HIV in the era of U=U and PrEP. Experiences and perceptions among MSM in Sweden and implications for prevention.

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Experiences and perceptions among MSM in Sweden and implications for prevention.

Tobias Herder

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Title and subtitle: HIV in the era of U=U and PrEP. Experiences and perceptions among MSM in Sweden and implications for prevention.

Abstract

Background

Men who have sex with men (MSM) are disproportionately affected by HIV globally and in Sweden. A number of factors affect access to and uptake of primary and secondary HIV prevention, both in regard to preventing transmission, and improving health and the quality of life for MSM living with HIV. In recent years the landscape of HIV prevention has changed due to new available tools such as pre-exposure prophylaxis (PrEP) and HIV self-testing (HIVST). In addition, aggregated evidence shows that well treated HIV cannot be transmitted sexually, which resulted in a global U=U campaign, udetectable equals untransmittable. The overall aim of this thesis was to gain a better understanding of experiences, preferences, and perceptions regarding factors relevant to primary and secondary prevention of HIV among MSM in Sweden, in order to contribute to strengthened HIV prevention strategies and programs in Sweden, informed by knowledge.

Methods

Paper I is a qualitative study based on in-depth interviews with 10 MSM living with HIV, analyzed using qualitative content analysis. Papers II-IV analyzed data from a venue-based survey collected at six HIV testing venues in Malmö, Gothenburg and Stockholm, with a total sample of 669 MSM. For the analyses logistic regressions, and latent class analysis were used.

Results

The main findings of Paper I was that MSM living with HIV experienced challenges due to inconsistencies in information they received from different sources regarding their rules of conduct and HIV infectiousness. Paper II found that MSM had a high interest in taking PrEP, which was associated with factors previously related to increased risk of HIV. Paper III found a broad interest in HIVST among the participants, but no clear associations with risk related factors. Findings also suggest that HIVST at cost would negatively affect uptake. Paper IV used latent class analysis to identify five distinct sub-groups of MSM based on HIV and STI testing behaviors and motivations. Probabilities of HIV risk associated characteristics were higher among groups that predominantly got tested within the public health care system.

Conclusions

In summary, this thesis highlighted that correct information about HIV in Sweden and knowledge transfer are important for the situation for MSM living with HIV, and information and knowledge also affect preventive preferences among MSM. Therefore, it is important to ensure that continued and updated information about HIV is available and accessible for all. While interest for new preventive tools was found to be high, further studies are needed to ensure effective referrals from HIVST to preventive services. Finally, this thesis suggests that patterns of HIV and STI testing are associated with HIV risk characteristics and could also identify potential areas of improvements of offering bacterial STI testing to MSM testing predominantly at community-based venues.

Key words
HIV, MSM, PrEP, HIVST, HIV prevention

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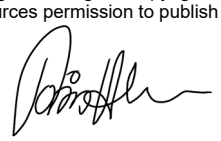
Signature:  Date: 2021-11-02

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”U=U, google it.”

Campaign by Positiva Gruppen Syd, 2020

Table of Contents

List of papers 10
Abstract 11
Abbreviations 12
Preface 13
Introduction 15
HIV risk among MSM 16
HIV in Sweden 17
HIV treatment and prevention 19
Defining HIV prevention strategies 23
Conceptual framework 27
A cyclical HIV testing and prevention model for MSM in Sweden 27
Rationale 33
Aim 35
Specific aims 35
Materials and methods 37
Paper I 37
Data collection and study population 37
Data analysis 39
Papers II-IV 40
Data collection and study population 40
Data analysis 43
Ethical considerations 47
Main Results 49
Paper I 49
Paper II 50
Paper III 53
Paper IV 56

Discussion **59**
General discussion 59
Methodological considerations 65
Implications for future research 67
Conclusions **69**
Acknowledgements **71**
References **73**

List of papers

This compilation thesis is based on the following original papers, referred to in text by their roman numerals:

I. **Herder, T.,** & Agardh, A. (2019). Navigating between rules and reality: a qualitative study of HIV positive MSM's experiences of communication at HIV clinics in Sweden about the rules of conduct and infectiousness. AIDS care, 31(10), 1304-1310.

II. **Herder, T.,** Agardh, A., Björkman, P., & Månsson, F. (2020). Interest in Taking HIV Pre-exposure Prophylaxis Is Associated with Behavioral Risk Indicators and Self-Perceived HIV Risk Among Men Who Have Sex with Men Attending HIV Testing Venues in Sweden. Archives of Sexual Behavior, 49(6), 2165-2177

III. Kinnman, E.*, **Herder, T.***, Björkman, P., Månsson, F. & Agardh, A. (2021). HIV self-testing for men who have sex with men in Sweden. A cross-sectional study concerning interest to use HIV self-tests. (*Manuscript submitted)*

IV. **Herder, T.,** Dennermalm, N., Persson, K.I., Månsson, F., & Agardh, A. (2021). Exploring Profiles of HIV and STI Testing: a Latent Class Analysis of Men who have Sex with Men (MSM) in Sweden. *(In manuscript)*

* Both authors contributed equally to the manuscript

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Conclusions: In summary, this thesis highlighted that correct information about HIV in Sweden and knowledge transfer are important for the situation for MSM living with HIV, and information and knowledge also affect preventive preferences among MSM. Therefore, it is important to ensure that continued and updated information about HIV is available and accessible for all. While interest for new preventive tools was found to be high, further studies are needed to ensure effective referrals from HIVST to preventive services. Finally, this thesis suggests that patterns of HIV and STI testing are associated with HIV risk characteristics and could also identify potential areas of improvements of offering bacterial STI testing to MSM testing predominantly at community-based venues.

Key words: HIV, MSM, PrEP, HIVST, HIV prevention

Abbreviations

AIDS	Acquired immunodeficiency syndrome
ART	Antiretroviral therapy
ARV	Antiretroviral (drug)
BIC	Bayesian information criterion
CDC	Centers for Disease Control and Prevention
CI	Confidence interval
EMIS	European MSM internet survey
HAART	Highly active antiretroviral therapy
HIV	Human immunodeficiency virus
HIVST	HIV self-testing
MSM	Men who have sex with men. *In this thesis the term men who have sex with men, abbreviated MSM, is used to describe a population based on behaviors rather than self-identified sexual orientation, regardless of underlying motivations for the same-sex sexual behaviors.*
NGO	Non-governmental organization
OR	Odds ratio
PLHIV	People or Person living with HIV
PrEP	Pre-exposure prophylaxis
RRR	Relative risk ratio
STI	Sexually transmitted infection, *in this thesis predominantly referring to bacterial STIs*
WHO	World Health Organization
U=U	Undetectable equals Untransmittable
UNAIDS	Joint United Nations Programme on HIV/AIDS

Preface

14 years ago, I entered the world of Swedish HIV prevention after having spent a couple of years working with HIV in another country. When I was being considered for a position I was asked "What do you believe is an important priority in Swedish HIV prevention for men who have sex with men?". Having recently read the results from the national MSM survey, I noticed that a large proportion of the younger MSM in the study had never had an HIV test, so here I saw a need to promote and ensure that HIV testing was accessible for MSM, regardless of age.

Starting my new job, I noticed that this prevention strategy that was important for me and my colleague was not always met with enthusiasm among others. We were told that HIV testing should *not* be seen as HIV prevention, because when a person takes a test it is already "too late". We should instead focus only on behavioral change, to increase condom use and to stop exposures from happening in the first place. I was lucky to have a strong and driven colleague, who was used to these comments from the senior professionals, and we continued our work based on our understandings of the needs expressed by the local MSM on how to improve motivation and access to HIV testing, in addition to condom distributions and promotion.

A great deal of progress has been made since then. Testing has become an integral component of HIV prevention in Sweden, and we have access to new tools such as self-tests for HIV (HIVST) and pre-exposure prophylaxis (PrEP), a pill that has proved to be a highly effective and safe way to prevent HIV acquisition. But still, there are challenges in accessing PrEP, and HIVST is not a tool fully utilized in a Swedish context.

We now see a global U=U campaign, raising awareness about how well treated HIV cannot be transmitted sexually - *Undetectable equals Untransmittable*. But the stigma against people living with HIV persists, also within MSM communities. It has become clear to me that policy changes are slow, and laws related to HIV around the world are not always based on current medical evidence. The message of Keith Haring's poster on the back of this thesis is still relevant today, more than 30 years later.

We have the tools necessary for an effective prevention, preventing HIV acquisition among those at risk, and preventing health inequities and stigma among those who live with HIV. But the systems need to be strengthened, and resources need to be invested. Instead, in recent years the national government grants for HIV prevention programs in Sweden have been heavily reduced. My hope is that this thesis can contribute with new knowledge and motivation to further strengthen the preventive work in Sweden, both by community-based organizations and local, regional, and national government agencies.

Introduction

According to UNAIDS and WHO estimates, 38.0 million people were living with HIV globally in 2019. That same year, 1.7 million people were newly infected and 0.7 million people died in HIV related deaths. Looking at the developments globally, there has been a 23% decrease in new diagnoses since 2010. However, this development is not equally distributed geographically. While a 35% decrease has been observed in the WHO African region, a 49% increase in new diagnoses was observed in the WHO European region over the same time period [1].

Today, key populations account for approximately 62% of new adult HIV infections globally. The term key populations has been described by UNAIDS as follows:

> UNAIDS considers gay men and other men who have sex with men, sex workers and their clients, transgender people, people who inject drugs and prisoners and other incarcerated people as the main key population groups. These populations often suffer from punitive laws or stigmatizing policies, and they are among the most likely to be exposed to HIV. Their engagement is critical to a successful HIV response everywhere - they are key to the epidemic and key to the response. [2]

During 2019, the proportion of new infections among key populations and their partners was estimated by UNAIDS to be 96% in western and central Europe and North America. As illustrated in **Figure 1,** men who have sex with men (MSM) accounted for the highest proportion, 64%, of new infections [3].

