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Adapting behavioural surveillance to antiretroviral-based HIV prevention: reviewing and anticipating trends in the Australian Gay Community Periodic Surveys

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Abstract. ***Background*:** In Australia, the preventative use of antiretroviral drugs [pre-exposure prophylaxis (PrEP) and treatment as prevention] is being embraced to protect individuals at high risk of HIV and reduce onward transmission. ***Methods*:** The adaptation of a behavioural surveillance system, the Gay Community Periodic Surveys, was reviewed to monitor the uptake and effect of new prevention strategies in Australia's primary HIV-affected population (gay and bisexual men, GBM). The national trends in key indicators during 2000–15 were reviewed and a new measure to take account of antiretroviral-based prevention was developed. ***Results*:** Between 2000 and 2015, there were significant increases ($P < 0.001$) in annual HIV testing (56.1–64.8%), condomless sex with casual partners (26.8—38.8%) and the proportion of HIV-positive men on HIV treatment (72.5–88.4%) and with an undetectable viral load (73.7–94.7%). The proportion of casual partners who were HIV negative, not on PrEP and who engaged in receptive condomless sex also increased between 2000 and 2015 from 12.8 to 19.3%. Two scenarios anticipating the effect of PrEP highlighted the need to target GBM who engage in receptive condomless sex while also sustaining condom use at a population level. ***Conclusions*:** Behavioural surveillance can be successfully adapted to follow the effect of antiretroviral-based prevention. It is anticipated that HIV testing and HIV treatment will continue to increase among Australian GBM, but to prevent new infections, intervention in the growing proportion of GBM who have condomless sex with casual partners is needed. For PrEP to have its desired effect, condom use needs to be sustained.

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Introduction

The Joint United Nations Program on HIV and AIDS (UNAIDS) and World Health Organization guidelines recommend that behavioural surveillance should be regularly conducted to monitor sex- and drug-related practices in HIV-affected populations.[1,2] In countries with concentrated epidemics, particular attention should be paid to behaviour that facilitates HIV transmission. Behavioural surveillance has an explanatory function to identify the behaviours that drive trends in the epidemic; an evaluative function to see if education and prevention programs are working; and a predictive function to identify changes that may increase HIV incidence and require intervention.[3] Ideally, behavioural surveillance should be conducted in a consistent manner over time, so that trends in critical indicators can be monitored;[1] However, few countries sustain repeated behavioural surveillance,[4] mainly due to restricted resources.

Although existing behavioural surveillance systems try to maintain consistency in methods and measures over time, they also need to adapt to follow new and emerging practices.[3,5,6] The advent of new forms of HIV prevention, particularly pre-exposure prophylaxis (PrEP) and treatment as prevention (TasP), pose particular challenges. PrEP and TasP complicate the ways in which 'safe sex' is conceptualised, measured and reported.[7–9] In particular, PrEP and TasP suggest that some forms of condomless anal intercourse may be as safe as consistent condom use, requiring more subtle (but potentially more complex) measures of safety and risk.[10]

Gay and bisexual men (GBM) remain the primary population affected by HIV in Australia, with male-to-male sex accounting for 70% of all HIV infections throughout the epidemic, and 9% of GBM in capital cities reporting that they are HIV positive.[11,12] Condomless anal intercourse between casual male partners, particularly receptive intercourse, remains the

main risk factor for HIV transmission in Australia, as found in behavioural studies and research with recently diagnosed GBM.[13,14] This differs from other jurisdictions (such as the United States) in which sex between regular or steady male partners has been reported as the main source of infections.[15]

As in other high income countries,[16,17] since the late 1990s, Australia has seen a gradual but steady increase in the proportion of GBM reporting condomless anal intercourse with casual partners,[18,19] and the number of annual HIV diagnoses has also increased, returning to levels not seen since the early 1990s.[11] In 1999, there were 718 new HIV diagnoses in Australia, 73% of which occurred as a result of homosexual sex.[20] In 2014, there were 1081 new HIV diagnoses in Australia, 75% of which occurred as a result of sex between men.[11]

In the context of rising HIV infections among GBM, Australian stakeholders have embraced new prevention options, particularly PrEP and TasP, in national and state HIV strategies.[21,22] Together with an intensification of HIV testing and the maintenance of condom use, the aim is to reduce significantly the sexual transmission of HIV by 2020. This has prompted a review of monitoring and evaluation mechanisms,[21] to make sure the implementation of the new strategies can be followed and adjusted, as required. Here, we review changes to the Gay Community Periodic Surveys, Australia's primary behavioural surveillance system for HIV, and consider recent and emerging trends in the sex practices of GBM. We present new measures of safety and risk that take account of antiretroviral-based prevention, and consider scenarios in which current risk-reduction strategies result in beneficial changes to HIV incidence or do not achieve their effect as expected.

