EDITORIAL COMMENTARY

Potential Impact and Cost-effectiveness of Self-Testing for HIV in Low-Income Countries

Benjamin P. Linas\textsuperscript{1,2}
\textsuperscript{1}Boston Medical Center, and \textsuperscript{2}Boston University Schools of Medicine and Public Health, Massachusetts

(See the major article by Cambiano et al on pages 570–7.)

Scale up of antiretroviral therapy (ART) in resource-limited settings has changed the face of human immunodeficiency virus (HIV) infection and dramatically reduced HIV-related mortality \cite{1}. Despite major progress, however, approximately 50\% of HIV-infected persons who live in resource-limited settings do not yet know their HIV status \cite{2}. Efforts to reduce the burden of HIV infection therefore require interventions to expand the reach of HIV screening.

Although there are multiple barriers to HIV screening, one important barrier at the health system level is the fact that, historically, most countries implement HIV screening though a provider-based model of standard voluntary counseling and testing (VCT) \cite{3}. Such screening requires that individuals present to a screening site (or allow a dedicated counselor and tester into the home), that providers offer the screening test, and that patients return for results of screening. In addition, the need for a professional HIV counselor creates a potential bottleneck, limiting the capacity to screen for HIV. This model is costly, and loss to follow-up along the HIV cascade of care is well documented \cite{1}.

HIV self-testing could reduce barriers to screening, increase the number of people aware of their HIV infection, and ultimately result in a greater percentage of the HIV-infected population having a suppressed HIV load \cite{4}, likely lowering the incidence of new HIV infections. Self-testing may be more convenient than provider-based screening, and potentially reduce the role of stigma in a patient’s choice to be screened. Furthermore, self-testing is less costly than provider-based screening, at least for the majority of people who have a negative result of HIV screening. It is therefore a reasonable hypothesis that HIV self-testing may both improve HIV outcomes and provide good value for the money for a ministry of health with a constrained budget.

In this issue of \textit{The Journal of Infectious Diseases}, Cambiano et al present the results of a model-based cost-effectiveness analysis, set in Zimbabwe, of expanding self-testing for HIV, compared with the current standard of provider-driven HIV testing and counseling (PHTC) \cite{5}. Using an established simulation model of HIV incidence and outcomes, the authors compared quality-adjusted life expectancy changes (measured in disability-adjusted life-years [DALYs] averted) and costs of expanding self-testing as compared to making no change and continuing with the current standard of PHTC. The following assumptions were important to the analysis: (1) the introduction of HIV self-testing results in a halving of the population who are unwilling to receive an HIV test and a 20\% increase in the rate of first-time screening for HIV; (2) self-testing is somewhat less sensitive and specific than PHTC (data on diagnostic characteristics of self-tests were taken from the Orasure package insert); (3) negative results of self-tests are less costly than negative results of tests received through PHTC, but positive results of self-tests are more costly than positive results received through PHTC (the bottom-line costs for positive self-test results include the extra cost of confirmatory testing by PHTC); (4) follow-up of positive self-test results is imperfect, owing to losses to follow-up related to self-testing; and (5) the model includes a secular trend toward more PHTC testing over time and considers various degrees of substitution of self-testing for PHTC.

With these assumptions, the authors found that, compared with the current standard of care, expanding HIV self-testing would be associated with a 20-year net savings of $75 million (discounted) and a very slight improvement in outcomes (7 DALYs avoided). Because self-testing both saves money and improves outcomes, it is a dominating strategy—it is cost saving and should be adopted no matter how few resources are available for HIV testing.

Just beneath this headline finding, however, is a more nuanced story of opportunity—and risk. Self-testing likely would expand HIV screening and reduce costs, and it could possibly improve population-level outcomes as well, but the analysis by Cambiano et al also includes many feasible scenarios in which self-testing results in outcomes that are
worse than those of the current standard of care. For example, if the sensitivity and specificity of a self-test are substantially worse than reported in the package insert, if follow-up for confirmatory testing of an individual with a positive self-test result is poor, or if ART initiation is delayed, then self-testing results in the accumulation of additional DALYs, compared with the current standard of care.