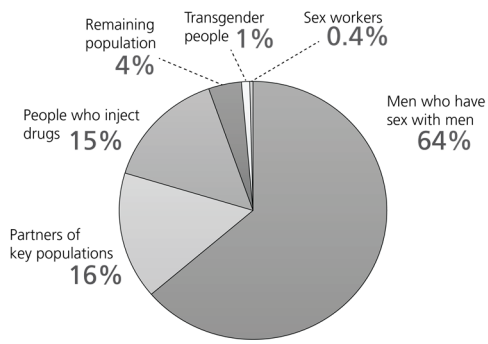

Figure 1. Distribution of HIV infections by adult population, Western and central Europe and North America, 2019. (Source: UNAIDS DATA 2020 [3])

While encouraging decreases in HIV incidence and mortality have been observed in epidemiological data from a variety of settings for the last decade, the epidemics among MSM have expanded in other settings, also in high income settings where information, testing and effective treatment should be readily available [4].

HIV risk among MSM

The disproportionate burden of HIV among MSM, and the increased risk of HIV for MSM individuals have been attributed to a number of factors, one such being that a higher prevalence of HIV in a population results in a greater risk of sexual exposure to HIV. One way of viewing vulnerability for HIV among MSM is to explore drivers for HIV risk by dividing these factors into biology, individual behavior, networks, and structural aspects [5].

Exploring contributing biological factors, the per-act probability of transmission of HIV is considerably greater for receptive anal sex than other forms of penetrative sex [6, 7]. While anal sex is not an exclusive practice for MSM, the significant proportion of MSM who engage in both insertive and receptive anal sex is likely to contribute to the increased efficiency of HIV transmission in MSM networks, in comparison to heterosexual ones [4]. In addition, other sexually transmitted infections (STI) with inflammation or ulceration, such as gonorrhea and syphilis, have been shown to increase the risk of HIV transmission and acquisition [8-11], with one recent study attributing approximately 10 % of HIV infections among MSM to gonorrhea and chlamydia infections [8].

We can also attribute certain increased risk to behavioral factors. Drug use, and specifically sexualized drug use, often termed chemsex, has been shown to be associated with sexual practices with higher risk of transmission, STI infections, as well as HIV seroconversion among MSM [12, 13]. It has been suggested that chemsex might facilitate transmission of HIV and STIs due to higher numbers of sexual partners associated with the practice, as well as through genital and rectal abrasions as a result of more intense sexual activities [14].

Studies have also shown that the burden of HIV is higher among MSM who sell sex [15]. This might not be caused directly by the activity but has been attributed to poor mental health, exposure to sexual violence, and drug use [16-18], among other factors. Selling sex might also be linked to intergenerational relationships, which have been suggested to put young MSM at increased risk of HIV acquisition. The HIV risk in the context of intergenerational relationships, as with other behavioral factors, interplay with factors such as economic disparity, lack of social support, and mental health [19].

The way in which sexual relationships are organized also affect the risk of HIV transmission within networks of MSM. Concurrent sexual partnerships have been found to be prevalent among MSM [20, 21]. Regardless of the number of partners, the concurrency of partnerships is likely to contribute to an increased speed of STI transmission in a population in comparison to if partnerships were in serial monogamy [22]. Another factor to consider is the high infectiousness during the primary HIV infection (see Figure 4), which can partly explain the rapid transmission that can occur in sexual networks of MSM [23]. The role of sexual networks is further supported by the findings of Pathela and colleagues, who found an association between HIV risk and multiple sexual partners, but not any clear increase in effects with the number of partners. The authors attributed this lack of a clear dose-response effect to the possible role of belonging to higher risk sexual networks [10].

It is important also to note the structural and societal factors which affect HIV transmission and risk among MSM. Studies have for example shown that higher levels of stigma may limit the uptake and provision of HIV preventive measures [24, 25], and experiences of enacted stigma and discrimination have been found to be associated with behaviors that might increase the risk for HIV [26]. In addition, discriminatory laws against same-sex relationships have been shown to have a negative association with HIV testing frequencies and HIV status awareness in countries on the African continent [27]. These are all factors that interact in different ways and contribute to the disproportionate burden of HIV among MSM, in Sweden and globally.

HIV in Sweden

In 2019 there were 8020 individuals living with a known HIV diagnosis in Sweden, which is the equivalent of a prevalence of 0.08% in the population of 10.3 million [28, 29]. While the number of new cases has been relatively unchanged over the last 10 years, 364 new HIV infections were registered in 2020 which was the lowest number since 2002. It is however unclear if this decrease can be attributed to strategies such as the introduction of PrEP, or whether this can be an effect of the Covid-19 epidemic, which might have affected accessibility of testing, as several clinics that participated in data collection for the studies presented in this thesis have reported declines in numbers of tests performed. A majority of the cases (77%, n=281) had acquired the infection in another country as shown in **Figure 2**, and among the 54 cases where transmission had occurred in Sweden, the route of transmission was reported as male-to-male sex for 37% (n=20) [30]. This was the first time in the last 10 years when the proportion of male-to-male sexual transmission was lower than heterosexual transmission, which can be seen in **Figure 3**.

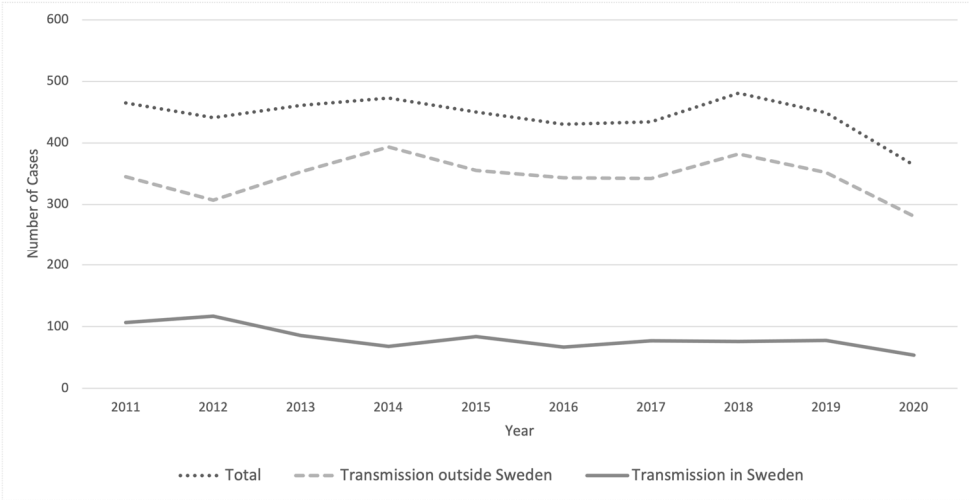

Figure 2. HIV transmissions diganosed in Sweden between 2011-2020. Data from the Public health agency of Sweden.

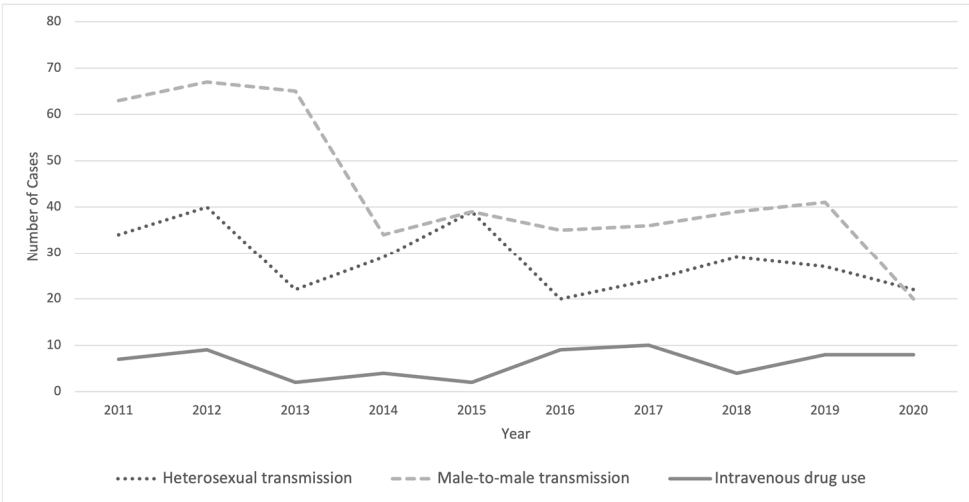

Figure 3. HIV transmissions diganosed in Sweden between 2011-2020, separated by route of transmission. Data from the Public health agency of Sweden.

In 2016, Sweden was the first country to officially claim to have achieved the 90-90-90 targets, meaning that at least 90 % of people living with HIV were diagnosed, 90 % of people diagnosed were on treatment, and 90 % of those on treatment had achieved viral suppression [31]. It has, however, been argued that the proportion of undiagnosed HIV infections in Sweden are underestimated, and that the true

proportion of undiagnosed HIV in Sweden is uncertain, but likely higher than previous estimates [32].

While not having a specific HIV law, Sweden has been criticized for the application of criminal laws and regulations affecting people living with HIV in the country [33]. Two laws are predominantly affecting HIV in Sweden, the Swedish Penal Code (1962:700), and the Swedish Communicable Diseases Act (SFS 2004:168).

HIV is classified as a public health hazard under the Swedish Communicable Diseases Act [34], where a number of rights and rules are specified. These include the right to access tests and treatment free of cost, but also obligates a person who has reason to believe they might be a carrier of one of the included communicable diseases to let a physician take the necessary tests. Additionally, the person is also required to take necessary measures to protect others from risk of transmission. If a person refuses the above measures, a court can decide on both mandatory testing and isolation of the person. The act also stipulates that at the time of HIV diagnosis the treating physician should give the patient a list of rules of conduct. These rules are formulated in Disease Control Sheets, developed by the organization for disease control physicians (Smittskyddsläkarföreningen) in Sweden. Up until 2019, the rules included disclosure obligation and mandatory condom use for people living with HIV, regardless of treatment status and viral load. There was, however, an opportunity for treating physicians to exempt well treated patients from the disclosure obligation to sexual partners [35]. Since 2019 there are now two separate patient information sheets, one for newly diagnosed or individuals who for other reasons do not reach viral suppression or are not deemed to be on "stable HIV treatment", and another one for individuals with viral suppression who are on "stable HIV treatment" [36, 37]. A person with stable HIV treatment is defined as a patient having stable undetectable (<20 or <50 HIV-RNA copies/ml plasma) viral load, who is deemed to have high treatment adherence, and who attends regular follow-up with the physician [38]. In the patient information for patients with stable HIV treatment, three rules of conduct have been removed, and some rules have been modified. The mandatory disclosure to sexual partners and mandatory condom use have been removed for persons on stable treatment, as well as the disclosure obligation for simpler or routine medical and dental examinations, including injections and drawing blood samples [37].

