CSIRO PUBLISHING
Sexual Health, 2017, **14**, 523–532
http://dx.doi.org/10.1071/SH16198

How partnership type and HIV seroconcordance affect HIV transmission risk in regular sexual partnerships: a cross-sectional survey of Australian gay and bisexual men

Benjamin R. Bavinton[A,D], *Andrew E. Grulich*[A], *Duane Duncan*[B,C], *Iryna B. Zablotska*[A] *and Garrett P. Prestage*[A,C]

[A]Kirby Institute, UNSW Sydney, Sydney, NSW 2052, Australia.
[B]University of New England, Armidale, NSW 2351, Australia.
[C]Australian Research Centre in Sex, Health and Society, La Trobe University, 215 Franklin Street, Melbourne, Vic., 3000, Australia.
[D]Corresponding author. Email: bbavinton@kirby.unsw.edu.au

Abstract. ***Background*:** Regular sexual partnerships among gay and bisexual men (GBM) who practice condomless anal intercourse (CLAI) have not been well characterised in terms of partnership type, HIV seroconcordance and risk of HIV transmission. Primarily sexual regular partnerships, although commonly reported by gay men, have largely been ignored in research and HIV prevention. Among regular partners reporting CLAI with each other, we determined factors differentiating romantic or committed relationships from partnerships organised primarily around sex ('fuckbuddies') and estimated the proportion of CLAI presenting risk for HIV transmission. ***Methods*:** An online, cross-sectional survey of Australian GBM was conducted. Univariate and multivariate generalised estimating equations were used to determine statistical associations. ***Results*:** Men reported on 2250 regular sexual partnerships. Over half the partnerships were romantic or committed relationships. Over half the partnerships were HIV-negative seroconcordant (54.9%), 3.1% were HIV-positive seroconcordant, 5.2% were serodiscordant and 36.8% were of unknown seroconcordance. Potential risks presented by CLAI were sometimes mitigated by protective factors, such as having a clear spoken agreement about sex with outside partners, having fewer outside partners, openly discussing HIV risk and having an agreement to reduce risk from outside partners. These protective factors were more often found in romantic or committed relationships than among primarily sexual partnerships, and were less often found in partnerships of unknown seroconcordance. ***Conclusion*:** CLAI is more common among regular sexual partnerships considered to be of a romantic, committed nature. However, factors associated with such romantic or committed partnerships can also protect against HIV transmission risk. Unknown seroconcordance, particularly lack of communication about HIV status among primarily sexual partnerships, is a key risk factor that needs to be addressed by HIV education.

Additional keywords: HIV prevention, men who have sex with men, relationships.

Received 23 October 2016, accepted 4 May 2017, published online 22 June 2017

Introduction

The majority of HIV infections in most developed and many developing countries are in gay and bisexual men (GBM),[1,2] with condomless anal intercourse (CLAI) as the primary transmission route.[3] Approximately one-third of infections among newly diagnosed men in Australia are estimated to be from regular partners,[4–6] whereas modelling from the US estimates that 68% of infections in GBM are from 'main' partners.[7] Intimacy and familiarity with partners have been associated with increased CLAI among GBM,[8–11] and HIV prevention and research have described ongoing sexual relationships as potentially high risk for HIV transmission.[12] However, CLAI in some types of regular partnerships has been found to be largely low risk, particularly among HIV-negative men with HIV-negative partners and among HIV serodiscordant couples, in the era of widespread, effective HIV treatments.[13,14] Modelling from the US and Peru indicates that if CLAI with casual partners was replaced with CLAI with 'main' partners, HIV prevalence could be reduced, reinforcing the suggestion that risk may be lower with regular compared with casual partners.[1]

Much HIV research among GBM distinguishes between 'regular' and 'casual' sexual partners, but does not differentiate between types of regular partners.[12] Regular sexual partnerships

not considered to be 'relationships' and primarily organised around sex (i.e. 'fuckbuddies') are common among GBM.[12,15,16] In Australia, among newly HIV-diagnosed GBM who ascribed their HIV infection to a regular partner, over two-thirds considered them to be 'fuckbuddies' rather than 'boyfriends'[6,17] and, among these newly diagnosed GBM, the majority of transmissions from regular partners were believed to have occurred within the first 3 months of meeting. Similarly, research on serodiscordant GBM regular partnerships, where one partner is HIV-positive and the other is HIV-negative, demonstrated that the HIV transmission rate was approximately 6 per 100 person-years in the first year, but decreased to approximately 1 per 100 person-years thereafter.[18]

Men who have acquired HIV are more likely to report CLAI with partners of unknown HIV status than men who have not acquired HIV.[19] Furthermore, men can have incorrect perceptions of the HIV-negative status of both themselves and their partners. In Australia, 9.1% of GBM who believed they were HIV negative were actually undiagnosed HIV positive,[20] whereas in two separate studies, 10% and 20% of new diagnoses among GBM were ascribed to a partner believed to be HIV-negative.[21,22] It is estimated that 31% of new infections in Australia are from people whose HIV infection is undiagnosed.[23]

Within HIV-negative seroconcordant relationships (i.e. where both partners are HIV-negative), negotiated safety agreements, where the couple agrees not to have CLAI with outside partners, are associated with a low HIV incidence.[24] Use of negotiated safety has been common in Australia since the mid-1990s,[25] and HIV testing rates are comparatively high.[26] This may explain, in part, the lower proportion of infections ascribed to romantic, committed relationships compared with elsewhere.[6] However, in Australia, the proportion of HIV-negative seroconcordant relationships with negotiated safety agreements has declined significantly over the past decade.[26]

Serodiscordant regular relationships have usually been considered a context of high transmission risk.[27,28] However, couples aware of being serodiscordant may present relatively low transmission risk in contexts of high antiretroviral treatment (ART) uptake.[14,29] In Australia, only 6.4% of newly diagnosed GBM ascribed their infection to a known HIV-positive regular partner.[22] In the era of 'treatment as prevention', GBM in serodiscordant partnerships are increasingly likely to rely on undetectable viral load to prevent transmission.[27,30,31] However, viral load-based agreements do not appear to have been widely promoted in HIV education.

There has been little analysis of how differences between partnership type (romantic or committed partners vs primarily sexual partners) and HIV serostatus concordance contribute to risk within regular partnerships among GBM. Regular partnerships that practice CLAI have not been well characterised; research has typically compared regular partnerships that include CLAI with those that do not, with little attention to the factors of partner type, seroconcordance and risk, and how these interact. In particular, primarily sexual regular partnerships have largely been ignored in research and HIV prevention.[12] The specific aims of the present study were to: (1) determine the proportion of partnerships of various seroconcordances; (2) determine the prevalence of CLAI among them; (3) determine the factors differentiating romantic or committed relationships from primarily sexual partnerships that reported CLAI; (4) estimate the amount of CLAI that may present high risk for HIV transmission; and (5) determine the factors associated with CLAI that may present HIV transmission risk.

