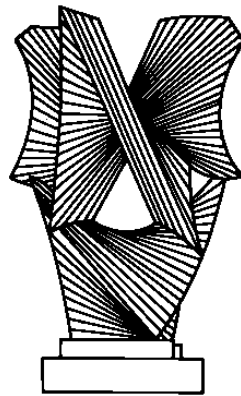


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OPTIMAL REGULATION OF AIDS

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The AIDS epidemic has focused attention on sexually transmitted diseases and on the public policy issues presented by proposals for combatting them, whether by prevention through changes in sexual behavior, or by treatment, or by subsidization of research. These issues may seem remote from economics—may seem to belong to psychology, sociology, epidemiology, medicine, and law. But we believe that economics can be helpful in evaluating the probable effects, and hence desirability, of such proposals, and more broadly in analyzing sexual behavior in the face of risk (the risk need not be disease—it could be an unwanted child). We treat risky sexual behavior as a market in which trading takes place under conditions of uncertainty about quality, and we explore the implications of this approach for understanding the growth and possible tapering off of the AIDS epidemic, the differences between the actual and the reported growth of the epidemic, and several normative issues, including mandatory testing for the AIDS virus.

Part I discusses the demand for unsafe sex, given uncertainty about infection status. The existence of a positive such demand is the reason for the AIDS epidemic. We explain first why there is such a demand (that is, why there isn't "full prevention," analogous to "full insurance" in the economic theory of insurance), and then why the demand for prevention is different in different cities in the United States.

Testing for the presence of the AIDS virus is one possible response to the risk of AIDS, and Part II of the paper discusses the private (market) demand for such testing. Here the emphasis falls on the different demands of altruists and of egoists for this particular service.¹

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¹ Parts I and II parallel our technical paper, "Sexual Behavior under Uncertainty: The Economics of AIDS," but with an important difference: The technical paper assumes that every person knows the probability that his potential sexual partner or partners is

Part III discusses normative issues raised by sexually transmitted diseases in general. Do sexual acts between consenting adults create real (that is, technological as distinct from pecuniary) externalities if procreation is ruled out (for example because the acts are homosexual)? Are restrictions on sexual freedom best viewed as involving tradeoffs between ethical values, such as privacy, and economic values?

Part IV applies the analysis in the first three parts to a number of proposals for control of the spread of AIDS, including mandatory testing, restrictions on immigration, and subsidization of medical research. These can be conceived of as different forms of taxation (or subsidization) of AIDS. The concept of optimal taxation may provide a useful framework for unified economic analysis of a diverse menu of policy proposals.

We anticipate the objection that sexual behavior is unsuited to economic analysis, which generally and in this paper assumes that the behavior of the persons it is studying is rational in the sense of responsive to real relative price changes. Much about sexuality is indeed outside the range of choice as ordinarily understood—not only the psychological and physiological mechanics of sex but also (in all probability) the preference for a particular sexual object: for example, whether same sex or opposite sex. In economic terms, many dimensions of sexuality are characterized by a very low elasticity of demand or supply. But not all. Questions of preference and performance must be separated from questions of voluntary behavior in the face of constraints supplied by preference, physical and psychological capability, and the like. Homosexual *preference*, which we treat as given rather than chosen, increases the cost of heterosexual intercourse. But whether a person who prefers homosexual relations decides to engage in a homosexual act or to substitute a heterosexual act (or abstinence) is determined by expected-utility considerations influenced but not controlled by preference, physical capacity, and other givens.²

infected. With this assumption, a person who tests positive for the AIDS virus—and whose known probability of infection therefore rises to 1—will be unable to find any noninfected person willing to engage in unsafe sex with him; hence he will not spread the disease. The assumption is relaxed in this paper because many persons who test positive continue having unsafe sex with persons not all of whom are themselves infected.

² The general case for applying rational-choice analysis to sexual behavior is argued in Richard A. Posner, *Sex and Reason* (1992), esp. ch. 5.

I. Rational Sexual Behavior under Risk of Infection

Assumptions. We make a number of simplifying assumptions, but we also discuss the consequences of relaxing them when sticking with them could affect our analysis significantly:

1. The only sexually transmitted disease is AIDS, and it is only transmitted sexually. The analysis can easily be extended to other sexually transmitted diseases, and also to cases in which AIDS is transmitted by blood transfusion, needle-sharing among drug addicts, or contact between health workers and patients; in fact we shall discuss some of these extensions.

2. AIDS cannot be transmitted by sexual intercourse between persons who are not carrying the AIDS virus. This is true but slightly misleading, because intercourse with a person carrying another sexually transmitted disease, such as syphilis, gonorrhea, or genital herpes, can, if infection results, weaken resistance to the AIDS virus.

