



# HIV risk reduction strategies among gay men

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## Summary

Several non-condom-based HIV risk reduction strategies have been described among gay men and other men who have sex with men (MSM):

- **Negotiated safety**—an agreement between HIV-negative men that limits unprotected anal intercourse (UAI) to only between partners within a regular relationship. Any sex with other partners outside the primary relationship must be protected. If consistently practised, negotiated safety appears as effective as avoiding UAI at preventing HIV infection.
- **Withdrawal**—when the insertive partner in UAI withdraws before ejaculation. This appears to be relatively common among men who engage in UAI, but it is not particularly effective in preventing HIV transmission if relied upon as a sole risk reduction strategy. HIV-negative men who rely upon withdrawal appear to be five times more likely to seroconvert than men who do not engage in UAI.
- **Strategic positioning**—the use of serostatus to determine sexual roles during UAI. The HIV-negative partner takes the insertive position and the HIV-positive partner takes the receptive position. This appears to be a less common practice than negotiated safety or withdrawal. Strategic positioning is probably more effective in preventing HIV transmission than withdrawal, although there is only limited evidence available.
- **Serosorting**—the restriction of UAI to only with partners believed to be of the same (concordant) HIV status. It has been relatively common practice among HIV-positive men for some time and appears to be becoming more common among HIV-negative men. The evidence suggests that HIV-negative men who rely on serosorting are more likely to become infected with HIV than men who do not engage in any UAI.
- **Undetectable viral load**—the use of viral load test results to assess the risk of HIV transmission when non-concordant partners engage in UAI. This strategy appears relatively uncommon among gay men and other MSM. There is, as yet, no evidence that the use of undetectable viral load is effective in preventing HIV transmission among serodiscordant gay couples who practise UAI.

## Introduction

Prior to the HIV epidemic gay men's steady relationships included but were not limited to monogamy (Adam, 2006; Hickson et al, 1992). The HIV epidemic required gay men to make significant changes to their sexual practices, most notably the use of condoms for anal intercourse. In some countries, although less so in Australia, there were also calls for gay men to reduce the number of sexual partners or to practise monogamy, even though the epidemiological evidence identified unprotected anal intercourse and not the number of partners as the primary determinant of risk for HIV

infection (Hickson et al, 1992). Most gay men adopted condoms, however abstinence, monogamy and a reduction in partner numbers were not widely adopted (Kippax & Race, 2003). Condoms remain the primary HIV risk reduction strategy for gay men, however a range of other non-condom-based strategies have emerged during the course of the epidemic. These include negotiated safety, withdrawal, strategic positioning, serosorting and the use of viral load test results. We reviewed the international literature to assess the frequency and effectiveness of these non-condom-based risk reduction strategies among gay men.

## Aims and method

This review examines the epidemiological, behavioural, social research and health promotion literature on the adoption and effectiveness of non-condom-based HIV risk reduction strategies among gay, bisexual and other men who have sex with men. The strategies we focused on were: negotiated safety; withdrawal; strategic positioning; serosorting, and; the use of viral load test results. The review focused on the research literature published in peer-reviewed journals since the introduction of combination or 'highly active' antiretroviral (ARV) therapy, in recognition of the fact that the availability of effective HIV treatment has influenced the development of non-condom-based risk reduction strategies among MSM in Australia and similar countries.

The following databases were searched for relevant literature published in the years 1996–2010: HIV/AIDS database (HIVA); MedLine; ScienceDirect; Social Sciences Citation Index; Web of Science.

In reviewing the literature, the key questions we considered were:

- Which non-condom-based strategies have been adopted by men to reduce the risk of HIV transmission?
- Which men adopt risk reduction strategies?
- Are risk reduction strategies applied in similar contexts across time?
- Which strategies are more or less effective in preventing HIV transmission?
- What other factors affect the success—or otherwise—of different strategies?

*continued overleaf*





## Negotiated safety

In the early 1990s researchers found evidence of increasing levels of unprotected anal intercourse (UAI) among MSM in a number of western countries, including Australia, the United Kingdom and USA, raising concerns that gay men were experiencing safe sex 'fatigue' or 'relapse' (Adib et al, 1991; Stall et al, 1990). Research from the UK and Australia confirmed that levels of UAI had indeed increased among gay men, but contested the idea that this was evidence of unsafe practices because much of the UAI was occurring between regular partners with the same HIV status (Hickson et al., 1992; Kippax et al., 1993). Data from interviews conducted in 1990 in the UK with 387 men found that gay men were intentionally making rules about sex inside and outside of their primary relationships in order to prevent HIV infection (Hickson et al., 1992). Of the 387 men interviewed, 252 (65%) had a regular partner (or partners). Of these men, 110 (44%) were in a relationship which was described as monogamous, and 142 (56%) were in an open relationship where the respondent or his partner (or both) had sex with other men. The British researchers argued that gay men in open relationships were extending rules that prior to HIV had been aimed at protecting the emotional integrity of the primary relationship to also include rules explicitly pertaining to

safe sex. Of the men in open relationships 43% had an agreement about what kind of sex partners they could have outside the relationship based on safer sex guidelines. Agreements could specify not having anal intercourse with casual partners, not ejaculating in a partner's mouth or only having anal sex with condoms. The same study found that while some men in open relationships used condoms with both their casual and regular partners, other men used condoms with casual partners but not with their regular partners.

Researchers in Australia subsequently found that among homosexually-active men in Sydney, the majority of men who practised UAI were only doing so with a regular partner with a concordant HIV status (Kippax et al, 1993). UAI was much less commonly reported with casual sex partners. The researchers argued that HIV status was being used by men in relationships to inform an HIV avoidance strategy and therefore should not be interpreted as evidence of relapse or safe sex fatigue. They proposed the term 'negotiated safety' to refer to UAI in the context of a regular relationship where both partners shared the same serostatus and the partners had agreed to avoid UAI with casual partners.

The Australian research team followed up their initial findings, specifying the conditions under which negotiated

safety would be most effective in preventing HIV infection and could be considered safe sex. These conditions were: the sexual partners are in a regular relationship; are both HIV-negative and aware of each other's status, and; have reached a clear and unambiguous agreement about sexual practices within and outside the relationship, specifically that all sex with casual partners is safe (Kippax et al, 1993; 1997).

