CHAPTER 4

Economic Cost of HIV and AIDS in India

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Introduction

According to the latest available estimates, there are currently about 2.5 million people living with HIV or AIDS in India, corresponding to a HIV prevalence rate of 0.36 percent for the population ages 15–49 (IIPS 2007). While HIV prevalence thus remains relatively low, there are several factors that are unique to India's HIV epidemic, and need to be taken into account when assessing the impact of HIV and AIDS. (1) The scale of the epidemic and patterns of infection differ across states, and even between neighboring districts (see Wilson, this volume). Together with the fact that some of these states and districts are larger than many African countries affected by HIV and AIDS, this illustrates the complexities of the response to HIV and AIDS in India. (2) Of the two types of HIV virus—a slow-progressing one and a fast-progressing one that kills within six to nine years without any antiretroviral therapy—the latter type of virus is the predominant one in India. (3) India is a predominantly poor country with low levels of nutrition and high exposure to various types of bacteria and viruses, including tuberculosis—factors that exacerbate the morbidity and mortality of HIV and AIDS.

Against this background, our study of the economic costs of HIV and AIDS in India relates to two different strands of literature on the economic implications of HIV and AIDS.

- Studies estimating the aggregate economic impact of HIV and AIDS. The most important approaches under this heading are (1) studies focusing on the impacts on GDP or GDP per capita, and (2) studies estimating welfare costs, which are defined more broadly, including by making explicit allowance for the impacts of HIV and AIDS on mortality.
- Studies focusing on the household-level effects of HIV and AIDS. Findings from such studies frequently accentuate not only the high costs of HIV and AIDS to the affected households and individuals, but also differences in the vulnerability to and the impacts of HIV across population groups.

Our study draws from and builds on both of these strands of literature. In terms of the *theoretical framework*, it is related to prior studies using an explicit utility framework to capture the welfare costs of increased mortality (see the discussion by Haacker, this volume). One important shortcoming of these approaches is that they put strong emphasis on the welfare effects of increased mortality, while estimates of the impacts of HIV and AIDS based on household surveys typically suggest a much more complex impact on the well-being of household members.

Meanwhile, much of the evidence of the impacts of HIV and AIDS obtained from *household surveys* is indirect. One reason for this is that, owing to the generally low HIV prevalence in South Asia, household studies include few questions that offer direct insights regarding the impacts of HIV and AIDS. For example, much of our understanding of the implications of HIV and AIDS on orphanhood or widowhood derives from studies focusing on the status of orphans and widows in general, but are not specific to HIV and AIDS.

Our study provides added value relative to both of these strands of literature. First, we offer a theoretical framework that captures more of the richness of the impacts of HIV and AIDS evident from household surveys. A key aspect of the impacts of HIV and AIDS in this framework is the impact on "mental health" (as opposed to physical health), which we measure based on survey responses regarding the subjective well-being of respondents. Second, our survey is designed from the outset to

capture the multiple impacts of HIV and AIDS. In addition to data on the economic impacts and consequences of HIV and AIDS (income, medical expenditure, wealth), we obtain measures of the impact of HIV and AIDS on both mental health and physical health.

The chapter is organized as follows. We start out by discussing in more detail the *context* of our chapter in terms of the available studies of the economic impacts of HIV and AIDS in terms of the impacts on growth, GDP, or income, and in terms of the broader welfare effects (typically focusing on increased mortality). Additionally, we also introduce some of the literature from which our notion of "mental health" draws. This section is followed by a summary of our findings from a *survey of households affected by HIV and AIDS*. This is followed by an *outline of the model* used to analyze the costs of HIV and AIDS to the households affected, and a section describing the process of *estimating the costs of HIV and AIDS* and presenting our findings. A *concluding section* closes the chapter.

Context

Most of the studies projecting the impact of HIV and AIDS on the growth rate of per capita GDP use some version of the neoclassical growth model and typically estimate declines of 0.5 percent to 1.5 percent, even for the worst affected countries with more than 20 percent HIV prevalence rates.[1] For countries like India, with an HIV prevalence rate of less than 0.5 percent, this translates into very small effects of HIV and AIDS on growth (see Haacker, this volume). Somewhat differently, Young (2005) emphasizes the decline of fertility associated with the HIV epidemic. Using South African data, he estimated that the positive effects of lower population growth on real wages would be strong enough to offset other adverse effects.

A growing body of relatively recent literature (see, for example, Ferreira and Pessoa 2003; Bell, Devarajan, and Gersbach 2004, 2006; Corrigan, Gloom, and Mendez 2004, 2005) emphasizes the transmission of human capital across generations and concludes that by disrupting the mechanism that drives the process of the transmission of knowledge and abilities from one generation to the next, the AIDS epidemic will result in a substantial slowdown of economic growth. Part of the analysis relies on the dynamic implication of the mechanism that AIDS lowers investment in human capital of children since ". . . the expected pay-off (*from this investment*) depends on the level of premature mortality among the children when they

attain adulthood" (see Bell, Devarajan, and Gersbach 2006, page 59; our italics). This mechanism may be applicable for high-prevalence countries such as South Africa, but is not quite relevant for India, with a prevalence rate of just 0.36 percent and where there are many other compelling reasons for not sending children to school. Overall, it thus appears likely that the adverse impacts of HIV and AIDS on economic growth or GDP per capita in India will remain limited.

A different approach estimated the welfare impacts of HIV and AIDS as a decline in the utility that can be derived from a consumption stream over the lifetime of an individual. Using this type of model, Crafts and Haacker (2003, 2004) find that the primary impact of HIV and AIDS arises from its impacts on mortality (reducing the expected duration of the lifetime consumption stream). For India, Haacker (this volume), using this approach, estimates that the annual welfare costs of HIV and AIDS amount to around 3 percent of GDP, much higher than any estimates of the impact of HIV and AIDS on GDP.[2]

However, this approach is also not very well suited to capture the complexities and the implications of the impacts of HIV and AIDS at the household level. The most significant household survey regarding the impacts of HIV and AIDS in India to date is the one by Pradhan and others (2006, also discussed by Haacker, this volume). Their findings highlight the adverse impacts of HIV and AIDS in particular on households in poorer wealth quintiles and on widows affected by HIV and AIDS. More generally (not specific to India), studies using household data find a considerable impact of HIV and AIDS on income, consumption, and children's education. Booysen and Bachmann (2002) find that the decline in per capita income in HIV households in South Africa is 40 percent to 50 percent. while the fall in per capita food expenditure is 20 percent to 30 percent. In Indonesia, Gertler et al. (2003) find that death of a male in his prime is associated with a 27 percent reduction in mean per capita household consumption. Many studies have reported a negative impact of HIV and AIDS on children's schooling. Deininger et al. (2003) show that foster children were at a distinct disadvantage in both primary and secondary school attendance before introduction of universal primary education. Gertler et al. (2003) find that orphans are less likely to start school and more likely to drop out. Yamano and Jayne (2005) and Evans and Miguel (2005) find the negative impact of adult mortality on school attendance of children to be more severe in poor households.

