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Correlates of Chlamydia trachomatis infection in a primary care sentinel surveillance network

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ABSTRACT

Background: Chlamydia is the most commonly notified infection in Australia. Prevention strategies should be accurately informed by routine data on populations at risk of infection.

Methods: The Victorian Primary Care Network for Sentinel Surveillance collates information from 11 primary health care services. We calculated chlamydia positivity and correlates of infection using multivariable logistic regression for data collected between April 2006 and June 2009.

Results: Chlamydia positivity was 5.6% in 12,233 females, 7.7% in 10,316 heterosexual males, and 6.2% in 7,872 men who have sex with men (MSM). Correlates of chlamydia positivity among females included younger age (OR 2.27, 95%CI 1.92-2.69), being born overseas (OR 1.50 95%CI 1.25-1.82), multiple sex partners in the past year (OR 1.72 95%CI 1.40-2.11) and inconsistent condom use with regular sex partners (OR 3.44 95%CI 1.65-7.20). Sex work was protective for females (OR 0.68 95%CI 0.53-0.86). Among heterosexual males, correlates of positivity were younger age (OR 1.87, 95%CI 1.62-2.17), being born overseas (OR 1.35 95%CI 1.16-1.58), symptoms at the time of testing (OR 1.64 95%CI 1.40-1.92), and multiple sex partners in the past year (OR 1.83 95%CI 1.46-2.30). Correlates of positivity among MSM were being born overseas (OR 1.23 95%CI 1.00-1.51), being HIV positive (OR 1.80 95%CI 1.32-2.47), and reporting six or more anal sex partners in the past six months (OR 4.45 95%CI 1.37-14.5).

Conclusions: Our analysis identified subgroups at highest risk of chlamydia in Victoria. These chlamydia positivity estimates will provide important baseline information to measure the impact of future chlamydia control strategies.

Key words: chlamydia, risk factors, primary care, proportion positive

INTRODUCTION

Chlamydia is the most commonly notified infectious disease in Victoria (the second most populous state in Australia); the number of infections diagnosed each year in Victoria is increasing steadily, from 7,694 in 2004 to 13,892 in 2009.[1] Population groups demonstrated to have a high burden of chlamydia infection in Victoria include young people and men who have sex with men (MSM), with prevalence estimates of 3-8% in these populations.[2-5]

In the past decade, millions of dollars have been invested on health promotion and clinical strategies to increase condom use and chlamydia testing and in turn reduce transmission, including a national chlamydia screening pilot in general practice planned for 2011-2013.[6, 7] It is important that these prevention programs are well informed by current data on populations at high risk of chlamydia infection and associated risk factors to ensure those at highest risk are targeted appropriately. Most previous studies of chlamydia prevalence and risk factors have involved data from clinic attendees generally based at single clinics, collected over short time frames and have reported limited information on risk factors in different groups.[3, 8-10]

Sentinel surveillance through primary health care clinics offers an opportunity to collect information on those being tested for chlamydia and provide ongoing estimates of chlamydia positivity and correlates of infection. When testing rates are sufficiently high, chlamydia positivity can be an accurate indicator of chlamydia prevalence in the population being tested.[11] In this manuscript, we present results from the first 39 months of operation (April 2006 to June 2009) of a chlamydia sentinel surveillance network based in Victoria, Australia. This manuscript will focus on chlamydia positivity and behavioural and demographic correlates of chlamydia infection in three groups – females, heterosexual males, and MSM.

METHODS

The Victorian Primary Care Network for Sentinel Surveillance on Blood Borne Viruses and Sexually Transmitted Infections comprises four disease networks for HIV, syphilis, chlamydia and hepatitis C that commenced data collection in April 2006.[12] In the chlamydia network, eleven sentinel sites were selected to cover at-risk populations; young people (aged 16 to 24 years) and men who have sex with men (MSM). The sites included sexual health clinics, primary care clinics, general practice clinics with a focus on gay men's health, and a juvenile justice clinic. The system methods have been described in detail previously[12] so only select methodological details follow.