A similar pattern (of UAI within regular relationships and safe sex with casual partners) was also apparent among HIV-positive men in concordant primary relationships, but concerns about the potential for HIV re-infection (superinfection), sexually transmissible infections and ART drug resistance prevented the Australian researchers from recommending that HIV-positive men be included under the banner of negotiated safety (Kippax et al, 1993). Negotiated safety was therefore only promoted as a risk reduction strategy for HIV-negative men in concordant partnerships. The use and effectiveness of relationship agreements as a risk reduction strategy among HIV-positive concordant couples has largely been ignored (Murphy, 2006). Some challenged the exclusion of HIV-positive men from negotiated safety on the basis that HIV-positive men were just as likely to be engaged in the safe negotiation of sex within and outside of relationships, and that to exclude them from negotiated safety suggested that safe sex was impossible for HIV-positive men (Sharp et al, 1996). British researchers noted that agreements about sex within and outside relationships also existed among HIV-positive men and carried little if any HIV transmission risk to an uninfected person (i.e. casual partners) (Elford et al, 1999). However, the same concerns about HIV re-infection and drug resistance were raised again.

## Negotiated safety or negotiated danger?

There has been significant debate and criticism of the concept of 'negotiated safety', with a number of Australian and international researchers raising concerns about its safety, effectiveness and the capacity of gay men and other MSM to meet the strict conditions outlined by Kippax and her colleagues (Davies, 1993; Ekstrand et al, 1993; Ridge, 1996; Sharp et al, 1996). Davies questioned whether anal intercourse without a condom could ever be thought of as completely safe, and therefore argued that negotiated

safety could only be promoted as a risk minimisation strategy and not a safe sex strategy (Davies, 1993). Californian researchers from the Center for AIDS Prevention Studies were critical of the strategy's reliance on men knowing and disclosing their HIV status, arguing that not all gay men would have the ability to know or reveal their HIV status, out of fear or because they were untested (Ekstrand et al, 1993). The same researchers suggested it would be more appropriate to refer to negotiated safety as 'negotiated danger' and that only gay men in monogamous relationships should consider abandoning condoms. In the Australian context, Damien Ridge questioned the effectiveness of negotiated safety, given that it was unclear whether it actually reduced HIV infections (Ridge, 1996). Based on qualitative research with gay men he argued unprotected sex occurred through a range of processes rather than through negotiated safety. Ridge also questioned the capacity of some gay men to successfully negotiate and keep agreements with their regular partners because of power imbalances, limited communication skills and the varied meanings of anal sex within (and outside) relationships. Others have suggested that where couples are able to establish HIV concordance and can talk openly about sex inside and outside of the relationship negotiated safety is a rational and relatively safe option (Moreau-Gruet et al, 2001). However, for some men the requirement of a high level of communication may make it an inappropriate strategy.

## Effectiveness

Susan Kippax responded to critics of 'negotiated safety' noting that they often blurred two sets of conditions: the analytic and the contingent (Kippax, 1996). She argued that logically it is impossible for HIV infection to occur between two uninfected (HIV-negative) men. However, it is less clear the extent to which gay men can negotiate the strict conditions required to maintain safety. Based on research with men recently infected with HIV in Melbourne and Sydney she argued that HIV transmission was more likely to occur in relationships where negotiations do not occur, when agreements are ambiguous and when trust is misplaced. In contrast, findings from a survey of MSM in Sydney found that when regular partners had agreements, they were generally kept and there was little unprotected sex with casual partners outside of seronegative

concordant relationships (Kippax, 1996; Kippax et al, 1997). The survey data showed that having an agreement was predictive of safe sex with casual partners, that effective negotiated safety was associated with no anal intercourse outside of the primary relationship and higher acceptability of condoms. The researchers found that negotiated safety appeared to work as well as monogamy at protecting men in relationships from HIV infection, although the numbers of men in this study were relatively small.

An analysis of men in London in 1999 found that a significant number of men appeared to have adopted the first principle of negotiated safety (to only have UAI with their primary partner), but nearly half of those men (44%) did not know their own HIV status or that of their partner (Elford et al, 1999). This indicated the importance of promoting all the key elements of negotiated safety and highlighted that negotiated safety may be ineffective or even risky when it is partially implemented, for example, where concordant status is not established, or when an agreement is assumed rather than explicitly discussed.

Findings from a cohort study of young gay men in Amsterdam, indicated that primary relationships were potential contexts for HIV transmission, with 50% of infections occurring with a primary partner (Davidovich et al, 2000). Only 12% of men in relationships in Amsterdam had negotiated safety agreements, and therefore UAI within most relationships represented a high risk for HIV transmission. The Dutch authors recommended negotiated safety be promoted and recommendations for dealing with broken agreements also be included in the initial negotiation. In 2001 Australian researchers analysed data from a larger sample, examining the effects of different agreements (Crawford et al, 2001). They found that having an explicit agreement made it less likely that gay men would engage in UAI with casual partners. Of men with a regular partner, 83% said they had a clear and spoken agreement about sex within and outside the relationship; 57% engaged in UAI with their regular partners; and 94% of men with agreements kept to the terms of their agreements. Negotiated safety agreements were found to be as effective in achieving low levels of risk practice as an agreement to only have protected anal intercourse. A more recent analysis of an Australian cohort data confirmed that negotiated safety, applied consistently,

'can substantially protect men from becoming HIV infected' (Jin et al., 2009). HIV-negative men who consistently practised negotiated safety (meeting all the conditions initially recommended) were no more likely than men who avoided UAI to become infected with HIV.