In many of the scenarios in which self-testing led to worse outcomes than PHTC, it was still found to be cost-effective, compared with PHTC. The findings are valid, but it is important to explore them further and to note that the outcomes differ from the pattern to which we have grown accustomed in HIV-related cost-effectiveness research. Most often, analyses of the cost-effectiveness of major HIV interventions, such as routine screening for HIV infection [6-8], interventions to improve follow-up along the HIV cascade of care [9, 10], or ART itself [11, 12], demonstrate that those new interventions both improve outcomes and add cost. It is the goal of cost-effectiveness analysis to determine whether that additional spending produces adequate benefit to be considered a good value for the money invested. The ratio of added cost to added benefit is the incremental cost-effectiveness ratio. When the incremental cost-effectiveness ratio falls below an accepted threshold for the amount that we, as a society, are willing to pay to save an additional year of life, we say that the intervention is a good use of resources, or cost-effective.

In this case, however, we find ourselves in the opposite position. In many scenarios, self-testing is associated with slightly worse outcomes than the standard of care but has substantial cost-savings. Because the decrement in outcomes is very small but the savings are large, it no longer makes economic sense to invest resources in expanding PHTC because we will get little benefit from that investment. Instead, we should fund more self-tests, even though outcomes might be just a little worse than they would have been had we stayed with the current standard of care.

We could reinvest the resources we save in some other HIV- or health-related intervention and get more value from them.

From an economist’s perspective, it does not matter why self-testing has an appealing incremental cost-effectiveness ratio. By moving to self-testing and lowering costs, a ministry of health could use the savings to implement other effective HIV-related programs that provide better value for money than PHTC. The combination of self-testing plus reinvestment of resources saved into effective HIV-related programs would result in better population-level outcomes than using available resources for PHTC. In the real world, however, resources are not always so fungible, and it is not clear that potential cost savings generated by self-testing would be reinvested in other HIV-related programs.

Another option to reduce costs might be to eliminate posttest HIV counseling for patients who have a negative result of screening. One of the main reasons that self-testing provided good economic value in the analysis by Cambiano et al was that it provided a substantially less costly means of ruling out HIV infection among individuals without disease. Studies in the United States find that eliminating posttest counseling for HIV-negative patients is cost saving [13, 14]. Eliminating posttest counseling for HIV-negative patients in resource-limited settings, therefore, might reduce the cost of PHTC, making possible broader implementation and better outcomes than were projected assuming the availability of self-testing. This article does not specifically address the cost-effectiveness of self-testing versus provider testing without counseling for HIV-negative patients, but it does demonstrate that as the cost difference between self-testing and PHTC narrows, cost-effectiveness conclusions change.

Thus, stakeholders and decision makers need to read this important study with a sophisticated eye. To come away from the article with only the top-line message that self-testing improves outcomes and saves costs misses several very important implementation messages. First, self-testing should likely be implemented only when it can be coupled to adequate monitoring and evaluation of real-world HIV screening test characteristics and follow-up along the HIV cascade of care. Self-testing is not always cost-effective. Blind faith that self-testing will work could result in one of the scenarios in which self-testing was not a cost-effective intervention. Second, self-testing is not a panacea. In this simulation analysis, self-testing did not result in large gains in ART scale-up and HIV survival. In fact, in many situations, self-testing is not even a way to improve HIV outcomes.

Rather, self-testing should be viewed as a way to reduce cost with little or no impact on public health. Third, one important way to realize the benefits of self-testing is to reinvest the savings generated by self-testing into highly cost-effective HIV-related interventions.

Effective ART, improved life expectancy, and adequate healthcare infrastructure make it possible to now consider wide-scale availability of HIV self-testing in resource-limited settings. This important article by Cambiano et al provides insight into what self-testing is likely to be and likely not to be. Most importantly, this detailed and thoughtful simulation study provides critical understanding of what matters for successful implementation of self-testing. With these findings, stakeholders will be well informed as they consider the role self-testing should play in their countries.

Notes

Financial support. This work was supported by National Institute of Drug Abuse R01 DA031059.

Potential conflict of interest. Author certifies no potential conflicts of interest.

The author has submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Conflicts that the editors consider relevant to the content of the manuscript have been disclosed.

References