HIV treatment and prevention

The natural course of HIV infection shows high variation between individuals, but the course of the infection follows a common pattern, which can be generalized as follows. Following infection, the virus replicates in the target cells, which for HIV primarily are the CD4+ T-cells. Rapid initial replication, during the first few

weeks of infection, leads to an initial increase of viral load resulting in high amounts of virus in the blood and a subsequent reduction of CD4+ T-cells [39]. At this stage, around two to four weeks after infection, a proportion of individuals with the infection experience transient flu-like symptoms, Acute HIV syndrome [40]. Following this primary infection, the viral load declines over the course of months, and then stabilizes at a so-called set point and the infection enters the chronic phase, or clinical latency. The median time between infection and development of symptoms related to immune-deficiency, acquired immunodeficiency syndrome (AIDS), is 10 years [39]. In the absence of treatment, AIDS will lead to death. This course of infection is illustrated in **Figure 4.**

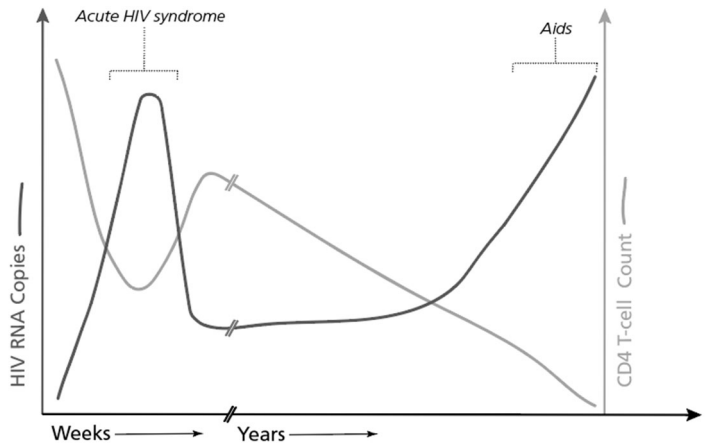

Figure 4. The development of HIV infection, showing how viral load (HIV RNA Copies) changes over time and the effects on the immune system (CD4 T-cell count). Illustration based on Pantaleo et al. (1993) [39]

Infectiousness of HIV is correlated with viral load, meaning that the more virus present in body secretions, the easier HIV is transmitted to another person. This can pose a challenge for prevention, as the initial viral load spike often occurs in a period when HIV has not yet been diagnosed. According to a number of studies, people with acute HIV infection represent a substantial proportion of onward transmission of HIV [41].

In the mid 90's highly active antiretroviral therapy was introduced (HAART). HAART is the treatment regime for HIV combining antiretroviral (ARV) drugs. The combination of several drugs leads to effective suppression of viral replication, and by this combination the risk of resistance to any one drug is also minimized [42]. It also means that with antiretroviral therapy that suppresses the viral load, infectiousness is decreased. The effects of ART on infectiousness at the population level had been discussed for many years [43-45], but following the results from the HPTN 052 trials in 2011, and following studies with larger samples of MSM, it was

clear that successful ART with viral suppression made the risk of sexual transmission of HIV effectively zero [46-48], which is illustrated in **Figure 5**.

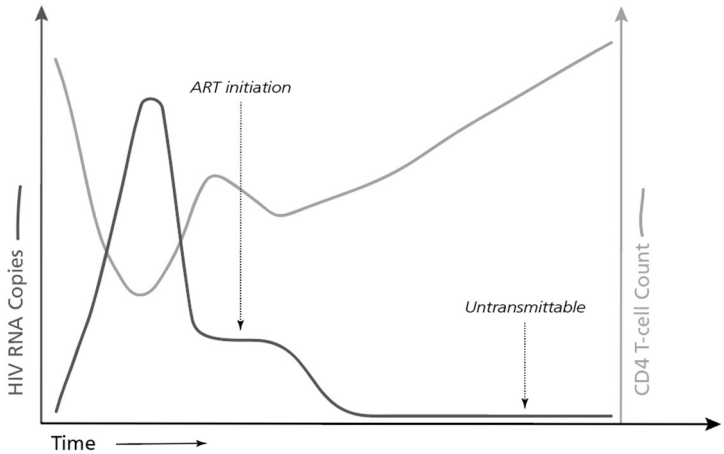

Figure 5. Illustrating the decline of HIV viral load (HIV RNA Copies) and recovery of the immune system (CD4 T-cell count) following successful ART initiation.

Based on the strong evidence which had aggregated by 2018, a consensus statement aimed at governments was released in which the authors encouraged that the application of criminal laws in cases related to HIV should be guided by scientific evidence regarding infectiousness. At the time of publishing this thesis, 68 countries still had laws criminalizing HIV to some extent, for example by classifying non-disclosure or HIV exposure as criminal offences [49]. Developed by 20 of the world leading HIV experts, the consensus statement has now been endorsed by over 70 HIV experts from around the world (see [49], Supplementary Material S1). This emerging evidence did not only affect the legal frameworks surrounding HIV globally, but also the strategies for and application of HIV prevention.

Reviewing the prevention strategies that have been promoted by HIV professionals and used by individuals to minimize the risk of transmission over time, we can identify three eras, guided by scientific progress and the introduction of Highly Active Antiretroviral therapy, HAART, as summarized in **Figure 6**. The figure also includes a fourth, yet to arrive, era. In this thesis the eras have been labeled as the Pre-HAART, Early HAART, Late HAART and Post-HAART eras. As access to, and time of implementation of, HAART differs enormously between countries, it is not possible to place the eras on a global timeline. The history of HIV, especially regarding MSM, is also most often viewed from a US or Western perspective, leaving out experiences from many other parts of the world. This needs to be considered when further discussing the development of prevention strategies.

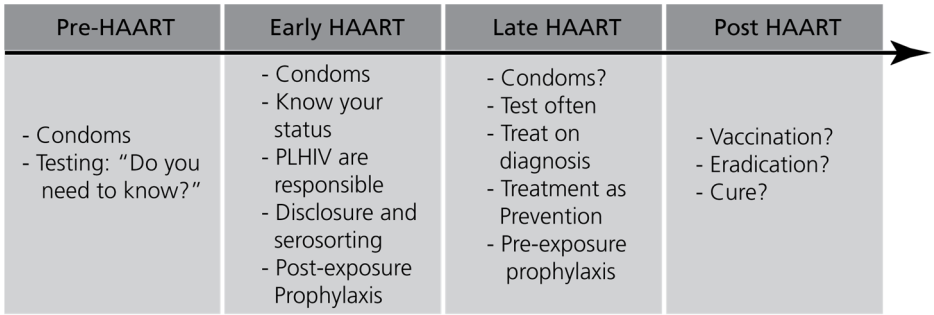

Figure 6. HIV prevention strategies and measures over time

It has been described how MSM in the early stages of the HIV epidemic developed safer sex practices with condom use as the norm or community ethic [45, 50], which became central in the 'AIDS activism' of the early 1980's [51, 52]. In the mid 80's HIV was identified as the cause of AIDS, and HIV testing had become available. At this point of the pre-HAART era, effective treatment options were not available [53], raising questions about what the benefits of knowing one's own HIV status would be. While one might question the idea of 'safe sex' as a norm in the (western) MSM communities, it is evident that the condom was the main tool for preventive messages, often promoted by community-based organizations [50, 54, 55].

With the discovery of combination treatment and the introduction and availability of highly active antiretroviral therapy in the mid-late 1990's [56], the prognosis and life expectancy of people living with HIV vastly changed, and thus the prevention strategies were also expanded. With effective treatment available, testing became a central prevention strategy with messaging about the importance of knowing your status. HIV testing now played a more central role in preventive messages, together with adapting individual strategies based on the results, such as disclosure of HIV status and serosorting, a strategy where HIV negative MSM choose to have condomless sex with other HIV negative men, and vice versa [50]. The responsibility of curbing transmission was, however, predominantly placed on people living with HIV [57], which is reflected in the legislations surrounding HIV that still persists in many countries [58].

The biomedical development and cumulative evidence that characterize the late-HAART era have had a big impact on the HIV prevention strategies for and by MSM. Already in 2008 the so called "Swiss statement", a consensus statement issued by the Swiss federal commission for HIV, created a global discussion when it stated that:

> An HIV-positive individual not suffering from any other STI and adhering to antiretroviral therapy (ART) with completely suppressed viremia (hereinafter "effective ART") does not transmit HIV sexually. [59]

Initially, the statement was heavily denounced by HIV experts and organizations [60]. However, in the following years evidence slowly accumulated though studies such as HPTN052 and PARTNER [46, 61], and the final results from the PARTNER study published in 2019 reaffirmed that HIV was not transmitted sexually when HIV viral load is suppressed, when the authors stated:

> Our results provide a similar level of evidence on viral suppression and HIV transmission risk for gay men to that previously generated for heterosexual couples and suggest that the risk of HIV transmission in gay couples through condomless sex when HIV viral load is suppressed is effectively zero. Our findings support the message of the U=U (undetectable equals untransmittable) campaign, and the benefits of early testing and treatment for HIV. [62]

Treatment as prevention, meaning early initiation of ART with the aim to curb further transmission, was at this point not a new idea and had been supported by modelling and ecological studies [43-45, 63, 64], but with the new evidence the effects of this strategy was undeniable.

