Anal human papillomavirus and HIV: A cross-sectional study among men who have sex with men in Moscow, Russia, 2012–2013

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Anal human papillomavirus (HPV) is prevalent among men who have sex with men (MSM), but has not been studied in the Russian Federation. A cross-sectional survey and HPV genotyping were conducted among HIV seropositive (n=58) and seronegative MSM (n=65) in Moscow. Multivariable logistic regression was performed to identify correlates of infection with oncogenic HPV genotypes 16 and/or 18 (HPV 16/18). Forty per cent (49/124) of all MSM were infected with at least one anal HPV genotype, 31.5% (39/124) had HPV16/18, and 11.5% (14/121) had high-grade squamous intraepithelial lesions (HSIL). HPV 16/18 was more prevalent in HIV seropositive than seronegative men (24/58, 41.4% vs 15/65, 23.1%; p=0.03). HIV infection was independently associated with HPV 16/18 (adjusted odds ratio (AOR): 5.08; 95% confidence intervals (CI): 1.49–17.34, p=0.01), as was having 2–4 steady male sex partners in the last year (vs ≤ 1 partner; AOR: 6.99; 95%CI: 1.94–25.24, p<0.01). History of prison/detention, migration to/within Russia and use of incompatible lubricants were marginally associated with HPV 16/18 (p<0.10). Comprehensive prevention options are needed to address HIV and HPV infection among MSM in Russia and may benefit from inclusion of young men in piloted HPV vaccination programmes.

Introduction

Globally, men who have sex with men (MSM) have the highest prevalence of human papillomavirus (HPV), high-grade anal dysplasia (pre-cancer) and anal squamous cell cancer (ASSC), compared with other risk groups [1]. The presence of high-risk (HR) HPV (types 16 and 18) in particular is closely associated with the progression from low-grade squamous intraepithelial lesions (LSIL) to high-grade SIL (HSIL) and also with ASSC [2–4]. This prevalence and incidence is more common in MSM infected with HIV [2,5]. In particular, there is an increased prevalence of HPV infections among MSM living with HIV, with a 35.4% pooled HPV 16 prevalence and anal cancer incidence of 45.9 per 100,000 HIV-infected men, as estimated by a recent meta-analysis [4]. Comparatively, in that same meta-analysis, HPV 16 prevalence was estimated to be 12.5% in HIV-uninfected men, with an anal cancer incidence of 5.1 per 100,000 men [4]. Evidence also suggests increased risk for HIV acquisition during infection with oncogenic HPV and persistent HPV infection is more common among men living with HIV compared with uninfected men [6].

Most epidemiological data on HPV in MSM is from North America, western Europe, and Oceania [4]. While recent epidemiological investigations have demonstrated high-risk sexual behaviours and up to 15% HIV prevalence among Moscow-based MSM, substantially higher than the 1% prevalence in the general adult population, HPV infection has not been a focus of research or public health surveillance among MSM in the Russian Federation [7–11]. Currently, estimates of the proportion of anal cancers that may be attributable to HPV in eastern Europe and central Asia are currently unavailable. Other modelling estimates from the Statistical Office of the European Union (Eurostat), however, suggest that of 72,694 new cancer cases each year among European men, 17,403 of these could be attributable to HPV and 15,497 attributable to high-risk HPV genotypes [12]. Approximately 30% of all new annual European cancer cases attributable to HPV16/18 are estimated to occur in men [12].

In light of the lack of information on anal HPV infection among MSM and potential co-infection among those living with HIV in the Russian Federation, this study aimed to explore the existence of anal HPV infection among HIV seronegative and seropositive MSM as well as correlates of infection with oncogenic HPV genotypes 16 and/or 18. Nested within a large epidemiological study of HIV among MSM in Moscow, circulating anal HPV genotypes, anal dysplasia, and other sexually transmitted infections (STIs) among HIV seropositive and seronegative MSM were evaluated.

Methods

Study population and site

Between January 2012 and January 2013, HIV seropositive and seronegative men (n=124) were enrolled from a pool of participants enrolled in a larger cross-sectional study of homosexual, bisexual and other MSM based in Moscow. This parent study also sought to compare the efficiencies of respondent-driven sampling (RDS) and Internet-based sampling (IBS) methods for recruiting MSM for HIV testing and counselling. Eligibility criteria for the parent study included adult men (age › 18 years) who reported anal sex with another man in the last 12 months.

