



# **First Things First: Infectious Disease, Child Mortality and the Poor in India 1992-2005**

**Nazmul Chaudhury**  
**The World Bank**

**Jeffrey Hammer**  
**Princeton University**

**Atul Pokharel**  
**The World Bank**

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Nazmul Chaudhury  
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Jeffrey S. Hammer  
Princeton University

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### **Abstract**

This paper examines the three rounds of the National Family Health Survey of India to examine infectious disease, non-communicable disease and child mortality between 1992 and 2005. Emphasis is on the gradient of prevalence (or incidence as appropriate) across people with different standards of living. We find a steep fall in incidence with wealth in all three rounds, an effect that is frequently masked by reporting health by standard of living as measured in quintiles since the standard of living between quintiles reflect very small differences in wealth. For self reported morbidity, there appear to be substantial problems with the data, showing an increase in infectious disease between 1992 and 1998 and a similar decrease from 1998, a peculiar result given the sustained increase in income over the period. We try to disentangle possible reasons - real and spurious - for this result. We also argue that the emphasis in the Indian health system is extremely skewed toward curative care while the poor would benefit more from primary prevention.

### **Introduction**

#### Who cares what happened to the poor in India during the 1990's?

Without entering into an enormous and contentious literature<sup>1</sup> it is worth noting that anything written about India, in particular the welfare of the poor, during the 1990's is fraught with political interpretations. Because of the liberalization of the economy that started in 1991, which clearly increased the economy's growth rate (without incurring unsustainable debt) everything that happened to poor people since then is examined in great detail by people of all political stripes to show either that a "rising tide lifts all boats" (from the right) or that only the "middle class" (meaning the rich) benefited while the poor were left behind (from the left). The main source of this debate is the data from the National Sample Surveys that form the basis of measures of poverty and has been argued over *ad nauseum*. So, the answer is: "lots of people care what happened".

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<sup>1</sup> See Deaton and Kozel (eds.), The Great Indian Poverty Debate, (2005) which, at 600 pages, gives an inkling of a hint of some of the issues in this literature.

This paper looks at the issue with a different source of data and different indicators of well-being. The alternative source is the National Family Health Surveys (NFHS) of 1992-3, 1998-9 and 2005. The alternative indicators are those directly related to health, in particular those associated with infectious disease. The advantage of this survey is that it is very large – covering all states in the country and 500,000 individuals<sup>2</sup>. Therefore even fairly rare events such as tuberculosis prevalence (rare from a statistical standpoint though they are all-too-common from a human standpoint) can be captured.

The disadvantage of the NFHS from the perspective of distinguishing among income groups is that they don't include measures of consumption or income. However, recent attempts have been made to create indices of wealth or standard of living from these surveys and these will form the basis of the analysis here.<sup>3</sup> A previous paper looked at changes in this index over time in India by state<sup>4</sup> but the current paper examines the bivariate relationship between this index and the incidence of particular diseases focusing primarily on infectious disease. With all its potential faults, this survey and the index of wealth is the only survey large and comprehensive enough to examine both economic conditions and health status in the Indian population.

#### Who cares about poor peoples' problems with infectious disease in particular?

For some years now we've been hearing about the "epidemiological transition" and the "dual burden of disease" in developing countries.<sup>5</sup> The former refers to the phenomenon that as countries get richer, the kinds of things that people die from change from infectious disease to non-communicable disease. The latter refers to the fact that poor countries still have a substantial incidence of infectious disease to contend with at the same time that non-communicable disease is rising. In fact, more poor people in India die from cardiovascular disease and cancer than they do from infectious disease. Even they have had increases in income that allow them to live to adulthood. So why worry about infectious disease among the poor, in particular, if that isn't their "biggest killer"?

First, everyone dies of something so the very fact that the disease pattern has changed isn't by itself cause for alarm. It is more a measure of success that old scourges have been moderated. Changing disease patterns affect the length and quality of life - such as the fear of re-infection. Conversely, of course, the length of life affects the disease pattern. Therefore this transition is an indicator of real improvement in well-being.

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<sup>2</sup> NFHS I, II and III includes 514,827, 517,379 and 523,450 individuals respectively.

<sup>3</sup> World Bank (1998, 2001), Filmer and Pritchett (2003), Bonilla-Chacin and Hammer (1999) as well as standard reporting in all Demographic and Health Surveys (of which the NFHS is the Indian version) of recent surveys based on Gwatkin et al (200\_).

<sup>4</sup> Chaudhury and Hammer (2007)

<sup>5</sup> Disease Control Priorities In Developing Countries, Chapter 1. Lopez, Mathers, Ezzati, Jamison and Murray, Global Burden of Disease and Risk Factors.

Second, “total burden of disease” is irrelevant for most public policy issues.<sup>6</sup> Marginal effects count, not total. With a scarce budget for health, we should be worried about both of the usual criteria of public spending: its efficiency as well as its equity effects. There is a big risk that the absolute numbers of deaths will obscure the more important application of “comparative (dis)advantage” which would argue that any money from a fixed budget that is allocated by disease (rather than by income) will hurt the poor. If policy makers can only choose from a menu of diseases to attack and can’t distinguish between beneficiaries of policy based on their income, money must be spent on diseases for which the poor suffer more-than-proportionately compared to richer groups if policy is to improve equity. No matter how much the absolute burden on the poor is, it is the relative burden compared to the less poor that determines the distributional impact of expenditure. We shall return to this point again but it is worth mentioning up front.

### Summary and main results

This paper presents a number of non-parametric regressions of the self reported incidence of various diseases (primarily tuberculosis, malaria and diarrhea) as well as child mortality, which is closely associated with infectious disease, across the income distribution between the two rounds of the NFHS. Since we are eschewing econometric (or any other formal) analyses, we will try to be as modest with our inferences as our personal dispositions allow. However, the following main results and several mysteries seem to emerge from the data if only as hypotheses for further examination.

- 1) Most indicators of health improved during the 1990’s. It appears that much of this improvement was due to increases in *private* income (wealth) over the period and not from any change in the function relating wealth to health.
- 2) Health indicators that are dependent on *public* intervention, primarily those related to infectious disease, did not improve over the period, with some (debatable) indication of substantial worsening in the second round that was temporary, returning to almost the same levels as the initial year.
- 3) Budgetary data suggests that public expenditure within the health ministry is extremely skewed toward the provision of curative care, almost entirely a private good, rather than toward the public goods and services with high externalities associated with the control of infectious disease. Across all ministries, expenditure on water and, especially, sanitation varies markedly. The problem with water and sanitation provision, however, is not so much as the amount of money spent but on ineffective spending.
- 4) The big losers in this story are the poor, not because of the liberalization of the economy, nor because of fewer public resources going to the health system but because of this imbalance in the types of services provided by the public sector.
- 5) Rural residents still suffer from most infectious diseases at higher rates than urban residents even controlling for level of income. However, urban areas that are

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<sup>6</sup> Pure research on curing or preventing illnesses with no information on costs or likelihood of success should certainly go after the biggest problems as a measure of its maximal impact. This is the only real exception to focusing exclusively on marginal impact.

- likely to absorb substantial migrants over the coming decades, should be ready to accommodate this population increase with proper sanitation.
- 6) Methodological result #1: Self-reported incidence of specific disease is fraught with serious potential biases. We can't solve most of them. However, comparisons with other sources of data throw substantial doubt on both survey and on official statistics. Facility-based official statistics are usually deficient relative to the survey based results since so few people visit public health clinics. On the other hand, anomalous results, most obviously in the 1998 (middle) round of the NFHS seem very suspect. We're left with conflicting conclusions from different sources and no real way to reconcile the results.
  - 7) Methodological result #2: The conventional way of presenting data from this type of survey – indicators classified into quantiles (usually quintiles) - is very deceptive and underestimates the impact of income on health, particularly at very low levels of income. Ordinal measures such as quintiles conflate the functional relationship between standard of living and health on the one hand, and the distribution of income on the other. Health policy might plausibly be expected to influence the former (by flattening the function through improvements in universal protection of the population) but not the latter, which is out of the hands of those policy makers usually concerned with health status.

OK, maybe we over-interpreted the results. On the other hand, the core message of the paper is relatively uncontroversial. Government action should follow Keynes' dictum "*The important thing for government is not to do things which individuals are doing already, and to do them a little better or a little worse; but to do those things which at present are not done at all.*"<sup>7</sup> In the Indian context the lesson is clear. Let's make sure that traditional 19<sup>th</sup> century public health measures (sanitation, vector control, safe water) are in place that would prevent diseases before spending lots of money on the medical system that might cure them<sup>8</sup>. For both efficiency reasons (do public goods first) and for equity reasons (poor people suffer from these diseases much more than do others), we should make sure the government does first things first.

### **The relation between illness and “wealth”**

Figures 1 through 3 show our basic results for TB, malaria and child mortality (under 5 mortality). The graphs are simple non-parametric regressions of the incidence (for TB the prevalence) of these health problems as functions of our measure of wealth. They also super-impose the cumulative distribution function (CDF) of wealth on these regressions. Non-parametric regressions are basically just moving averages of the dependent variable when the data is organized by the dependent variable. It allows for nonlinearities in the data to show through without making assumptions about the specific functional form these nonlinearities can take. There is a large literature on the optimal way to compute the moving average, involving the weighting scheme of data around its

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<sup>7</sup> J.M. Keynes, 1926.

<sup>8</sup> For arguments why the medical system might *not* cure them, see Kremer et al (2006 a&b) and Das and Hammer (2005, 2007)

midpoint. We used the default options in STATA which are rectangular windows (meaning a simple, un-weighted average) for an optimally chosen bandwidth (or the range on either side of the point of the independent variable for which the average of the dependent variable is calculated). There are several anomalies that jump out of these pictures.

