

## **The Human Development Roots of HIV and Implications for Policy: A Cross-Country Analysis**

*Ajay Mahal<sup>1</sup>*

**Abstract:** This paper argues that one-dimensional policies for addressing HIV, especially if technically oriented, will not be as effective as those that also involve elements of human development. The paper uses two types of evidence to lend weight to this assertion. First it presents qualitative evidence of the links between lack of achievements in human development, the spread of HIV infection and ineffectiveness of policies to prevent HIV. Second, it analyzes cross-country data from more than 70 countries to argue that human development can have quite significant implications for HIV prevalence.

Key Words: HIV, AIDS, Human Development

### **I. Introduction**

Twenty-five million people have now died of AIDS worldwide and the number of deaths is certain to rise from its current level of three million per year. Nearly 40 million people are currently living with HIV/AIDS and five million were infected with HIV in 2001 alone. Infection rates may be stabilizing in sub-Saharan Africa, home to 70% of those infected with the virus, principally because relatively few high-risk individuals remain uninfected. In other areas, however, the epidemic is still growing. Russia saw nearly a 50 percent increase in HIV infections in 2001, and the number of cases in Eastern Europe and Central Asia has risen by more than one-third in the last year (UNAIDS 2000d, 2001). With UNAIDS also voicing concerns over complacency in the West and in Asia (and with the numbers rising rapidly among some groups of young men in the United States), it seems likely that we continue to underestimate the future impact of this devastating epidemic (Haney 2001). Indeed, the number of people living with HIV today is 50 percent above the year 2001 predictions made by the United Nations in 1991 (UNAIDS 2000i).

These circumstances underlie the case for policy intervention. Apart from the obvious implications for the health of the affected individuals, several authors and policy leaders have argued that HIV/AIDS will have significant impacts on the affected countries, along a number of dimensions. These effects include adverse implications for the rate of growth of real income per capita (Bloom and Mahal 1997; Bonnel 2000; MacFarlan and Sgherri 2001; Over 1992). Potential effects could also include impacts on the distribution of economic resources, the educational achievements of populations, and other freedoms that people value, including basic human rights such as life and liberty (Barnett and Blaikie 1992; Bharat 1999; Bloom and Mahal 1995; Mahal 1996; Pyne 1998). In short, HIV/AIDS influences societies in ways that go beyond the pure health dimension, or beyond the pure economic dimension, and into the realm of human development, a goal that societies cherish, and one that could be adversely affected by HIV/AIDS.

While it is generally agreed that the HIV/AIDS epidemic calls for policy intervention, there is considerably less clarity about the appropriate content of any such policy response. Should it be a purely technical intervention? Should other goals be pursued as well? Who should participate in “delivering” the intervention? A number of policy approaches, incorporating one or more of the above characteristics, have been experimented with in different countries in the nearly two decades since the start of the HIV/AIDS epidemic. These have ranged from the screening of donated blood, HIV-testing of individuals (voluntary or forced), counseling, subsidized provision of anti-retroviral drugs, needle exchange programs, removal of (or prevention of) HIV-infected individuals from proximity to populations at risk, subsidized condom distribution, prevention messages (whether through the mass media, or via peer groups), and social and economic empowerment schemes. Sometimes the primary goal has been to reduce HIV infection, but at other times, additional goals such as economic betterment and protection of human rights appear to be incorporated as well. The government has played a central role in executing some interventions, whereas others have been conducted under the auspices of the private for-profit and non-profit sectors. Still others have been undertaken as partnerships between the private sector, the government and non-governmental organizations.

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<sup>1</sup> Harvard School of Public Health, Dept. of Population and International Health, 677 Huntington Avenue  
Boston, MA 02115 Email: amahal@hsph.harvard.edu / Tel: (617) 432 4065 / Fax: (617) 432 2181

This paper seeks to address the issue of appropriate policy by focusing attention on the causal link running from human development to HIV, both by way of empirical analyses based on cross-country data and qualitative evidence, primarily from South Asia. It might superficially appear from our analysis that there exists the possibility of exploiting a virtuous cycle flowing from reduced HIV infection to enhanced human development to further reduced HIV infection and so on, by focusing on purely technical interventions that address HIV. However, because of its influence both on HIV and policy measures seeking to reduce HIV transmission, a lack of human development can trump narrowly focused policy measures seeking to address the pure health dimensions of HIV/AIDS. Below I also provide qualitative evidence to support the contention that effectiveness of HIV-related interventions might depend on simultaneous improvements in the arena of human development. The paper does not focus as much attention on the appropriate methods for “delivering” interventions. The concluding section, however, does discuss two examples of successful interventions and in so doing sheds some light on strategies that policymakers might follow in implementing strategies to address HIV.

## **II. The Impact of Human Development on HIV: Examples**

There are several different ways in which human development can influence HIV transmission – the level of economic and educational achievement, the role of inequality, basic rights to privacy, life and liberty, and health.

### *Human development roots of HIV*

Economic deprivation and HIV/AIDS incidence appear to be linked, and there are a number of reasons why one can expect low levels of economic achievement to be rooted in HIV.<sup>1</sup> Consider, for example, the supply side of the sex industry. Extreme poverty often leads women and young girls to join the sex industry, members of which are at high risk for HIV infection (Estebanez, et al., 1993). In one study of female sex workers in Sri Lanka, nearly 37 percent of the women interviewed described the need for “survival” as a major reason for their entry into the sex trade. The numbers were even higher, 48 percent, for streetwalkers, who comprised the low value end of the sex market (Bloom et al, 1997). Poverty also leads to some parents selling their children into sex work, as another study for Sri Lanka suggests (Ratnapala, 1994). Two studies in India also indicate the role of economic status in influencing entry into the sex industry. Mukherjee (1989) studied the circumstances of nearly one thousand sex workers in Uttar Pradesh, India, and concluded that the “victims seem to hail from the lower economic strata of society.” A study of nearly six hundred sex workers in southern Maharashtra in India reached much the same conclusions (Misra et al., 2000). The role of economic circumstances in entry into the sex trade is further confirmed by analyses in other countries in the region. One recent qualitative analysis in the village Ichok in Sindhupalchowk district of Nepal has an interviewee concluding that “No can survive on farming only...There would be a famine here without the sex trade.” (CPAmedia, 2001). Ready examples of economic need leading to entry into sex work can be found in Bangladesh and Pakistan as well (Jeffreys 2001, Kukis 2001, World Health Organization 2001).

Economics also influences condom use. The Sri Lanka study showed that sex workers at the lower end of the market, such as streetwalkers, were also less likely to use condoms with their clients, because of the relatively high price elasticity of demand that they faced for their services (relative to higher-end sex workers) (Bloom et al. 1997). Of course, as the Sri Lanka study cited above suggests, not all women enter the trade for “survival.” The pure economic gains from entry into the trade are also relevant, especially if alternative economic opportunities are not as attractive. For instance, a study of Bangkok massage parlors in 1980 indicated that the average earnings of masseuses exceeded by nearly 1,700 percent what they earn in occupations elsewhere (Phongpaichit 1982; see also, Micaller 2002).