Methods

Recruitment

The methods of the Gay Community Periodic Surveys (GCPS) have been previously described.[6] In brief, the GCPS use time-location sampling in large cities to recruit GBM at gay community events, social venues, sex-on-premises venues and healthcare settings. Recruitment is undertaken by trained staff, employed by a local gay community or HIV organisation. During shifts, recruitment staff approach all men at an event or venue and ask them to self-complete a paper-and-pencil questionnaire. Recruitment periods are timed to coincide with gay community festivals. Data collection occurs in seven states and territories, with recruitment repeated every 1 or 2 years.

In 2014, online recruitment and data collection and the inclusion of Tasmania as a recruitment location were introduced. In Tasmania, all recruitment and data collection is online because of the limited number of gay events and venues. In the other six states and territories, online recruitment is a supplemental activity, conducted immediately after face-to-face recruitment. Online recruitment now accounts for approximately one-quarter of the GCPS sample and is driven by paid advertising on Facebook (targeted at men who are resident in the state or territory where recruitment is taking place and who indicate they are 'interested' in men in their profile). Paid advertising is supplemented by free advertising on community organisation websites and email lists for GBM. The GCPS website (http://gcpsonline.net) contains participant information and a link to the online version of the questionnaire, run on Key Survey software (WorldAPP; Braintree, MA, USA), optimised for viewing on web browsers, smartphones and tablets.

The eligibility criteria for participation are: lives in Australia, aged 18 years or over (face-to-face recruitment), aged 16 years or over (online recruitment), male (includes cisgender, transgender and intersex participants who identify as male), sex with a man in the past 5 years and/or identifies as gay/bisexual. The GCPS have ethics approval from the UNSW Australia Human Research Ethics Committee and the ethics committees of the community organisations, ACON and the Victorian AIDS Council.

Measures

Many survey indicators have been collected since the late 1990s. These include demographics, relationship status and agreements, HIV testing, HIV status, HIV treatment, sex with casual and regular male partners and drug use. Details of these measures have been previously published.[6] Viral load test results (undetectable/detectable/unknown) have been collected from HIV-positive participants since 2003, the intentional use of non-condom-based risk-reduction strategies (such as serosorting) with casual partners since 2011 and PrEP use by HIV-negative men since 2013.

The following variables were used to describe the sample and to control for potential confounding in the key indicators: age (in years), sexual identity (gay vs other), ethnicity (Anglo-Australian vs other), self-reported HIV status (HIV positive, HIV negative, untested/unknown), sex with regular male partners in the previous 6 months (yes/no), sex with casual male partners in the previous 6 months (yes/no) and recruitment source (gay community events and social venues, sex venues, clinical settings, online).

Key indicators included: ever tested for HIV (yes/no), tested for HIV in the previous 12 months (yes/no; non-HIV-positive men only), HIV treatment (on treatment at the time of the survey vs not for HIV-positive men), last viral load test result (undetectable vs not for HIV-positive men on treatment), more than 10 male sex partners in the previous 6 months (yes/no), no condomless anal intercourse (CAI) (with any partner) in the previous 6 months (yes/no), any CAI with regular male partners in the previous 6 months (yes/no; men with regular partners only), any CAI with casual male partners in the previous 6 months (yes/no; men with casual partners only) and serosorting (matching HIV status) before CAI with casual male partners in the previous 6 months (frequently vs infrequently; men who reported CAI with casual partners).