Finally, we provide some background that motivates our interest in integrating mental health in the evaluation of the welfare costs of HIV

and AIDS. Most directly, counselors and doctors working with HIV patients in India are unanimous in their opinion that the psychological and emotional costs on the HIV patients and their families are enormous. The medical science literature has long appreciated this aspect of terminal illnesses (see, for example, Emanuel et al. 2000; Grunfeld et al. 2004 for some recent work). In social sciences, this is related to an emerging body of literature on happiness and mental well-being (see, among others, Easterlin 1974, 2003; Blanchflower and Oswald 2004, 2007; Clark and Oswald 1997; Frey and Stulzer 2002; Gilbert 2006; Graham 2007; Helliwell 2006; Kahneman et al. 2006; Layard 2005; Lucas et al. 2004; Smith et al. 2005; Ubel et al. 2005). The mental well-being research is proven to be well suited in situations with limited information on welfare effects of unemployment, divorce, smoking, and so on. This approach can be used to evaluate effects of HIV and AIDS on significant fear of early death and stigma. While researchers have worked in painstaking details to investigate the determinants of happiness and mental well-being (see, for example, Andres 2004; Blanchflower and Oswald 2004, 2007; Case and Deaton 2006; Helliwell 2006), very little research has been done to quantify the value of mental health.[3] Given the importance of the psychological and emotional costs, the HIV experience in India gives us this unique opportunity to integrate mental health in welfare evaluation and to quantify its significance in welfare loss of the family.

A Survey of Households Affected by HIV and AIDS

In light of the low level of HIV prevalence in the population, our sampling process involves identifying households affected by HIV and AIDS through networks of physicians. The control group of "non-HIV households" is based on interviews of households from similar locations (villages, residential clusters). This process and other issues regarding the sampling process are discussed among our *considerations regarding data collection*. The presentation of our findings then proceeds in two steps. First, we present data on *socioeconomic characteristics of individuals and families affected by HIV and AIDS*. Second, we discuss our findings regarding variables included in the survey to serve as *indicators of the impact of HIV and AIDS*, such as measures of physical health, mental health, or the impact of HIV and AIDS on the household's labor supply and income. Our discussion is rounded out by a presentation of several case studies of households affected by HIV and AIDS (box 4.1).

Box 4.1

Case Studies of Financial Impact of HIV and AIDS

Case 1. Both adults HIV-positive (time since detection: 1 month). The surveyed patient is a 28-year-old woman from Jamalpur, U.P., who has been diagnosed with HIV a month ago. She had studied up to eighth grade and her husband up to ninth grade. She is a housewife and is getting herself treated in a free government clinic in Delhi. She spends about three days on the trip to Delhi to get her medicines. Her husband, who used to own a truck and drive it, was also diagnosed with HIV a couple of months ago and was probably the source of her infection. He used to earn about Rs. 15,000 a month, but recently, due to recurring fever, has been unable to work any more. The patient recently had a stomach surgery at the cost of Rs. 30,000 in a private hospital. The family has sold their truck for only Rs. 50,000. Jewelery valued at Rs. 7,000 has been sold out of the stock valued at Rs. 9000. Their entire personal savings of Rs. 10,000 has been spent, and the patient's husband has borrowed Rs. 10,000 from one of his siblings. The couple lives in a joint family with his parents in their ancestral home. Currently her father-in-law, with an income of Rs. 4,000–5,000 per month, provides for their living expenses. The family has cut down on their food, clothing, and entertainment expenses.

Case 2. Both adults HIV-positive (time since detection: 2 months): The patient is a 37-year-old man in Orissa who owns a tea stall, and three months ago used to earn Rs. 4,000 per month. He has five years of schooling, while his wife has four years of schooling. He has been suffering from TB for six months and was diagnosed with AIDS two months ago. His wife has also been detected with HIV, but has no symptoms. Her ex-husband died of TB. The patient thinks that he got infected during tattooing, but he may have contracted the infection from his wife, who in turn had the virus transmitted from her ex-husband. The family lives in an ancestral house. They have spent Rs. 12,000 on testing and medicines in the last three months. Currently, the family income is zero, whereas the medical bill is Rs. 7,000 per month. The patient firmly believes that with good medicines he will recover fast and go back to work. The monthly household expenses of Rs. 9,300 are being paid by his brothers. It is not clear how long it is feasible for this transfer to continue.

Case 3. HIV-positive widow (time since detection: 1 year): The patient is a 40-year-old illiterate widow living in Delhi. She lives with her two sons' families. She owns the house she lives in, but her sons pay for her living expenses. The family income is only Rs. 4,000 per month, and, not surprisingly, the family did

not have any savings when she fell ill. She says that she got infected due to unprotected sex with her neighbors after her husband died. During detection of her infection a year ago, the family spent Rs. 36,000 on testing and medicines, and currently her monthly medical expenditure is Rs. 1,500 per month. But since her detection she has sold one room of her two-room house for Rs. 75,000 and jewelry of Rs. 5,000. In addition, she has taken a loan of Rs. 50,000 from a money-lender. The loss of assets and increase in indebtedness do not match her medical needs. Perhaps there is some other reason that has not been mentioned. She is still in a state of depression. As compared to the family income, the financial loss in just one year is quite staggering.

Case 4. Man HIV-positive, woman HIV-negative (time since detection: 1.8 years): The patient is a 24-year-old male from U.P. who lived away from his family while working in Orissa for two years. He is a college graduate and his wife has studied up to two years in college. He used to earn Rs. 6,000 a month at a government job. He suspects that he got infected due to unprotected sex with commercial sex workers (CSWs). His infection was detected only when he returned home two years ago with TB and recurring fever and was unable to work any more. He believes he will not be able to work ever again. He now stays in his ancestral home with his wife, one child, parents, and two siblings. His wife is not infected and is a housewife. As he is unable to work, his parents, with an income of Rs. 8,100 per month, support him and his family. Since the time of detection they have spent Rs. 31,000 on testing and medicines. In addition, their monthly expenditure on medicine has gone up by Rs. 1,000. But the nuclear family is managing well due to the support of the extended family. The patient has current personal savings of Rs. 10,000 and has not had to sell any assets or take loans to cover his expenses.

Case 5. Both adults HIV-positive (time since detection: 2.8 years): The patient is a 27-year-old male from Haryana, who has been living with his wife, children, parents, and siblings. He has studied up to fifth grade and before detection he earned Rs. 5,000 per month working as a truck driver, staying away from his wife an average of 12 days in two weeks. He suspects that he got infected due to unprotected sex with CSWs. Currently he is unable to take the strain of his earlier job in which he worked for 12 hours every day, and instead works on his family farm for two hours daily. After his detection, his wife was tested and was also diagnosed with HIV the same month, most likely infected by her husband. But she is totally asymptomatic and continues to work on the family farm as before. Their

(continued)

Box 4.1 *(Continued)*

family income is Rs. 3,300 per month. Their loss of income due to HIV is Rs. 5,000 per month. He has spent a total of Rs. 3,850 on his medicines and testing. As a result of low income they have to curtail their monthly expenditure on food and clothing by Rs. 140, but have increased medical expenditure from nothing to Rs. 600. His father now pays Rs. 1,000 per month. In addition, the family has borrowed Rs. 50,000 from a moneylender at a monthly interest rate of 2 percent, which they believe they would be able to pay off in the coming two years. But given that they are barely surviving with their current income, it is not clear how they will manage to do so.