Methods

Procedures

The Monopoly Study methods used in the present study have been described in detail elsewhere.[12,32] Briefly, the present study was a cross-sectional online survey of Australian GBM conducted in December 2013–January 2014. Participants were recruited via gay community websites, online media, Facebook, mobile telephone applications and gay sexual networking websites. Ethics approval was provided by the Human Research Ethics Committees of UNSW Sydney and La Trobe University.

Measures

The questionnaire included respondent-level items about demographic characteristics, sexual identity and social engagement with gay men,[33] HIV testing history and self-reported serostatus, current partnerships and relational arrangements with those partners, and sexual behaviour with men. Men were asked to indicate whether they currently had one or more of any type of regular male partner(s) and, if so, were invited to answer partner(ship)-level items on up to three regular male partners, including partnership duration, description of the partner, whether they considered themselves to be 'in a relationship' with him, condom use, partnership agreements, HIV testing and partner serostatus. Data on ART and viral load were collected for HIV-positive respondents and partners. The choice of three regular male partners was determined from qualitative interviews conducted before the survey.[34] The first partner was identified as the 'primary partner'; if the respondent did not have a partner he considered to be the 'primary partner', it was the partner with whom he had been having sex with the longest. No direction was given to respondents in how to choose the other two partners to report on.

Definitions

In this paper, we have inferred two main types of regular partner for which technical definitions were needed for conceptual clarity, although we also document the language used by GBM to describe their regular partners. The term 'partnership' refers to any ongoing sexual arrangement with a man that respondents identified as a 'regular partner'. 'Relationships' were self-defined by respondents and typically implied a romantic, committed and often domestic arrangement. Thus, the term 'romantic/committed relationship' (RCR) refers to regular partnerships in which the respondents considered themselves to be 'in a relationship'. The term 'couple' is only used in relation to these relationships. Conversely, the term 'primarily sexual partner' (PSP) refers to regular sexual partners with whom the respondents did not consider themselves to be 'in a relationship', often referred to by GBM as 'fuckbuddies'.[12]

Relationship agreements regarding sex with outside partners were explored in this analysis. Respondents were asked whether

they had an agreement to be monogamous or not; whether this agreement was clear and spoken, and how regularly this was discussed; and whether they had an agreement about ways to reduce HIV transmission risk with outside partners. Sex with outside partners was considered to be 'any sex', not specifically anal sex.

CLAI was defined as presenting a risk of HIV transmission in different ways according to the seroconcordance of the partnership. In serodiscordant partnerships, CLAI was considered to present a risk for transmission when the HIV-positive partner had detectable or unknown viral load.[29,35,36] HIV-negative seroconcordant partnerships were considered to have CLAI presenting a risk of transmission if they did not have a 'negotiated safety-compatible' agreement (i.e. their agreement allowed CLAI with outside partners or they had no specified agreement about how to reduce risk from outside partners) and/or the relationship was shorter than 6 months in duration at the time. Finally, all CLAI in partnerships of unknown seroconcordance, where the respondent was unaware of the serostatus of either himself, his partner or both, was considered to present an HIV transmission risk unless one of the partners was HIV-positive and had undetectable viral load.

Participants and sample

Men who lived in Australia, aged ≥16 years, were eligible for participation in the study if they identified as gay or bisexual or had had sex with another man in the previous year. Overall, 5486 people accessed the survey, 4272 responded to any questions and 2724 described at least one specific partner (Fig. 1). Respondents and partnerships without complete responses to the critical variables of relationship status, condom use, length of partnership and serostatus were excluded. Thus, analyses for Aims 1 and 2 included 2250 partnerships reported from 1747 respondents (full sample). Differences between those with complete and incomplete data are described elsewhere.[12] Aims 3, 4 and 5 were examined using a restricted sample of 1278 partnerships reported from 1089 respondents, where HIV-positive concordant partnerships and partnerships that did not report any CLAI were excluded.

Statistical analysis

Data were analysed using Stata 14 (StataCorp, College Station, TX, USA). Within each seroconcordance category, the proportion of partnerships having CLAI presenting a risk for HIV transmission was determined and the differences between RCRs and PSPs were explored with univariate and multivariate tests. Factors associated with having CLAI presenting a risk for HIV transmission were also determined with univariate and multivariate models. Given that each respondent could report on up to three regular male partners, statistical associations were determined using generalised estimating equations to control for within and between-subject variability. Variables significant in univariate analysis were block-entered into the multivariate models.

Results

In the full sample ($n = 1747$ respondents), the mean age was 39.2 years (median 37 years; Table 1). Over half the sample was university educated and employed full-time. Over three-quarters were born in Australia and most were of Anglo-Celtic ethnicity. Most identified as gay. One-quarter reported that most or all their friends were gay men, and 15.6% spent 'a lot' of their free time with gay friends. Most respondents reported ever having had an HIV test, and most had been tested within the previous year (58.0% overall; 67.1% of those ever tested and 58.0% of the non-HIV-positive men only). Most respondents reported being HIV-negative (78.7%); 6.2% were HIV-positive and 15.1% did not know their HIV status.

Respondents considered themselves to be 'in a relationship' with over half of the regular partners and were thus defined for this analysis as 'RCRs'; within these RCRs, respondents most commonly described their regular partners as 'partners' (45.2%), 'boyfriends' (27.1%) or 'husbands' (15.7%); the remainder used other descriptors, as described elsewhere.[12] The remaining 44.7% of regular partners were PSPs, and were most commonly described as 'fuckbuddies' (75.0%), 'friends' (6.3%) or 'lovers' (3.9%); the remainder used other descriptors, as described elsewhere.[12] At the time of the survey, one-third of partnerships were of <12 months duration. The duration of partnerships were, on average, shorter for PSPs than RCRs (3.0 vs 7.0 years respectively; $P < 0.001$). Nearly one-third of partnerships were considered monogamous (52.3% of RCRs vs 4.6% of PSPs; $P < 0.001$).

Over half (54.9%) the partnerships were HIV-negative seroconcordant, 3.1% were HIV-positive seroconcordant, 5.2% were serodiscordant and 36.8% were of unknown seroconcordance. Among RCRs, 64.6% of the partnerships were HIV-negative seroconcordant, 2.9% were HIV-positive seroconcordant, 6.5% were serodiscordant and 26.0% were of unknown seroconcordance. Among PSPs, 42.8% were HIV-negative seroconcordant, 3.3% were HIV-positive seroconcordant, 3.6% were serodiscordant and 50.3% were of unknown seroconcordance.

Nearly 60% of partnerships were reported to have CLAI with each other. In RCRs, 61.3%, 11.9% and 26.9% always had CLAI, sometimes used condoms, and never had CLAI, whereas for PSPs, the corresponding proportions for these categories were 27.7%, 15.0% and 57.3%. CLAI was reported in 66.7% of HIV-negative concordant partnerships, 89.9% of HIV-positive concordant partnerships, 41.0% of serodiscordant partnerships and 49.0% of partnerships of unknown seroconcordance. Partnerships in which CLAI was reported were different to those in which CLAI was not reported in terms of longer partnership duration (mean 5.9 vs 4.3 years respectively; $P < 0.001$) and being more likely to be RCRs than PSPs (67.9% vs 32.1% respectively; $P < 0.001$).