Parent study participants were sampled via RDS and IBS, surveyed, and completed rapid HIV and syphilis testing. Briefly, RDS is a chain recruitment method often used to achieve representative samples of hard-to-reach populations [13]. Recruitment began with three purposively-selected 'seeds' who were each provided with four study-specific coupons with which to recruit peer MSM from their social network into the study. Seeds were recruited from the pool of MSM who were involved in local HIV prevention programmes or had participated in prior formative research and were selected to represent a range of individual characteristics. Individuals who were recruited by seeds were assessed for eligibility, consented, and enrolled in the study. At completion of study activities, participants were then provided with three study coupons for further recruitment of peers, constituting a new wave of recruitment. This process continued and 31 waves of participants were ultimately enrolled. A full description of traditional RDS methodology can be found elsewhere [14]. RDS was conducted in Moscow between October 2010 and April 2013 while IBS recruitment took place from late October 2010 to November 2012. IBS recruitment was conducted through banner ads posted on dating websites for MSM, including *Qguys*, *Parniplus*, and *Bluesystems.ru*. When clicked, banner ads linked interested viewers to an online consent form and a brief 10-item online quiz to obtain information on sociodemographic characteristics, sexual identity, and sexual practices. No personal identifiers or IP addresses were obtained from participants. Participants who were preliminarily deemed eligible for the full study, based on online quiz responses, were then directed to a study information page. Participants from both IBS and RDS were provided with the study telephone number via webpage or coupon, respectively, and advised to call to schedule an appointment. All procedures from the appointment onward were the same for RDS and IBS participants.

Participants who completed parent study activities, which included an interviewer-administered survey and HIV and syphilis rapid and confirmatory testing, were assessed for eligibility to participate in a nested HPV sub-study. Because the of the small sample size and the primary interest of identifying circulating HPV genotypes, eligibility for the sub-study was limited to those who self-reported inconsistent condom use during receptive anal sex (last 12 months) to ensure that men who are at risk of HPV infection were included in the sub-study. The HPV sub-study targeted enrolment to relatively equal samples of participants by HIV serostatus. Research activities were conducted in a private health clinic that is known to be accepting of MSM and activities were implemented by a local non-governmental organisation, AIDS Infoshare, which has a history of HIV research with key populations. All activities were conducted in the Russian language and all data collection and testing was anonymous. Remuneration for participation in the sub-study was RUB 2,000 (approximately EUR 50).

Survey measures

As part of the parent study, all participants were asked to complete an anonymous, interviewer-administered, structured survey to capture information on demographics, history of HIV and STI prevention and service use; sexual behaviours with men and women, including anal/oral/vaginal sex; number of sexual partners and partner characteristics; transactional sex (purchased or sold); and substance use. Sexual behaviour measures were adapted from the United States Centers for Disease Control and Prevention (CDC)'s National Health Behavior Survey [15]. Participants who reported past diagnosis of HIV infection were asked additional questions about HIV care and treatment. Additional sexual behaviour questions were asked of HPV sub-study participants to determine if any items had been placed in the anal canal within the last 24 hours, such as douching, use of sex toys, and anal sex, that might impair tests or result in indeterminate results. Computer-based surveys were administered by trained AIDS Infoshare interviewers and time for survey completion ranged from 60 to 90 minutes.

Biological sampling and testing

MSM were tested for HIV and syphilis infection within the parent study; these procedures have been described elsewhere [7]. Briefly, syphilis infection was measured with Lues rapid plasma reaction (RPR) (Nearmedic Plus, Moscow, Russia) and those samples testing positive for syphilis were confirmed with Lues RPGA test (Nearmedic Plus, Moscow, Russia). HIV testing used Determine HIV-1/2 test (Abbott Laboratories, Abbott Park, IL, US) rapid tests. Samples from those

Table 1

Demographic characteristics of Moscow-based men who have sex with men, stratified by HIV serostatus, cross-sectional study, Moscow, Russia, January 2012–January 2013 (n=123)