Overall, the published research indicates that when all the conditions of negotiated safety are met, it is an effective risk reduction strategy. A number of studies have identified factors that support successful negotiated safety among MSM including: regular HIV testing; investment in the relationship; capacity to communicate and reach a shared understanding of the agreement; disclosure and discussion of broken agreements; and revisiting and where appropriate revising the agreement during a relationship (Davidovich et al, 2000; Davidovich et al, 2006; Hoff & Beougher, 2010; Kippax et al, 1997; Prestage et al, 2006; Xiridou, et al, 2003). Californian researchers in particular note that agreements about whether to allow sex with outside partners are complex and that it is essential that partners' ways of understanding agreements overlap, for example that both partners agree on what degree they allow sex with outside partners. (Hoff et al, 2008; Hoff & Beougher, 2010). They also recommend that researchers and educators pay more attention to the potential barriers to the disclosure of broken agreements. A recent study has found that men with higher investments in their relationship agreement were more likely to keep the agreement and more likely to have positive feelings about the relationship, suggesting that relationships with high levels of support and trust are more likely to be able to successfully use negotiated safety as a risk reduction strategy (Neilands et al, 2010).

## Withdrawal

Withdrawal prior to ejaculation during sexual intercourse has its origins as a contraceptive practice during heterosexual sex. Australian research in the late 1990s showed that Sydney gay men reported using withdrawal before ejaculation for oral sex and particularly anal intercourse as a way to reduce the risk of HIV transmission (Van de Ven et al, 1997). Around half the men who reported UAI with casual partners said they practised withdrawal before ejaculation every time they had UAI. Subsequent research found that there was a perception among some gay men that withdrawal was at

least partially effective in preventing HIV transmission (Gold & Skinner, 2001). A recent analysis of risk reduction practices among MSM in Switzerland found that of the men who reported any risk reduction practice, withdrawal before ejaculation was the most common with 62% reporting that they used this strategy—compared with serosorting (50%) and strategic positioning (33%) (Balthasar et al, 2010).

Australian researchers found that, for some men who practise withdrawal, condom use is not an acceptable option and withdrawal is likely to be more useful than nothing (Richters et al, 2000). US researchers have also found that for some men withdrawal may be a compromise between using condoms and not having anal sex at all (Parsons et al, 2005). The researchers note the limited efficacy of withdrawal and recommend caution in how it is discussed to ensure that men understand its limitations. However, they acknowledge that men whose only risk reduction strategy is withdrawal have not given up all efforts at avoiding HIV.

## Effectiveness

Commentators have noted that the effectiveness of withdrawal during UAI has not been well documented, and that the receptive partner is likely to be exposed to body fluids and cells from untimely withdrawal and pre-ejaculate (van Griensven, 2009). This means that withdrawal is unlikely to be a particularly effective risk reduction strategy. A recent analysis of Australian cohort data seems to confirm this view (Jin et al, 2009). Assessing the effectiveness of withdrawal alongside other risk reduction strategies, the analysis confirms that the risk of HIV transmission among those who rely upon withdrawal as their primary HIV risk reduction strategy for UAI is substantial, with HIV-negative men who practised withdrawal being five times more likely to seroconvert than men who did not engage in UAI. However, withdrawal was less likely to result in HIV infection than UAI with ejaculation.

## Strategic positioning

‘Strategic positioning’ (also referred to as ‘sexual positioning’) was initially described in qualitative research with gay men in Sydney as a ‘folk belief’ that being the insertive partner during unprotected anal intercourse (UAI) with a HIV-positive partner was less risky for HIV-negative men than being the receptive partner (e.g. Rosengarten, Race & Kippax, 2000). This

seemed to reflect the limited available epidemiological evidence at the time and (perhaps) educational messages that had subsequently emphasised the risk of the receptive position for HIV-negative men (e.g. Vittinghoff et al, 1999). The first substantive quantitative analysis of strategic positioning was conducted on data collected between 1996 and 2000 in Sydney, looking at gay men with serodiscordant male sex partners (Van de Ven et al, 2002). It was found that among the minority of gay men in serodiscordant regular relationships who practised unprotected anal intercourse with their regular partner (UAIR), there was a distinct pattern of positioning during UAIR—most HIV-positive men took the receptive position and most HIV-negative men took the insertive position. This pattern of positioning for UAIR did not appear to just be a preference for a particular sexual position as the pattern disappeared when the same men used condoms with their serodiscordant regular partners i.e. when using condoms, men in serodiscordant relationships were just as likely to be insertive or receptive, regardless of their HIV status. The pattern of strategic positioning found among men in serodiscordant relationships (HIV-positive/receptive, HIV-negative/insertive) was still apparent among men who practised UAI with casual partners (UAIC), but was less common and less pronounced. Subsequent commentary on strategic positioning suggested it was becoming more common among Sydney gay men over time (Kippax & Race, 2003).

Strategic positioning among gay men and other MSM has been described in other contexts (primarily US cities). Qualitative research with gay men in San Francisco described HIV-negative men engaging in ‘frequent unprotected insertive intercourse’ with HIV-positive casual partners believing this was safer than being the receptive partner and that this practice was recognised by other gay men (Sheon & Crosby, 2004). As one HIV-positive man put it, ‘sometimes a person who is negative will still have unprotected sex with a person who is positive as long as the person who is negative is on the top.’ (p. 2115). An HIV-negative man who engaged in this practice said, ‘I feel the odds are in my favor in the respect that I’m not using a condom and I’m a top’ (p. 2110). A quantitative analysis of the sexual practices of gay and bisexual HIV-positive men in New York and San Francisco subsequently confirmed that men in San Francisco seemed to

be practising strategic positioning for UAIR and UAIC (Parsons et al, 2005). Men in New York showed no evidence of strategic positioning for UAIR but some evidence of positioning for UAIC. Because Parsons et al also examined oral sex practices, they concluded that HIV-positive men in both cities reported ‘more acts of sex as the receptive partner than the insertive partner’ with HIV-negative men (p. S20). A later analysis of data from San Francisco in 2004 concluded that 6% of HIV-negative men and 14% of HIV-positive men reported consistent strategic positioning for UAI (Snowden, Raymond & McFarland, 2009).