3. Intercourse between two persons both of whom are infected with the virus inflicts no incremental harm on either person. This is not quite true, because repeated infection with the AIDS virus can hasten the conversion of the infected person to the active disease state.

4. Safe sex is assumed to mean sex with condoms and is further assumed to be completely safe. (Abstinence and masturbation are also safe, but we confine our attention to intercourse.) Condoms are not in fact completely safe. And there are other ways of protecting against AIDS besides using condoms, such as reducing the number of one's sex partners (perhaps to zero) or screening them carefully. But we shall (largely) ignore the other methods, beyond pointing out that they are more attractive for heterosexual couples desiring children, since condoms are a contraceptive as well as a disease preventive.³

To summarize assumptions 2 through 4: AIDS is spread by, and only by, unsafe sex between an infected and an uninfected individual.

5. All sexually active persons are assumed to fall into one of two groups. In the first, persons are altruistic toward their sexual partners, meaning that a disease or other cost to a person's sexual partner or partners is also a cost (though not necessarily, or ordinarily, as great a cost) to the person. This implies that if he knows he's infected this

³ This suggests that there are differences between homosexuals and heterosexuals in regard to preferences for different methods of AIDS prevention, but we do not pursue this question.

knowledge becomes for him a reason to refrain from unsafe sex. In the second group, there is no altruism toward one's sexual partners, implying that knowing oneself to be infected does not operate as a reason against one's engaging in unsafe sex. We call persons in the first group altruists, and persons in the second group egoists.

Analysis. Persons derive utility from sex, and incur costs. The costs include expected costs of disease—medical costs, pain and suffering, lost earnings because of disability or stigma, possible loss of one's job even if one is not disabled, and, dominating all the other costs, a greatly reduced life expectancy. The costs are higher for an altruist than for an egoist because they include not only the altruist's own costs but also the costs (though smaller—few people value other people's welfare as much as they value their own) incurred by his sexual partner should the partner become infected as a result of the sex act. A second important class of costs is the costs of using condoms. The principal cost here is not monetary, but the cost in reduced pleasure. There is also an information cost, which is sometimes significant: odd as it may seem, some people don't know how to use condoms, where to buy them, or their function in preventing disease. And there is a time, bother, and information cost in buying, carrying about, and using a condom, the last being analogous to the cost of fastening an automobile seat belt.

Holding constant other factors that affect the costs and benefits of sexual activity, we predict that safe sex will be more common the higher the probability of infection with AIDS. Couples who know that either both partners have the disease (or the virus), or that neither does, incur no risk of infection from a sexual act between the two partners; hence their demand for safe sex will be zero. An egoist who knows he is infected but doesn't know his partner's status will also have a zero demand for safe sex, but an altruist in the same state of knowledge will have a positive demand.

We predict that among persons who do not know either their AIDS status or that of their prospective sex partners, the demand for safe sex will be higher, the higher the incidence of infection in the pool from which these persons' sex partners are drawn. We assume in other words that people who have not been tested for the AIDS virus infer their own risk of infection from the risk in the subgroup to which they and their sexual partners belong (for example, male homosexuals in Dubuque, Iowa). Hence, in this country, homosexuals will have a greater demand for safe

sex than heterosexuals,⁴ and homosexuals in cities that have a high incidence of AIDS will have a greater demand for safe sex than homosexuals in cities with a low incidence. Both of these predictions of the rational model of sexual behavior in the face of disease risk are supported by the data.⁵

The rational model of behavior toward risky sex implies a lower rate of growth of AIDS than is implied by the usual epidemiological models of disease, which have been applied to the AIDS epidemic⁶ and which, as the rational model would predict, have overpredicted that growth.⁷ Some epidemiological models predict exponential growth, because they assume that the more individuals that are affected at time t , the more will be affected at time $t+1$ by random interaction with the already infected ones. Other models limit the predicted growth of the epidemic only by the number of people who could be infected, whether or not they might take steps to avoid being infected. These approaches are fine when a disease is spread by airborne particles or insects, especially if (as in the Middle Ages) the causality of the disease is not well understood, so that the perceived costs of avoidance are extremely high. But that is not the case with AIDS; it can be avoided, though not costlessly, by substituting safe for unsafe sex. Our model implies, consistent with the data, that as the incidence of AIDS rises, so will the demand for safe sex, because the benefits, but not the costs, of safe sex will be rising as a result of the increasing incidence of the disease. (Stated otherwise, the demand for unsafe sex is price elastic where “price” is given by the probability of infection.) The epidemiological models cannot explain the observed leveling off in the growth of the AIDS epidemic because they either ignore behavior change,

⁴ We abstract from the demand for condoms as contraceptives—a source of demand limited to the heterosexual population.

