Predictors of first time and repeat HIV testing among HIV positive individuals in Kenya

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Abstract

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Introduction: Kenya's coverage of HIV testing has doubled over the last decade, yet approximately half of HIV positive individuals were unaware of their infection in 2012. HIV testing in resource-limited settings can be most effective in diagnosing unknown HIV positive individuals through frequent and strategic testing in populations at high risk of infection. An assessment of the frequency of testing and the predictors of first time and repeat testing is critical for monitoring the effectiveness of testing strategies in hard-to-reach populations.

Methods: We conducted a cross-sectional analysis of adults aged ≥18 who tested HIV-positive at 4 HIV testing and counseling clinics in Kenya from February 2015 to February 2016, we categorized individuals based on testing history and used Wilcoxon rank-sum test to assess differences in, intervals between the most recent and current HIV test among repeat testers (intertest interval), and logistic regression to determine characteristics associated with first-time and repeat testing.

Results: Among 1136 people testing HIV-positive, 336 (30%) had never tested for HIV and 70% had tested before, of whom 208 (26%) had previously tested positive. Among previously negative repeat testers, the median intertest interval was 414 days for key populations (IQR=179-1072) and 538 days for the general population (IQR=228-1299) [p=0.0936]. Compared to previously negative repeat testers, being a first-time tester was associated with being age ≥40 years (vs. 18-24 years; adjusted odds ratio [aOR]=2.36, 95% confidence interval [CI]=1.5-3.68),

male (vs. female; 1.89, IQR=1.43-2.51), and being tested through provider-initiated testing and counseling (vs. client-initiated; 0.73, IQR=0.55-0.97).

Conclusions: Our results confirm that there is need to increase HIV testing among older individuals and men in Kenya, increase the frequency of testing in key populations, and maintain efforts to offer provider-initiated and facility-based testing to reach first-time testers.

Keywords: HIV testing; repeat testing; intertest intervals; Kenya

INTRODUCTION

Gaps in HIV testing result in increased AIDS-related mortality and risk of onward HIV transmission (1,2). UNAIDS estimated that almost 40 million people were living with HIV in 2017 globally, of whom 25% did not know their status (3,4). Frequent testing in populations at high risk for HIV and rapid initiation of treatment upon an HIV positive result are critical to achieve global UNAIDS 90-90-90 targets (5). More strategic approaches to HIV testing are increasingly necessary to facilitate more efficient diagnosis of persons in hard to reach populations who have not previously tested and newly infected individuals.

In 2012, an estimated 53% of HIV infected individuals in Kenya were unaware of their infection despite 72% of people aged 15-64 reporting a prior HIV test (6,7). Testing coverage was lowest among men, older adults (55-65 years), people who had never married, and people who did not think they were at risk for HIV (6,7). Kenya has adopted several approaches to increase uptake of HIV testing including provider-initiated testing and counseling, assisted partner services, couple testing, and self-testing (8). Kenya's National HIV Testing Services Guidelines also recommend that the general population test annually and key populations at higher risk of infection such as men who have sex with men (MSM), people who inject drugs (PWID), and sex workers, test every three months (9). Persons newly HIV positive are recommended a second test at an HIV care clinic (known locally as Comprehensive Care Clinics) before enrollment into care and initiation of antiretroviral therapy (ART) (9).

Understanding which populations have never been tested before and the frequency of testing in key populations is critical for monitoring the adherence to guidelines and effectiveness of testing strategies and in hard-to-reach populations. To better understand gaps and potential redundancies in HIV testing and inform approaches for improving the reach and efficiency of testing strategies, we assessed the reasons people seek HIV testing, identified the time intervals between prior and current tests, and determined characteristics associated with prior HIV testing and test results in a population of adults testing HIV positive at HIV testing and counseling (HTC) clinics.

METHODS

Data Sources

This analysis is nested within a larger study that examined the feasibility and acceptability of the integration of an iris recognition biometric identification system into routine HIV counseling and testing in Kenya (10). The parent study included individuals who tested positive for HIV at HTC clinics in four study sites (one rural, two urban, and one peri-urban). The facilities include Kenyatta National Hospital (KNH), Kisumu East District Hospital, Kiambu District Hospital, and Kombewa Sub-County Hospital. Participants completed an adapted electronic version of the Kenyan Ministry of Health's standard-of-care HTC intake form. Data were collected using Open Data Kit (ODK) on a secure android-based data mobile device. Information was uploaded via an encrypted connection, into the National AIDS and STI Control Programme (NASCOP) case-based registry. Eligibility criteria for the parent study included being over 18 years of age, enrollment in no other studies, and providing oral consent. Ethical approvals for the study and secondary analysis were obtained from the University of Washington Institutional Review Board, the Kenyatta National Hospital-University of Nairobi Ethical Review Committee, and NASCOP.