Other studies have found evidence suggestive of strategic positioning. Survey research investigating ‘barebacking’ and risk reduction among gay and bisexual men in New York and Los Angeles found that men who identified as a ‘barebacker’ (13% of the sample) appeared to be more likely than other men to practise strategic positioning (Groves et al, 2007). HIV-positive men who identified as barebackers and who reported serodiscordant UAI were more likely to say they were the receptive partner (50% bottom vs. 20% top) while HIV-negative barebackers were more likely to say they were the insertive partner in serodiscordant UAI (55% top vs. 15% bottom). A more recent study in the Boston area made a similar finding: HIV-negative men who identified as barebackers were three times more likely than other HIV-negative men to report insertive UAI with serodiscordant partners but no more likely to report receptive UAI with serodiscordant partners (Reisner et al, 2009). An analysis of sexual practices among gay and bisexual men in Atlanta found that UAI and particularly insertive UAI had become more common between 1997 and 2005, and that HIV-negative and unknown status men were more likely than HIV-positive men to report insertive UAI (Kalichman et al, 2007).

A review of sexual risk behaviour among HIV-positive MSM identified five studies (in Australia and the US) in which HIV-positive men were more likely to engage in receptive UAI than insertive UAI and two studies (in the UK and US) in which this pattern was not found (van Kesteren, Kok & Hoppers, 2007). The authors concluded that ‘the results are inconclusive’ (p. 17) i.e. that strategic positioning was not consistently found among or practised

by MSM internationally, although rates of UAI did appear to be increasing.

Since the publication of this review, other researchers have described strategic positioning in different groups of MSM. A study of gay, bisexual and other MSM attending gyms in New York found evidence of strategic positioning among the minority of men in serodiscordant couples, with HIV-negative men reporting that they exclusively took the insertive position if they had unprotected anal intercourse with their HIV-positive partners (Halkitis, Moeller & Pollock, 2008). A meta-analysis of 30 studies of HIV-positive MSM in the US found that the minority of HIV-positive MSM who had had UAI with HIV-negative men were nearly twice as likely to report having adopted the receptive position rather than the insertive position (9% vs. 5%) (Crepaz et al, 2009). A similar pattern was found among HIV-positive MSM who reported UAI with untested men or men of unknown status (12% receptive vs. 8% insertive). Because this tendency towards the receptive position was not seen when HIV-positive MSM reported UAI with other HIV-positive men, the authors concluded that this was indeed strategic positioning (a risk reduction strategy) and not a preference for a sexual position. Finally, a recent analysis of risk reduction practices among MSM in Switzerland found that strategic positioning is the least common strategy among men who reported one or more risk reduction practices in the previous 12 months, with only one-third of men who had engaged in risk reduction having used this particular strategy (Balthasar et al, 2010).

### Effectiveness

A few Australian papers have attempted to assess the effectiveness of strategic positioning and other risk reduction practices. An analysis of the practices engaged in by gay men in Sydney and Melbourne during the event that led to their HIV seroconversion suggests that 10% of these men were practising strategic positioning during UAI (being insertive if they believed their partner to be HIV-positive) when they became infected (Jin et al, 2007). In a more recent analysis, Jin et al (2009) assessed the effectiveness of different risk reduction strategies using data from the Health in Men cohort of HIV-negative men. They found that men who consistently practised strategic positioning for UAI (which they defined as always taking the insertive



position during UAI, regardless of the partner's HIV status), were no more likely to seroconvert than men who reported no UAI i.e. strategic positioning (under this new definition) was as effective as avoiding UAI in protecting men from HIV infection. We note, however, that this new definition of strategic positioning for HIV-negative men (being exclusively insertive for UAIC, regardless of the partner's HIV status) is a more generous definition of strategic positioning (in not focusing exclusively on situations where the receptive partner is known to be HIV-positive). This is likely to have inflated the apparent effectiveness of strategic positioning, given that many of the respondents' receptive partners are likely to have been HIV-negative.

### Debate

Halkitis, Moeller and Pollock (2008) have argued that strategic positioning is often undermined by assumptions about serostatus (rather than explicit HIV disclosure). In contrast, research conducted with men who identify as barebackers in the US suggest strategic positioning could be encouraged for men who are unlikely to always use condoms (Reisner et al, 2009). In a commentary on Jin et al's (2009) analysis of the effectiveness of strategic positioning and other risk reduction strategies, van Griensven (2009) suggests that strategic

positioning is heavily reliant on accurate knowledge of one's HIV status, the willingness of HIV-positive men to disclose their status and an acceptance that men should adopt the HIV-positive/receptive, HIV-negative/insertive pattern for UAI. Van Griensven suggests the success of strategic positioning in Sydney may be due to a constellation of social factors, including: high HIV testing rates; a strong gay community; and a climate of 'open communication and responsibility'.

### Variations in terminology

Although the early Australian work on strategic positioning focused exclusively on positioning during unprotected anal intercourse, other researchers have used the term in different ways. Kalichman et al (2007), for example, included positioning in oral sex in their discussion of strategic positioning (with the HIV-positive/receptive, HIV-negative/insertive pattern). Confusingly, Dodge, Jeffries and Sandfort (2008) used strategic positioning as general term for a range of risk reduction practices including avoiding anal or vaginal penetration and withdrawal before ejaculation, rather than a reference to the HIV-positive/receptive, HIV-negative/insertive pattern. Snowden, Raymond and McFarland (2009) referred to strategic positioning as 'seropositioning', perhaps in response to the absence of knowledge about men's



intentions. The recent analysis of the effectiveness of risk reduction practices by Australian researchers (referred to above) loosened the initial definition of strategic positioning as HIV-positive/receptive, HIV-negative/insertive and used the definition of HIV-negative men always taking the insertive position for UAI, regardless of the HIV status of their partner (Jin et al, 2009).

### Serosorting

Possibly the earliest published use of the term 'serosorting' as a risk reduction practice is by Suarez and Miller (2001) from the Center for AIDS Intervention Research in Wisconsin. Referring back to some of their previous work on the HIV risk perceptions of HIV-negative MSM, Suarez and Miller used the label serosorting to refer to men who discussed their HIV status with potential partners and limited 'risk behaviour' (UAI) to men with the same status. Because the use of HIV status to guide assessments of transmission risk was far from new, Suarez and Miller appear to have coined the term serosorting to suggest that there was a changed environment (since the advent of antiretroviral therapy) in which some men were intentionally disclosing to one another to facilitate UAI (rather than, say, responding to incidental HIV disclosure). They therefore defined serosorting as 'rational

risk taking'. Suarez and Miller linked serosorting to an emerging concern of US researchers at the time (barebacking), stating that 'Many barebackers employ the strategy of serosorting'.

