



UvA-DARE (Digital Academic Repository)

Casual sex, risk and context

HIV risk-reduction strategies among men who have sex with men

van den Boom, W.

Publication date

2018

Document Version

Final published version

License

Other

[Link to publication](#)

Citation for published version (APA):

van den Boom, W. (2018). *Casual sex, risk and context: HIV risk-reduction strategies among men who have sex with men*. [Thesis, fully internal, Universiteit van Amsterdam].

General rights

It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations

If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: <https://uba.uva.nl/en/contact>, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.

HIV risk-reduction strategies among men who have sex with men

Casual sex, risk and context

Wijnand van den Boom



CASUAL SEX, RISK AND CONTEXT

HIV risk-reduction strategies among men who have sex with men

Wijnand van den Boom

Casual sex, risk and context. HIV risk-reduction strategies among men who have sex with men

<http://dare.uva.nl/dissertaties>

ISBN: 978-94-6361-082-7

The research in this thesis was funded by the Aidsfonds, the Netherlands, project number 2008025.

The printing of this thesis was financially supported by: Virology Education, Condomerie, GGD Amsterdam and Academic Medical Center/University of Amsterdam

Layout and print: Optima Grafische Communicatie, Rotterdam, The Netherlands (www.ogc.nl)
Cover photo by Paul Bogowicz

© 2018 Wijnand van den Boom, Amsterdam, the Netherlands

All rights reserved. No part of this publication may be reproduced, stored or transmitted in any way without permission from the author. Published papers were reprinted with permission from the publisher.

Casual sex, risk and context
HIV risk-reduction strategies among men who have sex with men

ACADEMISCH PROEFSCHRIFT

ter verkrijging van de graad van doctor

aan de Universiteit van Amsterdam

op gezag van de Rector Magnificus

prof. dr. ir. K.I.J. Maex

ten overstaan van een door het College voor Promoties ingestelde commissie,

in het openbaar te verdedigen in de Aula der Universiteit

op woensdag 9 mei 2018, te 13.00 uur

door Wijnand van den Boom

geboren te Leidschendam

Promotiecommissie

Promotores	Prof. dr. M. Prins	AMC-UvA
	Prof. dr. T.G.M. Sandfort	Columbia University in the City of New York

Copromotores	Dr. E. Davidovich	GGD Amsterdam
	Dr. I.G. Stolte	GGD Amsterdam

Overige leden	Prof. dr. S.E. Geerlings	AMC-UvA
	Prof. dr. F.G.J. Cobelens	AMC-UvA
	Prof. dr. J.E.A.M. van Bergen	AMC-UvA
	Prof. dr. J.B.F. de Wit	Universiteit Utrecht
	Prof. dr. G.J. Kok	Universiteit Maastricht
	Dr. B.H.B. van Benthem	RIVM, Bilthoven

Faculteit der Geneeskunde

I want to defy
The logic of all sex laws
Let the handcuffs slip off your wrists
I'll let you be my chaperon
At the halfway home
I'm a full grown man
But I'm not afraid to cry

Sexx Laws, by Bek David Campbell (Beck)

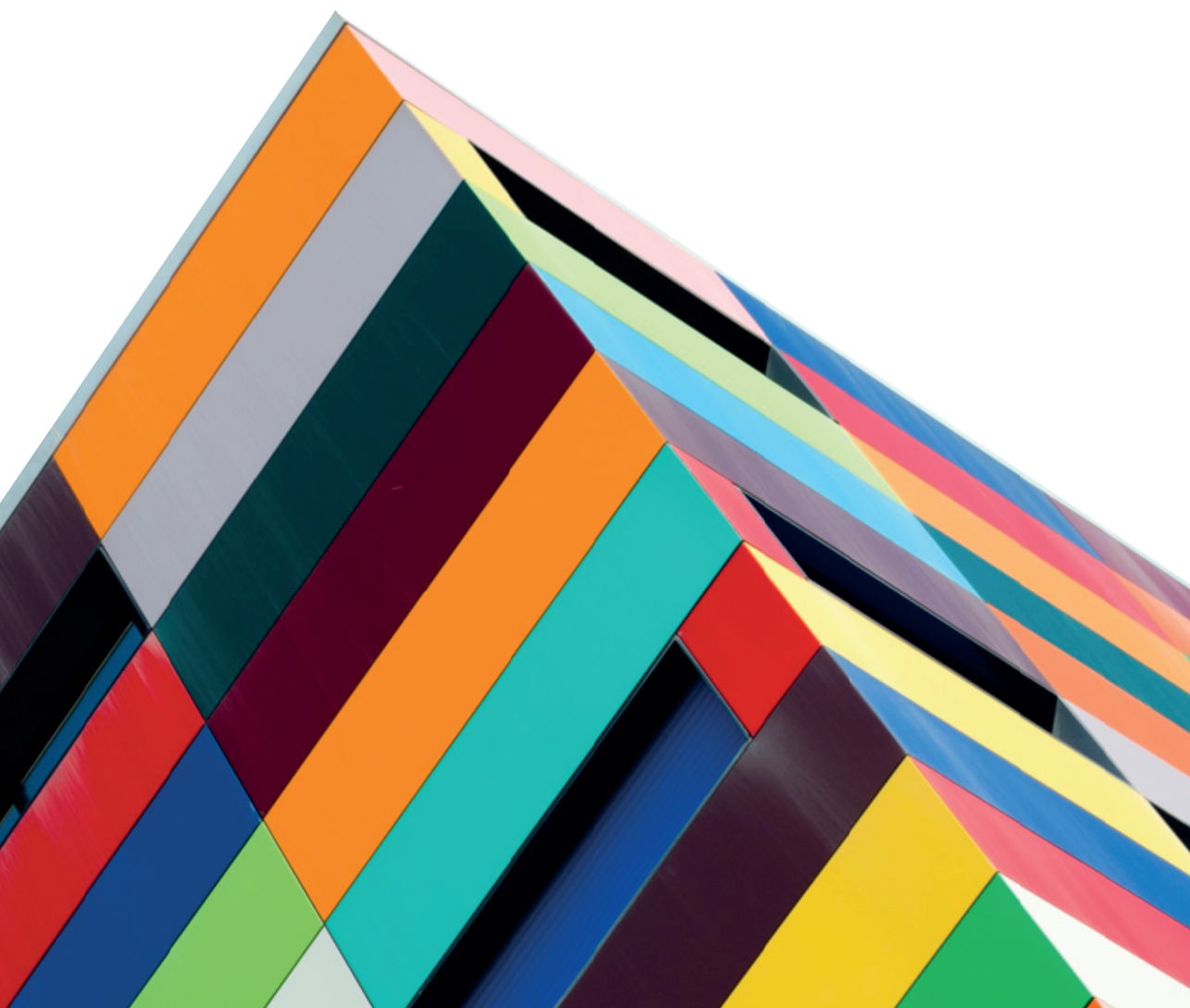
TABLE OF CONTENTS

Chapter 1	General introduction	9
Chapter 2	Non-condom based HIV risk-reduction strategies	29
2.1	Is serosorting effective in reducing the risk of HIV infection among men who have sex with men with casual sex partners?	31
2.2	Undetectable viral load and the decision to engage in unprotected anal intercourse among HIV-positive MSM	45
Chapter 3	Risk settings & sexual behavior	59
3.1	Serosorting and sexual risk behavior according to different casual partnership types among MSM: The study of one-night stands and sex buddies	61
3.2	Is group sex a higher-risk setting for HIV and other sexually transmitted infections compared with dyadic sex among men who have sex with men?	73
3.3	Is anyone around me using condoms? Site-specific condom-use norms and their potential impact on condomless sex across various gay venues and websites in the Netherlands	89
Chapter 4	The power of principles: the long-term effect of strong personal norms on condom use among men who have sex with men	105
Chapter 5	General discussion	117
Appendices	Summary	143
	Nederlandse samenvatting	149
	About the author	153
	List of publications	155
	List of contributing authors (this thesis)	157
	Contributions of the authors per chapter	159
	Portfolio	161



Chapter 1

General introduction



1.1 BACKGROUND

In 1981, AIDS (acquired immune deficiency syndrome) was first diagnosed [1,2], whereas the human immunodeficiency virus (HIV) causing AIDS was identified two years later [3,4]. Since effective treatment became generally available in 1996, HIV changed from a death sentence to a manageable and treatable chronic disease.

1.1.1 The HIV epidemic in 2016

In 2016, the estimated total number of people living with HIV was approximately 36.7 million and thus far the disease has claimed more than 35 million lives globally [5]. Approximately 1.8 million HIV infections were newly diagnosed, with the highest estimate in Sub-Saharan Africa (1.2 million) [5]. In the Netherlands, 22,900 individuals were estimated to be living with HIV, of whom 2,600 were estimated to be undiagnosed [6]. Although the all-cause mortality rate significantly declined over time from 17.9 cases per 1000 person-years in 1996 to 9.8 cases per 1000 person-years in 2016, it is still approximately 2.5 times higher than in the general Dutch population [6].

1.1.2 HIV in MSM

Men who have sex with men (MSM) have continuously been at elevated risk of HIV infection in countries of all income levels [7]. In the Netherlands, the majority (67%) of all new HIV diagnoses in 2016 were found in this population [6]. The disproportionate burden of HIV among MSM could partly be explained by the high per-act transmission probability of the anal sex route [8] in contrast to that of the vaginal route [9]. The good news is that in recent years, the number of newly diagnosed infections in MSM decreased in the Netherlands from 866 in 2008 to 545 (estimated) in 2016 [6] (see figure 1). However, new diagnoses might not reflect the actual incidence of HIV as the number of new diagnoses greatly depends on the frequency of (new) HIV testing uptakes [10].

In the Amsterdam Cohort Studies on HIV (ACS; see box 1) among MSM, the incidence moderately increased from 1.4 cases per 100 person-years in 1996 to 2.0 cases per 100 person-years in 2009 [11]. In recent years (2010-2016), the incidence has been in the range of 0.3 and 1.9 per 100 person-years [6] (see figure 2).

1.1.3 Brief historical overview of the HIV epidemic among MSM

Because first reports of AIDS were found among MSM [1,2] in 1982, the disease was denoted as gay-related immune deficiency (GRID) [12]. However, when in that same year similar disease symptoms were found in other groups, such as people who inject drugs (PWID) and recipients of blood products [13], GRID was renamed by the American Centers of Disease Control (CDC) as AIDS [14]. Soon after HIV was identified in 1983, HIV serological tests became available and the first cohort studies were initiated to monitor and understand the natural history of HIV and its spread within the gay community [15]. In the Netherlands, the ACS among MSM were initiated.

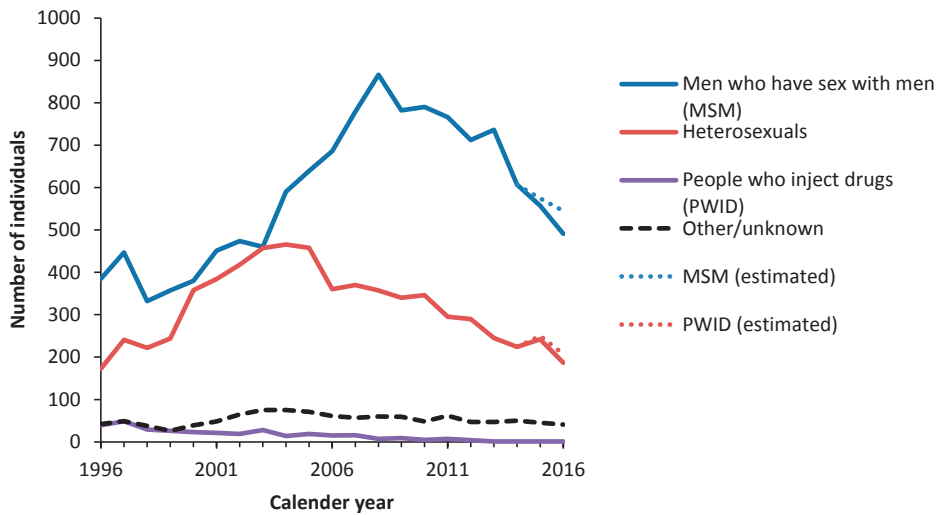


Figure 1. Annual number of new HIV-1 diagnoses in the Netherlands among adults, according to most likely mode of transmission. Reproduced with permission from SHM Monitoring Foundation (Stichting HIV Monitoring). Source: [6].

Box 1. The Amsterdam Cohort Studies (ACS) on HIV

Shortly after the first diagnosis of AIDS, researchers came to the conclusion, based on stored blood samples, that high numbers of MSM were already infected with HIV [16]. To try to understand the growing HIV epidemic in the Netherlands, the Amsterdam Cohort Studies (ACS) on HIV were initiated in 1984 as an open prospective cohort study [17]. The initial goals of the ACS were to investigate the epidemiology, psychosocial determinants, pathogenesis of HIV infection, and the effects of interventions among HIV-negative and HIV-positive MSM [11,18], and people who inject drugs [19]. At baseline (1984-1985), the HIV prevalence among MSM in the ACS was 31% [18]. Thirty three years to date, the ACS among MSM is still ongoing, with 630 HIV-negative men in active follow-up at the Public Health Service of Amsterdam (GGD Amsterdam) in 2016 [6]. As of December 2016, a total of 2,736 men have participated, of whom 607 were HIV-positive at the time they enrolled and 251 got infected during follow-up [6].

Men are eligible to participate in the cohort if they are living in or around Amsterdam and have had at least one male sexual partner in the preceding 6 months [11,20]. Men are recruited into the ACS by use of sampling in STI clinics, by advertising at specific gay locations, and by word-of-mouth [11]. Participants visit the GGD Amsterdam every six months to fill in a self-administered questionnaire. This questionnaire includes questions about sexual behaviors and their psychosocial determinants, knowledge about new interventions, and risk perceptions. At every visit, participants are asked to give blood, which is continuously stored at the Academic Medical Center (AMC), and which is used for HIV and STI testing, virological, and immunological studies [11,21]. Also rectal and pharyngeal swabs are collected as well as urine samples, to test for STI. This puts the ACS in a unique position to longitudinally investigate biomedical and clinical aspects as well and link them to behavior, as done in this thesis [20]. For most of the research presented in this thesis we used data that was collected as part of the ACS (chapter 2.1, 3.1, 3.2, and 4).

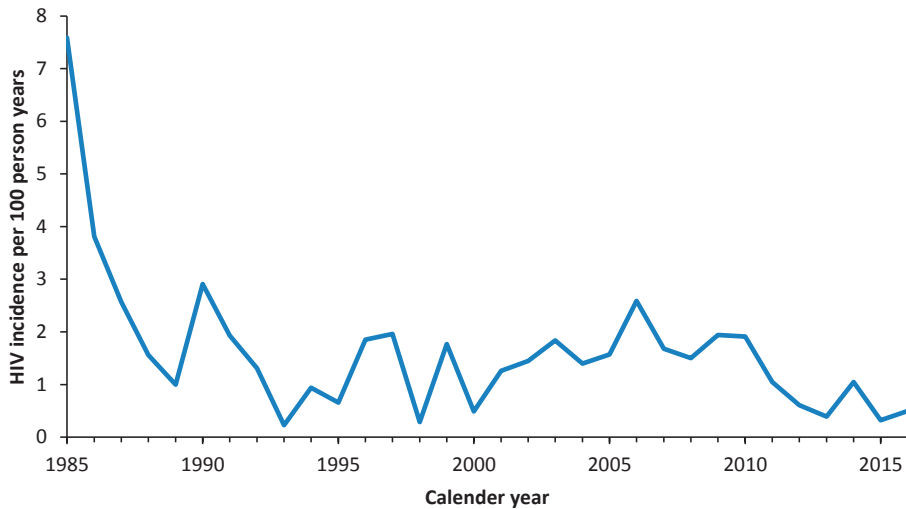


Figure 2. HIV incidence per calendar year in the Amsterdam Cohort Studies (ACS) among men who have sex with men, 1985-2016. Reproduced with permission from SHM Monitoring Foundation (Stichting HIV Monitoring). Source: [6].

1.1.4 The history of HIV prevention in the Netherlands

In the Netherlands, the first case of AIDS was diagnosed in May 1982 [22] and it soon became apparent that preventive measures were urgently needed for gay men. A first preventive campaign soon followed in 1983, on 'Roze Zaterdag' (Pink Saturday). Flyers containing information about AIDS symptoms and advice regarding anal sex were handed out to the public. In a 1984 flyer named 'AIDS- De situatie nu' (AIDS- The current situation), men were specifically advised not to have less sex, but to have sex with fewer partners and not with partners they did not know well [23].

Several (Dutch) studies made clear that among MSM, anal intercourse was the major route of HIV transmission [18,24]. Dutch health authorities and gay organizations that shaped HIV prevention messages believed, however, that in contrast to gay men in the US, Dutch gay men were less interested in anal sex [25]. It was also believed that there would be a strong aversion to condoms in the gay scene, because they were seen as a symbol of heterosexual sex. Furthermore, condoms did not seem to be suitable for the practice of anal sex because of a high failure rate [26,27]. For these reasons, avoiding anal sex was initially the primary prevention message for gay men.

Policy makers at the time, however, were convinced that anal sex could not be banned completely from the gay community and that if gay men wanted to use condoms they *should* talk about it with their partner [28]. In the course of 1984 these considerations eventually led to the 'double message': men should abstain from anal sex, but if they do practice anal sex, they

should use condoms [23]. In the words of Jan van Wijngaarden, National AIDS Coordinator and one of the most prominent people in HIV prevention at the time, the philosophy was “to aim for a behavioral intervention with a focus on the most risky behavior, namely anal sex, and try to achieve a change in that particular area while leaving the rest [of the sexual behaviors] alone” [23].

Authorities felt that this simple message was the only logical option to prevent HIV transmission among gay men. This policy was also supported by the National Commission against AIDS [29,30]: “stimulating condom use would have inevitably led to the continuation of anal sex or would have encouraged those who initially did not engage in anal sex, to eventually do so”. Also, it was pointed out that the double message perfectly matched that of the gay movement, which was trying to gain the acceptance and respect of the general population by emphasizing that anal sex did not play a major role in the lives of gay men [31].

While the importance of condoms was played down in prevention messages, several gay nightclubs and bars were provided with condom vending machines. Special condoms for anal sex came onto the market to increase the effectiveness of condoms for gay men [23]. Initial studies showed that these special gay condoms had a lower failure rate than conventional ones [32]. But despite these developments, the double message continued to be the primary focus of the Dutch HIV prevention for gay men in the period 1987-1991.

In apparent contradiction, while the double message was applied to gay men, the first 1987 mass-media campaign ‘De bloemetjes en de bijtjes’ (The birds and the bees), directed at the general heterosexual population, encouraged condom use to prevent HIV transmission. The campaign proved to be successful but also encountered resistance from several HIV-prevention professionals at the time for being “vacuous” and “fussy” [23]. However, the campaign also played an important additional role: it helped with the ‘de-homosexualization’ and de-stigmatization of AIDS. In targeting the general population, health authorities signaled that AIDS is everyone’s problem and not only that of specific risk groups [23,27].

All in all, the first-generation prevention messages seemed successful as several Dutch studies demonstrated that in the following years gay men were more likely not to have any anal sex [33], decreased their number of anal sex partners [17], and increased their use of condoms [33,34]. The decrease of risk-taking behaviors was accompanied by a decrease in the estimated annual HIV incidence [17,21]. Also, condom-failure rates decreased [35]. These findings suggested that previously reported failure (e.g., [32]) was in part due to lack of experience or skills in using condoms and not only because condoms were unsuitable for gay men. As of 1992, based on an evaluation of the prevention message [31], the double message was reversed, resulting in ‘Use a condom, or do not fuck’ [36].

However, over the following years, the dynamics of sexual risk behavior did not remain the same. By the late eighties and early nineties, it became clear that HIV prevention messages were beginning to lose their behavioral influence: condomless anal sex (CAS) increased [37] and after several years of decline, there were reports of increased STI incidence in the Netherlands [38], as well as increased HIV incidence in the United States [39]. By the mid-90s, some men had adopted alternative HIV risk-reduction strategies other than condom use. Examples of such early non-condom based strategies are ‘seropositioning’ (i.e., the situation in which the HIV-negative partner only takes the insertive role and the positive partner the receptive role) [40], ‘serosorting’ (i.e., engaging in CAS only with HIV-seroconcordant sex partners) [41], and serosorting that specifically takes place in the context of steady relationships, coined ‘negotiated safety’ [42]. Negotiated safety refers to the situation in which both steady partners have tested negative for HIV and agreed to be monogamous or to only practice safer sex outside the relationship, and inform each other if one of these conditions is violated [42,43]. Research from the ACS showed that CAS between steady partners, practiced in full compliance with the conditions of negotiated safety, might be considered low-risk behavior for HIV transmission [44]. However, non-adherence to the negotiated safety agreements without disclosing this to the partner was also reported [45]. According to psychosocial and epidemiological studies on risk behavior among MSM with steady partners, the high prevalence of negotiated safety agreements made it necessary to correct the assessments of behavioral risk for negotiated safety [44]. These findings are what first made the fields of research and HIV prevention aware of the distinction between lower-risk CAS and higher-risk CAS.

1.1.5 The availability of cART and the changing Dutch HIV-testing policy

In 1996, combination anti-retroviral therapy (cART) became generally available and resulted in a major reduction in AIDS-related deaths, increasing the life expectancy and quality of life of those infected with HIV [46]. However, in the following years, sexual risk behavior and the incidence of HIV and other STI increased among both HIV-positive and HIV-negative MSM [47-49]. Increases in sexual risk behavior have been linked to a lower HIV/AIDS threat due to the availability of cART [50] and this reduced HIV concern was found to be predictive of subsequent risk behavior [51].

The availability of cART gradually resulted in a change in the Dutch HIV testing policy. Before 1996, in contrast to other countries (e.g., the United States), the Dutch preferred to concentrate on promoting safer sex rather than encouraging testing for HIV because no effective treatment existed [29]. Therefore, testing was only performed on those who specifically asked for it or had a medical indication. Since 1996, the revised policy recommended testing specific groups at risk of HIV transmission (e.g., MSM) [52]. It took until 2001 for several Dutch gay-health organizations, like the Schorer Stichting and the Aidsfonds, to actively encourage MSM to test for HIV. In 2003, the Schorer Stichting launched the nationwide campaign ‘Steeds meer mannen weten het’ (More and more men know) [28]. Following this, first in 2004 in Limburg followed by Amsterdam in 2007 (and nationwide in 2010), an opt-out strategy was adopted

for HIV: At STI clinics all clients were tested for HIV unless they actively indicated they did not wish to do so [52]. Consequently, the uptake of HIV testing further increased among MSM and heterosexuals [52,53], and the number of MSM with an early HIV diagnosis (with a negative HIV test in the 6 months preceding diagnosis) entering HIV care per year increased from 18% in 2010 to 36% in 2016 [6]. Increased testing uptake also reduced the proportion of undiagnosed HIV-positive individuals. In 2016, this proportion was estimated to be around 10% of the total number of MSM living with HIV in the Netherlands [6].

1.1.6 The Swiss statement and the rise of biomedical risk-reduction strategies

Parallel to the development of successful HIV treatment, attention grew for the link between undetectable viral load and reduction of infectiousness. In 2008, this link entered public awareness with a statement by the Swiss National AIDS Commission. This statement officially acknowledged a public health stance that sexual transmission of HIV is very unlikely in a monogamous HIV-serodiscordant relationship if the HIV-infected person has an undetectable viral load (less than 40 copies/ml) that is suppressed by effective treatment for at least 6 months, tests regularly for viral load, and has no other STI [54]. Studies among heterosexuals (i.e., vaginal transmission route) supported the statement and therefore the overall message was also directed towards that segment of the population [55-57].

The statement helped inspire the idea of ‘treatment as prevention’ (TasP): as HIV treatment reduces the plasma viral load in the infected person, it can prevent the transmission of HIV to others. MSM were early adopters of TasP as an HIV risk-reduction strategy. Several studies have described the use of information on HIV viral load and HIV treatment in the individual’s decision to not use condoms among MSM (e.g., [58]). A recent epidemiological study among HIV-serodiscordant MSM couples, in which the HIV-positive partner had a suppressed viral load, only condomless sex was reported, and in which partners were not monogamous nor STI free, provided more evidence regarding the protective effect of undetectable viral load on transmission via the anal route [59].

In recent years yet another biomedical prevention option emerged: HIV pre-exposure prophylaxis (PrEP). PrEP is an antiretroviral drug that one takes to prevent HIV infection, hence preventing further HIV transmission to others. PrEP was shown to be effective in reducing the risk of HIV transmission (e.g., [60]). PrEP was not initially found to be associated with compensating risk behavior [61], but current results regarding rates of acquired STI other than HIV during PrEP use are rather mixed [62-64]. Importantly, the terminology of sexual risk among risk groups such as MSM in prevention work and research papers changed based on the findings on the effectiveness of biomedical prevention strategies (box 2).

Box 2. 'UAI' and 'condomless anal sex': changing the terminology of sexual risk

In 2013, a coalition of advocates led by the HIV Prevention Justice Alliance (community of people living with HIV, activists, advocates, researchers, providers, and policy-makers) sent an open letter [65] to the CDC, United States, in reaction to the 2013 MMWR Report on HIV testing and risk of US gay, bisexual, and other MSM [66]. The alliance advocated reevaluating the language in future CDC reports. They claimed that the CDC had so far not adjusted their language on risk and had missed the opportunity to accurately describe HIV risk behavior in the current and evolving HIV prevention landscape. For example, with the successes of TasP (e.g., [59]) and pre-exposure prophylaxis (PrEP) (e.g., [62]), the alliance argued that clearer language should be used: instead of 'unprotected sex' the CDC should use 'sex without condoms' to also reflect acts of condomless sex that are not risky of HIV transmission [65]. To meet these standards, we used 'condomless anal sex' (CAS) instead of 'unprotected anal intercourse' (UAI) in our papers published after 2014.

Although approved in the United States by the food and drug administration (FDA), and recently in Europe as well [67], PrEP has not yet been included in the Dutch health insurance structures. At this time, the way to obtain PrEP free of charge in the Netherlands is through studies, including participation in a demonstration project in Amsterdam. This ongoing Amsterdam PrEP project (AMPrEP) was initiated by the Public Health Service of Amsterdam in 2015 and is part of the H-TEAM ('Hiv-Transmissie Eliminatie Amsterdam'; an Amsterdam HIV elimination initiative). The AMPrEP project studies PrEP implementation among MSM and transgender people and its results will inform future Dutch PrEP implementation strategies [68].

1.2 THIS THESIS

The general aim of this thesis is to provide insights into the contextual and cognitive factors that affect sexual-risk behaviors and adopted prevention strategies among MSM with casual partners in the Netherlands using (longitudinal) psychosocial and epidemiological data. Over the course of the 35-year HIV epidemic, this diversity has been expressed, in part, in the themes that this thesis deals with.

1.2.1 Non-condom based HIV risk-reduction strategies (chapter 2)

In chapters 2.1 and 2.2, we will examine risk-reduction strategies other than condom use and their perceived and actual protection against HIV transmission with casual partners.

1.2.1.1 Serosorting and HIV infection (chapter 2.1)

In chapter 2.1 we investigate the implementation by MSM of one of the most practiced HIV risk-reduction strategies other than condom use, namely serosorting, with casual partners. As described previously, non-condom based HIV risk-reduction strategies have grown in popularity over the years among MSM (e.g., [69]). However, although questions have been raised about the true effectiveness of non-condom based risk-reduction strategies with casual partners [70], previous research has insufficiently considered their efficacy, especially in the context of the social and relational settings in which they take place [71].

In chapter 2.1 we look at the efficacy of serosorting as an HIV risk-reduction strategy by examining whether it is associated with decreased incidence of HIV infections. The ACS enabled us to answer this question by performing a longitudinal analysis with HIV seroconversion as outcome. In addition, as previous studies merely investigated serosorting as the ad-hoc establishment of matching HIV status without considering men's intentions (e.g. [72]), we were interested in how often men intentionally performed this strategy, and whether it provided sufficient protection against HIV infection.

1.2.1.2 Consideration of viral load (chapter 2.2)

As discussed in 1.1.6, the use of knowledge of undetectable viral load has emerged as an additional HIV risk-reduction strategy among MSM. The effectiveness of TasP on a population level has been studied widely (e.g., [57]). However, relatively little is known, on the individual level, about the extent to which HIV-positive MSM use knowledge of their undetectable viral load in their decision to have CAS with casual partners, and to what extent they involve their HIV-negative partners in that decision. In chapter 2.2, we examine to what extent the choice of CAS among HIV-positive MSM is driven by the motive of having an undetectable viral load. This study was based on data gathered from an open online panel consisting of HIV-positive MSM.

1.2.2 Risk settings & sexual behavior (chapter 3)

Chapters 3.1, 3.2, and 3.3 are dedicated to the different sexual risk settings, their sex-related behavioral norms, and their influence on sexual behavior.

1.2.2.1 Serosorting & types of casual partners (chapter 3.1)

From past research on sexual behavior among MSM with steady partners, we know that not all CAS is risky for HIV infection, as in the example of negotiated safety presented earlier [44]. While such a strategy is applicable in steady relationships, its implementation in the context of casual sex is much more complex, as establishing HIV seroconcordance with casual partners might prove more difficult than with steady partners [73], but may nevertheless be considered or attempted. Indeed, based on previous serosorting studies (e.g., [74]), it is clear that men use information regarding their own and their casual partner's HIV status in their decisions (not) to use condoms. However, as pointed out earlier, the operationalization of serosorting in these studies was often problematic, as the discussion of HIV status was not always operationalized as a pre-condition for engagement in condomless sex but by the matching of (ad-hoc) reports of the assumed HIV status of the partners as measured by the researchers.

Exchanging information regarding one's HIV status prior to the sexual act is an essential operationalization of the serosorting concept and can be facilitated by the level of familiarity with the casual partner [75]. In chapter 3.1 we therefore examine, with use of ACS data, the hypothesis that the more familiar a casual partner is, the more men would be inclined to use

some level of knowledge regarding HIV status in order not to use condoms through practicing serosorting.

1.2.2.2 Group sex (chapter 3.2)

MSM's risk taking is often influenced by encounter-level factors, such as the type of partner men have sex with or the location they have sex in. To further explore the situational factors that influence sexual risk behavior, in chapter 3.2 we study the specific sexual setting of group sex (defined as three or more sexual partners engaging in sex together). During group sex, men can have sex with multiple partners at the same time. Such encounters potentially increase the chance of exposure to HIV and other STI [76]. Group sex has been associated with increased levels of CAS and frequent use of hard drugs [77], the latter facilitating sexual risk behavior through sexual disinhibition and increasing sexual stamina [78]. The detailed data collection of the ACS gave us the opportunity to compare risk behaviors, associated STI, and drug use during group sex versus one-on-one sex both reported by the same men, hence examining the true effect of the group-sex setting only. With the availability of longitudinal data on these behaviors, we were also able to examine whether men consistently engaged in group sex and risk behavior over time.

1.2.2.3 Site-specific condom use norms (chapter 3.3)

Previous chapters sought to understand the effect of sexual settings (casual partner type, group sex) on men's sexual behavior. As MSM have a tradition of having sex in meeting places other than their homes, such as darkrooms, in chapter 3.3 we investigate whether the actual sex location and their related behavioral norms are also of influence on sexual behavior. Previous studies have shown that the type of venue and related social norms that exist at these venues are likely to play a role on shaping risk behaviors [79,80]. To understand the potential association between location and sexual risk, and to explore what type of sexual risk norms are dominant in sex venues in the Netherlands, we examined what men visiting such venues think that other visitors (or 'patrons') would do in regard to condom use at that location, measured as 'descriptive norms' [81] (see box 3). The anticipated norms and behaviors of others on location can influence the actual behaviors of individuals in that location. In this way, our study differs from most previous studies [82] in that we also focused on the perceived condom use by others and not only the perceived endorsement of one's behavior. In chapter 3.3 we also compare perceived norms at sex-related locations to similar norms that are experienced in locations where non-sexual social interaction is more common (e.g., bars) to examine whether the type of location also influences anticipated norms. Our study population was also recruited at sex-related and nonsex-related gay social network and dating websites to obtain a representative view of the norms.

Box 3. Psychosocial concepts applied in this thesis

Psychosocial theories and models of behavior are critical in developing effective HIV-related behavior prevention programs among MSM [83]. Based on empirical data, these theories provide us with frameworks for the measurement and operationalization of important determinants of risk and protective sexual behaviors. Consequently, these models also help us apply our findings effectively within HIV-prevention interventions.

In chapter 3.3, we use the concepts of descriptive and injunctive norms as defined by Cialdini and colleagues [81] in order to operationalize context-specific condom use norms. Descriptive norms are regarded as the perceptions of how other people would behave in a certain place and situation. Injunctive norms on the other hand are regarded as perceived endorsements of a specific behavior by others.

In addition to descriptive and injunctive norms we have applied the concept of subjective norms, derived from the Theory of Planned Behavior (TPB) [84]. The TPB is one of the most widely used theories and is considered to be useful in explaining condom use among MSM [85]. According to the TPB, behavior is predicted by intentions which in turn are determined by attitudes, perceived behavioral control and subjective norms [84]. Behavior can also be directly influenced by actual behavioral control. Applied to the context of condom use, attitudes are one's personal evaluations of condoms and condom use, perceived behavioral control is related to the level of perceived personal ability to use condoms (self-efficacy), and subjective norms are the perceived endorsements of others who are important to the person (such as friends or family) regarding the use of condoms [84]. The subjective norm, as defined by the TPB, neglects operationalization of the perceptions of what others normally do, i.e., descriptive norms [81].

In chapter 4, we apply the concepts of self-defined autonomous motivations versus externally-controlled motivations, which are motivations that are at the center of the Self-Determination Theory (SDT) [86]. According to the SDT, self-defined motivations are internalized motivations that are true to oneself, irrespective of what others think about the behavior. Individuals whose motivation is self-determined will experience a sense of autonomy if the relevant behavior is conducted in accordance to their intrinsic goals [86]. Externally-controlled motivations on the other hand, are controlled by the possible outcome of the behavior. Applied to the context of long-term condom use, men who have a self-determined motivation to use condoms because they are deeply committed to do so, will be more likely to consistently use condoms over time than those men whose motivation is controlled by external factors, such as social approval, pressure, or punishment.

1.2.3 The role of principles in consistent condom use (chapter 4)

Finally, in chapter 4 we take a closer look at specific cognitive aspects that might influence consistent safer-sex behavior. We use a 3-year longitudinal dataset of the ACS to examine whether strong internal principles or convictions predispose MSM to engage in consistent condom-use over time. The HIV prevention field has long been interested in why some men do and why some men do not consistently use condoms. According to the self-determination theory, people are more likely to achieve their behavioral goals, such as condom use, if their motivations are internally-driven [86] (see box 3). An example of an internally-driven motivation is a strong personal norm, or 'principle'. In this study, principles were defined as strong personal commitments that motivate an individual for or against a given behavior and are held irrespective of what others think. Intentions to use condoms, which have traditionally been used for the prediction of (sexual) behavior, were defined as the readiness to perform a specific behavior in a specific context [84], and have been found to predict behavior over shorter time periods [87]. We hypothesized that men who possess strong principles to always use condoms were more likely to consistently use them over the years, in comparison to men who have the intentions to do so.

1.3 RESEARCH QUESTIONS AND DATA SOURCES

In summary, the following research questions form the center of this thesis:

- How effective is serosorting with casual partners in lowering the risk of HIV infection, how often is it practiced and with which type of casual partners? (chapter 2.1 and 3.1)
- Do HIV-positive MSM use information about their viral load as a motivation to have CAS with HIV-negative men and to what extent are their HIV-negative partners involved in that decision? (chapter 2.2)
- Do MSM exhibit different sexual risk behavior patterns within casual sex and group sex settings and are these settings associated with increased rates of CAS and STI? (chapter 3.1 and 3.2)
- What are the prevailing condom-use norms at gay venues and websites in the Netherlands and how do they influence sexual risk taking at various locations? (chapter 3.3)
- Are strong principles to use condoms better indicators of long-term consistent condom use than behavioral intentions? (chapter 4)

Table 1 presents an overview of the different studies of this thesis and their design.

Table 1. Data sources and study characteristics of studies described in this thesis

Chapter	Study population	Period of data collection	Study design	Main variable of interest	Outcome(s)
2.1	445 HIV-negative MSM participating in the ACS	2007-2011	Longitudinal	Serosorting	HIV seroconversion
2.2	177 HIV-positive MSM participating in online panel of the 'HIV Vereniging Nederland' (Dutch HIV Association)	2010	Cross-sectional	Type and HIV-status of casual sex partner	Use of undetectable viral load as condition for engaging in CAS
3.1	240 HIV-negative MSM participating in the ACS	2007	Cross-sectional	Type of casual sex partner	Serosorting
3.2	465 HIV-negative MSM participating in the ACS	2009-2012	Longitudinal	Group sex versus dyadic sex	CAS, STI
3.3	2376 Visitors of gay on- and offline settings	2010	Cross-sectional	Type of location	Condom use norms, CAS
4	260 HIV-negative MSM participating in the ACS	2011-2014	Longitudinal	Principles versus intentions	Consistent long-term condom use during anal sex

MSM=men who have sex with men; ACS=Amsterdam Cohort Studies; CAS=condomless anal sex; STI=sexually transmitted infection

REFERENCES

1. Centers for Disease Control. **Pneumocystis pneumonia--Los Angeles**. 1981.
2. Friedman-Kien A, Laubenstein L, Marmor M, Hymes K, Green J, Ragaz A, et al. **Kaposi sarcoma and Pneumocystis pneumonia among homosexual men--New York City and California**. *MMWR Morbidity and mortality weekly report* 1981; 30(25):305-308.
3. Barre-Sinoussi F, Chermann JC, Rey F, Nugeyre MT, Chamaret S, Gruest J, et al. **Isolation of a T-lymphotropic retrovirus from a patient at risk for acquired immune deficiency syndrome (AIDS)**. *Science* 1983; 220(4599):868-871.
4. Gallo RC, Sarin PS, Gelmann EP, Robert-Guroff M, Richardson E, Kalyanaraman VS, et al. **Isolation of human T-cell leukemia virus in acquired immune deficiency syndrome (AIDS)**. *Science* 1983; 220(4599):865-867.
5. UNAIDS. **Fact Sheet July 2017**. Geneva: UNAIDS; 2017.
6. van Sighem A, Boender S, Wit F, Smit C, Matser A, Reiss P. **Monitoring Report 2017. Human Immunodeficiency Virus (HIV) infection in the Netherlands**. Amsterdam: Stichting HIV Monitoring; 2017.
7. Beyrer C, Baral SD, Collins C, Richardson ET, Sullivan PS, Sanchez J, et al. **The global response to HIV in men who have sex with men**. *Lancet* 2016; 388(10040):198-206.
8. Baggaley RF, White RG, Boily MC. **HIV transmission risk through anal intercourse: systematic review, meta-analysis and implications for HIV prevention**. *Int J Epidemiol* 2010; 39(4):1048-1063.
9. Patel P, Borkowf CB, Brooks JT, Lasry A, Lansky A, Mermin J. **Estimating per-act HIV transmission risk: a systematic review**. *AIDS* 2014; 28(10):1509-1519.
10. Dougan S, Elford J, Chadborn TR, Brown AE, Roy K, Murphy G, et al. **Does the recent increase in HIV diagnoses among men who have sex with men in the UK reflect a rise in HIV incidence or increased uptake of HIV testing?** *Sex Transm Infect* 2007; 83(2):120-125.
11. Jansen IA, Geskus RB, Davidovich U, Jurriaans S, Coutinho RA, Prins M, et al. **Ongoing HIV-1 transmission among men who have sex with men in Amsterdam: a 25-year prospective cohort study**. *AIDS* 2011; 25(4):493-501.
12. Oswald GA, Theodossi A, Gazzard BG, Byrom NA, Fisher-Hoch SP. **Attempted immune stimulation in the "gay compromise syndrome"**. *British medical journal (Clinical research ed)* 1982; 285(6348):1082.
13. Centers for Disease Control. **Update on Kaposi's sarcoma and opportunistic infections in previously healthy persons--United States**. *MMWR Morbidity and mortality weekly report* 1982; 31(22):294, 300.
14. Centers for Disease Control. **Update on acquired immune deficiency syndrome (AIDS)--United States**. *MMWR Morbidity and mortality weekly report* 1982; 31(37):507.
15. de Wit JB. **Prevention of HIV infection among homosexual men: behavior change and behavioral determinants** [PhD Thesis]. Amsterdam: University of Amsterdam; 1994.
16. Van Griensven F. **Epidemiology and prevention of HIV infection among homosexual men**. PhD Thesis. [PhD Thesis]. Amsterdam: University of Amsterdam; 1989.
17. van Griensven GJ, de Vroome EM, Goudsmit J, Coutinho RA. **Changes in sexual behaviour and the fall in incidence of HIV infection among homosexual men**. *BMJ* 1989; 298(6668):218-221.
18. van Griensven GJ, Tielman RA, Goudsmit J, van der Noordaa J, de Wolf F, de Vroome EM, et al. **Risk factors and prevalence of HIV antibodies in homosexual men in the Netherlands**. *Am J Epidemiol* 1987; 125(6):1048-1057.
19. van den Hoek JA, Coutinho RA, van Haastrecht HJ, van Zadelhoff AW, Goudsmit J. **Prevalence and risk factors of HIV infections among drug users and drug-using prostitutes in Amsterdam**. *AIDS* 1988; 2(1):55-60.