Here, we present a modification of the way we report sex with casual male partners in the 6 months before the survey. Up until recently, we have classified participants' responses to a set of questions about insertive and receptive anal intercourse with casual partners into three categories: no anal intercourse, consistent condom use and any CAI, sometimes distinguishing between men who reported any receptive CAI from those who only engaged in insertive CAI.[6,12,23] To take into account the protection offered by PrEP or sustaining an undetectable viral

load through HIV treatment (TasP), we developed the following mutually exclusive classification:

(1) No anal intercourse with casual partners (participants of any HIV status)
(2) Consistent condom use with casual partners (participants of any HIV status)
(3) Any CAI by HIV-positive men on HIV treatment and with an undetectable viral load
(4) Any CAI by HIV-negative men on PrEP
(5) Any CAI by HIV-positive men not on HIV treatment or with a detectable viral load
(6) Insertive-only CAI by HIV-negative or untested men not on PrEP
(7) Any receptive CAI by HIV-negative or untested men not on PrEP

Categories 1–4 are classified as 'safe sex' and categories 5–7 as risky for HIV transmission or infection, though the relative risk of each of these practices is not the same.[24] This classification system can be stratified by HIV status, reporting categories 1–2, 4 and 6–7 for HIV-negative and untested men and categories 1–3 and 5 for HIV-positive men only.

Statistical analysis

Statistical analysis was conducted using Stata version 13.1 (StataCorp LP, College Station, TX, USA). Statistical significance was set at $P < 0.05$. Data are reported for the period 2000–2015 inclusive. Descriptive statistics about the sample are reported. Trends over time in age, sexual identity, ethnicity, HIV status, sex with regular and casual male partners and recruitment source were analysed using linear or logistic regression to identify potential confounders (linear regression for age, logistic regression for the other variables). Trends in key indicators were calculated using multivariate logistic regression, adjusting for the potential confounders that had varied significantly during 2000–2015.

Results

Participant characteristics

During the period 2000–2015, 110 666 respondents participated in the GCPS (mean no. of participants per year = 6917). The majority of participants were from New South Wales (34.4%), Queensland (21.3%) and Victoria (29.8%), with smaller proportions from the Australian Capital Territory (1.8%), South Australia (6.3%), Tasmania (0.2%) and Western Australia (6.3%). The mean age of participants was 35.5 years (s.d. = 11.5). The majority of participants identified as gay (88.3%) and Anglo-Australian (71.4%). Participants self-reported that they were HIV negative (76.3%), HIV positive (8.8%) or had an untested/unknown status (14.9%). Majorities of men reported sex with regular male partners (68.8%) and casual male partners (65.3%) in the 6 months before the survey. The most common recruitment sources were gay community events and social venues (79.1%), sex-on-premises venues (12.8%), clinics and general practices (5.6%) and the Internet (2.5%).

An analysis of the sample profile over time showed several changes between 2000 and 2015. The mean age of the sample increased (from 35.1 years in 2000 to 35.4 years in 2015, $P < 0.001$), as did the proportion of gay-identified men (89.0 to 89.9%, $P < 0.05$). The proportion of Anglo-Australian men fell (73.8 to 69.0%, $P < 0.001$), as did the proportion of HIV-positive men (9.9 to 8.0%, $P < 0.001$). The proportions of men reporting recent sex with regular male partners (71.1 to 67.2%, $P < 0.001$) and casual male partners (68.7 to 60.7%, $P < 0.001$) both decreased, as did the proportion of men recruited from gay community events and social venues (75.6 to 64.4%, $P < 0.001$). These variables were used as control variables in the trend analyses of key indicators, as appropriate.

Key indicators

Table 1 shows trends in key indicators for the period 2000–2015. All trends were statistically significant at the $P < 0.001$ level,

Table 1. Key indicators from the Gay Community Periodic Surveys, 2000–2015
Denominators vary. Data are presented as percentages. CI, confidence interval; ART, antiretroviral treatment; CAI, condomless anal intercourse