At the 2004 Conference on Retroviruses and Opportunistic Infections in San Francisco, Willi MacFarland's team at the San Francisco Department of Health suggested increased serosorting among gay men in San Francisco could explain an increase in the city of STIs like syphilis and gonorrhoea but a stable number of HIV infections (AIDS Alert, 2004). These findings were subsequently published, showing that while UAI had significantly increased in San Francisco between 1998 and 2004, HIV-negative and HIV-positive MSM were less likely to report UAI with unknown status men, and MSM attending anonymous testing sites were significantly less likely to report UAI with HIV-positive partners (Truong et al, 2006). Although they noted that they could not be sure that men were intentionally engaging in selective UAI based on HIV status (because intentions were not measured), Truong et al concluded that serosorting could account for the stabilisation of the HIV epidemic in San Francisco, despite increases in STIs and UAI. They suggested that internet sex-seeking could facilitate serosorting, but notably did not elaborate whether they thought men were actively discussing

HIV status before UAI (i.e. a negotiated strategy with partners) or whether men were selectively choosing partners on the basis of (perceived) HIV status (e.g. from an online profile) and then seeking UAI (without a discussion of HIV status).

### Prevalence and contexts

Serosorting has subsequently been described (or inferred) in a range of other contexts. A study in Montreal, Canada found that HIV-positive MSM with a greater proportion of HIV-positive sex partners were more likely to report UAI than other HIV-positive men, so the authors suggested this might be evidence of serosorting (Cox, Beauchemin & Allard, 2004). Similarly, a pilot study of sex parties for HIV-positive MSM in New York suggested that the existence of the parties was evidence of serosorting among HIV-positive men (Clatts, Goldsamt & Yi, 2005). A more robust analysis of sexual behaviour among HIV-positive MSM in New York and San Francisco found that HIV-positive men were less likely to report unprotected anal (and oral) sex with HIV-negative regular and casual partners than HIV-positive partners, indicating (as the authors put it) 'some efforts at harm reduction via serosorting' (Parsons et al, 2005). However, the same study found that HIV-positive men were more likely to report unprotected sex with unknown status partners than with either HIV-positive or HIV-negative partners, suggesting (perhaps somewhat obviously) that serosorting only occurred when the partner's serostatus was known. In the absence of HIV disclosure, unknown status partners appeared to be treated as seroconcordant by HIV-positive men.

The first publication describing serosorting in Australia focused on HIV-negative gay men in the Health in Men cohort (Mao et al, 2006). It found that the mean number of UAIC partners per respondent decreased between 2002 and 2005, and the majority of UAIC occurred with partners of unknown HIV status. However, among those who had UAIC, the proportion of partners who were believed to be HIV-negative increased significantly, from 6.4% in 2002 to 24.6% in 2005. As the authors noted, the men were not asked whether they were intentionally serosorting (or selecting partners for UAI based on HIV status). Instead, serosorting was inferred from the behavioural data (what the men reported doing). The authors hypothesised that the apparent increase in HIV-negative seroconcordant UAIC was probably due

to an increase in HIV disclosure between casual partners, perhaps facilitated by online sex-seeking and the use of online profiles to disclose HIV status. A more recent analysis of Australian data from the Health in Men and Positive Health cohort studies confirmed that the frequency of serosorting with casual partners had increased significantly among HIV-negative and HIV-positive men since 2001 (Zablotska et al, 2009). Among men reporting any UAI with casual partners in 2006, 26% of HIV-negative men and 44% of HIV-positive men reported that UAI was only with seroconcordant partners. However, at least a third of HIV-negative men and quarter of HIV-positive men who reported serosorting assumed that their partners were seroconcordant, rather than using explicit HIV disclosure to confirm concordance (Zablotska et al, 2009). The authors called this 'seroguessing' rather than serosorting.

Elford's (2006) review of sexual behaviour among gay and bisexual men concluded that serosorting among HIV-positive men had been identified in London, Montreal, New York, San Francisco and Sydney. The review did not comment on serosorting among HIV-negative men, nor did it discuss limitations in the ways in which serosorting had been measured and inferred in different studies. A review of international research found 11 studies in which HIV-positive men were more likely to have UAI with regular or casual partners who were also HIV-positive than with HIV-negative or unknown status partners (van Kesteren, Hospers & Kok, 2007). The authors concluded that this was evidence of serosorting and harm reduction (to prevent HIV transmission) among HIV-positive men. A more recent review of UAI among HIV-positive MSM in the US confirms that HIV-positive men are more likely to have UAI with other HIV-positive men than HIV-negative or unknown status men, but that few studies have reported the proportion of HIV-positive men who exclusively practise serosorting for UAI (Crepaz et al, 2009).

Other publications suggested that serosorting was engaged in by HIV-negative and HIV-positive men in other places, such as Amsterdam, Atlanta, California, France, New York, Seattle and Switzerland (Balthasar et al, 2010; Golden et al, 2007; Grov et al, 2007; Eaton et al, 2007; Eaton, Kalichman & Cherry, 2010; Halkitis, Moeller & Pollock, 2008; Snowden, Raymond & MacFarland, 2009; Van der Bij et al, 2007; Velter et al, 2009; Xia et al, 2006). The

Atlanta study suggested HIV-negative men who serosorted were more likely to have UAI than other men, believed serosorting reduced the risk of HIV transmission, were less concerned about (or had problems) using condoms, and were more likely to report being insertive for UAI than receptive (suggestive of strategic positioning) (Eaton et al, 2007). Another analysis of data from Atlanta found that white MSM were more likely to practice serosorting and believe in its effectiveness than black MSM (Eaton, Kalichman & Cherry, 2009). A review of behaviour among MSM in San Francisco suggested that the number of men who said they exclusively practised UAI with seroconcordant partners had increased from 19% in 1997 to 27% in 2002 (Osmond et al, 2007). By 2002, exclusive serosorting was a more common strategy than 100% condom use for anal intercourse among men aged 18–29 years old (40% vs. 38%). A later analysis of 2004 data suggested that over a quarter of men in San Francisco were serosorting as their primary HIV prevention strategy (Snowden, Raymond & MacFarland, 2009). The study conducted in Amsterdam suggested that although serosorting for UAI appeared common, rates of nonconcordant UAI were still high, which probably explained rising rather than stable HIV incidence rates in Amsterdam (Van der Bij et al, 2007). French data from 2004–2005 showed that 26% of HIV-negative men and 14% of HIV-positive reported exclusive serosorting for UAI in a 12 month period (Velter et al, 2009). Men who used sex venues were less likely to serosort (regardless of HIV status), while serosorting was more likely among HIV-positive men who sought partners online and HIV-negative men with fewer sex partners. In Switzerland, half the men who reported any risk reduction practice used serosorting as a strategy (Balthasar et al, 2010).