Measures

The MOH intake form collected data on demographic characteristics, risk factors in the last 12 months, reasons for testing, whether the individual has ever tested before and the date of their most recent HIV test. Sociodemographic factors include: age, sex, and marital status. We categorized age as 18-24, 25-39, and ≥40 years. HIV risk factors in the MOH intake form were defined as: occupation as a fisherperson or truck driver; prisoners; men who have sex with men; and exchanging money or other material gain for sex. Participants reporting any of these risk factors were considered members of a key population for this analysis. Participants were asked "Why did you test for HIV today?" and could select one or more of the following reasons for testing: (1) partner tested positive, (2) pregnant or partner is pregnant, (3) starting a new relationship, (4) relationship (e.g. couple testing, separation) that is not new, (5) required testing (for travel, job, medical certificate), (6) provider initiated testing and counseling (PITC) - health worker recommended HIV test (not sick), (7) sought care and health worker recommended HIV test (sick), (8) diagnosed with an STI, (9) sickness that made you worried about HIV, (10) potential exposure to HIV (condom burst, unprotected sex, unknown partner status, blood exposure, rape, assault), (11) wanting to be screened for HIV (no specific reason given), (12) confirm HIV positive test result or enroll in care, and (13) other (specified).

Statistical Analysis

We excluded participants who completed the intake form after the HIV testing visit in an effort to reduce recall bias. The remaining individuals completed the form at the HIV testing visit. We categorized participants into HIV testing groups as follows: participants who reported they had never tested before (first time testing), tested before and reported their last test result was negative (previously negative repeat testing), and tested before and reported their last test result was positive (previously positive repeat testing).

The proportion of participants selecting each reason for testing was stratified by testing group. The intertest interval was defined as the number of days between the most recent HIV test (date self-reported) and the current HIV testing visit as a measure of testing frequency among repeat testers (11). In addition, we compared intertest intervals by result of last test (previously positive vs. previously negative) and, stratified by last test result, whether participants received client-initiated testing and counseling [CITC] vs. provider-initiated testing and counseling [PITC]), whether they were members of a key population vs. general population, and whether they were males exchanging money for sex vs. females exchanging money for sex to assess the adherence to recommended national testing guidelines and protocols using two-sample Wilcoxon rank-sum (Mann-Whitney U) tests.

A logistic regression model was used to compare characteristics associated with being a first time tester versus a previously negative repeat tester. A separate logistic regression model was used specifically among repeat testers to compare characteristics associated with being previously negative versus a previously positive. We considered the following potential predictors: sex, age, marital status, reporting at least one risk factor in the last 12 months, and exchanging money for sex. We included variables with p-values <0.1 in bivariate analyses in the multivariate logistic regression models, and variables with $p<0.05$ were considered significant and calculated odds ratios associated with testing status and presented estimates with 95% confidence intervals. All statistical analyses were conducted using STATA version 15.1 (College Station, TX).

RESULTS

Testing History, Study Population, and Reasons for Testing

From February 2015 to February 2016, 8,794 people tested HIV positive and enrolled in the parent study, of whom 1,136 (13%) completed the HTC intake form at the HIV testing visit and were included in the current analysis. Of the 1,136 participants, 336 (30%) were testing for the first time, and 800 (70%) had previously tested, among whom 592 (52%) reported their most recent test was negative and 208 (18%) reported their most recent test was positive.

The majority of participants were 25-39 years old (52%), female (57%), and in monogamous marriages (51%), approximately half (52%) initiated their HIV test themselves (i.e. CITC), while the other half had a provider initiate their test (i.e. PITC). A higher proportion of participants were enrolled in the study at Kenyatta National Hospital (32%), followed by Kiambu (25%), Kisumu East (25%), and Kombewa (18%). Fourteen percent (14%) of participants were members of at least one key population: 42 (3.7%) reported working as a fisherperson, 30 (2.6%) as a truck driver, 20 (1.8%) being a prisoner, 1 (0.2%) men who have sex with men, and 85 (7.5%) had exchanged money or other material gain for sex (Table 1).