⁵ Marshall H. Becker and Jill G. Joseph, “AIDS and Behavior Change to Reduce Risk: A Review,” 78 *American Journal of Public Health* 394 (1988); R.W. Conell and Susan Kippax, “Sexuality in the AIDS Crisis: Patterns of Sexual Practice and Pleasure in a Sample of Australian Gay and Bisexual Men,” 27 *Journal of Sex Research* 167 (1990); Janet S. St. Lawrence et al., “Differences in Gay Men’s AIDS Risk Knowledge and Behavior Patterns in High and Low Aids Prevalence Cities,” 104 *Public Health Reports* 391 (1989); Ron D. Stall, Thomas J. Coates, and Colleen Hoff, “Behavioral Risk Reduction for HIV Infection for Gay and Bisexual Men,” 43 *American Psychologist* 878 (1988).

⁶ See, for example, Stirling A. Colgate et al., “Risk Behavior-Based Model of the Cubic Growth of Acquired Immunodeficiency Syndrome in the United States,” 86 *Proceedings of the National Academy of Science* 4793 (1989).

⁷ U.S. General Accounting Office, “AIDS Forecasting: Undercounts Weaken Estimates” (GAO/PEMD-89-13 1989).

or simply condition their predictions on a range of assumptions about behavior change without examining which assumption is the most likely to be true.

There is a further problem with the epidemiological models. If the demand for unsafe sex is indeed elastic with respect to its price in probability of infection, the latency period of the AIDS virus gives rise to serious problems in measuring and forecasting the epidemic, even if an eventual conversion rate of 100 percent is assumed. Without universal testing for the AIDS virus the number of persons tested cannot be assumed to be a representative sample of the total sexually active population and therefore cannot be used to forecast the future incidence of the disease accurately. The number of persons with the active disease is known with some though not complete accuracy. But as that number is the consequence of sexual behavior in the past, it cannot be used to make reliable predictions about the future—precisely because, as the rational model makes transparent, a rising incidence of the disease increases the demand for safe sex. A high incidence of AIDS at time t could actually imply a low incidence at time $t+7$ (assuming a latency period of seven years), since the high incidence could, by making the expected cost of unsafe sex very high, increase the demand for safe sex and thereby reduce the spread of the disease.

II. Market Demand for AIDS Testing

Analogizing a sexual act that results in infection with AIDS to the sale of a defective product, one might suppose that the risk of infection would induce “sellers” to offer warranties of safety, especially if the cost of eliminating the defect (that is, the cost of safe sex) were high. Two sorts of warranty should be distinguished. In the first, the defect affects the product’s utility but not the consumer, so all the seller need do to honor the warranty is to replace the defective product with a sound one. This is not feasible with regard to sex that results in infection with AIDS because there is no cure for AIDS. The second type of warranty, illustrated by the implied warranty of fitness for human consumption that accompanies a retail sale of a food or beverage, promises compensation to the consumer injured by the defective product. This type of warranty is also unlikely to accompany an offer for risky sex. The seller of this particular defective “product” will rarely be financially capable of honoring such a warranty (so there would have to be compulsory liability insurance, as for operators of motor vehicles), especially since the amount of compensation

demanded would be astronomical because death reduces the utility of money so drastically.

Yet if *ex post* compensation—the replacement of the defective product, or compensation of the buyer for the injury resulting from the defect—is thus an infeasible means of coping with the risk of AIDS from sex, *ex ante* a person can try to reduce the risk to himself by ascertaining his own and his sexual partner's AIDS status. Or he can accept *ex ante* compensation. This must be common; otherwise the relatively high incidence of unsafe sex in high-risk populations could not be readily explained—except, of course, for unsafe sex between two persons who have tested positive. Suppose A has a strong aversion to safe sex. B does not, but values A as a sexual partner. B may, in exchange for A's willingness to have sex with him, forgo safe sex and thereby assume the risk of becoming infected with AIDS. This is compensated risk-taking, no different in kind from voluntary participation in unsafe sports or dangerous occupations, and is especially likely if B has no idea whether he is already infected (since if he is, which is one possibility, he has nothing to lose).

Our focus is not on *ex ante* compensation for bearing the risk of contracting AIDS but instead on the demand for AIDS testing, viewed as an institution for providing information that could be used to reduce AIDS risk to oneself, one's partner, or both, or otherwise to enhance (or reduce) utility. We emphasize market, that is, private, demand. Most analyses of AIDS testing, whether voluntary or mandatory, have treated such testing strictly as a public good ancillary to governmental monitoring of the epidemic. We treat it as a private good in order to explain the private demand for testing.

But immediately there is a question: Why is there any private demand for AIDS testing? What does a person who is sexually active and does not know whether he is infected with the AIDS virus have to gain from discovering whether he is or is not infected? One thing he has to gain is information valuable in making career and other plans unrelated to sexual consumption, but discovering that one has the virus imposes a nonsexual loss, too, arising not only from the widespread human aversion to knowing when one is going to die but also and more directly from the misery attendant upon contemplating the prospect of a premature and painful death.