Case 6. Man HIV-positive, woman HIV-negative (time since detection: 5 years): The patient is a 41-year-old male from Orissa who lived away from his family in Surat working as a factory worker. He was diagnosed with HIV five years ago. He worked for 12 hours a day, 7 days a week, and made Rs. 3,000 per month. Both husband and wife have studied up to third grade. Since his detection he lives with his family in Vishakhapatnam (closer to Orissa than Surat), where he and his wife sell snacks. His wife is not HIV positive. Earlier his wife did not work. Their family income is now only Rs. 1,600 per month. In the five years since his detection, the family has sold Rs. 35,000 worth of jewelery, and spent their entire personal savings of Rs. 20,000. In addition, they have also borrowed Rs. 40,000 from a moneylender at a monthly interest rate of 2 percent for treatment.

Source: Authors' study.

Considerations Regarding Data Collection

To better understand the social and economic impact of HIV and AIDS for the individuals affected and their households, and—ultimately—to arrive at estimates of the economic cost of HIV and AIDS in India, we need a data set describing the socioeconomic characteristics of households affected by HIV and AIDS, as well as corresponding data for a control group not affected by HIV and AIDS. In some countries with high prevalence rates of HIV and AIDS (for example, South Africa, with an estimated HIV prevalence of 19 percent of the population ages 15–49), such data are usually obtained by adding questions regarding the HIV status or the impact of HIV and AIDS to household surveys. The same approach does not work well in India, especially for a survey specifically designed to capture the impacts of HIV and AIDS, as obtaining responses

from an adequate number of people living with HIV and AIDS (say, 500) would require sampling a very large number of people not affected by HIV and AIDS (about 100,000, assuming an HIV prevalence around 0.5 percent) as opposed to a sample of about 2,600 in South Africa to locate 500 with HIV and AIDS. .

Second, in light of the paucity of data on the socioeconomic effects of HIV and AIDS in India, we designed a relatively elaborate questionnaire, which took about 1.5 to two hours to fill out. Also, soliciting responses from families affected by HIV and AIDS is a formidable task to start with due to the confidential nature of HIV infection. To ensure the necessary trust of patients, we expected that only doctors who knew us personally (including some of our field surveyors who worked with HIV patients earlier) would agree to the surveying of their patients, and the latter would trust our word of confidentiality.

We thus started with our professional network of physicians in New Delhi, who referred us to other doctors/NGOs in various parts of the country. In this manner, we collected data from both high- and low-prevalence states where transmission was predominantly heterosexual, as 86 percent of all transmission in India is through this route (table 4.1). At the same time, the sample states represent the four different regions of India: north (Delhi and Uttar Pradesh), south (Tamil Nadu and Andhra Pradesh), east (Orissa), and west (Maharashtra). Overall, our sample comprises 371 families where there is at least one member who is infected by HIV (*HIV families*).[4] We have also collected data from 479 families where there is no reported incidence of HIV (*non-HIV families*). The selection of non-HIV families was based on geographic proximity (same district and, where possible, same village or same residential cluster in a town)[5] and economic similarity (based on similar kind of residence) to the surveyed HIV

Table 4.1 Regional Distribution of Sample (Units)

State	*Families affected by HIV*	*Families not affected by HIV*
Low-prevalence states (Delhi, Uttar Pradesh, Orissa)	179	268
High-prevalence states (Tamil Nadu, Andhra Pradesh, Maharashtra)	192	211
Total	371	479

Source: Authors' survey.

families.[6] The distribution of HIV and non-HIV families across the different regions is given in table 4.1. In our analysis, we look at the effect of HIV on the infected adult, his or her spouse (if living) and his or her children (if present). We define this unit as "*family*." This is different from a *household*, as there may be members other than the above individuals in cohabitation, but we ignore the effects on them.

The doctors/NGOs explained the motives of our study to their patients, but the choice to be surveyed was ultimately left to individual patients. All patients contacted by an NGO in a state (Andhra Pradesh and Orissa) agreed to be surveyed and were surveyed by local personnel of the NGO (due to language constraints) in their households, but after being trained by our surveyor from Delhi. Consent forms were signed by all. Patients of doctors were mainly surveyed at the hospital or clinic of the doctors. A few declined the survey due to shortage of time. Seven of the patients mentioned only their district of residence rather than their village.

Even though this sample is not random, it is not a result of endogenous sampling, either. The criterion on which our sampling was done is largely uncorrelated to the nature of HIV infection, and standard econometric methodology is valid. We may be missing some rich urban patients who go to private doctors and are reluctant to participate in surveys, or infected individuals who do not receive treatment by a doctor. But this criticism is equally valid with regard to the profile of patients collected by the official National AIDS Control Organisation (NACO), or essentially any other HIV and AIDS-related survey, and we are therefore confident that our approach represents best practice. To account for oversampling of HIV patients in the overall population, we have used appropriate weights using NACO figures in our prediction of the effects of HIV and AIDS for the entire country.

Socioeconomic Characteristics of Individuals and Families Affected by HIV and AIDS

The total number of HIV-affected individuals in our sample is 497, of which 58 percent (288) are male and 42 percent (209) are female. HIV prevalence is highest among the cohorts ages 25–35 (table 4.2). Women tend to become infected at an earlier age. More than half of the women diagnosed with HIV and AIDS are age 30 or younger, but only 38 percent of males belong to this age group. The mean age of people living with HIV and AIDS is 33.

The occupation profiles of people living with HIV and AIDS (table 4.2) differ significantly by gender. Most of the males worked as factory

Table 4.2 Age Distribution and Occupation of HIV-infected Individuals
(Percent)

Age range	*Male*	*Female*	*Occupation (before being diagnosed with HIV)*	*Male*	*Female*
			Agricultural laborer	4	10
0–5	2	2	Unskilled worker	6	6
6–10	0.7	1	Truck driver	6	0
11–14	0.4	0.4	Auto/taxi/car/bus driver	10	0
15–18	0.8	0.0	Industry and factory worker	26	3
19–24	7	16	Hotel staff	3	0
25–30	27	32	Business owner	3	0
31–35	33	20	Petty shop owner	4	3
36–40	20	11	Housewife	0	60
41–45	11	2	Student	4	2
46–49	3	1	Other services	5	2
50+	5	2	Unemployed	5	3
TOTAL	100	100	Other occupations	24	10
			Total	100	100

Source: Authors' survey. Data may not add up to 100 due to rounding.

workers, or in certain types of services.[7] We highlight this here because of the increasing concern of HIV being spread among migrant laborers. Most of the factory workers and auto/bus drivers belong to this group. Among HIV-affected females in our sample, about 60 percent were housewives, while the next biggest group is agricultural laborers. The high share of female agricultural laborers may reflect that these are frequently spouses of migrant workers, suggesting one way in which the HIV virus enters the rural economy, that is, through migrant workers infecting their spouses when they visit home.