In addition to the added evidence of the preventive potentials and effects of ART, the late-HAART era has been characterized by the introduction of pre-exposure prophylaxis (PrEP) for groups with increased risk of HIV acquisition. Taking PrEP either daily or event-based has proved to be a highly effective and safe way of preventing HIV infection for MSM not living with HIV [65-67], contributing an additional tool for HIV prevention. However, this medicalization of HIV prevention has raised concerns regarding the decreases in condom use that had been observed among MSM [68, 69], in combination with increasing numbers of STI diagnoses observed recently in, for example, Europe [70, 71].

What lies ahead towards the post-HAART is still uncertain, but several new technologies of prevention are in development, including microbicides, long-acting PrEP, and long-acting ART [72]. If we will move into the post-HAART era, or when it would happen is still uncertain, given the challenges faced with developing vaccines for the infection [73]. Other ways forward being studied are eradication, where viral load is suppressed over time also without ART, or a cure where the virus is eliminated from the body [74].

Defining HIV prevention strategies

While the term *primary HIV prevention* has been used to describe work aiming to limit the risk of HIV acquisition among MSM not living with HIV, the term *secondary HIV prevention* has been used to describe work focused on limiting the risk of further HIV transmission from MSM living with HIV [75], sometimes labelled Prevention for Positive (see for example Fisher et al. 2010 [76]). Using

these definitions as a starting point, in this thesis I suggest an expansion of the scope of secondary HIV prevention to also include approaches that improve the lives of MSM living with HIV and limit the effects of the infection, both on a social and medical level, which would give us a more holistic approach to HIV prevention. This is also in line with the understandings of primary, secondary, and tertiary prevention as often described in public health literature, where the focus for secondary prevention is to reduce the negative effects of a disease or injury that has occurred.

We can use the cliff analogy suggested by Jones and colleagues in 2009 to explain the levels of public health prevention strategies further, as illustrated in **Figure 7**. In the simplified version of the analogy presented here, Jones described how we plan interventions on different levels to deal with "people falling off the cliff of good health". Placing a fence on the top of the cliff prevents people from falling off, which represents primary prevention. Preventing further injury from those still falling off the cliff, we can place a safety net midway down the cliff, which would represent secondary prevention. The third level, tertiary prevention, treatment and recovery, is represented by placing an ambulance at the very bottom of the cliff [77].

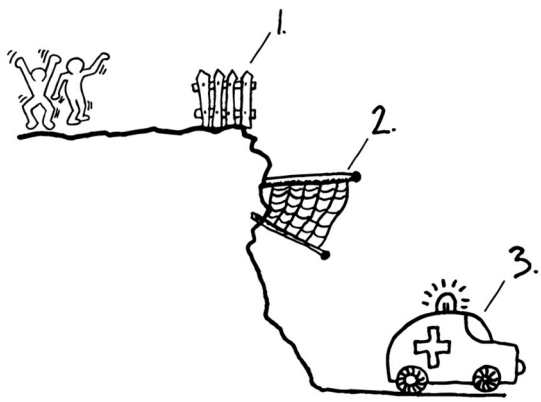

Figure 7. The cliff analogy. The fence (1) representing primary prevention, the net (2) representing secondary prevention, and the ambulance (3) representing tertiary prevention. Based on Jones et al. (2009)

One secondary prevention strategy often adopted is measures to increase early detection of disease. In the case of HIV, this strategy would fulfill both the aim of primary and secondary prevention. Early detection and treatment minimize the risk of further transmission of HIV and thus new infections (primary prevention), as well as improve the health outcomes for the person living with HIV (secondary prevention). In that sense, the terms primary prevention and secondary prevention could be interpreted differently depending on if one's understanding of the terminology is based on public health or on HIV prevention. From here on in this

thesis, *primary HIV prevention* should be understood as interventions for MSM who are not living with HIV with the aim of preventing HIV acquisition, and *secondary HIV prevention* should be understood as interventions for MSM living with HIV with the aim to prevent further transmission and to improve the health and quality of life of MSM living with HIV.

Conceptual framework

To assist in understanding the processes involved in HIV prevention, we used a model suggesting that testing offers an opportunity for preventive measures based on individual needs and assessments. Individual measures related to primary and secondary HIV prevention taken by MSM are affected by numerous factors, and optimally, these measures are based on informed decisions and full access to information, services, and tools. In this thesis the model will be used as a starting point to further explore associated factors affecting the processes.

A cyclical HIV testing and prevention model for MSM in Sweden

In 2016, Horn and colleagues presented a model for an integrated primary and secondary HIV prevention continuum for the United States [78]. In their model, the authors suggest a cyclical process of the primary HIV prevention, starting at an initial negative HIV test. Following a negative test result, individuals should receive a risk and needs assessment, which is the basis for access to prevention services such as specialized medical and mental health services. The final step of the cycle is ensuring engagement and retention of HIV prevention interventions, such as PrEP and other sexual health services – leading back to a re-test and thus, re-entry into the cyclical primary HIV prevention continuum. In this model, HIV testing is seen as an entry point for prevention services for individuals with increased risk of HIV acquisition and an opportunity for prevention services [78].

In the early stages of planning this PhD project, we were inspired by the cyclical prevention model presented by Horn and colleagues, but saw a need to adapt and expand the model to better suit the aim of the project, our definition of secondary HIV prevention, and to the Swedish context. During the course of the project, the model has been evaluated, discussed with peers and stakeholders, and based on that, further adapted and developed. In **Figure 8** we present a new model describing the cyclical processes of both primary and secondary HIV prevention for MSM in Sweden. Similarly to Horn et al. [78], we suggest that the HIV test should be viewed as a natural opportunity for entry into the prevention cycles, with the exception of HIV self-testing (HIVST), for which the opportunity needs to be further developed.

To the model we have added the processes leading up to the HIV test, which in a majority of cases is based on an individual decision to test.

The entry point into the process for an individual is in the vast majority of cases the decision to test, rather than the test itself. Several factors can affect the decision or ability to take a HIV test for MSM in Sweden. One needs to remember that this is also regulated through the Swedish Disease Control Act [34], as individuals have an obligation to seek medical examination if there are reasons to believe they might carry an infection regulated by the act, such as HIV. This could be, for example, based on the mandatory partner tracing. If an individual then resists medical examination, a decision can be made for mandatory testing and examination. Apart from this, the decision to take a test is more often based on individual preference and is voluntarily motivated.

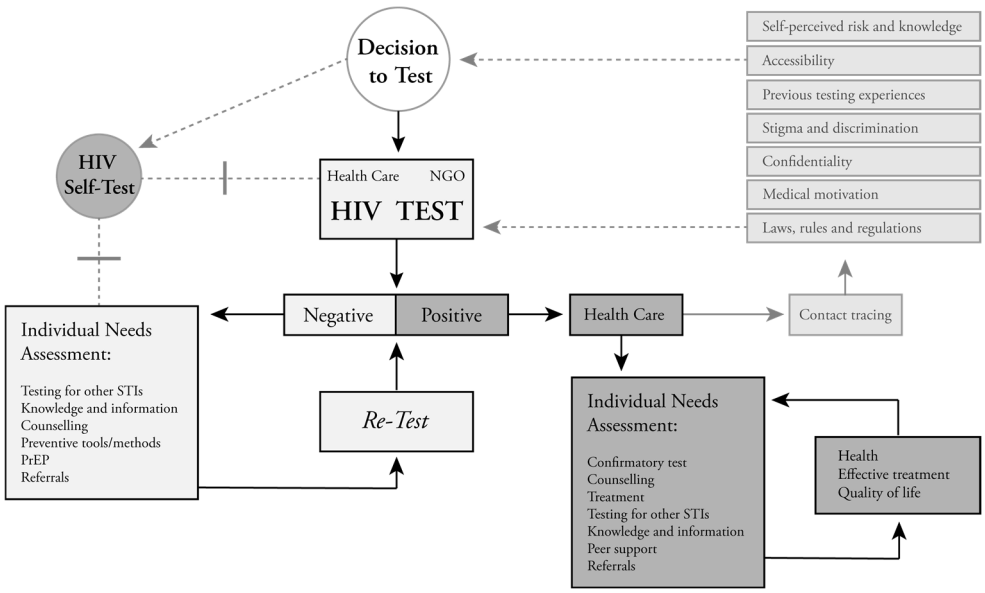

Figure 8. HIV testing and prevention model for Sweden, illustrating the testing event as an entry point to individualized primary or secondary HIV prevention services. Inspired by Horn et al. (2016) [78]

When the decision has been made to take a test, the options regarding where to test depend on what is available and accessible. The vast majority of HIV tests in Sweden are conducted within the public health care system, for example at a local STI clinic, at youth clinics, or within the primary health care system. In the larger cities there are also specific clinics specializing in MSM sexual health services, in Stockholm as a separate clinic, and in Gothenburg and Malmö integrated within general sexual health clinics.

Currently, HIV self-tests (HIVST) have limited availability though online web shops and they are comparably pricey (>250 SEK). None of the registered pharmacies in Sweden sell HIVST. In several cities, not only the major cities, community-based venues organized by non-governmental organizations (NGO) offer rapid HIV testing for specific target populations such as MSM, trans persons, or populations with migration background. These venues offer low threshold testing, with pre- and post-counselling, in addition to other services such as social activities and information. At the time of publication of this thesis, the organization Noaks Ark, working with HIV prevention and support for people living with HIV, offered 5 venues for HIV testing, and RFSL, The Swedish Federation for Lesbian, Gay, Bisexual, Transgender, Queer and Intersex Rights, offered 5 venues in different cities, one of which was in collaboration with PG Väst, an organization working with people affected by HIV.

For the cyclical prevention model to function effectively, a sound referral system between services is essential. This is not limited to the referral between community-based venues and other services within the public health care system, but also between service providers within the public health care system. The frequency of re-testing, and the assessments of additional needs, should be based on the individual. This cycle enables adaptations in services offered to meet the changing needs over time. Adding HIVST to this, the challenges of referrals to additional services and care are more complex, as the availability today is mostly unregulated, which is illustrated by the bars crossing the referral chain in the model.

In the model we also see the cyclical process of the secondary HIV prevention, where HIV care should include an individual needs assessment that, in addition to focus on ART, also should contribute to improved outlooks for health and quality of life by referrals to additional services based on need. Just like with HIV testing, this should be repeated over time, at intervals based on individual needs that are regularly assessed.