Our particular concern is with the gains and losses from testing that are directly related to future sexual activity. Here the principal gain is in enabling a person to make a more intelligent (from the standpoint of

utility maximization) choice whether to incur the cost of safe sex. The benefit of safe sex is a function of one's disease status. If one is an egoist and infected, the benefit is zero.⁸ If one is an altruist and infected, the benefit is great because of the risk to one's partners unless they practice safe sex.⁹ The egoist who is practicing safe sex for self-protection (the only reason he would do so) may, therefore, want to be tested in order to find out whether he is benefiting from safe sex, and the egoist who is not now practicing safe sex will want to be tested in order to find out whether he would benefit from switching to safe sex.

The fact that both altruists and egoists derive some benefit from voluntary testing doesn't imply (nor do we observe) that the practice will be universal even among the sexually active population that is at high risk from AIDS, such as male homosexuals in the U.S. The benefit may be slight. Persons who incur either little cost or enormous cost from practicing safe sex will derive little or no benefit from voluntary testing—the former because they will practice safe sex without being tested, the latter because they won't practice it regardless of the outcome of the test. Neither group will alter their behavior on the basis of the outcome of the test and therefore neither will benefit from the information that the test yields. Also unlikely to derive a net benefit from being tested are those sexually active persons who attach a very high cost to learning that they are doomed,¹⁰ a possible outcome of the test.

Egoists may have a greater demand for voluntary testing than altruists do. This suggestion is counterintuitive, because altruists, unlike egoists, derive a benefit from not infecting their sexual partners and therefore from learning their infection status. But precisely for this reason, altruists are likely to engage in safe sex without bothering to ascertain their disease status. For if they tested positive, they would adopt safe sex in order to protect their partners, while if they tested negative, they would still adopt safe sex, to protect themselves. Since they will adopt safe sex regardless of the outcome of the test, why test? One might think that an

⁸ Because of our simplifying assumption that there is no incremental risk from unsafe sex for the already infected. This is a slight exaggeration.

⁹ If safe sex by one partner alone protects him completely, as we are assuming, then the altruist who knows he is infected will either practice safe sex himself or inform his partner of his disease status, thus inducing the partner to practice safe sex himself. Realistically, both partners should practice safe sex with each other if one is known to be infected, since, contrary to our simplifying assumption, safe sex is not infallibly safe.

¹⁰ David W. Lyter, "The HIV Antibody Test: Why Gay and Bisexual Men Want or Do Not Want to Know Their Results," 102 *Public Health Reports* 468 (1987).

altruist who has a strong aversion to safe sex will test in the hope of testing negative in which event he will take a risk on becoming infected. But he is unlikely to want to take that risk, for by risking infection, he risks infecting others—a possibility that is costly to him, by the assumption that he is an altruist. Egotists, however, derive a definite benefit from learning that they are infected, because then they can abandon safe sex at no cost. They also benefit from learning they are negative, for then they can increase their utility by increasing their purchase of safe sex: the benefits of safe sex to an egoist are greater, the smaller the probability that he is already infected.

Given the existence of egoists in the sense in which we are using the word (recall assumption 5), the ideally best method of minimizing the spread of AIDS would be for each person to test his prospective sexual partners. In effect this is done by blood banks, acting as the representatives of the buyer of their blood, who is analogous to the sexual partner of a person who may be infected with the AIDS virus. Public policy proposals for the control of AIDS, such as mandatory testing or immigration controls, can be evaluated as methods for simulating what we have suggested would be the market solution if sure-fire on-the-spot partner tests were technologically feasible. Since in the blood-bank case transaction costs would preclude direct testing of donees by donors, the blood bank performs the familiar Coase-theoretic role of minimizing transaction costs. Not transaction costs in the usual sense, but technological obstacles to reliable transacting, obstruct the Coase theorem from preventing the spread of AIDS.

We can interpret the well-documented reduction in the average number of sexual partners per homosexual in the era of AIDS not only as a direct method of reducing risk of infection but also, and more subtly, as an indirect method of partner-testing. A person who knows he is HIV-positive may be able to conceal it from a one-night stand or other casual sex partner, but will find it much more difficult to conceal it from someone with whom he has an ongoing intimate relationship.

A related point is that monogamy may encourage the growth of altruism. As Adam Smith pointed out in the *Theory of Moral Sentiments*, people are not “global” altruists, but instead are selfish toward strangers and altruistic toward relatives and close friends. Friendship need not be thought wholly exogenous. The greater the gains from friendship, the more time and effort people will invest in cultivating friends. AIDS, by increasing the benefits of being a participant in an *altruistic* sexual

relationship, creates incentives to invest more in creating relationships that are likely to become altruistic ones.