Economic progress and its correlates (including migration) can serve as a factor in the expansion of the sex industry and unprotected sexual interactions. The demand side of the sex industry is driven by the fact that clients have the financial ability to afford the services of sex workers. The demand for commercial sex and more generally multiple sex partners, depends also, however, on opportunity and the need for such interaction. Thus mobile populations with extra income – migrant labor, truck drivers, merchant seaman, members of armed forces, and possibly tourists – (along with a combination of separation, loneliness and anonymity) are especially likely to demand commercially available sex, or engage in multiple-partner sex (Bloom and Mahal 1995). Thai long-haul truck drivers have routinely sought alcohol and sex at truck stops (Bloom and Mahal, 1995). The situation in India appears to be similar to that in Thailand, with infection rates in some trucking populations at around 1 percent, roughly 20 times the national average. Indeed one recent study found that truck drivers routinely “stop at roadside hotels which provide food, rest, alcohol, drugs and sex.” (Wilson 1999, Bryan, et al., 2001). Other countries in the region – for example, Bangladesh, Pakistan and Sri Lanka – have not experienced high rates of HIV infection among truck drivers thus far. The evidence available indicates, however, that truck drivers, even in these countries, are at high risk for HIV infection, with some 60 percent in a recent sample of Bangladeshi truck drivers reporting

engaging in commercial sex twice a month (National AIDS/STD Program Bangladesh 2001). There is also evidence that, based on the relatively significant numbers of reported cases of HIV infection, overseas migrant workers may be at high risk for HIV infection in Bangladesh, Pakistan and Sri Lanka (Bloom et al, 1997; National AIDS/STD Program, Bangladesh 2001, Pakistan AIDS Prevention Society 2001; UNDP 2001b; World Bank 2001). An example of a group at risk for HIV infection and sufficient income to purchase commercial sex is people in the armed forces, some 1,400 of whom, tested positive for HIV in India during the period from 1990 to 1997 (*The Week*, 1999). Evidence of high-risk sexual behavior among domestic migrant workers in India can be found in one study of Wazirpur Industrial Area in Delhi (Singh 2001).<sup>2</sup> Another study of Nepal workers, albeit working with small samples, found that HIV infection rates among migrants who had worked in India were substantially higher than those who had not, being 10 percent and 2 percent respectively (MAP 2001, p.23).

Even if engaging in multiple partner sex, it is not always apparent that the sex has to be at high risk for HIV-infection – that is, without condoms. Previously, we highlighted the role of market competition in influencing sex worker insistence on condom use by their clients. Education and awareness levels matter as well, as indicated in a recent survey of the literature on the roots of HIV (Bloom, Mahal, Sevilla and River Path Associates 2001). School enrolment rates and illiteracy rates in the majority of the developing world, and particularly in Africa, are substantially lower than in richer countries. Analyses of household data from Cambodia, Vietnam, Nicaragua and Tanzania shows a strong correlation between both wealth and education and knowledge that condoms prevent AIDS; knowledge of where condoms can be obtained; and use of condoms. Recent research in Cambodia, the country with the most advanced epidemic in Asia, demonstrates the poorest segments of society have much less knowledge of how AIDS is transmitted and prevented; are more likely to have sex at a younger age; and use condoms less frequently. A study in Brazil showed that three-quarters of people newly diagnosed with HIV in the early 1980s had a university or secondary education, but by the early 1990s this share had fallen to one-third. A study in rural Uganda, on the other hand, found that in a cohort of almost 20,000 adults aged 15-59 years followed over three and a half years, HIV-associated mortality was highest among the better educated. Another study in Uganda, however showed that the better educated were hit hardest during the early stages of the epidemic, but that infection rates are now falling quickest among those with more education (Bloom, Mahal, Sevilla and River Path Associates, 2001).

Specific to South Asia, there are four sets of analyses whose findings are especially instructive in terms of the relationship between protective measures against HIV risk and socioeconomic status. Basu, Gupta and Krishna (1997) in their examination of the impact of adult death on households in India found considerable socioeconomic variation in AIDS awareness among individuals. Specifically, indicators such as income, asset holdings, quality of housing, occupation and the level of educational achievement were all strongly and positively associated with awareness of HIV/AIDS. The study also found that the use of disposable needles for injections associated with health care in the sampled households increased with socioeconomic status (Basu, Gupta and Krishna, 1997). A study of 365 individuals who visited the sexually transmitted disease (STD) clinic and outpatient department of a hospital in Vellore, India, in the late 1980s indicated that economic status, and literacy were positively associated with awareness of HIV/AIDS (Jacob et al., 1989). In addition, studies of the general population, sex workers, overseas' migrant returnee workers in Sri Lanka all showed that HIV/AIDS awareness was much lower among individuals with lower levels of economic and educational achievement. In the case of the sample of Sri Lanka sex workers, "high class" sex workers (who were also relatively better educated) were much better informed about HIV/AIDS than brothel workers and streetwalkers who serve the lower end of the sex market. This was reflected in condom use patterns – only 44 percent of the streetwalkers used condoms "always", compared to 87 percent for the high class sex workers (Bloom et al, 1997). A fourth study, using data from a 1993 survey of nearly 600 sex workers in Calcutta found that condom use is negatively linked to the price of a sexual act and positively associated with the level of education, suggesting the key role that economic returns and education play in implementation of HIV prevention policies (Rao et al, 2001).

Social and economic *inequality* also likely influence HIV transmission as suggested, for example, by Over (1998) (See table 1). Earlier we focused on how extreme poverty influences entry into the sex trade. Economic inequality might also matter if it leads, for example, to demanders of sex work to be able to financially compensate others to have unprotected sex with them (Philipson and Posner 1993, 1995). Rural-urban economic differences play a role in migration, a standard feature in most models of economic development, and in turn can facilitate HIV transmission along the lines noted above. In many cases the economic inequality reflects an underlying social inequality – lower status of women relative to men, for example. This is reflected in their lower educational status relative to men, fewer remunerative opportunities and assets, and access to health. The United Nations Development Program (UNDP) human development report for 2001 clearly indicates that within the South Asia region, Bangladesh, India, Iran, Nepal and Pakistan have substantially lower proportions of literate women relative to men,

with the ratio of the two literacy rates ranging between 40 percent and 65 percent. By contrast, the ratio of the female to male literacy rate in Maldives and Sri Lanka are close to equal. This has obvious implications for women's ability to protect themselves against the risk of HIV infection as also the rate of HIV transmission to the extent that the HIV is more easily transmitted from men to women than the other way round. Asset ownership also matters, and is likely to be associated with the nature of inheritance laws in countries in the region (Dhaliwal, 2002). Filmer (1998), using Demographic and Health Survey (DHS) data from 9 African and Latin American countries, found that although household asset ownership is weakly associated with condom use, in cases where the statistical relationship is strong, it tends to support greater condom use among women, and the hypothesis of *lower* condom use among men.

Inequality can also increase the risk of HIV infection in more direct ways. Indian law, for example, does not recognize marital rape as an offense, so that wives of HIV-positive men have little chance of being able to avoid HIV-risk through protected sex without support from their male partner, even if they wanted to (Dhaliwal, 2002).<sup>3</sup> The effect of gender inequality under the law is compounded by the greater sexual permissiveness granted to males in many societies (Bharat, 1999).

Other components of human development, such as the protection of privacy and liberty, are critical in influencing HIV transmission. One obvious example of a lack of such rights is that of sex workers. In India, for instance, sex work *per se* is not illegal, if practiced without disturbing public order. Yet, there is constant harassment of sex workers by the police, leading often to incarceration in prisons or rehabilitation centers (Misra, Mahal and Shah, 2000). The "detainees" are often tested for HIV without their consent and the results sometimes disclosed to others (Bharat, 1999). The research of Estebanez, Fitch and Najera (1993) notes that measures such as mandatory HIV testing of sex workers and incarceration of sex workers have occurred in other countries.

In Iran and Pakistan, the practice of sex work is actually illegal, and presumably carries severe penalties if caught (United Nations 2002a, b).<sup>4</sup> There are extra-legal constraints as well. Brothel sex workers, because they are income earning "assets" of brothel owners are often forced to entertain clients, with or without condoms, even if they are HIV-positive as illustrated by the following comment of a peer educator in the sex worker community: "When a gharwali (madam) learns of a girl's positive HIV report she asks her to keep quiet and lets her entertain clients...Once the girl starts falling sick she sells her to another unsuspecting gharwali" (Bharat, 1999).

A second obvious example is the treatment of HIV-infected individuals in health care settings, where persons who are HIV-positive are actively discriminated against and their status disclosed to others without their consent (Bharat, 1999). Bharat found that one major consequence of these outcomes is that sex workers and HIV-positive individuals prefer to visit private doctors to meet their health care needs.