Several factors affect the steps within the prevention model, and these processes can be simplified into a conceptual framework, as shown in **Figure 9**. Overarching the steps are current and prioritized resources and policies, as well as laws and guidelines such as the Swedish Communicable Diseases Act and guidelines for PrEP assessments. The services or preventive measures then need to be available, and in a sufficient quantity to meet the needs, such as clinics offering comprehensive sexual health care with special competence regarding MSM. However, contextual determinants might affect the accessibility of those services or information, such as certain groups not receiving information in a language they can understand, or that services might not be affordable for certain groups, or available at feasible times for others. The intentions to adopt preventive measures rely on access to correct information and knowledge, to be able to make informed decisions that are further affected by individual determinants such as behaviors and risk perception. An example of this would be condom use for individuals living with HIV, and

knowledge about the rules of conduct in combination with an understanding of one's own infectiousness. It is through these processes that each step in the prevention model results in a decision of use or non-use of certain prevention strategies, and these decisions should, in an optimal situation, be based on informed decisions grounded in correct information.

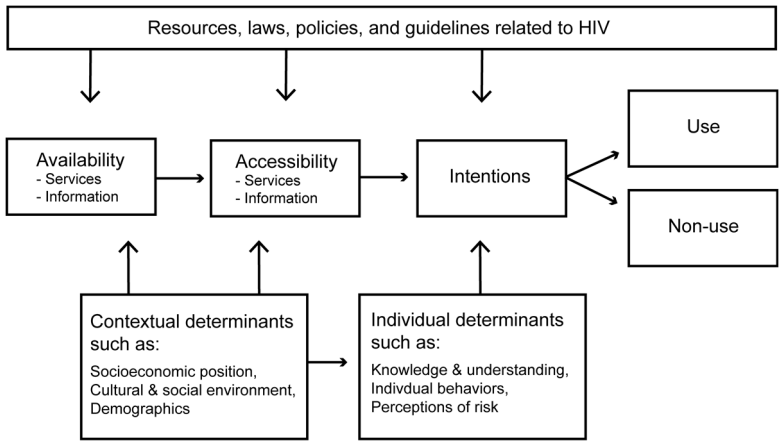

Figure 9. Conceptual framework of factors affecting use of individual HIV prevention strategies

To mention a few concrete examples of factors associated with steps in the prevention model, a previous study exploring motivators and barriers to testing among MSM in Sweden suggested that unawareness of risk or low risk perception were main reasons for not getting tested, but also suggested that concerns about confidentiality was another contributing barrier [79]. Other factors previously found to be associated with HIV testing uptake among foreign-born MSM have been the amount of time since migrating to Sweden and having been reached by HIV prevention workers and information [80]. In a European setting, disparities in access to HIV preventive information such as information about PrEP have been observed among migrant MSM [81], and in Sweden higher probabilities of being late presenters have been observed among certain migrant groups [82], indicating barriers to HIV testing. Thus, having a migrant background seems to be associated with barriers to HIV prevention access and uptake. We also see that information plays an important role regarding self-perceived risk and knowledge of services available, such as PrEP, both of which require receiving correct and updated information. This is relevant both for primary and secondary HIV prevention, with the aim of enabling individuals to make informed decisions, and as described before, to contribute to reducing HIV related stigma.

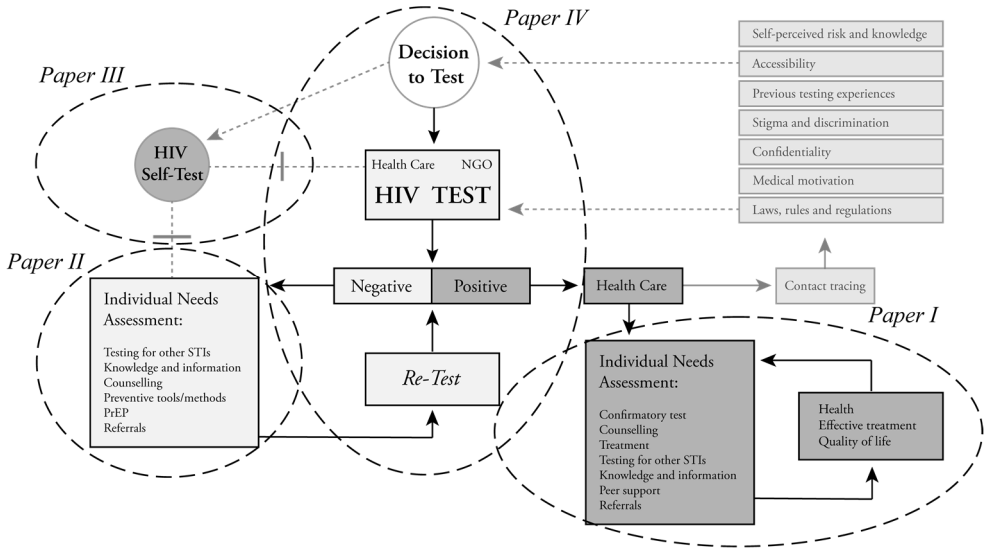

Figure 10. The included Papers' placements within the cyclical primary and secondary HIV prevention model.

By placing Paper I-IV within the prevention model, as shown in **Figure 10**, we see how each paper contributes to different parts of the model, by studying factors specific to the different processes related to the prevention cycles. This placement is of course not exact but it illustrates how the included papers can contribute to the understanding of the processes within the prevention model.

Through this framework, we can expect a multitude of factors affecting each step of the model. An interplay of sociodemographic factors, structural factors, knowledge, and actual and perceived HIV risk contribute to access to, acceptability of, and perceived need for preventive services included in the model. Understanding these associations and how they affect MSM is necessary to ensure equitable access to HIV preventive services and information.

Rationale

When this project was initiated in 2016-2017 a couple of years had passed since the last national MSM survey had been conducted, and the HIV prevention landscape was changing. Increasing evidence supporting U=U had emerged, PrEP was recently approved in Europe, and HIV self-tests were becoming increasingly available and used around the world. At this point, knowledge was very limited regarding how these emerging factors and prevention tools could be related to the needs among MSM in a Swedish context. There were studies that had been done in a European context exploring, for example, interest to take PrEP [83-85] experiences of MSM living with HIV sharing ARVs with partners not living with HIV to use as PrEP [86], and experiences of HIV self-testing [87-89]. However, no similar studies had been done in Sweden, and knowledge from a Swedish context was limited and anecdotal. Based on reports from staff at HIV testing venues, we knew that MSM were importing PrEP, and HIVST had recently been offered for sale in a Swedish web shop but the extent of utilization and uptake, and how it was perceived by MSM, was unknown.

A number of relevant studies have been published concerning HIV prevention for MSM in Sweden in recent years. Strömdahl and colleagues studied uptake of peer-led venue based HIV testing for MSM in Stockholm [80], and used data from MSM2013 to study HIV testing and prevention uptake among foreign-born MSM in Sweden [90]. Ingemarsdotter Persson and colleagues did a study on motivators and barriers to HIV testing among MSM, also based on MSM2013 data [79], and Johansson and colleagues looked at factors associated with condom use and HIV testing based on the same dataset [91]. While a modeling study has since studied the possible effects of PrEP-introduction in Sweden [92], no studies had been done on this topic or HIVST when this PhD project was initiated, and the knowledge gaps to inform prevention were evident.

This PhD project and thesis set out to fill some of these gaps, with the intention to contribute to an improved understanding of preventive needs among MSM, to better inform future directions of primary and secondary HIV prevention in Sweden.

Aim

The overall aim of this thesis was to gain a better understanding of experiences and perceptions regarding factors relevant to primary and secondary prevention of HIV among MSM in Sweden, in order to contribute to strengthened HIV prevention strategies and programs in Sweden, informed by knowledge. To achieve this, four studies were conducted.

Specific aims

Paper I: To explore experiences and perceptions regarding communication about infectiousness and the rules of conduct with clinical staff at HIV clinics among MSM living with HIV in Sweden.

Paper II: To examine if self-reported indicators for sexual risk behavior, self-perceived risk of HIV acquisition, PrEP knowledge, and self-reported history of sexually transmitted infections (STI) are associated with interest in taking PrEP for HIV prevention among HIV-negative MSM attending HIV testing venues in the three largest cities in Sweden.

Paper III: To examine the interest to use HIVST, as well as the willingness to pay for HIVST, and associated factors in a sample of MSM attending HIV testing venues in Sweden

Paper IV: To identify possible sub-groups based on testing behaviors among MSM attending six HIV testing venues in Sweden, analyze profiles of HIV and bacterial STI testing behaviors, and further study factors associated with specific testing profiles.

Materials and methods

The current thesis examines prevention needs and potentials for MSM in Sweden through four separate but interlinked studies. Paper I is based on a study performed with qualitative methods, and Papers II, III and IV are studies performed using quantitative methods. While paper I focused on a study population of MSM living with HIV, Papers II through IV were conducted with participants consisting of MSM not living with HIV. The motivation for this was to capture elements of both the primary and secondary prevention cycles as described in the prevention model presented earlier. An overview of materials and methods is presented in **Table 1.**

Table 1. Overview of the papers included in the thesis.