20. The Amsterdam Cohort Studies on HIV infection and AIDS. **A summary of the results 2001-2009.** Amsterdam; 2009.
21. Coutinho R, Prins, M. **The Amsterdam Cohort Studies on HIV and AIDS: a bridge between research and public health.** In: *Inspiratie in de epidemiologie Een bloemlezing van Nederlandse epidemiologische studies van het eerste uur.* Vereniging voor Epidemiologie; 2011.
22. Prummel MF, ten Berge RJ, Barrowclough H, Cejka V. **Kaposi-sarcoom en dodelijke opportunistische infecties bij een homoseksuele man met een deficiënt immuunapparaat [Kaposi's sarcoma and fatal opportunistic infections in a homosexual man with immunodeficiency].** *Ned Tijdschr Geneeskd* 1983; 127(19):820-824.
23. Mooij A. **Geen paniek! Aids in Nederland 1982-2004 [No panic! AIDS in the Netherlands, 1982-2004].** Amsterdam: Uitgeverij Bert Bakker; 2004.
24. Curran JW, Morgan WM, Hardy AM, Jaffe HW, Darrow WW, Dowdle WR. **The epidemiology of AIDS: current status and future prospects.** *Science* 1985; 229(4720):1352-1357.
25. Van Wijngaarden J. **The Netherlands: aids in a consensual society.** *AIDS in Industrial Democracies: Passions, Politics and Policies* 1992.
26. Wigersma L, Oud R. **Safety and acceptability of condoms for use by homosexual men as a prophylactic against transmission of HIV during anogenital sexual intercourse.** *British medical journal (Clinical research ed)* 1987; 295(6590):94.
27. Tielman RA, Moerkerk, H. **Aids. Ziekte, patiënt en samenleving [AIDS. Illness, patient and society].** Utrecht; 1986.
28. Dekkers T, Geerts I. **Je lust of je leven: Hiv-preventie voor homoseksuele mannen 1982-2005 [Your lust or your life: HIV prevention for homosexual men 1982-2005].** Schorer Boeken; 2005.
29. Nationale Commissie AIDS-Bestrijding. **Vroegtijdige interventie bij personen met een HIV-infectie [Early intervention in people with HIV infection].** Amsterdam: Nationale Commissie AIDS Bestrijding (NCAB); 1990.
30. Van Kerkhof MPN. **Seksueel (Onder) handelen. Een scripttheoretische benadering van anale seks onder homo-en biseksuele mannen [Negotiating around sex. A script-theoretical approach to anal sex among gay and bisexual men].** Universiteit van Amsterdam; 1999.
31. de Zwart O, Sandfort T, van Kerkhof M. **No anal sex please: We're Dutch: A dilemma in HIV prevention directed at Gay men.** *The Dutch Response to HIV: Pragmatism and consensus* 1998:135-152.
32. van Griensven GJ, de Vroome EM, Tielman RA, Coutinho RA. **Failure rate of condoms during anogenital intercourse in homosexual men.** *Genitourin Med* 1988; 64(5):344-346.
33. De Wit JB, Sandfort, T.G.M., De Vroome, E.M.M., van Griensven, G.J.P., Kok, G.J., Coutinho, R.A., Tielman, R.A.P. **Serieel cross-sectionele en longitudinale veranderingen in seksueel gedrag in cohort homoseksuele mannen in Amsterdam [Serial cross-sectional and longitudinal changes in sexual behavior in cohort homosexual men in Amsterdam].** *Tijdschrift Sociale Gezondheidszorg* 1992; 70:457-462.
34. Coutinho RA, van Griensven GJ, Moss A. **Effects of preventive efforts among homosexual men.** *AIDS* 1989; 3 Suppl 1:S53-56.
35. de Wit JB, Sandfort TG, de Vroome EM, van Griensven GJ, Kok GJ. **The effectiveness of condom use among homosexual men.** *AIDS* 1993; 7(5):751-752.
36. de Zwart O, Sandfort TG. **'Gebruik een condoom of neuk niet': een kwalitatief onderzoek naar de wijze waarop de nevenschikkende boodschap kan worden vormgegeven [Use a condom or do not fuck': a qualitative study of the way in which the companion message can be designed].** RUU, Interfacultaire Werkgroep Homostudies; 1993.
37. de Wit JB, van den Hoek JA, Sandfort TG, van Griensven GJ. **Increase in unprotected anogenital intercourse among homosexual men.** *Am J Public Health* 1993; 83(10):1451-1453.

38. van den Hoek JA, van Griensven GJ, Coutinho RA. **Increase in unsafe homosexual behaviour.** *Lancet* 1990; 336(8708):179-180.
39. Kingsley LA, Zhou SY, Bacellar H, Rinaldo CR, Chmiel J, Detels R, et al. **Temporal Trends in Human Immunodeficiency Virus type 1 Seroconversion 1984–1989 A Report from the Multicenter AIDS Cohort Study (MACS).** *American journal of epidemiology* 1991; 134(4):331-339.
40. Van de Ven P, Kippax S, Crawford J, Rawstorne P, Prestage G, Grulich A, et al. **In a minority of gay men, sexual risk practice indicates strategic positioning for perceived risk reduction rather than unbridled sex.** *AIDS Care* 2002; 14(4):471-480.
41. Suarez T, Miller J. **Negotiating risks in context: a perspective on unprotected anal intercourse and barebacking among men who have sex with men--where do we go from here?** *Arch Sex Behav* 2001; 30(3):287-300.
42. Kippax S, Crawford J, Davis M, Rodden P, Dowsett G. **Sustaining safe sex: a longitudinal study of a sample of homosexual men.** *AIDS* 1993; 7(2):257-263.
43. Kippax S, Noble J, Prestage G, Crawford JM, Campbell D, Baxter D, et al. **Sexual negotiation in the AIDS era: negotiated safety revisited.** *AIDS* 1997; 11(2):191-197.
44. Davidovich U, de Wit JB, Stroebe W. **Assessing sexual risk behaviour of young gay men in primary relationships: the incorporation of negotiated safety and negotiated safety compliance.** *AIDS* 2000; 14(6):701-706.
45. Guzman R, Colfax GN, Wheeler S, Mansergh G, Marks G, Rader M, et al. **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(1):82-86.
46. Antiretroviral Therapy Cohort Collaboration. **Life expectancy of individuals on combination antiretroviral therapy in high-income countries: a collaborative analysis of 14 cohort studies.** *The Lancet* 2008; 372(9635):293-299.
47. Stolte IG, Coutinho RA. **Risk behaviour and sexually transmitted diseases are on the rise in gay men, but what is happening with HIV?** *Curr Opin Infect Dis* 2002; 15(1):37-41.
48. Dukers NH, Fennema HS, van der Snoek EM, Krol A, Geskus RB, Pospiech M, et al. **HIV incidence and HIV testing behavior in men who have sex with men: using three incidence sources, The Netherlands, 1984-2005.** *AIDS* 2007; 21(4):491-499.
49. Bezemer D, de Wolf F, Boerlijst MC, van Sighem A, Hollingsworth TD, Prins M, et al. **A resurgent HIV-1 epidemic among men who have sex with men in the era of potent antiretroviral therapy.** *AIDS* 2008; 22(9):1071-1077.
50. Venable PA, Ostrow DG, McKirnan DJ, Taywaditip KJ, Hope BA. **Impact of combination therapies on HIV risk perceptions and sexual risk among HIV-positive and HIV-negative gay and bisexual men.** *Health Psychol* 2000; 19(2):134-145.
51. Stolte IG, Dukers NH, Geskus RB, Coutinho RA, de Wit JB. **Homosexual men change to risky sex when perceiving less threat of HIV/AIDS since availability of highly active antiretroviral therapy: a longitudinal study.** *AIDS* 2004; 18(2):303-309.
52. Heijman RL, Stolte IG, Thiesbrummel HF, van Leent E, Coutinho RA, Fennema JS, et al. **Opting out increases HIV testing in a large sexually transmitted infections outpatient clinic.** *Sex Transm Infect* 2009; 85(4):249-255.
53. Dukers-Muijers NH, Niekamp AM, Vergoossen MM, Hoebe CJ. **Effectiveness of an opting-out strategy for HIV testing: evaluation of 4 years of standard HIV testing in a STI clinic.** *Sex Transm Infect* 2009; 85(3):226-230.
54. Vernazza P, Hirschel B, Bernasconi E, Flepp M. **HIV transmission under highly active antiretroviral therapy.** *Lancet* 2008; 372(9652):1806-1807; author reply 1807.

55. Bunnell R, Ekwaru JP, Solberg P, Wamai N, Bikaako-Kajura W, Were W, et al. **Changes in sexual behavior and risk of HIV transmission after antiretroviral therapy and prevention interventions in rural Uganda.** *AIDS* 2006; 20(1):85-92.
56. Quinn TC, Wawer MJ, Sewankambo N, Serwadda D, Li C, Wabwire-Mangen F, et al. **Viral load and heterosexual transmission of human immunodeficiency virus type 1. Rakai Project Study Group.** *N Engl J Med* 2000; 342(13):921-929.
57. Cohen MS, Chen YQ, McCauley M, Gamble T, Hosseinipour MC, Kumarasamy N, et al. **Prevention of HIV-1 infection with early antiretroviral therapy.** *N Engl J Med* 2011; 365(6):493-505.
58. Prestage G, Mao L, Kippax S, Jin F, Hurley M, Grulich A, et al. **Use of viral load to negotiate condom use among gay men in Sydney, Australia.** *AIDS Behav* 2009; 13(4):645-651.
59. Rodger AJ, Cambiano V, Bruun T, Vernazza P, Collins S, van Lunzen J, et al. **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(2):171-181.
60. Molina JM, Capitant C, Spire B, Pialoux G, Cotte L, Charreau I, et al. **On-demand preexposure prophylaxis in men at high risk for HIV-1 infection.** *N Engl J Med* 2015; 373(23):2237-2246.
61. Grant RM, Lama JR, Anderson PL, McMahan V, Liu AY, Vargas L, et al. **Preexposure chemoprophylaxis for HIV prevention in men who have sex with men.** *N Engl J Med* 2010; 363(27):2587-2599.
62. McCormack S, Dunn DT, Desai M, Dolling DI, Gafos M, Gilson R, et al. **Pre-exposure prophylaxis to prevent the acquisition of HIV-1 infection (PROUD): effectiveness results from the pilot phase of a pragmatic open-label randomised trial.** *Lancet* 2016; 387(10013):53-60.
63. Molina JM, Charreau I, Spire B, Cotte L, Chas J, Capitant C, et al. **Efficacy, safety, and effect on sexual behaviour of on-demand pre-exposure prophylaxis for HIV in men who have sex with men: an observational cohort study.** *Lancet HIV* 2017; 4(9):e402-e410.
64. Volk JE, Marcus JL, Phengrasamy T, Blechinger D, Nguyen DP, Follansbee S, et al. **No new HIV infections with increasing use of HIV preexposure prophylaxis in a clinical practice setting.** *Clin Infect Dis* 2015; 61(10):1601-1603.
65. POZ Magazine. **Reevaluate MSM HIV language, methods and recommendations. Advocates urge the CDC to reduce its own risk of misleading perceptions.** 2017 <https://www.poz.com/article/cdc-msm-open-letter-25003-6613> (accessed 22-11-2017).
66. Centers for Disease Control (Prevention). **HIV testing and risk behaviors among gay, bisexual, and other men who have sex with men—United States.** *MMWR Morbidity and mortality weekly report* 2013; 62(47):958.
67. Reyniers T, Hoornenborg E, Vuylsteke B, Wouters K, Laga M. **Pre-exposure prophylaxis (PrEP) for men who have sex with men in Europe: review of evidence for a much needed prevention tool.** *Sex Transm Infect* 2016;sextrans-2016-052699.
68. Hoornenborg E, Achterbergh RCA, Schim van der Loeff MF, Davidovich U, Hogewoning A, de Vries HJC, et al. **MSM starting preexposure prophylaxis are at risk of hepatitis C virus infection.** *AIDS* 2017; 31(11):1603-1610.
69. Khosropour CM, Dombrowski JC, Swanson F, Kerani RP, Katz DA, Barbee LA, et al. **Trends in serosorting and the association with HIV/STI risk over time among men who have sex with men.** *J Acquir Immune Defic Syndr* 2016; 72(2):189-197.
70. Zablotska IB, Imrie J, Prestage G, Crawford J, Rawstorne P, Grulich A, et al. **Gay men's current practice of HIV seroconcordant unprotected anal intercourse: serosorting or seroguessing?** *AIDS Care* 2009; 21(4):501-510.
71. Grace D, Chown SA, Jollimore J, Parry R, Kwag M, Steinberg M, et al. **HIV-negative gay men's accounts of using context-dependent sero-adaptive strategies.** *Cult Health Sex* 2014.

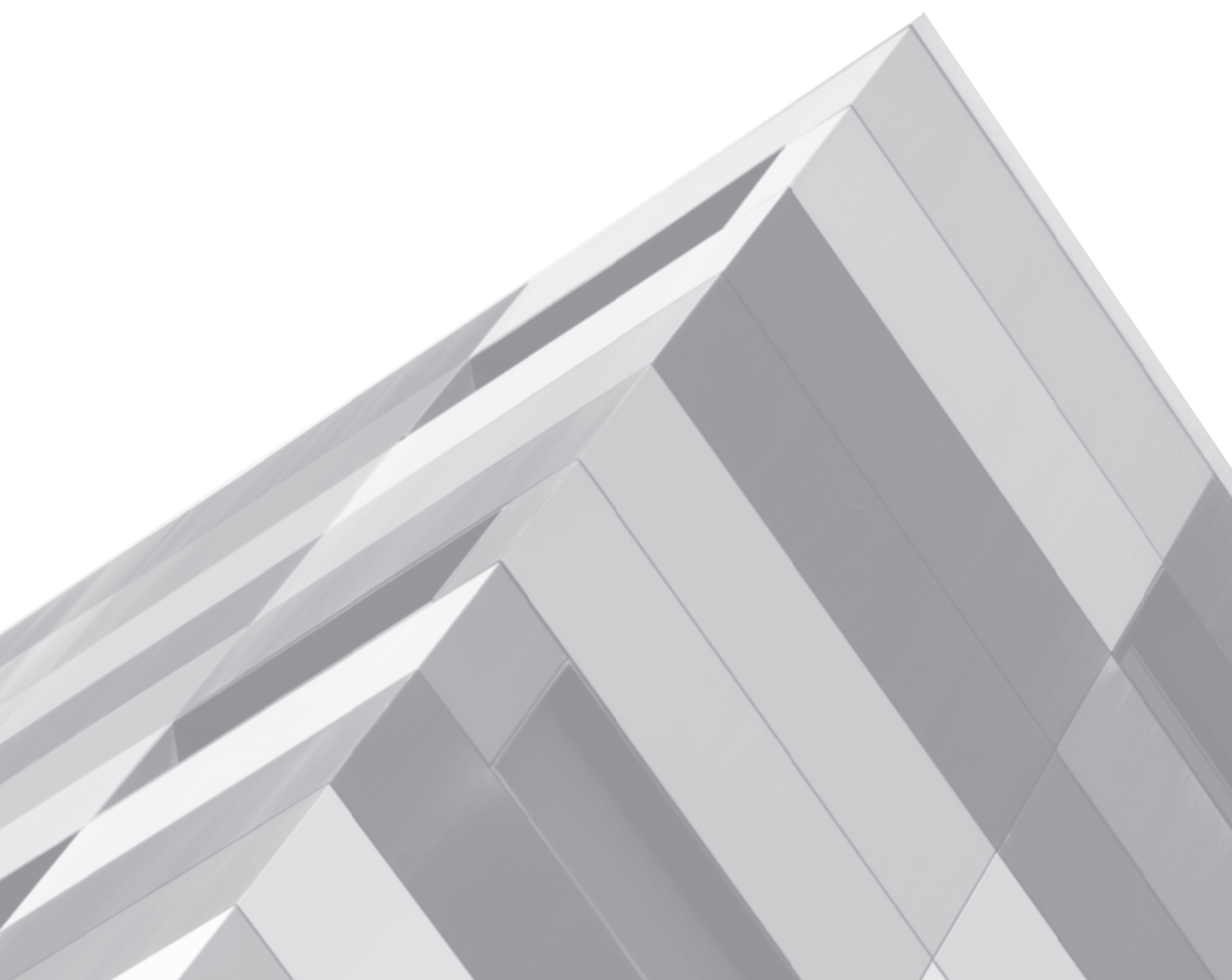
72. Jin F, Crawford J, Prestage GP, Zablotska I, Imrie J, Kippax SC, et al. **Unprotected anal intercourse, risk reduction behaviours, and subsequent HIV infection in a cohort of homosexual men.** *AIDS* 2009; 23(2):243-252.
73. Marcus U, Schink SB, Sherriff N, Jones AM, Gios L, Folch C, et al. **HIV serostatus knowledge and serostatus disclosure with the most recent anal intercourse partner in a European MSM sample recruited in 13 cities: results from the Sialon-II study.** *BMC Infect Dis* 2017; 17(1):730.
74. Mao L, Crawford JM, Hospers HJ, Prestage GP, Grulich AE, Kaldor JM, et al. **"Serosorting" in casual anal sex of HIV-negative gay men is noteworthy and is increasing in Sydney, Australia.** *AIDS* 2006; 20(8):1204-1206.
75. Holt M, Rawston P, Worth H, Bittman M, Wilkinson J, Kippax S. **Predictors of HIV disclosure among untested, HIV-negative and HIV-positive Australian men who had anal intercourse with their most recent casual male sex partner.** *AIDS Behav* 2011; 15(6):1128-1139.
76. Grov C, Rendina HJ, Ventuneac A, Parsons JT. **HIV risk in group sexual encounters: an event-level analysis from a national online survey of MSM in the U.S.** *J Sex Med* 2013; 10(9):2285-2294.
77. Hirshfield S, Schrimshaw EW, Stall RD, Margolis AD, Downing MJ, Jr., Chiasson MA. **Drug Use, Sexual Risk, and Syndemic Production Among Men Who Have Sex With Men Who Engage in Group Sexual Encounters.** *Am J Public Health* 2015; 105(9):1849-1858.
78. Weatherburn P, Hickson F, Reid D, Torres-Rueda S, Bourne A. **Motivations and values associated with combining sex and illicit drugs ('chemsex') among gay men in South London: findings from a qualitative study.** *Sex Transm Infect* 2017; 93:203-206.
79. Xia Q, Tholandi M, Osmond DH, Pollack LM, Zhou W, Ruiz JD, et al. **The effect of venue sampling on estimates of HIV prevalence and sexual risk behaviors in men who have sex with men.** *Sex Transm Dis* 2006; 33(9):545-550.
80. Clatts MC, Goldsamt LA, Yi H. **An emerging HIV risk environment: a preliminary epidemiological profile of an MSM POZ Party in New York City.** *Sex Transm Infect* 2005; 81(5):373-376.
81. Cialdini RB, Reno RR, Kallgren CA. **A focus theory of normative conduct: recycling the concept of norms to reduce littering in public places.** *J Pers Soc Psychol* 1990; 58(6):1015.
82. McKechnie ML, Bavinton BR, Zablotska IB. **Understanding of norms regarding sexual practices among gay men: Literature review.** *AIDS and Behavior* 2013; 17(4):1245-1254.
83. Higa DH, Crepaz N, Marshall KJ, Kay L, Vosburgh HW, Spikes P, et al. **A systematic review to identify challenges of demonstrating efficacy of HIV behavioral interventions for gay, bisexual, and other men who have sex with men (MSM).** *AIDS Behav* 2013; 17(4):1231-1244.
84. Ajzen I. **The theory of planned behavior.** *Organ Behav Hum Decis Process* 1991; 50(2):179-211.
85. Andrew BJ, Mullan BA, de Wit JBF, Monds LA, Todd J, Kothe EJ. **Does the Theory of Planned Behaviour explain condom use behaviour among men who have sex with men? A meta-analytic review of the literature.** *AIDS and Behavior* 2016; 20(12):2834-2844.
86. Ryan RM, Deci EL. **Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being.** *Am Psychol* 2000; 55(1):68-78.
87. Sheeran P, Orbell S. **Do intentions predict condom use? Meta-analysis and examination of six moderator variables.** *Br J Soc Psychol* 1998; 37 (Pt 2):231-250.



Chapter 2

Non-condom based HIV risk-reduction strategies





2.1

Is serosorting effective in reducing the risk of HIV infection among men who have sex with men with casual sex partners?

Wijnand van den Boom*, Roos Konings*, Udi Davidovich, Theo Sandfort, Maria Prins & Ineke G Stolte

*authors contributed equally

J Acquir Immune Defic Syndr. 2014; 65(3):375-9

ABSTRACT

Background

We investigated the prevalence and protective value of serosorting (i.e., establishing HIV seroconcordance in advance to practice unprotected anal intercourse [UAI]) with casual partners (CP) among HIV-negative men who have sex with men (MSM) using longitudinal data from 2007 to 2011.

Methods

Men of the Amsterdam Cohort Studies were tested biannually for HIV-1 antibodies and filled in questionnaires about sexual behavior in the preceding 6 months. HIV incidence was examined among men who practiced UAI, UAI with serosorting, or consistent condom use, using Poisson regression.

Results

Of 445 MSM with CPs, 31 seroconverted for HIV during a total follow-up of 1107 person-years. Overall observed HIV-incidence rate was 2.8/100 person-years. Consistent condom use was reported in 64%, UAI in 25%, and UAI with serosorting in 11% of the 2137 follow-up visits. MSM who practiced serosorting were less likely to seroconvert (adjusted incidence rate ratio [aIRR]=0.46; 95% confidence interval [95%CI]=0.13–1.59) than MSM who had UAI, but more likely to seroconvert than MSM who consistently used condoms (aIRR=1.32; 95%CI=0.37–4.62), although differences in both directions were not statistically significant. MSM who consistently used condoms were less likely to seroconvert than MSM who had UAI (aIRR=0.37; 95%CI=0.18–0.77).

Discussion

The protective effect for serosorting we found was not statistically significant. Consistent condom use was found to be most protective against HIV infection. Larger studies are needed to demonstrate whether serosorting with CPs offers sufficient protection against HIV infection, and if not, why it fails to do so.

INTRODUCTION

Men who have sex with men (MSM) have adopted several HIV risk-reduction strategies in order to reduce the risk of HIV transmission when engaging in unprotected anal intercourse (UAI) [1, 2]. One of these strategies is 'serosorting'. For HIV-negative MSM, serosorting means having UAI only with partners who are also known to be HIV-negative [3]. Some studies demonstrated that serosorting is common among HIV-negative MSM who engage in UAI with casual sex partners (with proportions of serosorting >20%), and that this practice is increasing [4, 5].

The validity of serosorting in reducing the risk of HIV is dependent on the knowledge of one's own and partner's HIV status. Therefore, serosorting is vulnerable to potential misperception of HIV status, especially in the context of casual sex when it may not be possible for the partners to know each other well [6]. Also, MSM who test infrequently for HIV might incorrectly assume they are HIV-negative when in fact they have (recently) been infected with HIV [7]. Modeling studies have shown that the effectiveness of serosorting depends on the frequency of HIV testing: in populations where testing is performed infrequently, serosorting can lead to an increased risk of HIV infection [8]. HIV-positive MSM, however, might not accurately or honestly disclose their HIV status because of stigma or fear of rejection involved with that disclosure [9]. Despite these difficulties in practicing serosorting, some studies suggest that serosorting is effective in preventing HIV infection [4, 10]. However, the effectiveness of serosorting seems to be lower when compared to consistent condom use [4, 10].

The Amsterdam Cohort Study (ACS) among MSM collects extensive behavioral data and tests for HIV every 6 months, and thus provides a good opportunity to investigate the association between serosorting and HIV infection. We conducted the present study to determine whether the proportion of serosorting has changed over the years and to investigate whether its practice is effective in lowering the risk of HIV infection, using longitudinal analyses. Most studies that have investigated serosorting in relation to HIV infection have assessed ad hoc reports of participants' and partners' HIV status and matched HIV status between partners to establish seroconcordance (e.g., Jin et al [4]). These studies failed to assess the conscious practice of serosorting by MSM as an HIV risk-reduction strategy. For our study we adopted serosorting measures from a previous cross-sectional ACS study, that assessed intentional serosorting among MSM [11]. We specifically asked our participants whether they had decided to engage in UAI because they knew in advance that their casual partner was HIV-negative and therefore had the a priori intention to engage in serosorting as an HIV risk-reduction strategy.

METHODS AND MATERIALS

Study population and study procedure

The ACS among MSM started in 1984 and is an open, ongoing prospective cohort study to investigate the epidemiology, psychosocial determinants, course of infection, and pathogenesis of HIV [12, 13]. Men can participate in the cohort if they are living in or around Amsterdam and had at least 1 male sexual partner in the preceding 6 months. Men are recruited into the ACS by ‘convenience sampling’ (e.g., brochures at the STI clinic, advertisements in the gay scene) and ‘chain referral sampling’ (participants recruited by other participants) [14].

Participants visit the Public Health Service of Amsterdam every 6 months to complete a self-administered questionnaire regarding their sexual (risk) behavior in the preceding 6 months; questions are asked regarding demographics at intake. At each visit, blood is drawn to test for HIV and for storage. Two commercially available enzyme-linked immunosorbent assays are used to test for HIV antibodies (AxSYM; Abbot Laboratories, North Chicago, IL, and Vironostika, Organon Teknika, Boxtel, the Netherlands). HIV-1 seroconversion is confirmed by Western blot analysis. For further details on ACS methods and recruitment, see Jansen et al [14].

During the study period (May 2007 to December 2011), detailed questions were asked about sexual behavior with casual partners in the preceding 6 months. Men were included in the present study if they were HIV-negative at start of the study period, had at least 2 visits during the study period, and reported having engaged in anal sex with casual partners.

Demographics

Demographic variables included age at the first visit in the study period, nationality (Dutch vs. non-Dutch), educational level, and sexual preference. Educational level was dichotomized into ‘high’ (completed higher vocational education or university) and ‘low-middle’ (completed high school, basic vocational education, primary school or secondary vocational level). Sexual preference score was measured using a 7-point Kinsey scale ranging from ‘exclusively heterosexual’ (1) to ‘exclusively homosexual’ (7).

Sexual (risk) behavior with casual partners

Participants were asked whether they had had insertive and/or receptive anal intercourse with their casual partners (yes/no). If participants reported anal intercourse with a casual partner, they were asked about their condom use with those partners (ranging on a 5-point scale from ‘never’ to ‘always’). Reporting no or no consistent condom use was defined as unprotected anal intercourse (UAI). If participants reported no or no consistent condom use, they were also asked whether they had decided to engage in UAI because they knew in advance that their casual partner was also HIV-negative (UAI with serosorting). Subsequently, participants were also asked whether they had decided to engage in UAI because they knew in advance

that their casual partner was positive (yes/no), and whether they had decided to engage in UAI because they did not know his HIV status (yes/no). If participants responded 'yes' to either one or both questions, this was also considered as a case of 'UAI without serosorting'.

Each participant was placed in only 1 category, which corresponded to his highest risk behavior with casual partners in the preceding 6 months. For example, participants who reported both serosorting and UAI (without serosorting) were consequently placed in the latter category. This resulted in our main variable of interest that consisted of 3 mutually exclusive categories; 'UAI (without serosorting)', 'serosorting', and 'consistent condom use', ranging from high to low risk.

Number of casual sex partners

If participants reported that they had had anal intercourse with casual sex partners, they were asked about the number of partners they had had anal intercourse with in the preceding 6 months.

Statistical analyses

We used descriptive statistics to describe baseline characteristics and the proportions of sexual (risk) behavior with casual partners. To investigate whether the proportion of serosorting among those who practiced anal intercourse with casual partners had changed during the study period, we used univariate logistic regression analysis. To account for within-participant correlations of the repeated behavioral measures over time, we used generalized estimating equations (GEE), assuming an exchangeable covariance matrix. For the whole period (2007-2011), an overall HIV incidence rate was calculated using person-time techniques.

Univariate and multivariate Poisson regression analyses were conducted to investigate the effect of sexual (risk) behavior with casual partners on HIV seroconversion. The logarithm of person-years was used as the offset value. As our questionnaires relate to the sexual behavior reported in the previous 6 months, individual follow-up time was calculated from 6 months before the first visit of the study period to the moment of HIV infection, the end of HIV negative follow-up, or the end of the study period (i.e., December 31, 2011), whichever occurred first. The estimated moment of seroconversion was defined as the midpoint between the last ACS visit at which the participant tested HIV-1-negative and the first HIV-1-positive visit.

All variables subject to change were treated as time-dependent variables. HIV status at every visit was linked to sexual (risk) behavior reported at that visit, since HIV infection is assumed to have occurred in the preceding 6 months and the behavior reports refer to that same period. This resulted in a study sample of 445 HIV-negative MSM with a total of 2137 visits.

Our main determinant of interest was sexual (risk) behavior with casual partners. Educational level and number of casual sex partners were considered potential confounders as they were

found to be associated with HIV infection in a previous study [14] and are also possibly associated with our main variable of interest. It could be that men who have a lower level of education might be less able to communicate about their HIV status with their casual partners. With increasing numbers of casual sex partners, it may be more difficult to discuss HIV seroconcordance with each of the casual partners.

We tested 2 models to investigate the effect of sexual (risk) behavior with casual partners on HIV seroconversion: (1) a model that only included sexual (risk) behavior, and (2) a model that included both sexual (risk) behavior and potential confounders of the association between sexual (risk) behavior and HIV seroconversion (i.e., educational level and number of casual sex partners). We also checked for the interaction between sexual behavior with casual partners and the other variables in the second model. A *p*-value of less than 0.05 was considered to be statistically significant.

All statistical analyses were performed using the statistical packages SPSS version 18.0 (SPSS Inc., Chicago, IL) and STATA Intercooled 11 (STATA Corp. LP, College Station, TX).

RESULTS

In total, 445 MSM were HIV-1-negative at study entry and met our inclusion criteria. Their median age was 33.9 years (interquartile range (IQR)=29.7-38.8), 90% (399/443) were Dutch, and 72% (313/437) were highly educated (Table 1). The mean sexual preference score was 6.7 (SD=0.7). The median number of casual sex partners was 19 (IQR=7-46). The median HIV-negative follow-up time during the study period was 2.5 years (IQR=1.2-3.6). The median number of visits during the study period was 5 visits (IQR=2-7), with a median time between visits of 6.0 months (IQR=5.8-6.4).

Sexual (risk) behavior

Consistent condom use with casual partners was reported at 63.5% (1358/2137) of the visits, followed by UAI at 25.1% (537/2137), and serosorting at 11.3% (242/2137). The proportions of visits at which MSM reported serosorting remained relatively stable over time (*P*=0.33), with 10.2% (20/196), 11.4% (56/485), 10.0% (48/472), 10.0% (50/492), and 13.9% (68/492), respectively, of the visits in the years 2007-2011.

Sexual (risk) behavior in relation to HIV seroconversion

Total follow-up time was 1107 person-years. Thirty-one MSM seroconverted for HIV during follow-up (overall observed incidence rate of 2.8/100 person-years). In model 1, Poisson analyses revealed that, compared with men who practiced UAI, men who reported consistent condom use were less likely to seroconvert for HIV (incidence rate ratio (IRR)=0.34; 95% confidence interval (CI)=0.16 to 0.72), as were men who practiced serosorting (IRR=0.45;

Table 1. Characteristics and sexual behavior of 445 MSM accounting for 2137 visits with reported events of anal sex with casual partners in the ACS, May 2007-December 2011, the Netherlands.

	N=445 MSM	Risk categories ^a			P value
		UAI (N=537 visits)	Serosorting (N=242 visits)	Consistent condom use (N=1358 visits)	
Median age (IQR)	33.9 (29.7-38.8)	37.0 (32.1-40.9)	37.0 (32.5-41.2)	36.4 (32.5-41.2)	0.795
Dutch nationality (% ^b) (vs. non-Dutch)	90.1	90.3	92.1	90.0	0.592
High educational level (% ^b) (vs. low-middle)	71.6	70.5	75.0	75.4	0.090
Sexual preference , Kinsey scale (mean; SD)	6.7 (0.7)	6.6 (0.7)	6.6 (0.8)	6.7 (0.6)	0.000
Number of casual sex partners (median; IQR)	19 (7-46)	6 (2-12)	5 (2-12)	4 (2-8)	0.000
Follow-up time in years (median; IQR)	2.5 (1.2-3.6)				
Number of visits (median; IQR)	5 (2.0-7.0)				
Months between visits (median; IQR)	6.0 (5.8-6.4)				

IQR, inter quartile range. SD, standard deviation.

^a Note that as these are longitudinal data, men can change their behavior and therefore change between risk categories over time.

^b In calculation of percentages, missing values were excluded.

95%CI=0.13-1.54), although the latter was not statistically significant ($p=0.24$) (Table 2). Additional analysis revealed that, compared with those who used condoms, men who practiced serosorting were more likely to seroconvert for HIV (IRR=1.30; 95%CI=0.37-4.57), although not statistically significant. In model 2, when adding potential confounders (i.e., educational level and number of casual sex partners), the effect of sexual (risk) behavior on HIV seroconversion we found in model 1 was retained.

Table 2. Association between sexual (risk) behavior with casual partners and HIV infection among 445 MSM, accounting for 2137 visits with reported events of anal sex with casual partners in the ACS, May 2007-December 2011, the Netherlands.

	Person- HIV sc	Person- years	Model 1		Model 2	
			IRR (95% CI)	P value	(a)IRR (95% CI) ^a	P value
Overall	31	1106.77				
Sexual (risk) behavior with casual partners						
UAI	13	277.94	1	0.016	1	0.027
Serosorting	3	124.78	0.45 (0.13-1.54)		0.46 (0.13-1.59)	
Consistent condom use	15	704.05	0.34 (0.16-0.72)		0.37 (0.18-0.77)	

Sc, seroconverter; (a)IRR, (adjusted) incidence rate ratio; CI, confidence interval; UAI, unprotected anal intercourse.

^a Adjusted for educational level and number of casual sex partners.

DISCUSSION

Using longitudinal data from the ACS, we found that in terms of incidence risk ratios, serosorting positioned itself in between condom use and UAI: the practice of serosorting seemed riskier than condom use but not as risky as UAI, however, differences in both directions were not statistically significant. The lack of significance in both directions might be due to lack of power, as there was a limited number of HIV seroconverters in our study.

Our findings suggest that some of our participants were not successful in effectively practicing serosorting. Their failure to distinguish in some cases between HIV-negative and HIV-positive casual partners could be, for example, attributed to their sex partners not knowing their correct HIV status, not honestly disclosing their HIV-positive status, or that the sex partners had not discussed their HIV status at all [6, 9, 15]. This is not surprising considering the context of casual sex in which communication about HIV is likely to be problematic. It would be of interest to investigate whether knowing a casual partner better would lead to more effective serosorting and thus in more effectively reducing the risk of HIV infection. A previous study found that MSM are more likely to practice intentional serosorting with partners they regularly contact to have sex with (sex buddies) than with partners they have occasionally met and had sex with only once (one-night stands) [11]. We did, however, not have the statistical power in the current study to stratify our analyses by type of casual partner, such as sex buddies versus one-night stands.

Other constraints to the protective effect of serosorting should be discussed. For example, on the population level, HIV testing rates can play a role in undermining effective serosorting. In the Netherlands, rates of recent HIV testing (in the last 6 months) among MSM, which range from 49% nation-wide [16] to 79% at STI centers [17], might be too low to make serosorting effective in preventing HIV. Mathematical models have indicated that under conditions of low HIV-testing frequency in the MSM population, any potential benefit of serosorting could be undermined by undiagnosed HIV infections [7, 8]. However, on the individual level, it is clear that in order for serosorting to become an effective strategy for casual partners, the HIV test on which the HIV status appraisal is made should be as close as possible to the moment of the sexual encounter and the window period of the test should be as small as possible, thereby increasing the likelihood that the knowledge of the HIV status is valid.

The relatively low (11%) and stable proportions of serosorting among HIV-negative MSM with casual partners in the ACS seems to be in line with a recent study among North American MSM (7.5-10.6% [18]). Relatively higher proportions were found by studies conducted in Sydney (24.6% [5]), France (26% [19]), San Francisco (27.5% [20]), and Switzerland (41.9% [21]). Differences between those studies and ours might partly be explained by the different study populations (e.g., study population characteristics, rates of HIV testing) investigated, or by how serosorting was assessed or inferred from the data. In contrast to our approach, in which

we measured intentional (planned) serosorting with casual partners, most studies assessed HIV seroconcordance by matching ad hoc reports of participants' and partners' HIV status, but did not assess whether participants used that information in advance of the sexual act in order to decide to engage in UAI (e.g., Mao et al [5]; Golden et al [22]). Therefore, in these studies, the practice of intentional serosorting as a conscious strategy among HIV-negative MSM might have been overestimated.

Some limitations of the present study should be mentioned. First, as MSM participating in the ACS tend to be strongly gay-identified, are relatively highly educated and are mostly from Dutch descent, generalization of our results must be made cautiously. Nevertheless, the data on risk behavior of the cohort have often been similar to larger nation-wide monitoring studies such as the Schorer Monitor [16], and therefore have good external validity. Second, we did not assess whether our participants practiced any HIV risk-reduction strategies other than serosorting, such as seropositioning. As a previous study [4] has shown that HIV-negative MSM who practice serosorting are not likely to practice any other strategy, this may only apply to the men in our study who had UAI (without serosorting). If such strategies have a protective value against HIV infection and are indeed practiced by those who had UAI without serosorting, we may have therefore underestimated the effect we found of serosorting in relation to UAI.

In conclusion, our findings highlight the need for the continuing encouragement of condom use for anal intercourse with casual partners, as in the present study consistent condom use was found to be most protective against HIV infection. Although serosorting has the potential to be an effective HIV risk-reduction strategy, in our study we did not find conclusive evidence of its protective effect in the context of casual sex. The failure of serosorting to offer better protection most likely concerns the problematic process of establishing valid HIV-negative seroconcordance between casual partners. If serosorting is to ever fulfill its protective potential in that context, a significantly better process of establishing HIV-negative seroconcordance must be achieved. This could be done by improving negotiation skills and realistic information exchange between sex partners, and likely most important, by increasing the frequency of HIV testing, especially for high-risk MSM. In addition, it is likely that the quality of rapid (home) HIV tests will improve in the future and will offer more sensitive test results with shorter window periods. If such a test becomes widely available to the public, we might see an increase of self-testing for HIV before engaging in sexual activity in order to properly serosort. In this way, serosorting might emerge in the future as an effective and valuable additional HIV risk-reduction strategy against HIV infection among MSM.

ACKNOWLEDGEMENTS

The authors would like to thank the research nurses Marc van Wijk and Marjolein Martens for their contribution in data collection; Linda May, Gerben Rienk Visser and Martijn van Rooijen for the cohort data management; Ronald Geskus for critically reviewing the statistical analyses and the manuscript; and Susan T. Landry for the English review. Furthermore, we express our gratitude to all the participants who made this study possible.