A third example is that of drug users. In the example for Manipur state cited above, it was common for drug users to be incarcerated in the early 1990s. Indeed, in circumstances where needle possession is illegal (as also drugs), it likely has the consequence of increasing the risk of arrest that injecting drug users faced when moving around with injecting equipment on their person. Drug use is illegal in Iran as well (UN 2002a). Depending on the laws in place, drug users risk being charged for illegally possessing equipment, and also the possibility that, conditional on needle possession, for drug possession (Mahal, 1995).<sup>5</sup> These are similar to findings in the United States, where injecting drug user respondents reported fearing arrest for possessing syringes without a prescription (Kaplan and O'Keefe, 1993).

In all of above cases, it is easy to imagine that punitive measures associated with HIV status, the role of legal and other restrictions related to the practice of sex work or drug contribute to the spread of HIV, rather than curtailing it. For sex workers under the control of madams, this is self-evident, as the former have little choice in terms of partners and protection from HIV infection. In addition to the anecdotal evidence cited above, a study of sex workers in Nepal found that women who had been "coerced" into entering the sex trade were three times as likely to be HIV-positive than those who had not been (MAP, 2001). The incarceration of sex workers in rehabilitation homes and prisons is also likely to result in remaining "underground", an approach that could potentially result in their not being able to access health messages. The research of Estebanez, Fitch and Najera (1993) lends further support to this conclusion by noting the *failure* of methods focusing on isolation and imprisonment in order to control syphilis in the early twentieth century.

The impact of coercive laws can be expected to increase drug user behavior and HIV risk for three reasons. First, the illegality of drug possession means that drug users might prefer to stay underground, and so are unable to obtain ready access to prevention messages associated with HIV. Second, drug users might prefer to move to more efficient methods of drug use – injection as opposed to inhalation or smoking – as a means to reduce the transaction costs associated with the risk of being caught while possessing drugs (Mahal 1995). Third, when either drug or paraphernalia possession is illegal it would be beneficial for injecting drug users to share injecting equipment, and not have everyone carry their own equipment as a means to reduce the risk of being suspected of carrying drugs.

Thus injecting drug users in the study by Kaplan and O'Keefe (1993) "claimed that injection drug users (IDUs) shared needles both because needles were scarce and because they feared arrest for possessing a needle without prescription."

Health status too, can affect HIV transmission, and we discuss three ways in which this might happen. There could be behavioral factors. Individuals who expect to live a fewer number of years can rationally be expected to discount the future heavily and hence take risks with their health at the present time, including HIV infection, compared to those in better health who expect to live longer. Thus, one recent economic article noted, "Stated in the language of human capital economics, the optimal investment in health human capital is lower the fewer the periods in which a return to the investment can be expected" (Philipson and Posner 1995). In similar vein, Borzello (1997) cites a researcher in Uganda who suggested that one key element in spread of HIV in Uganda was fatalism: "everybody is infected so we're going to die anyway. We can't avoid it, so why try? ... How do we make the community appreciate that not everyone is infected, so that people become more positive about their life and future?" (Borzello 1997) The same would be true if individuals put a lower value on their life, owing to poor health, even if they could live as long as the rest. Yim, Russo and La Croix (1993) provide some evidence to support this assertion by finding a positive association between condom use in the United States and the value that people put on their life.

Then, there are biological reasons. Available evidence indicates that an individual suffering from STDs is much more likely to be infected from a single unprotected sexual act with a person who is HIV-positive, compared to those who do not have STDs (Estebanez, Fitch and Najera 1993; Wald and Link 2002).

Finally, there is some evidence to suggest that the risk HIV infection is higher among individuals who have low levels of nutrition, all else the same. Indeed one study of women visiting an antenatal clinic in Malawi found that 47 percent of the anemic women in the sample were HIV-positive, compared to the average for all women visiting that clinic of about 30 percent (Piwoz and Preble 2000).<sup>6</sup>

### **III. HIV and Human Development: Cross-Country Analysis**

#### *Data and Methodology*

As used in the literature, there are essentially two notions of human development in vogue – the first, a conceptual definition, and the second, a set of mathematical definitions that seek to capture some of the ideas outlined in the conceptual definition. The first can be found in the writings of Amartya Sen (see, for example Dreze and Sen 1995). The second is available in the Human Development Reports of the United Nations Development Program (UNDP 2001).

As to the conceptual definition, Amartya Sen argues for a notion of development that refers to "the expansion in the real freedoms that the citizens enjoy to pursue the objectives they have reason to value..." (Dreze and Sen, 1995). Looked at in this manner, the term "development" goes beyond the standard notion of economic development that has come to be synonymous with growth in real income per capita. To be sure income will contribute to expanding the capability space in Sen's scheme of things. However, this framework also allows for enhancements in other areas to contribute to freedoms. Thus, improvements in health, besides being valuable in themselves have the potential of expanding earning opportunities for the individual, and also contribute to improved cognitive abilities at school. Improvements in education could contribute to improved economic opportunities, besides enabling an individual to be empowered, by learning about means to improve health, fight for one's rights in the public sphere, be able to read, and the like. Again, improvements in basic rights – speech, religious freedom, life and liberty – are examples of improved capabilities that would be natural ingredients in the notion of development that Sen talks about.

By contrast, human development in the sense that is used by the United Nations Development Program (UNDP) has a very specific connotation.<sup>7</sup> The most popular sense in which the UNDP uses the term is as an index, referred to as the Human Development Index (HDI) that combines three elements – life expectancy at birth, educational achievement (a weighted average of adult literacy and combined (primary, secondary and tertiary) enrolment rates), and per capita GDP. Thus, changes in HDI capture changes in three elements that would go into any reasonable interpretation of "development" as defined above – income, health and education. To calculate HDI, each of the three components is reduced to a dimension index, ranging between 0 and 1, and then a simple arithmetic average of the three is used to compute the HDI. The HDI does not appear to capture the entire gamut of freedoms that one could think of as going into "development." One obvious set of omissions from the list is the entire set of freedoms that we refer to as civil liberties and political rights. An example of an index that does take these aspects into account is the Freedom House Index that characterizes each country in the world as "Free," "Partly Free" and "Not Free" depending on its rating on two separate scales – one focusing on political rights, and

the other on civil liberties available to citizens and residents. However the correlation between the HDI and the Freedom House index of freedom and civil liberties in a cross-section of 90 countries turned out to be quite high, at about +0.7 by our calculations, so that not including elements such as rights and liberties in its formula need not be particularly debilitating for our purposes.

The data used in the analysis of this paper were obtained from several sources. Information about the human development index (HDI), life expectancy at birth, literacy rates among people aged 15 years and above, enrollment rates and real per capita GDP was obtained from the Human Development Report 2001 (UNDP, 2001) and the World Bank's *World Development Indicators Database* (World Bank, 2001). In addition, the paper utilized data on average years of schooling for people aged 15 years and above described in Barro and Lee (2000), the degree of openness of an economy as measured by the ratio of exports and imports to GDP in World Bank (2001), population growth rates (World Bank, 2001), proportion of that population that is Muslim and/or Judeo-Christian (Central Intelligence Agency (CIA), 2001), date of the first reported HIV and AIDS cases (United States Bureau of the Census, 2001; Mann, Tarantola and Netter, 1992), indicators of political freedom (Freedom House, 2002) and urban population growth (World Bank, 2001). Estimates of HIV prevalence for 1999 were obtained from the UNAIDS country epidemiological fact sheets (UNAIDS, various). These HIV prevalence estimates were obtained by careful examination of sentinel surveillance data sources among women visiting antenatal clinics in many countries and other sources of HIV data, coupled with an extensive process of double-checking and verifying the estimates.

Table 1 summarizes, for the sample countries, the main descriptive statistics relevant to our analysis of the potential impact of human development on HIV. The full list of countries is provided in the notes to Table 1. The data indicate the substantial variation in HIV prevalence among adults aged 15-64 years, from negligible levels in some countries, to a high prevalence of nearly 22 percent. Our sample of countries includes those with extremely low levels of human development in 1999 -- 0.258 for Sierra Leone -- and also countries such as Norway, with a very high HDI of 0.939 in 1999. Similar variation is apparent from data on education variables such as adult literacy, mean years of schooling and schooling enrolment, life expectancy at birth and real GDP per capita.

