HIV testing criteria to reduce testing volume and increase positivity in Botswana

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BACKGROUND

- An estimated 5-15% of the 330,000-370,000 persons living with HIV in Botswana have not yet been diagnosed
- Recent PEPFAR guidance seeks to diminish HIV testing volume and focus testing on higher positivity populations

Objectives

- To define testing criteria to reduce total tests performed and increase positivity in Botswana through creation of a risk score that identifies persons most likely to test positive for HIV
- To compare risk scores derived using 1) routinely collected demographic data and testing strategy with 2) data from new data collection tool with expanded demographic, clinical and behavioral information

METHODS

Data:

- HIV testing data collected in 134 Botswana Ministry of Health & Wellness facilities supported by I-TECH
  - Period 1 (Oct 2018-Aug 2019): 262,230 records
    - Sex (at birth), age, citizenship, testing point, testing strategy
  - Period 2 (Oct 2019-Dec 2019): 15,054 records
    - Above variables plus additional demographics, reason for testing, symptoms, HIV testing history and behavioral risks

Analysis:

- Randomly split each period into equally sized prediction and validation datasets
- Multivariate logistic regression on prediction datasets to identify factors associated with positivity
- Factors with significant adjusted odds ratios ≥1.5 included in the risk score with weight equal to their coefficient from regression
  - All models included strategies and sectors (areas of the clinic) where continued testing was considered essential (e.g. prenatal testing, partner services)
- Applied risk scores to the validation dataset to determine number of tests averted, test positivity, & proportion of positives missed

Costs:

- Costs based on total budgets allocated for HIV testing
  - Testing: includes only costs to procure tests ($2/negative test, $8.5/positive test)
  - Administration: includes staff time ($18/test)

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RESULTS

TABLE 1: Risk Scores Components from Period 1 vs Period 2 Prediction Datasets*

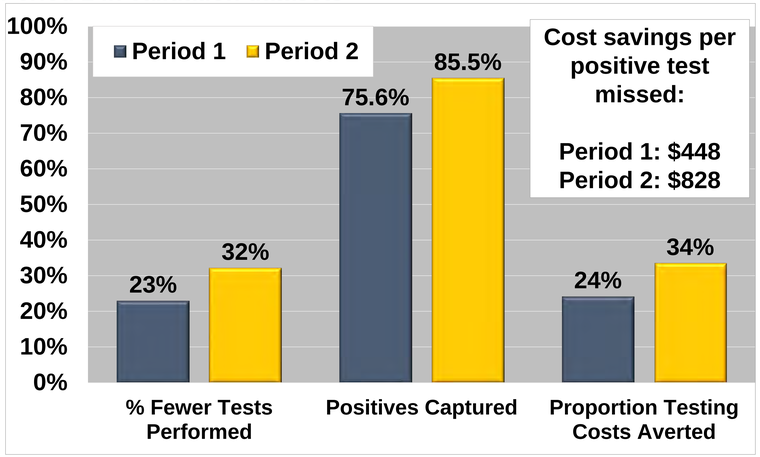
	Period 1 Risk Score (N=99,636) HIV Positivity: 4.1%				Period 2 Risk Score (N=3,890) HIV Positivity: 3.6%			
	N (%) with Risk Factor	HIV Positivity	aOR (95% CI)	Coef.	N (%) with Risk Factor	HIV Positivity	aOR (95% CI)	Coef.
Female Sex	52,131 (52.3%)	4.3%	NS	NS	1,614 (48.7%)	5.0%	2.46 (1.66-3.65)	0.902
Non-Citizen	3,838 (3.9%)	10.9%	2.40 (2.08-2.76)	0.87	241 (6.2%)	12.0%	4.05 (2.42-6.78)	1.40
Age 30-39ᵞ	27,433 (27.5%)	5.5%	1.97 (1.78-2.18)	0.68	1,305 (33.5%)	1.4%	NS	NS
Age 40+ᵞ	23,039 (23.1%)	5.9%	2.17 (1.96-2.41)	1.13	1,045 (26.9%)	4.7%	1.97 (1.13-.3.42)	0.68
Testing Strategy								
Emergency	6,083 (6.1%)	4.9%	1.55 (1.30-1.86)	0.44	602 (8.1%)	6.0%	4.57 (2.12-9.44)	1.52
Condomless Sex with HIV+ Partner**	-	-	-	-	202 (5.2%)	11.3%	3.20 (1.85-5.53)	1.16
TB Symptomsǂ	-	-	-	-	429 (11.0%)	9.8%	3.29 (2.14-5.04)	1.19
HIV Symptomsł	-	-	-	-	112 (2.3%)	11.6%	2.28 (1.14-4.55)	0.82
Divorced	-	-	-	-	29 (<1%)	10.5%	5.56 (1.06-29.10)	1.72
Self-Employed	-	-	-	-	503 (12.9%)	7.7%	3.22 (1.77-5.85)	1.17

*Models exclude persons tested through the following testing strategies & sectors: TB, STD, VCT, partner services, antenatal, labor & delivery, pediatrics malnutrition, gynecology, outreach testing, laboratory testing (Period 1: N=13,479, Period 2: N=3,637)
ᵞ: reference group=20-29 years of age
NS: not significant at $p \leq 0.05$.
- : Variables not captured in Period 1 HIV data: ǂcough, night sweats, fever lasting >2 weeks, weight loss or extreme tiredness łoral thrush, herpes zoster, or swollen lymph nodes ** Since last HIV test

Variables not significantly associated with positivity in Period 1: sex (at birth), testing point, testing strategy
Variables not significantly associated with positivity in Period 2: testing point, STI symptoms, history of recurrent STIs, sex under influence of alcohol, self-reported time since last HIV test, education

Abbreviations: PEPFAR (President's Emergency Plan for AIDS Relief), I-TECH (International Training and Education Center for Health), aOR (adjusted Odds Ratio); STIs (sexually transmitted infections; TB (tuberculosis)

Figure 1. Performance of Risk Scores derived from Period 1 vs Period 2 in validation datasets



- ❖ Application of Period 1 Risk Score reduced the number of tests performed but would have missed ~25% of positives
- ❖ Application of Period 2 Risk score (inclusive of behavioral and demographic risk factors) reduced the number of tests performed by nearly 33%, captured 85% of positives & reduced testing costs

LIMITATIONS

- Previously diagnosed positives may be included in positivity rate
- Test and program costs are estimates
- Limited generalizability; integration of risk score into data collection tools may not be feasible in all settings

SUMMARY

- In Botswana, a targeted approach to HIV testing incorporating HIV and TB symptom assessment may reduce testing volumes by 32% while missing only 15% of positive tests
- The majority of costs savings would come from reduced administrative and program costs per test (estimated $18)

CONCLUSIONS

- A targeted approach to HIV testing requiring new data collection could somewhat reduce testing volumes, but delay HIV diagnoses in ~15% of persons
- Whether implementation of such an approach is worthwhile will depend on operational considerations, whether reductions in testing allows programs to reduce staff or only decrease test procurement, and the value placed on delayed HIV diagnoses

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