Is there an association between HIV testing patterns and HIV diagnosis among men who have sex with men?

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ABSTRACT

Objectives

In the UK, quarterly HIV testing is recommended for high-risk men who have sex with men (MSM). We determined the probability of HIV diagnosis in MSM by HIV testing history, considering both the frequency and periodicity of testing.

Design

Data on HIV incidence in MSM attending a sexual health clinic (SHC) in England in 2013-2014 with testing history (previous two years) were obtained from the genitourinary medicine clinic activity dataset, the national sexually transmitted infection (STI) surveillance system in England. HIV testing pattern was defined using the frequency and periodicity of testing, based on 3-monthly intervals, in the year preceding the first attendance.

Methods

Cox proportional hazards regression was used to determine the association between HIV testing pattern and time to diagnosis with and without adjustment for demographic confounders. Analyses were stratified by risk-strata, with high-risk defined as a history of a bacterial STI in the past year. Adjusted hazards ratios (aHRs) with 95% confidence intervals (CIs) are reported.

Results

Among the 37,702 HIV-negative MSM attending a SHC in 2013-2014, 1,105 (3%) were diagnosed with HIV within one year of their first attendance. The probability of HIV diagnosis was highest in MSM who were tested quarterly compared to those who were not tested in the past year (aHR:2.51; 95%CI:1.33-4.74); this increased 1.8-fold among high-risk MSM (aHR:4.48; 95%CI:0.97-21.2).

Conclusions

The probability of HIV diagnosis is greatest in high-risk MSM who were tested most frequently. Quarterly HIV testing increases the likelihood of identifying undiagnosed HIV infection and should remain a continued recommendation for high-risk MSM.

Keywords: HIV testing, HIV diagnosis, HIV risk, Men who have sex with men

INTRODUCTION

In England, men who have sex with men (MSM) are at highest risk of HIV acquisition.[1] The National Institute for Health and Care Excellence (NICE) recommends at least annual HIV screening in MSM, with more frequent testing in those at greater risk of exposure.[2] Since 2012, MSM engaging in unprotected sex with new or casual partners have been encouraged to be tested every three months.[3] Quarterly testing recommendations have been extended to MSM disclosing drug use and in those with a newly diagnosed sexually transmitted infection (STI), both seen as proxies for high-risk sexual behaviour.[4]

Recent behavioural data suggest annual testing guidelines are unlikely to be met and a little over a quarter of MSM engaging in condomless anal intercourse reported testing at least four times in a year.[5] Despite modelling studies suggesting cost-effectiveness of quarterly testing for high-risk MSM,[6] there are limited UK observational studies that evaluate testing frequency and HIV diagnosis in high-risk MSM. Test periodicity (i.e. testing at regular intervals) has not been incorporated in test frequency measurements used in previous analyses despite recommendations for quarterly testing.[5, 7] With these evidence gaps in mind, this analysis utilises longitudinal surveillance data to assess the probability of HIV diagnosis in MSM by HIV testing history, considering both the frequency and periodicity of testing.

METHODS

Data were obtained from the genitourinary medicine clinic activity dataset (GUMCADv2), the mandatory surveillance system for STIs in England. Details on GUMCADv2 are provided elsewhere;[8] briefly, it is a patient-level dataset of all HIV/STI diagnoses and services at all sexual health clinics (SHCs) in England.

MSM were defined as men whose self-reported sexual orientation was gay or bisexual at least once throughout their clinic attendance history. All HIV-negative MSM at least 15 years of age who had at

least one negative HIV antibody test in the two years preceding their first attendance in the period 1 January 2013-31 December 2014 were included in the analysis.

Time to HIV diagnosis was defined as the time from the date of the first attendance in 2013-2014 to the date when a new HIV diagnosis was reported. HIV testing pattern in the year preceding the first attendance in 2013-2014 was defined as follows: 1- No tests; 2- One test; 3- Two tests, one in each six-monthly period; 4- Two tests in two consecutive quarters; 5- Three tests one in each of three distinct quarters of the year; 6- Four tests, one in each quarter of the year ("quarterly testers"). Those who did not meet the above criteria were excluded from the analysis. This testing pattern was used to define testing behaviour and to distinguish between those who were tested regularly and those who tested less frequently (Web-only figure).

Demographic confounders considered in the analysis include age-group, self-reported ethnicity, world region of birth, residential area-level deprivation and residence in London. In the absence of behavioural data in GUMCADv2, the history of a bacterial STI (chlamydia, gonorrhoea, primary/secondary/tertiary syphilis, lymphogranuloma venereum, donovanosis or chancroid) within the year preceding the first attendance in 2013-2014 was used as an indicator of high-risk behaviour.