<b>Table 1. Descriptive Statistics</b>						
<i>Variable</i>	<i>N</i>	<i>Mean</i>	<i>Standard Deviation</i>	<i>Minimum</i>	<i>Maximum</i>	
HIV prevalence, 1999 (per 100 adults 15-64)	73	2.12	4.68	0.01	22.44	
Years since beginning of epidemic	73	14.91	2.68	8.00	21.50	
Human Development Index, 1980	73	0.638	0.191	0.253	0.884	
Real Income Per Capita, 1980 (1995 US\$)	73	6,383	8,825	148	39,848	
Share of population that is Muslim(percent)	73	19.13	33.21	0.00	99.80	
Mean years of schooling 15+, 1980 (years)	73	4.69	3.04	0.10	11.91	
Ratio of female to male literacy rates, 1980 (percent)	73	78.54	25.44	19.10	110.85	
Ratio of female to male life expectancy at birth, 1980(percent)	73	107.56	3.48	96.71	123.20	
Ratio of females to males 15-49 years, 1980 (percent)	73	100.43	4.20	90.96	111.76	
Ratio of exports + imports to GDP, 1980 (percent)	73	57.92	26.24	15.37	124.05	
Gini coefficient, circa 1990	73	40.84	10.19	23.10	61.30	
Annual average increase in migrant population, 1980-90 (percent)	73	1.28	1.40	-0.14	7.08	
Ratio of armed forces to urban population, circa 1990 (percent)	73	1.03	1.01	0.00	5.38	
Freedom Index, 1995	73	3.08	1.69	1.00	7.00	

*Source(s):* Barro and Lee (2000); CIA (2001); Freedom House (2001); Human Development Report 2001 (UNDP 2001); United States Bureau of the Census (2001); UNAIDS (2001); World Bank (2000, 2001).

**Table 1 Notes:**

*Notes:* The indicator of freedom varies from 1 to 7, with 1 indicating the *greatest* degree of political freedom and civil liberties, and 7 the *lowest*. Our proxy for the rate of growth of rural to urban migration is the *difference* between the rate of growth of total urban population and the rate of total population of a country. This implicitly assumes that the rural and urban populations would have grown at the same rate, in the absence of migration, and so is most likely a lower bound of the actual rate of growth of migrant populations.

*Countries:* *Middle East and Africa:* Burkina Faso, Burundi, Central African Republic, Cote d'Ivoire, Egypt, Ghana, Israel Jordan, Kenya, Madagascar, Mali, Morocco, Mozambique, Niger, Nigeria, Senegal, South Africa, Tunisia, Zambia, Zimbabwe. *Asia:* Bangladesh, China, India, Indonesia, Japan, Republic of Korea, Malaysia, Nepal, Pakistan, Philippines, Sri Lanka, Thailand. *Latin America and Caribbean:* Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Nicaragua, Panama, Paraguay, Peru, Uruguay, Venezuela. *North America:* Canada, Mexico, United States. *Oceania:* Australia, New Zealand. *Europe:* Austria, Belgium, Denmark, Finland, France, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom

*The Econometric Model*

We use the following simple equation that is often used to describe the dynamics of HIV transmission in an adult population, whose HIV prevalence rate is H (Anderson and May 1991; Kremer 1996).

$$(3) \quad dH/dt = (1 - H) * H_p * \beta * T - \theta * H$$

Here dH/dt is the derivative of H with respect to time "t" and equation (3) describes the movement of HIV prevalence over time.  $H_p$  is the infection rate among the "sexual" partners of the above population,  $\beta$  is the proportion of unprotected sexual interactions in any given interval and T is the rate of transmission of HIV during unprotected sex;  $\theta$  denotes the proportion exiting from the infected pool in any time period.

The HIV prevalence rate among partners, the proportion of people in the population of interest who have unprotected sex and the rate of transmission of HIV that together determine the risk of HIV infection, will depend on a number of variables. These include the level of knowledge people possess about risk of infection, income levels and hence the opportunity cost of infection, concerns about health (including one's own infection status), opportunity, inequalities that allow some people to pay off others to incur increased risk as well as indicative of poverty, cultural norms that govern the practice of unprotected sex and the like (Kremer 1996; Philipson and Posner, 1993). Specifically, let us assume that the impact of these other forces is felt in such a way that

$$(4) \quad H_p * \beta * T = (\alpha + \pi * x) * \rho * H$$

Here x indicates all variables other than an average individual's HIV-status, H. H is taken to enter multiplicatively in this formulation. Thus, we can write

$$(5) \quad dH/dt = (1 - H) * (\alpha + \pi * x) * \rho * H - \theta * H, \text{ so that}$$

$$(6) \quad dH/dt = (\alpha * \rho + \rho * \pi * x - \theta) * H - (\alpha + \pi * x) * \rho * H^2$$

Equation (6) can also be derived from a simple microeconomic model, where a representative individual in the population of interest, with chance H of being already infected, chooses the overall risk resulting from the partner being infected, the number of partners and whether the sexual interaction is safe, or not (the left hand side of (4)).<sup>8</sup> The formulation in (6), under different assumptions, leads to three related econometric specifications, as I demonstrate below. The differential equation in (6) has a readily obtainable solution given by,

$$(7) \quad Z(t) = \exp(-k * t) * z(0) + (m/k) * (1 - \exp(-k * t))$$

$$k = (\alpha * \rho + \rho * \pi * x - \theta)$$

$$m = (\alpha + \pi * x) * \rho$$

$$z(t) = 1/H(t)$$

As  $k \rightarrow \infty$ ,  $Z(t)$  tends to the “steady state”  $m/k$ . We can also see that

$$(8) \quad Z(t) - (m/k) = [Z(0) - (m/k)] \exp(-k*t)$$

Case I: In the special case where  $\theta = 0$  (implying that  $m/k = 1$ ), we have from (8), after taking logs on both sides and substituting for  $z = (1/H)$

$$(9) \quad \ln(H/(1-H)) = \ln(H(0)/(1-H(0))) + k*t$$

or,

$$(9') \quad \ln(H/(1-H)) = \ln(H(0)/(1-H(0))) + \alpha*\rho*t + \rho*\pi*t*x$$

Assuming all countries start from roughly a similar sized epidemic (roughly 1 percent of some segment of the population), we can set forth the first version of our econometric formulation as

$$(10) \quad \ln(H/(1-H)) = \delta + \beta*t + \lambda*t*x + \varepsilon$$

Here,  $\delta$ ,  $\beta$  and  $\lambda$  are parameters (or vectors of parameters) to be estimated and  $\varepsilon$  is an “error” term with the usual properties. Notice that the assumption of  $\theta = 0$  is a stringent one, because it is effectively ruling out a faster rate of exits, relative to the rest of the population, from the infected population in the model. Moreover, the assumption implies that the population heads to a steady state HIV-prevalence level of unity, but with the proviso that the *rate* at which it get there depends on the parameters and the  $x$  variables characteristic of each group.

Case II: An alternative formulation is one is where  $\theta \neq 0$ . If so, we can write from above

$$(8') \quad Z(t) = \exp(-k*t) * z(0) + (m/k)*(1 - \exp(-k*t))$$

If we work with the assumption that we are still early in the epidemic, using a linear approximation around  $t=0$  we can write

$$(11) \quad Z(t) \approx Z(0)(1 - k*t) + m*t$$

From this we have,

$$(12) \quad Z(t) \approx Z(0) + (m - Z(0)*k)*t$$

The resulting econometric specification is:

$$(12') \quad 1/H(t) = Z(0) + \phi + \chi*t + \mu*t*x + v$$

Where  $v$  is an error term and  $(Z(0)+ \phi)$  is constant. Given that (12') is the outcome of a linear approximation, the estimation exercise also considered another specification that allowed for the natural log transform of  $(1/H)$  as the dependent variable of interest.