The average years of schooling among HIV-infected males is 10.3 years, while the average years of schooling among males in the control group is 8.4 years. The corresponding figures for females are 5.46 years and 5.2 years, respectively. While the PLWHA (people living with HIV and AIDS) in our sample are not very educated, it is interesting to note that the level of education among males is higher than that in the control group.

Additionally, our data capture the amount of time passed since a person was diagnosed with HIV, varying from less than a month to seven years (table 4.3). Consistent with our findings regarding the composition of "ever-married" households (mostly female or female-led, suggesting that in many cases of coinfection, males die first), we see that

Table 4.3 Time since HIV Detection

Age range	*Total*	*Males*	*Females*
Less than or equal to 6 months	30	28	34
7 months – 1 year	17	17	17
1–2 years	17	17	17
2–4 years	26	28	24
4–7 years	10	12	8
Total	100	100	100

Source: Authors' survey. Data may not add up to 100 due to rounding.

Table 4.4 Distribution of Households by Family Type
(Percent)

Family type	*HIV*	*Non-HIV*
Currently married	61	71
Never married	14	22
Ever married	25	7
Total	100	100

Source: Authors' survey. Data may not add up to 100 due to rounding.

among people living with HIV and AIDS, males are—on average—infected earlier than women.

Table 4.4 shows the various kinds of family structures in our data. Our sample includes "currently married" families where both adults are alive, never-married families (unmarried males or females) and "ever-married" families (widows, widowers, separated, and divorced). The higher proportion of ever-married families among HIV families is in most cases a consequence of death of an adult due to HIV and AIDS.[8] Our data point at the important role of coinfection between couples—in 54 percent of the "currently married" families affected by HIV and AIDS, both adults are infected with HIV and AIDS, while in 42 percent of them, only the male adult is infected, and in only 6 percent of cases only the female adult is infected. A one-member family is "male" or "female," depending on the gender of the only adult member. Of the never-married HIV "families" 84 percent are male, while 76 percent of the ever-married families are female. These cross-sectional data also provide some pointers regarding the dynamics of infection and coinfection between couples, as they are consistent with a pattern in which HIV in many cases is acquired first by a male, who then passes the virus on to his wife.

There are 1,418 children in our sample, of whom 1,189 are less than 18 years of age. The average number of such children per HIV family

(among families who have children) is 2.16, while the average number of such children per non-HIV family is 2.22. We assume that parents make decisions for children who are 18 years old or younger, and that children older than 18 are able to make decisions for themselves. For obvious reasons, schooling decisions are considered only for children of age 6 and older. The total number of such children is 892. Among HIV families, the average number of such children is 1.9, while the corresponding number for non-HIV families is 2.1.

Indicators of the Impact of HIV and AIDS

While the preceding section focused on indicators of the socioeconomic structure of families and individuals affected by HIV and AIDS, the present section discusses findings regarding variables that capture the impacts of HIV and AIDS on health, well-being, and the economic status of those affected.

Physical health status (H). The survey asked a number of questions on the occurrence of common symptoms of infection (fever, diarrhea, cough and cold, loss of appetite, general body ache, headache), and regarding some diseases and symptoms that are seen more often in HIV patients than non-HIV, such as tuberculosis, oral ulcers, and genital ulcers. The reference period for the above symptoms was the last three months.[9]

Given the symptoms, we enlisted an expert on HIV and AIDS assessment and treatment at a government antiretroviral treatment (ART) clinic, who assigned a numerical index based on the symptoms for all of the HIV and non-HIV respondents. This study uses that index as a measure of morbidity. The index ranges from 1 to 11, with 11 being the healthiest and 1 being the worst health. Where possible, we also tried to measure height and weight of individuals to be able to calculate a body mass index (BMI), which is commonly used as a measure of physical health. We also asked HIV patients to recall their normal weight before HIV detection, but in many cases where we felt the patient was not sure we did not record his or her weight. Table 4.5 summarizes various health indices by gender and HIV status.

Our data suggest a moderate decline in BMI following detection, and a lower BMI for people living with HIV and AIDS relative to the non-HIV group. However, none of these differences are statistically significant at a 5 percent confidence level. The health index based on morbidity is significantly lower for HIV individuals as compared to that of non-HIV individuals (t value of 16.5; significant at 1 percent under the alternative

Table 4.5 Health Indices

Age range	*Health index (Current)*	*Body mass index: BHD**	*Body mass index: Current*
HIV			
Male	7.8 (1.8)	20.26 (2.95)	19.04 (3.03)
Female	8.6 (1.9)	21.67 (5.72)	19.76 (3.72)
Average family	8.5 (1.5)		
Non-HIV			
Male	10.3 (1.1)	n.a.	20.78 (3.61)
Female	10.5 (0.9)	n.a.	20.90 (4.29)
Average family	10.3 (0.8)	n.a.	

Source: Authors' survey.
Note: Standard errors in parentheses.
* Based on a smaller sample.

hypothesis that non-HIV morbidity is higher). In our sample, the morbidity of HIV males is significantly higher than that of HIV females, which may reflect that usually husbands are infected earlier.

Since our analysis is at the family level, we construct the average health of a family by taking the mean over the health of existing adults in the family. This controls for the different number of adults in families. Thus, as expected, HIV families have lower physical health as compared to non-HIV families.

Mental health (M). Indicators of mental health (IMH) are based on self-reported occurrence of some feelings in a reference period by the respondent and spouse (for married respondents). Questions on feelings were asked using the questions in Case and Deaton (2006). The following statements were made and the respondents were asked if in the last 15 days the feeling captured by each statement occurred "hardly ever, sometimes, most of the time, or never."

- I felt that I could not stop feeling miserable, even with the help of my family and friends.
- I felt depressed.
- I felt sad.
- I cried a lot.
- I did not feel like eating; my appetite was poor.
- I felt everything I did was an effort.
- My sleep was restless.

The ranking of mental health was obtained by assigning a number to each answer: "never" was given 4 points, "hardly ever" 3 points, "sometimes" 2 points, and "most of the time" 1 point. Using these values, we constructed two indices: The minimum of the points across all questions answered by the respondent and, where present, by his or her spouse (denoted IMH_1 in table 4.6). This is the Rawlsian "maximin" criterion and is consistent with basic axioms regarding aggregation (Sen 1986). It does not rely on cardinality (as an average would have), and gives equal importance to all questions. It does, however, assume comparability of this ordinal measure across different subjects. To check if this makes a big difference, we also consider another index (denoted IMH_2 in table 4.6) which is similar in its Rawlsian flavor but uses responses to only one question: "I felt depressed."