Among individuals testing for the first time, and previously negative repeat testers, the reasons for testing most frequently cited were: sought care and health worker recommended and sickness made participant worried about HIV. Among repeat testers who previously tested positive, most frequently cited reasons for testing were: to confirm positive test/enroll in care and sought care and health worker recommended it (Table 2).

Time since last HIV test

Among the 800 participants who reported a prior HIV test, the median intertest interval was 438 days (interquartile range [IQR]: 146-1103). Previously positive repeat testers reported significantly shorter intertest intervals than previously negative repeat testers (previously positive: median = 142, IQR = 35-552; previously negative: median = 519, IQR = 222-1280; $p<0.001$).

Among participants whose most recent test was negative, the intertest interval did not significantly differ between client- and provider-initiated tests (PITC: median = 493, IQR= 228-1287; CITC: median = 557, IQR = 204-1272; p= 0.83) or by membership in a key population (key population: median = 414, IQR = 179-1072; general population: median = 538, IQR = 228-1299; p= 0.09) [Figures 1 and 2]. Among participants previously testing positive, clients receiving provider-initiated testing reported significantly shorter intertest intervals than those initiating testing themselves (PITC: median = 113, IQR = 34-448; CITC: median = 251, IQR = 44-743; p=0.03) but intertest intervals did not significantly differ by membership in a key population (key population: median = 131, IQR = 33-213; general population: median = 154, IQR = 38-588; p= 0.28) [Figures 3-4].

Among participants previously testing negative, the intertest interval did not significantly differ between female- and male- participants who exchanged money for sex in the last 12 months (Female: median = 240, IQR = 124-851; Male: median = 508, IQR = 244-845; p=0.14). Among participants previously testing positive, the intertest interval did not significantly differ between female- and male- participants who exchanged money for sex in the last 12 months (Female: median = 163, IQR = 24-217; Male: median = 49, IQR = 34-389; p=0.74).

Characteristics Associated with Being a First-time Tester vs. Previously Negative Repeat Tester

Marital status and membership in a key population were not significantly associated with first time testers compared to previously negative repeat testers in bivariate analyses ($p>0.1$). Table 3 presents the results of the multivariate analysis. The adjusted odds ratio of being a first time tester compared to a previously negative repeat tester were significantly higher for males, individuals age 40 years older, and those testing via provider initiated testing and counseling, ($p <0.001$, $p<0.001$; $p=0.029$, respectively) (Table 3).

Characteristics Associated with Being a Previously Positive vs Previously Negative Repeat Testers

Previously positive and previously negative repeat testers did not significantly differ with respect to sex, marital status, and membership in a key population in bivariate analyses ($p>0.1$) Table 4 presents the results if the multivariate analysis, the odds of being previously positive compared to previously negative were higher for individuals testing via client-initiated testing and counseling and for individuals 40 years of age or older ($p=0.016$ for all).

DISCUSSION

In this study of Kenyan adults who tested HIV positive in HIV testing and counseling clinics, we found that a large proportion had a history of testing, and more than one-fourth reported previously testing positive. In Kenya, PEPFAR-supported programs tested over 13 million people between July 2017 and June of 2018, and had an HIV positivity yield of only 1.4% (12). Among these 77% of tests were conducted through provider-initiated testing and counseling (12). In Kenya, the reliability of self-reporting as HIV positive is high, however a self-report as HIV negative has been less reliable, implying that there may be more previously positive testers in our population (14). Self-reported knowledge of HIV status has also been underreported in Malawi and Uganda (13). Our study found that individuals testing via provider-initiated testing and counseling were more likely to be testing for the first-time than to have tested before and report a negative test.

Among people HIV positive who were testing for the first time or had previously tested negative, the most common reasons for testing reported were feeling sick and feeling sick and having a provider recommend testing. Other reasons studies have found that reasons people test for HIV include an unfaithful or a new sexual partner, while this one of the reasons for testing reported in our study, especially among first-time testers, it was not one of the more common reasons (17). Understanding the reasons for testing can improve strategies that aim to increase testing and repeat testing. In our study reasons were primarily motivated by recommendations from health care providers and feeling sick while accessing the health facility. Lack of repeat testing may indicate an underestimation of HIV risk, especially after a previously negative HIV test result (41,42). Studies have demonstrated that higher perceived HIV risk, vulnerability, and risky behavior, is more common in repeat testers than first-time testers (43,44). Investigating external reasons for testing such as social ties may be worthwhile, for example, a study in South Africa, found that having a family or friend living with HIV resulted in a 1.5 increased risk of being a repeat tester (95% CI: 1.33, 1.68)($p<0.001$)(16).