We might even try to approximate the fraction of sexual altruists in an at-risk group such as male homosexuals in the U.S. by the fraction of persons in the group who are in a long-term monogamous relationship. Although this fraction is not known, it plainly is far below 1 and this is one bit of evidence (more later) that the at-risk groups contain many egoists.

We have been discussing second-best solutions to the problem of uncertainty about infection status, and this raises the question why the market has responded so sluggishly to the demand for credible certification of HIV-negative status. Given that unsafe sex (even when infallibly effective) is costly, persons who can credibly signal that they are HIV-negative could derive substantial gains in the market for sexual relations. So why do we not observe reputable companies offering forgery-resistant documentation to persons who test negative? Perhaps because homosexual-rights activists would resist a procedure that might have the practical effect of ostracizing HIV carriers, and because the six-month lag between infection and testing positive would greatly reduce the value of being certified as HIV-negative.

Here is a much simpler market response. A homosexual bar or bathhouse or other place for homosexual assignations might convert to a membership club and administer HIV tests regularly to its members. Only those who tested negative would be permitted to patronize the club. We do not know whether any homosexual (or for that matter heterosexual) establishments use this simple method of making unsafe sex (relatively) safe.

We have said that egoists who know they are HIV-positive have no demand for safe sex. But it does not follow, as we have been assuming, that they will be able to engage in unsafe sex save with other persons who know that they themselves are infected. If A knows he is not infected, he will be willing to engage in unsafe sex with another person who is not infected. B, who is infected (and selfish), offers to engage in unsafe sex with A. Although A knows that he (A) is uninfected, he also knows that B cannot know this. He will therefore infer from B's failure to demand safe sex that B knows himself to be HIV-positive, and he will therefore refuse to have unsafe sex with B. Hence, the argument continues, the more testing there is, yielding more A's (people who test negative), the harder it will be for infected persons to find sexual partners among the uninfected.

This is a powerful argument—maybe too powerful. Since no one can prove his test status to another, the argument implies that persons who

know they are HIV-negative will never engage in unsafe sex: any A will assume that *every* potential sexual partner who does not demand safe sex is HIV-positive and will not engage in unsafe sex with him—that is, with anyone. But zero unsafe sex is likely to be quite costly to some A's, so they will take some chances—hoping that the persons with whom they have sex are not infected. Testing positive will give the selfish an incentive to increase their efforts to convince the A's of this world to have unsafe sex with them, because the cost of unsafe sex to them (the B's) is zero. Particularly dangerous is a situation in which the B's are operating in a subpopulation where the risk of AIDS is (at present) low, for they will find it relatively easy to persuade A's to risk unsafe sex with them.

III. Normative Economics of Sexually Transmitted Disease

It might seem obvious that a contagious disease such as AIDS is a source of negative externalities justifying government intervention at least in principle. This is the accepted economic rationale for compulsory vaccination against smallpox, polio, and other such diseases.¹¹ However, at second glance a doubt arises because AIDS is spread primarily by voluntary interactions, either sexual or needle-sharing. A person who has unsafe sex with another person assumes the risk of being infected and, as suggested in the preceding part of this paper, is presumably compensated (not necessarily monetarily, of course) for assuming it; so far there is no externality. However, other sexual partners (call them C, D, and E), current or future, of a person (A) who has unsafe sex with a possible AIDS carrier (B) incur an expected cost which A, unless totally altruistic toward C, D, and E (in the sense of weighting their welfare as heavily as his own), will not take fully into account in deciding whether to assume the risk of contracting AIDS by having unsafe sex with A. Of course C, D, and E can protect themselves against AIDS by practicing safe sex, but safe sex is neither costless nor perfectly effective. So there is a negative externality.

There may be a subtler such externality as well. Remember that we are assuming that unsafe sex between either persons neither of whom have the virus or persons both of whom have it creates no risk of spreading AIDS; only unsafe sex between a person who does have the

¹¹ With the qualification that if a perfectly effective vaccine is available at low cost, everyone can protect himself by being vaccinated and therefore a person who is not vaccinated does not impose a significant cost on anyone else. Dagobert L. Brito, Eytan Sheshinski, and Michael D. Intriligator, "Externalities and Compulsory Vaccinations," 45 *Journal of Public Economics* 69 (1991).

virus and a person who does not have it creates a risk. Net social welfare might be enhanced if all the members of the last group were distributed between the first and the second groups (the further spread of the disease would be prevented), an outcome that would be facilitated if everyone knew both his AIDS status and that of his sexual partners. But until a cheap and accurate test for the virus is developed that can be administered on the spot to one's sexual partner, the market cannot be relied on to perform the sorting function adequately, because of the difficulty of *credibly* signaling to a sexual partner that one is not infected. Therefore a mechanism for compelling this information could in principle confer an external benefit.