<Fig 1>

<Fig 2>

<Fig 3>

There is a substantial increase in the incidence of malaria and tuberculosis between the first and second rounds. Questions concerning malaria were not asked in the third round. For TB, the relation between prevalence and wealth for the third round seem to fall back to the relationship found in the first round but with some “flattening”, that is, there was improvement for poor people and a small deterioration for the not-so-poor. The effect of the not-so-poor is within conventional bounds of significance (hypothesis testing in non-parametric contexts is not as standardized as in parametric models) but the effect on the poor appears significant. Further, the difference in overall mean of TB for the two samples is not significant. So the evidence points to a possible improvement between the first and third rounds for TB with a dramatic deterioration in between.

Can this jumping up and down be true? Specifically, can this large increase of malaria and TB in the second period be true? What other explanations could there be for this observation besides an actual worsening of the infectious disease problem in the middle round? These could include 1) deteriorating standards of living 2) mis-measurement in this standard and 3) self-reporting bias.

Deteriorating standard of living One possibility that comes to mind is that the people who are skeptical of the liberalization are right and life got harder for poor people in the 1990's and it's taken until the middle of the next decade to recover (at least for TB, for malaria we just don't know). However, this would not explain the upward shift in the whole function relating wealth and health, just a movement along the function due to deteriorating income. Further, on the basis of the index of “wealth” there doesn't appear to be deterioration among the poor in either period. The cumulative distribution functions of our measure of wealth shows a first order stochastic dominance improvement between the first and second rounds.<sup>9</sup>

Including the third round in this analysis complicates the picture somewhat but not in the range of incomes we normally worry about. We find some evidence of the CDF's crossing at relatively high levels of income indicating some reduction of inequality (though concentrated at the top). Banerjee and Picketty (200\_) looked at incomes of the top 1% of tax return filers (already a small subset of the population) and find their share

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<sup>9</sup> This improvement is described in greater detail and related to the larger controversy over changes in the standard of living among the poor in Chaudhury and Hammer (2005)

of total income increased enormously since 1991. The NFHS can't pick out this group since only automobile or television ownership distinguishes the richest measured "wealth" and many more than 1% of tax filers can afford these. If both the tax data and the NFHS data are correct, there is a lot of crossing at the upper tail of the distribution. However, for the whole lower 90% of the distribution, things seem to have gotten consistently better over time. If there were indeed a deterioration of health status in the 1990's, it must be for reasons other than income reduction.

In fact, the change in wealth and the steepness of the function at the low end make the problem seem even worse. Figures 4, 5 and 6 show the impact of wealth alone. Besides the two regressions on data as in the previous figures, there is a third function. This represents the fall in disease or mortality that can be attributed to someone at a given standard of living from the improvement in that standard over measured in the next survey round. These are constructed using the following procedure: for each point, the x-coordinate (wealth, income, standard of living<sup>10</sup>) is taken from the earlier survey while the y-coordinate is taken from the function relating wealth and health indicator for that same but evaluated at the level of wealth that a person at the same percentile of income would have in the subsequent round. The surveys are linked by assuming people occupy a common place on the income distribution and finding the absolute change in income for people at each percentile of that distribution.<sup>11</sup> This generates a synthetic function that reflects the movement along the original curve by the amount of the increase in wealth between the rounds for each percentile.

The procedure always results in a downward shift in the function for every disease due to the consistent, rightward shift of the CDF and the negative slope of the health/wealth function. The relative weight of moving along the curve and shifts of the curve can be assessed by the levels of the actual and the constructed curves. If they coincide, then the relative impact is equal: the calculated impact of income is the same as the observed shift in the curve. If the constructed curve is below the actual curve for the second period, then income has had a larger (negative) impact on illness and death. For child mortality we see that about half of the effect of the shift of the curve over the period is matched by this effect for much of the middle portion of the range of income with less effect near the tails. For TB and malaria between the first and second rounds, though, this effect only makes the unexplained upward shift of the function worse since there should have been an improvement due to income gains.

<Fig 4>

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<sup>10</sup> All three concepts are used interchangeably for the time being. The details of the variable used are given below.

<sup>11</sup> This can be done in the opposite way as well: for each level of income in the second round, the change is similarly decomposed into how much of the improvement came from the shift in the curve (which is directly graphed) and how much someone at that level of income should have gained by having seen a rise in living standards from a lower level as determined by the shift in the CDF. The results of the two methods are approximately the same – just as Laspeyres and Paasche indices are approximately the same for small changes.

<Fig 5>

<Fig 6>

Mismeasurement of standard of living What is this measure of wealth anyway? Maybe the problem lies with that. The NFHS asks a battery of questions concerning what the family owns, what the nature of their house is (materials and number of rooms), landholding for rural households and the family's source of light and heating. The measure is simply the weighted average of these ownership patterns based on the first principal component of the variance/covariance matrix of this set of variables.

Simple diagnostics for this exercise suggest the index is a reasonable measure of standard of living. One criterion for this is how much of the decomposition of the variance/covariance matrix is accounted for by the first principal component. This is measured by its eigenvalue, the principal components being eigenvectors of the original matrix. The first eigenvalue for this exercise is much larger than all subsequent ones, indicating that the variables are all closely correlated with each other and that much of the information in the matrix is captured by the first component. That is, assuming that each of the observed variables is linearly related to the underlying component does not do much violence to the data. A second criterion of "reasonableness" of the measure is if the pattern of coefficients makes sense. Do things one would expect to have high income elasticities have larger positive weights while things with low income elasticities have low or negative weights? In this application the answer is yes. For example, having a "kutcha" (bad) house, almost always associated with having a dirt floor, has a large negative weight as does using cow dung as the primary source of cooking fuel. The little jump way at the high end of the index is associated with automobile ownership.<sup>12</sup>

One big problem with the index using NFHS (and all DHS countries') data is its inability to make fine distinctions among the very poor. The CDF follows a step pattern up until about the thirtieth percentile of the population (about the official poverty rate in the 1992 period) meaning that there are few distinctions in ownership patterns in the data among the poorest. This is a problem that the NFHS might address in future<sup>13</sup> but as of now there is nothing we can do about the "choppiness" at the low end of the distribution.

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<sup>12</sup> A third criterion of "reasonableness" is how well the index performs relative to conventional measures. This can't be checked in the NFHS since there are no other measures. In the paper that best advocates the use of this measure, Filmer and Pritchett (2003) show that the error in measurement of conventional measures (relying, for example, on questions like "how much rice did you eat in the last two weeks") is much larger than the error for elements of the index ("do you own a bicycle?"). For most of the countries they examined with both sorts of data, the index performed noticeably better. Using consumption as conventionally defined in a regression and the index as an instrument showed big changes in estimates between OLS and IV. Treating the index as the variable and consumption as the instrument did nothing. This indicates that using an index of this sort is *better* than standard measures.

<sup>13</sup> Deaton (2004) suggests that surveys like the DHS add a few questions on food consumption to make finer distinctions among the poor.

Another characteristic shortcoming of this sort of index is that there is no natural metric for the constructed variable. It's not in rupees. As a result, there is a natural tendency to treat the variable as ordinal, grouping people into quintiles or deciles<sup>14</sup>. This is certainly a safe route but ignores perfectly interpretable aspects of the data and thereby throws away useful information. Further, when presented graphically, quantiles give a distorted picture of the effect of income on health relative to the index itself. That is, by treating the index as simply an ordinal measure, information is lost. Ordinal measurements preserve rank (or order) but differences in values between any two points are not equal. Cardinal measurements mean that such differences are equal, if only because all binary variables are cardinal by default. The index is, in fact, a linear combination of arguments that are themselves cardinally measured. Therefore while its units are not intuitive – not being in money, for example – it is still a cardinal measure.

The difference in treating the variable as an ordinal versus a cardinal measure is illustrated in figure 8. This shows Malaria incidence by both the value of the index and by its rank. This is the more general version of presenting data in quantiles and the reader can aggregate by eye this function as equal length horizontal intervals reflect quantiles. One could interpret the flatness of the ranking picture as meaning that you have to move someone all the way from the second to the sixth decile (say) before you see much of an effect on health. But the indices are made up of real things and the differences between the deciles can be interpreted in terms of particular ownership patterns. The difference between the second and the sixth decile can be simply having a wooden instead of dirt floor - all else the same. The difference between the first and second may only be due to the ownership of a clock.<sup>15</sup> The steep rise in the CDF right at the same place as the steep drop in malaria or child mortality stretches the function of health status out so that very minor changes in estimated indices look like major changes in wealth as measured by aggregated measures in quantiles.

<Fig 8>

Self reporting bias Some of the observed increase in infectious disease between the first and second rounds could be due to relying on self-reporting of clinical conditions. The main problem with self reported disease incidence is that we only observe the response to the statement “I have disease Z”. If  $X = 1$  when the response is “yes”, then we can decompose the probability into  $P(X) = P(X|Z) \cdot P(Z) + P(X|\sim Z) \cdot P(\sim Z)$ . We're really interested in measuring  $P(Z)$  but only observe  $P(X)$  having to contend with reporting false negatives  $P(X|Z) \neq 1$  generally from ignorance and mis-diagnoses<sup>16</sup> or false positives  $P(X|\sim Z) \neq 0$  from either mis-diagnosis or hypochondria.

Official explanations don't help much. For malaria, the NFHS reports<sup>17</sup> note the overall increase in incidence – obvious since figure 2 shows an increase at every level of income – but attributes it to differences in the time of year that the surveys took place. It

<sup>14</sup> Or terciles as is currently reported in recent DHS survey reports.