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Ever tested for HIV (all men)	89.0	89.4	90.3	90.5	89.1	90.8	90.6	90.3	90.4	88.5	85.1	87.0	86.1	86.6	86.7	88.3
Tested for HIV in previous 12 months (non-HIV-positive men)	56.1	55.7	56.3	57.9	58.4	60.9	60.7	63.0	61.8	61.2	57.1	60.5	59.1	60.3	61.1	64.8
On HIV treatment at time of the survey (HIV-positive men)	72.5	64.5	64.2	59.8	62.1	60.0	62.3	65.0	69.3	71.3	73.1	75.2	79.7	82.3	85.2	88.4
Undetectable viral load at last test (HIV-positive men on ART)	–	–	–	73.7	74.8	83.7	81.3	83.6	87.7	88.6	90.6	93.7	93.3	90.5	93.3	94.7
More than 10 male partners in 6 months before survey (all men)	27.2	27.0	27.2	28.0	26.8	26.4	24.2	22.1	23.0	21.7	21.9	21.5	21.3	20.7	18.9	20.3
No CAI in 6 months before survey (all men)	54.9	53.1	52.7	54.6	52.9	52.6	51.5	52.3	52.6	51.8	50.8	54.4	54.5	54.1	50.5	48.8
Any CAI in 6 months before survey (men with regular male partners)	49.0	52.7	51.7	49.7	52.1	52.1	52.8	51.1	52.3	53.8	58.9	50.8	52.1	52.0	56.2	58.8
Any CAI in 6 months before survey (men with casual male partners)	26.8	29.3	30.5	30.0	29.0	29.5	30.3	30.5	31.6	34.7	35.5	34.1	34.4	35.6	37.4	38.8
Frequently serosorted before CAI in 6 months before survey (HIV-positive and HIV-negative men who had CAI with casual male partners)	–	–	–	–	–	–	–	–	–	–	–	46.5	47.9	48.8	54.1	54.7

after adjusting for potential confounders. The proportion of men who reported ever having been tested for HIV varied over time (range 85.1–90.8%, mean 88.5%). The proportion of non-HIV-positive men reporting a HIV test within the previous year gradually increased over time (from 56.1% in 2000 to 64.8% in 2015). The proportion of HIV-positive men on antiretroviral treatment declined between 2000 and 2003, then increased substantially after that (reaching 88.4% in 2015). The proportion of HIV-positive men on treatment who report an undetectable viral load has increased substantially over time (reaching 94.7% in 2015). In terms of sexual practices, the proportion of men who reported more than 10 male partners in the 6 months before the survey declined gradually over time, while the proportion who engaged in CAI with any partner increased. Condomless anal intercourse was consistently more likely to be reported by regular male partners (boyfriends or 'fuck buddies') than casual male partners. CAI has gradually become more common between regular male partners over time but increased more noticeably between casual male partners. The proportion of HIV-positive and HIV-negative men who reported frequent serosorting (matching HIV status) before CAI with casual male partners also increased between 2011 and 2015.

Table 2 shows trends in sexual practices with casual male partners, taking into account antiretroviral-based prevention. All trends were statistically significant at the $P < 0.001$ level after adjusting for potential confounders. Consistent condom users remained the largest group, but this group decreased gradually over time (from 48.7 in 2000 to 42.1% in 2015). HIV-positive men who reported CAI were a relatively small group of men with casual partners during 2000–2015 (5–7%). Since 2003 (when viral load test results were incorporated into the surveys), there has been a substantial decline in the proportion of HIV-positive men not on treatment or with a detectable viral load who reported CAI (from 3.7 to 1.1%), and a corresponding increase in the proportion of HIV-positive men on treatment and with an undetectable viral load who reported CAI (5.7% in 2015). The majority of men who reported CAI with casual partners were HIV-negative and untested. Approximately 1 in 10 men who had sex with casual partners were HIV negative, untested, not on PrEP and only had CAI in the insertive (top) position; this group increased slightly over time. A larger group of HIV-negative and untested men not on PrEP reported any receptive CAI with casual partners; this group grew steadily over time (from 12.8% in 2000 to 19.3% in 2015). Over the last 3 years, a small group of HIV-negative men on PrEP who reported CAI have emerged; in 2015, this represented 1.2% of men with casual partners.

To demonstrate how the new classification system functions if we stratify it by self-reported HIV status, we examined the most recent year of survey data (2015). Among 4385 HIV-negative and untested men with casual partners in 2015, 19.9% reported no anal intercourse, 44.8% consistently used condoms, 1.3% were on PrEP and reported any CAI, 12.7% were not on PrEP and had insertive-only CAI and 21.4% were not on PrEP and reported any receptive CAI. Among 466 HIV-positive men with casual partners in 2015, 11.6% reported no anal intercourse, 17.0% consistently used condoms, 59.7% were on HIV treatment, had an undetectable viral load and reported CAI, and 11.8% were not on treatment or had a detectable viral load and reported CAI.