HIV-negative seroconcordant partnerships

The average duration of the 824 HIV-negative seroconcordant partnerships practicing CLAI was 6 years, and 79.3% were >1 year in duration (Table 2). One-fifth of partnerships sometimes used condoms, and over three-quarters had discussed HIV risk with each other. Most respondents were told their partner's HIV status (88.2%), but 10.9% saw the test result or were tested together. Less than half (44.7%) the respondents described the partnership as monogamous.

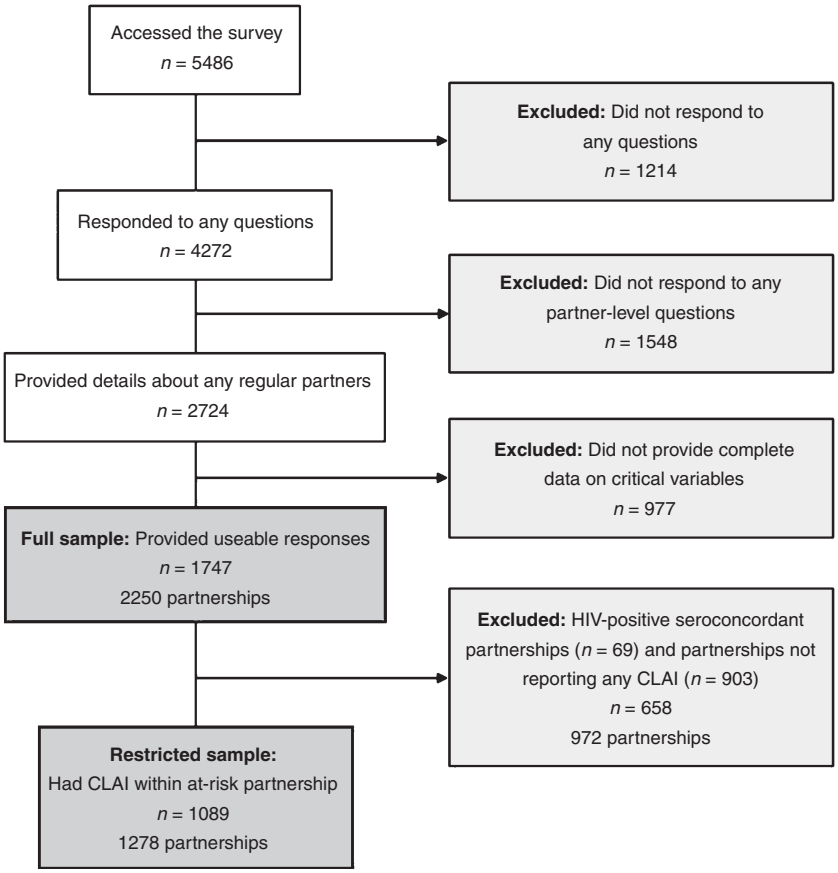

Fig. 1. Flow chart indicating the derivation of the full sample and restricted sample. CLAI, condomless anal intercourse.

Whether the partnership was monogamous or open was explicitly specified through a clear, spoken agreement in over two-thirds of partnerships. Most of those with a clear, spoken agreement had discussed it since, either once or twice or regularly. Sex with outside partners in the previous 6 months was reported by the respondents in over half of partnerships. One-fifth had no agreement about reducing the risk of HIV transmission from outside partners; most partnerships with an agreement agreed that condoms must always be used with outside partners or to be monogamous. Within the 254 partnerships with a monogamous agreement, 16.5% nonetheless reported recent sex with outside partners. Agreeing to always use condoms with outside partners or agreeing to be monogamous can be considered compatible with negotiated safety (70.6% of partnerships). In multivariate analysis, RCRs were more likely than PSPs to be of longer duration, be perceived to be monogamous, have a clear, spoken agreement about sex with outside partners and to discuss that agreement more regularly, and to use condoms less often. Overall, 35.7% of partnerships presented an HIV transmission risk; two-thirds of PSPs had risky CLAI compared with only one-quarter of RCRs ($P < 0.001$). In the 530 partnerships having CLAI of longer than 6 months that had a negotiated safety-compatible agreement, 495 (93.4%) respondents reported they had had an HIV test since the partnership began, and this was no different in RCRs and PSPs.

HIV serodiscordant partnerships

The 48 serodiscordant partnerships practicing CLAI were, on average, 7.3 years in duration (Table 2). Less than one-third of respondents believed the partnership to be monogamous, and the respondent reported having sex with outside partners in the previous 6 months in three-quarters of partnerships. This agreement about monogamy or otherwise was clear and spoken in most partnerships. One in ten partnerships had discussed HIV risk with each other. Less than half (41.1%) had no agreement to reduce HIV risk from outside partners. Of those with an agreement, most agreed that outside CLAI was allowed as long as some form of risk reduction was used or that condoms had to be used with outside partners. Half the partnerships sometimes used condoms with each other. Most HIV-positive members of these partnerships were taking ART ($n = 41$; 85.4%) and had an undetectable viral load ($n = 39$; 81.3%). In multivariate analysis, RCRs were more likely than PSPs to be of longer duration and have a clear, spoken agreement about monogamy or otherwise. Sometimes using condoms, ART status and undetectable viral load were no different between RCRs and PSPs. Nine serodiscordant partnerships (18.8%) practiced CLAI when the HIV-positive partner's viral load was detectable or unknown (i.e. the CLAI was higher risk), seven of which were RCRs and two were PSPs.

Table 1. Demographic and partnership characteristics for the full and restricted samples

Unless indicated otherwise, data are given as *n* (%). CLAI, condomless anal intercourse