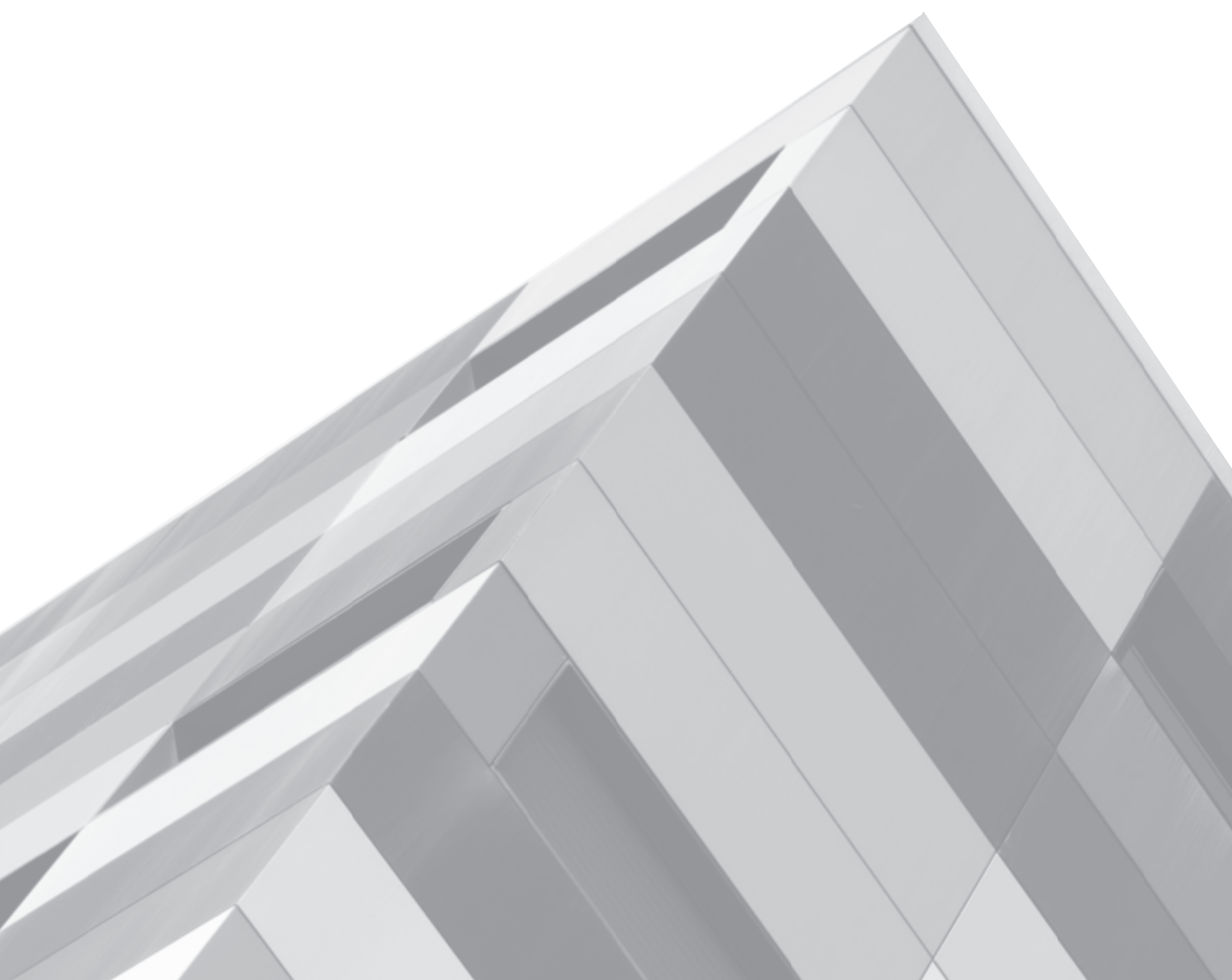
FUNDING

Funding for the present study was given by the Aidsfonds (project number 2008025). Dr. Sandfort's contribution was supported by NIHM Center Grant P30-MH43520

REFERENCES

1. Crepez N, Marks G, Liau A, Mullins MM, Aupont LW, Marshall KJ, et al. **Prevalence of unprotected anal intercourse among HIV-diagnosed MSM in the United States: a meta-analysis.** *AIDS* 2009; 23(13):1617-1629.
2. Hart GJ, Elford J. **Sexual risk behaviour of men who have sex with men: emerging patterns and new challenges.** *Curr Opin Infect Dis* 2010; 23(1):39-44.
3. Suarez T, Miller J. **Negotiating risks in context: a perspective on unprotected anal intercourse and barebacking among men who have sex with men--where do we go from here?** *Arch Sex Behav* 2001; 30(3):287-300.
4. Jin F, Crawford J, Prestage GP, Zablotska I, Imrie J, Kippax SC, et al. **Unprotected anal intercourse, risk reduction behaviours, and subsequent HIV infection in a cohort of homosexual men.** *AIDS* 2009; 23(2):243-252.
5. Mao L, Crawford JM, Hospers HJ, Prestage GP, Grulich AE, Kaldor JM, et al. **"Serosorting" in casual anal sex of HIV-negative gay men is noteworthy and is increasing in Sydney, Australia.** *AIDS* 2006; 20(8):1204-1206.
6. Zablotska IB, Imrie J, Prestage G, Crawford J, Rawstorne P, Grulich A, et al. **Gay men's current practice of HIV seroconcordant unprotected anal intercourse: serosorting or seroguessing?** *AIDS Care* 2009; 21(4):501-510.
7. Butler DM, Smith DM. **Serosorting can potentially increase HIV transmissions.** *AIDS* 2007; 21(9):1218-1220.
8. Wilson DP, Regan DG, Heymer KJ, Jin F, Prestage GP, Grulich AE. **Serosorting may increase the risk of HIV acquisition among men who have sex with men.** *Sex Transm Dis* 2010; 37(1):13-17.
9. Siconolfi DE, Moeller RW. **Serosorting.** *BETA* 2007; 19(2):45-49.
10. Philip SS, Yu X, Donnell D, Vittinghoff E, Buchbinder S. **Serosorting is associated with a decreased risk of HIV seroconversion in the EXPLORE Study Cohort.** *PLoS One* 2010; 5(9).
11. 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(2):167-173.
12. de Wit JB, van den Hoek JA, Sandfort TG, van Griensven GJ. **Increase in unprotected anogenital intercourse among homosexual men.** *Am J Public Health* 1993; 83(10):1451-1453.
13. van Griensven GJ, Tielman RA, Goudsmit J, van der NJ, de WF, de Vroome EM, et al. **Risk factors and prevalence of HIV antibodies in homosexual men in the Netherlands.** *Am J Epidemiol* 1987; 125(6):1048-1057.
14. Jansen IA, Geskus RB, Davidovich U, Jurriaans S, Coutinho RA, Prins M, et al. **Ongoing HIV-1 transmission among men who have sex with men in Amsterdam: a 25-year prospective cohort study.** *AIDS* 2011; 25(4):493-501.
15. Przybyla SM, Golin CE, Widman L, Grodensky CA, Earp JA, Suchindran C. **Serostatus disclosure to sexual partners among people living with HIV: examining the roles of partner characteristics and stigma.** *AIDS Care* 2013; 25(5):566-572.
16. Van Empelen P, Van Berkel M, Roos E, Zuillhof W. **Schorer Monitor 2011.** Amsterdam: Schorer Stichting; 2010.
17. Van Sighem A, Smit C, Holman R, Gras I, Stolte I, Bezemer D, et al. **Monitoring report 2012. Monitoring of human immunodeficiency virus (HIV) infection in the Netherlands.** Amsterdam: Stichting HIV Monitoring; 2012.

18. Vallabhaneni S, Li X, Vittinghoff E, Donnell D, Pilcher CD, Buchbinder SP. **Seroadaptive practices: association with HIV acquisition among HIV-negative men who have sex with men.** *PLoS One* 2012; 7(10):e45718.
19. Velter A, Bouyssou-Michel A, Arnaud A, Semaille C. **Do men who have sex with men use serosorting with casual partners in France? Results of a nationwide survey (ANRS-EN17-Pressé Gay 2004).** *Euro Surveill* 2009; 14(47).
20. Snowden JM, Raymond HF, McFarland W. **Seroadaptive behaviours among men who have sex with men in San Francisco: the situation in 2008.** *Sex Transm Infect* 2011; 87(2):162-164.
21. Dubois-Arber F, Jeannin A, Locicero S, Balthasar H. **Risk reduction practices in men who have sex with men in Switzerland: serosorting, strategic positioning, and withdrawal before ejaculation.** *Arch Sex Behav* 2012; 41(5):1263-1272.
22. Golden MR, Stekler J, Hughes JP, Wood RW. **HIV serosorting in men who have sex with men: is it safe?** *J Acquir Immune Defic Syndr* 2008; 49(2):212-218.



2.2

Undetectable viral load and the decision to engage in unprotected anal intercourse among HIV-positive MSM

Wijnand van den Boom, Ineke G Stolte, Robert Witlox, Theo Sandfort, Maria Prins & Udi Davidovich

AIDS Behav. 2013; 17(6):2136-42

ABSTRACT

We investigated how often HIV-positive MSM (n=177) decide to engage in unprotected anal intercourse (UAI) because they have an undetectable viral load (UVL). We found that 20-57% of the UAI acts were related to having UVL, varying by partner type and partner HIV status. Among HIV-seroconcordant partners, consideration of UVL before engaging in UAI was more prevalent with sex buddies (55%) than with casual partners (20%), although marginally significant ($p=0.051$). Among HIV-serodiscordant partners, no significant difference was found in the frequency of UVL considerations before engaging in UAI: 40% with sex buddies versus 57% with casual partners. Interestingly, while the decision to engage in UAI based on UVL was frequently discussed with HIV-seroconcordant partners (>91%), it was only discussed with HIV-serodiscordant partners in 13-25% of the UAI cases (according to partner type), suggesting that the decision was mostly unilateral.

INTRODUCTION

Studies conducted since the introduction of combination antiretroviral therapy (cART) indicate that some men who have sex with men (MSM) perceive that having an undetectable HIV load reduces the risk of HIV transmission [1-3]. Other studies reported that MSM were more likely to engage in unprotected anal intercourse (UAI) with their HIV-positive regular partner when they believed he had an undetectable rather than a detectable viral load [4, 5].

In 2008, the Swiss National AIDS Commission was the first to take a clear stance on the relationship between viral load and infectiousness and declared that sexual transmission of HIV is very unlikely within a monogamous HIV-serodiscordant relationship under the following conditions: the HIV-positive individual has an undetectable viral load (i.e., HIV RNA <40 copies/ml), receives effective cART, tests regularly for viral load, and has no other sexually transmitted infection [6]. This statement was primarily based on data regarding vaginal sex among heterosexual steady couples. While the implications of the Swiss statement for MSM could be significant, relatively little is still known of the extent to which HIV-positive MSM base their decision to engage in UAI on the knowledge that their viral load is undetectable.

The purpose of this study was to investigate how often the decision to engage in UAI with casual partners is based on knowledge of undetectable viral load (UVL) among HIV-positive MSM in the Netherlands. We distinguished between HIV-positive and HIV-negative sex partners because we assume that the consideration of UVL could have different underlying motivations related to the partner's HIV status. With HIV-positive partners, consideration of UVL could be, for example, related to the perception of men that the risk for becoming super-infected with an additional (resistant) HIV strain is lower [7, 8]. With HIV-negative partners, having an UVL when engaging in UAI could be perceived as a condition in which the risk of transmitting the virus to the negative partner is negligible. Furthermore, we chose to investigate two different sex partner types (i.e., casual partner versus sex buddy) as they have been shown to be associated with different risk behavior patterns in the past [9]: MSM were more likely to engage in serosorting (i.e., having unprotected sex only with HIV-seroconcordant partners) with sex buddies than with casual sex partners. This was understood as a consequence of increased familiarity with the sex partner, which could facilitate serosorting negotiations. We wanted to examine whether a similar pattern will exist in our study: men will engage in UAI more often with sex buddies than casual partners when having UVL, presumably because of the facilitating effect of familiarity with the sex partner on discussing such a matter. Therefore, among those who engaged in UAI based on the consideration of UVL, we additionally examined how often this decision was discussed in advance by both sex partners. Finally, we studied the association between perceived protective value of UVL against transmission of HIV and the decision to engage in UAI based on viral load knowledge.

METHODS

Procedure and study sample

In early 2010, all members of an open online panel of the Dutch HIV Association were invited by e-mail to participate in a cross-sectional study by filling out an online questionnaire. People can register for the panel via the Association's website. Requirements for participation in the panel are: (1) being 16 years or older, (2) being HIV-positive or directly involved with someone who is HIV-positive, and (3) living in the Netherlands. The panel is contacted on a regular basis to ask for opinions on different topics relevant for people living with HIV and for participation in research, and consists of 517 HIV-positive men and women. Only HIV-positive men were invited to participate in this study.

In total, 212 HIV-positive men filled out our questionnaire and all reported having had sex with men. Of these men, self-reported viral load was undetectable in 177 (83%), detectable in 31 (15%), and unknown in 4 (2%) cases. As our primary interest was to study the consideration of UVL in the decision to engage in UAI, we included only those men with an UVL, resulting in a study sample of 177 HIV-positive MSM.

Measures

We measured general characteristics, sexual behavior, the consideration of UVL in the decision to engage in UAI and the discussion thereof with the partner, knowledge of the participant's and partner's viral load level, and risk perceptions.

Sample characteristics

We measured the participants' age, nationality (Dutch versus non-Dutch), use of cART (yes/no), and level of education. Educational level was considered high with completion of higher vocational education or university, and middle to low with completion of secondary vocational education, high school, basic vocational education or primary school.

Type of sex partner

We distinguished two types of sex partners: casual (defined as 'someone you have met by chance and had sex with') and sex buddy (defined as 'someone you regularly contact in order to have sex with').

Unprotected anal intercourse (UAI)

We defined UAI as never or not always using condoms during insertive anal intercourse and/or receptive anal intercourse. If participants reported any incident of anal intercourse (insertive and/or receptive) in the preceding six months, they were asked about the frequency of condom use for those incidents (measured on a 5-point scale ranging from 'never' to 'always'). Participants who reported UAI were asked in more detail about the last time UAI occurred and the type of sex partner it occurred with.

HIV & viral load status of the partner

Participants were asked whether they knew the sex partner's HIV status (positive/negative/unknown) before engaging in UAI. Regarding HIV-positive partners, participants were asked whether they knew the partner's viral load level (undetectable/detectable/unknown) before they engaged in sex. Partners for whom status was reportedly negative or unknown will be henceforth referred to as '(potentially) HIV-negative'. The participants were also asked whether their partners knew the viral load status of the participant (yes/no).

Consideration of UVL in the decision to engage in UAI

We defined the consideration of UVL in deciding to engage in UAI as follows: (1) the decision made by the participant to have UAI with another HIV-positive man because that person's viral load was undetectable, or (2) the decision made by the HIV-positive participant to have UAI with a (potentially) HIV-negative man because the HIV-positive participant's viral load was undetectable. In case of UAI with an HIV-positive partner, we asked, "Did you decide to have anal intercourse without a condom with this [infected] partner because you knew that *his* viral load was undetectable?" (yes/no). In case of UAI with a (potentially) HIV-negative partner, we asked, "Did you decide to have anal intercourse without a condom with this [uninfected] partner because you knew that your *own* viral load was undetectable?" (yes/no). We measured the consideration of UVL, (1) ever since HIV diagnosis; and (2) during the last UAI contact (with either a casual partner or a sex buddy).

The discussion of the decision to engage in UAI based on an UVL

If participants reported they had considered their own or their partner's UVL in the decision to engage in UAI, they were asked whether they had discussed this with their partner before the engagement in UAI (yes/no).

Perceived protective value of UVL

Participants evaluated the risk of HIV transmission in two different sexual scenarios in which two partners decide against condom use based on their viral load knowledge. The first scenario involved UAI between two HIV-positive partners who both had UVL levels, and the second one involved UAI between an HIV-positive man with UVL level and an HIV-negative partner. For each scenario, participants rated the perceived protective value of having UVL on a 7-point scale ranging from (1) 'absolutely no risk' to (7) 'absolute risk'. Responses were dichotomized as: 'no to low risk' (values 1-2) and 'moderate to absolute risk' (values 3-7).

Statistical analyses

We first described the characteristics of the study population: demographics, the perceived protective value of UVL, the proportions of UAI per sex partner type, and the proportion of men who ever considered their UVL in the decision to engage in UAI since HIV diagnosis. We then described how often men considered their UVL in the decision to engage in their most recent UAI incident with HIV-positive and HIV-negative casual partners and/or sex buddies and

whether they discussed UVL considerations with these partners. The modified Wald method was used to compute 95% confidence intervals for the proportions of consideration of UVL [10].

Logistic regression analyses were used to explore whether the consideration of UVL in the decision to engage in UAI was associated with type of sex partner and perceived protective value of UVL. The logistic regression analyses included only those men who reported UAI during their last contact with a casual partner or a sex buddy ($n=73$). Two models were tested using the consideration of UVL as the dependent variable: one for HIV-positive partners and one for (potentially) HIV-negative partners, with the type of sex partner as the main determinant of interest. Nationality and educational level were included in order to explore whether these demographic factors might also have influenced the consideration of UVL in the decision to engage in UAI.

Since we had limited power, we chose to include only those covariates in the final multivariate model that were univariately associated with the consideration of UVL at $p<0.10$. As age was considered a potential confounder, it was always included in the final model. Our two main determinants, type of sex partner and perceived protective value of UVL, were forced into the final model to allow for comparability between the two models.

All analyses were performed with the SPSS 18 statistical package (SPSS Inc., Chicago, IL, USA).

RESULTS

The median age of the participants was 48 (IQR=42–55); 91% (161/177) had a Dutch nationality; 99% (175/177) of the participants used cART; 60.5% (107/177) had high educational levels and 39.5% (70/177) had middle to low educational levels; the median score of the perceived protective value of UVL regarding UAI between two HIV-positive partners who both had UVL levels was 2 (IQR=2–4); the median score of the perceived protective value of UVL regarding UAI between an HIV-positive man with UVL level and an HIV-negative partner was 3 (IQR=2–5) (Table 1). Of the participants who had practiced UAI with a casual partner in the preceding 6 months, 64% (43/67) also had their last UAI contact with this type of sex partner. Of the participants who had UAI with a sex buddy in the preceding 6 months, 58% (30/52) also had their last UAI contact with this type of sex partner. In total, 73 men had had their most recent UAI contact in the preceding 6 months with either a casual sex partner or a sex buddy.

Consideration of UVL in the decision to engage in UAI since HIV diagnosis

A majority of the participants (68%; 120/177) reported having UAI at least once since being diagnosed HIV-positive (Table 1). Of those, 63% (75/120) had ever considered UVL in the decision to engage in UAI with either HIV-positive or (potentially) HIV-negative partners; 44% (53/120) with an HIV-positive partner, and 38% (46/120) with a (potentially) HIV-negative partner.

Table 1. General characteristics, consideration of UVL since HIV diagnosis, and proportions of UAI with two types of sex partners among 177 HIV-positive MSM with an undetectable viral load, 2010.

	N	%
Total sample size	177	
Age (median; IQR)	48 (42-55)	
Nationality		
Dutch	161	91.0
Non-Dutch	16	9.0
cART		
Yes	175	98.9
No	2	1.1
Educational level		
High	107	60.5
Middle & Low	70	39.5
Perceived protective value of UVL (median; IQR)		
UAI between two HIV-positive partners with UVL levels	2 (2-4)	
UAI between an HIV-positive man with UVL level and an HIV-negative partner	3 (2-5)	
Ever had UAI since HIV diagnosis	120/177	67.8
Consideration of UVL with partners of any HIV status	75/120	62.5
Consideration of UVL with an HIV-positive partner	53/120	44.2
Consideration of UVL with an HIV-negative or status unknown partner	46/120	38.2
Insertive and/or receptive anal intercourse with a casual partner in the preceding six months	79/177	44.6
Unprotected	67/79	84.4
Last UAI contact was with a casual partner	43/67	64.2
Insertive and/or receptive anal intercourse with a sex buddy in the preceding six months	63/177	35.6
Unprotected	52/63	82.5
Last UAI contact was with a sex buddy	30/52	57.7

IQR=inter quartile range; cART=combination antiretroviral therapy; UAI=Unprotected Anal Intercourse; UVL=undetectable viral load

Consideration of UVL during the last UAI contact according to partner's HIV status and type of sex partner

Among participants who had UAI with an HIV-positive partner (n=35), 20% (3/15) considered their partner's UVL in the decision to engage in UAI with a casual partner and 55% (11/20) with a sex buddy (figure 1). Among participants who had UAI with a (potentially) HIV-negative partner (n=38), 57% (16/28) considered their own UVL in the decision to engage in UAI with a casual partner and 40% (4/10) with a sex buddy.

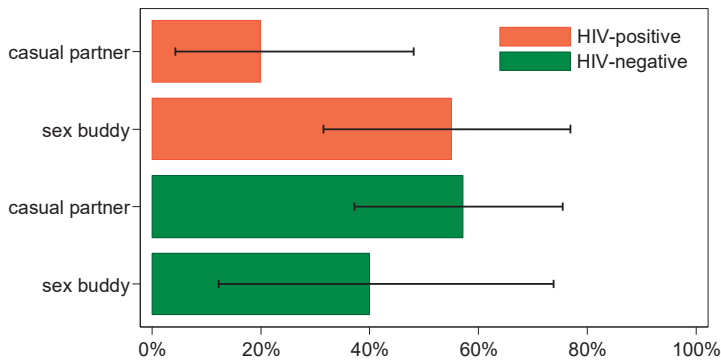


Figure 1. Proportions of consideration of undetectable viral load (UVL) among 73 HIV-positive MSM engaging in UAI, according to partner's HIV status and partner type, 2010.

UAI=unprotected anal intercourse; Note. Error bars represent 95% confidence intervals.

The discussion of the decision to engage in UAI based on an UVL and viral load knowledge

Among the participants who had considered UVL in the decision to engage in UAI with an HIV-positive partner, 100% (3/3) had discussed this with a casual partner and 91% (10/11) with a sex buddy. Accordingly, knowledge of the partner's UVL was reported by 100% (3/3) of the participants with a casual partner and by 91% (10/11) of the participants with a sex buddy. Among the participants who had considered UVL in the decision to engage in UAI with a (potentially) HIV-negative partner, only 13% (2/16) had discussed this with the casual partner and 25% (1/4) with the sex buddy. The partner's knowledge of the participant's UVL was reported by 25% (4/16) of the participants with a casual partner and by 50% (2/4) of the participants with a sex buddy.

Association between type of sex partner and consideration of UVL during the last UAI contact

Univariate analyses revealed that only type of sex partner and perceived protective value of UVL were associated with the consideration of UVL at $p < 0.10$, for HIV-positive and HIV-negative partners, respectively. Multivariate analyses (see Table 2) revealed that for sex with HIV-positive partners, type of partner was (marginally) significantly associated with the consideration of UVL: men were more likely to consider their partner's UVL in the decision to engage in UAI with a sex buddy than with a casual partner (OR=5.02; 95%CI=0.99–25.31; $p=0.051$). For (potentially) HIV-negative partners, only perceived protective value of UVL was significantly associated with the consideration of UVL: men who perceived having UVL to be less protective were less likely to consider UVL in the decision to engage in UAI (OR=0.23; 95%CI=0.06–0.96; $p=0.044$).

Table 2. Multivariate determinants of the consideration of UVL among 73 MSM who had had UAI during the last contact with either an HIV-positive or a (potentially) HIV-negative casual partner or an HIV-positive or a (potentially) HIV-negative sex buddy, 2010.

	HIV-positive partner			(potentially) HIV-negative partner		
	n/N (%)	OR _{adj} (95%CI)	p-value	n/N (%)	OR _{adj} (95%CI)	p-value
Type of sex partner						
Casual partner	3/15 (20%)	1	0.051	16/28 (57%)	1	0.170
Sex Buddy	11/20 (55%)	5.02 (0.99–25.31)		4/10 (40%)	0.28 (0.05–1.73)	
Age (per 10 years increment)		1.15 (0.94–1.42)	0.170		1.08 (0.92–1.28)	0.346
Perceived protective value of UVL against HIV transmission						
HIV-positive partners						
No to low risk	12/28 (43%)	1	0.764			
Moderate to absolute risk	2/7 (29%)	0.74 (0.10–5.42)				
(potentially) HIV-negative partners						
No to low risk				14/21 (67%)	1	0.044
Moderate to absolute risk				6/17 (35%)	0.23 (0.06–0.96)	

OR=odds ratio; *adj*=adjusted; 95%CI=95% Confidence Interval; UVL=undetectable viral load

DISCUSSION

In our sample of HIV-positive MSM, we found relatively high proportions of men who considered their own and their HIV-positive partner's current UVL in the decision to engage in UAI with various types of sex partners.

We found that men considered their partner's UVL before engaging in UAI more often with HIV-positive sex buddies than with HIV-positive casual partners. It could be that for men to engage in UAI based on UVL knowledge they need to disclose their viral load status and discuss such a relative complex issue with their sex partners. Knowing the sex partner well can facilitate such disclosure and discussion.

On the other hand, among the HIV-positive participants who had UAI with a (potentially) HIV-negative partner, the consideration of one's UVL was not related to partner type. The relatively high proportions of men who considered their UVL with (potentially) HIV-negative partners raise the question whether the viral load status was shared with the (potentially) HIV-negative partners and whether the latter have participated in the decision to engage in UAI based on the UVL of their partner. We have shown that only a small number of the (potentially) HIV-negative partners knew the participants' UVL status before engaging in UAI, and even a smaller number discussed the decision to engage in UAI based on their UVL levels. This suggests that the decision to engage in UAI based on the UVL status was mostly a unilateral

decision taken by our participants and was not mutually discussed in advance. Discussion of viral load levels with the (potentially) HIV-negative partner would require to disclose the positive HIV status, a known barrier because of possible stigma and fear of rejection [11]. In addition, if HIV-positive men disclose their status, they might prefer to avoid viral load information as a too complex subject to discuss because their (potentially) HIV-negative partners might be unaware of viral load issues. Since we collected data only from the HIV-positive participants, future investigations should include the perspectives of HIV-negative MSM in the communication around UVL and UAI.

As for the perceived protective value of UVL, this perception had a significant effect only with respect to UAI with (potentially) HIV-negative partners. If men believed an undetectable viral load would prevent infection during UAI, they were more likely to engage in UAI. The lack of such an association when deciding to engage in UAI with HIV-positive partners might raise the question why HIV-positive men choose to consider UVL when engaging in UAI with HIV-seroconcordant partners and what the perceived added value of such a strategy is in their view. Further qualitative studies should shed more light on this question.

Some limitations of our study should be noticed. We obtained data only from MSM participating in an ongoing online panel of the Dutch HIV Association. As our panel is a self-selected group of people it may not be representative of other HIV-positive MSM in the Netherlands. Also, as our data on viral load and sexual risk behavior are self-reported, they may be skewed by social desirability. Furthermore, differences in proportions of consideration of UVL between types of (potentially) HIV-negative partners were not statistically significant, probably due to limited power. However, with a larger sample this effect could have been significant and therefore we suggest to repeat this study with a larger sample to be able to confirm our results.

For future research, we recommend to study in more detail the conditions under which MSM consider UVL in the decision to engage in UAI. For example, the Swiss National AIDS Commission stated that having an UVL can potentially eliminate the risk of HIV infection if certain other conditions (e.g., no concurrent STI) are also fulfilled [6]. Whether our participants considered such conditions was not studied here. In addition, other limitations to the consideration of UVL as a risk-reduction strategy also exist. For example, the viral load level in blood is not always perfectly associated with load levels in semen, especially in concurrence with other STI [12, 13]. Therefore, when appraising their own levels of infectiousness, HIV-positive MSM who engage in insertive UAI cannot completely rely on measurements of the viral load levels in their blood. Furthermore, the Swiss statement is supported by studies among heterosexuals (i.e., vaginal transmission route) [14, 15], but evidence for its validity for MSM (i.e., the anal transmission route) is still lacking. It is therefore necessary that clear clinical and epidemiological evidence will be provided that supports the assumed protective value of having UVL against anal transmission of HIV among MSM. HIV prevention campaigners need

such evidence to take an informed stance in the debate around viral load considerations and urgently so, in the light of the already frequent use by MSM.

FUNDING

This study was supported by the Aidsfonds, project number 2008025. Dr. Sandfort's contribution was supported by NIH Center Grant P30-MH43520.

REFERENCES

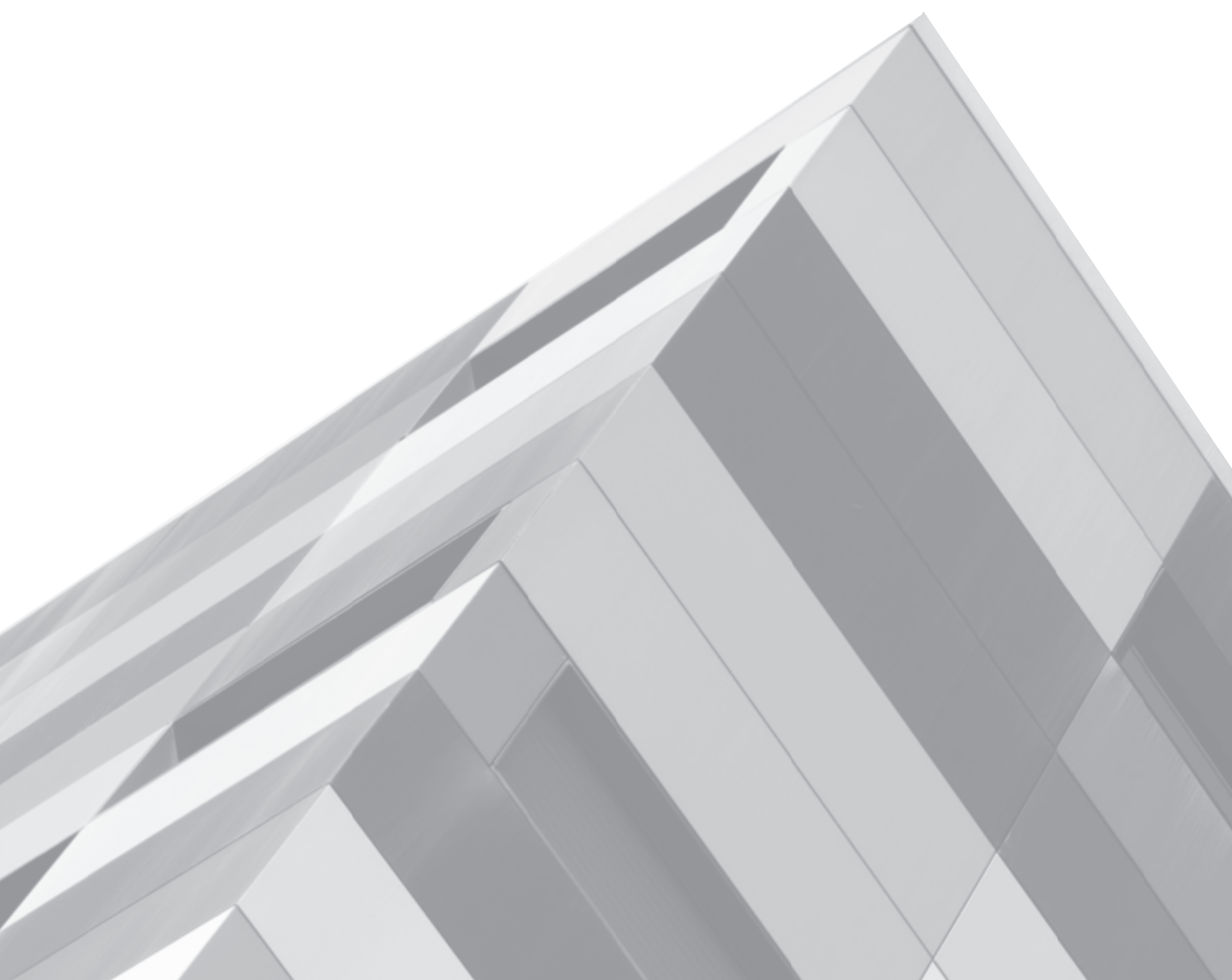
1. Kalichman SC, Nachimson D, Cherry C, Williams E. **AIDS treatment advances and behavioral prevention setbacks: preliminary assessment of reduced perceived threat of HIV-AIDS.** *Health Psychol* 1998; 17(6):546-550.
2. Suarez TP, Kelly JA, Pinkerton SD, Stevenson YL, Hayat M, Smith MD, et al. **Influence of a partner's HIV serostatus, use of highly active antiretroviral therapy, and viral load on perceptions of sexual risk behavior in a community sample of men who have sex with men.** *J Acquir Immune Defic Syndr* 2001; 28(5):471-477.
3. Venable PA, Ostrow DG, McKirnan DJ, Taywaditep KJ, Hope BA. **Impact of combination therapies on HIV risk perceptions and sexual risk among HIV-positive and HIV-negative gay and bisexual men.** *Health Psychol* 2000; 19(2):134-145.
4. Prestage G, Mao L, Kippax S, Jin F, Hurlley M, Grulich A, et al. **Use of viral load to negotiate condom use among gay men in Sydney, Australia.** *AIDS Behav* 2009; 13(4):645-651.
5. Van de Ven P, Mao L, Fogarty A, Rawstorne P, Crawford J, Prestage G, et al. **Undetectable viral load is associated with sexual risk taking in HIV serodiscordant gay couples in Sydney.** *AIDS* 2005; 19(2):179-184.
6. Vernazza P, Hirschel B, Bernasconi E, Flepp M. **Les personnes séropositives nesouffrant d'aucune autre MST et suivant un traitement antirétroviral efficace ne transmettent pas le VIH par voie sexuelle.** *Bull Med Suisses* 2008; 89:165-169.
7. Bourne A, Dodds C, Weatherburn P, Keogh P. **Perceptions of superinfection risk among gay men with diagnosed HIV who have unprotected anal intercourse.** *Int J STD AIDS* 2011; 22(4):190-193.
8. Poudel KC, Poudel-Tandukar K, Yasuoka J, Jimba M. **HIV superinfection: another reason to avoid serosorting practice.** *Lancet* 2007; 370(9581):23.
9. 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(2):167-173.
10. Agresti A, Coull B. **Approximate is better than 'exact' for interval estimation of binomial proportions.** *The Am Stat* 1998; 52:119-126.
11. Przybyla SM, Golin CE, Widman L, Grodensky CA, Earp JA, Suchindran C. **Serostatus disclosure to sexual partners among people living with HIV: examining the roles of partner characteristics and stigma.** *AIDS Care* 2013; 25(5):566-572.
12. Kalichman SC, Cage M, Barnett T, Tharnish P, Rompa D, Austin J, et al. **Human immunodeficiency virus in semen and plasma: investigation of sexual transmission risk behavioral correlates.** *AIDS Res Hum Retroviruses* 2001; 17(18):1695-1703.
13. Politch JA, Mayer KH, Welles SL, O'Brien WX, Xu C, Bowman FP, et al. **Highly active antiretroviral therapy does not completely suppress HIV in semen of sexually active HIV-infected men who have sex with men.** *AIDS* 2012; 26(12):1535-1543.
14. Quinn TC, Wawer MJ, Sewankambo N, Serwadda D, Li C, Wabwire-Mangen F, et al. **Viral load and heterosexual transmission of human immunodeficiency virus type 1. Rakai Project Study Group.** *N Engl J Med* 2000; 342(13):921-929.
15. Reynolds SJ, Makumbi F, Nakigozi G, Kagaayi J, Gray RH, Wawer M, et al. **HIV-1 transmission among HIV-1 discordant couples before and after the introduction of antiretroviral therapy.** *AIDS* 2011; 25(4):473-477.



Chapter 3

Risk settings & sexual behavior





3.1

Serosorting and sexual risk behavior according to different casual partnership types among MSM: The study of one-night stands and sex buddies

Wijnand van den Boom, Ineke G Stolte, Theo Sandfort & Udi Davidovich

AIDS Care. 2012; 24(2):167-73

ABSTRACT

Background

Among HIV-negative men who have sex with men (MSM), any incident of unprotected anal intercourse (UAI) between casual partners is usually regarded as risky for HIV transmission. However, men are increasingly using knowledge of their casual partner's HIV status to reduce HIV risk during UAI (i.e., serosorting). Since familiarity between casual partners may lead to higher levels of UAI and serosorting, we examined how often men have UAI and practice serosorting with three types of casual partnerships that differ in their degree of familiarity.

Methods

We included 240 HIV-negative men of the Amsterdam Cohort Study among MSM. We distinguished three types of casual partnerships: one-night stand ('met by chance and had sex only once'); multiple-time casual partner ('met and had sex with several times'); and the 'regular' casual partner ('sex buddy'). Serosorting was defined as UAI with an HIV-seroconcordant partner. Generalised estimating equations analyses were used to examine the association between type of casual partnership and sexual risk behavior.

Results

Analyses revealed that men with a sex buddy were more likely to have UAI than men with a one-night stand (OR[95%CI] 2.39 [1.39–4.09]). However, men with a sex buddy were also more likely to practice serosorting than men with a one-night stand (OR[95%CI] 5.20 [1.20–22.52]).

Discussion

Men with a sex buddy had more UAI but also reported more serosorting than men with a one-night stand. As a result, the proportion of UAI without serosorting is lower for men with a sex buddy, and therefore men might have less UAI at risk for HIV with this partner type. However, the protective value of serosorting with a sex buddy against HIV transmission needs to be further established. At this time, we suggest that a distinction between the one-night stand and the sex buddy should be incorporated in future studies as men behave significantly different with the two partner types.

INTRODUCTION

In the study of sexual risk behavior among HIV-negative men who have sex with men (MSM), any incident of unprotected anal intercourse (UAI) with a casual partner is usually regarded as risky for HIV transmission. This is based on the assumption that men could have little to no valid knowledge of that partner's HIV status.

However, within steady partner relationships not every incident of UAI is considered to be risky since men can practice negotiated safety (NS). NS refers to the situation in which both partners have been tested HIV-negative, make agreements about being monogamous or having only protected anal intercourse outside their relationship, and agree to warn the partner if such agreements were violated [1-3]. UAI that is practiced in full compliance with the conditions of NS can be considered as low-risk behavior for HIV transmission [2, 4, 5].

With a casual partner, NS is more difficult to practice. Some studies suggest, however, that men are increasingly using knowledge of a casual partner's HIV status to reduce risk of HIV transmission during UAI, a strategy commonly referred to as serosorting [6, 7]. In order to successfully practice serosorting, casual partners need to disclose their true HIV status to each other and have trust in that disclosure, which may come about as the result of some level of acquaintance or familiarity [8]. At the same time, familiarity between casual partners can also lead to the decision to engage in UAI, independent of HIV seroconcordance [9]. Following these rationales, it is very likely that the more familiar a casual partner is, the more likely men will engage in UAI as well as in some level of serosorting.

Therefore, it is meaningful to explore whether distinguishing types of casual partnerships, based on a familiarity gradation, results in different risk behavior. We distinguished three types of casual partnerships: (1) the one-night stand ('met by chance and had sex with only once'); (2) the multiple-time casual partner ('met and had sex with on several occasions'), and (3) the 'regular' casual partner ('sex buddy').

We examined the hypothesis that the more familiar a casual partner is, the more likely anal sex will be unprotected, and the more likely men will tend to practice serosorting with that partner. Unlike previous studies that established serosorting practices through post hoc HIV concordance measurements, we established serosorting through measuring HIV disclosure that took place prior to, and was the reason for, engagement in UAI.

METHODS

Sample

We used cross-sectional data from one wave (2007) of the Amsterdam Cohort Study (ACS) among MSM [10, 11]. During their bi-annual visits, men fill out psychosocial and behavioral questionnaires and are tested for HIV-1. The data wave included a total of 461 HIV-negative men. The median age was 35 years (IQR=31–39); 90% were native Dutch; 75% had high educational levels (completed higher vocational education or university), 20% had middle educational levels (completed secondary vocational education or high school), and 5% had low educational levels (completed basic vocational education or primary school). On a seven-point Kinsey scale ranging from exclusively heterosexual (1) to exclusively homosexual (7), the median sexual preference score was 7 (IQR=7–7). For the present study, only those men who had anal intercourse and provided full data on condom use during anal intercourse with one or more of the three casual partner types in the preceding 6 months were included (N=240). No significant differences regarding any of the demographics described earlier were found between the participants who qualified for inclusion and those who were excluded due to missing data on condom use (N=14).

Measures

Type of casual partnership

In the assessment of sexual behavior, participants were provided with descriptions of three types of casual partnerships: (1) one-night stand ('someone you have met by chance and had sex with only once'), (2) multiple-time casual partner ('someone you have met by chance on several occasions and had sex with on these occasions'), and (3) sex buddy ('someone you intentionally contact on a regular basis to have sex with').

Unprotected Anal Intercourse (UAI)

Participants were asked whether they had had sex with one or more types of casual partners in the preceding 6 months (yes/no), and if so, whether they had had insertive and/or receptive anal intercourse with these partners (yes/no). If the men reported any anal intercourse with a casual partner, they were asked how often they had used condoms with that partner (ranging on a 5-point scale from 'never' to 'always'). We defined UAI as no or inconsistent condom use during insertive and/or receptive anal intercourse.

Serosorting

Participants who reported to have had UAI with a casual partner were subsequently asked whether they had had UAI with a casual partner because they knew that his HIV status was negative before they had anal intercourse (yes/no). If participants responded 'yes', this was considered as a case of 'UAI with serosorting' (taking into account that all our participants themselves were reported HIV-negative at the time of measurement). In addition, participants were subsequently asked whether they had had UAI with a casual partner because they knew that his HIV status was positive before they had anal intercourse (yes/no), and whether

they had had UAI with a casual partner because they did not know his HIV status before they had anal intercourse (yes/no). If participants responded 'yes' to either one or both questions, this was considered as a case of 'UAI without serosorting', indicating 'at risk for HIV'.

Number of casual partners

If participants reported that they had had anal intercourse with one or several different types of casual partners, they were asked about the number of men they had anal intercourse with for each casual partner type. We summed the number of men reported for each casual partner type to get overall numbers of casual partners for each participant.

HIV status

Participant's actual HIV-1 status was obtained by testing for HIV-1 antibodies, using two commercially available enzyme-linked immunosorbent assays (AxSYM; Abbot Laboratories, North Chicago, IL, USA; Vironostika, Organon Teknika, Boxtel, the Netherlands). Seroconversion was confirmed by Western blot analysis. In addition, participants were asked to report whether they knew their own HIV status. For all participants, self-reported HIV status was fully corroborated by the results of the actual HIV tests typically obtained 2 weeks after data collection.

Educational level

Participants were asked about their highest level of completed education. Educational level was categorized into two categories; 'High' (completed higher vocational education or university) and 'Middle & Low' (completed secondary vocational education, high school, basic vocational education, or primary school).

Statistical analyses

We used descriptive statistics for the proportions of UAI and the proportions of serosorting with the three different types of casual partnerships. Univariate and multivariate logistic regression analyses were conducted to investigate the association between type of casual partnership and sexual risk behavior. Two separate models were constructed, one investigating the association between type of casual partnership and UAI, and one investigating the association between type of casual partnership and UAI with serosorting. We considered type of casual partnership, age, education, and number of casual partners as potential determinants. Only those variables with a univariate p value of less than 0.10 were included in the multivariate model. Model building was done using a stepwise backward procedure. Variables with a p value of less than 0.05 in the multivariate model were considered statistically significant and included in the final model. Our participants could report anal intercourse with up to a maximum of three different types of casual partners. To account for the fact that these reports might be dependent, we used generalized estimating equations (GEE), assuming an exchangeable covariance matrix to adjust for intra-individual correlations.

All analyses were performed with the SPSS 17 statistical package (SPSS Inc., Chicago, IL, USA).

RESULTS

Among the 240 MSM who reported anal intercourse with casual partners and were qualified for inclusion, 142 men (59%) reported anal intercourse with only one type of casual partner, 74 men (31%) reported anal intercourse with two types of casual partners, and 24 men (10%) reported anal intercourse with three types of casual partners (see figure 1). Among those who reported anal intercourse with one type of casual partner (n=142), the majority (78%) reported anal intercourse with a one-night stand, 21 (15%) reported anal intercourse with a multiple-time casual partner, and 10 (7%) reported anal intercourse with a sex buddy. Among those who reported anal intercourse with two types of casual partners (n=74), 47 (64%) reported anal intercourse with a one-night stand and a multiple-time casual partner, 24 (32%) reported anal intercourse with a one-night stand and a sex buddy, and 3 (4%) reported anal intercourse with a multiple-time casual partner and a sex buddy. Among those who reported anal intercourse with three types of casual partners (n=24), 6 (25%) reported anal intercourse with a one-night stand, a multiple-time casual partner, and a sex buddy, and 18 (75%) reported anal intercourse with a one-night stand, a multiple-time casual partner, and a sex buddy.