The issue of public policy presented by such proposals is often framed as a tradeoff between the economic gains from intervention—that is, reduced costs of AIDS—and ethical or emotional costs that resist quantification, such as infringement of personal freedom or privacy.¹² Most people have a strong aversion to the compelled disclosure of intimate facts about themselves, such as their disease status, especially when that status enables inferences to be drawn about their sexual behavior or preference. And there is a broader concern with governmental intrusiveness. But we shall see next that there are potentially heavy *economic* costs to several of the most popular forms of actual or proposed intervention, notably mandatory testing, so that even without regard to privacy and civil liberties considerations a number of proposed interventions are dubious from a social welfare standpoint, at least given the current technology of HIV testing.

IV. Mandatory Testing and Other Possible Interventions: Herein of “Optimal Taxation” of AIDS

Mandatory Testing. The key to normative economic analysis here is the private demand for voluntary testing. Mandatory testing¹³ affects only

¹² See, for example, Roger Crisp, “Autonomy, Welfare and the Treatment of Aids,” 15 *Journal of Medical Ethics* 68 (1989); Carol A. Tauer, “AIDS: Human Rights and Public Health,” 10 *Medical Anthropology* 177 (1989).

¹³ With disclosure to the person tested. If the mandatory disclosure were also to the person's actual and potential sexual partners, the effects on the further spread of AIDS would be dramatic, but it is doubtful that there is a politically acceptable method of compelling such disclosure. Tattooing would do it but is not politically acceptable. (Here then is an example where what we termed ethical or emotional factors would generally be considered decisive against a possibly efficient intervention.) In Part II, however, we

persons who decide not to test voluntarily, so if our analysis in Part II is sound, it will have less effect on altruists than on egoists. Not zero effect, because altruists who have a strong aversion to the possibility of learning that they are doomed to develop a fatal disease will not test voluntarily. Instead, however, they will practice safe sex to protect their partners (as well as themselves), unless they have a very strong aversion to safe sex as well. Forcing altruists to be tested, therefore, will impose disutility on them without affecting the spread of the disease commensurately.¹⁴

The benefits of mandatory testing depend, therefore, on the impact on egoists—and the startling implication of our analysis is that, from the standpoint of retarding the spread of AIDS, that impact may be perverse. Indeed, it may be socially undesirable for egoists to be tested for the AIDS virus whether voluntarily or involuntarily. Consider a group of egoists who have not been tested, and assume that 10 percent in fact are carrying the virus and that 50 percent (randomly distributed with respect to their AIDS status) engage in safe sex. Then 5 percent will be potential sources of contagion. Suppose now that all are tested and are told the result of the test, so that 90 percent know they are negative and 10 percent know they are positive. To those who are negative, the benefits of safe sex are now greater. Before, each faced a 10 percent probability that safe sex was not benefiting him because he already had the virus; now (for those in the negative group), that probability has fallen to zero. So we can expect a higher usage of condoms in this group. This is a social benefit even though none of the persons in this group is infected now, because some of them might otherwise have become infected in the future and then spread the virus to still other people.

But there is also a social cost to the testing: persons who test positive will stop using condoms (remember, we are considering here just egoists), with the result that the number of HIV-positive egoists who are engaging in unsafe sex will double. The cost in increased infection will probably exceed the benefit, for against the doubling of the number of infected

considered the possibility that disclosure would in effect be compelled by the refusal of persons who test negative to engage in unsafe sex with anyone who, by failing to demand safe sex, reveals himself as probably a person who tested positive.

We are aware of only one previous economic analysis of AIDS testing. It does not consider the egoism-altruism issue, which is central to our analysis. David E. Bloom and Sherry Glied, "Benefits and Costs of HIV Testing," 252 *Science* 1798 (June 28, 1991).

¹⁴ We are speaking of today, when the risks of AIDS are well known. Even today, however, there are pockets of sexually active persons—for example, young homosexuals in small towns—who may be poorly informed about the AIDS risk, and they, even if altruists, are potential sources of contagion.

persons engaging in unsafe sex there is only the deferred benefit from the fact that those who are not infected will use condoms somewhat more frequently and by doing so will become infected less and so will spread the disease less in the future.

All this assumes, of course, that HIV-positive persons can find sexual partners among persons who have either tested negative or do not know their HIV status. If the assumption is sound (and it seems empirically supported), there is reason to question the soundness of mandatory testing on strictly economic grounds, without regard to civil-libertarian concerns, concern with stigmatization and discrimination, etc. To the costs of mandatory testing in probably increasing the spread of AIDS must be added the disutility to persons who prefer not to know their disease status and the direct costs of testing. The direct costs (which would include not only the cost of the testing equipment and of the time of the medical personnel who administer it but also the time and aversion of the persons tested against their will) could be very great if high-risk populations such as male homosexuals could not be identified reliably; for then everyone would have to be tested.