	Full sample[A]	Restricted sample[B]
No. respondents	1747	1089
Mean (± s.d.) age (years)	39.2 ± 13.0	38.8 ± 12.6
University education	825 (53.0)	558 (51.2)
Full-time employment	1026 (58.8)	663 (60.9)
Born in Australia	1349 (77.2)	863 (79.3)
Anglo-Celtic ethnicity	1044 (59.8)	661 (60.7)
Sexual identity		
Gay	1538 (88.0)	972 (89.3)
Bisexual	183 (10.5)	106 (9.7)
Other	26 (1.5)	11 (1.0)
Most/all friends are gay men	426 (24.4)	263 (24.2)
A lot of free time spent with gay male friends	272 (15.6)	159 (14.6)
Ever had an HIV test	1509 (86.4)	936 (86.0)
Had an HIV test in the previous 12 months	1013 (58.0)	599 (55.0)
HIV status		
Negative	1374 (78.7)	897 (82.4)
Positive	109 (6.2)	23 (2.1)
Unknown[C]	264 (15.1)	169 (15.5)
Partnership characteristics		
No. partnerships	2250	1278
Partnership type		
Boyfriend ('in a relationship')	1244 (55.3)	880 (68.9)
Fuckbuddy (not 'in a relationship')	1006 (44.7)	398 (31.1)
Partnership duration		
≤6 months	468 (20.8)	180 (14.1)
7–12 months	253 (11.2)	131 (20.3)
1–5 years	887 (39.4)	543 (42.5)
≥6 years	641 (28.5)	423 (33.1)
Not stated	1 (0.0)	1 (0.1)
Believes partnership to be monogamous	697 (31.0)	532 (41.6)
Frequency of CLAI within partnership		
Always CLAI	1041 (46.3)	982 (76.8)
Sometimes CLAI	299 (13.3)	296 (23.2)
Never CLAI	910 (40.4)	0 (0.0)
Partnership seroconcordance		
HIV-negative seroconcordant	1235 (54.9)	824 (64.5)
HIV-positive seroconcordant	69 (3.1)	0 (0.0)
HIV serodiscordant	117 (5.2)	48 (3.8)
Unknown HIV seroconcordance	829 (36.8)	406 (31.8)

[A]The full sample comprised all respondents and partnerships where complete data was obtained on at least one partner for all critical variables.

[B]The restricted sample comprised partnerships in which CLAI was reported and that were not HIV-positive seroconcordant.

[C]Never tested or did not receive result.

Partnerships of unknown seroconcordance

The 406 unknown seroconcordance partnerships where any CLAI occurred were, on average, 5.3 years in duration, and over two-thirds were >1 year in duration (Table 2). Nearly three-quarters never used condoms with each other. Half had discussed HIV risk. Overall, 37.0% of these partnerships were described as monogamous. This was an unspoken expectation in 54.4% of partnerships. Most of those with a clear, spoken agreement had discussed it since, either once or twice or regularly. In practice, almost two-thirds of respondents reported any sex with casual partners in the previous 6 months. Less than half (41.1%) had no agreement to reduce HIV risk from outside partners. Those with an agreement mostly agreed to always use condoms with outside partners or agreed to be monogamous (although 16.5% of these had recent sex with outside partners). In multivariate analysis, RCRs were more likely to be of longer duration, be monogamous in both perception and practice, have clear, spoken agreements regarding sex with outside partners, never use condoms with each other and have an agreement about reducing risk from outside partners. In the 21 partnerships with an HIV-positive member, 90.5% ($n = 19$) were taking ART and 85.7% ($n = 18$) had an undetectable viral load. After excluding the 18 HIV-positive men with an undetectable viral load, 388 (95.6%) unknown seroconcordance partnerships reported CLAI presenting a risk for HIV transmission; this was statistically no different between RCRs and PSPs.

Factors associated with CLAI presenting a risk for HIV transmission

Individual- and partnership-level factors associated with CLAI presenting a risk for HIV transmission among those seroconcordant HIV-negative, serodiscordant and unknown seroconcordance partnerships that reported any CLAI are given in Table 3. After adjusting for respondent age, sexual identity, ethnicity and belief that the partnership was monogamous, factors that were independently associated with increased likelihood of having 'risky' CLAI were the partnership being a PSP rather than an RCR, the partnership being of <12 months duration, not discussing HIV risk within the partnership and having a lower level of trust in the partner.

Discussion

In the present sample, over half the regular partnerships practiced CLAI. Among those having CLAI, the potential risks were sometimes mitigated by protective factors, such as having a clear, spoken agreement about sex with outside partners, having fewer outside partners, openly discussing HIV risk with each other and having an agreement to reduce risk from outside partners. These factors were more often found in seroconcordant HIV-negative and serodiscordant partnerships than in unknown seroconcordance partnerships, as well as in RCRs than among PSPs. Consequently, among partnerships reporting CLAI, less than half the RCRs had CLAI that was classified as presenting a risk for HIV transmission compared with three-quarters of PSPs. Of the partnerships practicing at least some CLAI, nearly one-third were of unknown seroconcordance, and these partnerships had a very high proportion of CLAI presenting a risk for HIV transmission, regardless of partnership type. In contrast, HIV-negative seroconcordant partnerships comprised 61.5% of the partnerships having CLAI, but accounted for less than half (42.5%) of the 'risky' CLAI.

Serodiscordant couples in GBM populations are considered high risk for HIV transmission globally and it is often recommended that they be a key focus of HIV prevention.[37,38] In Sydney (NSW, Australia), although only

Table 2. Characteristics of partnerships practicing any condomless anal intercourse (CLAI) with each other, showing the total in each seroconcordance group, as well as comparisons between primarily sexual partnerships (PSPs) and romantic, committed relationships (RCRs) within each seroconcordance group using univariate (UV) and multivariate (MV) generalised estimating equations

Data are shown as *n* (%). Asterisks indicate the significance of differences between PSPs and RCRs on UV and MV analyses (*$P<0.05$, **$P<0.01$, ***$P<0.001$). NA, not applicable; NS, non-significant