Guidelines recommend annual testing for the general population in Kenya, however, in our study, participants reported a median of 519 days (approximately 17 months) between their last negative test and the current positive test. According to the KAIS, among those unaware of their HIV infection 56% reported having been tested in the past year. A study in South Africa, reported that the median time between the last negative test to a repeat HIV positive test was 2

years (32). Late initiation of treatment after a positive test may be based on the belief that treatment is not urgent because the person's health is "good enough" (35). Fear of stigmatization by family members, poor quality of pre- and post-testing, and financial barriers, are some of reasons people have delayed seeking care after a positive HIV test (33). Structural barriers can also impede access to HIV testing and counseling services, particularly for individuals that hardly interact with the health care system (34). Delays in testing have implications for the onward transmission of HIV, as risk is especially high in individuals with acute infection (36). Linkage to care shortly after a positive test is crucial, as late initiation of antiretroviral therapy results in increased morbidity and mortality (37,38). Approaches to shorten time to test in populations first-time and repeat testing are important and strategies such as self-testing with optional home initiation of care have shown an increase in ART initiation in HIV positive adults (39). Task sharing and partner services have also proven effective in increasing uptake of testing and identifying undiagnosed HIV infections (30,40).

We found that older individuals were more likely to be testing for the first-time than to have previously tested negative. Similar results have been found in other studies (15–17). This is also consistent with the results from the Kenya AIDS Indicator Survey (KAIS) which demonstrated that testing coverage was lowest for people between 55-64 years of age (50%) compared to the highest coverage for people between 25-34 years of age (85%) (18). Testing efforts may be directed towards these populations since adolescents and young adults contribute to 51% of new infections in Kenya (6). However older adults continue to face barriers to HIV testing. In Western Kenya for example testing in a health care setting was characterized as "hurried" by older adults, while home-based testing was seen as appropriate and supportive (19). Older adults identified the age and gender of a health care provider as important factors in HIV testing, expressing preference for providers of their same sex and of an older age (19). In rural areas of the U.S., older adults living with HIV have expressed that they are more concerned with old age and other chronic conditions, than with their HIV positive status (20). Health care providers may also assume older adults are not at risk, or not "worth the effort" (21,22). HIV testing for older populations may benefit from strategies that go beyond facility-based testing or integrate treatments of HIV with treatment for noncommunicable diseases (23).

Our study also found that men were more likely to be testing for the first time compared to women, this finding is consistent with much of the literature (15–17,24,25). Globally, almost 70% of adults that receive HIV testing services are women, with most of the testing taking place in antenatal care settings (26). This finding is consistent with the KAIS indicator survey, which found that among those who reported having been tested more than once, 73% were women, and 64% were men (7). Challenges in testing men may be attributed to gender norms that discourage health-seeking behavior and labor opportunities that require men to take extended absences from their homes (27). Perceived risks among men may play a role in testing, in Malawi, outwardly signs of failing health were a key consideration in men's decisions to undergo HTC (28). The provision of multiple self-test kits to women for distribution has been shown the be a safe and viable strategy that promotes HIV testing among male sexual partners in Kenya (29). Assisted partner notification testing has also been shown to increase case-finding of both men and women in Kenya (30). Risk reduction counseling, opt-out policies, and provider-initiated testing are effective strategies in increasing HIV testing of men attending health facilities, and attempts to reach men in community settings have also been identified as opportunities to increase their testing (31).

Limitations

This study is not without limitations. Behavioral risk factors may be underreported, and testing history could be inaccurate. Our study tried to correct for this by excluding participants who reported these data retrospectively, which in turn reduced the sample size. In addition, we were only able to determine one intertest interval, which may not represent trends of repeat testing for participants testing more than once over time. Participants in our cohort were recruited primarily from facility-based HTC which allowed us to estimate gaps in testing in this setting; however, we were not able to assess other HTC approaches, such as home- or community-based approaches.

Conclusion

In summary, older adults (> 40 years) and men were associated with testing for the first time compared to repeat testing previously negative and these populations may especially benefit from more strategic and tailored HIV testing interventions. Future research could focus on the multiple approaches to testing in Kenya through which individuals are first testing and repeat testing. In addition, a better understanding of repeat testers that are already known to be HIV-positive is important from a case-finding standpoint.

