Routine Screening for HIV Infection — Timely and Cost-Effective

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In the United States, HIV infection is generally discovered at an advanced stage, usually in the course of medical care and often during care for complications of AIDS. Earlier diagnosis would be far preferable, because it could speed access to appropriate care and increase the proportion of HIV-infected patients receiving care, thereby improving the quality of care for persons and populations.[1]

Two articles in this issue of the *Journal* indicate that widespread use of routine screening could offer these benefits and more at a reasonable cost. Paltiel and colleagues[2] and Sanders and colleagues[3] both predict that widespread use of routine screening will yield substantial benefits for HIV-infected patients. Paltiel et al. estimate that the average CD4 count at the detection of HIV infection would rise from 154 to 210 cells per cubic millimeter and that the proportion of cases diagnosed at the time of an opportunistic complication would drop. These factors are important, because earlier access to antiretroviral therapy is likely to make it easier to suppress viral replication, improve immunity, and reduce drug-related adverse effects.[4] Consistent with this outcome, both studies estimate that the effects of screening would extend survival by 1.5 years for the average HIV-infected patient.

These gains would come at a reasonable cost. The Centers for Disease Control and Prevention has recommended the routine use of screening in populations with a prevalence of HIV infection of 1 percent or greater. In such a population, Sanders et al. and Paltiel et al. estimate that the cost of one-time screening is $41,736 and $38,000 per quality-adjusted life-year gained, respectively; both estimates are less than the commonly cited threshold for cost-effective care of $50,000 per quality-adjusted life-year gained. Cost-effectiveness changes with the prevalence of disease. Paltiel and colleagues estimate that in high-risk populations (those with a 3 percent prevalence of HIV infection), the costs would decrease to $38,000 per quality-adjusted life-year gained, and in the general U.S. population (which has a 0.1 percent prevalence of HIV infection), the costs would increase to $113,000 per quality-adjusted life-year gained. Repeated testing decreases efficiency, since it detects only incident cases. Given a 3 percent prevalence of HIV infection,

Paltiel et al. estimate that testing every five years would cost $50,000 per quality-adjusted life-year gained, and testing every three years would cost $63,000 per quality-adjusted life-year gained. Overall, these results indicate that widespread use of HIV screening is consistent with commonly accepted standards for clinical practice when the prevalence of HIV infection is 1 percent or higher and that testing at five-year intervals may be a reasonable approach in some populations.

Shifting from an individual to a public health perspective, these studies indicate that the benefits of screening extend to society generally. Sanders et al. estimate that routine one-time screening would reduce the annual rate of transmission by slightly more than 20 percent.[3] Incorporating this effect on transmission into their model increases survival, lowers overall costs, and dramatically improves the cost-effectiveness of screening from $41,736 to $15,078 per quality-adjusted life-year gained in a population with a 1 percent prevalence of HIV infection. Furthermore, in the analyses that incorporated the effects of screening on transmission, the cost of routine HIV screening did not surpass $50,000 per quality-adjusted life-year gained until the prevalence fell to half that of the general U.S. population, or 0.05 percent.

In keeping with standard practice, these models do not incorporate certain secondary benefits of screening, even though some can be quite important. Preservation of health and reductions in transmission will reduce productivity lost as a result of HIV infection. The averted losses represent savings that, from society's perspective, can partially cancel out the direct expenditures. Because the indirect costs of HIV disease are substantial, the true economic costs of screening are far lower than reflected by direct expenditures. Greater knowledge of infection rates across facilities and regions will improve the allocation of resources to treat and prevent HIV infection. Earlier institution of HIV-prevention measures will help combat the epidemic of other sexually transmitted diseases. Most provocatively, reductions in transmission may appreciably reduce the effective person-to-person transmissibility (known as R) of HIV. If substantial, this effect will increase the likelihood that measures

such as a partially effective vaccine will decrease the rate of transmission to less than one new infection per infected person (i.e., R less than 1) and eventually extinguish the epidemic.