	HIV-negative seroconcordant (824 partnerships reported by 729 respondents)					HIV serodiscordant (48 partnerships reported by 40 respondents[A])					Unknown HIV seroconcordance (406 partnerships reported by 320 respondents[B])				
	Total ($n=824$)	PSPs ($n=201$)	RCRs ($n=623$)	UV	MV	Total ($n=48$)	PSPs ($n=16$)	RCRs ($n=32$)	UV	MV	Total ($n=406$)	PSPs ($n=181$)	RCRs ($n=225$)	UV	MV
Partnership duration				***	***				*	*				***	***
≤6 months	92 (11.2)	52 (25.9)	40 (6.4)			9 (18.8)	2 (12.5)	7 (21.9)			79 (19.5)	57 (31.5)	22 (9.8)		
7–12 months	78 (9.5)	31 (15.4)	47 (7.5)			5 (10.4)	5 (31.3)	0 (0.0)			48 (11.8)	21 (11.6)	27 (12.0)		
1–5 years	358 (43.5)	88 (43.8)	270 (43.3)			18 (37.5)	8 (50.0)	10 (31.3)			167 (41.1)	73 (40.3)	94 (41.8)		
≥6 years	295 (35.8)	30 (14.9)	265 (42.5)			16 (33.3)	1 (6.3)	15 (46.9)			112 (27.6)	30 (16.7)	82 (36.4)		
Not stated	1 (0.1)	0 (0.0)	1 (0.2)			0 (0.0)	0 (0.0)	0 (0.0)			0 (0.0)	0 (0.0)	0 (0.0)		
Respondent believes partnership is monogamous	368 (44.7)	14 (7.0)	354 (56.8)	***	***	14 (29.2)	0 (0.0)	14 (43.8)	NA[C]	NA[C]	150 (37.0)	11 (6.1)	139 (61.8)	***	***
Respondent had any casual partners in past 6 months	465 (56.4)	168 (83.6)	297 (47.7)	***	NS	36 (75.0)	15 (93.8)	21 (65.6)	NS		253 (62.3)	160 (88.4)	93 (41.3)	***	***
Clear, spoken agreement about sex with outside partners				***	***				*	**				***	***
No agreement (unspoken expectation or assumption)	260 (31.6)	116 (57.7)	144 (23.1)			14 (29.2)	9 (56.3)	5 (15.6)			221 (54.4)	140 (77.4)	81 (36.0)		
Have agreement...															
But discussed it only once	71 (8.6)	11 (5.5)	60 (9.6)			3 (6.3)	1 (6.3)	2 (6.3)			32 (7.9)	10 (5.5)	22 (9.8)		
Have discussed it once or twice since making it	262 (31.8)	45 (22.4)	217 (34.8)			12 (25.0)	3 (18.8)	9 (28.1)			99 (24.4)	12 (6.6)	87 (38.7)		
Discuss it regularly	231 (28.0)	29 (14.4)	202 (32.4)			19 (39.6)	3 (18.8)	16 (50.0)			54 (13.3)	19 (10.5)	35 (15.6)		
Frequency of condom use in the partnership				***	***				NS					***	**
Never	662 (80.3)	125 (62.2)	537 (86.2)			26 (54.2)	9 (56.3)	17 (53.1)			294 (72.4)	114 (63.0)	180 (80.0)		
Sometimes	108 (13.1)	49 (24.4)	59 (9.5)			12 (25.0)	3 (18.8)	9 (28.1)			78 (19.2)	24 (23.2)	36 (16.0)		
Often	54 (6.6)	27 (13.4)	27 (4.3)			10 (20.8)	4 (25.0)	6 (18.8)			34 (8.4)	25 (13.8)	9 (4.0)		
Have discussed risks of getting or passing on HIV	639 (77.6)	152 (75.6)	487 (78.2)	NS		44 (91.7)	13 (81.3)	31 (96.9)	NS		213 (52.5)	76 (42.0)	137 (60.9)	***	NS
How found out partner's HIV-negative status[D]				**	NS										
Told by partner	727 (88.2)	187 (93.0)	540 (86.7)												
Tested together or saw result	90 (10.9)	11 (5.5)	79 (12.7)												
Other	7 (0.9)	3 (1.5)	4 (0.6)												
Agreements to reduce HIV transmission risk with outside partners				***	NS				NS					***	*
No specified agreement	163 (19.8)	68 (33.8)	95 (15.3)			20 (41.7)	10 (62.5)	10 (31.3)			167 (41.1)	105 (58.0)	62 (27.6)		
Serosorting or risk reduction	79 (9.6)	47 (23.4)	32 (5.1)			11 (22.9)	5 (31.3)	6 (18.8)			43 (10.6)	28 (15.5)	15 (6.7)		
Always condoms outside	328 (39.8)	77 (38.3)	251 (40.3)			10 (20.8)	1 (6.3)	9 (28.1)			105 (25.9)	41 (22.7)	84 (37.3)		
Monogamy	254 (30.8)	9 (4.5)	245 (39.3)			7 (14.6)	0 (0.0)	7 (21.9)			91 (22.4)	7 (3.9)	64 (28.4)		
Respondent tested for HIV since partnership started[E]	733 (89.0)	166 (82.6)	567 (91.0)	***	NS										
Had CLAI presenting a risk for HIV transmission	294 (35.7)	135 (67.2)	159 (25.5)	**	***	9 (18.8)	2 (12.5)	7 (21.9)	NS		388 (95.6)	168 (92.8)	220 (97.8)	*	NS

[A]Of the 48 reported serodiscordant partnerships, 20 were when the respondent was HIV positive and 28 were when the respondent was HIV negative.

[B]Of the 406 unknown seroconcordance partnerships reported, there were 107 partnerships where the respondent did not know either his own or his partner's HIV status, 278 partnerships where one member of the partnership was HIV negative and 21 partnerships where one member of the partnership was HIV positive.

[C]Significance could not be determined because no serodiscordant PSPs were monogamous.

[D]This item is relevant only to seroconcordant HIV-negative partnerships.

[E]This item is relevant only to seroconcordant HIV-negative partnerships.

Table 3. Individual- and partnership-level factors associated with having condomless anal intercourse (CLAI) that presented a risk for HIV transmission among seroconcordant HIV-negative, serodiscordant and unknown seroconcordance partnerships reporting CLAI

Unless indicated otherwise, data are given as the mean ± s.d. or as *n* (%). CLAI, condomless anal intercourse; OR, odds ratio (unadjusted); CI, confidence interval; aOR, adjusted odds ratio; Reference, reference group for comparison in generalised estimating equations models; RCR, romantic, committed relationship; PSP, primarily sexual partnership

	Had CLAI presenting a risk for HIV transmission		OR	95% CI	*P*-value	aOR	95% CI	*P*-value
	No (*n* = 587)	Yes (*n* = 691)						
Age (years)	40.1 ± 12.0	38.9 ± 13.4	0.99	0.98–1.00	0.027	1.00	0.99–1.01	0.465
Gay sexual identity	535 (91.1)	609 (88.1)	0.61	0.42–0.90	0.012	0.94	0.61–1.44	0.775
Anglo-Celtic ethnicity	370 (63.0)	420 (60.8)	0.89	0.71–1.13	0.356	0.89	0.69–1.15	0.369
Partnership type								
RCR	494 (84.2)	386 (55.9)	Reference			Reference		
PSP	93 (15.8)	305 (44.1)	3.50	2.69–4.55	<0.001	2.20	1.57–3.08	<0.001
Partnership <12 months duration	67 (21.5)	244 (78.5)	3.46	2.65–4.52	<0.001	2.57	1.90–3.48	<0.001
Respondent believes partnership monogamous	282 (48.0)	250 (36.2)	0.68	0.54–0.84	0.001	0.91	0.69–1.20	0.505
Have discussed risks of getting or passing on HIV	480 (81.8)	416 (60.2)	0.36	0.28–0.46	<0.001	0.40	0.30–0.52	<0.001
Degree of 'trust' in partner[A]	3.31 ± 0.83	2.79 ± 1.06	0.60	0.54–0.68	<0.001	0.81	0.70–0.94	0.005

[A]Trust in a partner was scored on a scale of 0–4, where 0 indicates no trust and 4 indicates complete trust.

52.4% of HIV-positive men reported taking ART in 2000,[39] this number had increased to 90.7% by 2015.[40] Thus, most known serodiscordant couples are likely to have low HIV transmission risk due to ART.[29,36] Only nine serodiscordant partnerships were found that practiced CLAI when the HIV-positive partner had detectable or an unknown viral load, and known serodiscordant partnerships had the smallest proportion of CLAI presenting a risk for HIV transmission. However, it should be acknowledged that the risk of HIV transmission may be greater in serodiscordant couples living in contexts where access to and uptake of ART are low.