The Kenya AIDS Indicator Survey provides valuable data on the status of HIV in the country every 5 years but could benefit from a more case-based surveillance with a unique patient identification system. Such an system could analyze data on HIV testing patterns in a more accurate and timely way, reduce the potential for overestimating the incidence of HIV, and better link the right patients to HIV testing at the right time (18).

Table 1. Characteristics of study cohort

Characteristics	All	First Time Testing	Previously Negative Repeat Testing	Previously Positive Repeat Testing
	1,136	336 (30%)	592 (82%)	208 (18%)
Age				
18-24	176	38 (22%)	110 (63%)	28 (16%)
25-39	590	148 (25%)	331 (56%)	111 (19%)
40+	370	150 (41%)	151 (41%)	69 (19%)
Sex				
Male	483	181 (37%)	217 (45%)	85 (18%)
Female	653	155 (24%)	375 (57%)	123 (19%)
Marital Status				
Single	244	64 (26%)	131 (54%)	49 (20%)
Married Monogamous	576	173 (30%)	311 (54%)	92 (16%)
Married Polygamous	57	14 (25%)	34 (60%)	9 (16%)
Divorced	154	47 (31%)	70 (45%)	37 (24%)
Widowed	105	38 (36%)	46 (44%)	21 (20%)
Circumcised				
Yes	316	110 (35%)	136 (43%)	70 (22%)
No	167	71 (43%)	81 (49%)	15 (9%)
Testing initiated by				
Client	590	147 (25%)	314 (53%)	129 (22%)
Provider	546	189 (34%)	278 (51%)	79 (14%)
Key Population				
Yes	158	42 (26%)	88 (56%)	28 (18%)
No	1,000	300 (30%)	516 (52%)	184 (18%)
Exchanged money for sex				
Male	59	18 (31%)	32 (54%)	9 (15%)
Female	26	4 (15%)	17 (65%)	5 (19%)
Facility				
Kenyatta National	361	70 (20%)	212 (59%)	79 (22%)
Kiambu	289	106 (37%)	116 (40%)	67 (23%)
Kisumu East	282	113 (40%)	125 (44%)	44 (16)
Kombewa	204	47 (23%)	139 (68%)	18 (9%)

Table 2. Reasons for testing cited among each testing group[1]

Reasons	First-time N (%)	Previously Negative N (%)	Previously Positive N (%)
Partner tested positive	34 (10.1%)	50 (8.5%)	8 (4%)
Pregnant or pregnant partner	1 (0.3%)	3 (0.5%)	1 (0.5%)
Starting new relationship	4 (1.2%)	14 (2.4%)	4 (1.9%)
Relationship but not new	19 (5.7%)	43 (7.3%)	10 (4.8%)
Required testing	1 (0.3%)	4 (0.7%)	0 (0%)
PITC/health worker recommended	23 (6.9%)	51 (8.6%)	9 (4.3%)
Sought care and health worker recommend	**163 (48.5%)**[2]	**203 (34.3%)**	**37 (17.8%)**
Diagnosis of STI	1 (0.3%)	1 (0.2%)	1 (0.5%)
Sickness made worried about HIV	**96 (28.6%)**	**128 (21.6%)**	22 (10.6%)
Potential exposure	16 (4.8%)	76 (12.8%)	3 (1.4%)
Wanted screening	29 (8.6%)	70 (11.8%)	0 (0%)
Confirm positive test/enroll in care	2 (0.6%)	24 (4.1%)	**172 (83%)**
Other	2 (0.6%)	19 (3.2%)	9 (4.3%)

[1]*Participants were allowed to choose more than one reason, percentages do not add up to 100%*

[2]*Numbers in bold indicate the two most frequently cited reasons for testing among each group.*

Table 3. Correlates associated with first time testing vs previously negative repeat testing among HIV positive individuals

	Univariate Analysis				Multivariate Analysis			
Predictor	**N**	**Odds Ratio**	**95% Confidence Interval**	**p value**	**N**	**Odds Ratio**	**95% Confidence Interval**	**p value**
Age								
18-24	148	Ref	Ref	Ref	148	Ref	Ref	Ref
25-39	479	1.29	(0.85, 1.96)	0.225	497	1.12	(0.73, 1.72)	0.594
40+	**301**	**2.87**	**(1.87, 4.43)**	**>0.001**	301	2.36	(1.51, 3.68)	>0.001
Sex								
Female	530	Ref	Ref	Ref	530	Ref	Ref	Ref
Male	**398**	**2.02**	**(1.54, 2.65)**	**>0.001**	398	1.89	(1.43, 2.51)	>0.001
Marital Status								
Single	195	Ref	Ref	Ref				
Married Monogamous	484	1.13	(0.80, 1.62)	0.470				
Married Polygamous	48	0.84	(0.42, 1.68)	0.627				
Divorced	117	1.37	(0.85, 2.21)	0.190				
Widowed	84	1.69	(1.00, 2.85)	0.049				
Testing initiated by								
Provider	467	Ref	Ref	Ref	467	Ref	Ref	Ref
Client	**461**	**0.69**	**(0.53, 0.90)**	**0.007**	461	0.73	(0.55, 0.97)	0.029
Key Population								
No	798	Ref	Ref	Ref				
Yes	130	0.81	(0.55, 1.21)	0.319				
Exchanged money for sex								
Female	21	Ref	Ref	Ref				
Male	50	2.39	(0.70, 8.20)	0.166				

