

Identifying Patients with Undiagnosed HIV Infection: Derivation of the Denver HIV Risk Score

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BACKGROUND

Public health efforts, including the CDC's Advancing HIV Prevention Initiative, have attempted to increase awareness and testing for HIV infection. However, approximately 250,000 people remain unaware of their infections and 56,000 new infections occur annually in the United States.

Despite this, to our knowledge, no rigorously derived and validated clinical risk scoring method has been developed to assess an individual's probability of HIV seropositivity.

OBJECTIVE

To derive and internally validate a meaningful clinical risk score to predict HIV seropositivity among ambulatory STD clinic patients.

METHODS

Design and Setting: Secondary analysis of a large prospective database from the Denver Public Health STD Clinic in Denver, Colorado.

Population: Consecutive STD Clinic patients from 1993 through 2005.

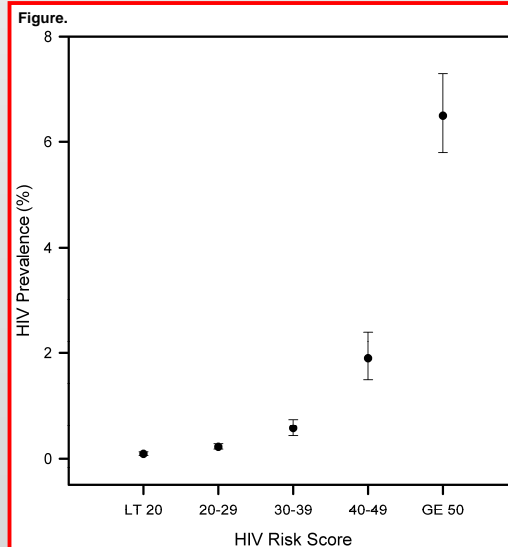
Data Collection: Patients were systematically queried about current symptoms, history of STDs, contraceptive use, sexual behaviors, and other HIV-related risk characteristics. All data were collected and stored using a closed-response electronic data collection process.

Outcome: Newly-diagnosed HIV-infection.

Statistical Methods: Multivariable logistic regression modeling was used to develop a risk score. The bivariate associations of each of 48 potential predictors were assessed and all variables with p-values <0.2 were included in the model. Additional variables previously demonstrated to be associated with HIV infection were also included. Continuous variables were modeled using fractional polynomials. No automated variable selection techniques were used.

Table. HIV Risk Score.

Variable	Score
Age	
<22 or >60 years	0
22-25 or 55-60 years	+4
26-32 or 47-54 years	+10
33-46 years	+11
Sex	
Female	0
Male	+26
Race/Ethnicity	
Black	+8
Hispanic	+3
Other	0
White	0
Sexual Behaviors	
Sex with Male	+21
Sex with Female in Past Year	-6
Sex with HIV-Infected Partner	+5
Type of Sexual Contact	
Vaginal Intercourse	-6
Insertive Anal Intercourse	-3
Receptive Anal Intercourse	+9
Oral Intercourse	-4
Other Behaviors	
Injection Drug Use	+7
Prostitution in Past Year	+7
Past HIV Test	-5
Symptoms	
History of Syphilis	+4
Rash	+5
Genital Discharge	+3



METHODS (Continued)

The final model included all variables that remained statistically associated with HIV infection. The regression coefficients were then multiplied by 10 and rounded to the nearest integer to define the risk score.

Ten-fold cross-validation was performed to assess the validity of the final model.

RESULTS

During the study period, 92,635 patients presented to the STD Clinic and 504 (0.5%) were identified with HIV infection. All patients were included in this analysis.

The final model included age, sex, race/ethnicity, specific sexual contacts and behaviors, injection drug use, prostitution, past HIV testing, history of syphilis, and genital rash or discharge (**Table**).

The score ranges from -24 to +106. HIV seropositivity was 0.09% (95% CI: 0.06%-0.13%) for those with a score <20, 0.22% (95% CI: 0.18%-0.28%) with a score of 20-29, 0.57% (95% CI: 0.43%-0.74%) with a score of 30-39, 1.9% (95% CI: 1.5%-2.4%) with a score of 40-49, and 6.5% (95% CI: 5.8%-7.3%) with a score ≥50 (**Figure**).

The score demonstrated excellent discrimination with an area under the receiver operating characteristics curve of 0.86 (95% CI: 0.84-0.88).

Those patients with a risk score ≥30 included 19% of the total population but resulted in 77% of all new HIV infections identified.

CONCLUSIONS

The risk score identifies groups of patients with increasing probabilities of HIV infection. Accurately assessing the probability of HIV infection would be highly valuable in a variety of clinical settings. Validation of this risk score is required prior to its implementation.

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