Paper	Study design	Data source	Participants	Data analysis
I	Qualitative	in-depth interviews	10 MSM living with HIV	Qualitative manifest and latent content analysis
II	Quantitative Cross-sectional	Self-administered questionnaire	658 MSM attending HIV testing venues in Stockholm, Gothenburg & Malmö	Univariable and Multivariable logistic regression analysis
III	Quantitative Cross-sectional	Self-administered questionnaire	663 MSM attending HIV testing venues in Stockholm, Gothenburg & Malmö	Univariable and Multivariable logistic regression analysis
IV	Quantitative Cross-sectional	Self-administered questionnaire	669 MSM attending HIV testing venues in Stockholm, Gothenburg & Malmö	Latent Class Analysis and Multinomial logistic regression

Paper I

Data collection and study population

For Paper I, in-depth interviews following a semi-structured interview guide [93] were conducted with 10 MSM living with HIV in Sweden. Prior to conducting the interviews, the interview guide was piloted and discussed with representatives of a patient organization. Initial participants were recruited through an online survey for people living with HIV conducted by the Public Health Agency of Sweden. Survey

respondents who were interested in participating in interviews were encouraged to send an email expressing their interest. The persons who expressed interest were then contacted and given further information. After receiving further information about the study, two respondents chose not to participate, which resulted in 6 potential participants for this study, of whom one later withdrew participation before the interview. Two respondents reached out to the research team wanting to participate after hearing about the ongoing study from a presentation for HIV organizations, and an additional three respondents were recruited through snowballing from other participants. Six interviews were conducted in person in Stockholm, Gothenburg and Malmö, and four interviews were conducted via video-calls, which allowed for a greater geographical coverage. Previous research suggests that videocalls yield data of similar quality to in-person interviews [94]. The interviews were conducted in Swedish and English by the main author, recorded digitally and transcribed verbatim. Transcripts were then verified by a second member of the research team. Recruitment of study participants continued until the team deemed that information power was sufficient for the aim of the study [95]. The interviews lasted between 41 and 95 minutes, and a thematic guide to the interviews can be seen in **Figure 11**. An additional two interviews were conducted with women living with HIV. These interviews were not included in the analysis for this study.

Figure 11. Overview of thematic interview guide

Data analysis

For Paper I the study set out to explore experiences and perceptions of the participants, for which a qualitative content analysis, according to the steps of analysis as described by Graneheim & Lundman [96] and further elaborated by Graneheim, Lindgren & Lundman [97], was deemed suitable. Data from interviews were analyzed while data collection was still ongoing, to continuously evaluate the information power attained in relation to the analysis [95]. Both transcription and analysis were done by using MAX QDA (version 12.3.2).

Table 2. Example of the analytical process

Meaning unit	Condensed meaning unit	Codes	Sub-category	Category
"No but, it feels really good and so, and yes, yes, that it feels good that the nurses kind of, well, they are knowledgeable about it, and that they, yes, well, and they are on our side so to say. So yes, it feels, well, it feels very good."	It feels very good that the nurses are knowledgeable about HIV and that they are on our side.	• Good that nurses are knowledgeable about HIV • Nurses are on our side	The nurses genuinely care about me	Having a good relationship with your clinic makes you feel safe

Following transcription of the interview, the text was read repeatedly to get familiar with the content. Keeping the aim of the study and research questions in mind, meaning units were identified. These were sections of the transcript with meaningful content related to the research questions. The meaning units were then condensed, into shorter meaningful text units, but kept close to the words that participants expressed. The next step was to abstract the material by labelling the condensed meaning units with meaningful codes. Codes were then clustered based on their content into sub-categories, that were then aggregated into categories, both of which represented the manifest meanings of the material. For the final step the transcripts were revisited and based on the content and the identified categories and sub-categories, a latent overarching theme was developed. An example of the analytical process is presented in **Table 2**. With the help of the organization Positiva Gruppen Syd in Malmö, member checks were done concerning the preliminary and final results of the analysis, which also contributed to assessing the information power of the material.

Papers II-IV

Data collection and study population

Papers II, III and IV all analyzed cross-sectional quantitative data from a survey specifically developed for this PhD project, to be distributed at six HIV testing venues in Malmö, Gothenburg and Stockholm. This type of venue or facility-based sampling is a commonly used strategy for hard-to-reach populations such as MSM [98]. When selecting the venues, we wanted to include venues specifically aimed at MSM and venues that were part of the public health care system as well as venues that were community-based. We did not, however, limit the data collection to times specifically for MSM at clinics that also cater to other men, based on feedback from the clinics that a majority of MSM visited them at other times than just when they had their MSM clinic or drop-in.

In Malmö participating venues were Hudmottagning Centrum för sexuell hälsa, which is the main STI clinic in Malmö catering to all people but with specific marketing and opening hours for MSM, and Checkpoint Skåne, a community-based HIV testing venue for MSM and trans persons run by RFSL Rådgivningen Skåne. In Gothenburg the participating venues were Könsmottagningen at Sahlgrenska sjukhuset, which is the main STI clinic with a specific MSM clinic, Gayhälsan, at specific hours, and Checkpoint Göteborg, a community-based HIV testing venue for MSM and trans persons by RFSL Göteborg in collaboration with PG Väst. In Stockholm participating venues were Venhälsan at Södersjukhuset, an STI clinic specifically for MSM, and Testpoint Stockholm, a community-based HIV testing venue for MSM and trans persons run by RFSL Stockholm. Each of the venues had one person coordinating the data collection.

Due to the sensitive topics that were to be included in the questionnaire, we chose a anonymous and self-administered design, which has been suggested to limit social desirability bias [99]. Several aspects needed to be considered when developing the questionnaire and a number of experts and community representatives were invited to give valuable inputs. The content of the questionnaire should capture data relevant to the aims of the studies, in this case experiences and perceptions about HIV preventive measures such as testing and PrEP, and also factors that can be hypothesized to affect the outcomes of these, such as sociodemographic information, sexual behaviors, and perceived risk.

We reviewed previously used questionnaires, such as the questionnaire used for the MSM2013 survey in Sweden [100], and consulted researchers involved in that study. To the greatest extent possible we wanted to use pre-tested or validated questions. One such example is that a two-step method was used to ask about gender identity, making it possible to identify trans individuals [101, 102]. Using informative shorter texts about PrEP in the questionnaire was inspired by the EMIS

survey [103] and adapted to a Swedish context. This enabled questions about PrEP interest based on a basic understanding of PrEP given in the survey itself.

The questionnaire was then discussed with representatives of community-based organizations, researchers, and the staff at the clinics, and based on the feedback further adjusted and improved. An important aspect to consider was the limited time potential participants had to answer the questionnaire, and after consulting the venues we aimed at a survey that took about 10 minutes to answer, which limited the scope of the survey. This time was based on the expected waiting time between registering at the venue and being invited to take the tests. Another essential component was that the survey needed to be inclusive and possible to answer regardless of HIV status, and a patient organization was consulted to give their input concerning this.

A first draft of the survey was then sent out to selected venues for them to test filling it in themselves to discuss among staff and return comments, after which the survey was translated into English. The Swedish and English surveys were then piloted on a heterogenous selected group of ten MSM and two non-MSM which included individuals who were non-Swedish speakers, or had Swedish as a second language, individuals with reading and writing difficulties, individuals living with HIV, and individuals of different ages and sexual orientations. The piloting group was asked to submit comments about the questions, rate the difficulty of answering the questions, and was asked to record how long it took to answer the survey. This was submitted anonymously through a web survey. In addition, we held an oral discussion on the content and interpretation of questions with each pilot participant. Following the piloting, minor revisions were made to the questionnaire. All pilot respondents had answered that it was “easy” or “very easy” to answer the questionnaire, and most finished it well within the 10 minute aim. This process led to a final questionnaire consisting of 33 main questions, which has been attached to this thesis in full, as **Appendix I**.

Two means of data collection were used based on feasibility and data security. At the public health care clinics, paper surveys were used and respondents were asked to submit them in a closed envelope to a locked post box. All submitted questionnaires were stored in the closed envelopes in a locked cabinet and were collected for scanning several times during the data collection. At the community-based organizations, an assigned person was available at all times, and questionnaires were collected electronically through iPads with an internet connection using an encrypted questionnaire tool, and therefore no data was stored locally. An overview of the participating venues and means of data collection is presented in **Table 3**.

Table 3. Overview of the participating venues

Venue	Type	Questionnaire	Target group(s)	Data collection period
Venhälsan, Södersjukhuset, Stockholm	Public HIV/STI clinic (Region Stockholm)	Paper	MSM	Oct 8–Nov 30, 2018
Testpoint, Stockholm	Community-based HIV testing venue (RFSL Stockholm)	Electronic	MSM and Trans persons	Sept 17–Nov 30, 2018
Könsmottagningen, Sahlgrenska sjukhuset, Gothenburg	Public HIV/STI clinic (Västra götalands-regionen)	Paper	All men and women, with integrated MSM clinic	Aug 27–Nov 30, 2018
Checkpoint, Gothenburg	Community-based HIV testing venue (RFSL Göteborg, PG Väst)	Electronic	MSM and Trans persons	Aug 13–Nov 30, 2018
Hudkliniken, Centrum för sexuell hälsa, Malmö	Public HIV/STI clinic (Region Skåne)	Paper	All men and women, with integrated MSM clinic	Aug 20–Oct 31, 2018
Checkpoint Skåne, Malmö	Community-based HIV testing venue (RFSL Rådgivningen Skåne)	Electronic	MSM and Trans persons	Aug 13–Nov 30, 2018

Sample size calculations were based on estimates of the proportion of MSM who had been tested for HIV in the preceding 12 months [100], and the estimated MSM population size [104]. A confidence interval of 95% and a margin of error of 0.05 resulted in a suggested sample size of 367. With expected non-response in combination with estimated proportions of MSM at the venues, we set up a target for inviting 2000 men, expecting a final sample of 500 MSM.

In total 1672 men were invited to participate by answering the survey. As sexual practice could not be assessed prior to invitation, all subjectively identified men attending the venues were given the information letter and the survey. A total of 1351 completed surveys were submitted either digitally or on paper in a closed envelope. This gave a crude response rate of 81 %. Response rates were generally higher at the community-based venues (81-95%) than at the public health care clinics (78-82%). No data on non-respondents was available to us, thus no analysis of non-respondents was conducted.

From the submitted data 613 respondents were excluded based on already having answered the survey, not self-identifying as a man, not reporting an age over 18 years, or not reporting any male sexual partners. This resulted in a sample of 738 eligible MSM respondents. An additional 56 respondents were excluded from the studies as they had not had sex, defined as oral or anal intercourse, with another man in the preceding 12 months, and 13 respondents were excluded as they

reported that they lived with HIV, resulting in a sample of 669 MSM who were potential participating respondents for Papers II-IV, as shown in the exclusion flow chart, **Figure 12**.