The magnitude of the effect of mandatory testing in increasing the spread of AIDS depends on the percentage of persons in the at-risk groups who are egoists. The percentage can be inferred from the behavioral response to disclosure of the results of AIDS tests. Empirical studies find that not everyone who learns that he has tested positive switches to safe sex or informs actual or potential sex partners of his condition. Far from it.¹⁵ The percentage of egoists must therefore be substantial.

So far we have been assuming that there is no penalty to testing positive for the AIDS virus beyond the disutility of discovering that one is doomed. But there may be a penalty. Suppose a person who tests positive cannot obtain life or medical insurance, or will lose his job, or (if a doctor or dentist, for example) will have his professional opportunities curtailed. Such penalties operate as a tax on voluntary testing, and should therefore reduce the amount of testing by both altruists and egoists. This may be a good thing. Altruists, not knowing whether they are infected, will be more inclined to practice safe sex to protect their sexual partners. Egoists, also not knowing whether they are infected, will practice safe sex to protect themselves. Remember that we don't *want* egoists to test.

¹⁵ Robin Fox et al., "Effect of HIV Antibody Disclosure on Subsequent Sexual Activity in Homosexual Men," 4 *AIDS* 241 (1987); Godfried J.P. van Griensven et al., "Impact of HIV Antibody Testing on Changes in Sexual Behavior among Homosexual Men in the Netherlands," 78 *American Journal of Public Health* 1575 (1988).

This is just another example of our main point, which is that, contrary to intuition, encouraging HIV-testing, whether by compelling it or by reducing the penalty for testing positive, may increase rather than limit the spread of the disease. A complication is introduced, however, if we are concerned with nonsexual means of transmission, such as from a medical worker to a patient. If there is no cheap equivalent to safe sex that will protect the patient, the penalty on medical workers who test positive may induce many of them not to test, even if they are altruists (it depends on their degree of altruism). This is an argument that *if* testing positive is to be penalized, the testing should be mandatory.

The analysis to this point can be restated in terms of taxation, viewed of course as a regulatory rather than as a revenue-raising device. Given that AIDS is more likely to be spread by egoists than by altruists, it would be nice if we knew who was who and taxed (or subsidized) accordingly. For example, we could in principle anyway permit only altruists to test, or to receive AZT; or we could condition AZT for egoists on their (somehow enforceable) promise not to engage in unsafe sex save with HIV-positive persons. (More on AZT below.) Lacking the necessary information, our regulatory options become blunt and limited. Mandatory testing operates as a tax on both altruists and egoists, but while it induces some altruists to avoid unsafe sex (those who would not have tested voluntarily because of their aversion to the test, would not have used condoms because of their aversion to condoms, and under the regime of mandatory testing test positive), it may induce many egoists to forgo safe sex. Subsidizing condoms is a straightforward subsidy of safe sex, but the corresponding tax on unsafe sex is not easy to devise.

Subsidizing AZT. The implications of our analysis are not limited to the issue of mandatory testing and are not invariably “liberal.” If the analysis is sound, *anything* that increases the number of egoists who are tested for the AIDS virus is questionable from a social standpoint, other things being equal. Consider therefore the social desirability of subsidizing the development of a drug with the following properties (AZT is the best-known example): (1) it does not cure AIDS or eliminate the virus, but it prolongs the life of the sufferer; (2) it is more effective in prolonging life, the sooner it is administered after a person has become HIV-positive; (3) it is costly, whether because of high price or rationing or because of side effects.¹⁶ The availability of such a drug will have three bad effects from a

¹⁶ The significance of the third condition is that otherwise every sexual active person would take the drug, without bothering to test for the presence of the virus.

social standpoint. It will reduce the expected costs of unshielded sex, by extending the latency period of the disease; this may have significant effects on persons who may have a high discount rate, and they may be overrepresented in the high-risk group anyway.¹⁷ It will encourage egoists to test, by conferring on them a private benefit from testing (remember that the drug is more effective, the earlier you discover you're HIV-positive), and we have said that this is likely to increase the spread of the disease. And it will prolong the period in which AIDS carriers, *known to themselves to be so*, are sexually active—and remember that egoists who know they are carrying the virus will not engage in safe sex. Of course, these costs must be compared with the benefits in longer life for AIDS sufferers—many of whom are altruists, who we are assuming do not spread the disease. The higher the fraction of altruists, therefore, the more likely the drug is to confer a net social benefit.