HIV-negative seroconcordant RCRs appeared to use negotiated safety more successfully than PSPs, with fewer PSPs having clear, spoken agreements about sex and risk reduction. This may explain, in part, the lower proportion of infections ascribed to 'boyfriends' seen in Australia[6] compared with 'main partners' in the US,[7] where negotiated safety has not been promoted widely.[41] Respondents in PSPs were also less likely to engage in practices essential to the ongoing maintenance of negotiated safety agreements, such as regularly discussing with that partner their agreement and testing for HIV over time.[4]

Within partnerships of unknown seroconcordance, agreements about both monogamy and reducing risk from outside partners were less common, as was general discussion of HIV risk. Attempts were made at some form of negotiated safety in approximately one-quarter of unknown seroconcordance PSPs and nearly two-thirds of RCRs. However, these agreements were insufficient given the potential risk coming from within the partnerships due to the men not knowing their own or their partner's HIV status.[42] The large proportion of unknown seroconcordance partnerships is a concern, because, by definition, it represents a lack of communication about HIV status, particularly among PSPs. Australian behavioural surveillance research among gay men suggests that the proportion of unknown seroconcordance regular partnerships increased steadily between 2012 and 2016, as did the proportion of men engaging in non-seroconcordant CLAI. Meanwhile, the proportion disclosing their HIV status to all casual partners increased.[40] Thus, although efforts to increase serostatus disclosure in casual sex settings may have been effective, it appears that more attention is needed to encourage men to disclose their serostatus in regular sexual partnerships.

These findings indicate the need for explicit discussions early into new sexual partnerships about frequency of HIV testing, sexual risk taking, pre-exposure prophylaxis (PrEP) status for HIV-negative men and viral load status and ART adherence for HIV-positive men. Although significant efforts are underway to achieve greater testing frequency in this population,[43] they often target highly sexually active men with high casual partner numbers (e.g. see the Australian testing guidelines for men who have sex with men[44]). Men who move from relationship to relationship ('serial monogamy') may not perceive themselves 'at risk' and in need of testing. Improved HIV testing messaging is required for men in the early stages of new ongoing sexual partnerships.

HIV prevention has typically focused on RCRs and largely ignored PSPs,[12] yet in the present study, PSPs represented greater risk for HIV transmission and were common (nearly half of all regular partnerships in this study). The analysis of predictors of CLAI presenting a risk for HIV transmission further supported these findings. 'Risky' CLAI was associated with being in a PSP, shorter relationship duration, not having discussed HIV risk with each other and a lower degree of trust in the partner. HIV prevention advice for PSPs is challenging due to shorter partnership duration, less communication and knowledge of each other, multiple partners (including multiple, concurrent PSPs) and lower levels of trust,[12,15] but advice for men about the appropriateness of negotiated safety in PSPs is necessary. Unlike RCRs, many of the characteristics of PSPs may not change over time. Negotiated safety should most likely be promoted explicitly for RCRs. This should be clarified in HIV educational materials, given that it appears many men do attempt some kind of negotiated safety agreement within PSPs. HIV education should also encourage serostatus disclosure based on a recent HIV test between fuckbuddies, so as to reduce the proportion of such partners that are of unknown seroconcordance. Other options should be explored for men in

PSPs practicing CLAI; PrEP in particular may have an important role to play here. Moving forward, partnership type, along with seroconcordance, should be better acknowledged and explored in HIV prevention education.[12]

These findings imply that there are specific relational dynamics in PSPs that mark them out as different to RCRs. It may be that communication about HIV risk is less practically possible in more fluid sexual partnerships, but also less central as an organising principle. Nonetheless, in HIV-negative seroconcordant relationships, discussion of HIV risk was no different between RCR and PSP partners, although men in PSPs were less likely to engage in partner-orientated prevention strategies (discussing agreements, using condoms, testing together or seeing each other's HIV test result). This may imply that the conventions of partner-centred prevention are not present; prevention for men in PSPs may be individualised. Insofar as risk is heightened in such relationships, it is because the measure of risk is dependent on the expectation that communication between partners includes negotiation and agreement, but this is not necessarily possible, or desirable, for men in a PSP. Among men in serodiscordant partnerships, discussion of HIV risk was less common among PSP partners than RCR partners; yet partners were equally likely to use condoms, and ART status and undetectable viral load were no different. PSPs may involve greater individuality and autonomy in managing HIV risk.

The present study had several limitations. It was a volunteer, online convenience sample, unlikely to be entirely representative of homosexually active men in Australia. Generalising these findings to other contexts may be limited because, in Australia, GBM have high rates of HIV testing and ART uptake, experience lower levels of overt homophobia and discrimination compared with other countries and relationships between same-sex partners are afforded legal protection. Causative relationships could not be determined in our cross-sectional data. As with many online surveys, there were some missing data, resulting in a reduced sample for analysis; included men did show some systematic differences from those excluded.[12] Conversely, this was a large sample. Because the present study was focused on relationships rather than HIV risk, data on sexual positioning and PrEP use were not obtained. The survey did not ask about CLAI with outside partners, so it was not possible to determine whether the outside sex presented any actual risk or not. In addition, details were not collected on some of the elements of negotiated safety, such as whether the partners had an agreement to inform each other if one of them had a risk event with an outside partner, whether the partner(s) of the respondent was tested for HIV after the negotiated safety agreement was made or the exact timing of HIV status disclosure. The proportion of partnerships of unknown seroconcordance in the present sample was higher than found in time-location samples of community-attached GBM.[40] We promoted our survey as being about gay men's relationships and not about HIV, and made it clear than any type of regular partner could be included, which may have increased the number of PSPs and thus partnerships of unknown seroconcordance reported. Finally, partnerships were treated independently: if a respondent had more than one partner and reported 'risky' CLAI with a partner, this is did not change the risk status of any CLAI with other partners.

Conclusion

CLAI is more common among regular sexual partnerships considered to be of a romantic, committed nature. However, factors associated with such partnerships can also be protective against HIV transmission risk. As less regular partnerships transition over time to become more regular, with some developing into relationships, men tend to learn about each other and discuss how to reduce risk from both within and outside the partnership. This includes discussing HIV status, openly discussing HIV risk with each other and having clear spoken agreements about sex with outside partners and reducing risk with outside partners. For RCRs, HIV prevention messages about agreements may need to be periodically redeployed, and perhaps expanded to include new types of agreements about viral load and PrEP status. However, for the most part, RCRs present less risk for HIV transmission compared with PSPs. PSPs have largely not been a focus of educational efforts and need greater attention, particularly given their common occurrence. Unknown seroconcordance, particularly lack of communication about HIV status among PSPs, is a key risk factor that needs to be addressed in HIV education.

Conflicts of interest

None declared.

Acknowledgements

This study was funded by the National Health and Medical Research Council of Australia (Grant no. APP602518). The Kirby Institute is affiliated with the Faculty of Medicine, UNSW Sydney. The Australian Research Centre in Sex Health and Society (ARCSHS) is affiliated with the Faculty of Health Sciences, La Trobe University. The Kirby Institute and ARCSHS receive funding from the Commonwealth of Australia Department of Health and Ageing.