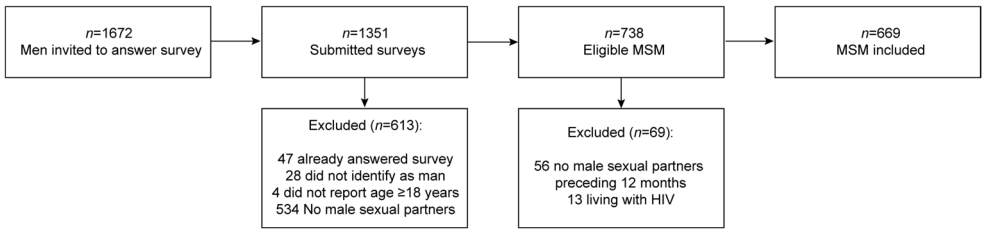

Figure 12. Exclusion flow chart

Data analysis

For the analysis for Paper II we used Stata/SE 12.1 (StataCorp. 2011. College Station, TX: StataCorp LLC.), and for Paper III and Paper IV we used Stata/SE 16.1 (StataCorp. 2019. College Station, TX: StataCorp LLC.). For all papers, significance level was set to $p<0.05$.

Paper II

Paper II is based on analysis of a sample of 658 MSM. The dependent variable *Interest in taking PrEP* was assessed in the questionnaire by "Are you interested in taking PrEP as a preventive measure against HIV?". In the answer, interested respondents could choose their preference of daily PrEP or event-based PrEP. Due to the hypothetical nature of the question these two were combined as *Interested in taking PrEP* for the further analysis. Descriptive statistics of frequencies of relevant covariates related to risk factors for HIV, self-perceived risk, knowledge about PrEP, as well as sociodemographic variables, were examined and stratified according to the dependent variable, and chi-square tests were used to identify significant differences between the strata.

Univariable and multivariable logistic regressions, giving crude and adjusted odds ratios presented with 95 % confidence intervals, were conducted to further examine possible associations between the selected covariates and being interested in taking PrEP.

Paper III

In Paper III we analyzed survey data from a sample of 663 MSM. The main dependent variable was *Interest to use HIVST*, assessed in the questionnaire by asking "Do you believe you will use self-tests for HIV in the future?". A secondary dependent variable, *Willingness to pay for HIVST* was included in further analysis. This assessment was possible due to the two alternatives of "yes" answers to the survey question, where one option was "Yes, but only if it is free", and the other "Yes, and I would be willing to pay for it".

Descriptive analysis was carried out by exploring frequencies of covariates related to sociodemographic, behavioral, HIV risk characteristics, as well as testing behaviors, and chi-square tests were used to examine possible association with the main dependent variable.

Covariates and their potential associations with the main dependent variable were further examined by univariable and multivariable logistic regressions, giving crude and adjusted odds ratios presented with 95 % confidence intervals.

Selection of included covariates in the multivariable model was done by combining results from the descriptive analysis and a theoretical discussion based on previous research. In the final model a full adjustment was made, including all selected covariates as well as adjusting for the venue where the survey had been submitted.

A second analysis was then carried out on the sub-sample of individuals who were interested in HIVST (n=436). Univariable and multivariable logistic regression was again performed to study associations between included covariates and the dependent variable *Willingness to pay for HIVST.*

Paper IV

To be able to identify possible subgroups by testing heterogeneity of HIV and STI testing profiles, in a sample of 669 MSM we conducted a latent class analysis (LCA). Eight observed binary categorical variables were included in the analysis. Three variables related to testing venues: Attended drop-in testing, Attended community-based HIV/STI-testing, and Attended public health care clinic for HIV/STI testing. Three variables related to motivation of testing: Routine tester, Medical motivation of seeking HIV/STI testing, and Event-initiated testing. The final two variables were related to testing frequency: Frequent tester STI, and Frequent tester HIV, indicating if the respondent tested twice a year or more.

Initially, latent class models ranging from two to six classes were examined and fit statistics and class separation were recorded. For model fit Bayesian information criterion (BIC) was used, as this has shown to be a suitable indicator for LCA [105]. Entropy was recorded for class separation. A combination of these results with interpretability and theoretical understanding was used to select the most suitable number of classes for the LCA model.

For the selected model, the profiles of the item response probabilities were analyzed and given meaningful labels. In the next step assignments of class membership to respondents was conducted based on estimated marginal class probabilities. Associations between class membership and a selection of relevant covariates were then further examined though multinomial logistic regressions, first as bivariate models, and then adjusted for possible confounding by age, education, country of birth and city where the survey had been answered, giving adjusted relative risk ratios (aRRR).

Ethical considerations

All studies included in this thesis followed ethical standards as defined in the Declaration of Helsinki. Paper I received ethical approval from the regional Ethical review board of Stockholm, 2017 (dnr. 2017/981), and Papers II-IV received ethical approval from the regional Ethical review board in Lund, 2017 (dnr. 2017/687).

The research included in this thesis, however deals with topics such as HIV and male same sex sexual behaviors, with high potential stigma within a Swedish context, and therefore the ethical considerations for the studies, the writing of this thesis and the presentations of results extend beyond securing the ethical approvals. This stigma is present on a societal level, but also within MSM communities. Paper II, as an example, deals with interest in taking PrEP among MSM, and a number of previous studies from the US have studied how PrEP users experience stigma [106-108].

Throughout the work with the studies and the writing of this thesis stigma was something that had to be taken into consideration. As researchers we have opportunities, but also responsibilities, to use findings to contribute to reducing related stigma through, for example, information dissemination and actively working to challenge misconceptions. However, at the same time research on HIV and risks carries the risk of further stigmatizing certain groups, such as PrEP users. Here we need to consider the balance between the risk of labeling groups as "risky", and the importance of understanding and knowledge gain to be able to meet the different preventive needs among MSM. This was in no way an easy task, but the risks of additional stigma have been carefully taken into consideration throughout the process, and we believe that the potential benefits of these studies are high for MSM, regardless of HIV status.

Main Results

Paper I

The 10 MSM living with HIV in Sweden who participated in the qualitative study in Paper I ranged from 25 to 71 years of age and had been living with HIV for between 2 and 27 years. Seven out of the ten participants were Swedish-born, and four had received an exemption from the disclosure obligation to sexual partners from their treating physician. Based on a qualitative content analysis of the interviews, five categories and an overarching theme, *Navigating between rules and reality*, were identified. The theme captures the latent meaning of the collective perception among the participants that they had to constantly find ways to act and cope with their experienced reality in relation to the information and rules they had received, which were often contradictory either to their lived experience or other information they had received.

The first of the identified categories, representing the manifest level of analysis, was *Having a good relationship with your clinic makes you feel safe*, which in most cases was an expression of how important the positive experiences of the staff at the clinics were. Here the nurses were often described in terms of friends, and the physicians were seen as trustworthy. It also became clear that this good relationship was not always a natural development, but participants had a proactive approach and would, for example, ask to change their physician if they had an experience or relationship that they were not happy with. The second category, *Belonging and finding important exchanges with peers,* captured the central role that other people living with HIV played for the participants. It became evident that the communication at the clinics did not exist in a vacuum. Among trustful peers information, knowledge, and experiences were shared, which contributed to how the communication with the staff at the clinics was understood, shaped and assessed, and such sharing contributed to social cohesion and learning how to live with HIV. Having other sources of information, and the importance of this, was also captured in the category *Taking responsibility for one's own knowledge*. While peers were one such source, the information from the clinics was experienced as not being given on a routine basis. Participants described how they had to ask about something specific to get the information, and there were also experiences of reluctance from staff to give certain information, such as information regarding infectiousness. Experiences of receiving the rules of conduct differed among the participants, and

it was not uncommon to perceive that information about the rules of conduct had been received through other channels than from the staff at the clinics. This was captured in the category *Finding ways to relate to the different rules.* The possibility to receive exemption from the disclosure obligation was described as a relief, but not something that everyone had been informed about. Criminal cases related to HIV also played a role and participants described how they had followed the rulings and hade drawn conclusions on their own related to the outcome of the criminal cases. While not everyone perceived that they had received their rules of conduct in accordance with the guidelines, and there were uncertainties and even misconceptions among the participants, this was also placed within the context of receiving a diagnosis, which was experienced as a time of crisis. In relation to the emerging evidence and understanding of infectiousness and the statement from the Public Health Agency of Sweden regarding "very low" risk of HIV transmission from a person with suppressed viral load, the participants described that while this new knowledge and understanding of infectiousness was a relief and support, frustration arose when different information was received from different sources. This was captured in the final category, *Being supported by the new knowledge, but inconsistencies create frustration.* This was not only limited to information about infectiousness, but also related to, for example, information about mandatory condom use. Depending on whom participants would ask, they would receive different and sometimes contradictory information, leaving them to draw conclusions on their own. These main findings of Paper I are summarized in **Figure 13**.

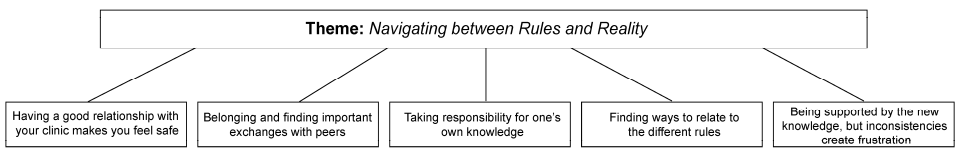

Figure 13. Main findings of Paper I: Theme and Categories

Paper II

This study included 658 respondents consisting of MSM not living with HIV attending HIV and STI testing venues in Stockholm, Gothenburg and Malmö. The median age in the sample was 32 years, and the majority (77.8%) of participants identified as homosexual. Seven individuals (1.1%) were assigned female sex at birth and identified as male. A large proportion (61.6%) of the participants reported a university education, and the majority (60.2%) were single. In the sample, 68.8% were interested in taking PrEP as a preventive measure against HIV, either daily or event

based. Event based PrEP was the more common selection with 300 (45.6%) of the respondents selecting this option. In **Table 4** we show the sociodemographic characteristics of the sample, stratified by the dependent variable *Interested in PrEP*.