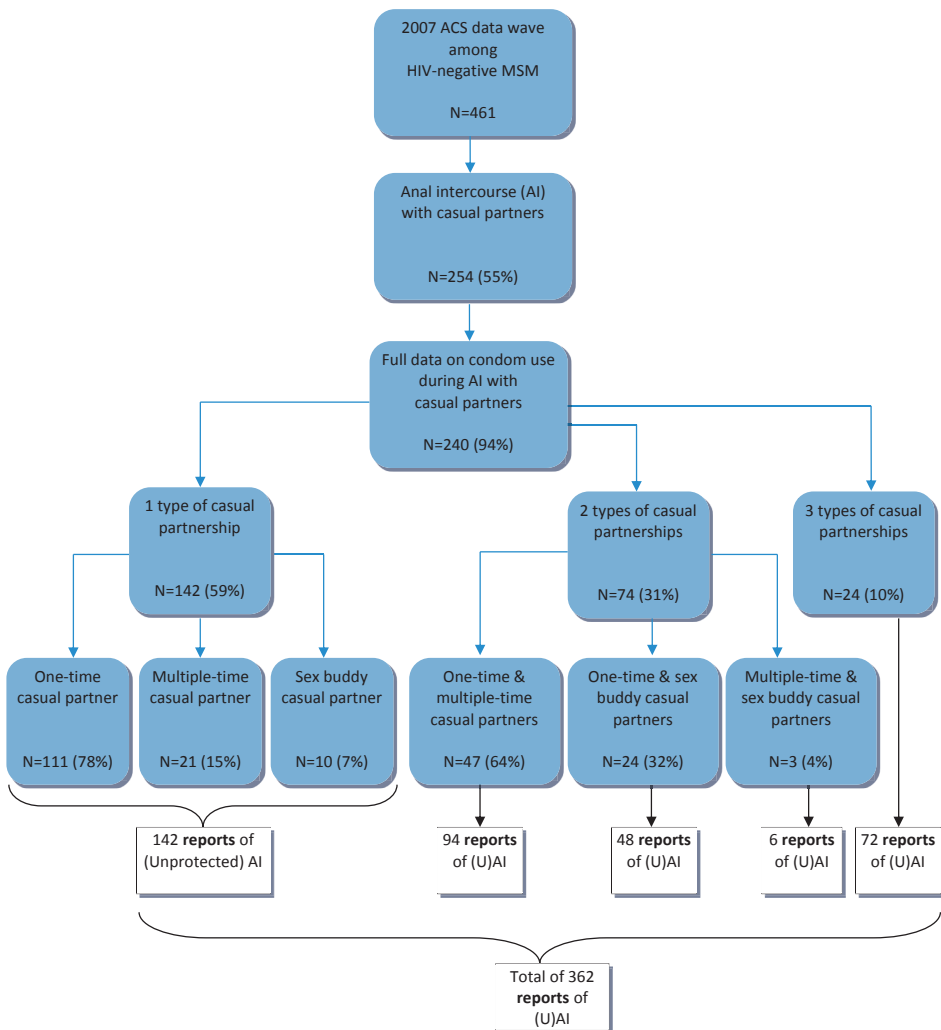


Figure 1. Working sample

reported anal intercourse with both one-night stands and multiple-time casual partners, 24 (32%) reported anal intercourse with both one-night stands and sex buddies, and 3 (4%) reported anal intercourse with both multiple-time casual partners and sex buddies. In total, this resulted in 362 reports of anal intercourse, of which 206 (57%) with one-night stands, 95 (26%) with multiple-time casual partners, and 61 (17%) with sex buddies.

The proportion of UAI was 19% (39/206) with a one-night stand, 20% (19/95) with a multiple-time casual partner, and 34% (21/61) with a sex buddy. In reports of UAI, the proportion of serosorting was 21% (8/39) with a one-night stand, 42% (8/19) with a multiple-time casual partner, and 52% (11/21) with a sex buddy.

Association between type of casual partnership and sexual risk behavior

Univariate analyses indicated that, with the exception of the type of casual partnership, none of the other variables examined, including age, educational level, and number of casual partners were significantly associated ($p < .10$) with either UAI or serosorting. Therefore, our final model included only the association between type of casual partnership and sexual risk behavior (Table 1). We found that men with a sex buddy were more likely to have had UAI than men with a one-night stand (OR[95%CI] 2.39 [1.39–4.09]). Men with a sex buddy were also more likely to have practiced serosorting than men with a one-night stand (OR[95%CI] 5.20 [1.20–22.52]). There was no difference in UAI or serosorting levels with a multiple-time casual partner as compared with the one-night stand and the sex buddy.

We did two additional analyses. First, we examined whether the type of casual partner or rather a participant's personal preference not to use condoms determined sexual risk behavior with a casual partner. In order to examine this, we selected those participants who had reported anal intercourse with all three types of casual partners in the preceding 6 months ($n=24$), and investigated differences in UAI between the three types of casual partners. If risk behavior is determined by a man's personal preference and not the casual partner type, one would expect that men behave consistently over the three types of partners, and therefore show no difference in sexual risk behavior between the partner types. On the other hand, if risk behavior is determined by the type of casual partner and not by a man's personal preference, one would expect that men behave differently with the three types of partners, resulting in differences in sexual risk behavior. We found that the same men were more likely to have had UAI with a sex buddy than with a one-night stand (OR[95%CI] 3.50 [1.23–9.92]). No serosorting was reported with a one-night stand (0%; 0/3), nor with a multiple-time casual partner (0%; 0/3); with a sex buddy, this proportion was 38% (3/8). Because the numbers were low, we did not test for associations.

Second, since there is a possible resemblance in the sexual circumstances (e.g., familiarity or trust) between a steady partner and a sex buddy, one might wonder whether these two types of partners actually yield different sexual risk patterns. The additional analysis indicated that

Table 1. Univariate associations between types of casual partnerships and sexual risk behavior among 240 MSM with 362 reports of anal intercourse, participating in the Amsterdam Cohort Study between July and December 2007.

	UAI			<i>p</i> value	Serosorting			<i>p</i> value
	N of UAI reports/ total N of reports	%	OR (95% CI)		N of serosorting reports/ total N of reports	%	OR (95% CI)	
Total	79/362	21.8			52/79	65.8		
Type of casual partnership								
One-time	39/206	18.9	1	<i>p</i> <.001	8/39	20.5	1	<i>p</i> <.05
Multiple-time	19/95	20.0	1.10 (.69–1.75)		8/19	42.1	1.11 (.53–2.33)	
Sex buddy	21/61	34.4	2.39 (1.39–4.09)		11/21	52.4	5.20 (1.20–22.52)	
Age (years)								
Less than 31	19/83	22.9	1	<i>p</i> =.98	8/19	42.1	1	<i>p</i> =.25
31-40	42/195	21.5	.93 (.48–1.79)		15/42	35.7	0.82 (.25–2.65)	
>41	18/84	21.4	1.01 (.44–2.33)		4/18	22.2	0.39 (.08–1.92)	
Educational level^a								
High	51/256	19.9	1	<i>p</i> =.29	15/51	29.4	1	<i>p</i> =.45
Middle & Low	27/101	26.7	1.40 (.75–2.63)		11/27	40.7	1.52 (.51–4.48)	
Number of casual partners								
			0.94 (.54–1.65)	<i>p</i> =.84			0.98 (.95–1.01)	<i>p</i> =.98

MSM=men who have sex with men; UAI=unprotected anal intercourse; OR=odds ratio; CI=confidence interval
^a Educational level: for UAI as outcome, five reports were missing; for serosorting as outcome, one record was missing.

men with a steady partner were more likely to have had UAI (OR[95%CI] 4.47 [2.56–7.81]) and were also more likely to have practiced serosorting (OR[95%CI] 6.68 [2.47–18.08]) than men with a sex buddy, indicating that men indeed behave differently with these two types of partners.

DISCUSSION

In our study we found, in line with our hypothesis, that men who had sex with a sex buddy were more likely to engage in UAI as well as in self-reported serosorting than men with a one-night stand. As a result, the proportion of UAI without self-reported serosorting (indicating at risk for HIV) is lower for men with a sex buddy. Therefore, one could argue that men with a sex buddy might have less UAI at risk for HIV than men with a one-night stand. This assumption, however, is reliant on the validity of the knowledge of the partner's HIV status. While men might know their sex buddy very well and might have various ways of validating what their partner has disclosed about his HIV status, it remains unclear whether that knowledge

is accurate. Therefore, HIV disclosure between sex buddies and to what extent it is a valid strategy in the protection against HIV transmission should be investigated. We need to know whether men directly discuss their sex buddy's HIV status, instead of relying on assumptions [12], a practice that has been coined as 'seroguessing' [13]. Furthermore, it is interesting to know whether an objective basis exists for the knowledge of the HIV status (e.g., a regular HIV test result or an on-the-spot home self-test result). If sex buddies disclose their HIV status to each other, it should be examined whether they directly disclose during their very first sexual contact or later on after several encounters. In addition, it is necessary to know with what frequency men revisit the validation of their sex buddy's HIV status as the sexual relationship progresses. Finally, it is important to establish whether men make agreements with a sex buddy concerning (unprotected) sex with other sexual partners as some men do with a steady partner. Making these agreements and complying with them is essential to guarantee the effectiveness of serosorting as an HIV risk reduction strategy [2, 3].

MSM seem to increasingly practice serosorting as a viable alternative for condoms as it offers many advantages over the latter, starting with increasing pleasure and achieving greater intimacy to avoiding criminal persecution and stigma [14]. These realities make it even more crucial to conduct a thorough investigation of serosorting practices to help us determine whether the high HIV transmission rates found between casual partners, for example in Amsterdam [15], are the result of serosorting or are simply the consequence of engaging in unbridled UAI.

As for the differences between the types of casual partnerships, the sex buddy type emerged in our data as a specific type of partner with its own sexual behavior patterns. First, we showed that the differences in sexual risk behavior between the different types of casual partnerships are indeed directly related to the type of casual partner men have sex with, rather than to what men's personal preferences are regarding condom use. In addition, we found that men also reported different sexual risk behavior with a steady partner than with a sex buddy. Men with a steady partner had more UAI but also had practiced more serosorting than men with a sex buddy.

In our study, the multiple-time casual partner did not yield different sexual risk patterns than the other two casual partnership types. Further research is needed to examine whether the multiple-time casual partner should still be treated as a separate type of casual partnership or rather should be merged with either the one-night stand or the sex buddy type.

Generalization of our results must be made cautiously. The men in our sample were highly educated, resided in the Amsterdam metropolitan area, and were strongly gay-identified [2]. However, behavioral outcomes from our cohort were found to be similar to those from other monitoring studies among MSM in the Netherlands [16].

In conclusion, we found that men with a sex buddy had higher levels of UAI but also higher levels of self-reported serosorting than men with a one-night stand. As a consequence, the proportion of UAI without serosorting is lower for men with a sex buddy than for men with a one-night stand. Therefore, men with a sex buddy might have less UAI at risk for HIV than men with a one-night stand. However, whether serosorting with a sex buddy has a protective value against HIV transmission needs further research. At this point though, based on our results, we do suggest that a distinction between the two types of casual partnerships, the one-night stand and the sex buddy, should be incorporated in future assessments of sexual risk for HIV among men with casual partners.

ACKNOWLEDGEMENTS

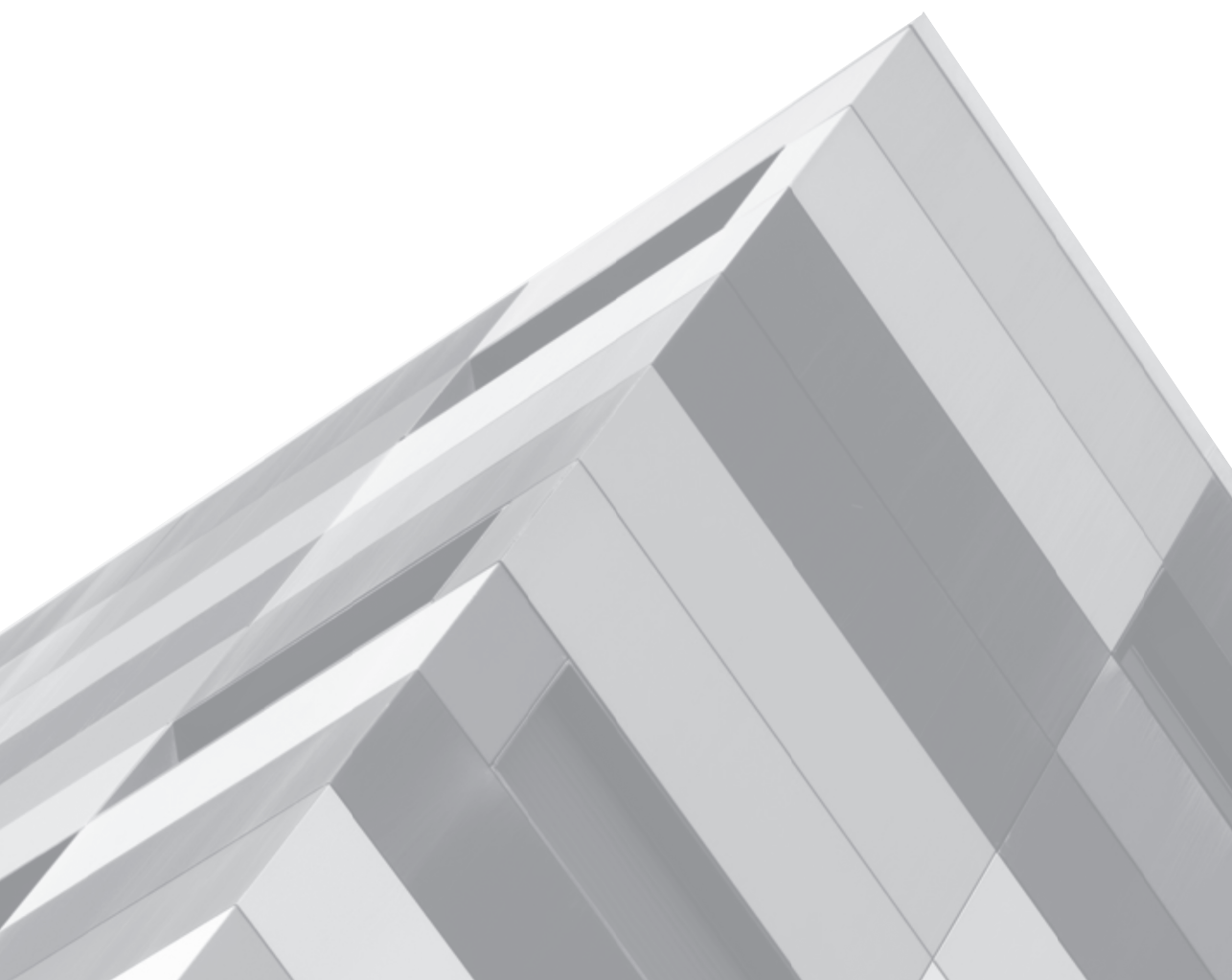
The authors would like to thank the research nurses Marc van Wijk and Marjolein Martens for their contribution in data collection; Bart Maertzdorf and Anneke Krol for the cohort data management; Martijn van Rooijen for helping out with the statistical analyses; Ronald Geskus for critically reviewing the statistical analyses and the manuscript; Roel Coutinho for critically reviewing the manuscript; and Susan T. Landry for the English review. Furthermore, we express our gratitude to all the participants who made this study possible.

FUNDING

Funding for the present study was given by the Aidsfonds (project number 2008025).

REFERENCES

1. Kippax S, Crawford J, Davis M, Rodden P, Dowsett G. **Sustaining safe sex: a longitudinal study of a sample of homosexual men.** *AIDS* 1993; 7(2):257-263.
2. Davidovich U, de Wit JB, Stroebe W. **Assessing sexual risk behaviour of young gay men in primary relationships: the incorporation of negotiated safety and negotiated safety compliance.** *AIDS* 2000; 14(6):701-706.
3. Kippax S, Noble J, Prestage G, Crawford JM, Campbell D, Baxter D, et al. **Sexual negotiation in the AIDS era: negotiated safety revisited.** *AIDS* 1997; 11(2):191-197.
4. Davidovich U, de Wit J, Albrecht N, Geskus R, Stroebe W, Coutinho R. **Increase in the share of steady partners as a source of HIV infection: a 17-year study of seroconversion among gay men.** *AIDS* 2001; 15(10):1303-1308.
5. Xiridou M, Geskus R, de Wit J, Coutinho R, Kretzschmar M. **The contribution of steady and casual partnerships to the incidence of HIV infection among homosexual men in Amsterdam.** *AIDS* 2003; 17(7):1029-1038.
6. Mao L, Crawford JM, Hospers HJ, Prestage GP, Grulich AE, Kaldor JM, et al. **"Serosorting" in casual anal sex of HIV-negative gay men is noteworthy and is increasing in Sydney, Australia.** *AIDS* 2006; 20(8):1204-1206.
7. Rietmeijer CA, Lloyd LV, McLean C. **Discussing HIV serostatus with prospective sex partners: a potential HIV prevention strategy among high-risk men who have sex with men.** *Sex Transm Dis* 2007; 34(4):215-219.
8. Prestage G, Van d, V, Grulich A, Kippax S, McInnes D, Hendry O. **Gay men's casual sex encounters: discussing HIV and using condoms.** *AIDS Care* 2001; 13(3):277-284.
9. Zablotska IB, Grulich AE, De Wit J, Prestage G. **Casual sexual encounters among gay men: familiarity, trust and unprotected anal intercourse.** *AIDS Behav* 2011; 15(3):607-612.
10. de Wit JB, van den Hoek JA, Sandfort TG, van Griensven GJ. **Increase in unprotected anogenital intercourse among homosexual men.** *Am J Public Health* 1993; 83(10):1451-1453.
11. van Griensven GJ, Tielman RA, Goudsmit J, van der NJ, de WF, de Vroome EM, et al. **Risk factors and prevalence of HIV antibodies in homosexual men in the Netherlands.** *Am J Epidemiol* 1987; 125(6):1048-1057.
12. Parsons JT, Severino J, Nanin J, Punzalan JC, von SK, Missildine W, et al. **Positive, negative, unknown: assumptions of HIV status among HIV-positive men who have sex with men.** *AIDS Educ Prev* 2006; 18(2):139-149.
13. Zablotska IB, Imrie J, Prestage G, Crawford J, Rawstorne P, Grulich A, et al. **Gay men's current practice of HIV seroconcordant unprotected anal intercourse: serosorting or seroguessing?** *AIDS Care* 2009; 21(4):501-510.
14. Siconolfi DE, Moeller RW. **Serosorting.** *BETA* 2007; 19(2):45-49.
15. Jansen IA, Geskus RB, Davidovich U, Jurriaans S, Coutinho RA, Prins M, et al. **Ongoing HIV-1 transmission among men who have sex with men in Amsterdam: a 25-year prospective cohort study.** *AIDS* 2011; 25(4):493-501.
16. Van Empelen P, Van Berkel M, Roos E, Zuillhof W. **Schorer Monitor 2011.** Amsterdam: Schorer Stichting; 2011.



3.2

Is group sex a higher-risk setting for HIV and other sexually transmitted infections compared with dyadic sex among men who have sex with men?

Wijnand van den Boom, Udi Davidovich, José Heuker, Femke Lambers, Maria Prins, Theo Sandfort & Ineke G Stolte

Sex Transm Dis. 2016; 43(2):99-104

ABSTRACT

Background

Group sex has been suggested as a potential high-risk setting for HIV and other sexually transmitted infections (STI) among men who have sex with men (MSM). We investigated whether group sex is associated with lower condom use during anal sex and higher proportions of STI compared with dyadic sex among HIV-negative MSM between 2009 and 2012.

Methods

Cross-sectional data from 7 data waves of the Amsterdam Cohort Studies were used. The sample consisted of 465 MSM who either reported *both* group and dyadic sex (at n=706 visits) or dyadic sex *only* (at n=1339 visits) in the preceding 6 months. Logistic regression with generalized estimating equations was used to investigate the association between sexual setting (group vs. dyadic sex), condomless anal sex, and STI.

Results

Group sex was reported at 35% (706/2045) of visits. Condomless sex was more often reported during dyadic than group sex (odds ratio, 3.64; 95% confidence interval, 2.57-5.16). Men who had group sex were more likely diagnosed as having gonorrhoea compared with men with dyadic sex (odds ratio 1.71; 95% confidence interval, 1.08-2.97), but this effect was not retained in the multivariate model.

Conclusions

Results demonstrate within-person differences in sexual behavior during group and dyadic sex among MSM. Men were more likely to use condoms during group sex than during dyadic sex. Thus, for some, group sex may not necessarily be risky for HIV infection compared with dyadic sex. However, group sex may be a higher-risk setting for acquiring STI other than HIV, such as gonorrhoea. Group sex encounters should be recognized as distinct sexual settings with specific risk characteristics that need to be addressed accordingly.

INTRODUCTION

Men who have sex with men (MSM) continue to be at high risk of acquiring HIV and other STI [1,2]. In the last few decades, STI rates increased among MSM populations in high-income countries [3-5], suggesting a rise in sexual risk behavior [6-8]. Many epidemiological and psychosocial studies have found that important behavioral risk factors for acquiring HIV and STI are condomless anal sex (CAS) with casual partners and a high turnover of sexual partners [9-11].

One of the casual sex settings involving a high turnover of sexual partners is group sex. During group sex, men have the opportunity to engage in many different sexual acts with different partners within a short period of time, thus enhancing the probability of exposure to HIV and other STI [12,13]. Studies among MSM engaging in group sex found proportions of CAS between 25%-55% [14-18]. Engaging in group sex was also associated with frequent reports of illicit drug use to enhance sexual experience [19, 20].

However, information on group sex activities and their health impact on MSM is limited and there is little insight into whether the same men behave differently during group sex with casual partners in comparison to sex with one casual partner at a time (dyadic sex). The few data available suggests that among MSM who reported both group and dyadic sex, during group sex men were more likely to engage in CAS and report more casual partners than during their one-on-one encounters [20].

The aims of the present study were to determine the proportion of HIV-negative MSM within the Amsterdam Cohort Studies (ACS) who engaged in group sex over a 3-year period (2009-2012). We also investigated among the same men whether group sex is associated with lower use of condoms during anal sex and higher prevalence of STI compared with casual dyadic sex, independent of drug and alcohol use. We furthermore examined, among men with multiple group sex reports over time, whether having more extensive and consistent experience with group sex would have affected men's behavior in this setting.

METHODS

Study Procedures

The ACS among MSM started in 1984 and is an open on-going prospective cohort to investigate the epidemiology, psychosocial determinants, course of infection, and pathogenesis of HIV, and to evaluate the effect of interventions among HIV-negative and HIV-positive MSM [21]. Men are eligible to participate in the cohort if they are living in or around Amsterdam and have had at least one male sexual partner in the preceding 6 months. Men are recruited

into the ACS by 'convenience sampling' (e.g., brochures at the STI clinic and advertisements in the gay scene) and 'chain referral sampling' (participants recruited by other participants) [9].

Participants visit the Public Health Service of Amsterdam every 6 months to complete a self-administered questionnaire regarding their sexual (risk) behavior in the preceding 6 months. At each study visit, blood is drawn to test for HIV and syphilis and for storage. Questions regarding demographics are asked at the very first visit. From 2008 onward, 6-monthly STI screenings were included in the assessments. Self anal swabs and urine samples are collected to test for anal and urethral gonorrhea and chlamydia and a research nurse collects throat swabs from each participant to detect the presence of pharyngeal gonorrhea and chlamydia.

HIV antibody testing is done using 2 commercially available enzyme-linked immunosorbent assays (AxSYM; Abbot Laboratories, North Chicago, IL; Vironostika, Organon Teknika, Boxtel, the Netherlands). To diagnose gonorrhea and chlamydia, a nucleic acid amplification test (Gen-Probe Aptima Combo 2 Assay; Gen-Probe Incorporated, San Diego, CA) is used. Serum is screened for syphilis antibodies (*Treponema pallidum* particle agglutination assay; Fujirebio, Tokyo, Japan). The Rapid Plasma Reagin (RPR) test and the fluorescent treponemal antibody absorption test (Nosticon and Trepo-spot IF; Biomérieux, Marcy l'Etoile, France) are performed to diagnose, confirm, and classify syphilis infection.

Ethical Approval

This study was approved by the Medical Ethics Committee of the Academic Medical Center, University of Amsterdam, Amsterdam, the Netherlands.

Study sample

We used data from 7 data waves of the ACS collected between 2009 and 2012. In total, 465 MSM who were HIV-negative at baseline participated in the cohort in this period. Nine men (2%) HIV seroconverted during the study period; of those men, all data were collected before their first HIV-positive ACS visit was used. The participants had a total of 2386 visits at which they provided information on dyadic sex (yes/no) and group sex with casual partners (yes/no) in the preceding 6 months (figure 1). At 94% (2245/2386) of these visits, MSM provided information on anal intercourse. We included 706 (31%) visits where MSM reported both group sex and casual dyadic sex and 1339 (60%) visits where MSM reported only casual dyadic sex. The 200 (9%) visits where MSM reported neither casual sex partners nor group sex were excluded from the analyses. Such periods of no sexual encounters were less likely to occur among men who had ever reported group sex than among men who had only reported dyadic sex partners during the study period ($X^2=28.03$, $df=1$, $p<0.001$). The total sample consisted of 2045 visits of 465 individual MSM, with a median number of 5 visits (interquartile range [IQR]=3-6). Data on STI were available for 460 individual MSM, with a total of 2001 (98%) visits.

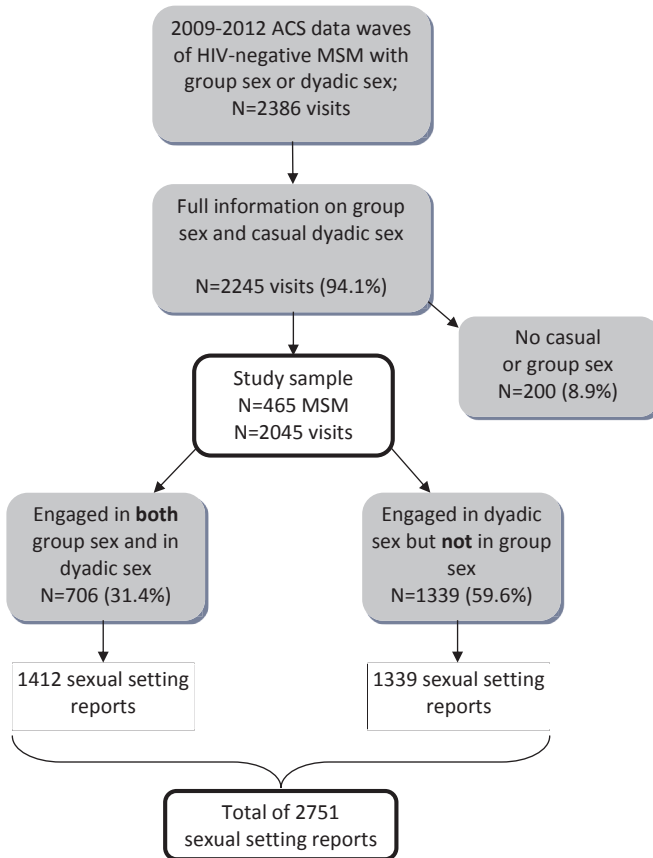


Figure 1. Flow Diagram

Measures

Outcome measures

Condomless anal sex with casual sex partners

Participants were asked whether they had practiced insertive and/or receptive anal sex during group sex and/or during dyadic sex in the preceding 6 months and whether a condom was used during group sex and/or dyadic sex (ranging from 'never' to 'always' on a 5-point scale). CAS with casual partners was defined as no or inconsistent condom use.

Sexually transmitted infection (STI)

Having an STI (yes/no) was defined as being diagnosed as having one or more of the following STI: gonorrhoea, chlamydia, or infectious syphilis.

Main independent variable: sexual setting

Group sex was defined as a sexual encounter with more than one casual sexual partner at the same time. Dyadic sex referred to sex with one casual sex partner at a time. As condomless sex is measured in the cohort per partner and setting type (e.g., casual partner, steady partner and group sex), we constructed a sexual setting predictor variable with 3 categories: (1) group sex, (2) dyadic sex among those who also reported group sex, and (3) dyadic sex only to investigate the association with condomless sex. Because STI diagnoses cannot be linked back to a specific partner type or sexual setting, the sexual setting variable was dichotomized into men who reported both group sex and dyadic sex versus men who reported dyadic sex only to investigate the association with STI.

Co-variables

Co-variables included age, ethnic origin, educational level, sexual orientation, number of casual partners in the preceding 6 months, drug and alcohol use during sex, and having a steady partner in the preceding 6 months.

Age was categorized into 3 categories, based on tertiles: <34, 34-40, and >40. Ethnic origin was categorized into 2 categories, 'Western European origin' and 'non-Western European origin'. Educational level was considered 'high' with completion of higher vocational education or university, and 'middle and low' with completion of secondary vocational education, high school, basic vocational education, or primary school. Sexual orientation was measured on a 7-point Kinsey scale, ranging from 0 'exclusively heterosexual' to 6 'exclusively gay'. Because most participants identified themselves as exclusively gay, sexual orientation was dichotomized into 'exclusively gay' (value 6) and 'not exclusively gay' (values 0-5). Number of casual partners in the preceding 6 months was divided into 3 categories based on tertiles; <5, 5-12, and >12. Participants reported on drug and alcohol use during group sex and dyadic sex. Drug use during sex was defined as any drug reported in each of the sexual settings in the preceding 6 months (yes/no).

Consistent engagement in group sex

Consistent engagement in group sex was defined as having reported group sex at 4 or more consecutive study visits (with a maximum of 7 visits).

Statistical analyses

Baseline characteristics of men who reported group sex and men who had dyadic sex only were compared using Chi-square tests for categorical data and Mann-Whitney U tests for continuous data.

Drug use and alcohol use were compared between the 3 sexual settings at baseline using Chi-square tests with Bonferroni corrected post-hoc analyses.

Bivariate and multivariate logistic regression analyses were performed to investigate the association between sexual setting and condomless sex on the one hand and sexual setting and STI on the other. Based on previous studies [13-16], the multivariate models included variables that were considered potential confounders for the association between engaging in group sex and CAS: number of casual partners, age, ethnic origin, educational level, sexual orientation, and having a steady partner. We also checked for interactions between sexual setting and the variables age, ethnic origin, and education. As for the use of drugs and alcohol, we additionally assumed that the relation between substance use and sexual setting is a bi-directional one: the use of substances, in the pursuit of sexual pleasure, might influence the decision to engage in group sex but at the same time participation in such encounters may be predictive for substance use. Therefore, multivariate models were run with and without the variables drug and alcohol use to examine the impact of these variables on the relation between sexual setting and condomless sex and STI.

Generalized estimating equations (GEEs) were used to account for within-participant correlations between the repeated behavioral measures over time and between the sexual behaviors reported within each sexual setting, assuming an unstructured correlation matrix. All analyses were performed with SPSS 21 (SPSS Inc., Chicago, IL).

RESULTS

Participants had a median age of 36 (IQR=32-41), most (93%) were of Western European origin, had an educational level of college degree or higher (75%), and identified as exclusively gay (76%). More than half (58%) of the participants had a steady partner (Table 1). At baseline (2009), 170 MSM (37%) reported having had both group sex and dyadic sex and 295 MSM (63%) reported dyadic sex only. Men who reported both group sex and dyadic sex were significantly older, were more likely to have a steady partner, and had more casual sex partners in the preceding 6 months.

Proportions of drug and alcohol use during sex

Proportions of drug use were highest during dyadic sex encounters among men who also had group sex: 69% (116/168); during group sex encounters, it was 49% (83/168). For men who had dyadic sex only, it was 37% (105/288). Differences between the 3 sexual settings were statistically significant ($p<0.05$). Proportions of alcohol use were also highest during dyadic sex encounters: 50% (84/169) among men who also had group sex and 43% (124/287) among men who had no group sex. The proportion of men who used alcohol during group sex encounters was 27% (467/169). Differences between the three sexual settings were statistically significant ($p<0.05$).

Table 1. Baseline characteristics according to sexual behavior of 465 HIV-negative MSM who engaged in group sex and/or dyadic casual sex, Amsterdam Cohort Studies, 2009-2012, the Netherlands.

	Total N=465 MSM	Sexual behavior in the preceding 6 months		P-value
		Engagement in <i>both</i> group sex and dyadic sex N=170 MSM	Engagement in dyadic sex <i>only</i> N=295 MSM	
Age Median (IQR), y	36.1 (31.9-41.1)	37.0 (32.7-42.4)	35.7 (31.3-40.5)	0.027
Ethnic origin ^a				
Western European origin	430/461 (93%) ^b	156/168 (93%)	247/293 (94%)	0.786
Non-Western European origin	31/461 (7%)	12/156 (7%)	19/293 (7%)	
Educational level ^a				
College degree	339/452 (75%)	121/164 (74%)	218/288 (76%)	0.651
Less than college degree	113/452 (25%)	43/164 (26%)	70/288 (24%)	
Sexual orientation ^a				
Exclusively gay	339/449 (76%)	122/165 (74%)	217/284 (76%)	0.558
Not exclusively gay	110/449 (25%)	43/165 (26%)	67/284 (24%)	
Have a steady partner ^a	262/453 (58%)	110/167 (66%)	152/286 (53%)	0.008
Number of casual partners				
Median (IQR)	10 (5-22)	11 (5-23)	4 (2-7)	0.000

^a Totals might not add up due to missing values.

^b In calculation of percentages, missing values were excluded.

IQR=inter quartile range.

Association between sexual setting and condomless sex

Bivariate and multivariate analyses revealed that condomless sex was more frequently reported during dyadic sex than during group sex (Table 2). No statistically significant difference in condomless sex was found between the 2 dyadic sex settings.

In the multivariate model, we found that, independent of sexual setting, men who had more sex partners were more likely to engage in condomless sex. Men who had a steady partner were more likely to use condoms. No significant interaction effects were found in the multivariate model. Alcohol and drug use during sex were not significantly associated with condomless sex, and including these variables in the multivariate model did not alter the direction or significance of the effect of sexual setting on condomless sex.

Consistent engagement in group sex

Among 30 men who reported group sex at 4 or more consecutive study visits (total of n=176 visits), a bivariate analysis revealed that condomless sex was more frequently reported during dyadic (38%; 66/175) than during group sex (16%; 28/175; odds ratio [OR], 2.88; 95% confidence interval [CI], 1.42-5.81).

Table 2. Bivariate and multivariate analyses of determinants of condomless anal sex with casual partners using logistic regression analysis with GEEs in 2751 sexual behavior reports among 465 MSM, ACS, 2009–2012, the Netherlands.

	Proportion of condomless sex n/N (%)	Bivariate		Multivariate ^a	
		OR (95% CI)	p-value	OR _{adj} (95% CI)	P-value
Group sex versus dyadic sex^b					
Visits at which men reported <i>both</i> group sex and dyadic sex	During group sex 73/706 (10.3)	1	<0.001	1	<0.001
	During dyadic sex 222/706 (31.4)	3.64 (2.57–5.16)		3.84 (2.21–6.69)	
Visits at which men reported <i>dyadic sex only</i>	379/1339 (28.3)	3.09 (1.55–6.17)		5.19 (3.10–8.71)	
Number of casual partners^b					
<5	166/873 (19.0)	1	<0.001	1	0.009
5–12	220/864 (25.5)	1.48 (1.17–1.88)		1.52 (1.12–2.07)	
>12	279/984 (28.4)	1.62 (1.21–2.17)		1.25 (0.47–3.27)	
Drug use during sex^b					
No	207/1198 (17.3)	1	0.136	1	0.634
Yes	431/1448 (29.8)	1.68 (0.85–3.32)		1.17 (0.62–2.21)	
Alcohol use during sex^b					
No	291/1480 (19.7)	1	0.216	1	0.676
Yes	349/1175 (29.7)	1.35 (0.84–2.18)		1.08 (0.75–1.55)	
Steady partner^b					
No	386/1214 (31.8)	1	<0.001	1	<0.001
Yes	280/1514 (18.5)	0.51 (0.38–0.68)		0.47 (0.34–0.64)	

^a Also adjusted for age, ethnic origin, education level, and sexual orientation.

^b In the preceding 6 months.

CI, confidence interval.

Association between sexual setting and STI

Men who also had group sex were just as likely to be diagnosed with any STI as men who had dyadic sex only (Table 3).

In the multivariate model, we found that, independent of sexual setting, men were more likely to be diagnosed as having an STI if they had engaged in condomless sex and had a higher number of partners. Men who had a steady partner were less likely to be diagnosed as having an STI. No significant interaction effects were found in the multivariate model. Alcohol and drug use were not significantly associated with an STI, and including these variables in the multivariate model did not alter the direction or significance of the effect of sexual setting on STI.

Table 3. Bivariate and multivariate analyses of determinants of STI using logistic regression analysis with GEEs in 2001 sexual reports among 460 MSM attending the STI screening, ACS, 2009-2012, the Netherlands.

	Proportion of ≥1 STI diagnosis n/N (%)	Bivariate		Multivariate ^a	
		OR (95% CI)	P-value	OR _{adj} (95% CI)	P-value
Group sex and dyadic sex versus dyadic sex only^b					
Dyadic sex only	93/1301 (7.1)	1	0.362	1	0.519
Group sex and dyadic sex	60/700 (8.6)	1.18 (0.83-1.67)		1.13 (0.70-2.05)	
Anal sex^b					
Condom use / no anal sex	91/1398 (6.5)	1	0.005	1	0.019
Condomless anal sex	62/603 (10.3)	1.66 (1.17-2.36)		1.59 (1.08-2.35)	
Number of casual partners^b					
<5	33/752 (4.4)	1	<0.001	1	<0.001
5-12	55/622 (8.8)	2.20 (1.38-3.51)		2.15 (1.28-3.61)	
>12	62/605 (10.2)	2.63 (1.65-4.20)		3.07 (1.78-5.27)	
Drug use during sex^b					
No	47/816 (5.8)	1	0.005	1	0.983
Yes	101/1099 (9.2)	1.66 (1.16-2.35)		0.99 (0.57-1.75)	
Alcohol use during sex^b					
No	69/982 (7.0)	1	0.275	1	0.099
Yes	76/942 (8.1)	1.20 (0.87-1.66)		1.74 (0.90-3.37)	
Steady partner^b					
No	81/902 (9.0)	1	0.008	1	0.105
Yes	69/1081 (6.4)	0.65 (0.47-0.89)		0.74 (0.52-1.06)	

^a Also adjusted for age, ethnic origin, education level, and sexual orientation.

^b In the preceding 6 months

Because gonorrhoea and chlamydia are the most prevalent diagnosed STI among MSM [22] we also examined the influence of sexual setting on diagnosed gonorrhoea (n=74 diagnoses) and chlamydia (n=84 diagnoses). We found that men who had also engaged in group sex were more likely to be diagnosed as having gonorrhoea compared with men who had dyadic sex only (OR, 1.71; 95%CI, 1.08-2.97), although this effect was not retained in the multivariate model. For chlamydia we found no significant association with sexual setting.

DISCUSSION

Our results contribute to the existing literature by highlighting the within-person differences in behavior between group sex and dyadic sex among MSM. The findings of this study suggest that MSM report different patterns of risk behavior in the group sex setting than during dyadic sex. Men who have sex with men reporting both group and dyadic sex reported more condom use in the group sex setting compared with the dyadic sex setting, independent of other factors known to be associated with sexual risk, including number of casual sex partners and alcohol and drug use [9, 19]. Also, among a subsample of men who had frequently engaged in group sex over time, we found, in line with the results described earlier, that men were more likely to use condoms during group sex than during dyadic sex. Apparently, having frequent group sex experiences did not increase risk behavior within this setting compared with dyadic sex. It could be that, as opposed to group sex, during dyadic sex encounters, it is easier for men to discuss issues concerning HIV, considering this setting involves only one-on-one communication. Therefore, men have better opportunities for engaging in HIV risk-reduction strategies, such as serosorting, than during group sex where communication with several different partners might prove much more difficult. This can be an explanation for the higher rates of condom use we found in the group sex setting.

Furthermore, we found that men who had engaged in group sex were significantly older and more likely to have had a steady partner than men who had dyadic sex only. Among the same men who had reported both group and dyadic sex, proportions of drug and alcohol use were lower during group sex encounters than during dyadic sex encounters.

No differences were found for any diagnosed STI; however, we did find suggestive evidence that men reporting group sex are more likely to be diagnosed as having gonorrhoea. It is seemingly contradictory that men are more likely to use condoms during group sex but are at increased risk for gonorrhoea compared with men who only had dyadic casual sex encounters. A possible explanation is that sex techniques other than anal sex, such as fingering, dipping, or toy use, and a high partner turnover rate may have also contributed to spreading gonorrhoea among men reporting group sex, which has also been suggested in a previous study [10]. In the group sex setting, such techniques are more likely to involve infections than during dyadic sex, as STI such as gonorrhoea can be more readily transmitted from one receptive partner to

another by the same person performing these techniques. However, it should be noted that we were not able to link STI diagnoses back to a specific partner type or sexual setting, so the STI we found among men who had reported group sex could also have been acquired during their encounters with dyadic casual partners. Because we found less gonorrhea diagnoses for men who had dyadic sex only, while having comparable levels of CAS to men who *also* had group sex, it is still plausible for men engaging in both sexual settings that STI were contracted during group sex encounters.

The proportion of men in our study who had engaged in group sex in the preceding 6 months (37%) was relatively similar to an Australian study [23]. However, our findings of lower risk behavior during group sex are in contrast with other studies that indicated that MSM participating in group sex are more likely to engage in condomless sex [12, 13, 15, 24]. Differences could be explained by the fact that these studies also included HIV-positive men who are often found more likely to attend group sex [20, 25] and are less likely to report condom use during these encounters [12, 15]. Differences could also be explained by the different samples used. These studies specifically recruited participants who had engaged in group sex or are part of an organized group sex network; such networks were found to be associated with MSM having a higher-risk profile [17, 19, 26, 27]. Our study inclusion was not conditioned to practicing group sex and therefore can reflect a more representative behavioral profile of MSM. Again, differences with previous group sex studies could be the result of a different risk-group profile of the MSM in our cohort and suggest that group sex is not a homogenous risk setting and that risk behavior might depend greatly on the risk profile of the men involved rather than only the setting itself.

