44.44**	0.04 (0.04)	0.84
All-India	***2608***	***37.04***	***52.69***	***55.95***	***65.92***	***70.19***	***54.75***	***0.12***** (0.12)	***0.53***

[a/] The Concentration Index and standard error (in parentheses) are calculated using the methodology of Kakwani et al (1997). * and ** indicate that the index is significantly different from zero (there is some degree of inequality) at the 5 percent and 1 percent levels respectively.

Table B9. No Immunization, Rural India - Male Children

State	N	Wealth Quintiles (% not immunized)					**State Level**	**C.I.** [a/]	**Poor/Rich Ratio**
		Poorest	Second	Middle	Fourth	Richest			
Andhra Pr.	239	7.14	9.09	3.77	3.92	5.26	**5.86**	-0.13** (0.04)	1.36
Assam	299	51.25	41.38	35.21	17.39	9.09	**34.11**	-0.24* (0.10)	5.64
Bihar	839	19.89	22.41	19.74	11.39	9.09	**16.65**	-0.15* (0.06)	2.19
Gujarat	266	11.11	7.14	9.26	1.75	0.00	**5.64**	-0.36 (0.18)	-
Haryana	270	22.81	9.80	1.82	3.70	3.77	**8.52**	-0.43** (0.04)	6.05
Himachal Pr.	230	12.50	0.00	4.35	0.00	0.00	**3.04**	-0.61** (0.18)	-
Jammu	281	23.21	10.20	5.26	6.45	0.00	**8.90**	-0.45** (0.13)	-
Karnataka	281	16.67	14.29	8.06	9.30	1.67	**9.96**	-0.29* (0.12)	9.98
Kerala	192	2.00	0.00	6.98	6.98	0.00	**3.65**	0.11 (0.23)	-
Maharashtra	263	6.90	1.61	0.00	0.00	0.00	**1.90**	-0.69** (0.16)	-
Madhya Pr.	648	19.69	21.71	19.51	11.41	5.83	**15.59**	-0.19 (0.09)	3.38
Orissa	402	12.20	13.41	6.41	3.09	3.17	**7.71**	-0.30** (0.07)	3.85
Punjab	204	21.74	8.51	5.00	0.00	0.00	**7.84**	-0.55** (0.15)	-
Rajasthan	811	34.57	29.56	25.00	15.09	4.96	**22.69**	-0.25** (0.10)	6.97
Tamil Nadu	234	0.00	0.00	0.00	0.00	0.00	**0.00**	0.00 (0.00)	-
Uttar Pr.	1118	39.83	36.32	28.33	25.93	15.35	**29.34**	-0.16* (0.05)	2.59
W. Bengal	252	17.91	18.64	19.51	20.00	7.50	**17.06**	-0.07 (0.09)	2.39
All-India	***7720***	***26.32***	***24.89***	***20.40***	***13.02***	***4.22***	***16.98***	***-0.27**** (0.10)	***6.24***

[a/] The Concentration Index and standard error (in parentheses) are calculated using the methodology of Kakwani et al (1997). * and ** indicate that the index is significantly different from zero (there is some degree of inequality) at the 5 percent and 1 percent levels respectively.

Table B10. No Immunization, Rural India - Female Children

State	N	Wealth Quintiles (% not immunized)					**State Level**	**C.I.** [a/]	**Poor/Rich Ratio**
		Poorest	Second	Middle	Fourth	Richest			
Andhra Pr.	256	4.08	10.20	3.92	3.77	0.00	**4.30**	-0.28 (0.19)	-
Assam	245	59.70	38.81	32.56	25.00	7.14	**37.55**	-0.24* (0.07)	8.36
Bihar	787	19.88	23.81	15.89	14.38	12.50	**17.53**	-0.11** (0.03)	1.59
Gujarat	245	17.24	1.85	0.00	9.09	0.00	**6.12**	-0.39 (0.23)	-
Haryana	232	13.46	7.84	6.67	4.88	4.65	**7.76**	-0.22** (0.04)	2.89
Himachal Pr.	173	26.67	5.71	0.00	0.00	3.03	**6.36**	-0.61** (0.10)	8.80
Jammu	223	22.86	17.39	5.41	10.81	3.03	**13.90**	-0.29* (0.09)	7.54
Karnataka	277	11.67	15.69	3.39	7.02	2.00	**7.94**	-0.27* (0.10)	5.84
Kerala	161	0.00	6.67	3.33	5.26	2.86	**3.73**	0.07 (0.20)	0.00
Maharashtra	217	7.41	5.88	0.00	0.00	0.00	**3.23**	-0.54* (0.21)	-
Madhya Pr.	641	23.66	25.78	23.36	11.43	2.86	**17.94**	-0.24 (0.13)	8.27
Orissa	399	8.79	12.16	6.56	8.47	5.08	**8.43**	-0.09 (0.06)	1.73
Punjab	193	29.41	16.00	3.03	3.70	0.00	**12.95**	-0.48** (0.14)	-
Rajasthan	667	43.15	29.20	24.03	14.96	18.45	**26.69**	-0.20** (0.04)	2.34
Tamil Nadu	236	0.00	1.85	0.00	0.00	0.00	**0.42**	-0.39 (0.35)	-
Uttar Pr.	1050	43.50	43.87	31.78	29.05	12.57	**32.67**	-0.18** (0.05)	3.46
W. Bengal	251	25.93	16.36	25.00	13.33	8.11	**18.73**	-0.15 (0.09)	3.20
All-India	***7012***	***28.04***	***26.28***	***19.00***	***13.09***	***6.27***	***18.25***	***-0.25**** (0.08)	***4.47***

[a/] The Concentration Index and standard error (in parentheses) are calculated using the methodology of Kakwani et al (1997). * and ** indicate that the index is significantly different from zero (there is some degree of inequality) at the 5 percent and 1 percent levels respectively.