Case III: At the other extreme, one can focus on the steady state outcomes for purposes of estimation if one believes that the country HIV/AIDS epidemics are far enough advanced. In particular, going back to

$$(4) \quad dH/dt = (\alpha*\rho + \rho*\pi*x - \theta)*H - (\alpha + \pi*x)*\rho*H^2$$

Putting  $dH/dt = 0$ , we have that in the steady state

$$(13) \quad (1 - H) = \theta/[(\alpha + \pi*x)*\rho]$$

This gives rise to the following econometric specification

$$(14) \quad H(1 - H)^{-1} = \delta + \lambda*x + \varepsilon$$

The statistical analysis of this paper on the determinants of HIV prevalence involves primarily the estimation of (9'), (12') and its logarithmic counterpart, and (14). However, as discussed below the paper also presents the results of specifications of the form in (15) below to compare the results using national level HIV prevalence data with those obtained by Over (1998) who used this specification to analyze urban HIV prevalence rates in developing countries.

$$(15) \quad \ln(H(1-H)^{-1}) = \delta + \lambda*x + \eta*t + \varepsilon$$

#### *Socioeconomic correlates of HIV infection*

The key dependent variable in the empirical analysis of this section is national level HIV prevalence estimates in 1999 provided by UNAIDS. In terms of explanatory variables I have previously discussed in section II the potential role of different indicators of human development in influencing HIV transmission, such as income, education, health, inequality, and civil liberties. Indicators of inequality used in this paper include the ratio of female to male literacy and female to male life expectancy at birth.

The discussion in section II also emphasized the role of migrant populations as a key factor in HIV transmission. However, other factors also matter. The first is the time elapsed since the start of the epidemic, a relevant variable in all but one of the specifications of interest (14), an unsurprising observation, first made in the context of such empirical analyses by Bloom and Mahal (1996). Second, cultural forces are relevant. Traditional Muslim societies, for instance, are likely to have lower tolerance thresholds for promiscuity. For instance, it is stated in the *Qur'an*, "the believers are...those who protect their sexual organs except from their spouses... Therefore, whosoever seeks more beyond that [in sexual gratification], then they are the transgressors." (23:5-6). Muslim scholars say this statement "makes it very clear that any sexual gratification outside marriage is considered a transgression of the law of God."<sup>9</sup>

Over (1998) suggests that the ratio of young adult males to young adult females (20-39 years) in urban areas might also be an important determinant of HIV infection among urban populations by increasing the demand for commercial sex. Given the focus of this paper on national level data, the ratio of females and males at the national level in the 15-49 year age group appeared appropriate. However, other proxies were also considered. The growth rate of urban populations (*less* growth of national population) was used as a means to capturing both the role of rural-to-urban migration in HIV transmission and the impact of the urban male to female ratio, since the majority of the migrants are likely to be men. Over (1998) also noted the importance of armed forces as a factor in promoting HIV infection, and this variable (total armed forces/total population) was included in some of the specifications. We use the ratio of exports and imports to gross domestic product as an indicator of the extent to which a country is open to outside influences, and the degree of international mobility of its population which as suggested above, is likely to be positively associated with HIV transmission (Bloom and Mahal (1996); Over (1998)).

## **Results and Discussion**

Table 1 provides descriptive statistics on the variables used in the analysis of this section, and lists the countries for which the full sets of such data were available. The data in Table 1 indicate that there is substantial variation in the variables of interest across the sample countries, with two key exceptions – the ratio of female to male life expectancy at birth and the ratio of females to males in the age group, 15-49 years. Particularly noteworthy is that the estimated length of the epidemic varied from 8 years to 21.5 years in others.<sup>10</sup> This suggests that assuming a "steady state" HIV prevalence will not be a useful assumption for the purposes of estimation purposes, a hunch that is confirmed by the econometric results that are discussed further below. The data indicate a substantial degree of gender inequality in educational achievement as measured by ratio of the female to male adult literacy rates in 1980. The gender inequality in literacy rates was highly correlated with the human development achievement of a country in 1980 – with a correlation coefficient of 0.91. Gender inequality in literacy was correlated to a somewhat lesser degree with economic achievement, with a correlation coefficient of 0.79.

The difference between the rate of growth of the urban population and the total population of a country during the period from 1980 to 1990 was used as a rough proxy for the rate of growth of migrant populations from rural to urban areas over the decade. The rate varied significantly between countries, with a mean annual average of growth of about 1.28 percent for the full sample of 73 countries, a low of -0.14 percent for Sri Lanka, and a high of 7.08 percent, for Mozambique. The calculation implicitly assumes that the rate of growth of urban and rural populations would be identical in the absence of migration, which is obviously incorrect. However, if the difference between urban and rural population growth rates is a constant *in the absence* of migration, even if the rates themselves are not equal, one can interpret the indicator of migration described above is equal to the actual rate of migration, plus a constant. The rate of growth of urban population during 1980 and 1990 was also used as another

proxy for migration, but including it does not qualitatively change the results of this paper, and so results from including it in the econometric specifications are not presented in Tables 2 and 3.

The indicator for armed forces used in this paper is the estimated size of the armed forces in 1990 divided by the estimated urban population for the same year. This is based on the formulation presented in Over (1998) who argues that armies are typically based near urban areas, contribute to further influencing the female to male sex ratio in urban settings and hence to commercial sex. Table 1 indicates that this may not a correct assumption, especially if armed forces end up getting counted as part of urban populations in censuses. In particular, the mean size of armies roughly equals the urban population in our sample of countries, increasing to a maximum of 5.4 times the urban population in Burundi.

Table 2 presents the results estimating specifications (10) and (12') and a specification using a logarithmic transform of HIV-prevalence of the dependent variable in (12'). For each specification, two cases were considered – one where the 1980 value of the human development indicator of the UNDP was used as a key explanatory variable, and one where the natural log of real income (GDP) per capita was used instead. In general, the statistical fit was quite good, especially under the log-transforms of the dependent variable, with the regression line “explaining” nearly 80 percent of the total cross-country variation in HIV prevalence. The results of the multivariate analysis also reveal several interesting associations between HIV prevalence in 1998 and the explanatory variables. First, the time length of the epidemic matters in all of the specifications where some log transform of HIV prevalence is used as the dependent variable. The effect of the length of time an epidemic is present in a country, however, is mediated by the influence of a number of factors. Human development achievements, a higher real income per capita, a greater proportion of population that is Muslim, a lower degree of “openness”, and lower degree of economic inequality as measured by the Gini coefficient all tend to lower the extent to which HIV prevalence is increased owing to the length of its presence in a population.

Holding the length of the epidemic as given, the analysis also indicates that the major indicators of human development achievements (whether the human development indicator of the UNDP or the log of real GDP per capita) are also strongly associated with HIV prevalence, and their effect is to *lower* HIV prevalence, in line with our expectations. The proportion of population that is Muslim is associated with lower HIV prevalence. Somewhat surprisingly, the degree of inequality in educational achievement appears not to matter statistically speaking, for HIV prevalence, and in specifications with the human development index, it even takes the “wrong sign.” The latter effect is probably due to the presence of the human development index in the same specification and its extreme degree of correlation with the indicator of gender inequality in literacy (of 0.91) as indicated previously. The other variable that has a statistically significant effect on HIV prevalence, at 5 or 10 percent levels of significance, is economic inequality as measured by the Gini-coefficient. The results of Table 2 indicate that, holding all other variables constant, a greater degree of economic inequality is associated with higher HIV prevalence in the adult population. Notice also that the effects of all these variables become larger in size the greater the length of time an epidemic is in prevalent in a given population.

The other explanatory variables in the econometric specification – migration during 1980-90, the size of the armed forces relative to urban population, and the ratio of females to males in the 15-49 years age group, did not have a significant association with HIV prevalence. It is worth noting, however, that the signs of the coefficients of the migration indicator and the female to male ratio are positive, in line with what the earlier discussion in this paper would suggest. On the other hand, the coefficient for the armed forces variable is of the “wrong” sign in the first four specifications of Table 3.

Notice also that estimating the non-logarithmic specification of (12') does not yield a good statistical fit, with the R-square hovering around 0.30, although the coefficients are generally of the expected sign. Most of the coefficients are statistically insignificant individually, but were found to be jointly significant.