	HIV seronegative (n=65)		HIV seropositive (n=58)		p value	Total	
	n	Col %	n	Col %		n	Col %
Age (years)					0.03		
‹25	24	36.9	10	17.2		34	27.6
25 to 29	20	30.8	17	29.3		37	30.1
30 to 35	10	15.4	20	34.5		30	24.4
›35	11	16.9	11	19.0		22	17.9
Place of birth					0.60		
Russia	56	86.2	48	82.8		104	84.6
Outside Russia	9	13.8	10	17.2		19	15.4
Moved to or within Russian Federation for work (n=122)					0.42		
No	41	64.1	33	56.9		74	60.7
Yes	23	35.9	25	43.1		48	39.3
Sexual identity					0.65		
Homosexual	44	67.7	37	63.8		81	65.9
Bisexual	21	32.3	21	36.2		42	34.1
Ever married to a woman					0.29		
Never	59	90.8	49	84.5		108	87.8
Past/current marriage	6	9.2	9	15.5		15	12.2
Number of dependents					0.17		
1	43	66.2	38	65.5		81	65.9
2 to 3	22	33.8	17	29.3		39	31.7
≥4	0	0.0	3	5.2		3	2.4
Education (level completed)					0.99		
Primary education	1	1.5	1	1.7		2	1.6
Secondary education	17	26.2	13	22.4		30	24.4
Specialised secondary education (diploma)	21	32.3	18	31.0		39	31.7
Undergraduate education	6	9.2	6	10.3		12	9.8
Higher education	20	30.8	20	34.5		40	32.5
Employment categories (n=121)					0.50		
Full-time	31	49.2	26	44.8		57	47.1
Part-time	26	41.3	22	37.9		48	39.7
Student only	3	4.8	2	3.4		5	4.1
Other, including retired, disabled	0	0.0	1	1.7		1	0.8
Unemployed	3	4.8	7	12.1		10	8.3
Income level					0.22		
Poverty	2	3.1	5	8.6		7	5.7
Low	37	56.9	25	43.1		62	50.4
Middle	25	38.5	28	48.3		53	43.1
High	1	1.5	0	0.0		1	0.8
Usual healthcare provider (n=117)					0.73		
Private only	18	29.0	12	21.8		30	25.6
Public and private/other	11	17.7	9	16.4		20	17.1
Public only	32	51.6	32	58.2		64	54.7
Other only	1	1.6	2	3.6		3	2.6

Col: column.

Table 2

HPV and anal cytology results among MSM in Moscow, Russia, stratified by HIV serostatus (n=123)

	HIV seronegative (n=65)		HIV seropositive (n=58)		p value	Total	
	n	Col %	n	Col %		n	Col %
Anal cytology results (n=120)					0.81		
Normal	57	87.7	49	89.1		106	88.3
HSIL	8	12.3	6	10.9		14	11.7
Infection with HPV genotype							
6[a] (ref: no)	7	10.8	13	22.4	0.08	20	16.3
11 (ref: no)	4	6.2	4	6.9	0.87	8	6.5
16 (ref: no)	9	13.8	11	19.0	0.44	20	16.3
18[b] (ref: no)	4	6.2	12	20.7	0.02	16	13.0
31 (ref: no)	8	12.3	9	15.5	0.61	17	13.8
33 (ref: no)	7	10.8	5	8.6	0.69	12	9.8
Any HPV genotype[b] (ref: no)	20	30.3	29	50.9	0.04	49	39.8
HPV16/18a (ref: no)	15	23.1	24	41.4	0.03	39	31.7

Col: column; HSIL: high-grade squamous intraepithelial lesions; HPV: human papilloma virus; Ref: reference category not displayed

[a] p-value<0.10;
[b] p-value<0.05

testing positive were sent to the local reference laboratory for confirmatory testing. The clinic staff physician provided pre- and post-test HIV counselling and followed all federal protocols [16]. For the purposes of the HPV study, participants are defined as HIV seropositive or seronegative, based on confirmatory study results.

Participants of the HPV sub-study provided additional biological specimens for testing for urethral, oral, and rectal gonorrhoea and chlamydia, as well as for anal cytology and anal HPV genotyping. All specimens for the sub-study were collected by the same study physician and transferred daily for laboratory analysis by a local reference laboratory (Lages Laboratory, Moscow, Russia).

Anorectal specimens were first collected for anal cytology (Papanicolaou (Pap) test) to detect HPV-associated anal dysplasia and followed by anorectal specimen collection for HPV genotyping. Both specimens were collected by inserting a saline-moistened polyester swab into the anal canal into the rectum to ensure sampling of the anorectal transition zone. The swab was rotated slowly during withdraw to capture cells. HPV testing of swabbed cellular material was conducted at the reference laboratory using PCR for amplification of a fragment of the L1 gene to detect the following HPV genotypes: 6, 11, 16, 18, 31, and 33.