Table 4. Correlates associated with previously positive vs previously negative repeat testing among HIV positive individuals

	Univariate Analysis				Multivariate Analysis			
Predictor	**N**	**Odds Ratio**	**95% Confidence Interval**	**p value**	**N**	**Odds Ratio**	**95% Confidence Interval**	**p value**
Age								
18-24	138	Ref	Ref	Ref	138	Ref	Ref	Ref
25-39	111	1.31	(0.83, 2.10)	0.248	442	1.33	(0.84, 2.13)	0.228
40+	**69**	**1.79**	**(1.09, 2.97)**	**0.023**	220	1.86	(1.13, 3.09)	0.016
Sex								
Female	498	Ref	Ref	Ref				
Male	302	1.19	(0.86, 1.65)	0.282				
Marital Status								
Single	180	Ref	Ref	Ref				
Married Monogamous	403	0.79	(0.53, 1.18)	0.253				
Married Polygamous	43	0.70	(0.32, 1.58)	0.400				
Divorced	107	1.41	(0.84, 2.38)	0.189				
Widowed	67	1.22	(0.66, 2.25)	0.523				
Testing initiated by								
Provider	357	Ref	Ref	Ref	129	Ref	Ref	Ref
Client	**443**	**1.45**	**(1.05, 1.99)**	**0.025**	314	1.48	(1.08, 2.06)	0.016
Key Population								
No	684	Ref	Ref	Ref				
Yes	116	0.89	(0.56, 1.41)	0.621				
Exchanged money for sex								
Female	22	Ref	Ref	Ref				
Male	41	0.96	(0.28, 3.31)	0.944				

Figure 1. Intertest intervals among previously negative repeat testers by population