Table 4.6 summarizes the distribution, with higher values of the index indicating a higher level of mental health. It is clear that the distribution of IMH_1 as well as IMH_2 for non-HIV families always dominates the distribution for HIV families. Thus, non-HIV families are mentally better off whichever index one considers.

Presence of stigma. What makes HIV different from many other diseases is the fear of stigma. In our sample, there are a large number of individuals who have not disclosed their infection to either their household members or their neighbors or their friends or at their workplace. Table 4.7 summarizes the proportion of HIV-positive individuals who have not disclosed their HIV status. This information is available only for the main respondent with HIV of the family. In cases where spouses are HIV positive we do not have the necessary stigma information for each separately.

It is apparent that patients generally avoid telling people outside their immediate household about their HIV infection. However, it could be

Table 4.6 Mental Health: Relative Frequency
(Percent)

	HIV families		*Non-HIV families*	
	IMH_1	*IMH_2*	*IMH_1*	*IMH_2*
"Most of the time" (1)	82.43	57.77	37.74	5.76
"Sometimes" (2)	14.05	28.34	17.82	15.57
"Hardly ever" (3)	3.24	7.36	24.95	23.67
"Never" (4)	0.27	6.54	19.50	55.01

Source: Authors' survey.

Table 4.7 HIV Patients Who Do Not Disclose Their Infection
(Percent)

Not disclosed to household members	25
Not disclosed to neighbors	74
Not disclosed to friends	72
Not disclosed at the workplace	85

Source: Authors' survey.

argued that this is merely a personal choice and not because of fear of discrimination. In our sample, among those who chose not to tell some of the above list of people, 64 percent reported that they did not do so because of one of the following reasons:

- They would think I was a person with bad moral values.
- They would force me to leave the community.
- My family would get a bad name.
- They would reject my whole family.

Thus the fear of stigma is not unfounded.

Labor supply. Our data regarding the employment status of people living with HIV and AIDS illustrate the impact of HIV and AIDS, but also the differences in the socioeconomic status of men and women. Table 4.8 shows that, for an employed HIV-positive male, the probability of becoming unemployed upon the HIV-positive status being detected and the workplace finding out is 20 percent. While some of that is offset by males who have gained employment since being diagnosed with HIV, the data point to a negative impact of HIV and AIDS on employment. Similarly, the sample unemployment rate among males living with HIV and AIDS (13 percent) is much higher than the rate of 5 percent for this group before being diagnosed with HIV (table 4.8). The picture for women is different: 21 of the 132 women living in families with HIV and AIDS who were unemployed or housewives before detection subsequently gained employment. One key factor behind this appears to be the loss of an income earner in the family, as 13 of these 21 women were widows.

Table 4.9 shows a similar picture. As expected, the health status of non-HIV males supplying labor outside the household is higher than for males living with HIV and AIDS, as well as for the non-HIV males who do not supply labor outside of the household. While the causality behind this correlation may run either way, we note that the gap between those

Table 4.8 Transition in Employment Status Following HIV Diagnosis
(Percent)

	Probability of Changing Status to:		
Status before HIV diagnosis;	*Employed*	*Unemployed*	*Housewife*
Employed			
Males	80	20	0
Females	90	8	2
Unemployed			
Males	7	93	0
Females	29	71	0
Housewife			
Nonwidow	11	0	89
Widow	35	0	65
Proportion of people living with HIV and AIDS by different status	74	15	11

Source: Authors' survey.

Table 4.9 State of Health by HIV Status and Gender (index)

	Non-HIV	*HIV*
Male labor supply is positive	10.34 (0.97)	8.09 (1.72)
Male labor supply is zero	10.08 (1.66)	7.02 (2.03)
Female labor supply is positive	10.45 (0.99)	8.53 (1.75)
Female labor supply is zero	10.57 (0.82)	8.72 (2.00)

Source: Authors' survey.
Note: Standard errors in parentheses. For details on the definition of the health index, see the discussion of the physical health status and table 4.5 above.

supplying labor and those who don't is much higher for people living with HIV and AIDS, suggesting that the impaired health status is causing the withdrawal from the labor market. For women, the health status of the group not supplying labor outside the household is somewhat higher than for those supplying labor outside the household, especially for women living with HIV and not supplying labor. This may reflect that the group not supplying labor is dominated by women from wealthier households, who withdraw from the labor market voluntarily and are in a better position to cope with the impact of the epidemic.

The effect of HIV can also be observed in terms of the quality of labor that is supplied. Table 4.10 highlights the self-reported effects on concentration during work and on problem-solving abilities. While in the short run these may not affect the wage earnings of the employed, they definitely affect their productivity and hence will affect the economy. Since

Table 4.10 Indicators for Impact of HIV and AIDS on Labor Productivity
(Percent)

Employed HIV patients who said "concentration/attention in daily work" had declined after HIV detection	54
HIV patients who said "speed in problem solving and decision making" had declined after HIV detection	56

Source: Authors' survey.

we do not explicitly model the production sector, we are not able to capture this effect here.

Morbidity may also affect the quantity of labor supplied, but there are also other factors that could play a role. For example, individuals could choose to supply labor based on wages; however, a simple correlation between wages and labor supply may be misleading if education levels sort individuals into various occupations, and a well-paying job comes with more certain employment and therefore more days of work.

For working males, we therefore check if the number of days of work in a week depends on the wage per day after controlling for their occupation, education, health status, the number of members in the family, and a dummy indicating whether the male is HIV-positive. We find that only the occupation dummies are significant (see appendix B, table B.1, for estimation results). This suggests that, conditional on being able to work, individuals cannot choose the number of days of work. This is consistent with the common notion of India being a labor-surplus economy. Hence, for the rest of the analysis, we take the labor days of males as exogenous with respect to wages.[10]

Effects on children. Does HIV in families affect school attendance? To answer this question, we measure the proportion of children in the age group 6–18 in a family (multiplied by the schooling expenditure on them to adjust for the quality of schooling) attending school. It seems that while both parents are alive, there is no big impact of HIV on school attendance. However, it is clear from the data on one-parent families that there are significant effects on school attendance when one parent is dead. From table 4.11 below, we can see that financial resources cannot be one of the reasons. This reflects the long-run adverse impact of HIV on human capital development.

Income, expenditure, and external funding. In order to obtain an impression of the forms the financial impacts of HIV and AIDS on families may

Table 4.11 HIV and AIDS and Children's Enrollment

	School attendance, ages 6–18 (Percent)	*Quality-adjusted attendance*
Families affected by HIV and AIDS		
Widow	73	71
Widower	75	106
Currently Married	93	152

Source: Authors' survey.

take, box 4.1 discusses a few cases in some detail. The first two cases examine the impacts around the time of an HIV diagnosis; the other four are spread out over the sample time span since HIV diagnosis. Most of the families covered in box 4.1 experienced a loss in income following the HIV diagnosis, an increase in medical expenditures, and a curtailing in nonmedical expenditures. In four of the six cases, the families received support from relatives. In many cases, the increased financial needs (owing to lower income and higher expenditures) were financed by liquidating family assets or borrowing from family or moneylenders.