<sup>15</sup> This is discussed in some detail in Chaudhury and Hammer

<sup>16</sup> A common problem; see Das and Hammer (2005, 2007)

<sup>17</sup> NFHS India Summary Volume 1999.

offers no supporting evidence for this claim. As it turns out, the 1998-9 interviews were *less* likely to take place in the malaria seasons following the monsoon and more likely to take place in January through March relative to the 1992 survey. So that's not it. Officially reported malaria cases were virtually identical at 2.2 million in the two survey periods and rainfall was similar in the two years as well. As for TB, official statistics show a substantial *fall* in prevalence from about 550 cases to 510 per 100,000 in the period between the surveys. The latter survey was done during a well-publicized and re-energized TB campaign in 1997 that appears to have had no impact on case detection rates (70, 68 and 72% in 1997-99 respectively). So that's not it.

It is possible that a well publicized campaign could have increased the false positives by having the word "Tuberculosis" being more commonly heard and therefore answered in the surveys. This doesn't do much to explain malaria, though. Generally, there is no reason to put more trust in the official statistics than in the survey results. Official statistics are based on visits to public clinics. It was estimated in 1995 (National Sample Survey) that about 80% of visits are to the private sector and that most visits in rural areas for (self reported) tuberculosis among the poorest fifth of the population were also to private practitioners.<sup>18</sup> Enforcement of reporting rules is lax at best and a large proportion of the visits to the private sector are not to qualified doctors at all and are not likely to report anything to the government. Official statistics are based on a small and singularly unrepresentative proportion of cases. On the other hand, the wide and obviously incorrect, gyrations between rounds make the NFHS suspect as well, at least for the self reported illnesses.

What can be inferred, however, is that little if any improvement in the functional relationship between infectious diseases since the beginning of the reform era. While levels seem to be hard to compare across surveys, a safer inference applies best to shape and pattern of the functions. The function for malaria clearly gets steeper over the 1990's unless there is systematic reporting bias across income groups between the rounds - that is the cross derivative of bias with respect to time and income - is large. This increase in slope indicates that while people may protect themselves or be more resistant to disease to some extent, the role of public policy to reduce *and flatten* these curves has not been played well.<sup>19</sup> For TB, the reverse is true for period 1992-98 where there is some flattening of the function even as it increased (as unlikely as that is). The improved shape seems to have persisted through the subsequent period as the function as a whole fell back to its original average level.

Most convincing, though, are the results for child mortality. Mortality is much more robust to reporting error.<sup>20</sup> Here the pattern is clearer. There has been small but steady improvement in the level of mortality but little change in the shape of the function.

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<sup>18</sup> Mahal et al (2002)

<sup>19</sup> Using the gradient of health with income as a potential role as well as an indicator of success of public policy has been discussed in the context of developed countries by Deaton (2002).

<sup>20</sup> This is not necessarily the case. People are sometimes sensitive to answering this question for strangers and this can bias one-shot survey responses. When repeated visits are made and the respondent feels more comfortable with the interviewer, some of this information comes out. The problem may not be recall rather than reticence (Das and Hammer, 2008).

## Infectious versus chronic problems

Figure 7 shows the same gradient for two chronic conditions – blindness which is primarily due to cataracts and diabetes (the latter condition being one that recent research has shown Indians to have a genetic predisposition towards) for the first round and asthma for the second. The NFHS did not ask about the same illnesses in the two rounds. Several points can be made. First, the data has the same recall problem as for infectious disease so while the level of prevalence could be way off, there is less reason to believe that ignorance varies dramatically across conditions. While it is true that ignorance may vary across income levels, there is less a priori reason to believe that the differential across illnesses is different over the income distribution (that is, the cross partial derivative of the reporting bias is systematic with respect to disease and income).

Second, accepting that such reporting biases are not systematic, it is clear that the gradient with respect to income for the chronic conditions is much flatter than with respect to infectious. This is not controversial. Besides being observed in other contexts, it is also the case that chronic conditions (blindness especially – from either cataracts or diabetes) are much more common at older ages. Many more, richer, people live to older ages than do poor. While poor people suffer from every disease more than do the less-poor, the rate of decline is much faster with infectious disease than with chronic conditions. A direct implication is that, *ceteris paribus*, any reallocation of a fixed budget from infectious to chronic problems will hurt poor people and help the non-poor. Further, unless one of the diseases is actually eradicated, this applies regardless of the overall numbers of people who suffer from each disease within an income group, being based on the marginal impact of spending. That is, this is true even if more poor people suffer from chronic diseases than from infectious. While the ethical controversies of saving a poor person's life relative to a rich person's is well beyond the scope of this paper, using the health system as a means of helping the poor is an oft-stated objective.<sup>21</sup> That being the case, the relative gradient argues for more concentration on infectious rather than chronic disease as a matter of policy.

## Government expenditure allocations

It is extraordinarily difficult to decompose the government's budget into specific uses. The following diagram, cobbled together from various sources and which should not be taken too seriously, does show the general pattern of spending on health and health care in India that takes place within the Ministry of Health. Obviously the lion's share of money is spent in the private sector. This has little or nothing to do with provision of public goods including preventive and promotive care unless spending is embodied in a product (vitamin pills or, often in urban areas, immunization). Private practitioners have been reviled in Indian policy discussions for not doing enough for traditional public health but, frankly, there is no particular reason why a purely private enterprise would or should have much responsibility for managing public goods or internalizing externalities.

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<sup>21</sup> The World Bank's World Development Report of 1990 advocated increased social spending, health included, as a key (in fact the only really observable) component of an anti-poverty strategy.

<Fig 9>

What is shocking is the negligible amount spent by the public sector on traditional (in the Western sense) population based public health interventions such as ensuring safe water (as opposed to simply extending piped water with no attention to health at all), vector control, health education, drainage of swamps and a host of other obviously public responsibilities. Indeed, the figure above underestimates the amount spent on curative care in primary health centers (PHC)<sup>22</sup>. What is left out of this diagram, since the main expenditures take place in the Ministries of Water Resources (called slightly different things across the states), is money spent on overall water provision (as opposed to its safety) and sanitation improvements. In this case, the problem is not always the level of funding (though that varies substantially across the states) but the type and effectiveness of the interventions.

If health care in the public sector was of substantially better quality than that of the private sector and there was substantial ignorance of the relative quality of the two sectors, there might be a justification for substantial expenditure on inexpensive health care<sup>23</sup>. However, recent work throws some doubt on the relative quality (in PHC's versus relatively untrained providers in the private sector) and on the degree of ignorance on the part of patients<sup>24</sup>. People appear to know when they are seeing "quacks" but prefer them to public providers because they are more reliably available and courteous.<sup>25</sup> Similarly, if poor people received the majority of the benefits from PHC services, this would be another possible justification even if very inefficient. However, even this is questionable depending on how "benefits" are attributed to recipients in the face of frequent absenteeism of medical personnel which can be interpreted as a form of rent accruing to salaried civil servants.<sup>26</sup>

Given that the evidence appears to show a deterioration of infectious disease control (or, at least, no evidence of improvement), that amounts of money spent on activities with large market failures are so small and that money that is spent does not tend to help the poor much, the experience of the 1990's shows substantial government failure in the health field. This was made worse by the central government in 1997 with the implementation of the fifth pay commission recommendations to increase salaries.

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<sup>22</sup> This is due to a methodological detail in Mahal et al which arbitrarily reduced PHC expenditure since their calculation of costs per patient seen were outrageously high – on the order of magnitude of poor peoples' incomes - and they wanted the figures to bear some relation to benefits to users and not just costs incurred.

<sup>23</sup> Given the ubiquitous failure of insurance markets, there is always reason to worry about expensive care that must take place in hospitals. This problem highlights the tradeoff between equity (hospitals are always used more by better-off people, even for out-patient problems, since they necessarily are located in cities. They are also much more likely to be run well but this takes us beyond the scope of this paper (see the "World Development Report, 2004: Making Services Work for Poor People" or, more India-specific, Hammer et al (2007) for a discussion of the relative difficulty of implementation between primary and hospital care.)

<sup>24</sup> Das and Hammer (2007)

<sup>25</sup> Probe Qualitative Research Team (2002)

<sup>26</sup> Kremer et al (2006b)

Health is a relatively labor intensive ministry in comparison to many others and the higher salaries raising the wage bill did not help in supporting non-salary inputs such as pesticides, earthworks, drainage installation and maintenance equipment and drugs (for TB, say). Health education is usually expected from “Anganwadi” workers associated with the ICDS program (a central government initiative) but they did not benefit from the pay increase. They are paid nominal contributions and are not on official pay scales. Auxiliary Nurse Midwives are on government pay scales but their performance (in terms of attendance, say) has been questionable as they are paid via salary with little or no performance-related incentives. Health is a “state subject” meaning allocation decisions are made by the states but the pay commission decision was an unfunded mandate to increase wage bills. Given the difficulty of firing civil servants, this had a direct, if unintended implication of the relative spending priorities of the states toward Health along with other, labor intensive, Ministries. It also shifted the budget towards personnel within the Ministry.

The special case of sanitation services deserves some mention here. The bulk of spending for improved sanitation in rural areas is through the budgets of Ministries of Water and Sanitation or of Rural Development (depending on the state). Here the problem has been less one of low spending, though in many states it is that too, but of extraordinarily poor implementation. Usually the problem is that such services are provided without concern for the health impacts of programs. For example, Kerala had a very extensive sanitation campaign of building latrines. It had a separate program for water supply. It was frequently the case that there was no coordination between the two and that the seepage of the new sanitation infrastructure directly contaminated the new water sources.<sup>27</sup>

In Maharashtra, the conventional intervention was the construction of latrines. However, the experience here was disappointing (to say the least). By official reckoning, fewer than half of the latrines built in villages in the late 1990’s were actually used for the purpose intended. The rest were used for a variety of purposes such as storage sheds and even small temples.<sup>28</sup> Only recently, with the introduction of the Total Sanitation Campaign, has the emphasis been shifted from hardware to behavior change. Studies show that the use of latrines is important but not guaranteed by the ownership of them.<sup>29</sup> In any event, the expenditure on this program is very small, has been financed from other water and rural development funds and has not been augmented by any re-allocation from the health sector.