The suggestion that public subsidization of medical treatment of AIDS may be perverse from a social standpoint may itself seem perverse. We have said that AIDS is a source of negative externalities, and it might seem to follow that subsidizing medical research on AIDS must confer a positive externality. But there is a vital difference between prevention and treatment. A reliable AIDS vaccine would be a public good and so would be subsidizing the use of condoms, through sex education and through making condoms readily available at zero price. And a cheap, swift, reliable cure for AIDS would reduce the negative externalities from AIDS to manageable, perhaps trivial, proportions. But a noncurative treatment can, as we have shown, increase the incidence, and quite possibly the social costs, of the disease.

Mandatory Testing within Selected Occupational Groups. This is being done already for military personnel and is under consideration by Congress for medical workers. The usual sequel to testing positive under such a program is exclusion from the occupational group or other curtailment of vocational opportunities. (We discussed earlier the penalty aspect—exclusion—without mandatory testing.) To the extent that people earn rents in these occupations, mandatory testing increases the expected costs of AIDS to them. But the increase is probably small, the forgone rents being swamped by the nonpecuniary costs of infection with the AIDS

¹⁷ If having a high discount rate is positively correlated with poverty (as argued in an unpublished paper by Gary Becker) which in turn is negatively correlated with education. The principal cost of AIDS is the cost in ill health and eventual death, and may be underrated by poorly educated persons. Such persons may also be ignorant of preventive methods other than abstinence—the costliest method.

virus. Exclusion of HIV-positive individuals from preferred occupations is not quite so futile a deterrent measure as criminal punishment for persons who infect others with the AIDS virus—since by the time their crime is discovered and they are prosecuted they will probably be dead—but the net increment in the deterrence of unshielded sex must be very small. In fact it may well be negative, since persons excluded from an occupation are not thereby rendered sexually inactive.¹⁸ Mandatory testing in selected occupational groups will have the same qualitative effect as universal mandatory testing: it will increase the spread of the disease by its effect on the incentives of egoists to engage in unsafe sex, and that effect is likely to outweigh the effect in increasing the expected cost of AIDS by adding a lost rent to the other costs of AIDS.

Liability. When we brushed aside the proposition that criminal or tort liability for knowingly or recklessly infecting another person with the AIDS virus could play a significant role in coping with the AIDS crisis, we were again being counterintuitive; the imposition of sanctions on persons who impose negative externalities is a conventional method (though Coase showed it is not invariably the most efficient method) of dealing with externalities. But as a person infected with AIDS is already as it were on death row, threatening him with criminal or civil sanctions is unlikely to weigh heavily in his decisions. However, it does not follow that effective sanctions for refusing to test under a regime of mandatory testing are infeasible. Most persons taking the test don't know whether they are HIV-positive—whether they are on death row. Therefore the expected cost of the sanction is discounted by a probability, ordinarily much lower than 1, that the test result will be positive.

Entry Controls. We consider last whether as under existing law HIV-positive persons should be denied immigrant or visitor visas. Despite the criticisms leveled against this policy, it is more attractive from an economic standpoint than mandatory testing. With mandatory testing, no direct restriction is placed on the sexual activity of those who test positive, whereas HIV-positive persons barred from entering the U.S. are thereby rendered sexually inactive in this country. Assuming that the relevant community whose welfare is to be maximized is limited to the U.S., the cost to excluded immigrants falls out of the picture, although there may be some costs to Americans who would have transacted with them (whether sexually or nonsexually) if they had been permitted to enter. Compared to

¹⁸ The results would be utterly perverse in a conscript army in time of war!

mandatory testing, then, the benefits of excluding HIV-positive foreign visitors or immigrants are larger and the costs smaller.

But there is a complication, buried in our reference to costs to persons who would have transacted with the immigrants. If HIV-positive homosexuals (say) are excluded from the U.S., this will reduce the supply of potential sex partners to American homosexuals and may cause some of the latter to travel more abroad and (or) when traveling abroad to engage in greater sexual activity. As a result they may become infected and they will carry the virus back to the U.S. and perhaps infect other Americans with it. The broader point is that unsafe sex is traded in an international market, and controls over immigration address only one aspect of that trade.

It is interesting to note that if and when the incidence of AIDS declines in this country, immigration and entry controls may become more rather than (as one might think) less attractive as a policy instrument from an economic standpoint. The more persons there are within a country who are infected, the smaller are the disease costs from allowing free entry of foreign visitors, since the foreign visitors who are HIV-positive will be only a small fraction of the total sources of infection to the country's uninfected population. If the disease were totally eliminated among the native population, the benefits from excluding all HIV-positive visitors might be very great: might be equal, in fact, to the costs of a restarted epidemic. The analogy is to England's strict policy of quarantining, for signs of rabies, animals brought into the country. Since England is rabies-free, the potential disease cost created by even one unquarantined animal is high, as it would not be in the U.S., where rabies is already widespread among the native animal population.

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