Table 3 presents the results from specifications (14) and (15) and lends additional support to the findings reported in Table 2. The results in columns (2)-(5) of Table 3 indicate that the length of time an epidemic has been present in a population is positively associated with HIV prevalence, a higher magnitude of indicators of human development is associated with lower HIV prevalence, the proportion of population that is Muslim is negatively associated with HIV prevalence, openness is positively associated with HIV and economic inequality negatively associated with HIV. Columns (2) and (3) in Table 3 also suggest that the assumption of a steady state and the resulting specification do not fit the data very well.

<b>Table 2. Socioeconomic “determinants” of HIV/AIDS, (specifications (10) and (12’))</b>						
<i>Regressors</i>	<i>H=HIV Prevalence Rate 1998</i>					
	<i>Ln(H/(1-H))</i>	<i>Ln(H/(1-H))</i>	<i>Ln(H)</i>	<i>Ln(H)</i>	<i>(1/H)</i>	<i>(1/H)</i>
Constant	-12.155 (0.656)	-12.199 (0.731)	-12.044 (0.651)	-12.078 (0.722)	6625.38 (2739.65)	6232.36 (2645.20)
Years since beginning of epidemic (T)	0.806 (0.258)	0.723 (0.313)	0.794 (0.257)	0.708 (0.311)	-621.87 (678.01)	-355.44 (635.43)
Human Development Index, 1980 <i>times T</i>	-0.535 (0.164)		-0.530 (0.163)		415.89 (340.73)	
Log of Real GDP per capita, 1980 <i>times T</i>		-0.053 (0.021)		-0.052 (0.021)		10.967 (32.584)
Percent of population that is Muslim <i>times T</i>	-0.0017 (0.0003)	-0.0016 (0.0004)	-0.0017 (0.0003)	-0.0016 (0.0004)	2.780 (1.735)	2.799 (1.815)
Ratio of female to male literacy rates, 1980 (percent) <i>times T</i>	0.0007 (0.0010)	-0.0013 (0.0009)	0.0007 (0.0011)	-0.0012 (0.0009)	0.335 (2.667)	2.669 (2.389)
Ratio of females to males 15-49 years, 1980 (percent) <i>times T</i>	-0.0015 (0.0022)	-0.0014 (0.0027)	-0.0015 (0.0022)	-0.0013 (0.0027)	0.093 (6.167)	-1.034 (6.288)
Ratio of exports + imports to GDP, 1980 (percent) <i>times T</i>	0.0006 (0.0003)	0.00062 (0.00035)	0.00055 (0.00034)	0.00059 (0.00036)	-1.000 (0.906)	-1.120 (0.950)
Annual average increase in migrant population, 1980-90 <i>times T</i>	0.147 (0.739)	0.225 (0.804)	0.115 (0.730)	0.200 (0.796)	-2254.72 (2298.57)	-1816.40 (2295.88)
Gini coefficient, <i>circa</i> 1990 <i>times T</i>	0.0016 (0.0011)	0.0024 (0.0010)	0.0015 (0.0011)	0.0024 (0.0010)	-1.460 (2.745)	-3.065 (2.415)
Ratio of armed forces to urban population, <i>circa</i> 1990 (percent) <i>times T</i>	-0.372 (0.769)	-0.728 (0.884)	-0.405 (0.748)	-0.754 (0.865)	1792.05 (1530.16)	1937.15 (1610.60)
Number of observations	73	73	73	73	73	73
R-squared	0.778	0.759	0.774	0.755	0.298	0.286

Source: Author’s calculations. Heteroskedasticity-corrected standard errors reported in parentheses.

<b>Table 3. Socioeconomic “determinants” of HIV/AIDS (specifications (14) and (15))</b>				
<i>Regressors</i>	<i>H=HIV Prevalence Rate 1998</i>			
	$(H/(1-H))$	$(H/(1-H))$	$\ln(H/1-H)$	$\ln(H/1-H)$
Constant	-0.249 (0.150)	-0.227 (0.138)	-8.749 (3.397)	-9.662 (3.824)
Years since beginning of epidemic (T)			0.445 (0.047)	0.442 (0.051)
Human Development Index, 1980	0.005 (0.070)		-7.760 (2.282)	
Log of Real GDP per capita, 1980		-0.006 (0.010)		-0.824 (0.296)
Percent of population that is Muslim	-0.0006 (0.0002)	-0.0006 (0.0002)	-0.022 (0.005)	-0.022 (0.005)
Ratio of female to male literacy rates, 1980 (percent)	-0.0011 (0.0005)	-0.0010 (0.0005)	0.0067 (0.0142)	-0.021 (0.011)
Ratio of females to males 15-49 years, 1980 (percent)	0.0029 (0.0014)	0.0028 (0.0014)	-0.0054 (0.0343)	-0.0033 (0.0390)
Ratio of exports + imports to GDP, 1980 (percent)	0.0004 (0.0002)	0.0004 (0.0002)	0.0104 (0.0052)	0.011 (0.005)
Annual average increase in migrant population, 1980-90	0.341 (0.651)	0.245 (0.636)	2.980 (11.630)	2.094 (12.390)
Gini coefficient, <i>circa</i> 1990	0.0013 (0.0009)	0.0011 (0.0008)	0.028 (0.015)	0.039 (0.014)
Ratio of armed forces to urban population, <i>circa</i> 1990 (percent)	-0.039 (0.511)	-0.085 (0.507)	-5.826 (13.002)	-13.352 (13.985)
Number of observations	73	73	73	73
R-squared	0.337	0.340	0.778	0.765

*Source:* Author’s calculations. Heteroskedasticity-corrected standard errors reported in parentheses.

#### **IV. Conclusions and Policy Lessons**

This paper set out to highlight the association running from human development to HIV. It sought to exhibit these relationships in two ways – case examples from around the world and especially from within the South Asian region; and empirical analyses using cross-country information over the period 1980 to 1998, on a range of socioeconomic and demographic variables, including indicators of human development, and HIV prevalence among adults.

The cross-country empirical analyses presented in this paper do not rule out the existence of the above link, specifically indicating the role of human development, economic inequality, and an indicator of international mobility as possibly important factors in influencing HIV prevalence. These analyses were supplemented by qualitative evidence from a range of countries and settings that linked liberty, economic and educational status, health and other elements of human development as causal forces in HIV infection. The qualitative analyses also suggest that the adoption and exposure of individuals to many of the standard prevention methods for HIV – condom use in sexual interactions, the use of clean needles in HIV, contacts with the formal health system and health care and prevention messages, for example – appear to be contingent on achievements in the human development arena.

These relationships suggest that the success of the prevention programs themselves may depend on gains in the human development arena, as suggested by the discussion on the potential influences on condom use patterns, needle sharing habits and access to health care and information. It might appear that human development approaches are too time consuming and so waiting endlessly for them to bear fruit might fail to prevent an HIV/AIDS epidemic going out of control. This conclusion is unwarranted, because some of the key elements on the human development front can be successfully addressed in the short run. These include the functioning of law enforcement agents in protecting the rights of those at risk for HIV infection and people living with HIV/AIDS, and often require only the *fair* application of existing laws, or a deletion of obviously harmful laws, and a reduction of stigmatization. Sometimes the mere *process* of a human development intervention can yield effects on prevention. Human development interventions need not be prohibitively expensive. If anything, human development is of value to the individuals towards whom the interventions are directed, or communities and institutions, who are affected by HIV, and it can be expected that they themselves will take an active interest in the outcomes and will likely be willing to bear the expenses of these interventions.