Some limitations in this study should be considered. First, because our study sample consisted of highly educated, mainly Western-European MSM, generalization of our findings must be made cautiously. However, data on risk behavior of the cohort have often been similar to larger nation-wide monitoring studies such as the Schorer Monitor [28] and therefore have good external validity. Second, we did not collect data on the type of group sex and number of partners per event (e.g., threesome) our participants engaged in, nor on the location (e.g., public vs. private venue). These factors have been found to play a role in determining sexual risk behavior during group sex encounters [13, 29]. Also, we did not collect other risk factors that are known to increase risk of HIV and STI during group sex, such as the frequency of partner turnover per event, perceived HIV status of other partners [25], mental health issues [20], such as depression, and use of other penetrative sexual techniques than anal sex (e.g., toys, fingering and dipping) [13, 30].

In conclusion, within a cohort of Dutch HIV-negative MSM, this study showed that close to one third of the men engaged in group sex. Our data suggest that during group sex, men were more likely to use condoms and use less drugs and alcohol than during dyadic sex. Therefore, group sex might not necessarily be a setting that poses an increased risk for HIV infection

compared with dyadic sex, as reported in other studies. However, at the same time, group sex encounters might be higher-risk settings as men reported higher numbers of casual sex partners and have a higher potential for acquiring STI other than HIV, such as gonorrhoea. Because we had a relatively low number of infections in our sample, more research is needed to affirm these findings. Nevertheless, this apparent discrepancy cannot be ignored and could be explained by the fact that sex techniques other than anal sex contribute to the spread of STI during group sex encounters. Similar to other studies, our data suggest that group sex encounters should be recognized as a distinct sexual setting which has specific risk and demographic characteristics that need to be addressed accordingly.

ACKNOWLEDGEMENTS

The authors wish to thank the participants of the Amsterdam Cohort Studies for their contribution, research nurses of the ACS Marc van Wijk and Marjolein Martens for data collection and cohort management, Gerben Rienk Visser for data management, Ronald Geskus for critically reading the manuscript, and Claire Buswell for editing the final manuscript.

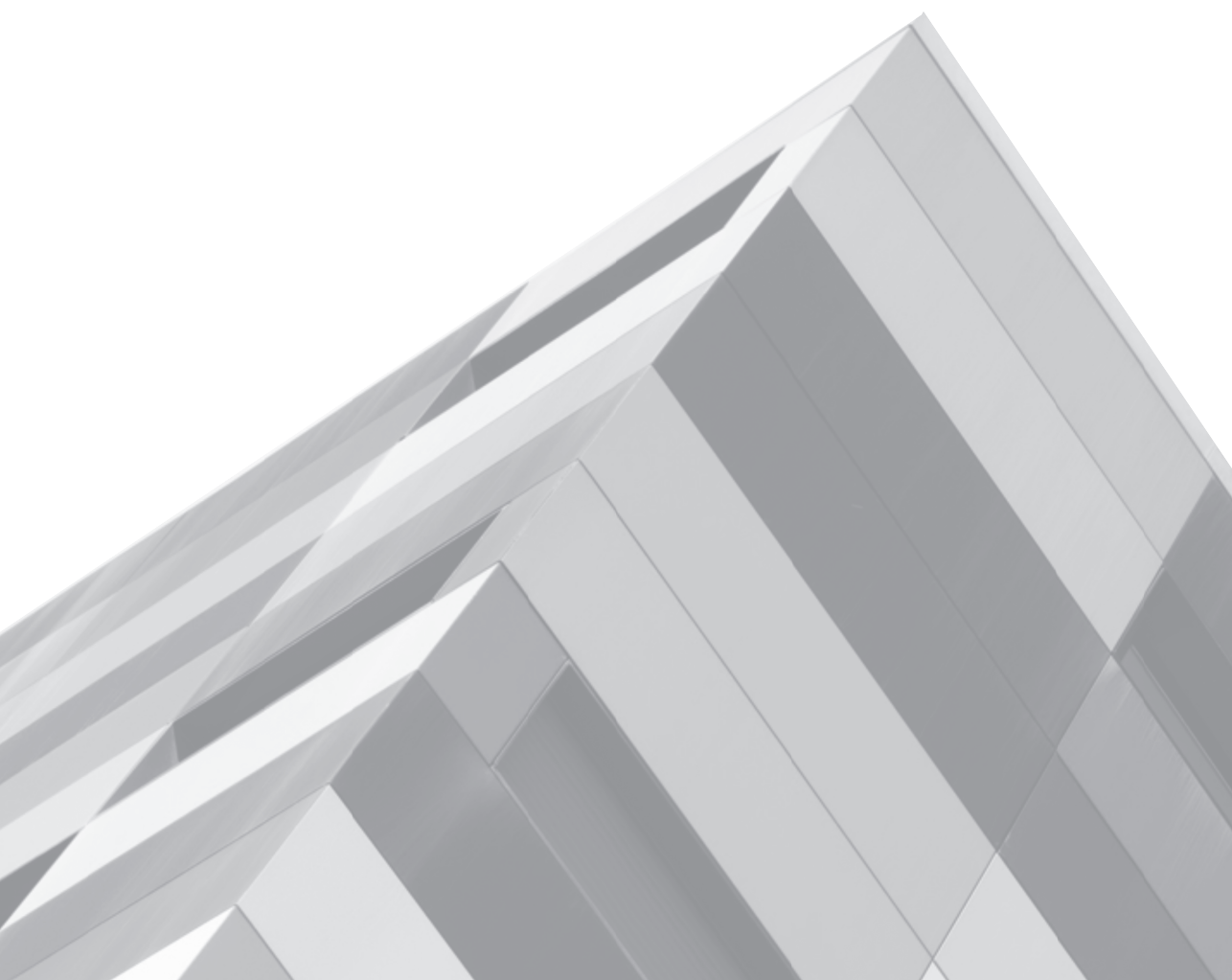
FUNDING

Funding for the present study was provided by the Aidsfonds (project number 2008025). Dr. Sandfort's contribution was supported by NIMH Center Grant P30-MH43520.

REFERENCES

1. European Centre for Disease Prevention and Control/WHO Regional Office for Europe. **HIV/AIDS surveillance in Europe 2013**. 2014. http://ecdc.europa.eu/en/publications/_layouts/forms/Publication_DispForm.aspx?List=4f55ad51-4aed-4d32-b960-af70113dbb90&ID=1217. (accessed 29-6-2015).
2. European Centre for Disease Prevention and Control (ECDC). **Sexually transmitted infections in Europe 2011**. 2014. http://ecdc.europa.eu/en/publications/_layouts/forms/Publication_DispForm.aspx?List=4f55ad51-4aed-4d32-b960-af70113dbb90&ID=1130. (accessed 29-6-2015).
3. Centers for Disease Control and Prevention. **Sexually transmitted disease surveillance 2012**. 2013. <http://www.cdc.gov/std/stats12/> (accessed 29-6-2015).
4. Savage EJ, Hughes G, Ison C, Lowndes CM. **Syphilis and gonorrhoea in men who have sex with men: a European overview**. *Euro Surveill* 2009; 14(47).
5. van der Bij AK, Stolte IG, Coutinho RA, Dukers NH. **Increase of sexually transmitted infections, but not HIV, among young homosexual men in Amsterdam: are STIs still reliable markers for HIV transmission?** *Sex Transm Infect* 2005; 81(1):34-37.
6. Marcus U, Bremer V, Hamouda O, Kramer MH, Freiwald M, Jessen H, et al. **Understanding recent increases in the incidence of sexually transmitted infections in men having sex with men: changes in risk behavior from risk avoidance to risk reduction**. *Sex Transm Dis* 2006; 33(1):11-17.
7. Snowden JM, Raymond HF, McFarland W. **Prevalence of seroadaptive behaviours of men who have sex with men, San Francisco, 2004**. *Sex Transm Infect* 2009; 85(6):469-476.
8. Stolte IG, Coutinho RA. **Risk behaviour and sexually transmitted diseases are on the rise in gay men, but what is happening with HIV?** *Curr Opin Infect Dis* 2002; 15(1):37-41.
9. Jansen IA, Geskus RB, Davidovich U, Jurriaans S, Coutinho RA, Prins M, et al. **Ongoing HIV-1 transmission among men who have sex with men in Amsterdam: a 25-year prospective cohort study**. *AIDS* 2011; 25(4):493-501.
10. Jin F, Prestage GP, Mao L, Kippax SC, Pell CM, Donovan B, et al. **Incidence and risk factors for urethral and anal gonorrhoea and chlamydia in a cohort of HIV-negative homosexual men: the Health in Men Study**. *Sex Transm Infect* 2007; 83(2):113-119.
11. Vallabhaneni S, Li X, Vittinghoff E, Donnell D, Pilcher CD, Buchbinder SP. **Seroadaptive practices: association with HIV acquisition among HIV-negative men who have sex with men**. *PLoS One* 2012; 7(10):e45718.
12. Prestage GP, Hudson J, Down I, Bradley J, Corrigan N, Hurley M, et al. **Gay men who engage in group sex are at increased risk of HIV infection and onward transmission**. *AIDS Behav* 2009; 13(4):724-730.
13. Grov C, Rendina HJ, Ventuneac A, Parsons JT. **HIV risk in group sexual encounters: an event-level analysis from a national online survey of MSM in the U.S.** *J Sex Med* 2013; 10(9):2285-2294.
14. Mimiaga MJ, Reisner SL, Bland SE, Driscoll MA, Cranston K, Isenberg D, et al. **Sex parties among urban MSM: an emerging culture and HIV risk environment**. *AIDS Behav* 2011; 15(2):305-318.
15. Phillips G, Magnus M, Kuo I, Rawls A, Peterson J, West-Ojo T, et al. **Correlates of group sex among a community-based sample of men who have sex with men (MSM) in Washington, DC**. *AIDS Behav* 2013; 8: 1413-1419.
16. Prestage GP, Hudson J, Jin F, Corrigan N, Martin P, Grulich AE, et al. **Testing for HIV and sexually transmissible infections within a mainly online sample of gay men who engage in group sex**. *Sex Transm Infect* 2009; 85(1):70-74.
17. Mimiaga MJ, Reisner SL, Bland S, Cranston K, Isenberg D, Driscoll MA, et al. **"It's a quick way to get what you want": a formative exploration of HIV risk among urban Massachusetts men who have sex with men who attend sex parties**. *AIDS Patient Care STDS* 2010; 24(10):659-674.

18. Rosenberger JG, Reece M, Schick V, Herbenick D, Novak DS, Van Der Pol B, et al. **Sexual behaviors and situational characteristics of most recent male-partnered sexual event among gay and bisexually identified men in the United States.** *J Sex Med* 2011; 8(11):3040-3050.
19. Prestage G, Grierson J, Bradley J, Hurley M, Hudson J. **The role of drugs during group sex among gay men in Australia.** *Sex Health* 2009; 6(4):310-317.
20. Hirshfield S, Schrimshaw EW, Stall RD, Margolis AD, Downing MJ, Jr., Chiasson MA. **Drug use, sexual risk, and syndemic production among men who have sex with men who engage in group sexual encounters.** *Am J Public Health* 2015; 105: 1849-1858.
21. van Griensven GJ, de Vroome EM, Goudsmit J, Coutinho RA. **Changes in sexual behaviour and the fall in incidence of HIV infection among homosexual men.** *BMJ* 1989; 298(6668):218-221.
22. STI Clinic Amsterdam. **Annual report STI clinic Amsterdam 2013 (in Dutch, summary in English).** Amsterdam: GGD Amsterdam; 2013.
23. Prestage G, Down I, Grulich A, Zablotska I. **Sex partying among gay men in Sydney, Melbourne and Brisbane, Australia.** *AIDS Behav* 2011; 15(2):298-304.
24. Grov C, Rendina HJ, Breslow AS, Ventuneac A, Adelson S, Parsons JT. **Characteristics of men who have sex with men (MSM) who attend sex parties: results from a national online sample in the USA.** *Sex Transm Infect* 2014; 90(1):26-32.
25. Grov C, Golub SA, Parsons JT. **HIV status differences in venues where highly sexually active gay and bisexual men meet sex partners: results from a pilot study.** *AIDS Educ Prev* 2010; 22(6):496-508.
26. Green AI, Halkitis PN. **Crystal methamphetamine and sexual sociality in an urban gay subculture: an elective affinity.** *Cult Health Sex* 2006; 8:317-333.
27. Sowell RL, Lindsey C, Spicer T. **Group sex in gay men: its meaning and HIV prevention implications.** *J Assoc Nurses AIDS Care* 1998; 9:59-71.
28. Van Empelen P, Van Berkel M, Roos E, Zuilhof W. **Schorer Monitor.** Amsterdam: Schorer Stichting; 2011.
29. Reisen CA, Iracheta MA, Zea MC, Bianchi FT, Poppen PJ. **Sex in public and private settings among Latino MSM.** *AIDS Care* 2010; 22(6):697-704.
30. Jin F, Crawford J, Prestage GP, Zablotska I, Imrie J, Kippax SC, et al. **Unprotected anal intercourse, risk reduction behaviours, and subsequent HIV infection in a cohort of homosexual men.** *AIDS* 2009; 23(2):243-252.



3.3

Is anyone around me using condoms?
Site-specific condom-use norms and their
potential impact on condomless sex across
various gay venues and websites in the
Netherlands

Wijnand van den Boom, Ineke G Stolte, Astrid Roggen, Theo Sandfort, Maria Prins
& Udi Davidovich

Health Psychol. 2015; 34(8):857-64

ABSTRACT

Objective

To investigate site-specific condom-use norms as assumed by visitors of gay venues and websites across the Netherlands and their association with men's own use of condoms.

Methods

In 2010, men who have sex with men (MSM) visiting 18 sex venues (e.g., saunas), 30 nonsex venues (e.g., bars), 6 dating websites, and 2 social network websites completed an on-site questionnaire measuring two site-specific norms concerning anal sex: descriptive (assumed condom use of others at venue or website) and injunctive (assumed approval of condom use by others at venue or website). We measured the association between assumed descriptive norms and own use of condoms using logistic regression.

Results

Among 2376 participants (median age=30 years; IQR=22–43), 62% (n=1483) assumed that other visitors would not use condoms. Among men self-reporting on their own use of condoms, 22% (318/1421) reported condomless anal sex (CAS). Men at nonsex venues assumed other visitors would use condoms more often and approved of using them more often compared to men at sex venues. At all sites (venues/websites), men who assumed that others did not use condoms were more likely to have CAS themselves.

Conclusions

At gay sites across the Netherlands, more than half of MSM believed visitors of these sites would not use condoms during anal sex. The perception that others would not use condoms was associated with less own condom use. HIV prevention should address problematic on-site condom-use norms, as they play a role in influencing sexual behavior between men that meet at these sites.

INTRODUCTION

“When in Rome, do as the Romans do”, is the old saying. Indeed, the places we visit can shape the way we think and behave. The same can apply to the sexual behavior of men who have sex with men (MSM): venues that MSM visit might influence the way they think and behave sexually. This study was designed to investigate site-specific condom-use norms that Dutch MSM believed to be prevalent at certain gay venues and gay websites. Site-specific norms can be formed in two ways. First, people observe behavior around them in a particular context and see others’ behavior as a source of information to help them define social reality and use this information as guidance for their own behavior [1, 2]. This type of norm is commonly known as a ‘descriptive norm’ and refers to what people believe others around them commonly do in certain social interactions or situations [3]. Second, people behave in ways they believe will be approved by others or avoid behaving in a way that is disapproved by others. The belief whether a behavior will or will not be approved by others is known as an ‘injunctive norm’ [3].

Norms are known to influence sexual behavior in general and among MSM in particular. Men who assume that others use condoms (descriptive norms) or approve of using them (injunctive norms) will be more likely to use condoms themselves than those who assume that others engage in condomless anal sex (CAS) or disapprove of condom use [4, 5]. Norms can be context-dependent and as such are likely to constitute an important factor in influencing site-specific sexual behavior among MSM [6-8]. In bathhouses, for example, MSM who believe that other visitors do not desire discussions about safe sex (‘silence norm’) feel reluctant to initiate such communication [7, 8]. In this study, we investigated the site-specific condom-use norms among MSM in the Netherlands and whether such norms are associated with own condom use.

Both site-specific descriptive norms (‘what others do’) and injunctive norms (‘what others approve/disapprove of’) regarding the use of condoms were investigated in more than 50 gay sex venues (e.g., saunas), nonsex venues (e.g., bars), dating websites, and social network (nonsex) websites in the Netherlands. We examined site-specific norms for two types of visitors: visitors unknown to the participant and a visitor who is significant to the participant, such as a good friend. A significant other is someone whose opinion is important to the participant and as such can influence his behavior, as suggested in the theory of planned behavior [9]. Furthermore, we explored whether type of site was associated with condom-use norms and whether these norms were associated with the participant’s self-reported condom use with men whom they met at these sites. Findings of the present study are important for developing more effective strategies to influence sexual risk behavior among MSM in the Netherlands and elsewhere.

METHODS

Recruitment, questionnaire, and sample

Recruitment took place both offline and online. Regarding offline sites, five paid and trained interviewers visited 48 gay venues across the Netherlands. By methods of convenience sampling, the interviewers approached visitors to request their participation in the study. To capture site-specific condom-use norms, men were asked to complete an anonymous questionnaire regarding the venue and its visitors. Participants filled in questionnaires while present at the venue, in a private location inside the venue. Participants were given computer notebooks with internet connection to access an online questionnaire. If no internet connection was available, men used a written questionnaire. As a token of gratitude, participants received a small gift valued at 5 Euro. Regarding online sites, visitors to Dutch gay websites were recruited over a 3-month period by banners that invited them to enroll in the study. Once men had clicked on a banner, they were directed to an online questionnaire. Participants in the online survey were not given an incentive.

Both offline and online, we used a 19-item questionnaire measuring demographics, descriptive and injunctive condom-use norms, and participants' own behavior, the latter being optional. Two versions of the questionnaire were constructed: one for offline sex venues to measure sex on-premises (e.g., darkrooms) and one for offline nonsex venues (e.g., clubs), dating websites (primarily for the finding of sex partners), and social network websites, to measure sex with partners met through these channels. All questionnaires were in Dutch.

After recruitment of 2512 participants, we excluded 86 (3%) with incomplete questionnaires and 50 (2%) who reported having had sex with women only, resulting in a total sample size of 2376 participants who filled out questions regarding other visitors. Sample sizes differed for MSM who had filled out questions regarding a good friend (if applicable; $n=1975$), their own behavior (which was optional) ($n=1421$), or both ($n=1262$).

Variables

General characteristics

We assessed participants' age (categorized into ≤ 22 years, 23-29 years, 30-42 years, ≥ 43 years; based on quartiles), nationality (Dutch vs. non-Dutch background), education level, and sexual orientation. Education level was considered 'high' with completion of higher vocational education or university and 'middle and low' with completion of secondary vocational education, high school, basic vocational education, or primary school. Sexual orientation was measured using a 7-point Kinsey scale, ranging from 0 (exclusively heterosexual) to 6 (exclusively homosexual). Participants' frequency of visiting a particular site in the preceding 6 months had the following three categorizations: (a) 'at least once every 2 weeks,' (b) 'once a month or less than once a month,' and (c) 'more than 6 months ago, or never before'.

Type of site

Sites were categorized into five types: (a) sex venues, (b) bars/clubs, (c) social and sports gathering venues, (d) dating websites, (e) and social network websites. The sex venue category included gay sex establishments and environments where men could have sex on the premises, such as darkrooms, bathhouses, saunas, and cruising areas. The bars/clubs category included gay bars and dance clubs that exclude sex on the premises. The social and sports gathering venues included organizations such as youth gatherings and fitness clubs, which likewise exclude on-premise sex. The dating websites category included sites that men visit to chat with the intent of finding potential sex partners, the social network websites category included sites that men visit to chat with other men socially, to network through friends, and to find information regarding safe sex and gay-related themes.

Descriptive condom-use norm (regarding other visitors)

For sex venues, the descriptive norm was operationalized as the perception of how frequently visitors at a specific venue engage in CAS on-premise. For the other types of sites, the norm was operationalized as the perception of how frequently visitors engage in CAS with men they meet through one of these sites. A 5-point scale was used ranging from 1 (always) to 5 (never). To facilitate interpretation, the negatively-keyed items were reverse-scored. A total of 2376 participants reported on descriptive norms.

Injunctive condom-use norm (other visitors)

The injunctive norm was measured by asking participants how they believed that other visitors at a site would react to engaging in CAS. A 5-point scale ranging from 1 (approving) to 5 (disapproving) was used. To facilitate interpretation, the negatively-keyed items were reverse-scored. A total of 2376 participants reported on injunctive norms.

Condom-use norm (good friend)

Participants were asked whether they had a good friend who also visited the particular site (yes/no). If yes, men were asked to answer two similar questions for site-specific norms as they had regarding other visitors, this time with their good friend in mind. A total of 1975 reported on norms regarding their good friend.

Participants' own condom use

Participants who filled out the questionnaire at a sex venue were asked optional questions as to whether they had had anal sex themselves in the preceding six months on-premise (yes/no) and whether they had used condoms during those incidences (yes/no). Likewise, participants at nonsex venues and websites were asked if they had had sex with men they met via these routes (yes/no) and whether they had used condoms during anal sex with them (yes/no). Questions regarding participants' own behavior were optional and were answered by 1421 participants (see Table 2).

Statistical analyses

We described the demographics and frequency of site visits across all five types of sites. To test for differences among them, chi-square tests were used for categorical variables and non-parametric Kruskal-Wallis tests for continuous variables.

The descriptive norm variable was dichotomized as follows: The responses 'never', 'mostly not' and 'sometimes' were categorized as having CAS, whereas 'mostly' and 'always' were categorized as using condoms. The injunctive norm variable was dichotomized as follows: The responses '3' and higher were categorized as disapproval of condom use, whereas the responses '1' and '2' were categorized as approval of condom use.

Univariate and multivariate logistic regression analyses were conducted to investigate the association between type of site and norms. For the type of site variable, sex venue was chosen as the reference category. Based on a previous study [10], the multivariate model included variables that were considered potential confounders for the association between type of site and norms: age, education level, nationality, and sexual orientation.

For MSM who reported both the assumed behavior and their own actual behavior ($n=1262$), we compared the scores on the norms variables using McNemar tests. Furthermore, univariate and multivariate logistic regression analyses were conducted to investigate the association between norms and one's own condom use. All norm variables were entered as continuous into the model. For these analyses, two multivariate models were constructed. Model 1 examined the associations between norms regarding other visitors and one's own condom use. Model 2 examined the associations between norms regarding the good friend and own condom use, controlling for norms regarding other visitors. Both models were adjusted for variables that were considered potential confounders for the association between norms and own condom use (i.e., age, education level, nationality, sexual orientation) as suggested in the literature (e.g., [11]).

For all analyses, we checked for interactions between the main variables of interest and the other variables in the final multivariate models. Prior to the logistic regression analyses, collinearity among all variables was checked by computing variance inflating factor (VIF) for each determinant and by computing correlations between the determinants. VIF values above 10 and correlations above 0.70 were regarded as an indication of collinearity.

For all analyses, a $p < 0.05$ was considered statistically significant. Analyses were performed with the SPSS 19 statistical package.

RESULTS

Enrollment

A total of 2376 participants enrolled in the study at 56 sites: 376 participants at 18 sex venues, 537 participants at 21 bars/clubs, 113 participants at 9 social/sports gathering venues, 495 participants at 6 dating websites and 855 participants at 2 social network websites.

Sample characteristics

The median age of the participants was 30 years (interquartile range [IQR] = 22-43), 56% were highly educated, and 82% were of Dutch background (Table 1). Overall, sample characteristics differed among types of sites. At offline sex venues, participants were on average older, and a higher proportion was non-Dutch. At all three types of offline sites, participants were more likely to be highly educated than at websites. Websites were most frequently visited, social/sports gatherings the least (Table 1).

Norms and self-reported behavior per site

At the 18 offline sex venues, 64% (242/376) and 24% (69/283) of participants assumed that other visitors and their good friend would have condomless sex, respectively. Only 19% (60/324) reported that they themselves had not used condoms. For norms and participants' own behavior at the other types of sites, see Table 2.

The association between type of site and norms (other visitors)

Among 2367 MSM, univariate analyses revealed that type of site and younger age were significantly associated with condom-use norms. Multivariate analyses showed that compared to men at sex venues, men at social/sports gathering venues assumed it more likely that other visitors would use condoms when engaging in anal sex (Table 3). Multivariate analyses likewise showed that, compared to men at sex venues, men at bars/clubs and social/sports gatherings assumed it more likely that other visitors would approve of condom use.

Descriptive norms per referent type and self-reported behavior

Among MSM who reported on *both* referent types and their own behavior ($n = 1262$), a high proportion assumed that other visitors would have CAS across all site types aggregated (67%; 839/1262); with regard to their good friend this was significantly lower (31%; 391/1262), $p < 0.001$. The proportion of participants who reported that they themselves had not used condoms was 24% (298/1262).

The association between norms and self-reported behavior

Univariate analyses revealed that if participants assumed that other visitors would not use condoms they were more likely to engage in CAS themselves (Table 4). VIF scores (< 10) and correlations (ranging from 0.27 to 0.64) did not reveal any collinearity among the 4 norm variables. Investigating the association between norms regarding other visitors and participant's

Table 1. Demographic characteristics and frequency of visits among 2376 MSM at the five types of gay venues and web sites across the Netherlands.

	Overall		Sex venues		Bars/clubs		Social/sports gatherings		Dating websites		Social network websites	
	N=2376	n (%)	N=376	n (%)	N=537	n (%)	N=113	n (%)	N=495	n (%)	N=855	n (%)
Age: Median [IQR]	30 [22-43]		44 [36-51]		27 [23-37]		41 [29.5-48.5]		41 [27-51]		23 [20-30]	
≥43	493 (20.7)		166 (44.1)		57 (10.6)		37 (32.7)		189 (38.2)		44 (5.1)	
30-42	479 (20.2)		129 (34.3)		103 (19.2)		36 (31.9)		120 (24.2)		91 (10.6)	
23-29	587 (24.7)		66 (17.6)		168 (31.3)		23 (20.4)		95 (19.2)		235 (27.5)	
≤22	485 (34.4)		15 (4.0)		209 (38.9)		17 (15.0)		91 (18.4)		485 (56.7)	
Educational level												
Low & middle	1031 (44.4)		142 (38.9)		191 (35.8)		31 (28.2)		227 (47.9)		440 (52.6)	
High	1289 (55.6)		223 (61.1)		343 (64.2)		79 (71.8)		247 (52.1)		397 (47.4)	
Nationality												
Dutch	1943 (81.8)		274 (72.9)		442 (82.3)		91 (80.5)		411 (83.0)		725 (84.8)	
Non-Dutch	433 (18.2)		102 (27.1)		95 (17.7)		22 (19.5)		84 (17.0)		130 (15.2)	
Sexual Orientation^a												
Mean (SD)	4.96 (1.35)		5.13 (1.30)		5.11 (1.31)		5.14 (1.30)		4.63 (1.56)		4.97 (1.22)	
Median [IQR]	5 [4-6]		6 [5-6]		6 [5-6]		6 [5-6]		5 [3-6]		5 [4-6]	
Frequency of visit^b												
at least once every 2 weeks	1630 (68.6)		175 (46.5)		196 (36.5)		58 (51.3)		458 (92.5)		743 (86.9)	
Once a month or less than once a month	506 (21.3)		145 (38.6)		225 (41.9)		44 (38.9)		30 (6.1)		62 (7.3)	
More than 6 months ago or never before	240 (10.1)		56 (14.9)		116 (21.6)		11 (9.7)		7 (1.4)		50 (5.8)	

Note. Totals might not add up due to missing values. MSM = men who have sex with men; IQR = inter quartile range; SD = standard deviation.

^a Sexual orientation was measured using a 7-point Kinsey scale, ranging from exclusively heterosexual (0) to exclusively homosexual (6).

^b Participants' frequency of visit of a specific site in the preceding 6 months.

Table 2. Descriptive and injunctive site-specific condom-use norms regarding other visitors (N=2376), regarding a good friend (N=1975), and proportions of MSM's self-reported condom use (N=1421) among MSM at gay venues and websites across the Netherlands.

	Overall	Sex venues	Bars/clubs	Social/sports gatherings	Dating websites	Social network websites	p
	N=2376 ^c	N=376	N=537	N=113	N=495	N=855	
	n/N (%)	n/N (%)	n/N (%)	n/N (%)	n/N (%)	n/N (%)	
Descriptive condom-use norm^a							
Perception that others would engage in condomless anal sex							
<i>Other visitors</i>	1483/2376 (62.4)	242/376 (64.4)	346/537 (64.4)	41/113 (36.3)	289/495 (58.4)	565/855 (66.6)	<0.001
Median [IQR]	3 [2-3]	3 [2-3]	3 [2-3]	2 [1-3]	3 [2-3]	3 [2-3]	
<i>Good Friend</i>	588/1975 (29.8)	69/283 (24.4)	109/471 (23.1)	14/92 (15.2)	165/407 (40.5)	231/722 (32.0)	<0.001
Median [IQR]	3 [2-3]	3 [2-3]	3 [2-3]	2 [1-3]	3 [2-3]	3 [2-3]	
Injunctive condom-use norm^b							
Perception that others would disapprove of condom use							
<i>Other visitors</i>	1153/2376 (48.5)	194/376 (51.6)	220/537 (41.0)	25/113 (22.1)	243/495 (49.1)	471/855 (55.1)	<0.001
Median [IQR]	2 [1-3]	2 [1-3]	2 [1-3]	1 [1-2]	2 [1-3]	2 [1-3]	
<i>Good Friend</i>	389/1975 (19.7)	63/283 (22.3)	83/471 (17.6)	8/92 (8.7)	119/407 (29.2)	183/722 (25.3)	<0.001
Median [IQR]	1 [1-2]	1 [1-2]	1 [1-2]	1 [1-2]	1 [1-3]	1 [1-2]	
Participants' engagement in condomless anal sex with visitors met at site	318/1421 (22.4)	60/324 (18.5)	31/204 (15.2)	7/38 (18.4)	98/376 (26.1)	122/479 (25.5)	<0.001

Note. Totals might not add up due to missing values. MSM = men who have sex with men; IQR = inter quartile range.

^a The responses 'never', 'mostly not' and 'sometimes' were categorized as having condomless anal sex, whereas 'mostly' and 'always' were categorized as using condoms.

^b The responses '3' and higher were categorized as disapproval of condom use, whereas the responses '1' and '2' were categorized as approval of condom use.

^c Denominators differ for responses regarding other visitors, the good friend (dependent on whether the good friend also visited the venue), and participant's own behavior (optional).

Table 3. The association between type of site and descriptive and injunctive site-specific condom-use norms regarding other visitors among 2376 MSM at gay venues and websites across the Netherlands.

	Univariate		Multivariate ^a	
	OR (95%CI)	p	OR (95%CI)	p
Descriptive norm				
Perception that others would engage in condomless anal sex ^b				
<i>Type of site</i>				
Sex venues	1	<0.001	1	<0.001
Bars/clubs	1.00 (0.76-1.32)		0.85 (0.63-1.14)	
Social/sports gatherings	0.32 (0.20-0.49)*		0.28 (0.18-0.45)*	
Dating websites	0.78 (0.59-1.02)		0.72 (0.54-0.96)	
Social network websites	1.08 (0.84-1.39)		0.89 (0.66-1.20)	
Injunctive norm				
Perception that others would disapprove of condom use ^c				
<i>Type of site</i>				
Sex venues	1	<0.001	1	<0.001
Bars/clubs	0.65 (0.50-0.85)*		0.47 (0.35-0.63)*	
Social/sports gatherings	0.27 (0.16-0.43)*		0.23 (0.14-0.39)*	
Dating websites	0.91 (0.69-1.18)		0.82 (0.62-1.08)	
Social network websites	1.15 (0.90-1.47)		0.74 (0.56-0.99)	

Note. MSM = men who have sex with men; OR = odds ratio; CI = confidence interval.

^a Adjusted for age, educational level, nationality and sexual orientation.

^b The responses 'never', 'mostly not' and 'sometimes' were categorized as having condomless anal sex, whereas 'mostly' and 'always' were categorized as using condoms.

^c The responses '3' and higher were categorized as disapproval of condom use, whereas the responses '1' and '2' were categorized as approval of condom use.

**p*-value <0.01.

Table 4. The association between descriptive and injunctive site-specific condom-use norms and self-reported condomless anal sex with visitors met at a particular site among 1262 MSM at gay venues and websites across the Netherlands.

	Univariate		Multivariate Model 1 ^a		Multivariate Model 2 ^a	
	OR (95%CI)	p	OR (95%CI)	p	OR (95%CI)	p
Descriptive condom-use norm^b						
Other visitors	1.87 (1.60-2.19)	<0.001	1.49 (1.28-1.82)	<0.001	1.33 (1.12-1.60)	0.002
Good Friend	1.89 (1.67-2.13)	<0.001			1.36 (1.16-1.59)	<0.001
Injunctive condom-use norm^c						
Other visitors	1.82 (1.61-2.07)	<0.001	1.60 (1.36-1.80)	<0.001	1.38 (1.19-1.60)	<0.001
Good Friend	1.97 (1.74-2.23)	<0.001			1.36 (1.15-1.61)	<0.001

Note. MSM = men who have sex with men; OR = odds ratio; CI = confidence interval.

^a Adjusted for age, educational level, nationality, and sexual orientation.

^b Descriptive norms: Perception that others would engage in condomless anal sex; measured using a 5-point scale, ranging from 'always' to 'never'.

^c Injunctive norms: Perception that others would disapprove of condom use; measured using a 5-point scale ranging from 'approving' to 'disapproving'.

own condom use revealed that men who assumed that other visitors would not use condoms and would disapprove of it, were more likely to engage in CAS themselves (Table 4). Likewise, investigating the association between norms regarding the good friend and participant's own behavior revealed that men who assumed that their good friend would not use condoms and would disapprove of it, were more likely to engage in CAS themselves. In model 2, the effects of norms regarding other visitors were retained.

DISCUSSION

The present study investigated site-specific descriptive and injunctive norms regarding condom use among MSM visiting sex and nonsex sites, offline and online, across the Netherlands. We found that more than half of our participants assumed that other men on site would engage in CAS and that almost half of participants assumed that other MSM would disapprove of condom use. However, these proportions were significantly lower regarding their perceptions of a good friend's condom use. These findings corroborate previous research suggesting that discrepancies between assumed behavior of others increases with the increase of social distance from the norm referent [12].

As far as self-report of condom use is concerned, our data have shown that among the subsample who reported on own condom use, 67% believed that others would not use condoms during anal sex, but only 24% of the participants reported not using condoms themselves. Questions arise regarding the potential underlying causes for such a discrepancy. It is possible that risk-takers systematically avoided our study or did not fill in this part of our questionnaire. However, it could also be that this discrepancy reflects a general inclination among our participants to overestimate the actual noncondom use of others. The term *pluralistic ignorance* has been coined for such situations, in which a majority privately disagrees with a norm that they incorrectly assume to be approved by most others [13, 14]. If this is true, then our participants might unjustifiably perceive themselves as 'a minority' that is willing to use condoms. Such misperceptions need to be corrected in the future since our findings have pointed to a significant association between negative norms and self-reported CAS, even when the latter was not frequent in our sample. We are further concerned that if these norms regarding condom use in the context of casual sex remain problematic, CAS might further increase in the future.

As for the differences in descriptive and injunctive norms among types of sites, our findings revealed that men at social/sports gatherings assumed it more likely that others would use condoms compared to men at the other types of sites. This is not surprising, as such gatherings are aimed more at social than sexual interaction, and visitors do not necessarily have the intent of finding potential sex partners there. As for the associations between norms and

condom use, our findings support previous studies that investigated comparable types of norms [4, 15-17].

An interesting question raised by our findings is the relative effect of norms versus the type of site on condom use. To gain more insight into this question we conducted an additional analysis including both type of site and norms in a final multivariate model predicting condom use. We found that type of site was not associated with condom use but that all norm effects on condom use were retained (data not shown). This suggests that behavior was less influenced by a particular type of site but rather by what men assumed regarding the behavior of others at that site. Apparently, a place is perceived to be risky through associated norms rather than its actual function as, for example, a sex venue, bar/club, or website. However, it is also conceivable that sites may facilitate the formation of such norms. Previous research suggested that condom-use norms that characterize certain venues are created by individuals, and such individuals are influenced by the functionality of the venue, and that both may synergistically influence sexual behavior on-premise [10, 18]. We recommend that such reciprocity be further studied and understood in the future.

Some limitations of our study should be mentioned. First, our convenience samples within each venue and website only represent those visitors who participated. As a consequence, generalization of our results to a larger population of MSM at the various venues and websites across the Netherlands must be made cautiously. Second, we were not able to correct for possible multiple submissions. However, we assume that multiple submissions are rare in our study. Our offline data collection spanned over a short period of time covering large and separated geographical regions. It is therefore unlikely that a significant amount of our participants could have been present in different regions in the Netherlands and participated more than once. For the online part of the study we offered no incentive for participation and thus individuals were probably not motivated to complete our questionnaires more than once. Therefore, we believe multiple responses in the online survey were also rare. We are not able to correct for hypothetical cases of multiple responses of those participating in both online and offline surveys. Third, another limitation is the fact that reporting on own condom use behavior was optional. Only 60% of the participants were willing to answer these optional items and their reported condom use might differ from that of the nonresponders. Nonetheless, proportions of self-reported condom use from the present study closely resembled findings of previous monitoring studies (e.g., [19]) and the Amsterdam Cohort Studies [20] regarding condom use during casual sex in the Netherlands. Finally, at the time of data collection, pre-exposure prophylaxis (PrEP) for HIV [21] was not attainable in the Netherlands and its efficacy was not yet endorsed by the Dutch public health authority. True to 2015, PrEP is not yet locally available outside trial structures. Once it becomes structurally available, its use could lead to decreasing condom use and could affect men's ideas about the risks of acquiring HIV which will further shape the norms and expectations around condomless sex.

In summary, the findings from the present study highlight the problematic site-specific norms regarding the use and approval of condoms by visitors of gay venues and websites in the Netherlands. MSM assumed that other visitors of these sites would not use condoms and would disapprove of them. However, participants themselves reported high levels of condom use suggesting that they might consider themselves to be in a minority in wanting to use condoms. Above all, if noncondom use was reported, it was associated with descriptive norm assumptions that others would engage in condomless sex. These norms, therefore, are problematic and HIV prevention should invest efforts in dealing with and correcting such descriptive norms, especially if they might reflect an overestimation of actual noncondom use. HIV prevention would do well to help MSM realize they are apparently not alone in using or wanting to use condoms in the context of casual sex across the Netherlands.

FUNDING

Funding for the present study was given by the Aidsfonds, The Netherlands (Project Number 2008025). Theo Sandfort's contribution to this article was supported by NIMH center grant P30-MH43520 (PI: Robert Remien, PhD) to the HIV Center for Clinical and Behavioral Studies.

REFERENCES

1. Cialdini RB, Demaine LJ, Sagarin BJ, Barrett DW, Rhoads K, Winter PL. **Managing social norms for persuasive impact.** *Soc Infl* 2006; 1(1):3-15.
2. Ravis A, Sheeran P. **Descriptive norms as an additional predictor in the theory of planned behaviour: A meta-analysis.** *Curr Psychol* 2003; 22(3):218-233.
3. Cialdini RB, Reno RR, Kallgren CA. **A focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places.** *J Pers Soc Psychol* 1990; 58(6):1015-1026.
4. Peterson JL, Bakeman R. **Impact of beliefs about HIV treatment and peer condom norms on risky sexual behavior among gay and bisexual men.** *J Community Psychol* 2006; 34(1):37-46.
5. McKechnie ML, Bavinton BR, Zablotska IB. **Understanding of norms regarding sexual practices among gay men: literature review.** *AIDS Beh* 2013; 17(4):1245-1254.
6. Reidy WJ, Spielberg F, Wood R, Binson D, Woods WJ, Goldbaum GM. **HIV risk associated with gay bathhouses and sex clubs: findings from 2 seattle surveys of factors related to HIV and sexually transmitted infections.** *Am J Public Health* 2009; 99 Suppl 1:S165-172.
7. Haubrich DJ, Myers T, Calzavara L, Ryder K, Medved W. **Gay and bisexual men's experiences of bathhouse culture and sex: 'looking for love in all the wrong places'.** *Cult Health Sex* 2004; 6(1):19-29.
8. Elwood WN, Greene K, Carter KK. **Gentlemen don't speak: Communication norms and condom use in bathhouses.** *JACR* 2003; 31(4):277-297.
9. Ajzen I. **The theory of planned behavior.** *Organ Behav Hum Decis Process* 1991; 50(2):179-211.
10. Grov C. **HIV risk and substance use in men who have sex with men surveyed in bathhouses, bars/clubs, and on Craigslist.org: venue of recruitment matters.** *AIDS Behav* 2012; 16(4):807-817.
11. Ghaziani A, Cook TD. **Reducing HIV infections at circuit parties.** *IAPAC Mon* 2005; 11(4):100-108.
12. Borsari B, Carey KB. **Descriptive and injunctive norms in college drinking: a meta-analytic integration.** *J Stud Alcohol* 2003; 64(3):331-341.
13. Katz D, Allport F, Jenness M. **Students' attitudes; a report of the Syracuse University reaction study.** Syracuse, NY: Craftsman Press; 1931; 408.
14. Prentice DA, Miller DT. **Pluralistic ignorance and the perpetuation of social norms by unwitting actors.** In: *Adv Exp Soc Psychol, Vol 28.* San Diego, CA: Academic Press; US; 1996. pp. 161-209.
15. Berg RC, Grimes R. **Do traditional risk factors predict whether men who have sex with men engage in unprotected anal intercourse? The need for locally based research to guide interventions.** *Health: An Interdisciplinary Journal for the Social Study of Health, Illness and Medicine* 2011; 15(5):517-531.
16. Franssens D, Hospers HJ, Kok G. **Social-cognitive determinants of condom use in a cohort of young gay and bisexual men.** *AIDS care* 2009; 21(11):1471-1479.
17. Hamilton CJ, Mahalik JR. **Minority stress, masculinity, and social norms predicting gay men's health risk behaviors.** *J Couns Psychol* 2009; 56(1):132-141.
18. Grov C, Hirshfield S, Remien RH, Humberstone M, Chiasson MA. **Exploring the venue's role in risky sexual behavior among gay and bisexual men: an event-level analysis from a national online survey in the U.S.** *Arch Sex Behav* 2013; 42(2):291-302.
19. Van Empelen P, Van Berkel M, Roos E, Zuillhof W. **Schorer Monitor 2011.** Amsterdam: Schorer Stichting; 2010.
20. Jansen IA, Geskus RB, Davidovich U, Jurriaans S, Coutinho RA, Prins M, et al. **Ongoing HIV-1 transmission among men who have sex with men in Amsterdam: a 25-year prospective cohort study.** *AIDS* 2011; 25(4):493-501.
21. Grant RM, Lama JR, Anderson PL, McMahan V, Liu AY, Vargas L, et al. **Preexposure chemoprophylaxis for HIV prevention in men who have sex with men.** *New Eng J Med* 2010; 363(27):2587-2599.