Table 4.12 summarizes the income and expenditure profiles of families affected by HIV and AIDS, as well as those of the control group. In many cases, it is not possible to "translate" family support, the sale of assets, or borrowing into monthly financial flows. Our summary table therefore captures such flows only indirectly under the heading "dissaving/financial support," in terms of the excess of household expenditure over incomes.[11]

Per capita incomes of the HIV and non-HIV families are not significantly different from each other. Families headed by widows have the lowest income. In comparing married families with HIV and families headed by widows, it is interesting to note that while income falls for both families, per capita consumption does not. The main reason for this is likely the rather large amounts of net external funding.

Outline of the Model

The measurement of the economic cost of HIV and AIDS for India is based on a model given in detail in Das, Mukhopadhyay, and Ray (2007). This section sketches out the main arguments of that paper. The unit of analysis is the nuclear family, consisting of a man, woman, and their children. All economic decisions of the family, including the decisions for the children, are taken by the adult members. The family maximizes its utility

Table 4.12 Per Capita Inflow and Outflow of Funds (rupees per month)

	HIV	*Non-HIV*	
Family type	*Sample average (standard errors in parentheses)*		t *values**
Currently Married			
Income	930 (1,116)	1,109 (1,121)	**1.87**
Consumption expenditure	760 (721)	690 (764)	1.10
Medical expenditure	190 (276)	69 (186)	**5.80**
Schooling expenditure	40 (75)	37 (56)	0.51
Dissaving/Financial support	60 (913)	–312 (1,039)	**4.5**
Never Married			
Income	2,054 (3,156)	2,171 (2,510)	0.23
Consumption expenditure	2,664 (1,873)	2,123 (1,556)	**1.77**
Medical expenditure	1,675 (7,069)	237 (578)	1.44
Dissaving/Financial support	2,285 (7,639)	188 (2,594)	**1.89**
Ever Married (Widows)			
Income	541 (1,314)	178 (224)	**2.28**
Consumption expenditure	753 (831)	419 (285)	**2.70**
Medical expenditure	159 (272)	29 (41)	**3.75**
Schooling expenditure	25 (55)	18 (34)	0.65
Dissaving/Financial support	396 (1,134)	288 (439)	0.61
Ever Married (Widowers)			
Income	1,375 (2,264)	1,969 (2,033)	0.68
Consumption expenditure	706 (663)	901 (798)	0.59
Medical expenditure	349 (550)	254 (472)	0.43
Schooling expenditure	56 (78)	6 (11)	**2.51**
Dissaving/Financial support	–264 (1,207)	–808 (1,351)	0.96

Source: Authors' survey.

Note: Standard errors in parentheses.

*The *t*-value relates to the one-sided test with a null hypothesis H_0: $|Mean_1 - Mean_2| = 0$ and an alternate hypothesis H_A: $|Mean_1 - Mean_2| > 0$. Bold type indicates that H_0 is rejected at the 5% level.

by allocating consumption expenditure (c), spending on children's education, and medical expenditure, with a utility function of the form

$$u = \alpha \log c + \beta \log(1 + M) + \gamma \log(1 + SC \cdot P_s) \quad (1)$$

for families with school-age children, and

$$u = \alpha \log c + \beta \log(1 + M). \quad (2)$$

for families without school-age children. Expenditure on children's schooling is defined as the product of per capita schooling expenditure SC and the proportion of school-going children P_S.[12] We observe that a

significant proportion of families in our sample (48 percent) do not have any children. We assume that these families do not put any weight on children's education, and hence maximize their utility only with respect to consumption and medical expenditure. Medical expenditure (*md*) enters the households' utility function indirectly as it affects the level of mental health (*M*), which is determined by

$$M = \delta_0 + \delta_1 \cdot md + \delta_2 \cdot H + \delta_3 HIV + 1 \cdot X. \quad (3)$$

Specifically, the link between medical expenditure and mental health may reflect the positive effect on expected future health for a given level of current health. Other key factors affecting mental health are the state of physical health *H* and whether a household is affected by HIV and AIDS (captured by an *HIV* dummy), as well as other household characteristics captured by the vector X (such as wealth, employment status, age, and gender) used in the recent literature on mental health and subjective well-being.[13]

Estimating the Costs of HIV and AIDS

In all our estimated equations we have pooled the relevant HIV and non-HIV samples. Since we have oversampled the former, we put low weights on those observations and higher weights on the non-HIV observations, so as to be representative of the Indian population (for details see Das et al.). The weights are computed using the overall prevalence data of the IIPS (2007) and the gender composition that is available from the National AIDS Control Organisation's last annual report.

We first estimate the mental health technology for all types of families for both indices of mental health—minimum mental health based on responses to all questions (IMH_1), and minimum mental health based on the question "I felt depressed" (IMH_2). Note that our mental health data are in discrete form, whereas the utility function uses a continuous measure. We easily obtain a continuous measure from the underlying latent variable obtained by estimating the mental health equation by ordered probit, which is appropriate for our observed ordered discrete measure of mental health. This is what we use in our utility function and empirical analysis below.

For both IMH_1 and IMH_2, better current health leads to better mental health. As hypothesized, controlling for health or HIV status, the higher the medical expenditure, the higher is mental health. This is an important

result for our model. We also find that HIV infection affects mental health negatively, irrespective of which measure one chooses. For the rest of the analysis, we report the results based on the mental health measure IMH_1 as it is a comprehensive measure based on all questions asked relating to mental health.

Given the continuous mental health measure, we then estimate the parameters of the optimum conditions of utility maximization separately for families with and without school-age children. In each case we pool HIV and non-HIV families. These estimates pin down our indirect utility functions for the families. Then the impact of the HIV epidemic at the family level is calculated by comparing the indirect utility functions of the families affected by HIV and AIDS with those of families not affected. To distinguish among different types of families, we represent the status of a family by the vector *(i,j)*, with *i* representing the male adult, and *j* the female adult. The markers *i* or *j* can take the values +, –, 0, or *na* to indicate whether the respective family member is HIV-positive (+), HIV-negative (–), deceased (0), or not available for unmarried, one-adult families. The position of *na* is determined by the missing gender in the family adult vector.