Figure 1 shows two imagined scenarios of the effect of PrEP uptake on sexual practices with casual partners, using the measures of antiretroviral-based prevention from Table 2. In both scenarios, the anticipated rate of PrEP uptake is the same, gradually increasing to 15% of men with casual partners in 2020. Scenario 1 represents the ideal situation in which the increase in PrEP use results in a decline in the relative size of two high-risk categories (HIV negative and untested men who report insertive or receptive CAI and who are not on PrEP); that is, men who engage in high-risk CAI gradually switch to PrEP use. Scenario 2 depicts a worst case scenario in which PrEP uptake is paralleled by a decline in consistent condom use and the relative size of the high-risk categories remains unchanged.

Discussion

Prompted by the incorporation of antiretroviral-based prevention in Australia's HIV response, we have adjusted behavioural surveillance so that the uptake and effect of

Table 2. Sexual practices between casual male partners in the previous 6 months, including antiretroviral-based prevention, 2000–2015
Data are presented as percentages. AOR, adjusted odds ratio; CI, confidence interval; CAI, condomless anal intercourse; ART, antiretroviral treatment; PrEP, pre-exposure prophylaxis

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
No anal intercourse	24.4	21.0	23.0	22.0	24.4	21.7	22.7	23.2	20.3	20.2	19.4	20.8	20.5	20.0	18.0	19.1
Consistent condom use	48.7	49.7	46.5	48.1	46.6	48.8	47.0	46.3	48.1	45.1	45.1	45.0	45.1	44.3	44.5	42.1
Any CAI by HIV-positive men on ART with an undetectable viral load	–	–	–	2.2	2.6	2.7	2.2	2.7	3.3	3.4	3.6	4.4	4.8	5.3	4.8	5.7
Any CAI by HIV-negative men on PrEP	–	–	–	–	–	–	–	–	–	–	–	–	–	0.9	0.7	1.2
Any CAI by HIV-positive men not on ART or with a detectable viral load[A]	4.7	6.1	5.4	3.7	2.7	2.4	3.0	2.9	2.4	2.4	2.1	1.8	1.6	1.7	1.4	1.1
Insertive only CAI by HIV-negative or untested men not on PrEP	9.3	8.6	9.6	9.4	8.7	9.0	9.4	8.6	8.9	11.0	11.4	9.8	9.3	9.0	10.6	11.4
Any receptive CAI by HIV-negative or untested men not on PrEP	12.8	14.6	15.6	14.7	15.1	15.4	15.7	16.4	17.0	18.0	18.4	18.2	18.7	18.7	20.0	19.3
Total (*n*)	4303	4167	4442	4600	4516	4141	4900	4329	4197	4653	5342	4820	4803	3780	4476	4851

[A]All HIV-positive men who reported CAI are included in this category in years 2000–2002 as viral load test results were not collected until 2003.