Chapter 4

The power of principles: the long-term effect of strong personal norms on condom use among men who have sex with men

Wijnand van den Boom, Ineke G Stolte, Maria Prins, Theo Sandfort & Udi Davidovich

Submitted



ABSTRACT

Strong personal norms, or principles, are internalized values or inner convictions as to performing a given behavior. These are strong beliefs that are held irrespective of the opinions of peers. We hypothesized that principles could predict condom use over longer periods than would behavioral intentions among men having sex with men (MSM). For this study we used data from the Amsterdam Cohort Studies (ACS) over a 4-year period. We included 260 MSM (mean age=39, sd=8.2) with at least two ACS visits at which they reported on condom use with casual partners. Principles and intentions were measured at baseline using three items each, Cronbach's alpha=0.91 and 0.73, respectively. Logistic regression was performed to examine the association between principles/intentions and condom use (yes/no) at 6 months follow-up and at last visit (median follow-up time 3.5 years; IQR=3.2-3.6). Bivariate analyses examining the effect of principles and intentions separately, revealed that, at both 6-months follow-up and last visit, men with strong principles and strong intentions were significantly more likely to report condom use than men with weak principles or intentions. However, multivariate analyses revealed that, at 6 months follow-up, higher condom use was reported only among men with strong intentions (OR=16.6; 95%CI=3.9-70.1) but not among men with strong principles (OR=3.4; 95%CI=0.8-16.6) while at the last visit the opposite was true: higher condom use was reported only by men with strong principles (OR=5.3; 95%CI=1.3-21.3) and the effect for intentions was not retained (OR=2.8; 95%CI=0.8-9.9). Our findings suggest that strong principles regarding safer sex are resilient cognitions that influence behavior over a long period time. HIV prevention should therefore try to facilitate the formation of principles regarding effective HIV risk-reduction strategies, while such a process may prove challenging, it most likely will yield long-term health benefits and good return on investment.

INTRODUCTION

Strong personal norms, or principles, are internally-driven personal values or inner convictions that motivate an individual for or against a given behavior [1]. Personal norms differ from social norms as they are held irrespective of what others think or expect [2].

Previous studies among HIV-negative men who have sex with men (MSM) found that personal norms have a direct effect on intentions to use condoms, even when attitudes, subjective norms, and self-efficacy have been accounted for [3, 4]. Men had higher intentions to use condoms when they felt that not using condoms was against their principles.

In this study, we examined the effect of personal norms on long-term behavior. Principles, operationalized as strong personal norms [5], reflect intrinsic convictions that are extremely important for an individual to adhere to and will do so irrespective of external factors, such as the opinions of peers. We hypothesized that individuals who possess such principles to use condoms are more likely to consistently use them over the years. Intentions on the other hand are defined as the readiness to perform a specific behavior in a specific context [6]. They are typically operationalized to predict shorter time-periods and are more sensitive to influence by the context of the behavior measured [7]. We examined the association of principles and behavioral intentions both measured at the same time with reports of condom use with casual partners over a period of 4 years among MSM participating in the Amsterdam Cohort Studies (ACS). We expected only principles to be able to predict condom use over a longer period of years. If strong principles are associated with more stable behavioral outcomes over the years they could be valuable assets for HIV prevention as their formation among target groups means long term behavioral effects and a good return on prevention investments.

METHODS

Study population

The ACS, initiated in 1984, is an open on-going prospective cohort study to investigate HIV epidemiology—its psychosocial determinants, course of infection, and pathogenesis—and to evaluate the effect of interventions among HIV-negative and HIV-positive MSM [8, 9]. Men are eligible to participate in the cohort if they are living in or around Amsterdam and have had at least one male sexual partner in the preceding 6 months. Men are recruited into the ACS by ‘convenience sampling’ (e.g., brochures at the STI clinic, advertisements in the gay scene) and ‘chain-referral sampling’ (participants recruited by other participants) [9].

Participants visit the Public Health Service of Amsterdam every six months to complete a self-administered questionnaire regarding their sexual risk behavior in the preceding six months. For further details on ACS methods, see [9].

Study sample

We used data from three ACS data waves representing the period of January 2011 through December 2014. At the start of the study period, 435 HIV-negative MSM were participating in the cohort (figure 1), of whom 99% (n=429) provided full information on their principles and intentions. Of these, men were included in the present study if during the study period they had at least two ACS visits at which they reported insertive and/or receptive anal intercourse with casual partners and provided complete data on condom use (n=266). Six men (2%) were subsequently excluded from the analyses because their HIV seroconversion during the study period could have impacted their sexual risk behavior over time. There remained a study sample of n=260 MSM who continued to be HIV-negative, with a median follow-up time of 3.47 years (IQR=3.24-3.57). The mean age was 39 years (SD=8.21); 76% (194/260) were highly educated, and 92% (236/258) were of Dutch background.

Of the original 429, 163 men were not included because they had only one ACS visit and/or had not reported on the necessary information. This group did not significantly differ on demographics (e.g., age), principles, intentions and sexual behavior from the participants who qualified for inclusion.

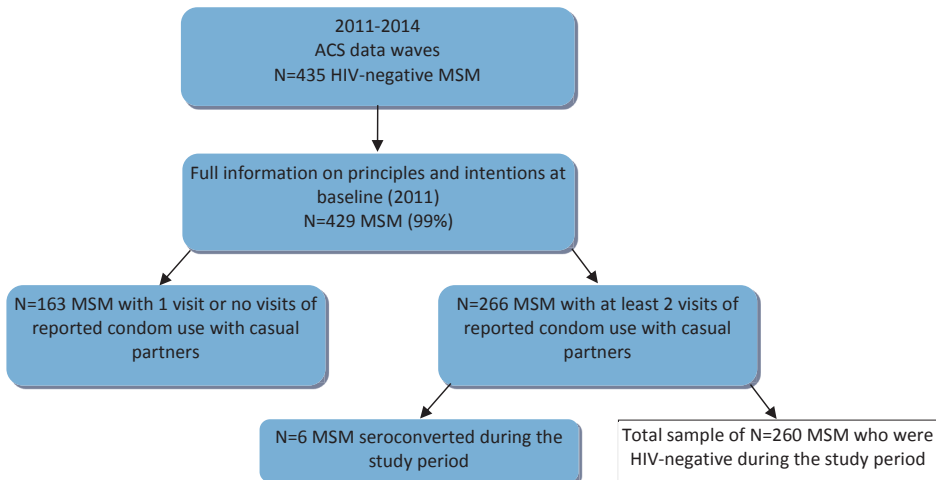


Figure 1. Study Sample

ACS=Amsterdam Cohort Studies. MSM=men who have sex with men

Measures

Casual sex partner

Casual sex partners in our study referred to ‘one-night stands’ and were defined as ‘someone you have met by chance and had sex with only once.’ Our constructs of principles and intentions were operationalized for this type of partner.

Condom use

If participants reported any anal intercourse with casual sex partners in the preceding six months, they were asked how often they had used condoms (ranging on a 5-point scale from 'never' to 'always'). Condom use was defined as always using condoms. Condomless sex was defined as never or inconsistently using condoms.

Principles

Principles were defined as self-defined internalized personal values regarding the use of condoms with casual partners [5]. Principles towards condom use at baseline (i.e., the first ACS visit in the period 2011-2014) were measured using three items (e.g., "According to my principles, I always use condoms during anal intercourse with casual partners"), with five response options ranging from 'highly unlikely' (1) to 'highly likely' (5) (Cronbach's $\alpha=0.91$).

Intentions

According to the Theory of Planned Behavior [6], intentions were defined as the readiness to use condoms in a specific context, which in this case meant, 'with casual sex partners' in the following 6 months. Intentions to use condoms at baseline were measured using three items (e.g., "In the upcoming six months, I intend to use condoms during anal intercourse with casual sex partners") with 7 response options ranging from 'highly unlikely' (1) to 'highly likely' (7) (Cronbach's $\alpha=0.73$).

Other measures assessed age, nationality ('Dutch' versus 'Non-Dutch'), and educational level ('high' versus 'low/middle'). Educational level was considered 'high' with completion of higher vocational education or university and 'low/middle' with completion of secondary vocational education, high school, basic vocational education, or primary school.

Statistical analyses

At baseline, we used descriptive statistics for demographic characteristics. The median score of all three separate principle and intention items was 5 and 7 (the highest possible scores), respectively. Hence, the distribution of responses was heavily skewed. Those having the highest score were defined as having 'strong' personal norms (principles) or intentions. Those participants who *did* deviate from this response pattern were considered a meaningful group as they appeared to have no (or less) strong ideas about using condoms. Again, because of the skewed distributions, we categorized those who scored a mean value of 4-4.99 for principles and 5.5-6.99 for intentions as 'medium' (sub-highest scores). Participants with a mean value of lower than 4 for principles and lower than 5.5 for intentions we categorized as possessing a 'weak' (lowest scores) principle/intention.

Proportions of condom use were compared between the participant's 6-months follow-up cohort visit and his last visit during the study period, using McNemar tests.

Two separate bivariate and multivariate models were constructed to test the effect of baseline principles and intentions on condom use reported at the two visits, using logistic regression analyses. Although intentions were operationalized to predict behavior over a period of 6 months, we added intentions into the multivariate model for the last visit in order to confirm that they indeed do not have a long-term predictive effect and to be able to demonstrate that principles are essentially a better long-term predictor of condom use.

Age, educational level, and nationality were considered potential co-variables. Only those variables with a bivariate p -value of <0.10 were included in the multivariate model. Variables with a p -value of <0.05 in the multivariate model were considered statistically significant and included in the final model. Total follow-up time in years between the 6-months follow-up visit and the last visit was forced into the multivariate model to correct for the possible differences in follow-up time between the participants.

We checked for interactions between the main variables of interest and the other variables in the final multivariate model. Prior to regression analyses, collinearity between principles and intentions was checked by computing the variance inflating factor (VIF) for each determinant. VIF values above 10 and Pearson correlations above 0.70 were regarded as an indication of collinearity. VIF values < 10 and a correlation of 0.63 ($p<0.01$) did not suggest strong collinearity between principles and intentions for the multivariate model. All analyses were performed using SPSS version 21 (SPSS Inc., Chicago, IL).

RESULTS

The proportion of participants who reported condom use in the preceding six months at both visits was 59% (154/260); 17% ($n=43$) changed from condom use to non-condom use; 10% ($n=26$) changed from non-condom use to condom use, and 14% ($n=37$) were consistent non-condom users, $p=0.053$.

A strong personal norm was reported by 79% ($n=205$), whereas weak and medium principles were reported by 6% ($n=15$) and 15% ($n=40$) of participants, respectively. Regarding intentions, 7% ($n=18$) reported a weak intention, 19% ($n=49$) a medium intention, and 74% ($n=193$) a strong intention. The overlap in responses between principles and intentions was 82% ($n=212$), with 4% ($n=9$) reporting both weak principles and intentions, 11% ($n=24$) medium, and 84% ($n=179$) strong.

Association between principles/intentions and condom use

Bivariate analyses revealed that, at the 6-months follow-up and last visit, men with strong personal norms and strong intentions were significantly more likely to report condom use

than men with weak principles and intentions (Table 1). At the 6-months follow-up visit, odds ratios were greater for intentions than for principles; at the last visit, the opposite was true.

Multivariate analysis for the 6-months follow-up visit revealed that only men with strong intentions were significantly more likely to report condom use at that visit (OR=16.57; CI=3.92-70.08) (Table 1). The effect of strong personal norms was not significant in this model (OR=3.35; CI=0.77-16.62). Regarding the last visit, multivariate analysis revealed that men with strong personal norms were significantly more likely to report condom use (OR=5.25;

Table 1. Bivariate and multivariate associations between principles and intentions (measured at the baseline visit) and proportions of anal sex with a condom with casual partners reported at 6-months follow-up and the last visit, among n=260 HIV-negative MSM with at least two study visits, participants in the ACS between 2011-2014.

		6-months follow-up				
		Proportion of condom sex				
		n/N (%)	Bivariate OR (95%CI)	p-value	Multivariate OR (95%CI)	p-value
Principle						
weak	4/15 (27%)	1		<0.001	1	0.146
medium	23/40 (57%)	3.72 (1.01-13.72)			1.65 (0.36-7.59)	
strong	170/205 (83%)	13.36 (4.02-44.38)			3.35 (0.77-16.62)	
Intention						
weak	3/18 (17%)	1		<0.001	1	<0.001
medium	30/49 (61%)	7.90 (2.01-30.95)			6.48 (1.50-27.98)	
strong	164/193 (85%)	28.28 (7.70-103.85)			16.57 (3.92-70.08)	
		Last visit				
		Proportion of condom sex				
		n/N (%)	Bivariate OR (95%CI)	p-value	Multivariate OR* (95%CI)	p-value
Principle						
weak	4/15 (27%)	1		<0.001	1	0.006
medium	18/40 (45%)	2.25 (0.61-8.28)			1.70 (0.40-7.17)	
strong	158/205 (77%)	9.29 (2.81-30.58)			5.25 (1.30-21.30)	
Intention						
weak	6/18 (33%)	1		<0.001	1	0.151
medium	26/49 (53%)	2.26 (0.73-6.99)			1.67 (0.46-6.03)	
strong	148/193 (77%)	6.58 (2.34-18.52)			2.84 (0.82-9.91)	

*Odds Ratios for last visits were corrected for the time between the 6-months follow-up first and the last visit during the study period.

Principles were defined as self-defined internalized personal values regarding the use of condoms with casual partners.

Intentions were defined as the readiness to use condoms with casual partners in the following six months.

OR=odds ratio. MSM=men who have sex with men. CI=confidence interval.

CI=1.30-21.30); however, the effect of intentions on condom use was not retained (OR=2.84; CI=0.82-9.91). None of the other variables examined, including age, educational level, and nationality, were significantly associated with reporting condom use at either visit.

DISCUSSION

The present study demonstrated, in line with our hypotheses, that strong personal norms, or principles, regarding condom use with casual partners predicted long-term condom use. As expected, intentions to use condoms predicted short-term condom use, as proposed by the Theory of Planned Behavior [6]. Our findings suggest that a strong personal norm regarding consistent condom use is a core cognition that retains its association with behavior over time. Intentions reflect the readiness to use condoms only in the period of time and the context in which they were measured in.

To understand the association of strong personal norms with consistent behavior over time we can consider the concepts of the Self-Determination Theory (SDT): internally self-determined motivation versus externally-determined motivation [10]. A strong personal norm is comparable to, or is a reflection of, self-determined motivation. Those individuals whose motivation is self-determined, or internally-driven, will experience a sense of autonomy when conducting a relevant behavior in accordance with their intrinsic goals [10]. According to the SDT, such individuals are more likely to achieve their behavioral goals than individuals whose motivation is controlled by external factors such as pressure, demand or reward.

Our findings regarding intentions are corroborated by previous research showing that the longer the time interval between the assessment of intentions and behavior, the more likely reported behavior is shifted away from previously reported intentions [7]. This increased discrepancy between intention and behavior over time is explained by unexpected situational events that change decisions about when and with whom to use condoms [11].

Our results suggest that strong personal norms can add to our understanding of consistent condom use among HIV-negative MSM. The results also underline the importance of such internalized cognitions. While over the past decade individual-motivational theories were criticized as having limited capacity to predict or change behaviors due to their incapacity to incorporate contextual influences on behavior (e.g., [12]), it is important to realize that individual-level factors can apparently have strong lasting effects on sexual behavior. In order to develop more effective strategies to influence MSM's sexual risk behavior, HIV prevention should try to facilitate the formation of strong personal norms regarding condom use and other risk-reduction strategies which an individual might consider desirable, either by creating new principles or by activating existing ones. According to the Norm-Activation Theory, to activate concrete personal norms of an individual requires the possession of two types of

beliefs related to the particular behavior: the individual must accept personal responsibility for the behavior and must also be aware of the consequences of its performance or non-performance [5]. If HIV prevention efforts succeed in supporting the formations of such types of beliefs, they might be able to contribute to the formation of strong safer-sex personal norms or principles.

In today's world of HIV prevention, the formation or activation of safer-sex principles may not be successful to a full extent just by activating men's condom use principles. Rather, in the era of biomedical interventions, safer-sex principles are likely to emerge regarding new behavioral strategies for preventing HIV that were not previously available. Strategies such as the use of HIV pre-exposure prophylaxis [13], selection of partners with undetectable viral load [14], or selection of partners based on serosorting [15] are all examples of strategies that can be the themes of new emerging principles to avoid HIV transmission. Changing personal norms regarding safer-sex strategies is not an easy task, but interventions that can facilitate self-determined beliefs and goals regarding different safer-sex options, might produce the persisting behavioral effect that is needed. Meanwhile, qualitative research among HIV-negative MSM should investigate how principles regarding prevention strategies other than condom use are formed and examine their resilience over time.

The present study has several limitations. First, as our study sample consisted of highly educated and mainly Western-European MSM, generalization of our findings to other populations must be made cautiously. Second, in this study we concentrated on the principles regarding condom use with one-night stands only. Sex with other types of more familiar casual partners, such as sex buddies, or with steady partners, can influence men's values regarding condom use in such settings [16, 17]. Men could perceive one-night stands to be a riskier setting than that of more familiar sex partners or steady partners and therefore it might be easier to retain principles to always use condoms in the context of strictly casual sex. Third, as principles were measured only at baseline, we could not determine whether they changed over the 4-year study period. Although we showed their association with long-term condom use behavior, we recommend further investigation as to how principles are subject to change over time and how such changes might have an effect on maintaining condom use with casual partners.

In conclusion, the present study found that having a strong personal norm to use condoms predicted long-term future condom use. Our findings suggest that principles about always using condoms are core cognitions that retain their association with behavior over time, in contrast to strong intentions that represent a more temporal and context-specific association with condom use. In order to develop more effective strategies to influence MSM's sexual risk behavior, HIV prevention efforts should try to facilitate the formation of principles about using condoms or other effective HIV risk-reduction strategies.

ACKNOWLEDGMENTS

The authors wish to thank the participants of the Amsterdam Cohort Studies for their contribution, research nurses of the Amsterdam Cohort Studies Marc van Wijk and Marjolein Martens for data collection and cohort management, Gerben Rienk Visser for data management, Ronald Geskus for advice on the statistical analyses, and Lucy Phillips for editing the final manuscript.

FUNDING

Funding for the present study was given by the Aidsfonds, the Netherlands, project number 2008025. Dr. Sandfort's contribution to this manuscript was supported by National Institute of Mental Health Center Grant P30-MH43520.

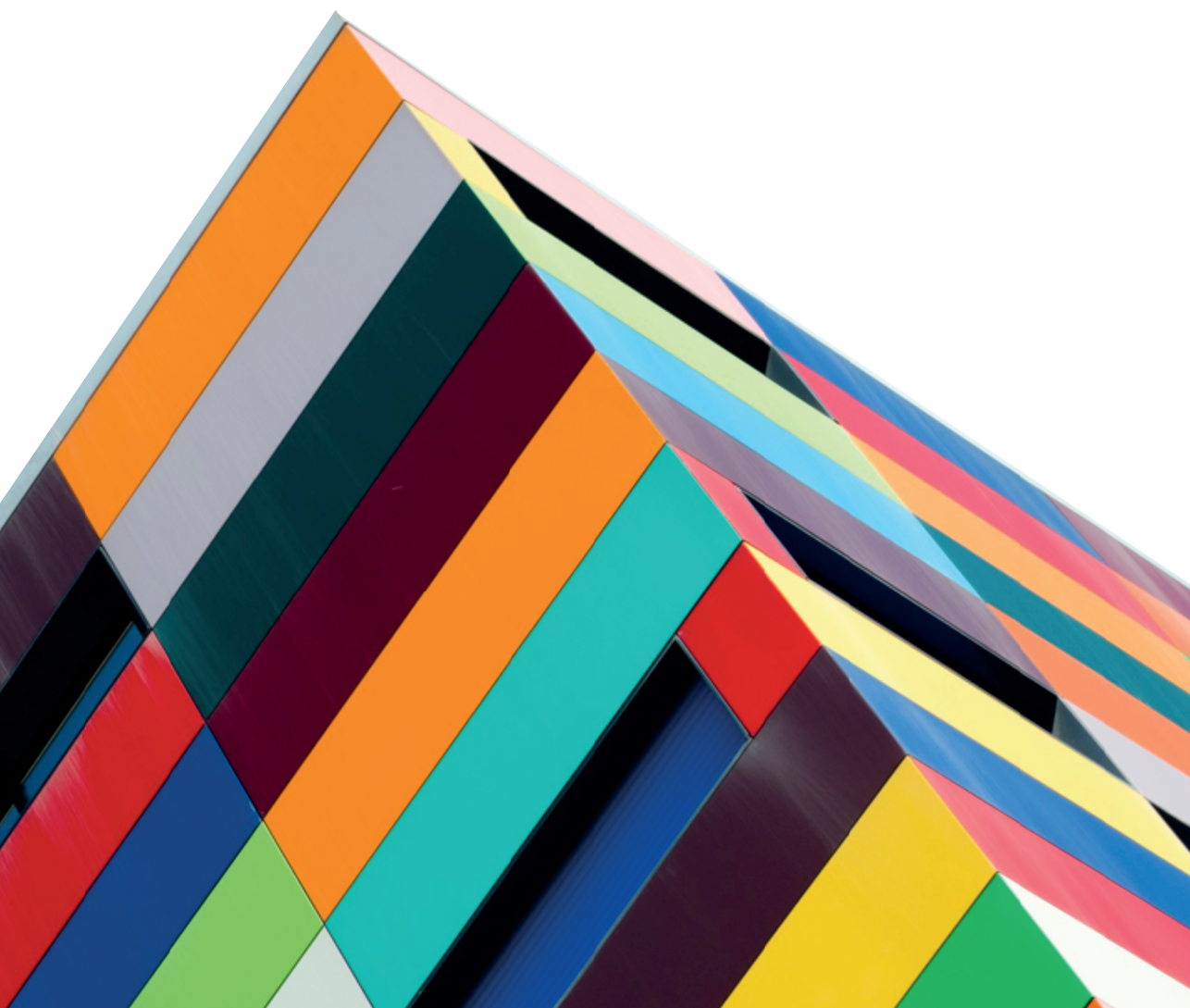
REFERENCES

1. Triandis HC. **Values, attitudes, and interpersonal behavior.** *Nebr Symp Motiv* 1980; 27:195-259.
2. Godin G, Conner M, Sheeran P. **Bridging the intention-behaviour 'gap': the role of moral norm.** *Br J Soc Psychol* 2005; 44(Pt 4):497-512.
3. Franssens D, Hospers HJ, Kok G. **Social-cognitive determinants of condom use in a cohort of young gay and bisexual men.** *AIDS Care* 2009; 21(11):1471-1479.
4. Kok G, Hospers HJ, Harterink P, De Zwart O. **Social-cognitive determinants of HIV risk-taking intentions among men who date men through the Internet.** *AIDS Care* 2007; 19(3):410-417.
5. Schwartz SH. **Normative influences on altruism.** *Adv Exp Soc Psychol* 1977; 10(221):279.
6. Ajzen I. **The theory of planned behavior.** *Organ Behav Hum Decis Process* 1991; 50(2):179-211.
7. Sheeran P, Orbell S. **Do intentions predict condom use? Meta-analysis and examination of six moderator variables.** *Br J Soc Psychol* 1998; 37 (Pt 2):231-250.
8. van Griensven GJ, Tielman RA, Goudsmit J, van der Noordaa J, de WF, de Vroome EM, et al. **Risk factors and prevalence of HIV antibodies in homosexual men in the Netherlands.** *Am J Epidemiol* 1987; 125(6):1048-1057.
9. Jansen IA, Geskus RB, Davidovich U, Jurriaans S, Coutinho RA, Prins M, et al. **Ongoing HIV-1 transmission among men who have sex with men in Amsterdam: a 25-year prospective cohort study.** *AIDS* 2011; 25(4):493-501.
10. Ryan RM, Deci EL. **Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being.** *Am Psychol* 2000; 55(1):68-78.
11. Morrison DM, Rogers Gillmore M, Baker SA. **Determinants of condom use among high-risk adults: A test of the theory of reasoned action.** *J Appl Soc Psychol* 1995; 25:651-676.
12. Burke NJ, Joseph G, Pasick RJ, Barker JC. **Theorizing social context: rethinking behavioral theory.** *Health Educ Behav* 2009; 36(5 Suppl):55S-70S.
13. Marcus JL, Volk JE, Pinder J, Liu AY, Bacon O, Hare CB, et al. **Successful implementation of HIV preexposure prophylaxis: Lessons learned from three clinical settings.** *Curr HIV/AIDS Rep* 2016; 13(2):116-24.
14. van den Boom W, Stolte IG, Witlox R, Sandfort T, Prins M, Davidovich U. **Undetectable viral load and the decision to engage in unprotected anal intercourse among HIV-positive MSM.** *AIDS Behav* 2013; 17(6):2136-2142.
15. Cassels S, Katz DA. **Seroadaptation among men who have sex with men: emerging research themes.** *Curr HIV/AIDS Rep* 2013; 10(4):305-313.
16. Davidovich U, de Wit JB, Stroebe W. **Assessing sexual risk behaviour of young gay men in primary relationships: the incorporation of negotiated safety and negotiated safety compliance.** *AIDS* 2000; 14(6):701-706.
17. 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(2):167-173.



Chapter 5

General discussion



In this thesis, we aimed to understand the contextual and cognitive factors that affect HIV-related sexual risk behaviors and engagement in protective behaviors among men who have sex with men (MSM) during sex with casual partners. Such insights will assist the development of effective prevention interventions and guide further research objectives. The practice of serosorting and its effectiveness in preventing HIV infection was addressed in chapter 2.1. In chapter 2.2 we investigated whether having an undetectable viral load influences the decisions of HIV-positive MSM to engage in condomless anal sex (CAS). Next, we elaborated on the situational factors that may influence use of condoms by MSM. We studied the effect of type of casual partners in chapter 3.1, the role of group sex in chapter 3.2 and that of meeting locations in chapter 3.3. Finally, in chapter 4 we examined whether strong intrinsic principles to always use condoms versus behavioral intentions to always use condoms predispose MSM to consistently use condoms.

5.1 NON-CONDOM BASED HIV RISK-REDUCTION STRATEGIES

5.1.1 How often is serosorting being practiced with casual partners?

In chapter 2.1, we found that 11% of HIV-negative men with a casual partner in the Amsterdam Cohort Studies had practiced serosorting in the preceding six months. Higher proportions were reported in studies in Switzerland [1], and Seattle [2]. We also demonstrated that the practice of serosorting remained relatively stable over a 4-year period (2007-2011). Other recent studies have reported increases in the practice of serosorting with casual partners over longer time spans. For example, increases were found in Seattle (29% in 2002 to 49% in 2013 [3]) and in other US cities (21% in 2005 to 27% in 2014 [4]). It is likely that the differences in actual levels of serosorting between those studies and ours might partly result from the different study populations and time periods investigated, but could also be related to the different ways in which serosorting was operationalized.

In our study, we have chosen for a purposely-based operationalization of serosorting and we therefore believe that the prevalence we established better reflects the actual level of serosorting practice. In the literature, however, most studies regarding serosorting have used an ad-hoc definition of the behavior [5]. Instead of measuring whether men have engaged in communication over HIV status to establish HIV seroconcordance before the sexual act, the practice of serosorting was exclusively determined based on retrospective reports of HIV-seroconcordant sex. In these studies, instead of planning ahead to establish HIV seroconcordance before engaging in sex, it is plausible that some of the men established HIV seroconcordance or communicated about HIV status with their partners after the sex act, or simply assumed or guessed their partners' HIV status. If such practices in the studies we refer to were counted as 'serosorting', this may have led to an overestimation of the practice of serosorting as a consciously-practiced protection strategy, explaining the differences in serosorting proportions found between aforementioned studies and ours. In accordance,

Khosropour and colleagues [2] showed that using either a purposely-based or ad-hoc based definition of serosorting can result in different prevalence estimates and associated risks. Thus, in comparing the practice of serosorting with casual partners between studies, researchers should be aware of how serosorting has been defined and operationalized.

5.1.1.1 The effectiveness of serosorting

In chapter 2.1, we investigated the effectiveness of serosorting in preventing HIV transmission in the context of casual sex. In line with results from a recent systematic review and meta-analysis [6], we learned that MSM who had CAS with serosorting were less likely to acquire HIV infection than men who had CAS without serosorting, but more likely to seroconvert than men who consistently used condoms. Even though in our study only the difference between CAS and consistent condom use was statistically significant, our results suggest that serosorting as practiced by HIV-negative MSM with casual partners, might still offer some protection against HIV infection, but less effectively than condom use. Larger studies, however, are needed to demonstrate such an effect.

Whether serosorting will lead to an increase or decrease of HIV infections at the population level, is related to how well and consistently it is practiced and the behavior it replaces. For example, in the previously mentioned study from Seattle, increases in serosorting over time among HIV-negative MSM went hand in hand with decreasing practices of CAS with HIV-serodiscordant partners [3]. Men who practiced serosorting had a 47% lower risk of acquiring HIV-infection than those who had HIV-serodiscordant CAS without serosorting. The authors concluded that this change in behavior over time may have contributed to the declines in the observed HIV incidence [3]. However, because of the potentially high error margins in establishing valid HIV seroconcordance, serosorting in the context of casual sex is not as effective as condom use. Furthermore, while still not compared to the effect of biomedical prevention interventions, serosorting will most likely not be as effective as pre-exposure prophylaxis (PrEP), an antiretroviral drug that one takes to prevent HIV infection.

Mathematical models suggest that the efficacy of serosorting largely depends on the validity of disclosure of one's own and the partner's HIV status, which in turn depends on the frequency of HIV testing among the population [7]. In populations in which undiagnosed HIV infections are common, serosorting might lead to more transmissions according to certain mathematical models (e.g., [8]). Higher frequency of testing [9], and an increasing number of MSM who regularly test [10], could lead to an increase in diagnoses of recent HIV infections, and consequently the establishment of more accurate HIV seroconcordance. This is important as individuals who have recently been infected and are not aware of their infection, account for a relatively high proportion of new HIV infections as they have high HIV viral load levels [11].

Therefore, in order to increase the effectiveness of serosorting at a population level, frequent testing should be advised. The Amsterdam STI clinic and STI AIDS Netherlands (Soa Aids Nederland) recommend sexually active MSM to test every 6 months [12]. This test-interval however was not established in order to increase the efficacy of serosorting, and it is only adhered to by 19% of MSM at STI clinics throughout the Netherlands, which raises the question whether such a recommendation is achievable and applicable for all MSM [13]. While there are indications that MSM who have higher levels of risk behavior (e.g., higher number of sex partners) tend to test more often [13,14], for serosorting with casual partners to be effective at the individual level, every serosorting encounter needs to be based on valid knowledge of the recent HIV status, i.e. an HIV test right before the sexual act that takes into account the relevant window period. Merely 'frequent testing' will not meet these serosorting-specific requirements. Therefore, for the advocacy of reliable practice of serosorting in the context of casual sex, additional specific HIV-testing guidelines are needed, which will be discussed in 5.1.5.

5.1.2 Viral load sorting as a treatment as prevention measure

Another non-condom based risk-reduction practice we investigated is viral load sorting (chapter 2.2). We operationalized this 'treatment as prevention' (TasP) strategy as 'the decision of an HIV-positive individual to have condomless anal sex based on his own undetectable viral load'. We found the practice of viral load sorting with HIV-positive partners (48%) and HIV-serodiscordant (negative or HIV-status unknown) partners (38%) in the preceding 6 months to be common among the HIV-positive MSM on cART in our sample. Since our findings were published, other studies have reported proportions ranging from 39% [15] to 58% [16], which are in line with our data. However, different from our examination, these studies did not assess the HIV status of the partner with whom viral load sorting was practiced, which limits the comparability to the practice of viral load sorting as we have operationalized it.

Among those men who practiced viral load sorting, we also assessed if this strategy was discussed with the sexual partner. We found that undetectable viral load was discussed in 91% of the HIV-seroconcordant condomless acts; however, with HIV-serodiscordant partners this was only the case in 13-25% of the condomless acts. This suggested that viral load sorting was a unilateral practice performed by the HIV-positive person without the active participatory decision of the HIV-negative partner. Although levels of protection in such sexual acts remain similarly effective, irrespective of the notification of the HIV-negative partner, our findings may point towards the stigma and taboo that surround the practice of viral load sorting that need to be addressed by HIV-prevention professionals.

We did not examine the practice of viral load sorting by HIV-negative MSM. Recent studies that did, reported lower proportions of viral load sorting practiced by HIV-negative men than by HIV-positive men, ranging from 8 to 12% [15-17]. Bavinton and colleagues showed that 20% of their HIV-negative participants were willing to use viral load information in order

to engage in CAS [18]. Most of their other participants however were skeptical about the preventive value of this strategy, especially those men who reported always using condoms. These findings suggest that the acceptance of viral load sorting among HIV-negative men was related to their own reported preventive behaviors. This was further confirmed by Holt et al [19]: HIV-negative men who reported to be at higher risk of HIV infection (e.g., higher number of sexual partners, having an HIV-positive partner) were more likely to agree that treatment prevents HIV transmission. Therefore, HIV-positive MSM who wish to discuss viral load sorting with their HIV-negative partners, not only need to be concerned with the disclosure of their HIV status, but also with the beliefs and perceptions of their HIV-negative partners regarding the protective value of undetectable viral load.

5.1.2.1 Debate around undetectable viral load and HIV transmission

Attitudes regarding viral load sorting have continuously changed as more epidemiological evidence supporting its effectiveness in preventing HIV infection became available. As described in the introduction of this thesis, in 2008 the Swiss statement [20] was released that declared that transmission of HIV is very unlikely if the HIV-positive partner has an undetectable viral load, which is suppressed by effective treatment for at least 6 months, tests regularly for viral load, and has no other STI. Since 2008, several studies have provided evidence that supported the Swiss statement [21]. In 2011, the first randomized controlled trial (i.e., HPTN 052 study) among HIV-serodiscordant heterosexual couples in Asia, Africa and the Americas reported that early initiation of cART reduced the risk of acquiring HIV by 96% [22]; after more than 5 years of follow-up, this effect was sustained [23]. However, most follow-up years were in the context of participants reporting consistent condom use, and thus the low rates of HIV transmission in the virally suppressed groups could have reflected the effects of both treatment *and* condom use. Also, a very limited number of HIV-serodiscordant MSM couples were included.

In 2012, the observational PARTNER (Partners of People on ART – A New Evaluation of the Risks) study was initiated including HIV-serodiscordant heterosexuals and MSM couples who reported condomless sex, to evaluate the effect of cART use of the HIV-positive partner as a prevention strategy [24]. For both HIV-serodiscordant heterosexual and MSM couples, the first results from the PARTNER study, published in 2016, were promising, as there was no evidence of HIV transmission between partners [25]. However, there were still relatively few person-years of follow-up available for the MSM group, resulting in relatively wide 95% confidence intervals around the estimate, with an upper limit of 20% risk over a 10-year period [25]. Hence, according to the authors, the generalizability of the findings to the MSM population should be taken with caution. The second phase of the PARTNER study (PARTNER2) will hopefully provide more conclusive evidence regarding transmission among MSM.

The PARTNER results added further strength to the statement of ‘Undetectable = Untransmittable’ by the Prevention Access Campaign [26], which represents the growing consensus

among professionals that this statement is also the reality in the context of the anal transmission route of HIV. This statement was signed by many organizations around the world, including the Dutch HIV Association (HIV Vereniging Nederland). However, this stance regarding undetectable viral load and transmission is not without its critics. For example, in 2017, the *Hello Gorgeous* magazine and the Dutch HIV Association distributed a flyer that included the message ‘undetectable = untransmittable; it’s that simple’. This flyer, of which 15.000 copies were printed, was spread to several institutions in the Netherlands, including several hospitals. In a *Hello Gorgeous* magazine column [27], Leo Schenk, an HIV activist, pointed out that the one specific hospital avoided the spread of this folder among their HIV-positive patients. According to Schenk, the hospital argued “the chance of transmitting the virus while having an undetectable viral load is indeed very small, but saying that the chance is zero, goes too far”.

Awaiting the additional results of the PARTNER study, HIV-prevention professionals should provide HIV-negative men with accurate and updated information on HIV treatment in relation to onwards HIV transmission and the benefits of early treatment for HIV-infected individuals [28,29]. HIV-negative MSM using viral load sorting as a preventive measure should be aware of valid and recent viral load levels of their HIV-positive partner(s) and be willing to accept a very small theoretical risk of transmission.

5.1.3 PrEP and other non-condom based strategies

It is important to continue monitoring and examining changes in the practice, attitudes and beliefs regarding viral load sorting and serosorting among HIV-negative MSM in the coming years. The increasing availability of biomedical options for HIV prevention targeted at HIV-negative men, such as PrEP, might make CAS with HIV-positive partners more acceptable as men are less concerned about getting infected [30]. It is also very likely that attitudes among HIV-negative MSM regarding biomedical strategies will continuously change, as information about their effectiveness against HIV infection, and their successful application, spreads more widely [31]. Such changes will probably aid in reducing stigma around condomless prevention interventions and thus might increase disclosures of HIV status and viral load level.

On the other hand, one could argue that if PrEP is used more widely, the disclosure and discussion of HIV status and viral load may be perceived as irrelevant by some HIV-negative MSM [32]. In recent years, the proportion of ACS participants who reported an intention to use PrEP on a daily basis increased from 13% in 2012 to 18% in 2015 [33]. However, the use of PrEP, while offering a great sense of freedom and reducing anxiety, is not without cost. Some HIV-negative men on PrEP experience barriers to using it, such as possible physical and mental side effects or the fear of forgetting a dose [34]. Furthermore, there could be scenarios in which PrEP use may be considered undesirable or perceived as unnecessary, for instance, when having an HIV-positive steady partner who has an undetectable viral load [35] or when temporarily sexually inactive while using daily PrEP [34].

In general, it is reasonable to assume that there will be ample situations in which men will still prefer more traditional protection strategies, such as condom use, or rely on non-condom based protection other than PrEP. Future research is needed to investigate how decisions to use non-condom based interventions such as PrEP, viral load sorting and serosorting come about and which motives and conditions predispose men to choose one strategy over another.

5.1.4 Non-condom based risk-reduction strategies and sexually transmitted infections (STI)

In the discussion of the effectiveness of non-condom based risk-reduction strategies, we should not lose sight of the fact that such strategies may increase the chance of acquiring STI other than HIV. In recent years, antibiotic-resistant gonorrhoea has become more prevalent [36], and several outbreaks have been reported among MSM in the United Kingdom [37] and the United States [38]. Furthermore, alarming rises in syphilis among MSM have been reported [39].

Among both HIV-negative and positive MSM, men who engaged in serosorting more often acquired a bacterial STI than men who did not engage in CAS [3,40]. The effect of CAS between seroconcordant HIV-positive partners may also create new dynamics in the transmission of STI. HIV-positive MSM are at increased risk of Hepatitis C virus (HCV) infection [41] and the virus continues to spread among HIV-positive MSM [42], although the incidence appears to have stabilized in the Netherlands [43]. As serosorting is commonly practiced by HIV-positive MSM [44] alongside high-risk sexual techniques, such as fisting [45], this might explain that sexual transmission of HCV is largely confined to HIV-positive MSM. A recent modeling study suggests that behavioral and not biological factors drive the epidemic in this group [46].

Because serosorting theoretically predisposes HIV-negative and HIV-positive men to have sex separately from one another, one could argue that the practice of serosorting might foster separate STI transmission networks of HIV-negative and HIV-positive MSM. However, using data from the ACS, Matser and colleagues [47] found that molecular networks of chlamydia and gonorrhoea did not separate between HIV-positive and HIV-negative MSM. These findings suggest that the prevalence of serosorting is not sufficient to induce a sexual network effect on the spread of these STI. In fact, it is very likely that the interconnectivity of HIV-positive and HIV-negative MSM will increase in the future because of the increasing use of non-condom based strategies [41]. In this context, serosorting may become less urgent and less popular, and thus less common, and STI that were disproportionately present in networks of HIV-positive MSM may now also be introduced into the larger HIV-negative MSM population. This is supported by recent findings of the AMPREP study (see also 1.1.6). At baseline before starting PrEP, HCV prevalence among HIV-negative MSM was higher (4.8%) than was previously found in the larger group of HIV-negative MSM (0.6%; at the STI clinic Amsterdam), with HCV strains found to already be circulating among HIV-positive MSM [48]. This suggests that

sexual networks of HIV-negative and HIV-positive MSM partly overlap, and in the near future might even more so with the anticipated increasing number of men taking PrEP.