As the debate about serosorting unfolded (see below), some researchers began to assess whether serosorting based on mutual HIV disclosure (actual serosorting) would be effective in preventing HIV infections, given that some HIV-negative people engaging in serosorting are likely to have undiagnosed HIV infection. Butler and Smith (2007) modelled the effects of serosorting based on mutual HIV disclosure in the US, estimating that 4% of people in 'high risk' groups (e.g. MSM) who believed they were HIV-negative actually had undiagnosed, recent HIV infection and that 10% had undiagnosed, chronic HIV infection.

Under these criteria, the risk of acquiring HIV for a HIV-negative person serosorting in a 'high risk' group was 4% higher than if the person had unprotected sex with a known HIV-positive partner (infectiousness was assumed to be lower among known HIV-positive people because of treatment). In contrast, a model of the HIV epidemic among MSM in Seattle suggested that without current levels of serosorting, HIV incidence would be significantly higher, and that, from this perspective, serosorting is 'highly protective' (Cassels et al, 2009).

A more recent model considered the conditions under which serosorting would have positive, protective effects or undermine HIV prevention among men who have sex with men (Wilson et al, 2010). The authors concluded that in countries like Australia with high levels of HIV testing and a high level of treatment uptake among HIV-positive men, serosorting would help prevent HIV transmission as long as the level of undiagnosed infection among men was below 20% and the level of treatment uptake among HIV-positive men was at least 70%. If HIV testing rates dropped or treatment uptake fell, then serosorting would increase the number of HIV infections.

## Effectiveness

A few researchers have attempted to assess the effectiveness of serosorting and other risk reduction practices using empirical data. An analysis of practices engaged in by gay men in Sydney and Melbourne suggests that 21% of men who seroconverted were 'certain' their partner was HIV-negative during the event that led to their HIV seroconversion (Jin et al, 2007). A similar analysis of MSM who seroconverted in Seattle found that 32% of new HIV infections occurred among men who believed they were having UAI with a seroconcordant HIV-negative partner (Golden et al, 2008). The same study found that HIV-negative men who serosorted were 1.7 times more likely to seroconvert than men who only used condoms for anal intercourse. The authors concluded that serosorting offered 'limited protection from HIV'. A more recent analysis of data from the Australian Health in Men cohort study found similar results for the effectiveness of serosorting among HIV-negative men (Jin et al, 2009). Confusingly, the paper included negotiated safety and UAI with concordant regular partners as forms of serosorting, as well as UAI with concordant casual partners.

However, the analysis did assess these practices separately, finding that men who practised UAI exclusively with HIV-negative casual partners were nearly three times as likely to seroconvert as men who reported no UAI, although this result did not reach statistical significance.

## Debate

In general, researchers seem slightly more comfortable with the idea of HIV-positive serosorting, given the certainty of an HIV-positive status compared with HIV-negative status. Positive-positive serosorting has even been actively promoted as a HIV prevention strategy in a US intervention in three states (the Healthy Living Project) (Morin et al, 2008). However, there are acknowledged downsides to serosorting for HIV-positive men, such as 'superinfection' with another strain of HIV, the acquisition of other STIs or the sexual transmission of hepatitis C (Eaton et al, 2009; Hart & Elford, 2010; Van de Laar et al, 2009; Owen, 2008; Poudel et al, 2007; van Kesteren, Hospers & Kok, 2007). It has, in fact been suggested that the increased frequency of positive-positive serosorting has contributed substantially to increases in STI notifications among MSM in Western Europe (Dougan, Evans & Elford, 2007) and increased sexual transmission of hepatitis C (Van de Laar et al, 2009).

Discussion of HIV-negative MSM and serosorting was initially avoided by some researchers, such as Elford (2006) in his review of MSM and sexual behaviour. This seemed to imply that only HIV-positive MSM can or should serosort. This position evolved to one which acknowledges that HIV-positive serosorting does effectively prevent HIV transmission while HIV-negative serosorting offers 'limited protection' against HIV (Hart & Elford, 2010). Others who have described HIV-negative serosorting are similarly concerned about its effectiveness, given the likelihood that some men who believe they are HIV-negative will have acute and undiagnosed HIV infection (Mao et al, 2006; Marcus, Voss, Kollan & Hamouda 2006; Pinkerton, 2008). The need for HIV-negative men who engage in serosorting to reconfirm their HIV status by testing at regular intervals has become a particular concern. A study in Atlanta, for example, found that HIV-negative men who serosorted didn't test for HIV any more frequently than other men, and did not believe they were putting themselves at any more risk than other

men (Eaton et al, 2007). A subsequent review went further, saying 'it is nearly impossible for persons who engage in high risk behaviors to ever be certain of their HIV status in part because they do not test often enough' (Eaton et al, 2009).

While many authors agree that serosorting is highly reliant on accurate knowledge of HIV status, there is less consensus about whether explicit HIV disclosure between partners is necessary, or whether men can rely on implicit assumptions of HIV status, internet profiles or some other means of ascertaining HIV status (Elford, 2006; Mao et al, 2006; Sheon & Crosby, 2004; Truong et al, 2006). Parsons et al (2006), for example, argue that serosorting is (or should be) 'based on discussion and truthful disclosure of serostatus' but that this is far less common than researchers had initially assumed. They found that when HIV-positive MSM reported UAI with unknown status partners, in 55% of occasions they assumed that those partners were HIV-positive. In the absence of discussion, HIV-positive MSM relied on cues such as physical appearance, behaviour, context and normative assumptions about gay men to guess the HIV status of their partners (Parsons et al, 2006). Sheon and Crosby (2004) suggest that, in San Francisco in particular, encouraging HIV disclosure among gay men is unlikely to succeed, given that men appear to resent discussions of HIV intruding in anonymous or public sex environments. This suggests that what Parsons et al (2006) call perceived serosorting (where concordance is assumed rather than confirmed) is more common than actual serosorting (where concordance is known), and that perceived and actual serosorting are often conflated in behavioural data, inflating estimates of the frequency of serosorting.