We conclude by providing two examples of HIV prevention efforts – one from within the South Asian region, and one from without -- to lend support to these arguments. The degree to which the human development component is emphasized in the program varies, but it is clear in all cases, that the technical aspect is only one part of the overall strategy. There is the case of VAMP (Vaishya AIDS Muqabla Parishad), formed in 1996 in southern Maharashtra in India, consisting of two collectives – with 2,000 to 3,000 sex worker members in each group – both emerging out of the work of a non-governmental organization called SANGRAM based in Sangli, Maharashtra.<sup>11</sup> SANGRAM's goal was to create a sustainable response to the AIDS epidemic by treating women in sex work as individuals who could be empowered to change their circumstances, and founded on the belief that sex workers could become agents for change for both themselves and the broader community. Thus the activities of VAMP and SANGRAM involve peer education programs in which women in sex work acted as peer educators, disseminating information to women in sex work about HIV/AIDS, distributing condoms, training and counseling women who were unable to enforce condom use by clients, and helping women with obtaining access to medical care. One immediate outcome is that members of VAMP do not think of themselves as victims but rather as members of a community with mutually beneficial goals. Apart from running the condom distribution program, VAMPs represent the interests of their community in several different ways. They arbitrate community disputes, lobby with the police, help women access government programs and develop leadership potential. For example, VAMPs frequently address disputes between sex workers and the powerful brothel owners. Through discussions with the crime investigation units of the state and local police, raids on sex worker establishments have been greatly reduced (communication with Meena Seshu, SANGRAM). By building a common identity with other women in sex work, VAMP members are beginning to place their own demands on policy platforms – such as decriminalization of sex work, better medical care at public hospitals, and ending police raids on brothels (Misra, Mahal and Shah, 2000). Moreover, one key HIV-related outcome appears to have been high rates of condom-use based on self-reports in a recent survey carried out among 600 sex workers in areas where VAMP operates (Mahal et al, 2001).

The legal and human rights components are also visible in the strategy followed for the New Haven needle exchange program introduced in 1990, in New Haven, Connecticut, in the United States (Kaplan and O'Keefe, 1993). Three elements of this program were noteworthy aside from the pure technical intervention aspect – changes in law, no testing for HIV and maintenance of participant confidentiality. Needle exchange programs (NEPs) have historically faced significant opposition from policymakers and others in the United States since they are perceived

to signal a softening of the “war on drugs.” Prior to the introduction of the NEP in New Haven, possessing injecting equipment in the state of Connecticut was illegal. However, as part of a strategy to check whether needle exchange programs worked, the state legislature exempted program participants from statutes that prohibited syringe possession without prescription. Moreover, the committee in-charge of the NEP set mechanisms in place that would ensure confidentiality of program participants and treat them with respect. One outcome of the sensitive approach of the program implementation was a high rate of enrollment – nearly 50 percent of New Haven’s injecting drug users were estimated to have participated in the NEP (Kaplan and O’Keefe, 1993). The high rate of success of the New Haven NEP – with an estimated 33 percent reduction in HIV infections – led to decriminalization of syringe possession in Connecticut and other states as well as expansion of NEP in other states.<sup>12</sup>

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## References

- Anderson, R. and R. May. 1991. *Infectious Diseases of Humans: Dynamics and Control*. Oxford, United Kingdom: Oxford University Press.
- Barnett, T. and P. Blaikie. 1992. *AIDS in Africa: Its Present and Future Impact*. New York: The Guilford press.
- Barro, R. J. and J-W. Lee. 2000. "International Data on Educational Attainment: Updates and Implications." CID (Center for International Development) Working Paper no. 42. Cambridge, MA: Harvard University, Kennedy School of Government.
- Basu, A., D. Gupta and G. Krishna. 1997. "The household impact of adult morbidity and mortality: some implications of the potential epidemic of AIDS in India." In D. Bloom and P. Godwin (eds.) *The Economics of HIV and AIDS: The Case of South and Southeast Asia*. New Delhi: Oxford University Press, pp. 102-154.
- Bharat, S. 1999. *HIV/AIDS Related Discrimination, Stigmatization and Denial in India*. Mumbai, India: Tata Institute of Social Sciences, Unit for Family Studies.
- Bloom, D. and A. Mahal. 1997. "Does the AIDS epidemic threaten economic growth?" *Journal of Econometrics*. 77:105-24.
- Bloom, D., A. Mahal, J. Sevilla and River Path Associates. 2001. "AIDS and economics." Draft. Boston, MA: Harvard School of Public Health, Department of Population and International Health.
- Bloom, D., A. Mahal, L. Christiansen, A. de Silva, S. de Sylva, M. Dias, S. Jayasinghe, S. Mahawewa, T. Sanmugam and G. Tantrigama. 1997. "Socioeconomic dimensions of the HIV/AIDS epidemic in Sri Lanka." In David Bloom and Peter Godwin (eds.) *The Economics of HIV and AIDS: The Case of South and Southeast Asia*. New Delhi, India: Oxford University Press, pp. 155-263.
- Bonnel, R. 2000. "HIV/AIDS and economic growth: A global perspective?" Draft. Washington, D.C.: The World Bank, ACT Africa.
- Borzello, A. 1997. "AIDS in Uganda: Understanding the causes of high risk sexual behavior." Report. (<http://www.idrc.ca/books/reports/1997/20-01e.html#overcoming>).
- Bryan, A., J. Fisher and T. J. Benziger. 2001. "Determinants of HIV risk among Indian truck drivers." *Social Science and Medicine*. 53(11):1431-26.
- CIA (Central Intelligence Agency). 2001. *The World Fact Book 2001*. Langley, VA: United States Government, Central Intelligence Agency.
- CPAmedia. 2001. "Commercial sex and the daughters of Nepal." Syndication Spotlight: December 2001. ([http://www.cpamedia.com/services/syndication/0112\\_01/](http://www.cpamedia.com/services/syndication/0112_01/))
- Dhaliwal, M. 2002. "Creation of an enabling and gender just legal environment as a prevention strategy for HIV/AIDS among women in India." Lawyers Collective, India. (<http://www.hri.ca/partners/lc/unit/women-hiv.shtml>).
- Dreze, J. and A. Sen. (1995). *India: Economic Development and Social Opportunity*. New Delhi: Oxford University Press.
- Estebanez, P., K. Fitch, and R. Najera. 1993. "HIV and female sex workers." *Bulletin of the World Health Organization*. 71(3/4):397-412.

Filmer, D. 1998. "The socioeconomic correlates of sexual behavior: A summary of results from an analysis of DHS data." In Martha Ainsworth, Lieve Fransen and Mead Over (eds.) *Confronting AIDS: Evidence from the developing world*. Washington, D.C.: The World Bank.

Freedom House. 2002. *Freedom in the World 2002: The Democracy Gap*. Washington, D.C.: The Freedom House.

Gwartney, J. and R. Lawson. 1997. "Measuring economic freedom." ([Http://www.cato.org/dailys/8-15-97.html](http://www.cato.org/dailys/8-15-97.html)).

Jacob, K.S., H. Jayakumari, J. K. John and T. J. John. 1989. "Awareness of AIDS in India: Effect of public education through the mass media." *British Medical Journal*. 299(16 September):721.

Jeffreys, B. 2001. "Inside a Peshawar Brothel." BBC, December 19. ([http://news.bbc.co.uk/1/hi/english/world/from\\_our\\_own\\_correspondent/newsid\\_1711000/1711362.stm](http://news.bbc.co.uk/1/hi/english/world/from_our_own_correspondent/newsid_1711000/1711362.stm)).

Kaplan, E. and E. O'Keefe. 1993. "Let the needles do the talking! Evaluating the New Haven Needle Exchange." *Interfaces*. 23(1): 7-26.

Kremer, M. 1996. "Integrating behavioral choice into epidemiological models of AIDS." *Quarterly Journal of Economics*. May, 549-73.

Kukis, M. 2001. "Pakistan's sex trade draws in Afghan refugees." *Middle East Times* ([http://www.metimes.com/2K1/issue2001-47/women/pakistans\\_sex\\_trade.htm](http://www.metimes.com/2K1/issue2001-47/women/pakistans_sex_trade.htm)).

MAP(Monitoring the AIDS Pandemic). 2001. "The Status and Trends of HIV/AIDS/STI Epidemics in Asia and the Pacific." Provisional Report. ([http://www.dec.org/pdf\\_docs/PNACM798.pdf](http://www.dec.org/pdf_docs/PNACM798.pdf)).

MacFarlan, M. and S. Sgherri. 2001. "The macroeconomic impact of HIV/AIDS in Botswana." IMF Working Paper #01/80. Washington, D.C.: International Monetary Fund (IMF).