Another signal of STI increase comes from an Australian demonstration PrEP trial, which showed that after 12 months of follow-up, PrEP-using men had increased levels of not only CAS but also STI [49]. However, a recent meta-analysis including different study designs such as RCTs, observational, and (open-label) demonstration studies, demonstrated that PrEP does not necessarily lead to risk compensation [50]. For individuals using PrEP, no evidence was found for a decreasing use of condoms or increased numbers of sexual partners. This could be the result of the fact that participants in many of the included studies already had high levels of reported risk behavior and number of partners before starting PrEP, alongside high STI levels. One could argue that due to a ceiling effect, a further increase in risk behavior in such populations is very difficult to achieve. In addition, a recent modeling study showed that PrEP use can ultimately lead to a significant decrease in STI incidence among MSM, most likely because of frequent testing and early treatment for STI offered to men using PrEP [51]. It was therefore suggested that for PrEP to be successful in the context of STI prevention, regular STI screening is essential. The question remains if and when PrEP uptake will also increase among lower-risk MSM populations for whom PrEP is not considered, and whether we might observe an increase in risk compensation and an increase of associated STI prevalence in this group.

To better understand the ongoing spread of STI among HIV-negative MSM, more research is needed on how non-condom based risk-reduction strategies, including biomedical strategies, contribute to the spread of STI in this population. In the future, HIV-prevention professionals should concentrate on devising ways to counteract the possibility of rising STI incidences, as biomedical prevention strategies will continue to evolve and become more widely available. Such a mission will be highly challenging as the rationale for the practice of safer sex for the purpose of avoiding STI other than HIV, might be very different from the motivation to want to avoid an HIV infection.

5.1.5 Future challenges for non-condom based risk reduction

Our findings urge for safer-sex messages to address the reality and reliability of serosorting and viral load sorting in the context of casual sex. For serosorting, true on-demand knowledge of HIV status between casual partners is still a fairly unattainable goal. Although studies have reported that self-testing kits (e.g., OraQuick) for HIV lead to increased test uptake [52], such tests still have a relatively long window period and are unable to detect primary infections [53]. Home-based testing could thus leave men attempting to engage in serosorting in the context of casual sex unaware of a recently acquired HIV infection. Therefore, men who attempt to engage in serosorting with casual partners and use home-testing, should be informed about the limitations of this strategy.

It will undoubtedly be a very favorable development for serosorting if ‘event-driven’ testing becomes available, using rapid HIV RNA self-tests with a very short window period of approximately 10 days [54]. Home-based RNA tests are not (yet) commercially available, but once they are, we might see an emergence of effective serosorting in the context of casual sex. Since 2015, Dutch MSM have had the opportunity to use an online self-referral diagnostic tool in order to identify acute HIV infection (www.hebikhiv.nl). If the tool identifies that men are at high risk for acute HIV infection, they are referred to the Amsterdam STI clinic where a point-of-care HIV RNA test is performed. So far, this self-referral tool has been successful in identifying men with acute infections and has shown to be a valuable option for screening acute infections until event-driven RNA home-based tests become a reality [55].

In addition to infrequent testing and limitations regarding testing methods, non-condom based risk-reduction strategies might be vulnerable to potential misperception or lack of knowledge regarding HIV and viral load status. This could be especially true in the context of casual sex where there might be limited opportunities for men to obtain the necessary valid information to ensure the safety of a condomless sex act [56]. HIV-positive men, for instance, might be hesitant to disclose their HIV status due to fear of stigma or fear of rejection [57], which will further hamper the discussion of viral load sorting. Furthermore, when engaging in assumed HIV-negative concordant condomless sex, this type of serosorting practice still fully relies on the validity of the disclosure of an HIV-negative status.

In order for HIV-negative MSM to successfully practice non-condom based prevention strategies (including PrEP), men need to know how to start a conversation with their casual sex partners regarding the validity of their partners’ claims and become more skilled in evaluating the robustness of the strategies involved. This could be achieved by improving negotiation skills, a realistic exchange of information between sex partners, and addressing issues related to increased risk of the acquisition of STI other than HIV. Condom use and use of PrEP could be presented by HIV-prevention professionals as the default options for safer sex with casual partners, and serosorting and viral sorting as alternative strategies in situations where strict guidelines can be followed regarding the establishment of HIV seroconcordance or the validity of the disclosed viral load levels.

HIV-prevention professionals should also be aware of the developments in the use of social media by MSM. These media play an increasingly important role for MSM in meeting sex partners and the mainstreaming of non-condom based intervention strategies. For example, mobile dating apps could facilitate viral load disclosures by providing low-threshold environments for HIV-positive MSM to disclose. Such dynamics have already occurred in the disclosure of HIV status between HIV-positive men who specifically seek HIV-positive concordant sex [58], or for HIV-positive MSM who seek PrEP-using HIV-serodiscordant sex partners [59]. However, the validity of the information disclosed online should always be judged critically, which is founded in having accurate knowledge on the matter.

As for general online information dissemination regarding non-condom based prevention strategies, obtaining the correct and updated information resources might prove challenging. The ‘information landscape’ is constantly changing as new scientific evidence emerges on the efficacy of TasP and other biomedical prevention strategies. Institutions that are entrusted with HIV prevention in the Netherlands should focus on disseminating up-to-date information in a timely manner and targeted to the specific needs of key populations like MSM. This can most easily be done through the use of websites, dating apps and social media channels (e.g., Facebook). Social media in particular are increasingly used as an online source for health-related information and are successfully used by HIV-prevention professionals to promote sexual health [60]. However, these media also allow for people to spread experiences and strategies that may lack proper scientific basis, especially now when safer-sex strategies related information is much more complex than in the time when the only available message was to use condoms. HIV-prevention professionals should monitor relevant social media sites for such communication in order to prevent potential online dissemination of incorrect information.

5.2 RISK SETTINGS & SEXUAL RISK BEHAVIOR

5.2.1 Types of casual sex partners, risk behavior and serosorting

In chapter 3.1, we looked at sexual behaviors with three types of casual sex partners: one-night stands, multiple-time casual partners and sex buddies. Our findings confirmed our hypothesis that the degree of familiarity with a sex partner facilitated sexual risk behavior. We found that HIV-negative MSM who had sex with a sex buddy were more likely to engage in CAS than men who had sex with a one-night stand. In addition, we learned that the degree of familiarity with the casual partner facilitated the practice of serosorting. The same dynamics were found in chapter 2.2: men were more likely to practice viral load sorting with sex buddies than with one-night stands.

Being more familiar with a sex partner may facilitate the disclosure and discussion of HIV status and viral load levels, and thus the practice of serosorting and viral load sorting. This might also be true for PrEP disclosure, but this has not yet been studied. Therefore, researchers who aim to measure sexual risk behavior in the form of CAS among MSM with casual partners should take into consideration that the more familiar the casual partner is, the more likely men engage in the practice of risk reduction other than condom use. Whether such practice is sufficiently protective, depends on the type of non-condom based risk-reduction strategy used and how well it is applied.

5.2.1.1 *The sex buddy as a partner type*

When examining the spectrum of familiarity with casual sex partnerships, the more anonymous part of the spectrum, the one-night stand, is easy to define. However, the other side

of that spectrum, the sex buddy, is more challenging to operationalize. Some researchers have operationalized the sex buddy type as a non-committed/non-romantic type of steady partner and found different behavioral patterns and associated risks [61-63]. For example, the Australian Seroconversion Study showed that, of those men who thought to have acquired HIV infection from their steady partners, the majority attributed their infection to their sex buddies, rather than to their ongoing romantic relationship ('boyfriend') [63]. Furthermore, in comparison to reporting having a boyfriend, reporting having a sex buddy was associated with having more concurrent partners, less knowledge of partners' HIV status [61], and acquiring more STI [62].

In the literature there is no consensus on whether sex buddies should be included within the casual or steady cluster types of partners. Traditionally, partner types among MSM have been dichotomized by researchers into either steady (conceptualized as romantic relationships) or casual (relationships without emotional and social commitment). However, incorporating the sex buddy into either the casual or the steady category might strongly influence the observed proportions of sexual risk in each category. For the casual partner category the proportion of MSM engaging in risky behaviors might increase when including reported behaviors with sex buddies, while for the steady partner category including sex buddies might decrease this proportion. We strongly recommend the sex buddy type of partnership be measured and operationalized separately in any future study assessing risk behavior and its relation to HIV and STI transmissions among MSM.

5.2.2 Group sex

A type of casual sex setting in which men have the opportunity to engage in sexual behaviors with multiple (casual) partners was investigated in chapter 3.2. We learned that men who reported having had both dyadic (one-on-one) partners *and* group sex, behaved differently within each sexual setting: men were more likely to report condom use during group sex than during dyadic sex. This was found independently of other risk factors that have frequently been linked to group sex encounters, such as use of drugs [64]. Our findings are in contradiction with other studies on group sex (e.g., [65]) that argue that group sex is a high-risk setting for HIV infection. In chapter 3.2 we have provided possible reasons for the apparent differences in results.

One of these suggested reasons was related to the possibility that the men in our sample might have been involved in group sex that is lower risk for HIV infection. For example, unplanned spontaneous group sex encounters that are performed in the public domain (e.g., cruising parks) could simply offer less comfortable or less feasible conditions to perform anal sex or other intensive and high-risk sexual practices (such as fisting or toy sharing). In support of this assumption, we found that men in our sample were significantly less likely to report any form of anal sex during group sex. On the contrary, group sex settings that take place in private homes or sex clubs organized specifically for such purposes, might offer more facilities

and opportunities for sexual practices such as anal intercourse and other more intense sexual (risk) techniques [66,67]. Unfortunately, at the time of our study, we did not measure the type of group sex setting men were engaged in. We have included this in the current ACS questionnaires and future research can shed some more light on its relative effect.

5.2.2.1 Group sex and drug use

A substantial proportion of men in our sample used drugs during group sex (see chapter 3.2), corroborating other research findings [68]. While we did not find a statistically significant association between drug use and sexual risk behavior in our study, the use of drugs is frequently reported as a major determinant of sexual risk in group sex [65]. Drugs may limit the ability of users to take proper decisions and to judge the consequences of sexual risk during group sex, as well as feeling more self-confident and losing sexual inhibitions. More specifically to group sex, drugs can help men maintain an erection over longer periods of time, heighten pain thresholds, and thus help to extend and enhance physical sexual capabilities with multiple partners [69]. Such long and extensive sexual interactions with multiple partners place a heavier burden on the human body and bring about more genital and internal anal injuries, which in their turn increase the physiological susceptibility to HIV and other STI and even HCV infection [41].

The use of some certain drugs during sex, like mephedrone, GHB and crystal meth is often referred to as 'chemsex' [70]. Chemsex is often reported among attendees of private sex parties [71] and is associated with STI acquisition among HIV-positive [72] and HIV-negative MSM [73]. Close monitoring of changes in drug use over time in Amsterdam should be performed as chemsex can bring about serious (long-term) harm, especially crystal meth and GHB, which are highly addictive. High-risk individuals who practice chemsex and have recurrent STI would benefit from enhanced combined services such as regular STI testing, promotion of safer sex or the use of PrEP, and counseling and referral for their drug use [74]. To meet the anticipated emergence of chemsex use in Amsterdam, the STI clinic at the Public Health Service of Amsterdam recently initiated monitoring and linkage-to-care services for chemsex-practicing clients, in corporation with the Jellinek, a Dutch institute for addiction care [75].

5.2.2.2 Group sex and STIs

Interestingly, our multivariate analyses indicated that reporting group sex was not associated with a higher risk of acquiring an STI compared with one-on-one sex. However, univariate analyses did show that group sex was linked to the acquisition of gonorrhoea. According to a recent US study, MSM who reported group sex were two times more likely to have a gonorrhoea infection, adjusted for CAS, than men who did not report group sex [76]. Other studies reported on increased risks of HCV infection among MSM engaging in group sex [77,78]. However, these studies, like ours, were only able to show a univariate effect of group sex on STI. A reason for this could be that engaging in group sex itself is not a risk factor for acquiring STI but rather a facilitator for men to engage in many risk behaviors other than anal sex (e.g.,

fingering) that can easily transmit STI such as gonorrhoea, but less so HIV, as put forward in chapter 3.2. During group sex, such techniques may more easily spread STI from one partner to another by a third partner, leading to 'indirect' infections [79]. Without the proper hygienic measures taken to remove these bodily fluids, for example, by not cleaning hands or toys, onward transmission of STI is highly likely during group sex. The same accounts for not changing gloves (in the case of fisting or fingering) or not changing condoms between different sex partners [80]. It is therefore important that locations where group sex is performed have facilities to maintain hygiene and enhance awareness regarding the risk of STI.

5.2.2.3 Group sex and mobile dating apps

The use of mobile geospatial social networking and hook-up apps has been found to be associated with engagement in group sex (e.g., [81]). Geospatial apps provide men with a platform through which they can select their sex partners in a very efficient and fast manner. An example of such an app is Grindr which shows a grid of photos of users and uses GPS to identify other users by their proximity [82]. In this way, group sex activities can be organized on a very short-term basis, unbound by the spatiotemporal constraints that characterize the traditional gay scene [83]. Apps such as Grindr can also provide opportunities for prevention: men can engage in in-advance risk reduction as they can communicate about their health status and sexual preferences before the group sex encounter [84]. They can a-priori negotiate and plan for the protective measures that can be present or practiced in that event (e.g., 'PrEP only' parties; [85]). HIV-prevention efforts should be channeled towards facilitating risk reduction within group sex encounters among MSM who use dating apps, as it is technically possible to target men intending to engage in group sex through these apps before such activities take place. A key component for such online interventions is being able to predict which men will engage in high-risk (group) sex behavior and prompt these men with the required information to facilitate risk-reduction negotiation and behavior. An example of an app that has incorporated online interventions in relation to behaviors is the gay-dating app Hornet. The app awards men when they share their HIV status in their profiles and is able to get users in contact with the nearest STI clinic and provide men with reminders to get re-tested for HIV and other STI [86].

5.2.2.4 Group sex: future research

Until now, the characteristics (e.g., frequency, duration) and effectiveness of non-condom based HIV risk-reduction strategies within group sex settings remain relatively unknown. Future research should pay attention to the uptake and effects of biomedical risk-reduction measures, such as PrEP, in the context of group sex. It is interesting to know when and how these measures are applied in a context in which men have sex with multiple partners and may engage in multiple sexual activities as well. Such dynamics ask for different approaches for the effective use of these measures, also with respect to STI including HCV acquisition, than for one-on-one encounters.

5.2.3 Site-specific condom-use norms

In our quest to understand men's setting-specific sexual behaviors, we examined whether the assumed behaviors and opinions of patrons (i.e., visitors) of gay venues concerning condom use are of significance in the decision to use a condom on location (chapter 3.3). Such perceptions, or perceived norms, might guide men to behave according to what they perceive is custom and socially accepted at a specific location. As outlined in box 3 of the introduction, Cialdini and colleagues [87] defined two types of norms: descriptive and injunctive. We defined descriptive condom-use norms as the perceptions of our participants of what others 'do' on premises in terms of condom use; injunctive condom-use norms were defined as what others would 'think' about the participant's condom use on those premises. We examined these norms at on- and offline gay-related locations nationwide (e.g., darkrooms, bars, sport clubs, dating and hook-up websites), and found that MSM assumed negative descriptive and injunctive norms regarding condom use by others. Hence, the majority of our participants, mostly evident at sex venues, assumed that most patrons of the premises they visited would not use or would not support condom use while engaging in anal sex. These negative condom-use norms are worrisome for future on-site sexual behavior, as we have shown that such norms are associated with the practice of more sexual risk.

Interestingly, most participants reported that they themselves in most cases used condoms on location while they assumed that others would not. To reconcile this paradoxical finding, we ascribed it to a phenomenon called 'pluralistic ignorance': the situation in which the majority thinks they are the minority [88]. Such a phenomenon has been described previously among MSM who visit sex venues (e.g., [89]). It is the role of future research to investigate the validity of the assumed discrepancy between own reported behaviors and perceived behaviors of others. HIV-prevention interventions should correct such faulty beliefs, if indeed they represent an overestimation of risky behaviors of others.

5.2.3.1 Addressing safer-sex norms at sex venues

Given the continued importance of condoms in reducing the risk of HIV infection and other STI, it is troublesome to find that the normative beliefs regarding condom use that are dominant in gay meeting venues and websites in the Netherlands are far from being pro-condom. We think that for HIV prevention the future challenge lies in the formation of a new safer-sex norm among gay men. We argue that with the increasing availability and usage of biomedical prevention strategies such as PrEP, non-condom based prevention strategies should be integrated with the option of condoms to form a new safer-sex norm, which emphasizes choice and can offer condom and non-condom based solutions that would fit individuals in different sexual settings.

In this sense, the type of protection that biomedical interventions can now offer suits the specific setting of sex venues perfectly. Negotiation or communication in advance are often difficult in sex venues, as patrons experience low motivation to do so [90], may tend to so-

cially disconnect from each other [91], or do not feel responsible for protecting their partners against HIV/STI infection [92]. Also, the continued normalization of recreational drugs among MSM at sex venues [93] and the sex venues' physical constraints (e.g., reduced lighting in crowded darkrooms meant for sex) may be responsible for difficulties around risk-reduction communication [89]. By using PrEP, patrons do not need to rely on any communication and as such can take full control of their sexual health independently of the desires and behaviors of others. Efforts to enhance condom-use negotiations at sex venues should therefore expand to include the option of PrEP. If men are not able to negotiate condom use at sex venues, they should at least feel responsible for engaging in other protection options such as PrEP. The new safer-sex norm could sound as follows: "No one comes unprepared for sexual intercourse. One either uses condoms or successfully applies one of the efficient HIV non-condom based protection strategies".

Interventions that aim to form or correct normative beliefs have shown promise for a variety of behaviors, including condom use [94]. For social norm interventions to be effective, campaigns should take the following four steps as proposed by Burchell et al [95]. The intervention should (1) be well planned, implemented, and evaluated; (2) use messages that people believe and can relate to (considering the source of the data and the way it is presented); (3) be sensitive to undesired boomerang effects: that individuals who already perform the desired behavior (who are on the 'right' side of the norm) change their behavior towards the more 'problematic' side of the norm; (4) use appropriate reference groups [95]. Relating Burchell's point 4 to our study in chapter 3.3, the perceptions regarding patrons may vary according to the different types of locations that were investigated. At nonsex locations, such as bars, it is possible that the 'others' will be more familiar and intimate referrals (e.g., friends and acquaintances one interacts with at such locations), while for sex venues men are more likely to relate their perceptions to non-familiar/anonymous visitors [96]. HIV-prevention professionals should therefore consider the correct reference group when addressing men with normative feedback for the various sex and nonsex venues.

Also, the presence of physical representation of HIV-prevention measures such as on-site HIV testing can facilitate the preservation or formation of on-location safer-sex norms. For men who have sex on-site, initiatives that include on-site HIV testing [97] and the free availability of condoms and lubricants, located at clearly marked places that are easy to find for patrons, can still be helpful [98]. Recent Dutch research showed that by providing STI/HIV testing at various sex venues, MSM who are at risk of HIV and (asymptomatic) STI can be reached [99]. The authors argue that by diagnosing STI and by making men aware of the sexual risks, outreach activities might prevent ongoing transmission on-site. Also, for on-site HIV-prevention initiatives like HIV testing to be successful, key stakeholders such as venue and website owners, staff, and patrons should be involved and provide feedback on the usability and acceptability of prevention interventions [100].

Further research on the subject of setting-specific safer-sex norms should pay attention to the relative effect of the person versus the location on the formation of new safer-sex norms. As discussed in chapter 3.3, we could not discern the relative effect of a location over the effect of interaction with individuals who visit that location. A key question remains: do the physicality and the conditions of a location predispose certain behaviors or do the norms of the visiting patrons play a bigger role in shaping on-premise behavior, and how do these factors interact. Some studies indicate that it could be that the location itself facilitates the formation of norms and that these norms may appear to attract certain MSM subpopulations who engage in specific (on-site) risk-taking behaviors [96]. Future research should examine within-person differences in behaviors across locations, where individuals could serve as their own control [101]. Such comparisons, often relying on statistical analysis methods such as ‘case-crossover analyses’, could provide a better understanding of the synergy between individual preferences, the physical properties of sex venues, and existing on-site social norms.

5.3 PRINCIPLES FOR ALWAYS USING CONDOMS

Finally, in chapter 4, we investigated the effects of MSM’s ‘principles’ (strong personal norms) on the use of condoms with casual partners. These types of principles were defined as ‘clear-cut self-internalized commitments to use condoms’. We tested the hypothesis that those men who reported strong internal principles about always using condoms are more likely to engage in consistent condom use over time. The effects of principles on condom use were compared to the effects of behavioral intentions, which are usually operationalized to predict shorter time periods (e.g., in our study the previous 6 months), and are therefore expected to be more sensitive to contextual influences [102]. We found that principles predicted behavior better in the long term (i.e., 4 years), while the intention to use a condom was a stronger predictor for condom use in the short term (i.e., 6 months). Our findings suggest that strong internalized principles are strong core cognitions that retain their effects over time.

Our findings should be considered in light of the current available (biomedical) non-condom based prevention strategies as described in chapters 2.1, 2.2, and 3.1. These preventive strategies may, for some men, be more appealing than condoms. As such, we expect that given the increasing availability of biomedical strategies to prevent HIV infection, men can ultimately develop safer-sex principles that are more inclusive than only the use of condoms. Hence, if the drop in the acceptability of condoms might have hampered the maintenance of safer-sex norms and principles, the availability of new biomedical measures can create a new impulse for the formation of newly and revised safer-sex concepts to create new safer-sex principles. An example of such a principle could be “I always protect myself against HIV, if not by using a condom then by using PrEP”.

Researchers should find a way to investigate the formation of safer-sex principles that are inclusive of the new HIV risk-reduction strategies available. Such studies can inform new HIV-prevention interventions that will be able to facilitate the emergence of such new safer-sex principles among MSM. By doing so, we believe long-term positive behavioral change can be achieved.

5.4 CLOSING REMARKS

In this thesis, we aimed to identify current sexual risk determinants among MSM and understand the sexual prevention strategies that they practice, in particular non-condom based strategies. In our studies we observed MSM's (in)ability to engage in a wide range of protective sexual behaviors according to different settings and types of sex partners. Additionally, we gained insights into the different external and internal motives that influence the engagement in protective behaviors.

When considering the potential drawbacks of some non-condom based risk-reduction strategies, one could simply argue that condoms are often still the best strategy to avoid HIV infection and other STI among MSM. However, for the prevention of HIV infection for individuals who have difficulty with the use of condoms or have strong preferences against it, biomedical prevention strategies (e.g., PrEP), in addition to other non-condom based prevention strategies, can offer viable solutions.

An ongoing challenge for HIV-prevention researchers is to get better insights into which factors underlie the choices that men make between risk-reduction strategies. The extent to which PrEP and other non-condom based biomedical prevention strategies will influence men's sexual lives in the coming years is still a relatively uncharted terrain. It is very likely that condomless anal sex will continue to rise among MSM with the anticipated increasing number of men taking PrEP. It will therefore be important to closely monitor the uptake of these measures and to discern their impact on the sexual behaviors of MSM, their sexual wellbeing, and the spread of HIV and other STI. Crucial in that respect are longitudinal data of studies like the Amsterdam Cohort Studies on HIV which provide both psychosocial and biological results regarding sexual risk behavior, choice of protective behaviors, and HIV and STI incidence among MSM.

Assisted by this gained knowledge, HIV-prevention professionals can support men in making the protective choices that better match their desires and needs. HIV-prevention professionals should therefore keep endorsing the full range of HIV-protection strategies that are available to men, and remember to address the barriers and consequences of each chosen strategy. Such an approach, which should also integrate the promotion of HIV and STI testing

and take into account individual as well as situational factors, will most likely be the winning future formula for successful HIV prevention among MSM.

REFERENCES

1. Dubois-Arber F, Jeannin A, Locicero S, Balthasar H. **Risk reduction practices in men who have sex with men in Switzerland: serosorting, strategic positioning, and withdrawal before ejaculation.** *Arch Sex Behav* 2012; 41(5):1263-1272.
2. Khosropour CM, Dombrowski JC, Hughes JP, Manhart LE, Simoni JM, Golden MR. **Operationalizing the measurement of seroadaptive behaviors: A comparison of reported sexual behaviors and purposely-adopted behaviors among men who have sex with men (MSM) in Seattle.** *AIDS Behav* 2017.
3. Khosropour CM, Dombrowski JC, Swanson F, Kerani RP, Katz DA, Barbee LA, et al. **Trends in serosorting and the association with HIV/STI risk over time among men who have sex with men.** *J Acquir Immune Defic Syndr* 2016; 72(2):189-197.
4. Paz-Bailey G, Mendoza MC, Finlayson T, Wejnert C, Le B, Rose C, et al. **Trends in condom use among MSM in the United States: the role of antiretroviral therapy and seroadaptive strategies.** *AIDS* 2016; 30(12):1985-1990.
5. Siegler AJ, Sullivan PS, Khosropour CM, Rosenberg ES. **The role of intent in serosorting behaviors among men who have sex with men sexual partnerships.** *J Acquir Immune Defic Syndr* 2013; 64(3):307-314.
6. Purcell DW, Higa D, Mizuno Y, Lyles C. **Quantifying the harms and benefits from serosorting among HIV-negative gay and bisexual men: A systematic review and meta-analysis.** *AIDS Behav* 2017.
7. Cassels S, Menza TW, Goodreau SM, Golden MR. **HIV serosorting as a harm reduction strategy: evidence from Seattle, Washington.** *AIDS* 2009; 23(18):2497-2506.
8. Wilson DP, Regan DG, Heymer KJ, Jin F, Prestage GP, Grulich AE. **Serosorting may increase the risk of HIV acquisition among men who have sex with men.** *Sex Transm Dis* 2010; 37(1):13-17.
9. Fairley CK, Law M, Chen MY. **Eradicating syphilis, hepatitis C and HIV in MSM through frequent testing strategies.** *Curr Opin Infect Dis* 2014; 27(1):56-61.
10. Reitsema M, Steffers L, Wallinga J, van Benthem B, Visser M, de Munnik S, et al. **Cost-effectiveness of increased HIV testing among men who have sex with men in the Netherlands.** NCHIV2017: Amsterdam; 2017.
11. Ratmann O, van Sighem A, Bezemer D, Gavryushkina A, Jurriaans S, Wensing A, et al. **Sources of HIV infection among men having sex with men and implications for prevention.** *Sci Transl Med* 2016; 8(320):320ra322.
12. Soa Aids Nederland. **Onder controle. Strategie voor de aanpak van soa's en hiv onder MSM in Nederland 2013-2018**[Under control. Strategy for the management of STIs and HIV under MSM in the Netherlands 2013-2018]. Amsterdam: Soa Aids Nederland; 2013.
13. Visser M, Heijne JC, Hogewoning AA, van Aar F. **Frequency and determinants of consistent STI/HIV testing among men who have sex with men testing at STI outpatient clinics in the Netherlands: a longitudinal study.** *Sex Transm Infect* 2017;sextrans-2016-052918.
14. Vriend HJ, Stolte IG, Heijne JC, Heijman T, De Vries HJ, Geskus RB, et al. **Repeated STI and HIV testing among HIV-negative men who have sex with men attending a large STI clinic in Amsterdam: a longitudinal study.** *Sex Transm Infect* 2015; 91(4):294-299.
15. Card KG, Lachowsky NJ, Cui Z, Carter A, Armstrong H, Shurgold S, et al. **A Latent Class Analysis of Seroadaptation Among Gay and Bisexual Men.** *Arch Sex Behav* 2016.
16. Holt M, Lea T, Mao L, Zablotska I, Prestage G, de Wit J. **Brief Report: HIV Prevention by Australian Gay and Bisexual Men With Casual Partners: The Emergence of Undetectable Viral Load as One of a Range of Risk Reduction Strategies.** *J Acquir Immune Defic Syndr* 2015; 70(5):545-548.

17. Bogowicz P, Moore D, Kanters S, Michelow W, Robert W, Hogg R, et al. **HIV testing behaviour and use of risk reduction strategies by HIV risk category among MSM in Vancouver.** *Int J STD AIDS* 2016; 27(4):281-287.
18. Bavinton BR, Holt M, Grulich AE, Brown G, Zablotska IB, Prestage GP. **Willingness to Act upon Beliefs about 'Treatment as Prevention' among Australian Gay and Bisexual Men.** *PLoS One* 2016; 11(1):e0145847.
19. Holt M, Lea T, Schmidt HM, Murphy D, Rosengarten M, Crawford D, et al. **Increasing Belief in the Effectiveness of HIV Treatment as Prevention: Results of Repeated, National Surveys of Australian Gay and Bisexual Men, 2013-15.** *AIDS Behav* 2016; 20(7):1564-1571.
20. Vernazza P, Hirschel B, Bernasconi E, Flepp M. **HIV transmission under highly active antiretroviral therapy.** *Lancet* 2008; 372(9652):1806-1807; author reply 1807.
21. Vernazza P, Bernard EJ. **HIV is not transmitted under fully suppressive therapy: The Swiss Statement-eight years later.** *Swiss Med Wkly* 2016; 146:w14246.
22. Cohen MS, Chen YQ, McCauley M, Gamble T, Hosseinipour MC, Kumarasamy N, et al. **Prevention of HIV-1 infection with early antiretroviral therapy.** *N Engl J Med* 2011; 365(6):493-505.
23. Cohen MS, Chen YQ, McCauley M, Gamble T, Hosseinipour MC, Kumarasamy N, et al. **Antiretroviral Therapy for the Prevention of HIV-1 Transmission.** *N Engl J Med* 2016; 375(9):830-839.
24. Rodger A, Bruun T, Weait M, Vernazza P, Collins S, Estrada V, et al. **Partners of people on ART - a New Evaluation of the Risks (The PARTNER study): design and methods.** *BMC Public Health* 2012; 12:296.
25. Rodger AJ, Cambiano V, Bruun T, Vernazza P, Collins S, van Lunzen J, et al. **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(2):171-181.
26. Prevention Access Campaign. **Risk of sexual transmission of hiv from a person living with hiv who has an undetectable viral load.** 2017 <https://www.preventionaccess.org/consensus> (accessed 15-11-2017).
27. Hello Gorgeous Magazine. **AMC weigert folder over niet meetbaar = niet overdraagbaar.** 2017 <http://www.hellogorgeous.nl/2017/01/amc-weigert-folder-meetbaar-overdraagbaar> (accessed 15-11-2017).
28. Lundgren JD, Babiker AG, Gordin F, Emery S, Grund B, Sharma S, et al. **Initiation of Antiretroviral Therapy in Early Asymptomatic HIV Infection.** *N Engl J Med* 2015; 373(9):795-807.
29. Reitsema M, Wallinga J, van Benthem B, van Sighem A, Schim van der Loeff M, M X. **The impact of immediate initiation of combination antiretroviral therapy on the HIV epidemic among MSM.** NCHIV2017: Amsterdam; 2017.
30. Whitlock G, Boccino S, Kanagalinghan U, Nwokolo N. **Risk perception in MSM taking prep: a survey.** *Sex Transm Infect* 2017; 93(5):325.
31. Hall EW, Heneine W, Sanchez T, Sineath RC, Sullivan P. **Preexposure Prophylaxis Modality Preferences Among Men Who Have Sex With Men and Use Social Media in the United States.** *J Med Internet Res* 2016; 18(5):e111.
32. Bavinton B. **Biomedical HIV prevention: Implications for the sexual practices and relationships of gay and bisexual men.** Sydney: The University of New South Wales; 2016.
33. Coyer L, van Bilsen W, Bil J, Davidovich U, Hoornenborg E, Prins M, et al. **Pre-exposure prophylaxis (PrEP) among men who have sex with men (MSM) in the Amsterdam Cohort Studies (ACS): Eligibility, intention and actual use.** NCHIV2017: Amsterdam; 2017.
34. Zimmermann HML, Eekman SW, Achterbergh RCA, Prins M, Schim van der Loeff MF, de Vries HJC, et al. **Pre-exposure prophylaxis (PrEP) among men who have sex with men (MSM) in the Netherlands: motives for starting, choosing for, switching to, or stopping with daily or event-driven PrEP.** AIDS Impact: Cape Town; 2017.

35. Bil JP, van der Veldt WM, Prins M, Stolte IG, Davidovich U. **Motives of Dutch men who have sex with men for daily and intermittent HIV pre-exposure prophylaxis usage and preferences for implementation: A qualitative study.** *Medicine (Baltimore)* 2016; 95(39):e4910.
36. Unemo M, Shafer WM. **Antimicrobial resistance in *Neisseria gonorrhoeae* in the 21st century: past, evolution, and future.** *Clin Microbiol Rev* 2014; 27(3):587-613.
37. Didelot X, Dordel J, Whittles LK, Collins C, Bilek N, Bishop CJ, et al. **Genomic Analysis and Comparison of Two Gonorrhoea Outbreaks.** *MBio* 2016; 7(3).
38. Kirkcaldy RD, Harvey A, Papp JR, Del Rio C, Soge OO, Holmes KK, et al. ***Neisseria gonorrhoeae* Antimicrobial Susceptibility Surveillance - The Gonococcal Isolate Surveillance Project, 27 Sites, United States, 2014.** *MMWR Surveill Summ* 2016; 65(7):1-19.
39. Abara WE, Hess KL, Neblett Fanfair R, Bernstein KT, Paz-Bailey G. **Syphilis Trends among Men Who Have Sex with Men in the United States and Western Europe: A Systematic Review of Trend Studies Published between 2004 and 2015.** *PLoS One* 2016; 11(7):e0159309.
40. Jin F, Prestage GP, Templeton DJ, Poynten IM, Donovan B, Zablotska I, et al. **The impact of HIV seroadaptive behaviors on sexually transmissible infections in HIV-negative homosexual men in Sydney, Australia.** *Sex Transm Dis* 2012; 39(3):191-194.
41. van de Laar TJ, Richel O. **Emerging viral STIs among HIV-positive men who have sex with men: the era of hepatitis C virus and human papillomavirus.** *Sex Transm Infect* 2017; 93(5):368-373.
42. van Santen DK, van der Helm JJ, Del Amo J, Meyer L, D'Arminio Monforte A, Price M, et al. **Lack of decline in hepatitis C virus incidence among HIV-positive men who have sex with men during 1990-2014.** *J Hepatol* 2017; 67(2):255-262.
43. Vanhommel JW, Stolte IG, Lambers FA, Geskus RB, van de Laar TJ, Bruisten SM, et al. **Stabilizing incidence of hepatitis C virus infection among men who have sex with men in Amsterdam.** *J Acquir Immune Defic Syndr* 2014; 66(5):e111-115.
44. Chan DP, Sun HY, Wong HT, Lee SS, Hung CC. **Sexually acquired hepatitis C virus infection: a review.** *Int J Infect Dis* 2016; 49:47-58.
45. Urbanus AT, van de Laar TJ, Stolte IG, Schinkel J, Heijman T, Coutinho RA, et al. **Hepatitis C virus infections among HIV-infected men who have sex with men: an expanding epidemic.** *AIDS* 2009; 23(12):F1-7.
46. MacGregor L, Martin NK, Mukandavire C, Hickson F, Weatherburn P, Hickman M, et al. **Behavioural, not biological, factors drive the HCV epidemic among HIV-positive MSM: HCV and HIV modelling analysis including HCV treatment-as-prevention impact.** *Int J Epidemiol* 2017.
47. Matser A. **Sexually transmitted infections: unravelling transmission & impact;** 2015.
48. Hoorenborg E, Achterbergh RCA, Schim van der Loeff MF, Davidovich U, Hogewoning A, de Vries HJC, et al. **MSM starting preexposure prophylaxis are at risk of hepatitis C virus infection.** *AIDS* 2017; 31(11):1603-1610.
49. Lal L, Audsley J, Murphy D, Fairley CK, Stooove M, Roth N, et al. **Medication adherence, condom use and sexually transmitted infections in Australian PrEP users: interim results from the Victorian PrEP Demonstration Project.** *AIDS* 2017.
50. Fonner VA, Dalglis SL, Kennedy CE, Baggaley R, O'Reilly KR, Koechlin FM, et al. **Effectiveness and safety of oral HIV preexposure prophylaxis for all populations.** *AIDS* 2016; 30(12):1973-1983.
51. Jenness SM, Weiss KM, Goodreau SM, Gift T, Chesson H, Hoover KW, et al. **Incidence of Gonorrhoea and Chlamydia Following HIV Preexposure Prophylaxis among Men Who Have Sex with Men: A Modeling Study.** *Clin Infect Dis* 2017.

52. Johnson CC, Kennedy C, Fonner V, Siegfried N, Figueroa C, Dalal S, et al. **Examining the effects of HIV self-testing compared to standard HIV testing services: a systematic review and meta-analysis.** *J Int AIDS Soc* 2017; 20(1):21594.
53. Stevens DR, Vrana CJ, Dlin RE, Korte JE. **A Global Review of HIV Self-testing: Themes and Implications.** *AIDS Behav* 2017.
54. Centers for Disease Control and Prevention and Association of Public Health Laboratories. **Laboratory Testing for the Diagnosis of HIV Infection: Updated Recommendations.** 2014 <http://dx.doi.org/10.15620/cdc.23447> (accessed 22-12-2017).
55. Dijkstra M, Bruisten S, Hoornenborg E, Hogewoning A, de Vries H, van der Loeff MS, et al. **Implementation of a rapid HIV-1 RNA test in diagnosing acute HIV infections among visitors of the Amsterdam clinic of sexually transmitted infections.** *J Clin Virol* 2016; 82:S7-S8.
56. Zablotska IB, Imrie J, Prestage G, Crawford J, Rawstorne P, Grulich A, et al. **Gay men's current practice of HIV seroconcordant unprotected anal intercourse: serosorting or seroguessing?** *AIDS Care* 2009; 21(4):501-510.
57. Li H, Chen X, Yu B. **Disclosure appraisal mediating the association between perceived stigma and HIV disclosure to casual sex partners among HIV+ MSM: a path model analysis.** *AIDS Care* 2016; 28(6):722-725.
58. Heijman T, Stolte I, Geskus R, Matser A, Davidovich U, Xiridou M, et al. **Does online dating lead to higher sexual risk behaviour? A cross-sectional study among MSM in Amsterdam, the Netherlands.** *BMC Infect Dis* 2016; 16(1):288.
59. Newcomb ME, Mongrella MC, Weis B, McMillen SJ, Mustanski B. **Partner Disclosure of PrEP Use and Undetectable Viral Load on Geosocial Networking Apps: Frequency of Disclosure and Decisions About Condomless Sex.** *J Acquir Immune Defic Syndr* 2016; 71(2):200-206.
60. Tso LS, Tang W, Li H, Yan HY, Tucker JD. **Social media interventions to prevent HIV: A review of interventions and methodological considerations.** *Curr Opin Psychol* 2016; 9:6-10.
61. Bavinton BR, Duncan D, Grierson J, Zablotska IB, Down IA, Grulich AE, et al. **The Meaning of 'Regular Partner' in HIV Research Among Gay and Bisexual Men: Implications of an Australian Cross-Sectional Survey.** *AIDS Behav* 2016; 20(8):1777-1784.
62. Cornelisse VJ, Fairley CK, Phillips T, Walker S, Chow EP. **Fuckbuddy partnerships among men who have sex with men - a marker of sexually transmitted infection risk.** *Int J STD AIDS* 2017;956462417717647.
63. 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 Behav* 2017; 21(8):2543-2550.
64. Hirshfield S, Schrimshaw EW, Stall RD, Margolis AD, Downing MJ, Jr, Chiasson MA. **Drug Use, Sexual Risk, and Syndemic Production Among Men Who Have Sex With Men Who Engage in Group Sexual Encounters.** *Am J Public Health* 2015; 105(9):1849-1858.
65. Rich AJ, Lachowsky NJ, Cui Z, Sereda P, Lal A, Birch R, et al. **Substance use, sexual behaviour and prevention strategies of Vancouver gay and bisexual men who recently attended group sex events.** *Cult Health Sex* 2016; 18(4):361-376.
66. Grov C, Parsons JT, Bimbi DS. **Sexual risk behavior and venues for meeting sex partners: an intercept survey of gay and bisexual men in LA and NYC.** *AIDS Behav* 2007; 11(6):915-926.
67. Grov C, Rendina HJ, Ventuneac A, Parsons JT. **HIV risk in group sexual encounters: an event-level analysis from a national online survey of MSM in the U.S.** *J Sex Med* 2013; 10(9):2285-2294.
68. Bourne A, Weatherburn P. **Substance use among men who have sex with men: patterns, motivations, impacts and intervention development need.** *Sex Transm Infect* 2017; 93(5):342-346.