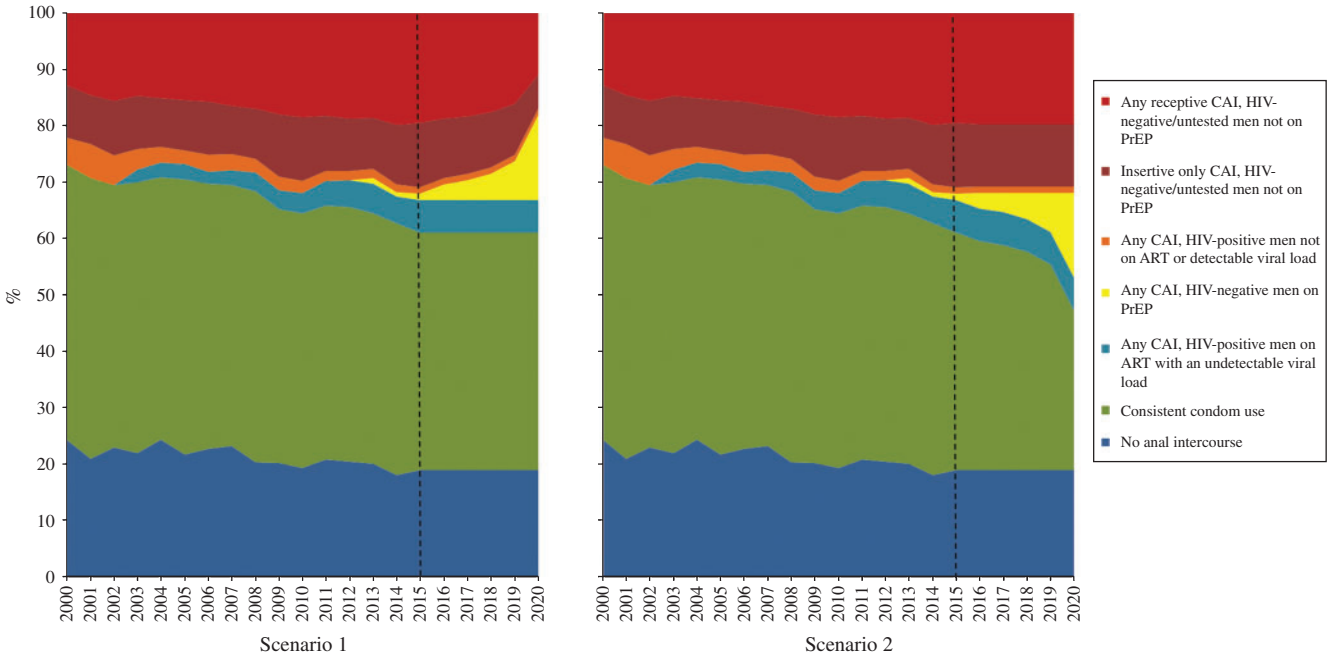

Fig. 1. Scenarios depicting imagined effect of pre-exposure prophylaxis (PrEP) use on sexual practices with casual male partners, 2000–2020. ART, antiretroviral treatment; CAI, condomless anal intercourse.

strategies such as PrEP and TasP can be better assessed. We also reviewed trends in Australian gay and bisexual men's practices since the turn of the century, to consider what may happen between now and 2020. The following discussion considers these trends, their relationship to HIV notifications, why changes in sexual practices may have occurred and what we anticipate may happen in the next few years.

First, the limitations of our analysis should be borne in mind. We limited our analysis to a restricted set of key indicators, and did not engage with a broader range of measures that may be affected by PrEP and TasP, such as sexually transmissible infections. Repeated, cross-sectional behavioural surveillance is valuable for identifying trends in practices in affected populations, but it cannot track changes in the practices of individuals over time or identify causal relationships between variables.[1,2] Changes to the popularity and availability of venues and events prompt changes in sampling, which may affect key indicators (although we have controlled for sampling variation in the analysis of trends, wherever possible). As is best practice, the GCPS consistently target the primary population at risk of HIV in Australia (sexually active GBM in metropolitan areas), but our sample is not representative of GBM across Australia.[25] Until 2015, our measures did not take into account the perceived HIV status of casual male partners or their use of antiretroviral-based prevention. Our measures may therefore exaggerate the risk of condomless sex between casual partners in situations in which the participant is not on HIV treatment or PrEP, but their casual partner is. These are problems we seeking to address, both within the GCPS and in other monitoring mechanisms.

Turning to our analysis of trends, our data show that nearly all Australian GBM have been tested for HIV at least once in their lifetime, and the proportion of non-HIV-positive men who report testing in the previous year has increased gradually over time to 65% in 2015. The gradual increase in HIV testing may have contributed to the gradual increase in HIV notifications observed among GBM in Australia.[11,26] However, the proportion of late diagnoses among GBM has not changed in over 10 years,[11] suggesting that the increase in HIV testing coverage is insufficient or failing to effectively engage those at high risk of infection. It is likely to require a substantial ongoing effort to further increase HIV testing uptake and frequency and address ongoing barriers, such as the fear and inconvenience of testing.[27–30]

Since 2000, there have been substantial, positive changes in the uptake of HIV treatment and the proportion of Australian HIV-positive GBM with an undetectable viral load. Our data suggest that in 2015, Australia nearly reached the UNAIDS target of 90% of diagnosed, HIV-positive GBM being on treatment and that over 90% achieved viral suppression several years ago.[31] The levels of treatment use found in behavioural surveillance are at the lower end of Australian estimates, with clinic samples showing higher levels of uptake.[32] However, the upward direction of change in treatment and viral suppression is similar in these sources.[32] Our data suggest that the promotion of the benefits of HIV treatment, the availability of more potent and tolerable regimens and the removal of CD4 count prescribing restrictions have encouraged more doctors and patients to agree on treatment initiation.[33]

We expect HIV treatment uptake and viral suppression to continue to increase, particularly in the context of the continuing promotion of the benefits of HIV treatment.[34] It is noticeable that increasing levels of effective treatment have reduced the rate of HIV infections as a proportion of diagnosed HIV-positive people in Australia, but increasing treatment coverage has not resulted in a decline in HIV incidence or notifications.[11]