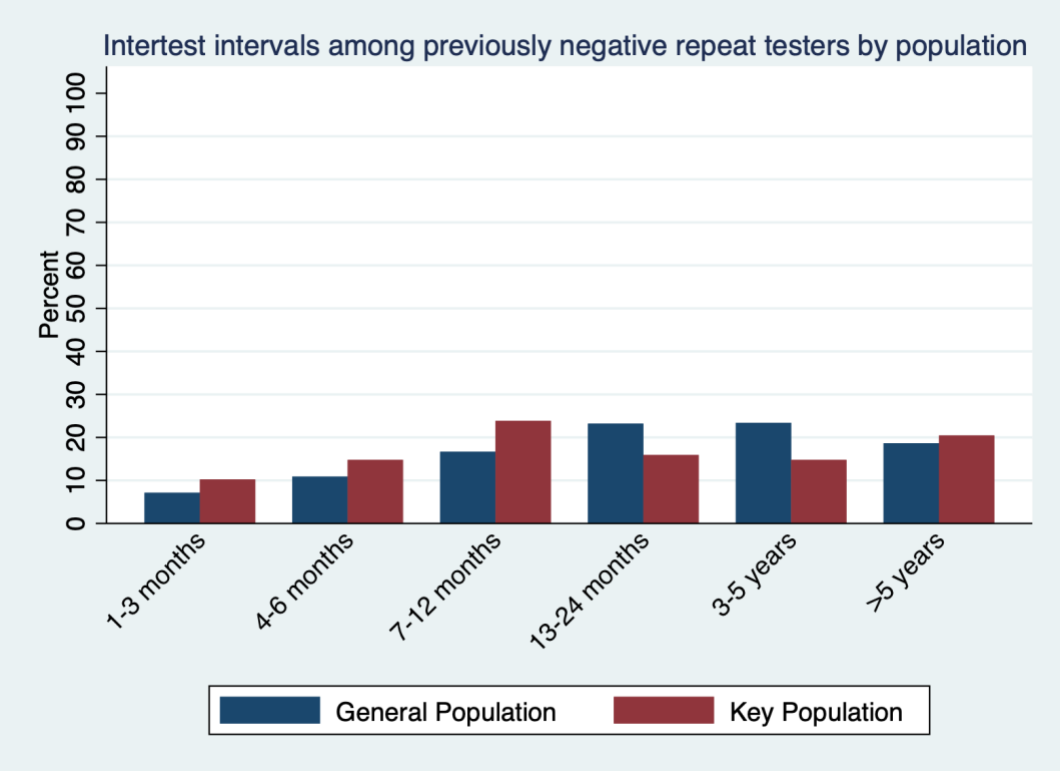


Figure 2. Intertest intervals among previously negative repeat testers by testing type

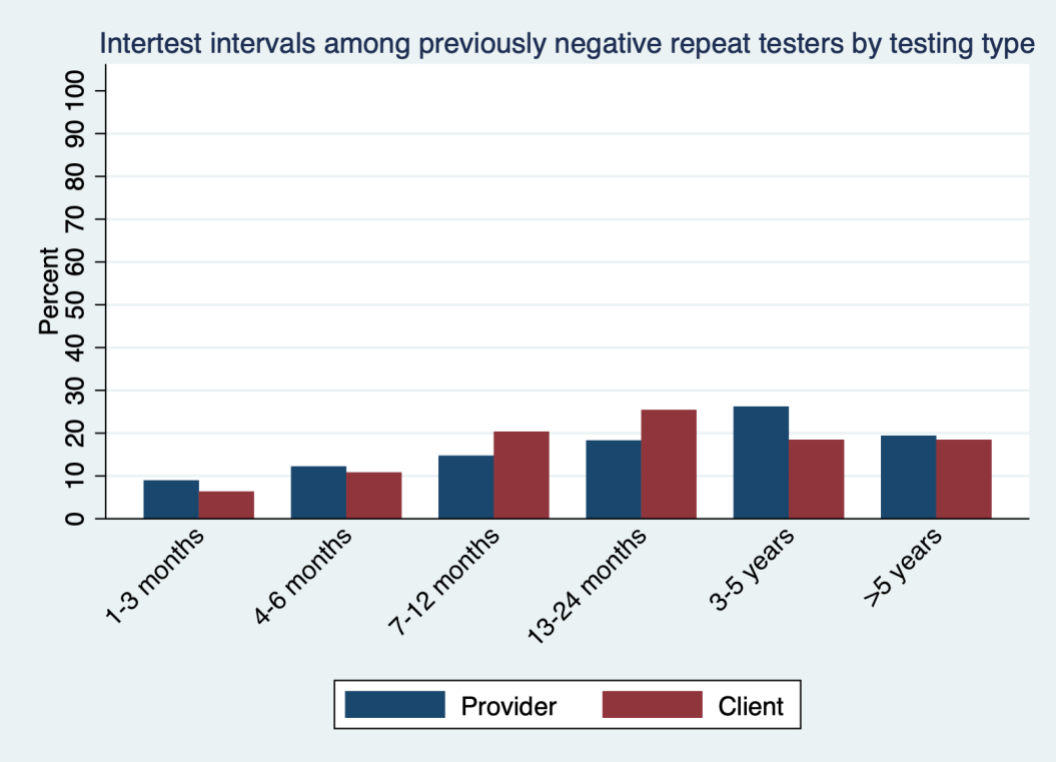


Figure 3. Intertest intervals among previously positive repeat testers by population

