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Attributes of diagnostic tests to increase uptake of dual testing for syphilis and HIV in Port-au-Prince, Haiti

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Abstract

Introduction: Syphilis and HIV screening is highly recommended for pregnant women and those at risk for infection. We used conjoint analysis to identify factors associated with testing preferences for HIV and syphilis infection.

Methods: We recruited 298 men and women 18 years and over seeking testing or care at GHESKIO (Haitian Study Group for Kaposi's Sarcoma and Opportunistic Infections) clinics. We created eight hypothetical dual HIV-syphilis test profiles varying across six dichotomous attributes. Participants were asked to rate each profile using Likert preference scales. An impact score was generated for each attribute by taking the difference between the preference scores for the preferred and non-preferred level of each attribute. Two-sided one-sample t-test was used to generate *p* values.

Results: Of 298 study participants, 61 (20.5%) were male. Of 237 females, 49 (20.7%) were pregnant. Cost (free vs. US\$4; *p* < .0001) had the highest impact on willingness to test, followed by number of blood draws (1 vs. 2; *p* < .0001), blood draw method (fingerprick vs. venipuncture; *p* < .0001), test type (rapid vs. laboratory; *p* = .0005), and time-to-result (20 minutes vs. 1 week; *p* = .0139).

Conclusion: HIV and syphilis testing preferences for this study sample in Port-au-Prince prioritized cost, single fingerprick, laboratory-based testing and timeliness.

Keywords

Conjoint analysis, HIV, syphilis, diagnostics, testing

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Introduction

Screening for syphilis and HIV is highly recommended for pregnant women and those at risk for infection.^{1–4} Syphilis is caused by the spirochete *Treponema pallidum*, which, like HIV, can be transmitted through sex, blood, and from mother to child during pregnancy or at birth. The similarities in screening recommendations for HIV and syphilis offer an important opportunity to strengthen prevention programs for the elimination of congenital syphilis along with preventing mother-to-child transmission of HIV infection by means of integrated screening.⁵ Peeling and colleagues commented on the tragedy of babies avoiding HIV through effective prevention of mother-to-child transmission of HIV programs but dying of syphilis because of the lack of screening for syphilis available to the

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women.⁶ Integrated screening could profoundly change medical and public health practice.^{5,7} With a shortened time to diagnosis, patients may be treated and rendered less infectious or non-infectious much quicker resulting in reduced complications from untreated infection as well as the decreased spread of infection to others.

In Haiti, a demographic health survey conducted in 2005–2006 showed a HIV prevalence of 2.3% among women aged 15 to 49 and a 2.0% prevalence among men.⁸ Additionally, in parts of Haiti a significant proportion (7.6%) of pregnant women have serologic evidence of syphilis.⁹ Screening is the main strategy for identifying HIV and syphilis infections. Enhanced control and prevention can be accomplished through increased uptake of testing and subsequent treatment for those infected.

It is imperative to understand the variable determinants of test uptake in order to reduce barriers. Screening and treatment programs that utilize laboratory-based testing have been hampered by limited laboratory access, long turn-around time for results, and loss to follow-up of syphilis-infected individuals.^{10–13} When diagnostic testing involves multiple tests performed off-site, only a proportion of infected individuals receive treatment and continued transmission occurs.^{14,15} There have been several advances in point-of-care diagnostic tests; however, it is unknown what factors are associated with increased preference for testing in Haiti.

Conjoint analysis is a technique that has been used successfully in healthcare and is gaining widespread use.¹⁶ Conjoint analysis is a method for systematically estimating consumer preferences across discrete attributes. It allows for estimation of the relative importance of different aspects of a product or healthcare, the trade-offs between these attributes, and the total satisfaction or preference that participants associate with the product or care. This analytic method is perfect for use in determining preferences of respondents in a low-resource setting like Haiti where informed decisions must be made about how to prioritize limited resources.