#### Urban and rural differences

Finally, we run separate regressions for urban and rural areas for malaria, TB and child mortality. Ever since Dickens cities have been characterized as unhealthy places to live. This could well have been true and it may be true in lots of other places but the story is more complicated in India. Most health problems are worse in rural areas with the non-parametric regression relating wealth to health is noticeably lower in urban areas

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<sup>27</sup> World Bank, South Asia Water and Sanitation Program, (2001).

<sup>28</sup> *ibid*

<sup>29</sup> Ghosh Moulik et al. 2007.

throughout the range in wealth. Since it is the function with respect to income that is being compared it is not because urban areas are richer that they are healthier (though that helps too). For child mortality, the differences started out fairly small but there seems to be improvements among the poor in urban areas between the periods

<Fig 10>

<Fig 11>

<Fig 12>

Some of this effect is easily explained. Malaria is usually a rural problem and, indeed, urban expansion crowding out breeding areas for Anopheles mosquitoes has been the main factor in malaria eradication in richer countries. Curiously, urban malaria seems to have shifted up more than rural between the rounds so that the functions are not very different and, at the same time the gradient in urban incidence appears to have increased noticeably over the period. Even if we remain skeptical about the interpretation of levels across the years, the change in slope is more disturbing. Official statistics could have systematic urban/rural differences (the location of health officials versus private practitioners influences reporting) but it is unclear why survey based data would have this problem. India has been urbanizing unusually slowly for a country whose economy is increasing so the expansion of cities couldn't have reduced malaria overall in the 1990's. If there is, indeed, an increase in malaria within cities, particularly among the poor, there is further reason to continue to fear continued problems with the disease.

If India does, in fact, begin to urbanize, it is a good bet that urban infrastructure, particularly related to sanitation, is likely to be a major challenge. Figure 13 illustrates one of the exceptions to the rule that urban life seems healthier than rural both being about the same, both experiencing similar upward shifts and, as with malaria, maybe even a slightly steeper relation appearing in urban areas. That wouldn't be surprising if true given the extreme differences in sanitation facilities between rich and poor in cities. On the other hand, the effect is subtle at best. In any case, urban diarrhea is a clear exception to our "cities are healthier than country sides in India" position. Some forward thinking on the nature of city structure could do much to make sustained growth of the economy lead to a healthier as well as wealthier India.

<Fig 13>

#### Explanations and Conclusions

The NFHS is the most complete source of data on health and socio-economic status. The other major source of data – the National Sample Surveys of 1995 and 2005 are not large enough to even attempt measurement of health status by type of ailment, being confined primarily to behavior related to health care. Unfortunately the data from

the NFHS raise at least as many questions as they answer. What does appear to be true is that increases in the standard of living have improved health status but that infectious diseases do not appear to be under control. A priori this could have been expected since little effort has been made on population-based public health of the 19<sup>th</sup> century European variety relative to publicly provided curative care that, to a great extent, has not reached the poor. On both efficiency and equity grounds, increased and sustained effort on infectious disease control seems more than justified. On the other hand, with the exception the data is not strong enough to reach this conclusion with any more conviction than theoretical reasoning would have produced.

Why does this apparent misallocation of expenditure persist? That the public sector should take care of public goods seems hard to dispute.<sup>30</sup> However, political pressures seem to bias spending patterns toward curative care. From the politician's perspective, facilities have opening ceremonies in which they can officiate and are easy to observe by their constituents. They also open job opportunities which can be handed out as patronage. The outcome of this expenditure in terms of health status improvements is much harder for constituents to observe and to attribute to the policies that lead to better health. No one may connect the reduction of malaria mosquitoes with public works projects even if it was a major factor.<sup>31</sup> Ironically, it is easier to claim credit politically for private goods rather than truly public goods. Beneficiaries know who they are.

From the service provider's perspective, medical personnel are influential and biased in favor of medical care. The bias could be self interest or it could merely be their natural inclination given their professional background. While Secretaries may not have much of a technical bias, they transfer sufficiently often to have limited lasting influence on policy. The higher level state service officials who become directors within the ministries are disproportionately medically trained. This is the "supply side" of the problem.

A constructive role for international agencies and independent observers of Indian health problems is to act as a counterweight to this bias. An active public discussion of "public goods" and "private goods" would be welcome as would a clarification of the distinction between them. India may be getting richer but its public services in many areas are lagging behind. For health, it is important for all of us to emphasize starting with the basics and the importance of doing first things first.

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<sup>30</sup> Though, oddly, a 1995 World Bank report makes the recommendation that the private sector should be brought in to handle public goods freeing the Ministries of Health to focus on the curative care that they prefer to do. In addition, it recommends (not in conformity with the preferences of government) the standard increase of primary health care rather than finance of expensive care though the latter may address the failure in insurance markets.

<sup>31</sup> WDR 2004 and Kiefer and Khemani, 2003.