References

1 Beyrer C, Baral SD, van Griensven F, Goodreau SM, Chariyalertsak S, Wirtz AL, Brookmeyer R. Global epidemiology of HIV infection in men who have sex with men. *Lancet* 2012; 380: 367–77. doi:10.1016/S0140-6736(12)60821-6

2 Beyrer C, Baral SD, Walker D, Wirtz AL, Johns B, Sifakis F. The expanding epidemics of HIV type 1 among men who have sex with men in low- and middle-income countries: diversity and consistency. *Epidemiol Rev* 2010; 32: 137–51. doi:10.1093/epirev/mxq011

3 Baggaley RF, White RG, Boily M-C. HIV transmission risk through anal intercourse: systematic review, meta-analysis and implications for HIV prevention. *Int J Epidemiol* 2010; 39: 1048–63. doi:10.1093/ije/dyq057

4 Kippax S, Slavin S, Ellard J, Hendry O, Richters J, Grulich AE, Kaldor J. Seroconversion in context. *AIDS Care* 2003; 15: 839–52. doi:10.1080/09540120310001618685

5 Volk JE, Prestage GP, Jin F, Kaldor J, Ellard J, Kippax S, Grulich AE. Risk factors for HIV seroconversion in homosexual men in Australia. *Sex Health* 2006; 3: 45–51. doi:10.1071/SH05020

6 Down IA, Ellard J, Bavinton BR, Triffitt K, Brown G, Prestage GP. In Australia, most HIV infections among gay and bisexual men are attributable to sex with 'new' partners. *AIDS Behav* 2017. doi:10.1007/s10461-017-1747-0

7 Sullivan PS, Salazar L, Buchbinder S, Sanchez TH. Estimating the proportion of HIV transmissions from main sex partners among men

who have sex with men in five US cities. *AIDS* 2009; 23: 1153–62. doi:10.1097/QAD.0b013e32832baa34

8 Greene GJ, Andrews R, Kuper L, Mustanski B. Intimacy, monogamy, and condom problems drive unprotected sex among young men in serious relationships with other men: a mixed methods dyadic study. *Arch Sex Behav* 2014; 43: 73–87. doi:10.1007/s10508-013-0210-1

9 Theodore PS, Durán RE, Antoni MH, Fernandez MI. Intimacy and sexual behavior among HIV-positive men-who-have-sex-with-men in primary relationships. *AIDS Behav* 2004; 8: 321–31. doi:10.1023/B:AIBE.0000044079.37158.a9

10 Prestage GP, Jin F, Grulich A, de Wit J, Zablotska I. Gay men are less likely to use condoms with casual sex partners they know 'well'. *AIDS Behav* 2012; 16: 664–8. doi:10.1007/s10461-011-9952-8

11 Zea MC, Reisen CA, Poppen PJ, Bianchi FT. Unprotected anal intercourse among immigrant Latino MSM: the role of characteristics of the person and the sexual encounter. *AIDS Behav* 2009; 13: 700–15. doi:10.1007/s10461-008-9488-8

12 Bavinton BR, Duncan D, Grierson J, Zablotska IB, Down IA, Grulich AE, Prestage GP. The meaning of 'regular partner' in HIV research among gay and bisexual men: implications of an Australian cross-sectional survey. *AIDS Behav* 2016; 20: 1777–84. doi:10.1007/s10461-016-1354-5

13 Jin F, Prestage GP, Mao L, Poynten IM, Templeton DJ, Grulich AE, Zablotska I. 'Any condomless anal intercourse' is no longer an accurate measure of HIV sexual risk behavior in gay and other men who have sex with men. *Front Immunol* 2015; 6: 1–7.

14 Bavinton BR, Phanuphak N, Jin F, Zablotska IB, Grinsztejn B, Prestage GP, Grulich AE. A small proportion of acts of anal intercourse within homosexual male serodiscordant couples in three countries are high risk for HIV transmission. In: 21st International AIDS Conference (AIDS 2016) Abstract Supplement, *J Int AIDS Soc* 19(Suppl 5), 82–3; 21 July 2016; Durban, South Africa; 2016. Oral Presentation THAC0101.

15 Van den Boom W, Stolte I, Sandfort T, Davidovich U. Serosorting and sexual risk behaviour according to different casual partnership types among MSM: the study of one-night stands and sex buddies. *AIDS Care* 2012; 24: 167–73.

16 Lachowsky NJ, Saxton PJ, Hughes AJ, Dickson NP, Summerlee AJ, Milhausen RR, Dewey CE. Younger gay and bisexual men's condom use with main regular sexual partner in New Zealand. *AIDS Educ Prev* 2015; 27: 257–74. doi:10.1521/aeap.2015.27.3.257

17 Gianacas C, Down IA, Ellard J, Kidd P, Brown G, Triffitt K, Persson A, Prestage G. Experiences of HIV: the seroconversion study final report 2007–2015. Sydney: UNSW Sydney; 2016.

18 Bavinton BR, Jin F, Mao L, Zablotska I, Prestage GP, Grulich AE. Homosexual men in HIV serodiscordant relationships: implications for HIV treatment as prevention research. *J Int AIDS Soc* 2015; 18: 19884–90. doi:10.7448/IAS.18.1.19884

19 Down IA, Bradley J, Brown G, Hurley M, Prestage GP. Risk reduction in practice. Western Australia Sexual Health and Blood-borne Virus Applied Research and Evaluation Network Research Symposium; 6 May 2011; Perth, Australia; 2011.

20 Holt M, Lea T, Asselin J, Hellard M, Prestage G, Wilson D, de Wit J, Stoové M. The prevalence and correlates of undiagnosed HIV among Australian gay and bisexual men: results of a national, community-based, bio-behavioural survey. *J Int AIDS Soc* 2015; 18: e20526. doi:10.7448/IAS.18.1.20526

21 Jin F, Prestage GP, Ellard J, Kippax SC, Kaldor JM, Grulich AE. How homosexual men believe they became infected with HIV: the role of risk-reduction behaviors. *J Acquir Immune Defic Syndr* 2007; 46: 245–7. doi:10.1097/QAI.0b013e3181565db5

22 Down I, Ellard J, Bavinton BR, Brown G, Prestage G. In Australia, most HIV infections among gay and bisexual men are attributable to sex with 'new' partners. *AIDS and Behavior* 2017. doi:10.1007/s10461-017-1747-0.