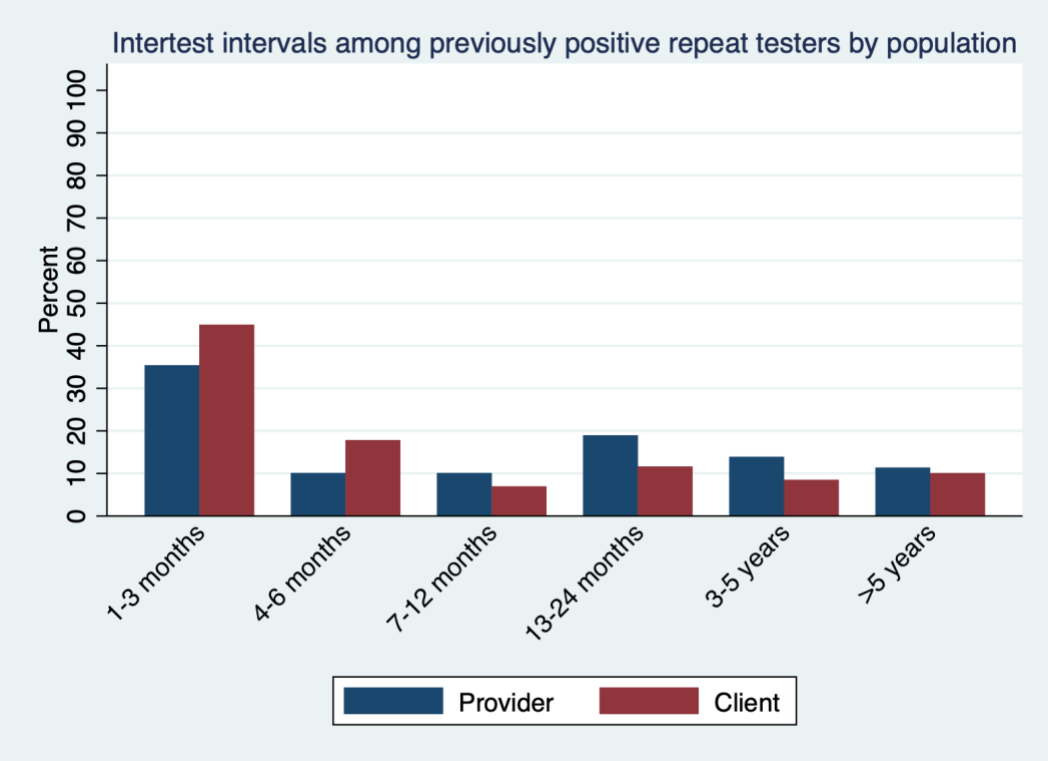
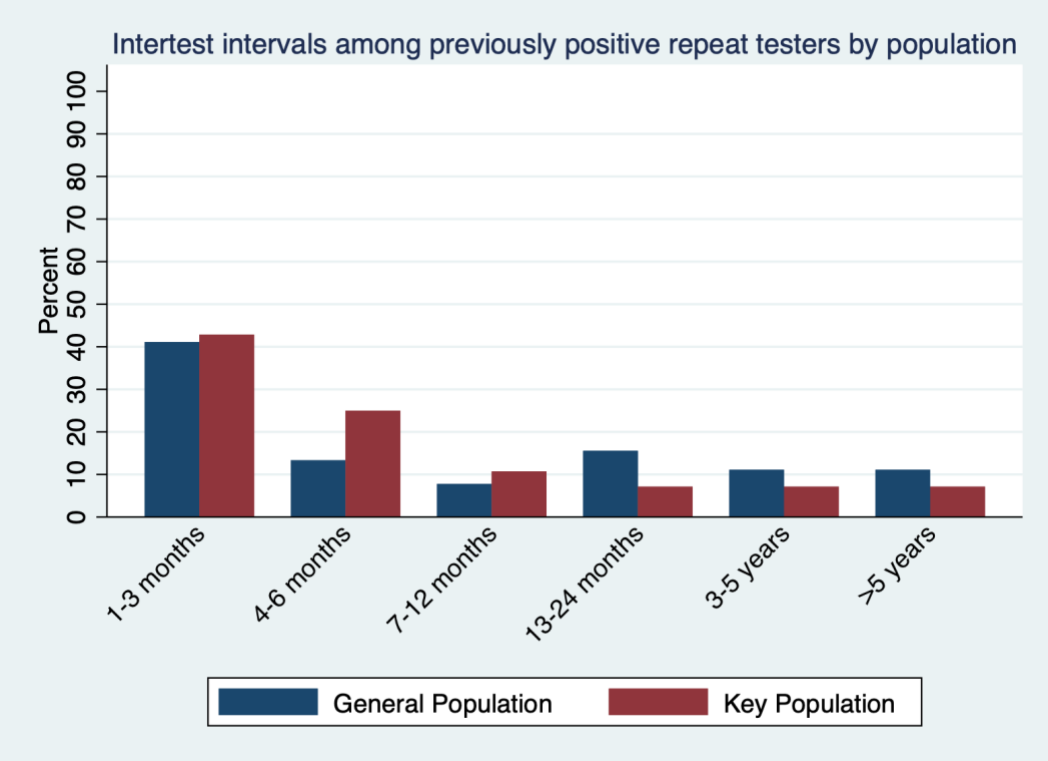


Figure 4. Intertest intervals among previously positive repeat testers by testing type



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