Demographic and sexual risk behaviour data were collected from all patients undergoing chlamydia testing as part of standard clinical practice using a paper questionnaire. Sites targeting MSM and sites targeting young people used different questionnaires to assess relevant risk behaviours, using a 12-month recall period for heterosexual behaviours and a six-month period for MSM. One sexual health clinic used a computerised medical records system to collect less detailed pre-testing risk assessment and sexual behaviour questions using a 12-month recall period. Either the doctor or the patient completed the behavioural survey, depending on the clinic. The questionnaire also asked whether the patient had symptoms of sexually transmitted infections (STIs) at the time of the consultation, however these were not defined and the response was based on the clinician's judgement; symptoms may have been unrelated to chlamydia.

All chlamydia pathology results from participating sites were collected directly from the laboratories that conduct chlamydia testing for the sentinel sites. These were linked with questionnaire results at the Burnet Institute, the coordinating organisation for the surveillance system. Indeterminate chlamydia results were excluded. If patients had samples taken from multiple anatomical sites during the same visit, they were classified as chlamydia positive if a test from any anatomical site was positive. Only one visit (the first visit) from each individual across the entire time period (39 months)

was included in analyses of correlates of chlamydia positivity, all subsequent tests and questionnaires from an individual were excluded, regardless of the timing and result.

Multivariable logistic regression models were used to determine the factors associated with chlamydia infection in females, heterosexual males, and MSM. All variables were included in the multivariable model, except for condom use with any partner as this was a summary of other variables also included in the model. The sexual health clinic did not collect some sexual behaviour variables, so their data for these variables was categorised as 'not available' but still included in the analysis to avoid case-wise elimination of data and maximise the sample size. We also included 'missing' as a category in most variables in the regression analysis. Men at young people's sites who reported sex only with men were excluded from the analysis, as were patients attending MSM sites who reported no male-male sex. Men were classified as MSM if they reported any sex with a male in the past 12 months and heterosexual if they reported sex with only females. Analyses were conducted in Stata version 10 with a significance level of 0.05.

RESULTS

Chlamydia tests and surveys

Between April 2006 and June 2009, 71,470 chlamydia test results were received from laboratories and 60,623 questionnaires conducted among patients tested for chlamydia were received from sites, equating to an overall response rate of 85%. Clinicians administered 89% of questionnaires, while 11% were self-completed by the patient.

Chlamydia positivity

Chlamydia positivity among all tests was 5.3% (95%CI 5.1-5.5). Chlamydia positivity was significantly lower for repeat tests in females than first tests, but there was no difference in men (Tables 1 and 2).

Chlamydia positivity was lower among female sex workers than non sex workers, but similar among men regardless of sex worker status (Tables 1 and 2). Questionnaires from sex workers and repeat tests were excluded from further analysis due to this difference in positivity, and the potential for bias in sexual behaviour questions.

Among all matched test records from unique patients (excluding sex workers), chlamydia positivity was 6.2% (95% CI 6.0-6.4). In females, overall chlamydia positivity was 5.6% (95% CI 5.2-6.0), and was 7.6% (95% CI 6.9-8.2) among those aged 16 to 24 years compared to 3.5% (95% CI 3.0-4.0) in those aged 25 and over (OR 2.27, 95%CI 1.92-2.69). In heterosexual males, the overall chlamydia positivity was 7.7% (95% CI 7.2-8.2), and was 11.0% (95% CI 10.0-12.2) among those aged 16 to 24 years compared to 6.2% (95% CI 5.7-6.8) in those aged 25 and over (OR 1.87, 95%CI 1.62-2.17). In MSM chlamydia positivity was 6.2% (95% CI 5.7-6.8). In transgender patients chlamydia positivity was 5.7% (95% CI 1.6-14.0).

Among heterosexual males, chlamydia positivity was lower in those attending a sexual health centre than those attending other clinics (Table 1). Among females and MSM, chlamydia positivity was higher in sexual health centre attendees than those attending other clinics (Table 1 & 2).