Other researchers acknowledge the limitations of inferring intentional, planned serosorting (where men set out to find partners of the same HIV status for UAI) from behavioural data, particularly when men were not asked about their intentions in selecting partners (e.g. Eaton et al, 2009; Mao et al, 2006; Truong et al, 2006). This is important because the use of the term serosorting implies a planned risk reduction strategy among gay men and other MSM, but it has not been convincingly demonstrated that men are actively selecting sex partners because of their HIV status or for UAI. It is also not clear whether it is usual for explicit and mutual HIV disclosure to occur between men who are classified

as serosorting. Studies from 2007 onwards did try to assess some level of intentionality, although this improved but did not necessarily solve some of the definitional problems. A study in Atlanta, for example, classified HIV-negative men as 'serosorters' if they answered in the affirmative to the statement 'I will only have anal sex without a condom with a man who has the same HIV status as I do' (Eaton et al, 2007). However, this study did not then ascertain whether men followed through on the intention to serosort (or not), and did not ask men about the HIV status of their partners for UAI. Other studies have been more rigorous in defining 'exclusive' serosorting (UAI only with seroconcordant partners), such as a review of behaviour in San Francisco (Osmond et al, 2007).

## Variations in terminology

Suarez and Miller's (2001) early use of the term serosorting limited it to HIV disclosure/discussion and then UAI only with partners of the same HIV status. Truong and colleagues (2006) widened the definition of serosorting to 'selective unprotected sex with partners of the same HIV status' (not specifying whether HIV disclosure or discussion had occurred). Elford (2006) limited serosorting to HIV-positive men, describing it as HIV-positive men choosing to only engage in UAI with casual partners who are also HIV-positive. Others have used serosorting to refer to a preference for seroconcordant partners, regardless of the type of sex engaged in (Cassels et al, 2009; Halkitis, Moeller & Pollock, 2008). Snowden, Raymond & MacFarland (2009) called the practice of having exclusively concordant partners for protected and unprotected anal intercourse 'pure serosorting'. They called the original definition of serosorting (selecting partners of the same HIV status specifically for UAI) 'condom serosorting' and found that pure serosorting was more common than condom serosorting in San Francisco.

Parsons et al (2006) suggested that researchers distinguish between actual serosorting (where the HIV status of both partners is known) and perceived serosorting (where concordance is assumed). Zablotska et al (2009) called perceived serosorting 'seroguessing'.

Some researchers (particularly US researchers) have used serosorting to describe seroconcordant unprotected anal intercourse with both regular and casual partners (Eaton et al, 2009;

Ostrow et al, 2008; Xia et al, 2006). This appears to confuse serosorting with negotiated safety. Appearing to concede that serosorting has become a general term used to describe practices with both casual and regular partners, a recent Australian paper assessing the effectiveness of risk reduction strategies described negotiated safety as a 'form of serosorting with regular partners' (Jin et al, 2009).

An infrequently used alternative term to serosorting acknowledged in some publications is 'assortive mating', where assortive refers to sorting on the basis of a category (in this case, HIV status) (Ostrow et al, 2008).

### Viral load

The introduction of ARV therapy led to significant interest in, and speculation on, its effect on sexual risk behaviour, and in particular whether advances in treatment would influence perceptions about the severity of HIV and the need to maintain safer sex practices (Kelly et al, 1998). ARV therapy has offered people living with HIV (PLHIV) greatly improved health and in many cases resulted in PLHIV achieving a low or undetectable viral load (a measure of the number of viral copies in a given volume of body fluid, usually blood plasma).

The majority of published research has investigated the relationship between perceptions of HIV risk, treatment optimism, safe sex fatigue and risk behaviours (Kelly et al, 1998). There has been little research on the extent to which viral load has explicitly been used as a HIV risk reduction strategy. Further, there have been reservations on the part of clinicians, researchers and educators about the effectiveness of undetectable viral load as a risk reduction strategy, given uncertainty about whether undetectable viral load in the blood is also undetectable in semen, the variability of viral load, and the possibility of drug resistant strains of HIV resulting from more frequent UAI (Kalichman et al, 2002; Vanable et al, 2003; Van de Ven et al, 2005).

### Use of viral load as a risk reduction strategy

Currently the research literature on MSM provides limited evidence of the use of viral load as an explicit HIV risk reduction strategy. A number of studies have found a relationship



between reduced concern about HIV due to improved treatments and beliefs that an undetectable viral load makes a person less infectious, but no association between viral load status and risk behaviour (Kalichman et al, 2002, 2007; Kelly et al, 1998; Ostrow et al, 2008; Vanable et al, 2003). Contrary to their initial hypothesis, Vanable et al (2003) found that HIV-positive gay men who reported having an undetectable viral load were less rather than more likely to report unprotected anal sex, compared with men with a detectable or unknown viral load. A small number of these men believed that having an undetectable viral load made them less infectious, but such beliefs were not reflected in their sexual practice (Vanable et al, 2003). Crepez et al (2004) undertook a meta-analysis of 25 English language studies to determine whether: i) being treated with ARVs; ii) having an undetectable viral load; or iii) holding beliefs about ARVs and viral load were associated with an increased likelihood of engaging in unprotected sex. The review was framed in terms of risk-taking, rather than in terms of viral load as a risk reduction strategy. All studies were conducted between 1996 and 2001, and 16 were conducted in the United States. More than half the studies were conducted with MSM or included a majority of MSM in the sample. The analysis found that the prevalence of unprotected sex

was not significantly higher among HIV-positive people receiving ARV therapy or those with an undetectable viral load. However, the likelihood of unprotected sex was associated with people's beliefs about viral load and ARV therapy. Regardless of serostatus, people who agreed that being on ARVs or having an undetectable viral load protects against HIV transmission or that the availability of ARV therapy reduces concerns about having unsafe sex were more likely to report unprotected sex (Crepez et al, 2004). The authors noted that studies that explored the association between beliefs and behaviour were correlational in nature and therefore unable to specify a causal relationship. However, they proposed that while it is reasonable to assume beliefs are antecedents of behaviour it is also possible that beliefs originate from or are intensified in response to behaviour (Crepez et al, 2004).