A patient-level analysis was conducted with all confounders associated with the first attendance during 2013-2014. A Kaplan-Meier analysis was performed to investigate time to diagnosis by HIV testing pattern. Censorship was defined as the date of HIV diagnosis or as 31st December 2014 in those who were not diagnosed with HIV. Incidence rates (per 1,000 person-years) and 95% confidence intervals (CIs) for HIV were determined. A Cox proportional hazards regression analysis was performed to determine the association between HIV testing pattern and time to diagnosis with and without adjustment for demographic confounders. Models were stratified by risk-strata, with high-risk defined as a history of a bacterial STI in the past year. Unadjusted and adjusted hazard ratios (HRs and aHRs, respectively) with 95% CIs are reported. All associations with a type-I error rate less than 5% were considered to be statistically significant. All analyses were performed using Stata v13.1 (StataCorp LP, College Station, TX, USA).

Ethics statement

As GUMCADv2 is a routine public health surveillance activity, no specific consent was required from the patients whose data were used in this analysis. PHE has permission to handle data obtained by GUMCADv2 under section 251 of the UK National Health Service Act of 2006 (previously section 60 of the Health and Social Care Act of 2001), which was renewed annually by the ethics and confidentiality committee of the National Information Governance Board until 2013. Since then the power of approval of public health surveillance activity has been granted directly to PHE.

RESULTS

Of the 37,702 HIV-negative MSM who met the inclusion criteria and attended an SHC in 2013-2014, 217 (1%) were quarterly testers, 1,183 (3%) had three tests one in each of three distinct quarters of the year, 2,414 (6%) had two tests in two consecutive quarters, 2,343 (6%) had three tests one in each of three distinct quarters of the year, 17,811 (47%) had one test and 13,734 (36%) did not have any tests in year preceding their first attendance in 2013—2014. Overall, 1,105 (2.9%) were diagnosed with HIV within the year following their first attendance in 2013-2014.

From the Kaplan-Meier analysis, the probability of HIV diagnosis within one year of the first attendance was highest in quarterly testers, with the lowest probability in those with one test in the past year (Fig. 1a). The HIV diagnosis rate was 52.0 per 1,000 person-years (95%CI: 28.8–93.9) for quarterly testers, compared to 20.3 per 1,000 person-years (95%CI: 17.9–23.0) and 17.5 per 1,000 person-years (95% CI: 15.7–19.6) for those with no tests and for those with one test in the past year, respectively.

When restricted to high-risk MSM (Fig. 1b), the probability of diagnosis within one year of the first attendance increased notably among quarterly testers. There was no difference in the probability of HIV diagnosis among low-risk MSM by testing pattern (Fig. 1c).

Overall, the probability of HIV diagnosis within 12 months was significantly higher in quarterly testers (HR: 2.66; 95%CI: 1.46–4.87) and in those who had two tests in two consecutive quarters

(HR: 1.34; 95%CI: 1.02–1.78), compared to those with no tests in the past year (Tab 1a). After adjusting for demographic characteristics, quarterly testers (aHR: 2.51; 95%CI: 1.33–4.74) and those who had two tests in two consecutive quarters (aHR: 1.34; 95%CI: 1.01–1.78) were significantly more likely to be eventually diagnosed with HIV compared to those with no tests in the past year (Tab 1a).

Among high-risk MSM, quarterly testers were more likely to be diagnosed with HIV (HR: 5.20; 95%CI: 1.12–24.05) compared to those with no tests in the past year (Tab 1b). With adjustment for demographic factors, high-risk quarterly testers retained the highest probability of HIV diagnosis, however, this result marginally exceeded the type-I error rate (aHR: 4.48; 95%CI: 0.97–21.2). Among low-risk MSM, the probability of HIV diagnosis in quarterly testers was not statistically different from those with no tests in the past year (Tab 1b).

DISCUSSION

We found that MSM with a history of a bacterial STI and more frequent HIV testing were more likely to be diagnosed with HIV within a year of baseline, and this implies that frequent testers may have higher risk behaviours. Among MSM without a history of a bacterial STI, the probability of HIV diagnosis was not statistically different among frequent testers compared to those who were not tested in the previous year.

Some of the differential in risk of HIV may be due to a frequent testing being a proxy for high HIV risk and case ascertainment may be better in more frequent testers. However it is possible that more frequent testing in MSM with a history of a bacterial STI could increase the diagnosis rate of incident HIV.