Correlates of chlamydia infection

Among the 12,233 females included in multivariable analysis, younger age, being born overseas, reporting multiple sexual partners in the past year, and inconsistent condom use or never using condoms with regular sexual partners in the past year were associated with chlamydia infection (Table 1). Among the 10,316 heterosexual males included in multivariable analysis, younger age, being born overseas, STI symptoms at the time of testing, and reporting multiple sexual partners in the past year were significantly associated with chlamydia infection (Table 1). Among the 7,872 MSM included in multivariable analysis being born overseas, being HIV positive, and reporting six or more

anal sex partners in the past six months were significantly associated with chlamydia infection (Table 2).

DISCUSSION

This paper reports the findings of a chlamydia sentinel surveillance system established in Victoria, Australia in 2006. We have estimated chlamydia positivity and predictors among three population groups at risk of chlamydia infection using data from routine chlamydia testing linked to questionnaires.

The overall chlamydia positivity found among patients attending the sentinel sites in this system was 6.2%. This is higher than the mean prevalence of 3.4% (95% CI 3.1-3.6%) reported in a systematic review of Australian clinic-based studies from 1997 to 2004.[3] The higher chlamydia prevalence reported here may reflect the increased risk among people attending the clinics in the sentinel network. For example, those attending a sexual health or family planning clinic are perhaps more likely to have engaged in high risk behaviours than those attending a standard general practice.[13] Higher chlamydia positivity in this study may also reflect increasing chlamydia prevalence in Victoria between 2006 and 2009, compared with 1997 to 2004 the period covered by the systematic review.[1, 14]

Among females and heterosexual males, chlamydia positivity was highest in those aged 16 to 24 years (7.7% and 10.9% respectively). Importantly, in heterosexual males aged 25-29 years the chlamydia positivity of 8.6% was nearly double that of females in the same age group (4.9%). These findings confirm guidelines that recommend young women aged 16-24 and men aged 16-29 years should be targeted for chlamydia screening.[15] Chlamydia prevalence among MSM was fairly

uniform across all age groups suggesting that age-targeted screening in this group is not currently justified.

Being born overseas correlated with chlamydia infection in both men and women, consistent with findings from recent a case-control study based in a Sydney sexual health clinic.[16] It is possible that some of these overseas born patients were travellers. The increased risk of chlamydia associated with overseas travel or a sexual partner from overseas has also been observed among heterosexuals in Sydney.[17]

Despite chlamydia being identified more commonly in symptomatic heterosexual men, infection was also detected in a substantial proportion of asymptomatic men. In females, reported symptoms were not significantly associated with infection. The difference in symptoms and chlamydia positivity between sexes may be related to differential pathogenicity between sexes as well as different health seeking behaviour, with men testing more in response to symptoms or contacts, and women presenting more routinely for opportunistic asymptomatic screening during health service visits for other reasons such as seeking contraceptive advice or cervical screening. These findings support clinical guidelines that recommend chlamydia testing based on age or risk behaviours, regardless of symptoms.[15, 18] STI symptoms were not recorded for MSM for the first 20 months of surveillance (only HIV seroconversion illness was asked), therefore the lack of association between chlamydia and presenting with symptoms in MSM may be due to limited statistical power to detect such a correlation. Additionally, by collapsing test results from different anatomical sites into a single result, we may have obscured an association between urethral infection and symptoms.

Higher chlamydia positivity was shown in heterosexual men and women who used condoms inconsistently with regular partners. Contrary to expected dose response patterns, chlamydia positivity was higher among those reporting inconsistent condom use than those reporting never use

of condoms. This may indicate adoption of a risk compensation strategy whereby inconsistent condom use reflects failed intentions to use condoms with higher risk or multiple sexual partners, whereas never use reflects sex with partners perceived to be of lower risk. This finding highlights the importance of continuing to promote consistent condom use in safe sex interventions. Although many recent Australian safe sex campaigns have focused predominantly on the risks of casual sex,[19, 20] non-use of condoms in regular relationships was associated with increased risk of chlamydia in females in this study suggesting that sexual risk in regular relationships should be incorporated into future chlamydia prevention campaigns.