In order to understand preferences for the integration of HIV and syphilis testing, we used conjoint analysis to identify factors associated with willingness to test for HIV and syphilis infection.

Methods

We recruited 298 men and women 18 years of age and over seeking sexually transmitted infection, HIV testing or antenatal care at GHESKIO (Haitian Study Group for Kaposi's Sarcoma and Opportunistic Infections) Health Centers between March and July of 2014. Currently, GHESKIO receives about 100,000 patient visits annually, of which most (approximately 70%)

are female patients. Central to the GHESKIO model is the concept that an individual at risk or already infected with HIV should be quickly identified and provided access to a package of services including voluntary counseling and testing, management of sexually transmitted infections, tuberculosis screening and treatment, reproductive health services, HIV care including antiretroviral therapy, and services to prevent mother-to-child transmission of HIV.

We utilized conjoint analysis methods to assess likelihood of testing (willingness to test).¹⁷ The testing attributes were identified using characteristics of existing HIV and syphilis testing strategies.^{7,10,18} Testing attributes included cost (free vs. approximately US\$4), accuracy (no potential for false positive syphilis result vs. potential for false positive syphilis result), time-to-result (20 minutes vs. 1 week), blood draw method (finger prick vs. venipuncture), number of draws (1 vs. 2), and test type (rapid vs. laboratory-based). We created scenarios that describe all possible combinations of attributes to create a hypothetical test profile. Because each attribute has two levels and we have six attributes, there will be 64 (2^6) different combinations that can be made using these attributes. Using the fractional factorial design, we reduced the number of scenarios to eight hypothetical test scenarios across the six dichotomous attributes to measure the main effect of each attribute.¹⁹ This design method assumes no interactions between attributes.

Preferences for the hypothetical test scenarios were determined using an interview conducted by a trained counselor in Haitian Creole. We assessed willingness to test by asking participants to rate how likely they were to test using each individual test profile on five-level Likert preference scales: (1) Very unlikely, (2) Somewhat unlikely, (3) Neutral/Do not know, (4) Somewhat likely, (5) Very likely.

Ratings were converted to 100-point preference scores; higher scores suggest increased willingness to test. The mean of each hypothetical test scenario was determined. An impact score was generated for each attribute by taking the difference between the average preference scores between the preferred scenarios and non-preferred scenarios of each attribute. Two-sided one-sample t-test was used to generate *p* values for the comparisons between the preferred and non-preferred levels for each attribute. Data analysis was conducted using SAS software v9.3 (Cary, NC, USA).

Results

Of 298 study participants, 61 (20.5%) were male. Of 237 females, 49 (20.7%) were pregnant. For the overall population, cost (free vs. \$4; impact score = 27.2, SD = 36.6, $p < .0001$) had the highest impact on willingness to test, followed by number of blood draws (1 vs. 2;

impact score = 17.5, SD = 29.8, $p < .0001$), blood draw method (fingerprick vs. venipuncture; impact score = 9.7, SD = 26.5, $p < .0001$), test type (rapid vs. laboratory; impact score = -4.5, SD = 21.9, $p = .0005$), and time-to-result (20 minutes vs. 1 week; impact score = 3.6, SD = 25.6, $p = .0139$) (Tables 1 and 2).

Additionally, we looked at differences among three groups included in our sample: pregnant women, non-pregnant women, and men. Each of the groups had similar prioritization of attributes. Cost was the most important driving factor for all groups, followed by number of blood draws and sample collection method. However, among the three groups, only pregnant women prioritized time to result (impact score = 17.22, SD = 30.15, $p = 0.0002$). Additionally, males did not prioritize test type (impact score = -2.77, SD = 20.4, $p = 0.2937$), while females did.

Discussion

We used conjoint analysis to determine factors associated with willingness to test simultaneously for HIV and syphilis in Port-au-Prince, Haiti. The study participants in all three groups, males, pregnant and non-pregnant females, prioritized cost and a single blood draw using a fingerprick. It was only pregnant women that prioritized timeliness from specimen collection to result for HIV and syphilis tests. In addition, females prioritized laboratory-based testing while males did not.