Jonathan Elford (2006) conducted a review of the literature to describe the changing patterns of sexual behaviour among gay/bisexual men in Europe, Canada, Australia and the USA in the era after the introduction of ARV therapy. A number of studies found that people who are on treatment were no more likely to engage in unprotected sex than those not taking ARVs. Nor were HIV-positive men with undetectable viral loads more likely to



engage in UAI. The review found little evidence to support the proposition that having an undetectable viral load leads to sexual risk-taking among HIV-positive men. The review did find that the likelihood of UAI was higher among gay men who believed that ARV therapy reduced HIV transmission or were less concerned about HIV given the availability of ARVs. The studies were all cross-sectional and therefore causality could not be established. Elford (2006) suggested that beliefs about ARV therapy may trigger high risk behaviour or they may be used as a 'post-hoc justification' for unsafe sex. Overall, he found that the evidence at the time did not support the suggestion that taking ARVs or having an undetectable viral load led to risky sexual behaviour among people with HIV.

### Beliefs about ARV therapy and clinical markers

Kalichman et al (2007) examined changes in HIV treatment beliefs and sexual risk behaviours among gay and bisexual men, during the period 1997–2005. The authors note that 'co-occurring' with the availability of ARVs have been increases in high risk behaviours such as UAI, sexually transmissible infections and continued HIV infections in gay communities. In 1997 they conducted a survey of gay and bisexual men attending a gay pride festival in Atlanta, Georgia. The study found HIV-negative men who were not in an exclusive sexual relationship and who engaged in unprotected receptive

anal intercourse were significantly more likely to believe that HIV treatments could prevent HIV transmission than were men who did not engage in receptive UAI. Consistent with other studies they found that men who engaged in UAI perceived the risk of HIV transmission with an HIV-positive partner who was on treatment to be lower than with an untreated man and even lower still if the positive partner had an undetectable viral load. They proposed that these beliefs seemed to reduce the motivation to practise safe sex (Kalichman et al, 2007). However, a recent review by Hart et al (2010) found little evidence of undetectable viral load being intentionally used as risk reduction strategy by gay men.

Qualitative research exploring aspects of risk management practices among HIV-positive gay men in relation to HIV treatment and sexual practice in the UK found that men were divided in their views of the meaning of undetectable viral load (Davis et al, 2002). Men often believed they were less infectious but that transmission was still possible. Knowledge of viral load was used by some men to reduce anxiety about unprotected sex, but other men were opposed to using knowledge of viral load to justify unprotected sex. Gay men in this study expressed a degree of frustration with the lack of (or conflicting) advice offered by the clinicians about viral load, transmission risk and re-infection which they felt left them without adequate advice on how to manage sexual

decisions, particularly with other HIV-positive partners (Davis, et al, 2002).

An Australian qualitative study of gay men's sexual practices and understanding of clinical markers suggested undetectable viral load provided some gay men in serodiscordant couples with a sense of confidence that HIV transmission was reduced and that they could therefore engage in UAI (Rosengarten et al, 2000). Van de Ven et al (2005) investigated whether an HIV-positive partner's viral load was associated with UAI in HIV serodiscordant couples. The participants were 74 HIV-positive and 45 HIV-negative men in HIV serodiscordant regular relationships of at least six months duration. The study found that the majority of serodiscordant couples did not engage in any UAI, but when UAI did occur, it was significantly more likely that the HIV-positive partner had an undetectable viral load (Van de Ven et al, 2005). Prestage et al (2009) also examined the relationship between viral load and UAI between HIV serodiscordant regular partners. Among the HIV-negative partners, serodiscordant UAI was more likely when the men believed their partner had an undetectable viral load, but the same was not true of HIV-positive respondents—HIV-positive men with a detectable viral load were just as likely to report UAI with their serodiscordant partners as HIV-positive men with an undetectable viral load. This indicates that HIV-positive and HIV-negative partners may have very different understandings

of the role of viral load in decisions about whether to use condoms or not for anal intercourse. Prestage et al (2009) argue that regardless of the clinical evidence for and against viral load to minimise risk of HIV transmission, consideration needs to be given to the complexities of implementation of the strategy.

### The 'Swiss Statement'

Undetectable viral load has been used by serodiscordant heterosexual couples as a means to reduce the risk of HIV transmission while trying to get pregnant. In 2008 the Swiss National AIDS Commission released a consensus statement which asserts the view that a person with an undetectable viral load is non-infectious for HIV. The Swiss consensus statement proposes that a person receiving ARV therapy with an undetectable viral load and without other genital infections cannot infect a sexual partner with HIV (Vernazza et al, 2008; Wilson et al, 2008). Researchers in other jurisdictions have been less enthusiastic about the promotion of undetectable viral load as a risk reduction strategy (Wilson et al, 2008). Wilson et al (2008) argue that the Swiss consensus statement is not a 'sensible' public health message as it will lead to a reduction in condom use by people with effectively treated HIV infection. This has the potential to increase HIV infections over time, if people with HIV infection increase their partner numbers and make incorrect assumptions about their viral load (Wilson et al, 2008). There is currently a lack of evidence about whether the strategy would be effective among MSM for anal intercourse. To better understand the feasibility, effectiveness and conditions under which undetectable viral load might be used as risk reduction strategy among MSM research studies will need to assess the use of viral load among gay serodiscordant couples.

A recent mathematic model based on MSM in the Netherlands concluded that the risk of transmission between serodiscordant regular partners is significantly reduced if UAI is restricted to only the period straight after an undetectable viral load test result. If condoms are never used the risk of transmission was estimated at 22%, but if UAI occurred only in the six months after an undetectable viral load test result the risk was reduced to 3% and even lower if UAI occurred only in the three months after an undetectable result (Hallett et al, in press).

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