Increasing HIV treatment coverage has undoubtedly reduced the infectiousness of HIV-positive GBM on treatment, but this appears to have been insufficient to lead to declining annual notifications.[35,36] This suggests to us that the preventative benefits of treatment have been outweighed by other changes, such as increases in condomless sex and the disproportionate role of undiagnosed HIV in driving new infections.[37]

In the arena of sexual practices, our results indicate that while the proportion of GBM with a high number of recent sexual partners has declined since 2000, condomless anal sex has become more common. It is unclear why partner numbers have declined. The switch to mobile phone apps as the primary way to find partners (at the expense of gay venues, particularly sex venues) and a greater focus on serial monogamy (rather than non-exclusive relationships) may be contributing factors.[18,38] This is an area worthy of further research. The decline in partner numbers should have contributed to a reduced likelihood of transmission, but (as noted above) annual HIV notifications have not declined. In Australia, condomless sex has become more common since the widespread availability of effective HIV treatments. We think the diminished threat of HIV (and greater optimism about avoiding transmission) as a result of treatments has contributed to the rise in condomless sex, although it is by no means the only explanation.[16,34,39]

The increase in condomless sex between casual male partners appears to be the main reason that HIV notifications have increased among GBM in Australia.[11,13] This is despite the increase in HIV treatment and undetectable viral load, the decline in partner numbers, the relatively high level of ongoing condom use and the increase in use of risk-reduction strategies such as serosorting during condomless anal sex.[12,23] Serosorting has become much more commonly practised by GBM in the last decade,[12,40] but it is does not protect HIV-negative men if HIV status is incorrectly assumed or a partner has undiagnosed HIV.[24,41,42] In fact, the greater reliance on serosorting may have increased the exposure of HIV-negative men to undiagnosed HIV, which may explain why other positive changes (such as the increase in HIV treatment and undetectable viral load) have had limited effect.[12,37] Based on current trends, we expect CAI between casual partners to become more common over time and for HIV notifications to continue to rise if additional protective strategies are not deployed. Therefore, other than trying to sustain current levels of condom use, there is considerable focus in Australia on the introduction of PrEP.

We have developed new measures of sex with casual male partners that can follow the introduction of antiretroviral-based prevention (PrEP and TasP) and gauge their effect. The measures clarify that the majority of GBM who have condomless sex with casual partners are HIV negative and untested men, not currently on PrEP, and the proportion who report any receptive condomless sex (the riskiest practice for HIV transmission) has grown since 2000 (hence rising HIV notifications). As outlined in our imagined scenarios, we anticipate PrEP use increasing substantially over the next 4 years, driven by interest in PrEP and an expansion of availability.[43–46] The question is whether the uptake of PrEP reduces the size of the 'at risk' population (by reducing the relative number of 'unprotected' GBM), thus assisting in reducing HIV incidence, or whether its uptake results in a (further) decline in consistent condom use and the 'at risk' population remains too large to effectively reduce incidence. In San Francisco, PrEP has been introduced in the context of declining HIV notifications and declining condom use by GBM.[47] There, the uptake of PrEP has been followed by further declines in HIV notifications and condom use (and an increase in serosorting by men not on PrEP). In Australia, PrEP is being introduced in the context of gradually rising notifications and declining condom use. We therefore anticipate a range of possible outcomes as a result of the introduction of PrEP; behavioural surveillance will be one way we can follow its impact.

We have shown the utility of an existing behavioural surveillance system, the Gay Community Periodic Surveys, in reviewing influences on the Australian HIV epidemic among GBM. We have also shown that we can adapt the system to the introduction of antiretroviral-based prevention. Based on recent trends and current efforts, we anticipate that HIV testing and HIV treatment will continue to increase, but to prevent new infections, we must intervene in the growing proportion of GBM who have condomless sex with casual partners. It is hoped that PrEP uptake will protect many GBM who are currently at high risk of HIV. However, condom use will also need to be sustained by GBM not on treatment or PrEP to achieve the maximum net benefit of antiretroviral-based prevention. Behavioural surveillance will enable us to see whether antiretroviral-based prevention has its desired effect.

Conflicts of interest

The authors have no conflicts of interest to declare.

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