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Different Positive Predictive Values of Commercially Available Human Immunodeficiency Virus Enzyme-Linked Immunosorbent Assays

We report our findings concerning the positive predictive values (PPVs) of commercially available human immunodeficiency virus (HIV) antibody tests in an evaluation of HIV prevalence in Peru. The specificity of enzyme-linked immunosorbent assays (ELISAs) varies according to multiple factors, including antigen characteristics, avidity of serum antibodies, patient comorbidities, and specimen processing (2–4). Despite high test specificity, our study found significant variability in the PPVs of several commercially available HIV ELISA kits.

As part of a large HIV/STD Collaborative Prevention Trial sponsored by the U.S. National Institute of Mental Health (NIMH) and conducted by the NIMH Collaborative HIV/STD Prevention Trial Group, two population-based surveys were performed to evaluate the prevalence of HIV type 1 (HIV-1) infection and sexually transmitted diseases (STDs) in Lima, Peru, and in northern Peru in 2001 and 2003. While the 2001 study (survey 1) evaluated the general population, the 2003 study (survey 2) examined groups at higher risk for infection. Sera were screened by ELISA for antibodies to HIV-1 using Vironostika (bioMerieux, Inc., Durham, NC) and for antibodies to HIV-1/HIV-2 using Genscreen Plus Ag-Ab (Bio-Rad Laboratories, Marnes la Coquette, France) or Genetic Systems (Bio-Rad Laboratories, Hercules, CA). We confirmed ELISA-positive samples by HIV-1 Western blotting using New Lav Blot I (Bio-Rad France) or Genetic Systems (Bio-Rad USA). Due to several reported "indeterminate" results in survey 1 using New Lav Blot I, these samples were retested with Genetic Systems Western blot kit. ELISA-positive samples in survey 2 were confirmed by using only the Genetic Systems Western blot kit. Results from the Genetic Systems assay were used as the gold standard for determining PPVs in subsequent calculations. The absence of reported cases of HIV-2 in Peru to date obviated the need for HIV-2-specific Western blot analysis. All samples were processed at the U.S. Naval Medical Research Center Detachment (Lima, Peru) by skilled technicians and were subject to rigorous quality control standards. All of the tests used were reported to have a specificity at or close to 99% in manufacturers' trials and in surveys of available tests published by the World Health Organization and the Centers for Disease Control and Prevention (1, 5). The PPV of the Vironostika assay, however, was significantly higher than the PPVs of the Genscreen test in survey 1 (100.0% versus 62.8% [$P = 0.001$]) and the Genetic Systems test in survey 2 (98.3% versus 85.2% [$P = 0.009$]) (Table 1). The PPV of the Vironostika assay was statistically comparable in the two surveys despite the lower prevalence of disease in the general population tested in survey 1 ($P = 1.000$).

Despite optimal test specificity, our study illustrates the drastic variation in the PPVs of these assays when applied to large-scale HIV testing. Seemingly minor differences in test specificity are amplified when used in population-based studies, even in communities with what is considered a relatively high prevalence of disease. These results emphasize the value of selecting an ELISA according to the characteristics of the testing population and the critical importance of confirming any positive ELISA results by Western blot analysis.

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TABLE 1. Test performance of HIV ELISA and Western blot assays in population-based surveys in Peru in 2000 to 2003

Survey, population, and yr	HIV-1 prevalence (%)	ELISA	ELISA result		Western blot confirmation[b]		
			No. of positive sera	PPV (%) (CI [%])[a]	No. of positive sera by New Lav Blot I	Genetic Systems	
						No. of positive sera	No. of negative sera
Survey 1, general population, 2001 ($n = 1,363$)	1.6	Vironostika	22	100 (81.5–100)	22	22	0
		Genscreen	35	62.8 (44.9–78.0)	22 (13)	22 (0)	13 (13)
Survey 2, higher-risk communities, 2003 ($n = 1,255$)	4.6	Vironostika	59	98.3 (89.7–99.9)	ND	58	1
		Genetic Systems	68	85.2 (72.8–91.3)	ND	58	10

[a] CI, confidence interval.
[b] The number of indeterminate results with New Lav Blot I in survey 1 is shown in parentheses. ND, not done.

The study protocol was approved by the Naval Medical Research Center Institutional Review Board (protocol NMRCD.2002.0007 [DoD 31555]) in compliance with all federal regulations governing the protection of human subjects.

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