We found that the most impactful attribute of HIV and syphilis tests was the cost; this is not surprising in a country where more than half of the population live under the national poverty line of US\$2.42 per day.²⁰ GHESKIO Health Centers offer HIV and syphilis screening free of charge; however, we recommend that screening tests be offered free of charge in other settings around Haiti that are aiming to increase test uptake.

The results of this study can influence the way that people are getting tested for syphilis and HIV. Additionally, groups prioritized one blood draw over two when testing for the two infections and preferred fingerprick specimen collection to venipuncture. Dual rapid tests could be used to meet these preferred methods of testing. Dual rapid tests that have multiple analytes for the detection of antibodies for both HIV and syphilis infections are now available.²¹ Those tests use one drop of fingerprick whole blood and one device to test for two infections in minutes at the point-of-care. Dual tests enable testing for both HIV and syphilis at the same time. There are several advantages of rapid point-of-care tests that include rapid time to result, low cost, minimal equipment, minimal training needed (easy to perform), and suitable for use in non-clinical settings.^{10,11,22-26}

In contrast with our hypothesis, women prioritized laboratory testing over rapid testing that can be performed at the point-of-care. We hypothesized that rapid testing would be preferred; however, we had a negative (but statistically significant) impact score among females, indicating that females preferred laboratory-based testing. One explanation for this is the setting in which the study was performed may have driven this preference. At GHESKIO, most testing for syphilis and HIV is performed in a laboratory/phlebotomy setting even when rapid tests are used. Therefore, the participants could be more comfortable in this setting away from the waiting room and patient rooms. In a study in a US urban hospital, patients reported that they believed the rapid test was less accurate than a laboratory-based test.²⁷ This is perhaps also the case in Haiti, which would highlight the need for appropriate pre-screening education to explain to the patient the utility and high performance of rapid testing.

Table 2. Impact of HIV and syphilis test attributes on hypothetical test acceptability among the total sample in Port-au-Prince, Haiti (N = 298).

Test Attributes	Attribute values	Acceptability of testing with preferred attribute (mean)	Acceptability of testing with non-preferred attribute (mean)	Impact on testing acceptability mean (SD)	p Value
Cost	Free vs. \$4	64.83	37.60	27.22 (36.62)	<0.0001
Number of blood draws	1 vs. 2	59.94	42.49	17.45 (29.80)	<0.0001
Sample collection method	Fingerprick vs. Venipuncture	56.08	46.35	9.73 (26.52)	<0.0001
Test type	Rapid vs. Laboratory	48.97	53.46	-4.49 (21.85)	0.0005
Time to result	20 min vs. 1 week	53.04	49.39	3.64 (25.46)	0.0139
Potential for Syphilis false-positive	No vs. Yes	51.89	50.55	1.34 (23.69)	0.3288

SD: standard deviation.

Scores were converted from preferences described using a five-scale Likert to scores on a 100-point scale.

Table 1. Acceptability (mean) of hypothetical HIV and syphilis tests with different attributes in Port-au-Prince, Haiti (N = 298).