23 Wilson DP, Hoare A, Regan DG, Law MG. Importance of promoting HIV testing for preventing secondary transmissions: modelling the Australian HIV epidemic among men who have sex with men. *Sex Health* 2009; 6: 19–33. doi:10.1071/SH08081

24 Jin F, Crawford J, Prestage GP, Zablotska IB, Imrie J, Kippax SC, Kaldor JM, Grulich AE. HIV risk reduction behaviours in gay men: unprotected anal intercourse, risk reduction behaviours, and subsequent HIV infection in a cohort of homosexual men. *AIDS* 2009; 23: 243–52. doi:10.1097/QAD.0b013e32831fb51a

25 Australian Federation of AIDS Organisations. Negotiated safety: briefing paper – July 1997. Sydney: Australian Federation of AIDS Organisations; 1997.

26 De Wit J, Mao L, Adam P, Treloar C. Annual report of trends in behaviour 2015: HIV/AIDS, hepatitis and sexually transmissible infections in Australia. Sydney: Centre for Social Research in Health, UNSW Sydney; 2015.

27 Van de Ven P, Mao L, Fogarty A, Rawstorne P, Crawford J, Prestage G, Grulich A, Kaldor J, Kippax S. Undetectable viral load is associated with sexual risk taking in HIV serodiscordant gay couples in Sydney. *AIDS* 2005; 19: 179–84. doi:10.1097/00002030-200501280-00010

28 Starks TJ, Gamarel KE, Johnson MO. Relationship characteristics and HIV transmission risk in same-sex male couples in HIV serodiscordant relationships. *Arch Sex Behav* 2014; 43: 139–47. doi:10.1007/s10508-013-0216-8

29 Rodger AJ, Cambiano V, Bruun T, Vernazza P, Collins S, van Lunzen J, Corbelli GM, Estrada V, Geretti AM, Beloukas A, Asboe D, Viciana P, Gutiérrez F, Clotet B, Pradier C, Gerstoft J, Weber R, Westling K, Wandeler G, Prins JM, Rieger A, Stoeckle M, Kümmerle T, Bini T, Ammassari A, Gilson R, Krznaric I, Ristola M, Zangerle R, Handberg P, Antela A, Allan S, Phillips AN, Lundgren J. PARTNER Study Group Sexual activity without condoms and risk of HIV transmission in serodifferent couples when the HIV-positive partner is using suppressive antiretroviral therapy. *JAMA* 2016; 316: 171–81. doi:10.1001/jama.2016.5148

30 Bavinton BR, Jin F, Zablotska IB, Prestage GP, Grinsztejn B, Khalili Friedman R, Phanuphak N, Grulich A; Opposites Attract Study Group. Agreements and communication about viral load within gay male serodiscordant couples: implications for treatment as prevention. 26th Annual Conference of the Australasian Society for HIV Medicine; 17 September 2015; Brisbane, Australia; 2015. Oral presentation 416.

31 Guzman R, Buchbinder S, Mansergh G, Vittinghoff E, Marks G, Wheeler S, Colfax GN. Communication of HIV viral load to guide sexual risk decisions with serodiscordant partners among San Francisco men who have sex with men. *AIDS Care* 2006; 18: 983–9. doi:10.1080/09540120500497908

32 Prestage GP, Duncan D, Grierson J, Bradley J, Bavinton BR, Kolstee J, Smith A. Monopoly: a study of gay men's relationships, 2014. Sydney: Kirby Institute, UNSW Sydney; 2015.

33 Mao L, Crawford J, Van De Ven P, Prestage G, Grulich A, Kaldor J, Kippax S. Differences between men who report frequent, occasional or no unprotected anal intercourse with casual partners among a cohort of HIV-seronegative gay men in Sydney, Australia. *AIDS Care* 2006; 18: 942–51. doi:10.1080/09540120500343144

34 Duncan D, Prestage GP, Grierson J. Trust, commitment, love and sex: HIV, monogamy, and gay men. *J Sex Marital Ther* 2015; 41: 345–60. doi:10.1080/0092623X.2014.915902

35 Cohen MS, Chen YQ, McCauley M, Gamble T, Hosseinipour MC, Kumarasamy N, Hakim JG, Kumwenda J, Grinsztejn B, Pilotto JH, Godbole SV, Mehendale S, Chariyalertsak S, Santos BR, Mayer KH, Hoffman IF, Eshleman SH, Piwowar-Manning E, Wang L, Makhema

J, Mills LA, de Bruyn G, Sanne I, Eron J, Gallant J, Havlir D, Swindells S, Ribaudo H, Elharrar V, Burns D, Taha TE, Nielsen-Saines K, Celentano D, Essex M, Fleming TR. HPTN 052 Study Team. Prevention of HIV-1 infection with early antiretroviral therapy. *N Engl J Med* 2011; 365: 493–505. doi:10.1056/NEJMoa1105243

36 Grulich AE, Bavinton BR, Jin F, Prestage GP, Zablotska IB, Grinsztejn B, Phanuphak N, Moore R, Koelsch KK. HIV transmission in male serodiscordant couples in Australia, Thailand and Brazil. 22nd Conference on Retroviruses and Opportunistic Infections; 25 February 2015; Seattle, USA; 2015. Abstract 1019LB, p. 77. Available online at: http://www.croiconference.org/scientific-program/electronic-materials/croi-2015 [verified 2 June 2017].

37 Muessig KE, Cohen MS. Advances in HIV prevention for serodiscordant couples. *Curr HIV/AIDS Rep* 2014; 11: 434–46. doi:10.1007/s11904-014-0225-9

38 Crepaz N, Tungol-Ashmon MV, Vosburgh HW, Baack BN, Mullins MM. Are couple-based interventions more effective than interventions delivered to individuals in promoting HIV protective behaviors? A meta-analysis. *AIDS Care* 2015; 27: 1361–6. doi:10.1080/09540121.2015.1112353

39 Holt M, Mao L, Prestage GP, Zablotska IB, De Wit J. Gay community periodic surveys: national report 2010. Sydney: National Centre in HIV Social Research, The University of New South Wales; 2011.

40 Hull P, Mao L, Kolstee J, Duck T, Feeney L, Prestage GP, Zablotska I, Lea T, de Wit J, Holt M. Gay community periodic survey: Sydney 2016. Sydney: UNSW Sydney; 2016.

41 Guzman R, Colfax GN, Wheeler S, Mansergh G, Marks G, Rader M, Buchbinder S. Negotiated safety relationships and sexual behavior among a diverse sample of HIV-negative men who have sex with men. *J Acquir Immune Defic Syndr* 2005; 38: 82–6. doi:10.1097/00126334-200501010-00015

42 Kippax S, Noble J, Prestage GP, Crawford JM, Campbell D, Baxter D, Cooper D. Sexual negotiation in the AIDS era: negotiated safety revisited. *AIDS* 1997; 11: 191–7. doi:10.1097/00002030-199702000-00009

43 Roberts N, Holden J, Duck T, Kitchener S. Health promotion 'on steroids': The value of an experiential approach to promote rapid HIV testing in NSW, Australia. *Public Health Res Pract* 2015; 25: e2521522.

44 STIs in Gay Men Action Group. Australian STI and HIV testing guidelines for men who have sex with men. Sydney: STIs in Gay Men Action Group; 2014.