Rectal specimens to test for gonococcal and chlamydial infection were then collected by polyester swab inserted at least 2 inches beyond the anal margin and withdrawn in a rotating motion. Participants had the option to provide urethral swabs or urine specimen collection to test for urethral gonococcal and chlamydial infection. The local reference laboratory analysed swabs and urine specimens for gonococcal and chlamydial infection using nucleic acid amplification tests (DiaGen, Moscow, Russia).

All tests, except those for HPV, were performed within 2–3 days of collection, so that participants could be informed of their test results and provided with treatment according to national treatment standards for genital warts, gonorrhoea, syphilis, and chlamydia. Treatment was provided by the study clinic. Participants who screened positive for anal dysplasia by cytology were provided with referrals to the Institute of Proctology in Moscow, where the participant could receive specialised care. Participants with HPV infection, with exception of those with HPV-related genital warts, were not informed of HPV test results as testing was conducted in batches and no treatment was available for men.

Statistical analysis

Descriptive analyses were conducted to estimate the distribution of HPV genotypes, STIs, behavioural characteristics, sexual health history, and use of antiretroviral therapy (ART). Bivariate analysis was used to compare distributions of HPV genotypes among participants with and without HIV infection as well as to compare distributions of characteristics of participants with and without HPV 16/18 infection. HPV 16 and 18 were the focus of this analysis due to the attribution of HPV 16 or 18 to most anal cancers and the inclusion of these genotypes in the quadrivalent vaccine. Chi-squared tests were used to evaluate statistical significance in bivariate analysis. HIV status, known confounders (such as age), and variables that test at least

Table 3A

Distribution of demographic and sexual behaviour characteristics among men who have sex with men in Moscow, Russia, by oncogenic human papilloma virus infection (n=124)

	No HPV 16/18 infection (n=95)		HPV 16/18 infection (n=29)		p value	Total	
	n	Col %	n	Col %		n	Col %
Demographics					0.81		
Age, years					0.14		
‹25	30	31.6	4	13.8		34	27.4
25–29	25	26.3	12	41.4		37	29.8
30–35	21	22.1	9	31.0		30	24.2
›35	19	20.0	4	13.8		23	18.5
Born in Russia (ref: born outside of Russia)	82	86.3	23	79.3	0.36	105	84.7
Homosexual identity (ref: bisexual)	61	64.2	21	72.4	0.41	82	66.1
Ever married to a woman (ref: never)	12	12.6	3	10.3	0.74	15	12.1
Moved to or within Russian Federation for work (n=123; ref: no)[a]	32	33.7	16	57.1	0.03	48	39.0
Usual healthcare provider (n=118)[b]					0.07		
Private only	24	26.7	6	21.4		30	25.4
Public and private/other	12	13.3	8	28.6		20	16.9
Public only	53	58.9	12	42.9		65	55.1
Other only	1	1.1	2	7.1		3	2.5
Lifetime history of prison/detention (ref: no)[a]	5	5.3	7	24.1	0.01	12	9.8
Sexual behaviours							
Ever disclosed sexual identity/ behaviour to others (n=121; ref: no)	70	75.3	25	89.3	0.11	95	78.5
Age of first sex (n=122)					0.73		
‹=18	61	64.9	16	57.1		77	63.1
19–25	31	33.0	11	39.3		42	34.4
›25 yrs.	2	2.1	1	3.6		3	2.5
No. of male sexual partners (last 12 months)					0.58		
One or less	16	16.8	4	13.8		20	16.1
2 to 4	20	21.1	4	13.8		24	19.4
5 or more	59	62.1	21	72.4		80	64.5
No. of steady male partners (last 12 months) [a,c]					0.02		
One or less	60	64.5	13	48.1		73	60.8
2 to 4	20	21.5	13	48.1		33	27.5
5 or more	13	14.0	1	3.7		14	11.7
Received money/goods for sex (last 12 months; n=118; ref: no)	36	39.1	8	30.8	0.44	44	37.3
Paid money/goods for sex (last 12 months; n=118; ref: no)[a]	24	26.7	2	7.1	0.03	26	22.0
Use alcohol or drugs before sex (last 12 months; n=120)					0.27		
Alcohol only	59	63.4	18	66.7		77	64.2
Drugs only (including poppers)	1	1.1	2	7.4		3	2.5
Both alcohol and drugs (including poppers)	19	20.4	4	14.8		23	19.2
Neither	14	15.1	3	11.1		17	14.2
Incompatible lubricant used during sex (n=121; ref: Compatible)[b]	36	38.7	16	57.1	0.08	52	43.0

ART: antiretroviral therapy; *C. trachomatis*: *Chlamydia trachomatis*; Col: column; HPV: human papilloma virus; HSIL: high-grade squamous intraepithelial lesions; *N. gonorrhoeae*: *Neisseria gonorrhoeae*; Ref: reference category not displayed.