For MSM, reporting six or more anal sex partners or unprotected anal sex with casual and regular partners correlated with chlamydia infection. These findings highlight the importance of taking a sexual history and conducting appropriate testing according to recommended guidelines. Testing guidelines released in October 2010 by the Royal Australasian College of Physicians, Chapter of Sexual Health Medicine, recommend testing for HIV and STIs at least once a year for all men who have had any sex with another man in the previous year, with or without symptoms, and 3-6 monthly testing for men reporting designated high-risk behaviours (episodes of unprotected anal sex, more than 10 partners in the past six months, attend sex-on-premises venues, use of recreational drugs or seek partners via the internet), as well as follow up testing for men with bacterial STIs after three months.[21] Despite these recommendations, a recent analysis found that these standards were often not being met.[22]

Chlamydia positivity among MSM who were known to be HIV positive was nearly twice as high as in those known to be HIV negative. Other STIs have also been shown to disproportionately affect HIV positive men.[23, 24] This finding reinforces the need for regular targeted STI screening among MSM with HIV infection. Other data have indicated that the frequency of syphilis testing is increasing in HIV positive MSM in Australia due to the integration of testing as part of routine HIV management

checks, however chlamydia and gonorrhoea testing, which require collection of extra samples (anal swab or urine test) is conducted less frequently.[22]

Sex work was found to be protective for chlamydia infection for females. This most likely reflects the STI screening regulations for legal sex workers in Victoria that requires regular STI checks and an increased likelihood of practicing safe sex.[25] Among MSM who reported sex work, chlamydia positivity was equivalent to non sex-workers.

Among heterosexual men and MSM, repeat testers were equally likely to have a positive chlamydia result than those being tested for the first time within the system. This may suggest that at the time of the initial visit an opportunity had been missed to provide effective risk reduction counselling, including the importance of partner notification and treatment, reduction in sexual risk behaviour and the importance of a follow up test to confirm treatment success. This result warrants further investigation.

Limitations in this study are that data were not collected for all questions from one large site which may have reduced our power to investigate the associations between risk behaviour and chlamydia positivity. Symptoms were not defined on the questionnaire, so response to this question was at the clinician's discretion and any reported symptoms may have been unrelated to chlamydia. Symptoms were not asked about of MSM prior to February 2008. The results were not stratified by anatomical site of infection, which may have been important for MSM. Some questionnaires were completed electronically and others on paper, while some were self-completed and others were clinician-administered; the effect of these differences on reported behaviours is not known.

The sentinel surveillance system captures information on a substantial proportion of all chlamydia diagnoses in Victoria - 4.3% of all diagnoses in females and 12.2% of all diagnoses in males. The

system would likely cover an even higher proportion of state-wide chlamydia diagnoses in MSM.[12] Most chlamydia testing and diagnoses in Victoria occur across thousands of general practices which, on a per clinic basis, equates to a small number of tests and diagnosis for each clinic. Thus clinics which accounted for higher numbers of Chlamydia diagnoses were deliberately recruited for this system.[12] However, it is possible that the sentinel sites may be not representative of the whole population or key subgroups who are at particular risk of chlamydia. The system only includes those patients who sought medical attention and had chlamydia testing at one of the sentinel clinics. That being said, the system is a useful tool with which to study and design appropriate interventions for specific high-risk populations and to monitor changes in chlamydia positivity in response to interventions. For such monitoring, the findings presented in this study offer valuable baseline data to compare to over time.

In conclusion, this sentinel surveillance program provides a unique opportunity to identify risk behaviours for chlamydia infection in Australia across a large number of clinics, and to repeat these measures over time. This system also has the important advantage of collecting behavioural and demographic information in addition to the number of patients tested and diagnosed with chlamydia, which improves the ability to interpret trends in chlamydia epidemiology. The results of this system provide a mechanism that will be useful to inform interventions, screening programs and policy.