Let $V^{(i,j)}(S)$ denote the indirect utility function when the family HIV status is (i,j), as defined above.[14] The loss to the country then is:

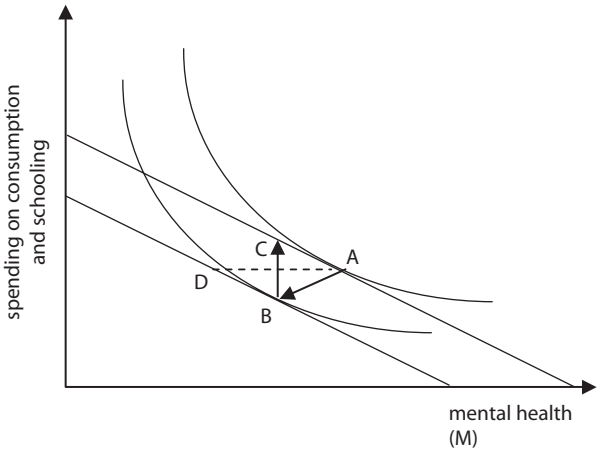
$$\int_{(i,j)} \left(V^{(-,-)}(S) - V^{(i,j)}(S)\right) \cdot d\mu(i,j),$$

where $\mu(i, j)$ stands for the measure of families with HIV status *(i, j)*. To calculate the amount that would be required to compensate a family for the losses associated with HIV and AIDS, we introduce the parameter τ to denote the hypothetical transfer that is needed to equate the indirect utility of a given type of HIV family with the reference non-HIV family. In other words, the monetary equivalent of the loss to the family *(i,j)* is given by the transfer $(\tau^{(i,j)})$ measuring the compensating variation to the family *(i, j)* and is defined by:

$$V^{(i,j)}(S|\tau) = V^{(-,-)}(S|0)^{-15}.$$

Our findings are summarized in figure 4.1 and table 4.13. First, in terms of the direct impacts of HIV on mental health, we find that most of the reduced mental health can be attributed to impaired physical health (table 4.5) and to the HIV dummy, which may capture the implications for future health as well as some of the economic repercussions discussed

Figure 4.1 Estimating the Cost of HIV/AIDS



Source: Authors' calculation.

Table 4.13 Losses by Family Types

	Utility loss (per family per month): IMH_1 (Rs)	*Utility loss (per family per month): IMH_2 (Rs)*	*Loss from transfers (per family per month) (Rs)*
Currently Married			
Only male HIV	85,727	89,631	1,363
Only female HIV	68,502	83,658	574
Both HIV	91,663	101,266	1,327
Ever Married			
Widow HIV	94,394	106,063	2,214
Widower HIV	78,764	61,808	901
Never Married			
Males	86,324	61,039	2,084
Females	87,148	99,655	2,134

Source: Authors' estimates.

above. The impact of HIV and AIDS can therefore be summarized as a contraction in the combinations of mental health on one hand, and spending on consumption and schooling on the other hand, which can be attained by the household, with the shift from A to D in figure 4.1 representing this direct impact. As a consequence of this shift, the household, after reallocating its expenditures, may find itself at point B, representing a lower level of utility than before. To return to its previous level of utility, it would require a transfer corresponding to the distance between points B and C (compensating variation).[16]

Table 4.13 reports the money equivalent of welfare losses in the first two columns for both measures of mental health, in terms of the compensating variation illustrated in figure 4.1. We use a married non-HIV family as the reference group because being a widow, a widower, or unmarried can be a consequence of HIV infection. The losses for each category are weighed by the sample proportions of families with children and without children to calculate the current loss to each kind of family.

Table 4.13 shows that in the case of "currently married" families, the loss (using either measure), as expected, is greatest when both members are HIV positive. The highest loss among all family types occurs for widows living with HIV and AIDS or widow-led families. For this group, the adverse impacts of HIV and AIDS are exacerbated by a drop in family income.

In the last column of table 4.13, we report the losses associated with dissaving for each type of family (again with married non-HIV families as the reference group). These are positive because of lower savings or because of increases in money transfers from relatives. We treat these as losses as they represent reductions in the material wealth of the respective households due to loss of labor income and increased medical expenditure. These losses are the highest for the unmarried families and widows.

In order to obtain estimates of the costs of HIV and AIDS for all of India, we need to "scale up" our family-level estimates. However, we only have estimates of the total number of males and females living with HIV and AIDS in India, but no breakdown across the different types of "HIV" families listed above. We therefore use our estimates to impute the loss for males and females in our sample, and then impute estimates for India, assuming that the distribution of various family types is the same as in our data. To this end, we first compute the loss to each family (depending on its type). For married couples with one infected member, widow, widowers, and unmarried individuals, we ascribe the whole loss to the infected member. For married couples where both members are infected, we split the loss equally between both members. We then add up all the losses for our sample, and derive the loss per male and per female. We then scale these up in proportion to the number of HIV-positive males and females in India.

The total loss (using IMH_1) per month is Rs. 67,601 for a male living with HIV and AIDS and Rs. 65,120 for a female (the respective figures using IMH_2 are Rs. 76,986 for males and Rs. 84,272 for females). Based on a total number of 1.55 million males and 950,000 females living with HIV and AIDS in India,[17] this implies that the loss to the male population living with HIV and AIDS in India (using IMH_1) is Rs. 104.78 billion per month, and that for the female population is Rs. 61.86 billion per

month, adding up to a total of Rs. 166.64 billion per month. The total annual cost of HIV and AIDS per year, with 0.36 percent of the population affected, comes out at Rs. 1,999.8 billion (7 percent of GDP), which is more than the annual health expenditure of Rs. 1,356 billion (2004) for all ailments in India!

One obvious point of comparison for our findings is the literature estimating the costs of increased mortality. Haacker (this volume) summarizes this literature, and estimates these costs at about 3 percent of GDP for India (based on the most recent data on HIV prevalence), a similar order of magnitude (though somewhat lower) as our estimates. While it may be tempting, on the face of it, to add up these estimates of the impacts of increased mortality and our findings of the costs of HIV and AIDS based on mental health, the two approaches overlap more than it appears at first sight. First, mortality-based estimates such as the ones discussed and applied by Haacker are based on valuations of mortality risks implied by data on wages and professional mortality risks. However, these underlying estimates do not generally separate the adverse effects of the possibility of premature death and the expectation of a period of sickness; the estimated impacts of the welfare effects of increased mortality therefore also capture an increased expectation of sickness. Second, our estimates of mental health likely also capture the expectation of a premature death. Against this background, the fact that the two different approaches return broadly similar estimates of the costs of HIV and AIDS is encouraging.[18]

Concluding Remarks

Using primary household data, we estimate household utility function parameters that measure the relative importance of consumption, schooling of children, and mental and physical health effects of HIV and AIDS in India. Since mental health is not directly observable, we first compute an ordinal measure based on a series of questions following Case and Deaton (2006). Then we use an ordered probit model to obtain a continuous measure, which is then used to estimate the parameters of the family utility function. The welfare loss due to HIV is then obtained using the principle of willingness to pay to come up to the utility level of non-HIV married families, used as the benchmark.