[a] p-value‹0.05

[b] p-value‹0.10

[c] Steady partner was defined as 'another man whom you consider to be your boyfriend or partner and to whom you are most committed.'

Table 3B

Distribution of demographic and sexual behaviour characteristics among men who have sex with men in Moscow, Russia, by oncogenic human papilloma virus infection (n=124)

	No HPV 16/18 infection (n=95)		HPV 16/18 infection (n=29)		p value	Total	
	n	Col %	n	Col %		n	Col %
Sexually transmitted infections, HIV serostatus and treatment							
HSIL (n=121; ref: normal)[a]	7	7.6	7	24.1	0.02	14	11.6
Positive rectal *N. gonorrhoeae* results (n=124; ref: negative)	4	4.2	3	10.3	0.21	7	5.6
Positive urine/urethral *N. gonorrhoeae* results (n=123; ref: Negative)	1	1.1	0	0.0	0.58	1	0.8
Positive rectal *C. trachomatis* results[a] (n=124; ref: negative)	6	6.3	6	20.7	0.02	12	9.7
Positive urine/urethral *C. trachomatis* results (n=122; ref: Negative)	5	5.3	2	7.1	0.72	7	5.7
Positive syphilis results (n=123; ref: negative)	13	13.7	7	24.1	0.36	20	16.1
HIV seropositive (n=123; ref: negative)[a]	39	41.5	19	65.5	0.02	58	47.2
Last CD4 count (among 7 HIV seropositive men who had ever had a CD4 test)					0.65		
>500 cells/µL	1	25.0	1	33.3		2	28.6
200 –500 cells/µL	2	50.0	2	66.7		4	57.1
<200 cells/µL	1	25.0	0	0.0		1	14.3
Currently on ART (n=11; ref: no)	2	33.3	2	40.0	0.82	4	36.4

ART: antiretroviral therapy; *C. trachomatis*: *Chlamydia trachomatis*; Col: column; HPV: human papilloma virus; HSIL: high-grade squamous intraepithelial lesions; *N. gonorrhoeae*: *Neisseria gonorrhoeae*; Ref: reference category not displayed.

[a] p-value<0.05

[b] p-value<0.10

[c] Steady partner was defined as 'another man whom you consider to be your boyfriend or partner and to whom you are most committed.'

marginally significant in bivariate analysis (p<0.10) were used to construct a multivariable logistic regression model to identify independent factors associated with infection with HPV 16/18. Statistical significance was set at p<0.05 and marginal significance at p<0.10. Sensitivity analyses were conducted to evaluate the associations with HPV 16/18 when the comparison group comprised only those with no HPV infection of any kind. Data were not weighted for RDS network size during modelling, given that participants of this sub-study were selected on the basis of HIV status and using both RDS and IBS sampling methods. All statistical analyses were conducted using Stata version 12 (StataCorp, College Station, TX, USA).

Research ethics

The study was conducted in partnership with a local non-governmental organisation, AIDS Infoshare, and approved by both the Ethics Committee of the State Medical University, IP Pavlov, Saint Petersburg, Russia and the Johns Hopkins Bloomberg School of Public Health Institutional Review Board, Baltimore, Maryland, USA.

Results

Final enrolment of HPV sub-study participants included 124 MSM, of whom 58 were HIV-seropositive, and 65 HIV seronegative, based on confirmatory testing, and one with indeterminate HIV test results. Four participants who reported a past diagnosis of HIV, tested positive by rapid test, and declined further confirmatory testing were included among the sample of HIV-seropositive participants. One participant provided only a rapid test, which was negative, but had reported a past diagnosis of HIV infection. This participant's HPV and behavioural data were included in the analysis, but HIV status was considered indeterminate for this analysis. No indeterminate HPV results were returned for any of the 124 sub-study participants. Three participants had indeterminate anal cytology results, yielding a final anal cytology sample of 121.