Hypothetical test profile	Test attributes									
	Test acceptability among total sample mean (SD) ^a	Test acceptability among pregnant females (n = 49) (SD) ^a	Test acceptability among non-pregnant females (n = 188) (SD) ^a	Test acceptability among males (n = 61) (SD) ^a	Cost	Potential for Syphilis false positive	Time to result	Number of blood draws	Blood draw method	Test type
1	45.05 (43.41)	33.16 (37.98)	46.94 (44.19)	48.77 (44.12)	Free	No	20 min	1	Finger prick	Laboratory
2	85.91 (30.20)	91.84 (20.66)	84.97 (31.19)	84.02 (33.24)	Free	No	20 min	2	Venipuncture	Rapid
3	66.70 (43.86)	51.02 (47.04)	69.41 (42.98)	70.90 (41.88)	Free	Yes	1 week	1	Venipuncture	Rapid
4	42.11 (45.74)	48.98 (46.20)	39.23 (45.83)	45.49 (45.07)	\$4	No	1 week	1	Finger prick	Rapid
5	35.40 (45.10)	36.22 (45.66)	32.98 (44.36)	42.21 (46.89)	\$4	No	1 week	2	Venipuncture	Laboratory
6	57.97 (46.89)	48.46 (47.16)	58.64 (47.34)	63.52 (44.85)	Free	Yes	1 week	2	Finger prick	Laboratory
7	48.74 (47.99)	44.39 (46.57)	48.80 (48.66)	52.05 (47.50)	\$4	Yes	20 min	1	Venipuncture	Laboratory
8	27.85 (42.89)	19.90 (35.35)	28.59 (44.15)	31.97 (44.28)	\$4	Yes	20 min	2	Finger prick	Rapid

SD: standard deviation.

^aTest acceptability score is based on a five-point Likert scale converted to 0–100 point scale; higher results indicate higher preference.

Overall test acceptability: 51.22 (SD: 25.05).

Overall test acceptability among pregnant women: 46.75 (SD: 19.68).

Overall test acceptability among non-pregnant women: 51.20 (SD: 26.39).

Overall test acceptability among men: 54.87 (SD: 24.38).

We also found attributes of HIV and syphilis tests that are less important to consumers. Participants' willingness to test for HIV and syphilis was not as affected by a potential for false-positive syphilis result. This finding has implications on roll out of dual testing for HIV and syphilis, which can include screening tests that may require further confirmatory testing for positive results.

This study was subject to some limitations. Some of the attributes were not necessarily 100% mutually exclusive. Sample collection method could be related to test type, laboratory-based vs. rapid point-of-care. Therefore, there might be some overlap in attributes even though our analysis assumed independence. However, creating separate attributes for potentially related factors allowed us to parse out the specific impact of a characteristic related to willingness to test. An additional limitation is that participants were presenting to GHESKIO, a site where they had access to free HIV and syphilis testing, making these results less generalizable to other places where the patient population may be unaccustomed to diagnostic access. Another limitation is that we do not have any formal measure of whether participants fully understood the meaning of each choice. Specifically, it would be useful to know whether participants realized that rapid testing implies rapid treatment and would avoid another visit to obtain results. However, the data collection tool was piloted prior to use and was successfully understood among pilot participants. We also suspect that the concept of a false-positive result may not have been fully understood. In order to maximize comprehension on this attribute, we used simple language explaining that there would be a chance the test will show that a patient has syphilis when they do not, and therefore may be treated for syphilis when they do not need to be.

Based on this first study using conjoint analysis in Haiti to detect preferences around attributes of tests for HIV and syphilis, we have found several attributes that affect people's decision about how to test. Future research could look at interactions across the most impactful attributes as well as additional levels of each attribute. For example we used only two levels of cost, free and \$4. Additional levels of cost could be explored to identify a threshold of cost that would be prohibitory.

Conclusions

Our study provides important information on preferences for HIV and syphilis testing, which in combination with studies on test efficacy, cost, and feasibility can help identify best practices for prevention, screening, and treatment to reduce the continued burden of sexual and reproductive health-related diseases, like

HIV and syphilis, in low-resource settings. Other studies have also found that the implementation of an accurate and low-cost integrated rapid testing strategy for HIV and syphilis has been deemed acceptable, often preferred by patients and providers, and has the capacity to improve the rates of screening.^{28–30} Implementation of a low-cost dual rapid test in the laboratory for HIV and syphilis could improve screening uptake and accessibility to accelerate time to treatment in Haiti.

Declaration of Conflicting Interests

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