69. Weatherburn P, Hickson F, Reid D, Torres-Rueda S, Bourne A. **Motivations and values associated with combining sex and illicit drugs ('chemsex') among gay men in South London: findings from a qualitative study.** *Sex Transm Infect* 2017; 93(3):203-206.
70. Bourne A, Reid D, Hickson F, Torres-Rueda S, Steinberg P, Weatherburn P. **"Chemsex" and harm reduction need among gay men in South London.** *Int J Drug Policy* 2015; 26(12):1171-1176.
71. Schmidt AJ, Bourne A, Weatherburn P, Reid D, Marcus U, Hickson F, et al. **Illicit drug use among gay and bisexual men in 44 cities: Findings from the European MSM Internet Survey (EMIS).** *Int J Drug Policy* 2016; 38:4-12.
72. Hegazi A, Lee MJ, Whittaker W, Green S, Simms R, Cutts R, et al. **Chemsex and the city: sexualised substance use in gay bisexual and other men who have sex with men attending sexual health clinics.** *Int J STD AIDS* 2017; 28(4):362-366.
73. Drückler S, van Rooijen MS, de Vries HJ. **Chemsex among men who have sex with men; a sexualized drug use survey among clients of the STI outpatient clinic and users of a gay dating app in Amsterdam, the Netherlands.** *Sex Transm Des* 2017.
74. Ottaway Z, Finnerty F, Buckingham T, Richardson D. **Increasing rates of reported chemsex/sexualised recreational drug use in men who have sex with men attending for postexposure prophylaxis for sexual exposure.** *Sex Transm Infect* 2017; 93(1):31.
75. Achterbergh RCA, van der Helm JJ, van den Brink W, de Vries HJC. **Design of a syndemic based intervention to facilitate care for men who have sex with men with high risk behaviour: the syn.bas.in randomized controlled trial.** *BMC Infect Dis* 2017; 17(1):398.
76. Rice CE, Lynch CD, Norris AH, Davis JA, Fields KS, Ervin M, et al. **Group Sex and Prevalent Sexually Transmitted Infections Among Men Who Have Sex with Men.** *Arch Sex Behav* 2016; 45(6):1411-1419.
77. Vanhommelrig JW, Lambers FA, Schinkel J, Geskus RB, Arends JE, van de Laar TJ, et al. **Risk Factors for Sexual Transmission of Hepatitis C Virus Among Human Immunodeficiency Virus-Infected Men Who Have Sex With Men: A Case-Control Study.** *Open Forum Infect Dis* 2015; 2(3):ofv115.
78. Ireland G, Higgins S, Goorney B, Ward C, Ahmad S, Stewart C, et al. **Evaluation of hepatitis C testing in men who have sex with men, and associated risk behaviours, in Manchester, UK.** *Sex Transm Infect* 2017.
79. Gotz HM, van Doornum G, Niesters HG, den Hollander JG, Thio HB, de Zwart O. **A cluster of acute hepatitis C virus infection among men who have sex with men--results from contact tracing and public health implications.** *AIDS* 2005; 19(9):969-974.
80. Phillips G, 2nd, Magnus M, Kuo I, Rawls A, Peterson J, West-Ojo T, et al. **Correlates of group sex among a community-based sample of men who have sex with men (MSM) in Washington, DC.** *AIDS Behav* 2014; 18(8):1413-1419.
81. Winetrobe H, Rice E, Bauermeister J, Petering R, Holloway IW. **Associations of unprotected anal intercourse with Grindr-met partners among Grindr-using young men who have sex with men in Los Angeles.** *AIDS Care* 2014; 26(10):1303-1308.
82. Wikipedia. **Grindr.** 2017 <https://en.wikipedia.org/wiki/Grindr> (accessed 22-11-2017).
83. Tang W, Tang S, Qin Y, Zhang Y, Zhang W, Liu C, et al. **Will Gay Sex-Seeking Mobile Phone Applications Facilitate Group Sex? A Cross-Sectional Online Survey among Men Who Have Sex with Men in China.** *PLoS One* 2016; 11(11):e0167238.
84. Lewnard JA, Berrang-Ford L. **Internet-based partner selection and risk for unprotected anal intercourse in sexual encounters among men who have sex with men: a meta-analysis of observational studies.** *Sex Transm Infect* 2014; 90(4):290-296.

85. Grov C, Rendina HJ, Breslow AS, Ventuneac A, Adelson S, Parsons JT. **Characteristics of men who have sex with men (MSM) who attend sex parties: results from a national online sample in the USA.** *Sex Transm Infect* 2014; 90(1):26-32.
86. Vocativ. **Gay Dating Apps Are Leading The Way On Safer Sex.** 2015 <http://www.vocativ.com/247660/gay-dating-apps-are-leading-the-way-on-safer-sex/index.html> (accessed 23-11-2017).
87. Cialdini RB, Reno RR, Kallgren CA. **A focus theory of normative conduct: recycling the concept of norms to reduce littering in public places.** *J Pers Soc Psychol* 1990; 58(6):1015.
88. Prentice DA, Miller DT. **Pluralistic ignorance and the perpetuation of social norms by unwitting actors.** *Adv Exp Soc Psychol* 1996; 28:161-209.
89. Downing Jr MJ, Hirshfield S. **Physical and Social Influences of Sex Venue Behavior: An Ecological Psychology Approach to Studying HIV Risk among Sexual Minority Men.** *N Am J Psychol* 2015; 17(2):323.
90. Elwood WN, Greene K, Carter KK. **Gentlemen don't speak: Communication norms and condom use in bathhouses.** *J Appl Commun Res* 2003; 31(4):277-297.
91. Aynalem G, Smith L, Bemis C, Taylor M, Hawkins K, Kerndt P. **Commercial sex venues: a closer look at their impact on the syphilis and HIV epidemics among men who have sex with men.** *Sex Transm Infect* 2006; 82(6):439-443.
92. Parsons JT, Halkitis PN. **Sexual and drug-using practices of HIV-positive men who frequent public and commercial sex environments.** *AIDS Care* 2002; 14(6):815-826.
93. Ahmed AK, Weatherburn P, Reid D, Hickson F, Torres-Rueda S, Steinberg P, et al. **Social norms related to combining drugs and sex ("chemsex") among gay men in South London.** *Int J Drug Policy* 2016; 38:29-35.
94. McKechnie ML, Bavinton BR, Zablotska IB. **Understanding of norms regarding sexual practices among gay men: literature review.** *AIDS Behav* 2013; 17(4):1245-1254.
95. Burchell K, Rettie R, Patel K. **Marketing social norms: social marketing and the 'social norm approach'.** *J Consum Behav* 2013; 12(1):1-9.
96. Rusow JA, Fletcher JB, Reback CJ. **Sexual Venue Choice and Sexual Risk-Taking Among Substance-Using Men Who have Sex with Men.** *AIDS Behav* 2017; 21(4):1149-1162.
97. Brantley M, Schumacher C, Fields EL, Perin J, Safi AG, Ellen JM, et al. **The network structure of sex partner meeting places reported by HIV-infected MSM: Opportunities for HIV targeted control.** *Soc Sci Med* 2017; 182:20-29.
98. Mimiaga MJ, Reisner SL, Bland S, Cranston K, Isenberg D, Driscoll MA, et al. **"It's a quick way to get what you want": a formative exploration of HIV risk among urban Massachusetts men who have sex with men who attend sex parties.** *AIDS Patient Care STDS* 2010; 24(10):659-674.
99. Drückler S, Van Rooijen M, Davidovich U, Mulder B-J, Hogewoning A, De Jong K, et al. **Evaluation of STI screening in MSM during outreach at public sex venues and regular screening at the STI clinic in Amsterdam, the Netherlands.** In preparation.
100. Wohlfeiler D, Hecht J, Volk J, Fisher Raymond H, Kennedy T, McFarland W. **How can we improve online HIV and STD prevention for men who have sex with men? Perspectives of hook-up website owners, website users, and HIV/STD directors.** *AIDS Behav* 2013; 17(9):3024-3033.
101. Melendez-Torres GJ, Nye E, Bonell C. **Is Location of Sex Associated with Sexual Risk Behaviour in Men Who Have Sex with Men? Systematic Review of Within-Subjects Studies.** *AIDS Behav* 2016; 20(6):1219-1227.
102. Sheeran P, Orbell S. **Do intentions predict condom use? Meta-analysis and examination of six moderator variables.** *Br J Soc Psychol* 1998; 37 (Pt 2):231-250.



Appendices

Summary

Nederlandse samenvatting

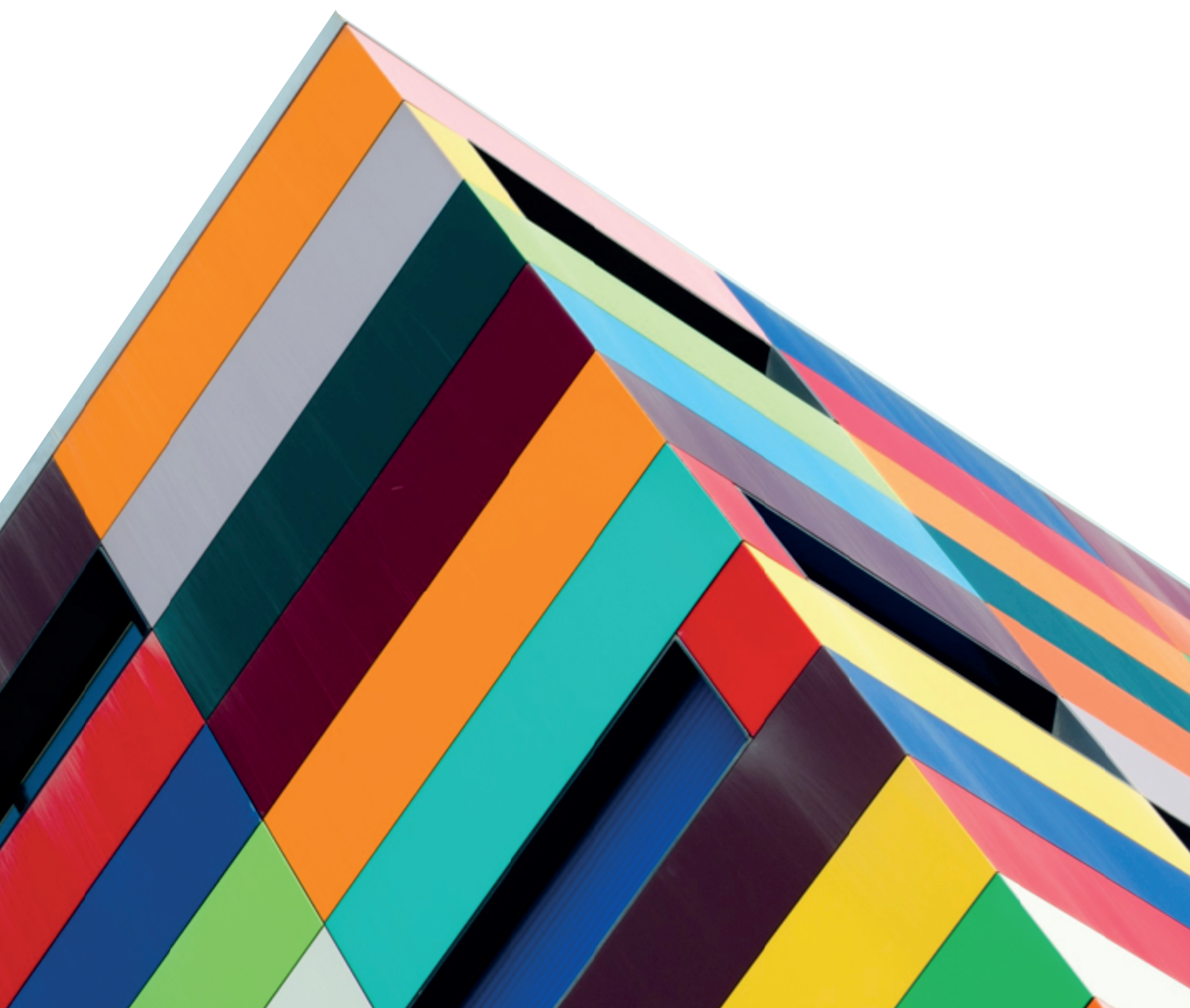
About the author

List of publications

List of contributing authors (this thesis)

Contributions of the authors per chapter

Portfolio



SUMMARY

This thesis presents studies that aim to understand the contextual and cognitive factors that affect HIV-related sexual risk behaviors and engagement in protective behaviors among men who have sex with men (MSM) to avoid human immunodeficiency virus (HIV) infection during sex with casual partners. In chapter 1 (general introduction), we provide a brief historical overview of the HIV epidemic among MSM. Although in recent years the number of new infections among this group has dropped in the Netherlands, MSM continue to be disproportionately affected by HIV. Furthermore, we provide a summary of the HIV-prevention approaches that have been undertaken among this group in the Netherlands since the early 1980s, as well as the more recent developments in HIV treatment and the introduction of biomedical HIV-prevention strategies.

NON-CONDOM BASED HIV RISK-REDUCTION STRATEGIES

The topic of chapter 2 is the use and effectiveness of non-condom based HIV risk-reduction strategies. In chapter 2.1, we investigated the proportion of HIV-negative MSM who engage in 'serosorting', and whether this risk-reduction strategy offers sufficient protection against HIV infection. Serosorting is the practice of establishing HIV seroconcordance between partners in order to engage in condomless anal sex (CAS). Using longitudinal data from the Amsterdam Cohort Studies (ACS) on HIV, we demonstrated that the proportion of MSM who practice serosorting with casual partners was relatively low but stable over time. We found that men who practiced CAS with serosorting were less likely to get infected with HIV than men who engaged in CAS without serosorting, but were more likely to get infected than men who consistently used condoms, although differences in both directions were not statistically significant. However, the difference in the protective effect between condomless sex and consistent condom use was statistically significant.

We argued that serosorting with casual partners, as reported by our participants, provides insufficient protection for HIV infection. We further argued that if serosorting with casual partners is to ever fulfill its protective potential in reducing the risk of HIV infection, a significantly better process of establishing HIV concordance must be achieved. This could be done by improving negotiation skills and a realistic information exchange on accurately obtained HIV status between sex partners. Also, efforts should also be made for MSM to make rapid HIV tests available for the home setting that can provide a reliable HIV status as closely as possible to the moment of serosorting.

In chapter 2.2, we examined 'viral load sorting' as a conscious protective behavior that can be seen as part of the 'treatment as prevention' approach (TasP). TasP is when an HIV-positive individual achieves such a low number of virus particles in his blood that it can no longer be

detected (also called ‘undetectable’) as a result of successful HIV treatment, and therefore the transmission risk of HIV to others is practically impossible. We defined viral load sorting as the decision by the HIV-positive partner not to use a condom based on his own or his HIV-positive partner’s undetectable viral load. Using an online questionnaire among an existing panel of HIV-positive MSM, we observed that viral load sorting was commonly practiced among our participants. Furthermore, we found that the decision to engage in CAS with HIV-serodiscordant partners based on undetectable viral load was mostly the unilateral decision of the HIV-positive participant and not a shared decision with the HIV-negative partner. Our findings point towards difficulties around the implementation of viral load sorting in sexual negotiations between HIV-serodiscordant sex partners. Such aspects need to be addressed through HIV-prevention professionals in order to ensure that future implementation of the stance that ‘Undetectable=Untransmittable’ is successful among MSM.

RISK SETTINGS & SEXUAL BEHAVIOR

The second topic of this thesis focuses on whether sexual risk behavior is shaped by the context in which sexual activity takes place. Such contexts can be the type of partners one has sex with or the physical place or situations in which the sexual activities occur.

In chapter 3.1, we investigated sexual behaviors with different types of casual partners: one-night stands, multiple-time casual partners, and sex buddies. We hypothesized that the more familiar a casual partner is, the more likely men take sexual risks. Using data from the ACS, we found that HIV-negative MSM were more likely to engage in CAS with familiar sex partners, such as sex buddies, than with one-night stands. However, men were also more likely to practice serosorting with their more familiar partners. Therefore, researchers who aim to measure sexual risk behavior among MSM with casual partners should take into consideration that the more familiar the casual partner is, the more likely condomless sex with that partner will involve the practice of risk-reduction strategies other than condom use. As we argued earlier in chapter 2.1, the application of serosorting can reduce the general risk of infection, but that reduction is greatly dependent on the process of implementation and efficacy of the risk-reduction strategy. HIV-prevention interventions can play an important role in helping MSM to better practice and evaluate their non-condom based risk-reduction strategy of choice when having CAS with familiar sex partners.

In chapter 3.2 we examined another sexual setting, that of group sex, in which men have sex with multiple (casual) partners at the same time. Using longitudinal ACS data sets including behavioral data and sexually transmitted infections (STI) testing results, we learned that men who report having both group sex and dyadic (one-on-one) sex behave differently within each sexual setting: the same men were more likely to report condom use during group sex than during dyadic sex. However, we did find suggestive evidence for more gonorrhea infections

among men engaging in group sex. Our findings suggest that the context of group sex, as measured in the ACS, may be a higher-risk setting for acquiring STI. Engaging in group sex may have facilitated the use of sexual techniques other than anal intercourse such as ‘anal fingering’, which could have contributed to the spread of STI within this context. Such group sex behaviors merit special attention by prevention efforts for the reduction of risk behaviors related to STI other than HIV.

To further increase our understanding of men’s setting-specific sexual behaviors, in chapter 3.3 we examined sexual risk-related perceptions and behaviors in different physical and online settings across the Netherlands. We were interested in perceived location-specific condom-use norms in the Netherlands and how they are related to actual reports of on-location sexual risk taking. Data was collected at gay venues and popular gay dating and social network websites nationwide. We demonstrated that the majority of our participants assumed that patrons would not use or would not support condom use while engaging in anal sex on location and that such beliefs were significantly related to self-reported on-location sexual risk taking. Our findings suggest that the normative beliefs regarding condom use dominant in gay venues and websites in the Netherlands are not pro-condom and are negatively associated with condom use. However, we also found that most of our participants indicated using condoms themselves when on location. It is a challenge for future HIV-prevention researchers to investigate whether perceived negative condom-use norms on locations in the Netherlands constitute an underestimation of actual condom use by others, and if so, how to address and change such perceptions. Furthermore, with the rise of biomedical prevention strategies, such as pre-exposure prophylaxis (PrEP) and TasP, it is a challenge how to change negative condom-use norms into positive norms regarding the application of both condom and non-condom based HIV-prevention strategies.

A

PRINCIPLES VERSUS INTENTIONS

Finally, in chapter 4, we were interested in core individual values that might play a role in shaping sexual risk choices. We investigated whether condom-use ‘principles’ (internally-driven strong convictions to always use condoms) predispose MSM to engage in consistent condom use over time. The effects of principles were compared to the effects of ‘intentions’ (readiness to use condoms), which, we hypothesize, will predict the engagement in condom use over shorter time periods. Using longitudinal data from the ACS, we indeed observed that having strong condom-use principles predicted long-term consistent condom use, while intentions predicted short-term condom use. We argued that in order to develop strategies to maintain MSM’s protective behaviors over longer periods of time, HIV-prevention efforts should try to facilitate the formation of individual principles regarding the implementation of such behavioral goals.

CONCLUSION

In our studies, we observed MSM's (in)ability to engage in a wide range of protective sexual behaviors according to different settings and types of sex partners. Additionally, we gained insights into the different external factors and internal motives that influence engagement in such behaviors. In chapter 5 (general discussion), we call for this knowledge to be used by HIV-prevention professionals to support MSM in their decision to engage in protective behaviors that best suit their desires and needs and to address the consequences of the strategies chosen. An approach that takes into account both individual and situational influences will most likely constitute future successful HIV prevention among MSM.

NEDERLANDSE SAMENVATTING

Dit proefschrift biedt inzicht in de factoren die van invloed zijn op het gedrag van mannen die seks hebben met mannen (MSM) om een hiv-infectie (humaan immunodeficiëntie virus) te voorkomen wanneer zij seks hebben met losse partners. Een losse partner is een seks partner die niet als een vaste relatie wordt beschouwd, bijvoorbeeld een 'onenightstand'.

In hoofdstuk 1 (algemene inleiding) geven we een kort historisch overzicht van de hiv-epidemie onder MSM. Hoewel de afgelopen jaren het aantal nieuwe infecties in deze groep is gedaald in Nederland, blijven MSM onevenredig veel getroffen door hiv. Verder beschrijven we in dit hoofdstuk de interventies op het gebied van hiv en seksuele gezondheid die sinds het begin van de jaren tachtig van de vorige eeuw voor deze groep in Nederland zijn ingezet. Daarnaast bespreken we de ontwikkelingen in hiv-behandeling en de opkomst van biomedische hiv-preventiestrategieën zoals PrEP ('pre-exposure prophylaxis'), een pil die een hiv-infectie voorkomt.

RISICOREDUCTIESTRATEGIEËN OM EEN HIV-INFECTIE TE VOORKOMEN

Hoofdstuk 2 behandelt naast het gebruik van condooms ook het gebruik en de effectiviteit van andere hiv-risicoreductiestrategieën. Hiv-risicoreductiestrategieën zijn strategieën om tijdens seks het risico op een hiv-infectie te verkleinen. In hoofdstuk 2.1 hebben we onderzocht hoe vaak MSM een specifieke hiv-risicoreductiestrategie, namelijk 'serosorting', praktiseren met losse partners en in hoeverre deze strategie bescherming biedt tegen een hiv-infectie. Serosorting is een strategie waarbij mannen, voorafgaand aan het hebben van anale seks en op basis van kennis van de hiv-status, een seks partner met dezelfde hiv-status kiezen en om die reden geen condooms gebruiken. We maakten gebruik van de longitudinale gegevens van de Amsterdam Cohort Studies (ACS) naar hiv. Binnen de ACS wordt een groep seksueel actieve MSM een lange tijd gevolgd. Zij vullen ieder half jaar een vragenlijst in over hun seksueel gedrag en worden op soa (seksueel overdraagbare aandoening) en hiv getest. We toonden aan dat het percentage MSM dat serosorting praktiseert met losse partners relatief laag en stabiel was gedurende een lange termijn. We vonden dat MSM die serosorting als strategie hanteren minder vaak een hiv-infectie opliepen dan mannen die het condoom achterwege laten zonder serosorting. Echter, voor mannen die serosorting rapporteerden, was de kans groter dat zij hiv opliepen dan voor mannen die wél condooms gebruikten. De gevonden verschillen waren niet statistisch significant voor beide effecten. Dit betekent dat het niet uit te sluiten is dat de verschillen op toeval berusten. Aan de hand van onze bevindingen beargumenteerden we dat de manier waarop serosorting met losse partners nu wordt gepraktiseerd onvoldoende bescherming biedt. Serosorting met losse partners heeft echter wel de potentie om tegen een hiv-infectie te beschermen. Om dit te bereiken kunnen hiv-preventie professionals zich inzetten om MSM vaardiger te maken in de uitwisseling van accurate informatie

over hiv-status met hun sekspartners. Ook zou ingezet kunnen worden op het beschikbaar stellen van gevoelige hiv-zelftesten die zo dicht mogelijk op het moment van serosorting een betrouwbare en accurate uitslag van de hiv-status geven.

In hoofdstuk 2.2 onderzochten we een andere risicoreductiestrategie, namelijk 'viral load sorting', dat kan worden gezien als onderdeel van de 'treatment as prevention'-benadering (TasP; behandeling als preventie). TasP houdt in dat, als gevolg van succesvolle hiv-behandeling, het aantal virusdeeltjes in het bloed zo laag is dat hiv niet meer detecteerbaar is en dat daarmee het risico van overdragen in de praktijk nihil is. Viral load sorting houdt in dat op basis van een niet te detecteren aantal virusdeeltjes de keuze wordt gemaakt om geen condoom te gebruiken. Met behulp van een online vragenlijst, die is uitgezet bij een bestaand panel van hiv-positieve MSM, vonden we dat viral load sorting relatief veel voorkomt met partners die hiv-negatief zijn, of met partners van wie men de hiv-status niet wist. Verder hebben we vastgesteld dat de beslissing om geen condoom te gebruiken op basis van een niet-detecteerbare viral load meestal een eenzijdige beslissing was van de hiv-positieve partner. Onze bevindingen wijzen op factoren die het gebruik van viral load sorting met hiv-negatieve sekspartners mogelijk in de weg staan, zoals taboe of stigma. Professionals die met MSM werken zouden bij de ontwikkeling van interventies rekening kunnen houden met dit soort factoren om ervoor te zorgen dat een succesvolle toepassing van het principe 'niet-detecteerbaar=niet overdraagbaar' in de toekomst wordt gewaarborgd.

RISICO CONTEXTEN EN SEKSUEEL GEDRAG

Hoofdstuk 3 behandelt seksueel risicogedrag van MSM en hoe dit onder andere wordt gevormd door de context waarin de seksuele activiteit plaatsvindt. Dergelijke contexten kunnen zijn het type partner met wie mannen seks hebben, of de fysieke plaats of situatie waarin de seksuele activiteiten plaatsvinden. In hoofdstuk 3.1 onderzochten we daarom seksueel gedrag met verschillende typen losse partners, zoals onenightstands en 'seksbuddy's'. We veronderstelden dat hoe bekender een losse partner is, des te meer mannen geneigd zullen zijn om seksuele risico's te nemen. Aan de hand van gegevens van de ACS vonden we inderdaad dat hiv-negatieve MSM eerder geneigd waren om anale seks te hebben zonder condoom met vertrouwde sekspartners, zoals seksbuddy's, dan met onenightstands. Echter, met deze meer bekende partners waren mannen ook meer geneigd om serosorting te praktiseren. Onderzoekers en hiv-preventieprofessionals die inzicht willen bieden in seksueel risicogedrag van MSM met losse partners adviseren we daarom om er rekening mee te houden dat hoe bekender de losse partner is, des te waarschijnlijker het is dat seks plaatsvindt met gebruik van serosorting. Zoals we eerder in hoofdstuk 2.1 hebben betoogd kan een dergelijke toepassing van serosorting het algemene risico op een hiv-infectie verminderen, maar die vermindering is in grote mate afhankelijk van hoe effectief serosorting wordt gepraktiseerd. Preventieprofessionals die met MSM werken spelen een belangrijke rol door mannen, die

ervoor kiezen geen condoom te gebruiken met hun seksbuddy's, te ondersteunen in het gebruik van de door hen gekozen alternatieve risicoreductiestrategieën. Ook kunnen zij MSM er op wijzen dat zij in hun afweging ook de effectiviteit van deze strategieën meenemen.

Vervolgens hebben we ons in hoofdstuk 3.2 gericht op een andere seksuele context: die van groepsseks. Groepsseks is een seksuele activiteit waarbij mannen tegelijkertijd seks hebben met meerdere (losse) partners. Met behulp van gegevens uit de ACS over gedrag en soa, vonden we dat mannen die zowel groepsseks als één-op-één-seks rapporteerden zich afhankelijk van de seksuele context anders gedragen. Condoomgebruik kwam tijdens groepsseks vaker voor dan tijdens één-op-één-contacten. Echter, onze resultaten suggereerden ook dat mannen die deelnamen aan groepsseks vaker een soa hadden. Onze bevindingen wijzen op het gebruik van andere seksuele technieken dan anale seks in de context van groepsseks, zoals anaal vingeren. Deze technieken hebben mogelijk bijgedragen aan de verspreiding van soa's tijdens groepsseks. Preventieprofessionals zouden voor MSM die dergelijk groepsseksgedrag rapporteren, speciale aandacht kunnen besteden aan manieren om het risicogedrag voor een soa te verminderen.

Om ons begrip van context-gerelateerd seksueel gedrag onder MSM verder te vergroten, onderzochten we in hoofdstuk 3.3 seksueel gedrag en de percepties daarvan (ook wel 'normen' genoemd), op verschillende fysieke en online locaties in heel Nederland. We waren specifiek geïnteresseerd in locatie-gerelateerde normen van condoomgebruik en hoe deze gerelateerd zijn aan het eigen risicogedrag ter plaatse. Gegevens werden verzameld op verschillende locaties (bijvoorbeeld darkrooms en kroegen) in het hele land waar MSM samenkomen en online (populaire gay dating- en sociaalnetwerksites). We toonden aan dat de meerderheid van onze deelnemers aan het onderzoek ervan uit ging dat bezoekers tijdens anale seks ter plaatse geen condooms zouden gebruiken of het gebruik ervan niet zouden goedkeuren. Dergelijke percepties over anderen waren gerelateerd aan seksueel risico gedrag dat men zelf rapporteerde op locatie.

Onze resultaten suggereren dat percepties over andermans condoomgebruik op verschillende homolocaties en websites in Nederland negatief zijn: anderen gebruiken geen condooms of keuren ze af. Deze negatieve percepties zijn daarnaast geassocieerd met het eigen condoomgebruik. We vonden echter tegelijkertijd ook een discrepantie tussen verondersteld gedrag van anderen en het door de deelnemer zelf gerapporteerde gedrag: de meeste MSM gaven aan zelf wél condooms te gebruiken tijdens seks op locatie. Het is daarom aan toekomstige onderzoekers om te achterhalen of de door ons waargenomen negatieve condoomgebruiksnorm op locaties in Nederland een onderschatting is van het feitelijke condoomgebruik onder MSM. En zo ja, hoe dergelijke percepties, die gerelateerd zijn aan risicogedrag, kunnen worden aangepakt en veranderd. Met de opkomst van biomedische preventiestrategieën is het daarnaast een uitdaging hoe negatieve normen ten aanzien van condoomgebruik kunnen

worden omgebogen in positieve normen die naast condoomgebruik ook betrekking hebben op de toepassing van hiv-preventiestrategieën waarbij géén condoom wordt gebruikt.

PRINCIPES VERSUS INTENTIES

In hoofdstuk 4 bestudeerden we individuele karakteristieken die een rol kunnen spelen bij seksueel gedrag. We hebben onderzocht of het hebben van geïnternaliseerde sterke overtuigingen om altijd condooms te gebruiken ('principe') ervoor kan zorgen dat MSM consistent over een lange periode condooms gebruiken. De effecten van principes werden vergeleken met de bereidheid om condooms te gebruiken ('intentie'), waarvan we veronderstelden dat deze het gebruik van condooms gedurende kortere perioden kan voorspellen. In dit hoofdstuk hebben we gegevens van de ACS gebruikt die een periode van 4 jaar bestrijken. We vonden dat het hebben van sterke principes om altijd condooms te gebruiken gerelateerd was aan consequent gebruik op de lange termijn, terwijl het hebben van hoge intenties om een condoom te gebruiken juist gerelateerd was aan gebruik op de korte termijn (6 maanden). We adviseerden preventieprofessionals om de vorming van sterke interne principes betreffende de toepassing van beschermend seksueel gedrag bij MSM te faciliteren. Hiermee zouden MSM hun beschermend gedrag over langere perioden kunnen handhaven.

CONCLUSIE

In onze studies hebben we vastgesteld dat MSM een breed scala aan seksueel (risico) gedrag rapporteren, afhankelijk van de verschillende contexten waarin de seks plaatsvindt en de verschillende type partners met wie men seks heeft. Daarnaast hebben we inzicht verkregen in de verschillende interne en externe motieven die de betrokkenheid bij beschermend gedrag beïnvloeden. In hoofdstuk 5 (algemene discussie) concludeerden we dat kennis uit dit proefschrift professionals in hiv-preventie kan informeren hoe zij MSM kunnen ondersteunen bij de keuze voor de beschermende strategieën die het beste aansluiten op hun wensen en behoeften. Ook is het belangrijk MSM te wijzen op de mogelijke gevolgen van hun keuze. Een benadering waarbij rekening wordt gehouden met zowel individuele als situationele invloeden zal hoogstwaarschijnlijk garant staan voor succesvolle toekomstige hiv-preventie onder MSM.

ABOUT THE AUTHOR

Wijnand van den Boom was born on December 11, 1981, in Leidschendam, the Netherlands. He grew up in Oegstgeest and completed secondary school at VWO level in 2000 at the Visser 't Hooft Lyceum in Leiden. He then studied Social Geography at Utrecht University and received his Propedeuse in 2002. After a successful year working in the 'Thuiszorg' (homecare), he returned to study (Psychology) in 2003 and earned his Bachelor's degree at Leiden University in 2006. In 2006, he remained at Leiden University and started a two-year Research Master in Cognitive Neuroscience. He attended the University of California, Davis, United States, as a visiting scholar in 2007 under the supervision of Charan Ranganath and Rachel Diana of the Dynamic Memory Lab. During this internship he used electroencephalography (EEG) to demonstrate that familiarity can support recognition if stimulus and context are encoded as one integrated unit. He received his Master's degree in 2008 and commenced his PhD at the Department of Infectious Diseases Research and Prevention at the Public Health Service of Amsterdam in 2009. His research focus was the diversity in sexual-risk motivations and related HIV risk-reduction strategies among men who have sex with men in the Netherlands. The results of this work are presented in this thesis. Wijnand has worked at the Department of Epidemiology, Health Promotion and Care Innovation (EGZ) at the Public Health Service of Amsterdam since 2013. He currently investigates daily functioning among vulnerable populations using the 'Zelfredzaamheid-Matrix' (ZRM), the Dutch version of the Self-Sufficiency Matrix (www.zrm.nl).

LIST OF PUBLICATIONS

(Inter)national peer-reviewed publications

Achterbergh R, van der Helm JJ, **van den Boom W**, Heijman T, Stolte IG, van Rooijen MS, de Vries H. Is rectal douching and sharing douching equipment associated with anorectal chlamydia and gonorrhoea? A cross-sectional study among men who have sex with men. *Sex Transm Infect.* 2017; 93:431-7.

Van Den Boom W, Davidovich U, Heuker J, Lambers F, Prins M, Sandfort T, Stolte IG. Is group sex a higher-risk setting for HIV and other sexually transmitted infections compared with dyadic sex among men who have sex with men? *Sex Transm Dis.* 2016; 43(2):99-104.

Van Den Boom W, Klaufus L, Fassaert T, Lauriks S, de Wit M. Psychometrische kenmerken van de Zelfredzaamheid-Matrix (ZRM) en het ZRM-Supplement Ouderschap. *Kind & Adolescent.* 2016; 37(2):105-19.

Van Den Boom W, Stolte IG, Roggen A, Sandfort T, Prins M, Davidovich U. Is anyone around me using condoms? Site-specific condom-use norms and their potential impact on condomless sex across various gay venues and websites in The Netherlands. *Health Psychol.* 2015; 34(8):857-64.

Van Den Boom W, Konings R, Davidovich U, Sandfort T, Prins M, Stolte IG. Is serosorting effective in reducing the risk of HIV infection among men who have sex with men with casual sex partners? *J Acquir Immune Defic Syndr.* 2014; 65(3):375-9.

Van Den Boom W, Stolte IG, Witlox R, Sandfort T, Prins M, Davidovich U. Undetectable viral load and the decision to engage in unprotected anal intercourse among HIV-positive MSM. *AIDS Behav.* 2013; 17(6):2136-42.

Van Den Boom W, Stolte I, Sandfort T, Davidovich U. Serosorting and sexual risk behavior according to different casual partnership types among MSM: the study of one-night stands and sex buddies. *AIDS Care.* 2012; 24(2):167-73.

Diana RA, **Van Den Boom W**, Yonelinas AP, Ranganath C. ERP correlates of source memory: unitized source information increases familiarity-based retrieval. *Brain Res.* 2011; 7;1367:278-86.

NON PEER-REVIEWED PUBLICATIONS

Van Den Boom W & Smit P. Niet alleen het condoom beschermt... Hiv nieuws 2011; 129: 8-10.

SUBMITTED MANUSCRIPT

Van Den Boom W, Stolte I, Prins M, Sandfort T, Davidovich U. The power of principles: the long-term effect of strong personal norms on condom use among HIV-negative MSM.

LIST OF CONTRIBUTING AUTHORS (THIS THESIS)

Dr. U. Davidovich

Department of Infectious Diseases, Research and Prevention, Public Health Service of Amsterdam, Amsterdam, the Netherlands

Drs. J. Heuker

Department of Infectious Diseases, Research and Prevention, Public Health Service of Amsterdam, Amsterdam, the Netherlands

Drs. R. Konings

Department of Infectious Diseases, Research and Prevention, Public Health Service of Amsterdam, Amsterdam, the Netherlands

Drs. F.A.E. Lambers

Department of Infectious Diseases, Research and Prevention, Public Health Service of Amsterdam, Amsterdam, the Netherlands

Prof. dr. M. Prins

Department of Infectious Diseases, Research and Prevention, Public Health Service of Amsterdam, Amsterdam; Department of Internal Medicine, Division of Infectious Diseases, Academic Medical Center, Amsterdam, the Netherlands

Drs. A. Roggen

Netherlands Institute for Homosexuality, Health and Well-Being, Amsterdam, The Netherlands, the Netherlands

Prof. dr. T. Sandfort

HIV Center for Clinical and Behavioral Studies, Department of Psychiatry, New York State Psychiatric Institute; Columbia University, New York, NY, United States

Dr. I.G. Stolte

Department of Infectious Diseases, Research and Prevention, Public Health Service of Amsterdam, Amsterdam, the Netherlands

Drs. R. Witlox

Dutch HIV Association, Amsterdam, The Netherlands

CONTRIBUTIONS OF THE AUTHORS PER CHAPTER

2.1 Is serosorting effective in reducing the risk of HIV infection among men who have sex with men with casual sex partners? Van den Boom W, Konings R, Davidovich U, Sandfort T, Prins M, Stolte IG. *J Acquir Immune Defic Syndr*. 2014; 65(3):375-9.

W.v.d.B. and R.K. analyzed and interpreted the data and wrote the draft article. M.P., U.D. and I.S. designed the study. I.S. and U.D. supervised the overall study and contributed to the analyses and interpretation of the data. T.S. and M.P. gave substantial contributions to the analyses and interpretation of the data. All authors contributed to subsequent drafts and approved the final version of the manuscript.

2.2 Undetectable viral load and the decision to engage in unprotected anal intercourse among HIV-positive MSM. Van Den Boom W, Stolte IG, Witlox R, Sandfort T, Prins M, Davidovich U. *AIDS Behav*. 2013; 17(6):2136-42.

W.v.d.B. analyzed and interpreted the data, and wrote the draft manuscript. U.D. and I.S. designed and supervised the overall study, and contributed to the analyses and interpretation of the data. R.W., T.S. and M.P. gave substantial contribution to the analyses and interpretation of the data. All authors contributed to subsequent drafts and approved the final version of the manuscript.

3.1 Serosorting and sexual risk behavior according to different casual partnership types among MSM: the study of one-night stands and sex buddies. Van den Boom W, Stolte I, Sandfort T, Davidovich U. *AIDS Care*. 2012; 24(2):167-73.

W.v.d.B. analyzed and interpreted the data, and wrote the draft manuscript. U.D. and I.S. designed and supervised the overall study, and contributed to the analyses and interpretation of the data. T.S. gave substantial contribution to the analyses and interpretation of the data. All authors contributed to subsequent drafts and approved the final version of the manuscript.

3.2 Is anyone around me using condoms? Site-specific condom-use norms and their potential impact on condomless sex across various gay venues and websites in The Netherlands. Van den Boom W, Stolte IG, Roggen A, Sandfort T, Prins M, Davidovich U. *Health Psychol*. 2015; 34(8):857-64.

W.v.d.B. analyzed and interpreted the data, and wrote the draft manuscript. I.S. and U.D. designed and supervised the overall study, and contributed to the analyses and interpretation of the data. A.R., T.S., and M.P. gave substantial contribution to the analyses and interpretation of the data. All authors contributed to subsequent drafts and approved the final version of the manuscript.

3.3 Is Group Sex a Higher-Risk Setting for HIV and Other Sexually Transmitted Infections Compared With Dyadic Sex Among Men Who Have Sex With Men? Van den Boom W, Davidovich U, Heuker J, Lambers F, Prins M, Sandfort T, Stolte IG. *Sex Transm Dis*. 2016; 43(2):99-104.

W.v.d.B. and J.H. analyzed and interpreted the data and wrote the draft manuscript. U.D. and I.S. designed and supervised the overall study and contributed to the analyses and interpretation of the data. F.L., M.P., and T.S. provided substantial contributions to the analyses and interpretation of the data. All authors contributed to subsequent drafts and approved the final version of the manuscript.

4 The power of principles: the long-term effect of strong personal norms on condom use among HIV-negative MSM. Van Den Boom W, Stolte I, Prins M, Sandfort T, Davidovich U. W.v.d.B. analyzed and interpreted the data, and wrote the draft manuscript. U.D. and I.S. designed and supervised the overall study, and contributed to the analyses and interpretation of the data. T.S. and M.P. gave substantial contribution to the analyses and interpretation of the data. All authors contributed to subsequent drafts and approved the final version of the manuscript.

PORTFOLIO

Academic Medical Center (AMC) Graduate School, Amsterdam, NL

- Clinical Data Management, 2009
- Infectious Diseases, 2010
- Medical Literature: PubMed basics & PsycInfo, 2010
- Clinical Epidemiology, 2010
- Scientific (English) Writing, 2011

Erasmus Medical Center, Rotterdam, NL

- NIHES course: Regression Analysis, 2010

Public Health Service (GGD) Amsterdam, NL

- Weekly epidemiological PhD training, 2009-2013

Organizing of and presenting at seminars, workshops

- 13th National Conference on STI, sexual behavior and AIDS, Amsterdam, NL, 2009
- 14th National Conference on STI, sexual behavior and AIDS, Amsterdam, NL, 2010
- Debate day Amsterdam Men's matinee (Discussiedag Amsterdamse Mannenmatinee), Amsterdam, NL, 2011

Oral abstract presentations

- 9th International AIDS Impact Conference, Gaborone, Botswana, 2009
- 8th Conference on Psychology and Health, Lunteren, NL, 2010
- 10th International AIDS Impact Conference, Santa Fe, United States, 2011
- 36th Dutch Epidemiology Conference (Werkgroep Epidemiologisch Onderzoek Nederland; WEON), IJmuiden, NL, 2011
- 12th International AIDS Impact Conference, Amsterdam, NL, 2015

Poster abstract presentations

- 3rd Netherlands Conference on HIV Pathogenesis, Prevention and Treatment (NCHIV), Amsterdam, NL, 2009
- 4th Netherlands Conference on HIV Pathogenesis, Prevention and Treatment (NCHIV), Amsterdam, NL, 2010
- 35th Dutch Epidemiology Conference (WEON), Nijmegen, NL, 2010.
- XVIII International AIDS Conference (AIDS 2010), Vienna, Austria, 2010
- 5th Netherlands Conference on HIV Pathogenesis, Prevention and Treatment (NCHIV), Amsterdam, NL, 2011
- 21st International Society for Sexually Transmitted Diseases Research (ISSTD), Quebec City, Canada, 2011

- XIX International AIDS Conference (AIDS 2012), Washington D.C., United States, 2012
- XXI International AIDS Conference (AIDS 2016), Durban, South Africa, 2016

Coordinating tasks

- Coordinating of the Amsterdam Cohort Studies (ACS) among MSM within the GGD Amsterdam, 2009-2013

Supervising

- Master student (VU University, Amsterdam, NL), Roos Konings, "Is serosorting among HIV negative MSM engaging in anal sex effective in reducing the risk for HIV transmission with casual partners?", 2011
- Master student (VU University, Amsterdam, NL), Frieda Hartoog, "Changes in subjective safe sex norms among men who have sex with men with casual partners after the introduction of highly active anti-retroviral therapy: A 13-year longitudinal cohort study", 2012

Reviewer of submissions to

- Journal of Homosexuality
- Culture, Health and Sexuality
- Journal of AIDS
- Archives of Sexual Behavior
- AIDS Care
- Sexually Transmitted Infections