Table 1 presents demographics and select sexual practices of participants in the sub-study, stratified by HIV serostatus. Overall, participants had a median age of 29 years (range: 19–50 years) though HIV-seropositive participants tended to be slightly older, compared with seronegative participants (p=0.03). No other differences across HIV serostatus existed among collected demographic characteristics.

All evaluated HPV types were present among study participants and 39.5% (49/124) were diagnosed with infection by at least one HPV genotype. Table 2 presents HPV diagnoses among MSM participants, stratified by HIV serostatus. Infection with any HPV genotype was higher among HIV seropositive men (29/58; 50.0%) compared with seronegative men (20/66, 30.3%; p=0.04). Some 41.4% (24/58) of seropositive men were identified with HPV 16/18 compared with 23.1% among seronegative men (15/65; p=0.03).

Table 4*

Crude and adjusted associations of demographic and sexual behaviour characteristics with human papilloma virus 16/18 infection among men who have sex with men in Moscow, Russia (n=124)

	Crude analysis				Adjusted analysis[a]			
	OR	95% CI		p value	AOR	95% CI		p value
Demographics								
Moved to or within Russian Federation for work (n=123)[b,c]								
No	Ref				Ref			
Yes	2.63	1.11	6.21	0.03	3.18	1.00	10.09	0.05
Usual healthcare provider (n=118)[d]								
Private only	Ref							
Public and private/other	2.67	0.75	9.45	0.13				
Public only	0.91	0.30	2.70	0.86				
Other only	8.00	0.62	103.67	0.11				
History of prison/detention[b,e]								
No	Ref				Ref			
Yes	5.66	1.64	19.55	0.01	6.53	0.85	50.42	0.07
Sexual behaviours								
No. of steady male partners (last 12 months) [b,c,f]								
One or less	Ref				Ref			
2 to 4	3.00	1.20	7.53	0.02	6.99	1.94	25.24	P<0.01
5 or more	0.36	0.04	2.96	0.34	0.14	0.01	2.09	0.16
Purchased sex (last 12 months; n=118)[b,e]								
No	Ref				Ref			
Yes	0.21	0.05	0.96	0.04	0.23	0.04	1.26	0.09
Type of lubricant used during sex (n=121)[d,e]								
Condom compatible	Ref				Ref			
Incompatible	2.11	0.90	4.97	0.09	2.84	0.86	9.44	0.09
Sexually transmitted infections								
Rectal *C. trachomatis* results[b]								
Negative	Ref				Ref			
Positive	3.87	1.14	13.12	0.03	3.17	0.67	14.90	0.15
HIV diagnosis (n=123)[b,c]								
Seronegative	Ref				Ref			
Seropositive	2.68	1.12	6.39	0.03	5.08	1.49	17.34	0.01

AOR: adjusted odds ratio; *C. trachomatis: Chlamydia trachomatis*; CI: confidence intervals; OR: odds ratio.

[a] The final model included HIV status, rectal Chlamydia infection, migration to/within Russia, lifetime history of detention in prison, number of steady male sex partners, type of lubricant typically used during anal sex with men (condom compatible v. incompatible), and age (continuous); Dependent variable reference group is no HPV 16/18 infection;

[b] Crude analysis p-value for total variable<0.05;

[c] Adjusted analysis p-value for total variable<0.05;

[d] Crude analysis p-value for total variable <0.10;

[e] Adjusted analysis p-value for total variable <0.10;

[f] Steady partner was defined as 'another man whom you consider to be your boyfriend or partner, to whom you are most committed.'

HPV genotypes among HIV seropositive MSM demonstrated slightly different patterns and prevalence compared with HIV seronegative men. Among the total sample, prevalence of HSIL was 11.7%, with no difference by HIV serostatus (p=0.81).

Table 3 presents the distribution of sexual and health behaviours among participants with and without HPV 16/18 infection. Participants were similar across most demographic characteristics. Among those with HPV 16/18, over 57.1% (16/28) had moved within or into Russia for work, compared with 33.7% of those without HPV 16/18 (32/95; p=0.05). Likewise, 24.1% (7/29) of those with HPV 16/18 infection had a lifetime history of detention or prison, compared with 5.3% of those without HPV 16/18 (5/94; p=0.01). Differences were observed across some sexual behaviours. Higher proportions of MSM with HPV 16/18 tended to report greater numbers of steady male sexual partners than those without HPV 16/18 infection (p=0.02), although the total numbers of male sexual partners in the last 12 months did not differ by HPV infection. Over half of