CONFLICT OF INTEREST

None to declare

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Table 1: Predictors of chlamydia positivity in heterosexual males and females

		Females						Males					
				Univariable		Multivariable				Univariable		Multivariable	
		n tests	% pos	OR	95%CI	OR	95%CI	n tests	% pos	OR	95%CI	OR	95%CI
All		28029	3.6					13155	7.7				
Repeat test	First test	14329	5.3	1.00				10404	7.7	1.00			
	Repeat test(s)	13700	1.9	**0.34**	**0.29-0.39**			2751	7.6	0.99	0.84-1.16		
Sex worker (repeat tests excluded)	No	12233	5.6	1.00				10316	7.7	1.00			
	Yes	2096	3.9	**0.68**	**0.53-0.86**			88	5.7	0.72	0.29-1.79		
All (excluding sex workers and repeat tests)		**12233**	**5.6**					**10316**	**7.7**				
Site type	Sexual health centre	8416	6.3	1.00		1.00		9703	7.3	1.00		1.00	
	Primary care clinics	3817	4.1	**0.63**	**0.53-0.76**	0.78	0.17-3.18	613	13.5	**1.98**	**1.55-2.53**	3.01	0.39-23.3
Age group (years)	16-19	2034	7.7	1.00		1.00		603	11.00	1.00		1.00	
	20-24	4243	7.5	0.97	0.79-1.18	**0.71**	**0.57-0.88**	2578	11.1	1.01	0.76-1.34	1.23	0.88-1.71
	25-29	2860	4.9	**0.61**	**0.48-0.77**	**0.42**	**0.32-0.54**	2614	8.6	0.76	0.57-1.02	0.97	0.68-1.38
	30-34	1327	2.6	**0.32**	**0.22-0.47**	**0.25**	**0.17-0.37**	1543	6.1	**0.53**	**0.38-0.73**	**0.67**	**0.46-0.99**
	35+	1769	1.9	**0.23**	**0.16-0.33**	**0.22**	**0.14-0.32**	2978	4.2	**0.36**	**0.26-0.49**	**0.45**	**0.31-0.66**
Country of birth	Australia	6064	4.8	1.00		1.00		6075	6.9	1.00		1.00	
	Other	3436	7.5	**1.60**	**1.34-1.90**	**1.50**	**1.25-1.82**	3587	9.2	**1.37**	**1.18-1.60**	**1.35**	**1.16-1.58**
	Missing	2733	4.9	1.01	0.82-1.25	0.90	0.63-1.31	654	6.9	1.00	0.73-1.38	1.07	0.75-1.52
Aboriginal and/or Torres Strait Islander	No	9115	5.7	1.00		1.00		9017	7.7	1.00		1.00	
	Yes	75	8.0	1.44	0.62-3.33	1.68	0.71-3.98	95	13.7	**1.90**	**1.06-3.44**	1.47	0.78-2.77
	Missing	3043	5.2	0.90	0.75-1.08	1.03	0.72-1.41	1204	7.3	0.95	0.75-1.19	1.07	0.83-1.38
STI symptoms**	No	7369	5.9	1.00		1.00		5682	7.1	1.00		1.00	
	Yes	4196	5.3	0.89	0.75-1.05	0.85	0.71-1.01	4241	8.8	**1.28**	**1.10-1.48**	**1.64**	**1.40-1.92**
	Missing	668	3.6	**0.59**	**0.39-0.90**	0.65	0.43-1.02	393	4.6	0.63	0.39-1.03	0.82	0.50-1.35
Opposite sex sexual partners, past 12 months	One partner	4501	3.4	1.00		1.00		2032	4.9	1.00		1.00	
	No partners	376	0.8	**0.23**	**0.07-0.73**	0.30	0.09-0.95	190	1.6	0.31	0.10-1.00	**0.19**	**0.04-0.90**
	Two or more	6738	7.5	**2.30**	**1.91-2.77**	**1.72**	**1.40-2.11**	7518	8.8	**1.88**	**1.51-2.33**	**1.83**	**1.46-2.30**
	Missing	618	4.1	1.21	0.78-1.86	1.14	0.72-1.80	576	5.6	1.15	0.76-1.73	1.33	0.87-2.04
Condom use with any partner, past 12 months	Always used condoms	1588	2.6	1.00		--	--	1449	3.2	1.00		--	--
	Didn't always use condoms	9665	6.3	**2.48**	**1.81-3.41**	--	--	8018	8.8	**2.89**	**2.14-3.91**	--	--
	Missing	980	3.1	1.16	0.72-1.87	--	--	849	4.5	1.40	0.90-2.16	--	--
Condom use with regular partner/s, past 12 months+	Always used condoms	561	1.4	1.00		1.00		70	5.7	1.00		1.00	
	Inconsistent condom use	1906	5.5	**3.99**	**1.93-8.24**	**3.44**	**1.65-7.20**	341	15.5	**3.04**	**1.07-8.68**	2.44	0.82-7.26
	Never used condoms	997	3.2	**2.29**	**1.05-5.01**	**3.03**	**1.36-6.73**	131	13.0	2.46	0.79-7.62	2.34	0.71-7.67
	No regular partner	235	4.7	**3.39**	**1.35-8.55**	**2.69**	**1.04-6.94**	76	9.2	1.67	0.47-5.98	1.50	0.40-5.60
	Not collected*	8454	6.2	**4.58**	**2.26-9.25**	--	--	9692	7.3	1.31	0.47-3.59	--	--
	Missing	80	2.5	1.77	0.37-8.50	1.23	0.14-10.5	6	33.3	**8.25**	**1.15-59.4**	14.31	0.54-380
Condom use with casual partner/s, past 12	Always used condoms	550	4.4	1.00		1.00		132	10.6	1.00		1.00	
	Inconsistent condom use	721	7.4	**1.74**	**1.06-2.85**	1.32	0.79-2.19	271	15.9	1.59	0.84-3.02	1.38	0.70-2.72