Table B11. No Immunization, Urban India - Male Children

State	N	Wealth Quintiles (% not immunized)					**State Level**	**C.I.** [a/]	**Poor/Rich Ratio**
		Poorest	Second	Middle	Fourth	Richest			
Andhra Pr.	86	0.00	0.00	0.00	0.00	0.00	**0**	0	-
Assam	59	14.29	12.50	20.00	0.00	0.00	**10.17**	-0.28 (0.23)	-
Bihar	63	15.00	5.88	0.00	18.18	0.00	**9.52**	-0.13 (0.23)	-
Gujarat	146	12.50	0.00	0.00	0.00	0.00	**3.42**	-0.73** (0.20)	-
Haryana	100	19.23	0.00	0.00	0.00	0.00	**5.00**	-0.74** (0.20)	-
Himachal Pr.	79	0.00	0.00	4.55	0.00	0.00	**1.27**	0.22 (0.37)	-
Jammu	20	5.26	0.00	0.00	0.00	0.00	**1.14**	-0.78** (0.18)	-
Karnataka	127	17.24	12.90	8.33	4.35	0.00	**9.45**	-0.36* (0.14)	-
Kerala	52	0.00	0.00	0.00	0.00	0.00	**0**	0	-
Maharashtra	312	1.85	0.00	0.00	0.00	0.00	**0.32**	-0.83** (0.17)	-
Madhya Pr.	195	6.52	2.56	0.00	2.56	0.00	**2.56**	-0.44* (0.15)	-
Orissa	85	30.43	5.56	6.67	0.00	0.00	**10.59**	-0.58** (0.14)	-
Punjab	86	0.00	5.00	0.00	0.00	0.00	**1.16**	-0.28 (0.37)	-
Rajasthan	181	25.58	28.57	18.18	0.00	6.45	**17.13**	-0.31 (0.14)	3.97
Tamil Nadu	218	0.00	0.00	0.00	0.00	0.00	**0**	0	-
Uttar Pr.	236	31.71	8.33	10.64	7.02	0.00	**11.02**	-0.43* (0.14)	-
W. Bengal	150	7.50	10.00	2.70	0.00	0.00	**4.67**	-0.40 (0.20)	-
New Delhi	281	8.97	0.00	0.00	0.00	0.00	**2.49**	*-0.72*** *(0.20)*	-
All-India	***2817***	***13.22***	***5.75***	***5.50***	***2.04***	***0.36***	***5.47***	***-0.43**** (0.13)	***36.72***

[a/] The Concentration Index and standard error (in parentheses) are calculated using the methodology of Kakwani et al (1997). * and ** indicate that the index is significantly different from zero (there is some degree of inequality) at the 5 percent and 1 percent levels respectively.

Table B12. No Immunization, Urban India - Female Children

State	N	Wealth Quintiles (% not immunized)					**State Level**	**C.I.** [a/]	**Poor/Rich Ratio**
		Poorest	Second	Middle	Fourth	Richest			
Andhra Pr.	108	16.00	3.85	9.52	0.00	0.00	**6.48**	-0.44* (0.19)	-
Assam	54	27.78	7.69	28.57	14.29	0.00	**16.67**	0.30 (0.28)	-
Bihar	79	12.50	15.79	13.33	5.88	8.33	**11.39**	-0.13 (0.06)	1.50
Gujarat	145	17.14	5.71	7.41	0.00	0.00	**6.90**	-0.48* (0.17)	-
Haryana	59	18.18	13.33	12.50	0.00	0.00	**11.86**	-0.30 (0.17)	-
Himachal Pr.	62	0.00	0.00	0.00	11.11	0.00	**1.61**	0.40 (0.37)	-
Jammu	73	12.50	6.25	0.00	0.00	0.00	**4.11**	-0.63** (0.19)	-
Karnataka	118	11.76	4.35	4.55	0.00	0.00	**5.08**	-0.48* (0.16)	-
Kerala	57	0.00	0.00	0.00	0.00	0.00	**0**	0	-
Maharashtra	326	2.86	1.12	0.00	0.00	0.00	**0.92**	-0.62** (0.17)	-
Madhya Pr.	205	18.00	14.55	0.00	0.00	0.00	**8.29**	-0.52* (0.11)	-
Orissa	84	31.82	9.09	0.00	6.67	0.00	**11.90**	-0.50** (0.20)	-
Punjab	80	28.57	0.00	0.00	0.00	0.00	**7.50**	-0.74** (0.20)	-
Rajasthan	189	29.63	9.76	7.89	4.35	0.00	**12.70**	-0.46** (0.12)	-
Tamil Nadu	181	0.00	0.00	0.00	0.00	0.00	**0**	0	-
Uttar Pr.	200	32.84	15.56	12.50	7.41	3.45	**18.00**	-0.34** (0.09)	9.52
W. Bengal	136	9.68	4.55	4.76	0.00	0.00	**4.41**	-0.42* (0.17)	-
New Delhi	207	21.31	2.22	2.27	0.00	0.00	**7.25**	-0.61** (0.15)	-
All-India	***2608***	***16.43***	***8.67***	***4.46***	***2.47***	***0.70***	***7.29***	***-0.43**** (0.03)	***23.47***

[a/] The Concentration Index and standard error (in parentheses) are calculated using the methodology of Kakwani et al (1997). * and ** indicate that the index is significantly different from zero (there is some degree of inequality) at the 5 percent and 1 percent levels respectively.

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1818 H Street, NW
Washington, DC USA 20433
Telephone: 202 473 1000
Facsimile: 202 477 6391
Internet: www.worldbank.org
E-mail: feedback@worldbank.org