We find that mental health effects are far more important than the effect of consumption or children's schooling in determining utility and the total welfare loss per month. The total annual loss for the entire country exceeds

India's annual health expenditure in 2004 and is 7 percent of GDP. This huge magnitude is not surprising as it includes private valuation of one's own life, as well as the loss from stigma. The additional loss due to loss of labor income and increased medical expenditure measured by the external transfers account for 5 percent of the country's health expenditure and 0.23 percent of GDP. Given that the HIV incidence rate is only 0.36 percent in India, these losses are quite staggering. Further, these losses are an underestimate since they do not take into account the long-term fall of transfers from relatives, borrowing, and sale of assets, and because we do not have any orphaned children in our sample.

Annex 4.1 Summary Statistics

	Mean	*Std Dev.*
Per capita monthly consumption (c)	1,019	1,189
Education (PS. SC)	70	170
Medical expenditure (md)	591	2,748
Family size (N)	2.9	1.38
Average physical health of family (H)	8.5	1.44
Maximum time span (ts)	2.07	1.71
Square of max time span (ts^2)	7.23	9.5
Wealth (W)	18,634	50,168
Age of child	11.6	3.5
Square of age of child	136	82
Average years of schooling of family members (*E*)	5.72	3.9
Number of children in family	3.04	1.42
Health of male member (H_m)	9.35	1.87
Age of male member (A_m)	29	14
Education of male member (E_m)	8.4	4.5
Number of school-age children (n_s)	1.04	1.24
Number of children under 6 years (n_p)	0.34	0.63
Education of female member (E_f)	5.2	4.5
Family resides in north India (D_{NORTH})	0.52	0.49
Family has female adult member (D_{FEM})	0.80	0.39
Patient lives in a joint family (D_{JOINT})	0.63	0.48
Family has at least one unemployed adult (D_{UNEMP})	0.12	0.32
Average age of adult members (Av_age)	32.4	8.7
Square of average age of adult members (Av_age^2)	1125	659

Annex 4.2 Determinants of Male Labor Supply

	Male Labor Supply (p-values)
Male wage (w_m)	–0.005 (0.603)
Male education (E_m)	–0.01 (0.198)
Female education (E_f)	0.007 (0.488)
W	0.0000006 (0.41)
Health of male (H_m)	0.0055 (0.84)
Number of school-age children (n_s)	0.02 (0.447)
D (Male member is HIV = 1)	–0.111 (0.173)
D (Unskilled laborer = 1)	0.59 (0.013)
D (Truck driver = 1)	0.77 (0.017)
D (Auto driver = 1)	0.84 (0.00)
D (Industry and factory workers = 1)	0.75 (0.00)
D (Hotel staff = 1)	0.79 (0.00)
D (Business owners = 1)	0.60 (0.04)
D (Shopkeepers = 1)	1.07 (0.00)
D (Service sector = 1)	0.65 (0.02)
D (Self-employed = 1)	0.57 (0.07)
D (Agriculture = 1)	1.58 (0.00)
D (Others = 1)	0.762 (0.00)
Number of observations	642
R^2	0.12

Source: Authors' survey and calculations
Note: Unskilled labor excludes agriculture laborers.

Notes

1. See, for example, Kambou, Devarajan, and Over (1992); Cuddington (1993a and 1993b); Cuddington and Hancock (1994); Bloom and Mahal (1997); Arndt and Lewis (2000); Bonnel (2000); and the Joint United Nations Programme on HIV and AIDS (UNAIDS 2004). Recent reviews of this literature can be found in Haacker (2004), Bell, Devarajan, and Gersbach (2006), and Corrigan, Gloom, and Mendez (2005).
2. Other papers using a similar approach include Bell (2005) and Philipson and Soares (2005).
3. Blanchflower and Oswald (2004) is the only work we are aware of that has used the coefficients of a subjective well-being equation to estimate welfare losses from incidents like divorce or unemployment. We compare our work with Blanchflower and Oswald (2004) in section 9.
4. Since an extremely small proportion of HIV patients in India get direct support from NGOs such as YRG CARE in Tamil Nadu, where the HIV families live in an HIV community, we did not survey such families even though we could have done so relatively easily.

5. In Delhi and Maharashtra, HIV patients were surveyed in the hospitals. We have home addresses of all these patients except seven for whom we have only the district. Hence in most cases it was feasible to sample non-HIV families from the same neighborhoods. In a few exceptions, the non-HIV families were sampled from neighborhoods with similar wealth levels in the same districts as the patients.
6. Since the data have not been collected to calculate prevalence, the proportions of HIV to non-HIV families should not be used to deduce prevalence.
7. We do not report current occupation data here as that is endogenous. While we do not use recall data for most of our analysis as it is unreliable, it is unlikely that the occupation before HIV detection will be misreported. Hence we use this part of the recall data.
8. While in many cases widows do not list AIDS as the reason for death of their spouse, they mention diseases like TB, which make it likely that the spouse did suffer from HIV but it was not detected.
9. We are aware that health experts are in favor of much shorter reference periods, for example last 15 days. We extended the period to pick up the fact that PLWHA do, on the average, have higher morbidity but go through periods of "normal" health and so we wanted a long enough period to pick up this difference.
10. It appears unreasonable to assume that in mainstream Indian society, not working is a choice for males, and only 6 percent of males not infected with HIV (who are less health constrained than those living with HIV and AIDS) do not work. Female labor supply is ignored because, as seen in table 4.2, 65 percent of them did not work before HIV detection in the family, and after it only a few do so.
11. Apart from labor income, in some cases, there are rental incomes, which we add to calculate total income of a family.
12. *Proportion* seems to be the right weight rather than the *total number*. Multiplying with the total number has the undesirable property that it gives undue advantage to having more children. We focus on the quality of a representative child.
13. While medical expenditures can be considered to improve health, poor health triggers higher medical expenditures. Consequently, medical expenditure and current health are negatively correlated in our sample. With our data set, we are not able to disentangle these two effects and therefore treat the current state of health as predetermined.
14. Here S stands for all the exogenous variables in the model: $S = (Y, H, N, n_s, W,$ ts, $D_{HIV}, D_{FEM}, D_{JOINT},$ Av_age).
15. We do not differentiate between the equivalent variation (an income loss equivalent to the welfare loss associated with the impacts of HIV and AIDS

on economic status, physical health, and mental health) and the compensating variation (a transfer that would return the household to the same utility level as it enjoyed before the onset of HIV and AIDS, because the log-linear structure of the utility function, coupled with the linear mental health specification, mean that these two measures coincide.

16. Differences in the composition of households would change the shape of the indifference curves in figure 4.1. As we find that such changes have a minor impact on our findings, figure 4.1, for illustrative purposes, abstracts from this effect.
17. This assumption is in line with the latest estimates of the total number of people living with HIV and AIDS in India (2.5 million), while assuming the same breakdown by sex as NACO.
18. Another reference point is the literature attempting to quantify subjective well-being. For example, Blanchflower and Oswald (2004) estimate large figures for welfare loss associated with adverse events. For example, they estimate that a typical individual in the United States or Britain would need US$100,000 per annum to compensate for the loss in well-being resulting from divorce. The corresponding figure for job loss for an average male is US$60,000 per annum.

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