Mahal, A. 1995. *Three Essays on the Economics of HIV/AIDS*. Ph.D Dissertation. New York, NY: Columbia University, Department of Economics.

Mahal, A. 1996. "Is the exclusion of HIV-positive foreigners justified: Some economic, legal and public health considerations." Draft. New York: Barnard College, Department of Economics.

Mahal, A, M. Seshu, S. Mane and S. Mane. 2001. "Old age financial security among sex workers in India: Evidence from Maharashtra and Karnataka." Draft. Cambridge, MA: Harvard University, School of Public Health, Department of Population and International Health.

Mann, J., D. Tarantola, and T. Netter. 1992. *AIDS in the World*. Cambridge, MA: Harvard University Press.

Micaller, C. 2002. "Fast money sex trade lures Hong Kong maids." *Taiwan Economic News*, January 30. (<http://www.atimes.com/china/DA30Ado1.html>).

Misra, G., A. Mahal, and R. Shah. 2000. "Protecting the rights of sex workers: The Indian experience." *Health and Human Rights*. 5(1): 88-115.

National AIDS/STD Program. 2001. *HIV/AIDS in Bangladesh: Current Situation*. ([Http://www.bangla-aids.org/document/scenario.htm](http://www.bangla-aids.org/document/scenario.htm)).

Over, M. 1998. "The effects of societal variables on urban rates of HIV infection in developing countries: An exploratory analysis." In M. Ainsworth, L. Fransen and M. Over (eds.) *Confronting AIDS: Evidence from the developing world*. Washington, D.C.: The World Bank.

Pakistan AIDS Prevention Society. 2001. *HIV/AIDS in Pakistan*. ([Http://31stcentury.com/paps/aids\\_situationer.htm](http://31stcentury.com/paps/aids_situationer.htm)).

Phongpaichit, P. 1982. *From Peasant Girls to Bangkok Masseuses*. Geneva: International Labor Office.

Philipson, T. and R. Posner. 1993. *Private Choices and Public Health: The AIDS Epidemic in an Economic Perspective*. Cambridge, MA: Harvard University Press.

\_\_\_\_\_. 1995. "The microeconomics of the AIDS epidemic in Africa." *Population and Development Review*. 21(4):835-48.

Piwoz, E. and E. Preble. 2000. *HIV/AIDS and Nutrition: A Review of the Literature and Recommendations for Nutritional Care and Support in Sub-Saharan Africa*. Washington, D.C.: United States Agency for International Development (USAID), Bureau for Africa, Office of Sustainable Development, Support for Analysis and Research in Africa (SARA) Project.

Pyne, H. H. 1998. "International law and the rights of people living with HIV/AIDS." In Martha Ainsworth, Lieve Franssen and Mead Over (eds.) *Confronting AIDS: Evidence from the developing world*. Washington, D.C.: The World Bank.

*AIDS: The Case of South and Southeast Asia*. New Delhi: Oxford University Press.

Rao, V., I. Gupta, M. Lokshin and S.t Jana. 2001. "Sex workers and the cost of safe sex: The compensating differential for condom use in Calcutta." Draft. Washington, D.C.: The World Bank, Development Research Group.

Ratnapala, N. 1994. *Report on the sexually high-risk groups in Sri Lanka*. Colombo, Sri Lanka: World Health Organization.

Singh, R. 2001. "Labor Issues: Stresses and Risks." *Frontline* 18(9) (<http://www.flonnet.com/fl1809/index.htm>).

UNAIDS (Joint United Nations Program on HIV/AIDS). 2000. *Epidemiological Fact Sheets on HIV/AIDS and Sexually Transmitted Infections*. Geneva: UNAIDS. [Http://www.unaids.org](http://www.unaids.org).

\_\_\_\_\_. (2001). *AIDS Epidemic Update: December 2001*. Geneva: UNAIDS. [Http://www.unaids.org](http://www.unaids.org).

UNAIDS Task Force on Drug Use and HIV Vulnerability. 2000. *Drug Use and HIV Vulnerability: Policy Research Study in Asia*. Geneva: UNAIDS.

UNDP (United Nations Development Program). 2001a. *Human Development Report 2001*. New York: United Nations. ([Http://www.undp.org](http://www.undp.org))

\_\_\_\_\_. 2001b. Country Fact Sheet: Bangladesh. (<http://aidsouthasia.undp.org.in/contryfsheet/bangla.htm#Back>).

United States Bureau of the Census. 2001. *HIV/AIDS Surveillance Database*. Washington, D.C.: Population Division, International Programs Center, Health Studies Branch.

Wald, A. and K. Link. 2002. "Risk of Human Immunodeficiency Virus infection in Herpes Simplex Virus Type 2 seropositive persons." *Journal of Infectious Diseases*. 85(1):45-52.

*Week, The*. 1999. "Over 1,400 forces personnel tested HIV positive." March 20, New Delhi.

Wilson, J. 1999. "India's HIV highway." BBC News.  
([http://news.bbc.co.uk/1/hi/english/world/south\\_asia/newsid\\_255000/255538.stm](http://news.bbc.co.uk/1/hi/english/world/south_asia/newsid_255000/255538.stm)).

World Bank, The. (2000). *World Development Report 2000/2001: Attacking Poverty*. Washington, D.C.: Oxford University Press for the World Bank.

\_\_\_\_\_. 2001. *Regional Updates: South Asia Region (SAR) \_ Pakistan*.  
(<http://www.worldbank.org/ungass/pakistan.htm>).

WHO(World Health Organization). 2001. *Sex Work in Asia*. Manila, Philippines: WHO, Regional Office for the Western Pacific.

Yim, T., G. Russo and S. La Croix. 1993. "Condom use in the presence of HIV risk: The role of economic and epidemiological variables." Draft. Honolulu, HI: University of Hawaii, Department of Economics.

Zierler, S., N. Krieger, Y. Tang, W. Coady, E. Siegfried, A. DeMaria, and J. Auerbach. 2000. "Economic deprivation and AIDS incidence in Massachusetts." *American Journal of Public Health*. 90(7):1064-73.

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<sup>1</sup>Zierler et al. (2000) find evidence from the state of Massachusetts in the United States that economic deprivation has a strong positive association with the incidence of AIDS.

<sup>2</sup>Similarly, several experts believe that a not-insubstantial number of tourists visiting Sri Lanka participate in high-risk sex with commercial sex workers. On the other hand, available evidence on the participation of the importance of sex-tourists in the South Asian region appears to be weak (For a list of references, see Bloom et al., 1997).

<sup>3</sup>In case of forced sex, however, women can file for divorce for "cruel" treatment.

<sup>4</sup>A member of Iran's National AIDS Committee was recently cited as saying "We don't have any commercial sex workers. It is extremely illegal..." (United Nations 2002a).

<sup>5</sup>If law enforcement officials find drug residue in the injecting equipment.

<sup>6</sup>Of course, one can be careful to guard against the possibility of reverse causality – that is, lower nutrition may be an outcome of HIV infection (Powiz and Preble 2000).

<sup>7</sup>The HDI is the most recent of a class of indicators of "development" that go beyond the simple initial focus on growth of real income per capita (for further details, see Bloom *et al.* 1996).

<sup>8</sup>The derivation can be obtained from the author if needed.

<sup>9</sup>See [http://www.beliefnet.com/features/chastity\\_chart.html](http://www.beliefnet.com/features/chastity_chart.html).

<sup>10</sup>The start date of the epidemic was assumed to be the year the first AIDS case was reported in each country or, a population sample found with HIV prevalence exceeding 0.5 percent, further adjusted by the commonly accepted starting year of the epidemic for each region.

<sup>11</sup>There is also the better known "Sonagachi" project based in Calcutta, but we do not discuss it here because it has already attracted extensive interest worldwide and several research papers and projects (Misra, Mahal and Shah 2000).

<sup>12</sup>The estimated number of HIV infections averted was based on a sophisticated epidemiological model and the testing of injecting equipment rather than HIV testing of program participants (Kaplan and O'Keefe 1993).