Figure 1: Tuberculosis in India, 1992-2005 by index of wealth

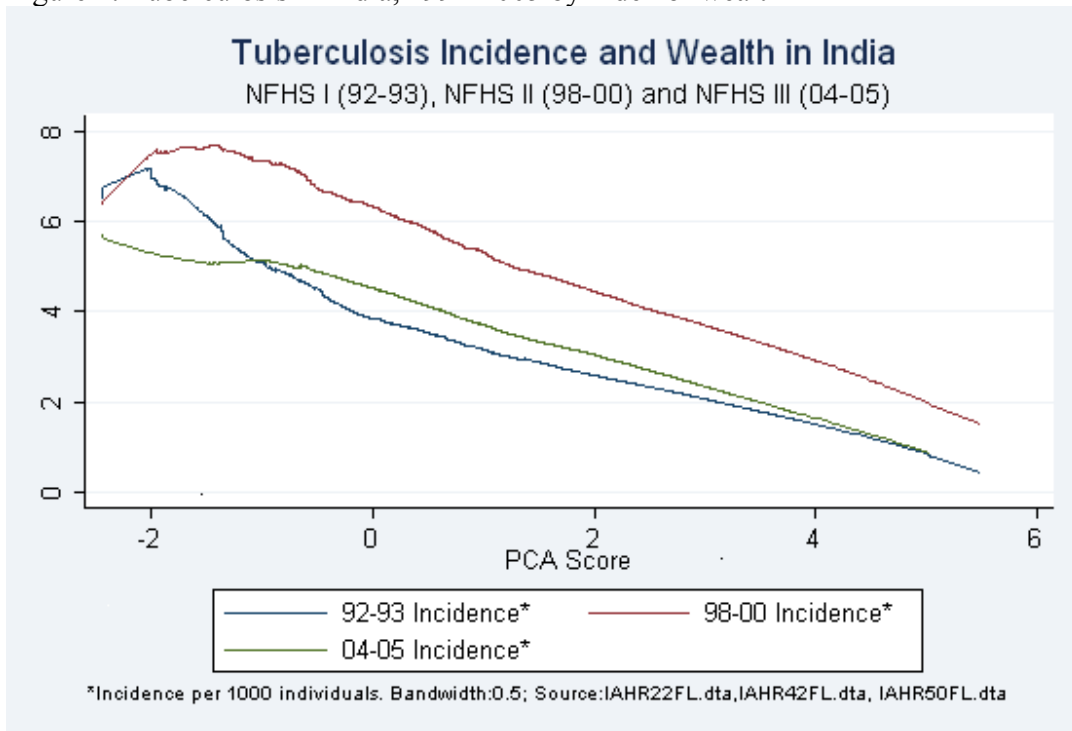


Figure 2: Malaria in India, 1992-1993 and 1998-2000

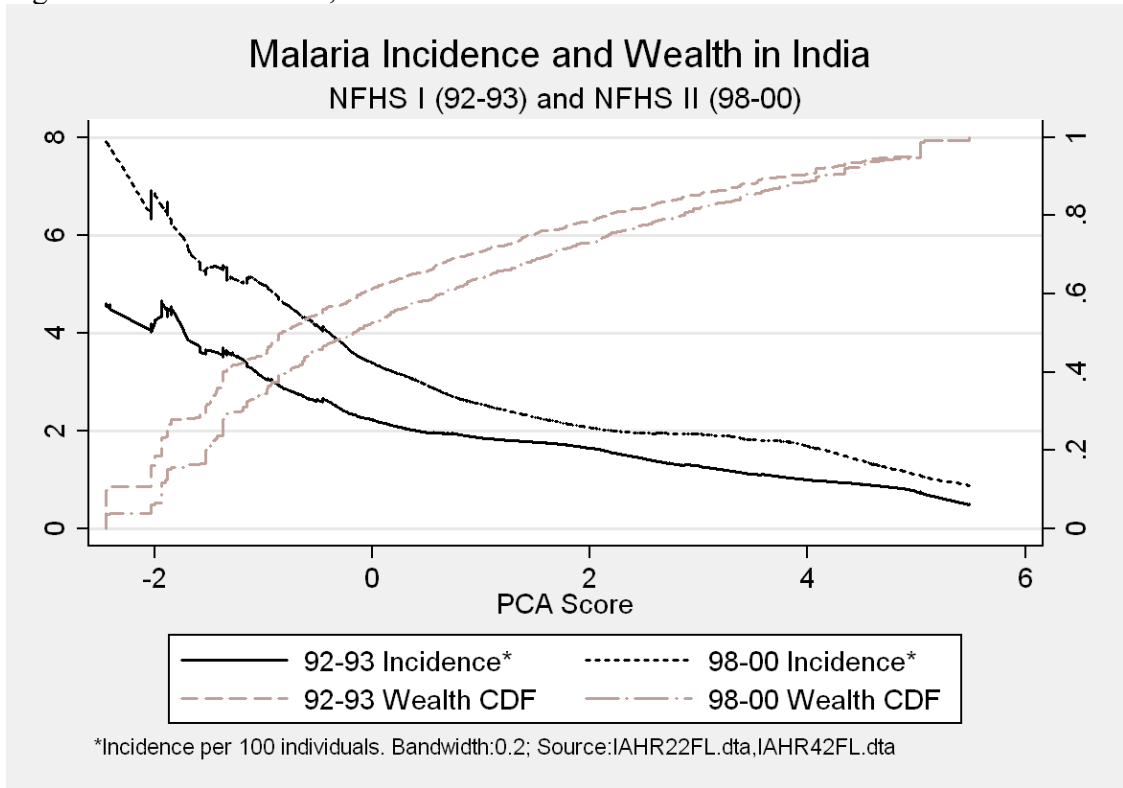


Figure 3: Under-5 Mortality in India, 1992-1993 and 1998-2000

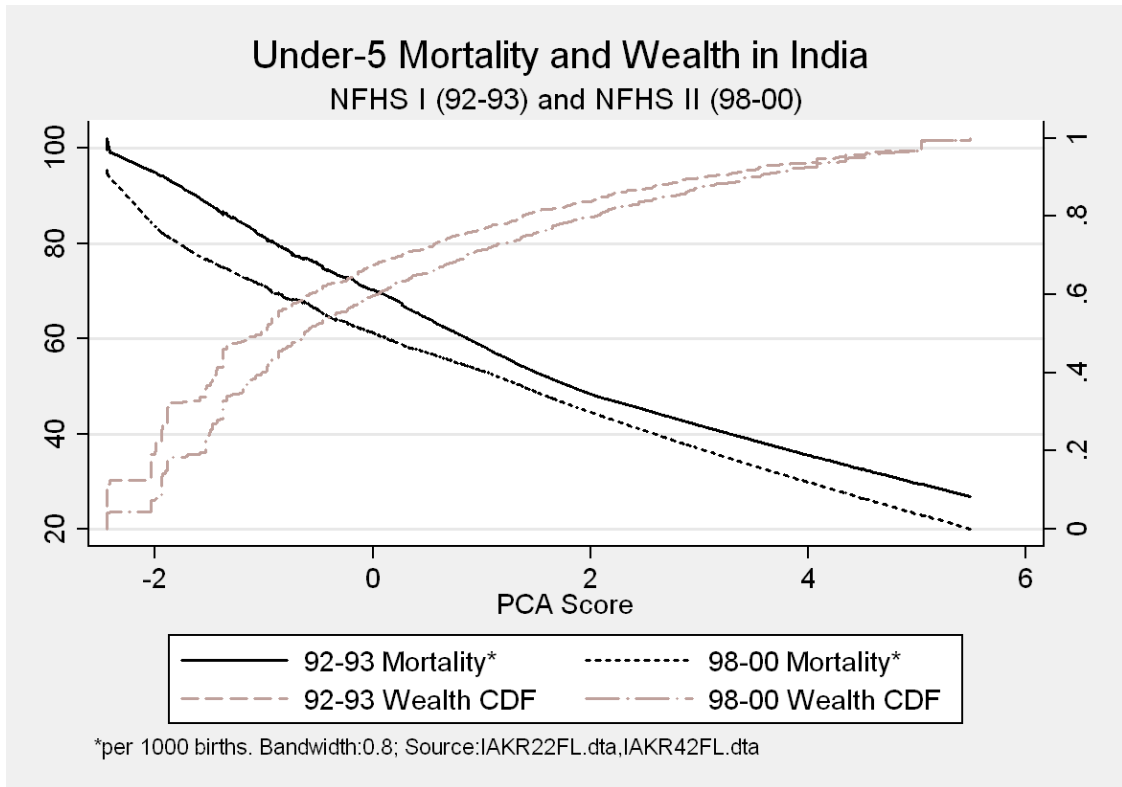
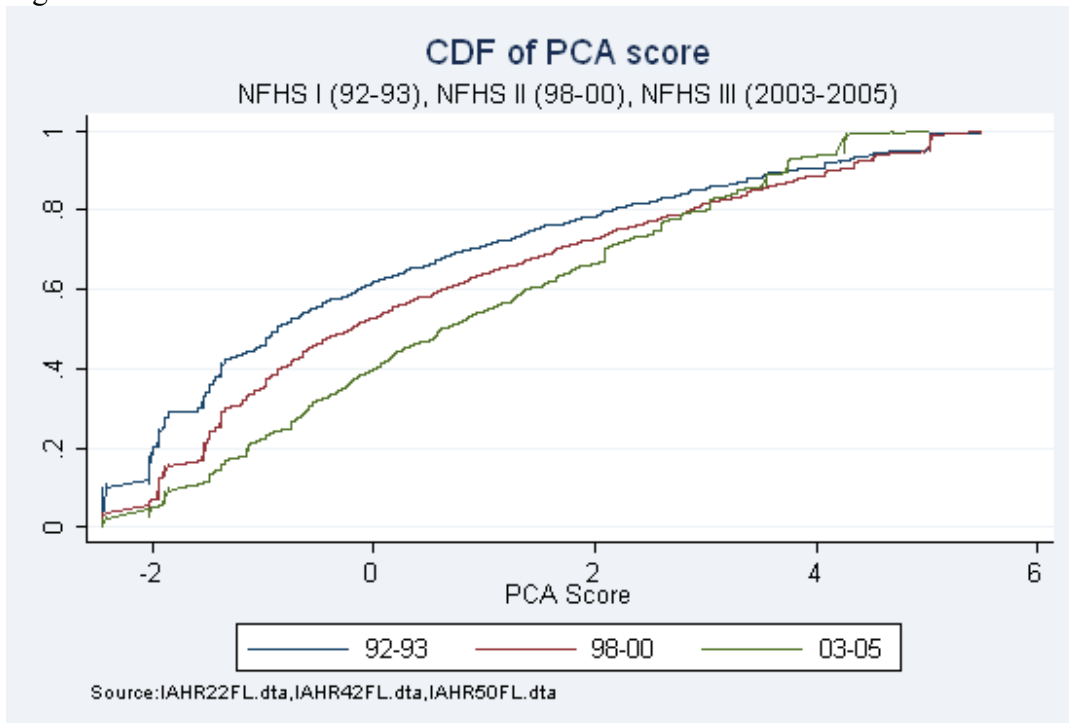


Figure 3a: The distribution of “wealth” from 1992 to 2005



PCA = Principal component analysis. The graph shows the Cumulative Distribution Function of the indices constructed on the basis of ownership of consumer durables and assets with weights for the index chosen from a principal component analysis of the first round of data.