The use of national surveillance data is a key strength of this study as data are collected from all SHCs with 100% reporting compliance and over 90% completion for all variables collected[8]. This provides a comprehensive overview of HIV testing and diagnoses nationally. Patients were categorised based on their HIV testing pattern in the year preceding the first attendance, and we

assumed that HIV testing patterns prospectively (i.e. time from first attendance to new HIV diagnosis) were similar to those retrospectively. Under this assumption, no adjustment on testing pattern in the year following the first attendance in 2013-2014 was considered. Within GUMCADv2, patient attendances can be linked within but not across SHCs; as a result, HIV testing frequency and diagnosis rates may have been underestimated. Venue loyalty is assumed given the history of testing within the same clinic. Small numbers within strata following adjustments for demographic factors limit the precision of measures of association. In addition, no behavioural data are collected through GUMCADv2 so we were unable to assess the impact of behaviour on HIV testing pattern, but have defined risk based on the history of a bacterial STI.[7]

Testing is a key component of HIV prevention strategies to reduce the incidence of HIV infection and rates of late and undiagnosed HIV.[9] Despite this, the evidence on testing frequency and HIV diagnosis in higher risk MSM is limited. A pattern of quarterly HIV testing may be more reflective of health-seeking behaviour in high-risk MSM, but also presents more opportunities for earlier diagnosis and partner notification. Early identification of undiagnosed infection can improve individual outcomes and reduce onward transmission by facilitating quicker access to care, treatment initiation and behaviour change.[10, 11]

Our findings highlight that a history of a bacterial STI is a useful indicator of HIV risk in MSM and this should be acknowledged in HIV testing frequency guidelines. Quarterly HIV testing among MSM, especially those with history of a bacterial STI, is essential to ensure early diagnosis and to reduce the number of undiagnosed HIV infections. Increased HIV testing improves the likelihood of identifying undiagnosed HIV infection and quarterly testing should remain a continued recommendation for high-risk MSM.

Conflicts of Interest: None declared

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MF, HMi, DO and HMo performed the analysis. MF, HMi, DO and HMo wrote the manuscript. SW, NC, GH and AN contributed to further interpretation of the findings and provided critical review of the manuscript.

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Web-only figure: HIV testing pattern in the previous year

Figure 1. Kaplan-Meier curves showing time to HIV diagnosis among MSM attending a sexual health clinic in England in 2013—2014, by HIV testing pattern in the previous year

Table 1: Unadjusted and adjusted Hazard ratios for HIV diagnosis, by HIV testing pattern

a) among MSM attending a sexual health clinic in England in 2013—2014

	Patients at risk	Number of failures	HR	p-value	95% CI		Adjusted HR*	p-value	95% CI	
HIV testing pattern in the previous year										
No test	13734	378	1				1			
One test	17811	482	0.90	0.231	0.76	1.07	0.88	0.158	0.74	1.05
Three tests one in each of three distinct quarters of the year	2343	78	1.09	0.586	0.80	1.48	1.05	0.743	0.77	1.44
2 tests in 2 consecutive quarters	2414	104	**1.34**	0.038	1.02	1.78	**1.34**	0.040	1.01	1.78
Three tests one in each of three distinct quarters of the year	1183	48	1.37	0.098	0.94	2.11	1.15	0.276	0.83	1.93
Four tests, one in each quarter of the year – quarterly testers	217	15	**2.66**	0.001	1.46	4.87	**2.51**	0.004	1.33	4.74

HR: Hazard Ratio. CI: confidence interval. Adjusted and unadjusted hazard ratios calculated using Cox Proportional Hazards models
**Analysis adjusted for age-group, self-reported ethnicity, world region of birth, residential area-level deprivation and residence in London.*

*b) among high-risk** MSM attending a sexual health clinic in England in 2013—2014*

	Patients at risk	Number of failures	HR	p-value	95% CI		Adjusted HR*	p-value	95% CI	
HIV testing pattern in the previous year										

No test	141	9	1				1			
One test	3299	159	2.25	0.256	0.56	9.12	2.08	0.307	0.51	8.43
Three tests one in each of three distinct quarters of the year	730	36	2.07	0.324	0.49	8.81	1.85	0.406	0.43	7.91
2 tests in 2 consecutive quarters	836	59	2.74	0.166	0.66	11.43	2.64	0.183	0.63	11.03
Three tests one in each of three distinct quarters of the year	492	24	2.38	0.246	0.55	10.30	2.46	0.233	0.56	10.78
Four tests, one in each quarter of the year – quarterly testers	120	13	**5.20**	0.035	1.12	24.05	**4.48**	0.056	0.95	21.17

HR: Hazard Ratio. CI: confidence interval. Adjusted and unadjusted hazard ratios calculated using Cox Proportional Hazards models

**Analysis adjusted for age-group, self-reported ethnicity, world region of birth, residential area-level deprivation and residence in London.*

*** High-risk based on the history of a bacterial STI (chlamydia, gonorrhoea, primary/secondary/tertiary syphilis, lymphogranuloma venereum, donovanosis or chancroid) within the year preceding the first attendance in 2013—2014*