MSM with HPV 16/18 infection (57.1%; 16/28) reported the use of a condom-incompatible lubricant or no lubricant (incompatible lubricants are those which are not water- or silicon-based, including oils and lotions), which was marginally higher than those without infection (36/93; 38.7%; p=0.08). HSIL (p=0.02) and rectal infection with Chlamydia trachomatis (p=0.02) were associated with HPV 16/18 infection HSIL was present among 24.1% (7/29) of participants with HPV 16/18 infection, compared with 7.6% of those without HPV16/18 (7/92; p=0.02). In the sensitivity analysis (data not shown) with a comparison group of those without any HPV infection, patterns of association were similar to those in Table 3.

Table 4 presents crude and adjusted associations with HPV 16/18 infection. HIV infection was independently associated with HPV 16/18 infection (adjusted odds ratio (AOR): 5.08; 95% confidence intervals (CI): 1.49–17.34; p=0.01), as was having 2–4 steady male sex partners in the last year (vs ≤ 1; AOR: 6.99; 95% CI: 1.94–25.24; p<0.01). History of prison or detention (AOR: 6.53; 95% CI: 0.85–50.42; p=0.07), use of incompatible lubricants (AOR: 2.84; 95% CI: 0.86–9.44; p=0.07), and migration to/within Russia (AOR: 3.18; 95% CI: 1.00–10.09; p=0.05) were marginally associated with HPV 16/18. Rectal infection with C. trachomatis was no longer associated with HPV 16/18 after adjustment for other variables, though the magnitude of the odds ratio suggests potential association. In the sensitivity analysis (data not shown) for the crude and adjusted logistic regression, HIV infection, rectal C. trachomatis infection, history of moving to/within the Russian Federation, having 2–4 steady male partners were independently associated with HPV16/18.

Discussion

HPV, particularly its oncogenic genotypes, is prevalent among this sample of Moscow-based MSM and more common among those living with HIV infection. All tested genotypes were detected among the total sample, with 41.2% infected with at least one HPV genotype, the majority of which were comprised of HPV 16 or 18 genotypes. To a lesser degree, HSIL was also identified among this sample. HPV 16/18 infection was significantly or marginally associated with structural factors, sexual behaviours, and individual biological factors. In this context, HIV infection may act as a biological factor for HPV infection, as well as serving as a marker for sexual risk. While rectal C. trachomatis infection was not significant after inclusion in the full model, the magnitude of the odds ratios suggests that such infections may be related to HPV 16/18, which is consistent with studies in other settings [17]. These data represent the first data on HPV and anal dysplasia in MSM from the Russian Federation, as well as the wider EECA Region.

Consistent with other research of HPV in MSM, HPV 16/18 was associated with individual sexual behaviours [3,18]. In this study, HPV was specifically associated with higher numbers of steady male sexual partners in the last 12 months. While there was no difference across the total numbers of sex partners within the last 12 months, the association with the number of steady partners may actually reflect the sexual relationships where condoms are most inconsistently used, given that condoms tend to be used more consistently during relationships with new partners [9,19]. Additionally, increased numbers of steady partners among MSM with HPV 16/18 infection may reflect more transient relationships and greater risk behaviour among this subgroup. HPV 16/18 was also associated with regular use of lubricants that are incompatible with latex condoms. Oil-based lubricants or other methods of lubrication (such as body lotion) have been shown to degrade latex condoms during use, potentially facilitating exposure to HPV infection during anal intercourse [20]. Simple interventions that improve condom use with all sexual partners and increase use of condom-compatible lubricants may reduce HPV transmission, as well as HIV and other STIs.

Several structural factors were marginally associated with HPV 16/18. These factors included history of detention in prison and migration to or within the Russian Federation. These may be markers of exposures to new networks in which HPV and/or HIV may be prevalent (e.g. among MSM networks in prison or in a new city) or may reflect low access to prevention methods for HIV/STI [9,21]. In the absence of data on HPV in Russia or EECA, understanding of HPV transmission related to these structural factors may be derived from research on HIV and other STI. An Internet survey conducted among MSM in 38 European countries in 2010 found that around 65% of Russian men had received information about how STIs can be transmitted during same-sex practices and only 50% had accessed HIV prevention programmes. These indicators for information and access to HIV prevention were below the median estimates for their European counterparts [22]. For those detained in prison/detention or who are new migrants, access to information and prevention methods may be even more limited [23]. Condoms and other HIV prevention methods are not available within prisons or detention facilities in Russia, despite evidence of exposure opportunities and transmission within prisons in Russia and wider EECA countries [24,25]. During detention, HIV, HPV and other STI transmission may occur through consensual same sex behaviours, rape or other non-consensual practices, and HIV exposure through shared syringes among those who inject drugs [24]. Outside of prison or detention, access to public healthcare is limited by the propiska-like system that requires individuals to be registered and hold documentation for their city of residence. For migrant populations, including internal migrants, this limits access basic HIV and STI prevention [23,26]. In other European countries, migration status has been associated with increased prevalence of HIV and STI infection [27].