Figure 4: Estimated Impact of Wealth on TB

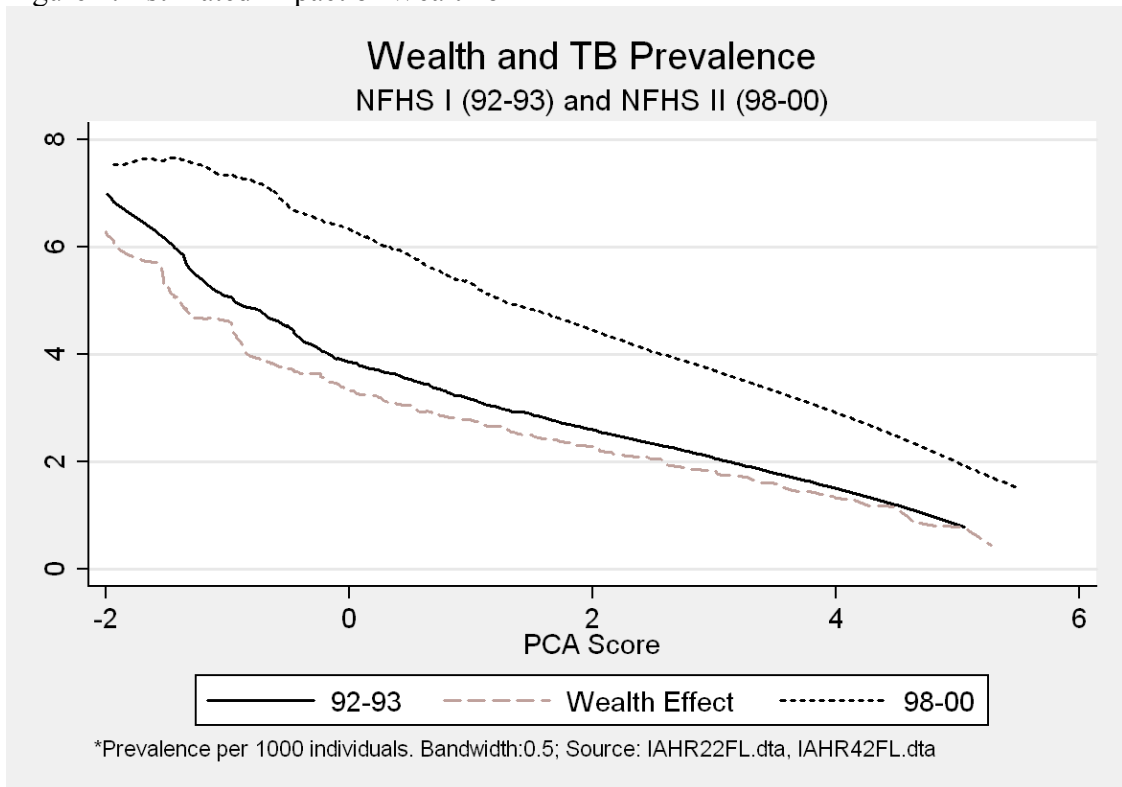


Figure 5: Estimated Impact of Wealth on Malaria

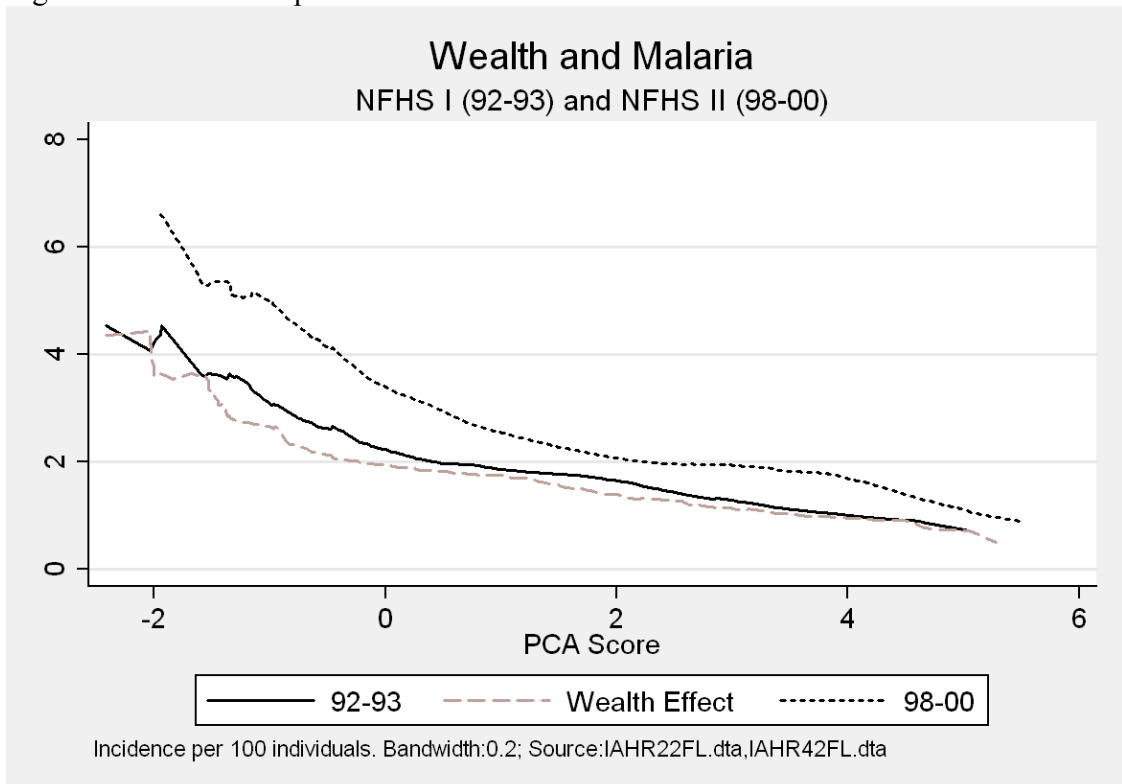


Figure 6: Estimated Impact of Wealth on Mortality

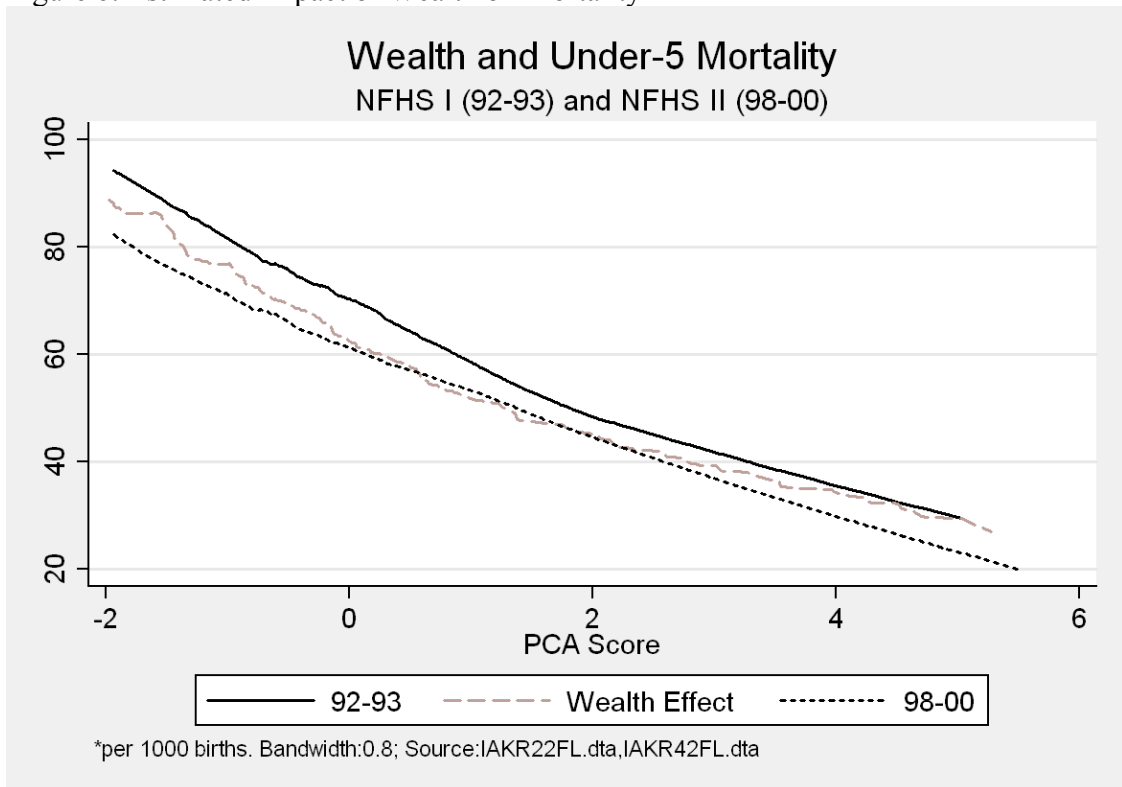


Figure 7: Blindness and Asthma in India

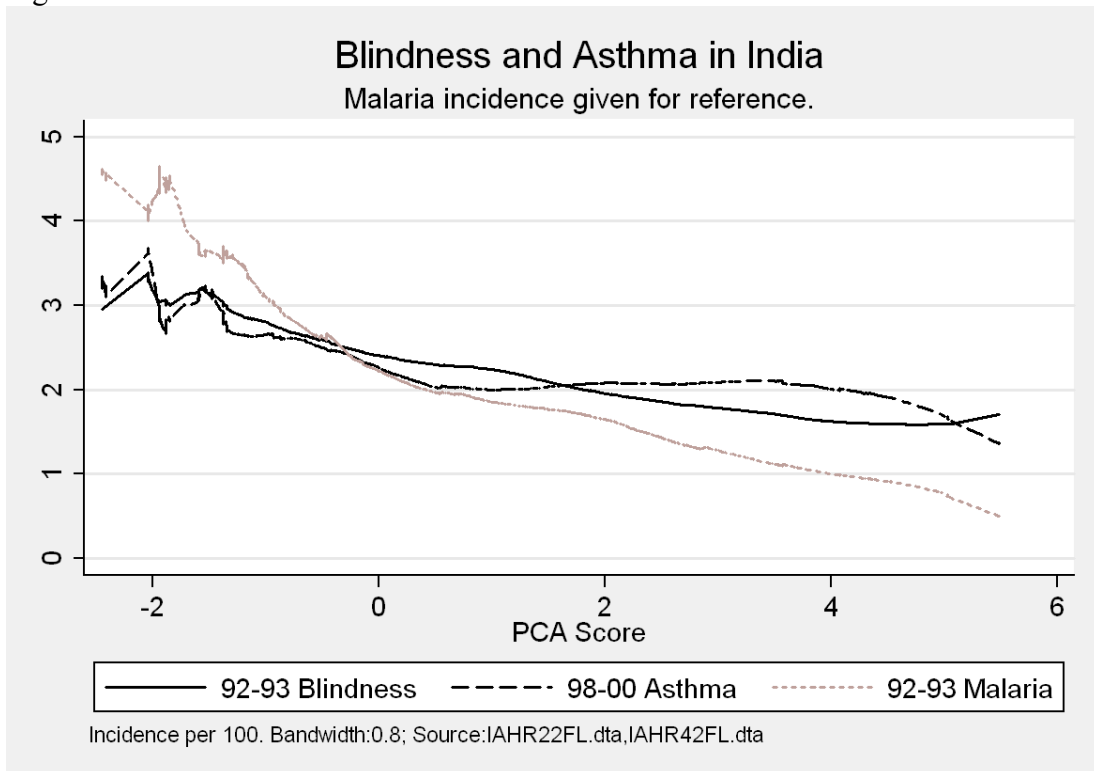


Figure 8: How ordinal data (rankings) conflate functional relationships and income distribution , Malaria in India 1999-2000