months+	Never used condoms	311	5.1	1.19	0.62-2.27	1.006	0.53-2.08	68	10.3	0.97	0.37-2.52	0.91	0.32-2.55
	No casual partner	2076	2.8	0.63	0.39-1.02	1.003	0.60-1.77	146	11.6	1.11	0.52-2.35	1.71	0.74-3.94
	Not collected*	8454	6.2	1.45	0.95-2.21	--	--	9692	7.3	0.67	0.38-1.17	--	--
	Missing	121	5.0	1.14	0.46-2.86	2.62	0.85-8.07	7	28.6	3.37	0.60-19.0	7.35	0.48-111
New sexual partner/s, past three months	No	2393	2.9	1.00		1.00		266	11.7	1.00		1.00	
	Yes	1371	6.2	**2.23**	**1.61-3.08**	1.42	0.96-2.10	362	14.4	1.27	0.79-2.05	1.23	0.71-2.12
	Not collected*	8369	6.3	**2.25**	**1.75-2.91**	--	--	9677	7.3	0.60	0.41-0.88	0.30	0.01-8.07
	Missing	100	3.0	1.04	0.32-3.37	1.28	0.24-6.74	11	9.1	0.76	0.09-6.13	0.08	0.00-2.89

* One large site was excluded because it uses electronic data collection which collects briefer behavioural information than the sentinel surveillance form,