Findings should be viewed in light of several limitations. First, this was a small, cross-sectional study to explore circulating HPV and oncogenic HPV genotypes among MSM in Moscow, Russia; thus, this small sample size limits statistical power and broader inferences. Selection on the basis of HIV status and self-reported inconsistent condom use may bias the estimates of HPV prevalence. Consistent with other socio-behavioural surveys, additional bias may be introduced with the length of the survey and/or selection bias associated with presenting to the study clinic for participation and participant incentives. As such, these data are not intended to provide prevalence estimates for the country or Moscow city, but provide insight into anal HPV infection among Moscow-based MSM and circulating genotypes. Findings from the multivariable analysis are informative for future research, but the generalisability may be limited by the small sample and non-random sampling method and should be interpreted with caution. Studies with larger samples and prospective analyses are needed to fully understand correlates or predictors of HPV infection among Russian MSM. Data were not collected on smoking duration or dose, which is a known risk factor for progression to HSIL and is relevant in Russia where smoking remains very common [3]. As this was a cross-sectional study, longitudinal data on anal clearance rate of the different HPV types or persistence of infection were not collected and further research is warranted, as persistence has been significantly greater for persons living with HIV, compared with those who are uninfected [6,18].

Interventions to reduce HPV transmission among MSM in the Russian Federation are warranted. Both the quadrivalent and bivalent vaccines have demonstrated efficacy against oncogenic HPV-vaccine-type infections in MSM and other men [28]. Modelling estimates have taken such findings further and estimated an 86% reduction in HPV 16/18-related carcinomas among men in Europe with implementation of vaccination of girls and boys vs screening alone [29]. Relative to a female-only programme, vaccination of both genders has demonstrated a greater reduction in male and female HPV-related carcinomas [29]. The quadrivalent HPV vaccine has been licensed for use in Russia and is being tested in school-based, pilot programmes for adolescent girls in four Russian cities, including Moscow, though regional experts have recommended inclusion of boys in vaccination campaigns [30,31]. While HIV prevention programmes for MSM in the Russian Federation are limited by stigmatization and laws ban 'homosexual propaganda', equitable HPV vaccination programmes for young men and women in the country may impart benefit without requiring disclosure of sexual preferences [32, 33]. Research from North American settings also support the use of anal Pap screening among MSM as an acceptable means of secondary prevention, though cost-effectiveness analyses have yielded mixed results [34,35].

Prevention of HPV infection among MSM in the Russian Federation - and ultimately prevention of HSIL - may rely on basic tenets of HIV prevention: condom distribution and ART treatment for those living with HIV. Enabling access to and encouraging use of appropriate condoms and compatible lubricants with all partners during anal intercourse provides protective barriers against HPV acquisition in the absence of other HPV prevention methods. Given that ART has also demonstrated protective benefits against oncogenic HPV, in addition to preventing onward transmission of HIV, HIV testing and access to ART care for MSM who are living with HIV remain critical [36,37]. As resources for HIV prevention among key populations in the Russian Federation become limited, programmes that are comprehensive and address multiple STIs, including HIV and HPV, and facilitate engagement with HIV care, may be most efficient and promising for protecting health of Russian MSM.

* Erratum:

The title of Table 4 was corrected on 28 April 2015.

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Conflict of interest

None declared.

Authors' contributions

CB, AW, CZ, NG, VM, AP, and CL collaborated in the design and oversight of the overall study. RC, IM, and AD provided additional expertise into the design and analysis of the HPV sub-study. IK and PD coordinated local study implementation and conducted data collection. AW wrote the initial drafts of this manuscript. AW conducted the statistical analysis and composed the initial draft of the paper. All authors had full access to the data, reviewed and edited the manuscript, and all take responsibility for its integrity as well as the accuracy of the analysis.

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