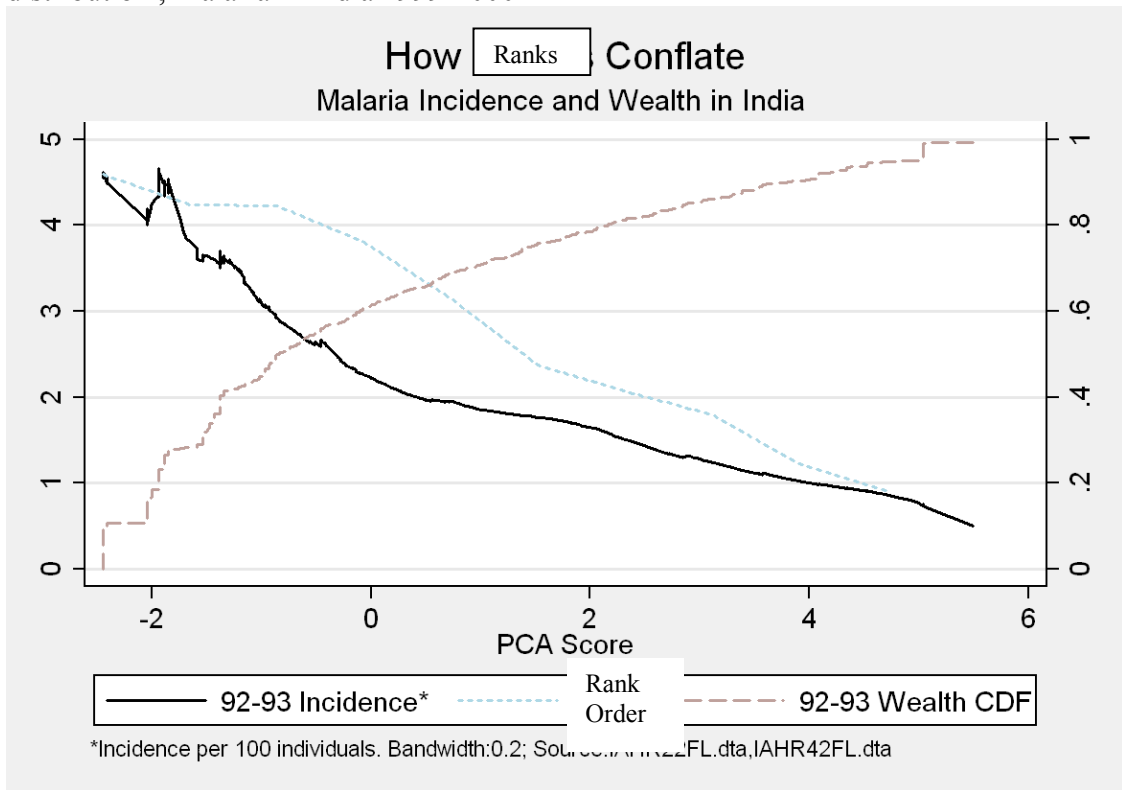
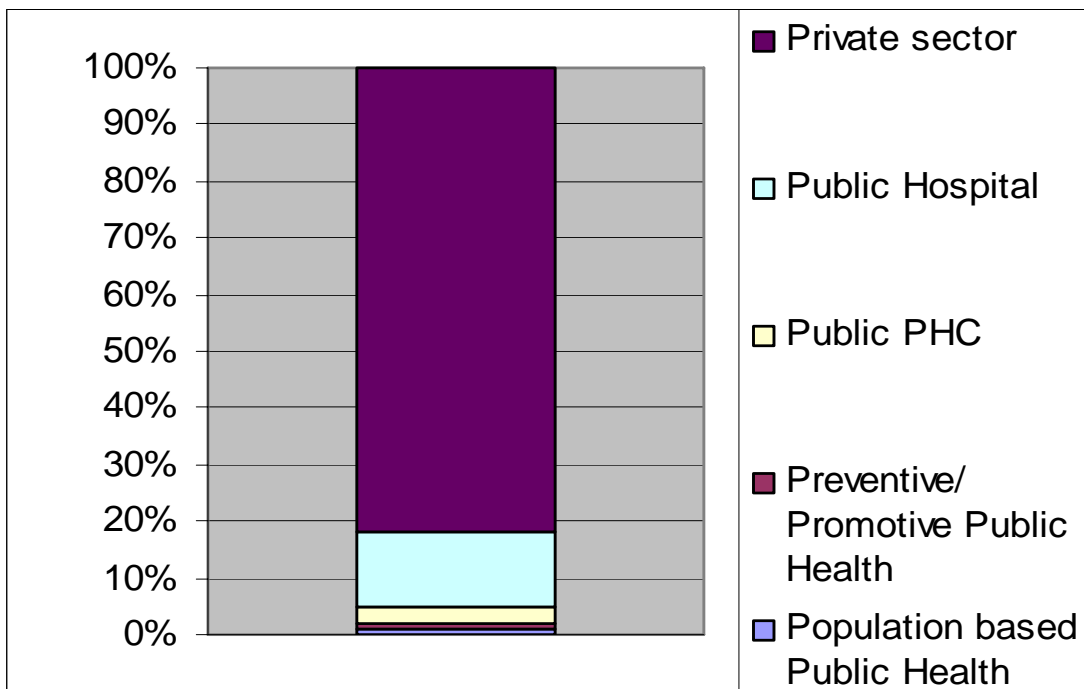


Figure 9: Health Spending in India



Source: Mahal et al (2002), Planning Commission (2004)