The models also do not incorporate certain negative effects of screening. The complexity of screening programs will vary according to type and setting, and operational difficulties could cause the total costs of such programs to exceed those assumed in these studies. The need for counseling of patients will divert clinic staff from other tasks. At some sites, much of this counseling will be for false positive results, even given the low expected rate of only 1 false positive result per 200,000 persons screened in the general population. The strain on clinic budgets and the budgets of certain programs (e.g., the AIDS Drug Assistance Program) will increase. Fear of HIV screening may lead some patients to avoid needed care for other conditions. For these reasons, screening programs should be routine but not mandatory, should pay scrupulous attention to patients' privacy, and should be supported by new resources.

Examining the models used in the two studies provides further insights. Sanders et al. used a Markov model that manipulates fractions of the whole population to track the course of groups of like patients.[5] Paltiel et al. used a microsimulation model that evaluates the course of many individual patients and then aggregate the resulting data to the population level.[6] The credibility of these authors' conclusions is greatly enhanced by the similarity of findings from the two different models. In their sensitivity analysis, Sanders et al. showed that the effectiveness of preventive measures greatly influences overall cost-effectiveness. Paltiel et al. showed that a 50 percent decrease in access or adherence to antiretroviral therapy leads to a 33 percent increase in cost per quality-adjusted life-year gained and that improving the linkage between testing and care increases the gains in survival without affecting the cost-effectiveness ratio. Overall, these relationships suggest that programs should optimize the linkage between obtaining specimens for testing and delivery of results, entry into appropriate care, access to antiretroviral therapy, and receipt of effective preventive measures.

The findings of Paltiel et al. and Sanders et al. show that, given the availability of effective therapy and preventive measures, it is possible to improve care and perhaps influence the course of the epidemic through widespread, effective, and cost-effective screening. Routine, one-time HIV screening linked to high-quality clinical and preventive services should be instituted, starting in high-prevalence areas. Screening programs should be based in health care settings in order to minimize the complexity and stigma of such programs and to exploit the fact that 81 percent of adults in the United States see health care providers at least annually.[7] The use of more aggressive screening programs outside of the clinical setting is justifiable for subpopulations with limited access to care. Such programs will have a relatively high yield but must be designed with great caution to avoid difficulties related to the use of profiling, the stigma of testing, and community acceptance. Repeated screening should be considered for high-risk populations, and its value in other populations should be reassessed after one-time screening programs have been firmly established. Failure to implement widespread routine screening for HIV infection represents a critical disservice to patients who are currently infected, those at risk for infection, and the future health of the nation.

1. Measuring what matters: allocation, planning, and quality assessment for the Ryan White CARE Act. Washington, D.C.: National Academies Press, 2004:188-220.
2. Paltiel DA, Weinstein MC, Kimmel AD, et al. Expanding HIV screening in the United States — an analysis of cost-effectiveness. N Engl J Med 2005;352:586-95.
3. Sanders GD, Bayoumi AM, Sundaram V, et al. Cost-effectiveness of screening for HIV in the era of highly active antiretroviral therapy. N Engl J Med 2005;352:570-85.
4. Holmberg SD, Palella FJ Jr, Lichtenstein KA, Havlir DV. The case for earlier treatment of HIV infection. Clin Infect Dis 2004;39:1699-704.
5. Sonnenberg FA, Beck JR. Markov models in medical decision making: a practical guide. Med Decis Making 1993;13:322-38.
6. Statistics Canada home page. (Accessed January 3, 2005, at http://www.statcan.ca.)
7. Lethbridge-Çejku M, Schiller JS, Bernadel L. Summary health statistics for U.S. adults: National Health Interview Survey, 2002. Series 10. No. 22. Washington, D.C.: Government Printing Office, 2004. (DHHS publication no. (PHS) 2004-1550.)