**symptoms were not defined on the questionnaire, so response to this question was at the clinician's discretion

-- dropped from multivariable analysis due to collinearity

Table 2: Predictors of chlamydia positivity in MSM

				Univariable		Multivariable	
		Number tests	% positive	OR	95%CI	OR	95%CI
All		16170	6.4				
Repeat test	First test	8051	6.2	1.00			
	Repeat test(s)	8119	6.5	1.06	0.93-1.20		
Sex worker (repeat tests excluded)	No	7872	6.2	1.00			
	Yes	179	5.6	0.89	0.47-1.70		
All (excluding sex workers and repeat tests)		**7872**	**6.2**				
Site type	Sexual health centre	5231	7.0	1.00		1.0	
	GP specialising in gay men's health	2641	4.6	**0.64**	**0.52-0.79**	1.12	0.14-8.89
Age group (years)	16-19	236	6.4	1.00		1.0	
	20-29	2997	6.3	0.99	0.58-1.71	0.99	0.57-1.70
	30-39	2410	7.6	1.20	0.70-2.07	1.21	0.70-2.10
	40-49	1413	4.5	0.69	0.39-1.25	0.70	0.39-1.25
	50+	816	4.9	0.76	0.41-1.40	0.74	0.40-1.37
Country of birth	Australia	5251	5.6	1.00		1.0	
	Other	2167	7.1	**1.29**	**1.06-1.58**	**1.23**	**1.00-1.51**
	Missing	454	9.5	**1.77**	**1.26-2.48**	**1.52**	**1.01-2.28**
Aboriginal and/or Torres Strait Islander	No	7130	6.0	1.00		1.0	
	Yes	61	3.3	0.53	0.13-2.17	0.51	0.12-2.10
	Missing	681	8.5	**1.45**	**1.09-1.93**	1.10	0.77-1.55
STI symptoms**	No	1785	6.1	1.0		1.0	
	Yes	657	7.2	1.18	0.83-1.69	1.01	0.70-1.45
	Missing	5430	6.2	1.01	0.81-1.26	0.93	0.74-1.17
HIV status	Negative	7348	6.0	1.00		1.0	
	Positive	524	10.1	**1.78**	**1.32-2.40**	**1.80**	**1.32-2.47**
Male oral sex partners, past 6 months	0 to 5	1487	3.7	1.00		1.0	
	6 +	1063	5.9	**1.64**	**1.13-2.38**	1.04	0.62-1.73
	Not collected*	5213	7.0	**1.97**	**1.48-2.63**	6.11	0.55-68.2
	Missing	109	4.6	1.25	0.49-3.19	1.79	0.01-440.3
Male anal sex partners, past 6 months	None	313	1.3	1.00		1.0	
	1 to 5	1689	4.3	**3.44**	**1.25-9.48**	2.80	0.94-8.36
	6 +	545	7.7	**6.45**	**2.29-18.2**	**4.45**	**1.37-14.5**
	Not collected*	5213	7.0	**5.85**	**2.17-15.8**	--	--
	Missing	112	4.5	3.61	0.95-13.7	0.94	0.00-307.9
Condom use with any partner, past 12 months	Always used condoms	1694	5.4	1.00		--	--
	Didn't always use condoms	2688	8.7	**1.67**	**1.30-2.15**	--	--
	Not collected*	2676	4.6	0.85	0.64-1.12	--	--
	Missing	814	5.3	0.98	0.68-1.43	--	--
Anal sex with regular partner/s, past 6 months	Always used condoms	707	3.8	1.00		1.0	
	Inconsistent condom use	537	6.9	**1.86**	**1.12-3.10**	1.48	0.86-2.56
	Never used condoms	338	3.0	0.77	0.37-1.61	0.73	0.34-1.59
	No partner	884	4.2	1.10	0.66-1.83	1.12	0.63-1.99
	Not collected*	5213	7.0	**1.91**	**1.28-2.84**	--	--
	Missing	193	6.2	1.67	0.83-3.36	2.33	0.90-6.08
HIV status of current regular partner	Negative	918	4.0	1.00		1.0	
	Positive	172	4.1	1.01	0.44-2.30	0.92	0.39-2.14
	Don't know/he hasn't had a test	296	5.4	1.36	0.75-2.48	1.28	0.69-2.36
	Not collected* or no partner	6322	6.7	**1.71**	**1.21-2.41**	1.02	0.61-1.72
	Missing	164	4.3	1.06	0.47-2.42	0.61	0.13-2.83
Anal sex with casual partner/s, past 6 months	Always used condoms	1217	4.2	1.00		1.0	
	Inconsistent condom use	576	8.0	**1.98**	**1.31-2.99**	1.51	0.96-2.37
	Never used condoms	38	5.3	1.27	0.30-5.42	1.73	0.38-7.95
	No partner	702	2.6	0.60	0.35-1.04	0.87	0.47-1.60
	Not collected*	5213	7.0	**1.73**	**1.28-2.34**	--	--
	Missing	126	4.8	1.14	0.48-2.72	1.57	0.23-10.81

* One large site was excluded because it uses electronic data collection which collects briefer behavioural information than the sentinel surveillance form,
**symptoms were not defined on the questionnaire, so response to this question was at the clinician's discretion. This question was not asked of MSM prior to February 2008.
-- dropped from multivariable analysis due to collinearity