Figure 10: Urban and Rural Malaria in India

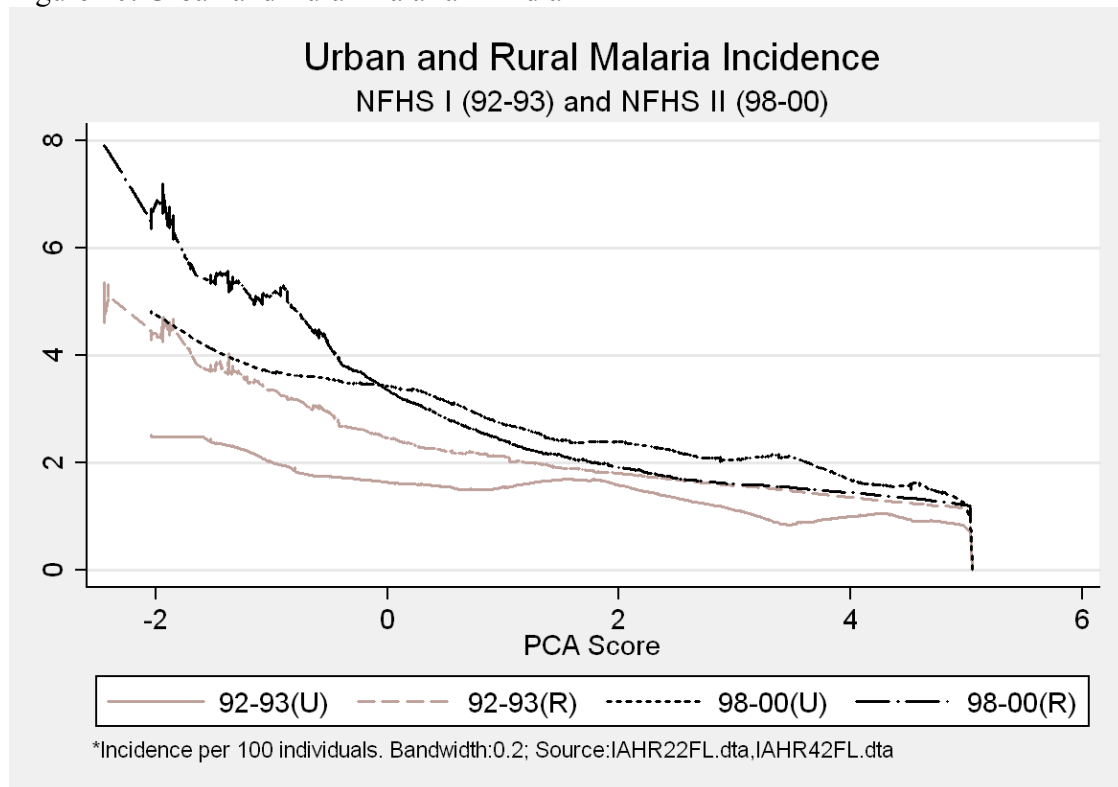


Figure 11: Urban and Rural TB in India

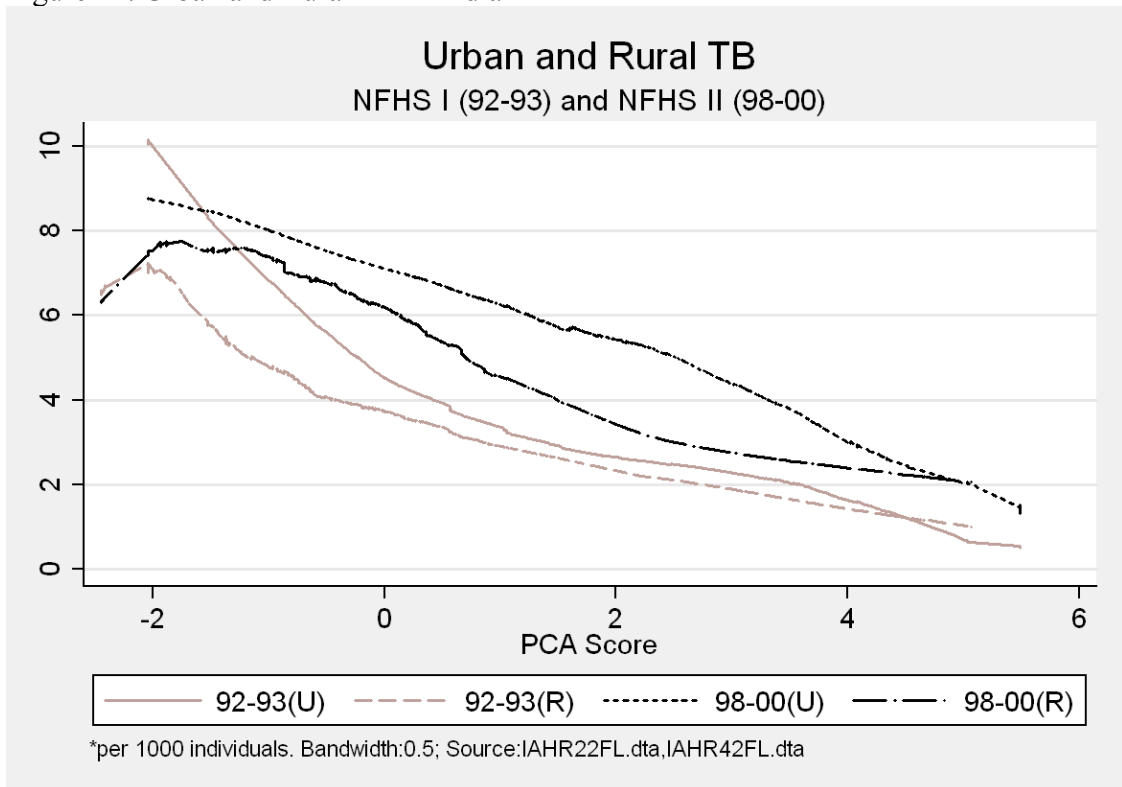


Figure 12: Urban and Rural Under-5 Mortality

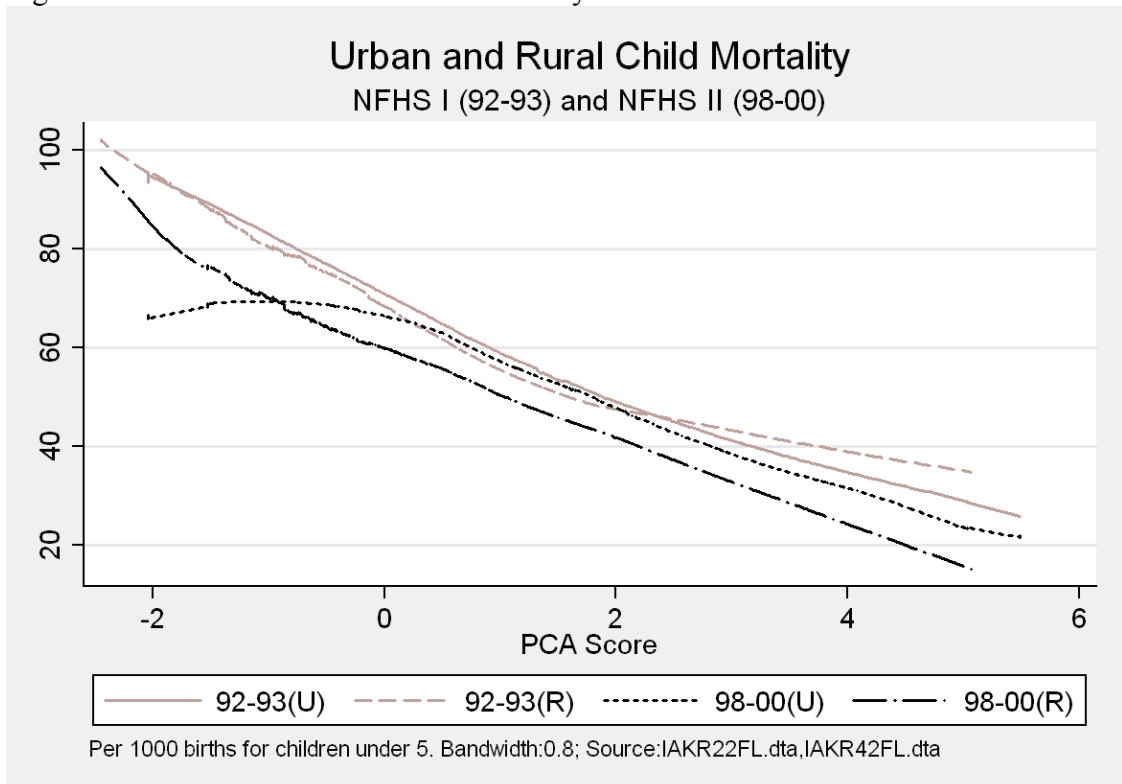
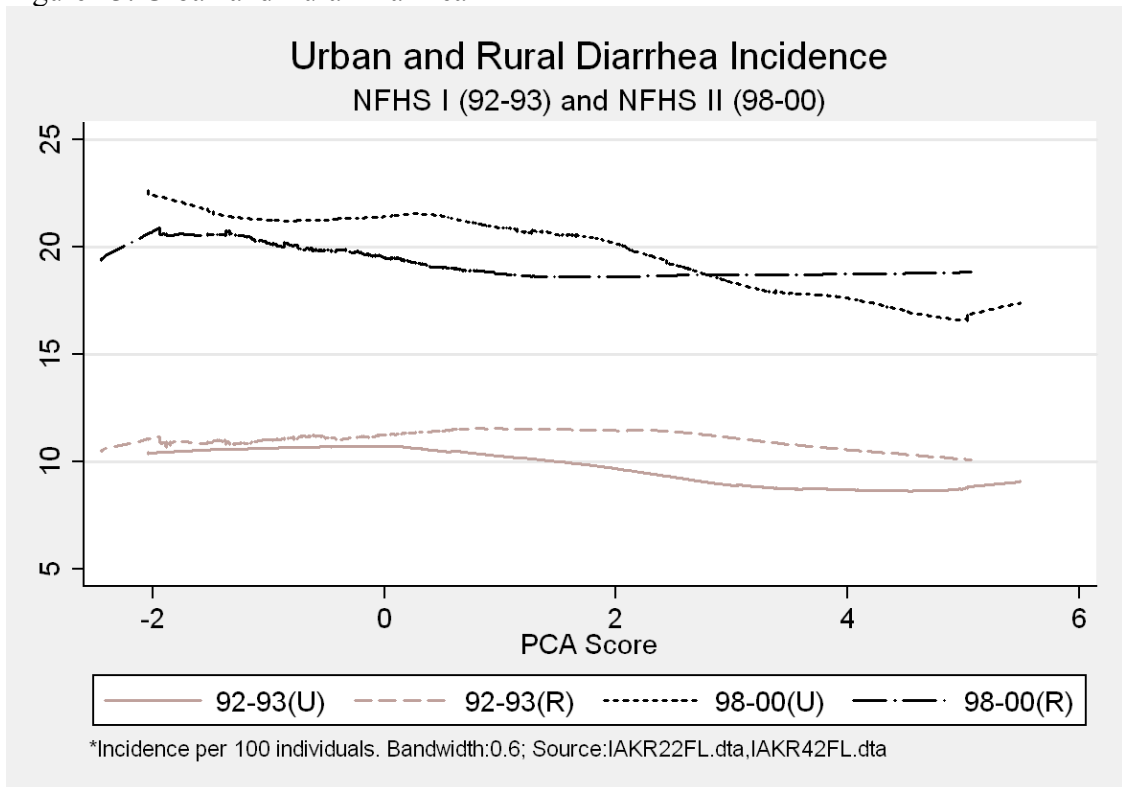


Figure 13: Urban and Rural Diarrhea



## Bibliography

Bonilla-Chacin, Maria Eugenia and Jeffrey S. Hammer (1999), "Life and Death among the Poorest", World Bank Economist's Week.

Chaudhury, Nazmul and Jeffrey S. Hammer (2005), "Another Paper on Poverty in India in the 1990's: Evidence from the National Family Health Surveys", World Bank, processed.

Das, Jishnu, J. Hammer, S. Devarajan and L. Pritchett (2006), "Will a Wealthier India be a Healthier India?" presented at NBER/NCAER Conference on Growth in India, New Delhi

Das, Jishnu and Jeffrey S. Hammer (2005), "Which Doctor?: Combining Vignettes and Item Response Theory to Measure Doctor Quality", Journal of Development Economics, v. 78, pp. 348-383.

\_\_\_\_\_ (2007), "Money for Nothing: The Dire Straits of Indian Health Care", Journal of Development Economics, v. 83, no. 1, pp. 1-36.

\_\_\_\_\_ (2008), "Chronically Misinformed: Information, Income and Illness in Delhi".

Deaton, Angus (2002), "Policy implications of the gradient of health and wealth", Health Affairs, March/April.

\_\_\_\_\_ (2004), "Using food consumption to improve measures of wealth", World Bank

Deaton, Angus and Valerie Kozel (eds.), (2006), The Great Indian Poverty Debate, Macmillan India, New Delhi.

Disease Control Priorities Project, (2007) The World Bank, Washington, D.C.

Filmer, Deon and Lant Pritchett (2001), "Estimating Wealth Effects without Expenditure Data – or Tears: An application to enrollments in states of India", Demography.

Gwatkin, Davidson, S. Rutstein, K. Johnson, R. Pande and A. Wagstaff, (2000) "Socio-economic differences in health, nutrition and population: 45 countries", World Bank.

Hammer, Jeffrey, Yamini Aiyar and Salimah Samji (2007), "Understanding Government Failure in Public Health Services" Economic and Political Weekly, October.

Kiefer, Philip and Stuti Khemani, (2003) "Democracy, Public Expenditures and the Poor", World Bank Policy Research Working Paper Series no. 3164.

Kremer, Michael, Nazmul Chaudhury, Jeffrey S. Hammer, Karthik Muralidharan and F. Halsey Rogers (2006a), “Missing in Action: Teachers and Health Worker Absence in Developing Countries” Journal of Economic Perspectives, v. 20, no. 1

\_\_\_\_\_ (2006b) “Is There a Doctor in the House?: Absenteeism among health workers in India”, Harvard Conference on Health in India and China, New Delhi.

Lopez, Alan, and Christopher J.L. Murray (2007), Global Burden of Disease and Risk Factors, Oxford UP

Mahal, Ajay, et al, (2002) “Who Benefits from Health Care Subsidies in India?”, World Bank, Health, Population and Nutrition Working Paper Series.

National Family Health Survey (Indian Institute of Population Studies) (1993, 1999) National Summary of Results, New Delhi and Bombay

Planning Commission, Government of India (2004), Mid-term evaluation of the 10<sup>th</sup> plan, New Delhi

Probe Qualitative Research Team (2002), Health Care Seeking Behavior in Andhra Pradesh, Bombay.

World Bank (2003), World Development Report 2004: Making Services Work for Poor People, Oxford University Press.

World Bank (1998), Reducing Poverty in India: Options for More Effective Public Services, Washington.

World Bank (1995), India: Policy and Financing Strategies for Strengthening Primary Health Care Services, Report no. 13042-IN)