Table 4. Socio-demographic characteristics, total and stratified by Interest in taking PrEP (N=658)

Characteristics	Total, No. (%) (n=658)		Interested in PrEP, No. (%) (n=453)		Not interested in PrEP, No. (%) (n=205)	
Age, years median (IQR)	32	(27-41)	32	(27-40)	33	(27-44)
Age group						
18-25 years	130	(19.8)	90	(19.9)	40	(19.5)
26-35 years	269	(40.9)	193	(42.6)	76	(37.1)
36-45 years	137	(20.8)	96	(21.2)	41	(20.0)
46-55 years	76	(11.6)	51	(11.3)	25	(12.2)
≥ 56 years	46	(7.0)	23	(5.1)	23	(11.2)
Sexual orientation						
Heterosexual	21	(3.2)	7	(1.6)	14	(6.9)
Bisexual	124	(19.0)	73	(16.2)	51	(25.1)
Homosexual	509	(77.8)	371	(82.3)	138	(68.0)
Sex assigned at birth						
Female	7	(1.1)	3	(0.7)	4	(2.0)
Male	651	(98.9)	450	(99.3)	201	(98.1)
University education						
Yes	402	(61.6)	269	(59.9)	133	(65.2)
No	251	(38.4)	180	(40.1)	71	(34.8)
Country of birth						
Sweden	412	(63.9)	282	(63.2)	130	(65.3)
Europe outside Sweden	118	(18.3)	80	(17.9)	38	(19.1)
Outside Europe	115	(17.8)	84	(18.8)	31	(15.6)
Relationship status						
Single	395	(60.2)	285	(63.1)	110	(53.9)
In a relationship	261	(39.8)	167	(37.0)	94	(46.1)

The median number of male sexual partners in the preceding 12 months was 7, and comparing those interested in PrEP with those not interested, showed the numbers of partners generally was higher among those interested (median 10 partners), than those not interested (median 4 partners), and a higher proportion reported condomless receptive anal intercourse, drug use during sex, and sex abroad. A higher proportion also perceived their HIV risk as moderate to high (18.1% vs. 6.9%).

Selection of covariates to include in the multivariable logistic regression was based on descriptive results in combination with univariable logistic regressions and a review of the literature. For the thesis we included an adjustment for the venue where the survey had been answered, to adjust for possible biases due to sampling. This did however not affect the main findings of Paper II. Results from the logistic regressions are presented in **Table 5**. The final model showed an

independent association between the dependent variable, interest in taking PrEP, and covariates concerning PrEP knowledge, higher number of partners for condomless anal intercourse, hard drug use during sex, and higher levels of self-perceived HIV risk.

Table 5. Univariable and multivariable logistic regression for interest in taking PrEP (N=658)

Characteristics	Univariable Analysis Crude OR (CI, 95 %)		Multivariable Analysis* Adjusted OR (CI, 95 %)	
Age group				
18-25 years	**2.25**	**(1.13-4.47)**	1.61	(0.71-3.66)
26-35 years	**2.54**	**(1.34-4.80)**	1.73	(0.80-3.72)
36-45 years	**2.34**	**(1.18-4.64)**	1.82	(0.81-4.11)
46-55 years	2.04	(0.96-4.32)	1.83	(0.75-4.50)
≥ 56 years	1	(ref.)	1	(ref.)
Sexual orientation				
Heterosexual	1	(ref.)	1	(ref.)
Bisexual	**2.86**	**(1.08-7.59)**	1.79	(0.60-5.36)
Homosexual	**5.38**	**(2.13-13.60)**	2.46	(0.85-7.16)
Relationship status				
Single	**1.46**	**(1.04-2.04)**	1.27	(0.85-1.92)
In a relationship	1	(ref.)	1	(ref.)
PrEP knowledge				
0 statements	1	(ref.)	1	(ref.)
1 statement	**2.34**	**(1.28-4.28)**	**2.50**	**(1.22-5.12)**
2 statements	**3.39**	**(1.99-5.78)**	**3.11**	**(1.64-5.89)**
3 statements	**2.95**	**(1.77-4.93)**	**1.89**	**(1.01-3.55)**
4 statements	**3.97**	**(2.29-6.88)**	**2.52**	**(1.27-5.01)**
Self-perceived HIV risk				
No risk	1	(ref.)	1	(ref.)
Low risk	**3.20**	**(2.04-5.02)**	**4.10**	**(2.44-6.87)**
Moderate to high risk	**7.58**	**(3.78-15.18)**	**8.18**	**(3.78-17.71)**
Number of male rCLAI partners, grouped				
0 rCLAI male partner	1	(ref.)	1	(ref.)
1 rCLAI male partner	1.41	(0.92-2.16)	1.37	(0.82-2.27)
2-4 rCLAI male partners	**3.86**	**(2.32-6.43)**	**3.17**	**(1.76-5.72)**
≥5 rCLAI male partners	**4.32**	**(2.25-8.30)**	**4.72**	**(2.06-10.80)**
Combined high risk STI †				
Yes	1.53	(0.89-2.64)	0.71	(0.36-1.42)
No	1	(ref.)	1	(ref.)
Hard drug use ‡				
Yes	**2.81**	**(1.55-5.10)**	**2.13**	**(1.01-4.51)**
No	1	(ref.)	1	(ref.)
Poppers use				
Yes	**2.19**	**(1.51-3.19)**	1.19	(0.75-1.88)
No	1	(ref.)	1	(ref.)
Sex abroad				
Yes	**1.54**	**(1.10-2.15)**	1.07	(0.72-1.61)
No	1	(ref.)	1	(ref.)

Bold font indicate P-value < .05. * All variables included in multivariable model, and adjusted for venue where survey was taken. P-value for goodness-of-fit (Hosmer-Lemeshow): 0.74. † Rectal chlamydia, rectal gonorrhea or syphilis (past year), ‡ amphetamine, GHB/GBL, heroin, ketamine, cocaine, mephedrone, MDMA/ecstasy, methamphetamine/ice (during sex, past year)

Paper III

Paper III analyzed data from 663 MSM not living with HIV, predominantly consisting of the same sample as Paper II. Thus, the median age among the participants was also 32 years, and the demographic characteristics are similar to those described above. Overall interest to use HIVST was high in the sample, with 436 (65.8%) respondents expressing interest to use, regardless of whether it was for free or came with a fee. Among those interested, 205 (47%) were willing to pay for HIVST. This study first examined possible associations between interest to use HIVST and covariates concerning sociodemographic, risk characteristics for HIV, and Testing habits.

The multivariable logistic regression showed that being in the age group 55 years or above was independently negatively associated with interest in HIVST when compared to the youngest (18-24) age group. It also found that the odds of interest in using HIVST were lower among those reporting a syphilis, rectal chlamydia, or rectal gonorrhea in the preceding year. The results of the univariable and multivariable logistic regression analyses for interest to use HIVST can be seen in **Table 6**.

Further exploring the subsample of the 436 MSM who were interested in HIVST, showed that belonging to the age groups 35-44 years, 45-54 years or 55 years and above were posetively associated with willingness to pay for HIVST when comparing to the 18-24 years age group, and being single was negatively associated with willingness to pay, as shown in **Table 7**.

Table 6. Univariable and Multivariable logistic regression for interest to use HIVST among the study population. (N=663)

Characteristics	Univariable analysis Crude OR (CI 95%)		Multivariable analysis* Adjusted OR (CI 95%)	
Age group				
18-24	ref		ref	
25-34	0.86	(0.51-1.44)	0.76	(0.43-1.34)
35-44	1.02	(0.58-1.83)	1.00	(0.53-1.89)
45-54	0.55	(0.29-1.03)	0.57	(0.28-1.15)
= >55	**0.32**	**(0.16-0.66)**	**0.31**	**(0.14-0.71)**
University education				
No	ref		ref	
Yes	0.94	(0.68-1.32)	0.90	(0.61-1.33)
Born outside Sweden				
No	ref			
Yes	1.38	(0.98-1.94)		
New residents in Sweden, lived in Sweden up to 5 years				
No	ref		ref	
Yes	**1.57**	**(1.01-2.43)**	1.43	(0.86-2.37)
Non-heterosexual sexual orientation				
No	ref		ref	
Yes	1.20	(0.49-2.34)	0.91	(0.33-2.52)
Being single				
No	ref		ref	
Yes	1.14	(0.82-1.58)	1.03	(0.71-1.49)
Seven partners or more, 12 months				
No	ref		ref	
Yes	1.10	(0.79-1.52)	0.98	(0.66-1.45)
Receptive condomless anal intercourse, 12 months				
No	ref		ref	
Yes	1.03	(0.75-1.43)	1.26	(0.86-1.85)
Hard drug use during sex, 12 months [a]				
No	ref		ref	
Yes	1.20	(0.75-1.92)	1.12	(0.65-1.91)
Poppers use during sex, 12 months				
No	ref			
Yes	1.23	(0.88-1.74)		
Combined risk STI, 12 months [b]				
No	ref		ref	
Yes	0.78	(0.48-1.26)	**0.56**	**(0.32-0.99)**
Sex abroad, 12 months				
No	ref		ref	
Yes	**1.47**	**(1.06-2.04)**	1.37	(0.94-2.01)
Moderate to high self-assessed HIV risk				
No	ref		ref	
Yes	0.98	(0.62-1.54)	1.01	(0.61-1.68)
First-time tester				
No	ref			
Yes	1.60	(0.79-3.23)		
High frequency tester, twice a year or more				
No	ref		ref	
Yes	0.96	(0.70-1.33)	0.87	(0.59-1.28)
Used a self-sampling kit for chlamydia and/or gonorrhea, 12 months				
No	ref			
Yes	2.43	(0.99-5.98)		
Tested at NGO, 12 months				
No	ref			
Yes	1.17	(0.84-1.63)		

* For the multivariable analysis, all included variables in the analysis were mutually adjusted for each other and for venue. Bold font indicates statistical significance, CI 95%. a. Amphetamine, GHB/GBL, heroin, ketamine, cocaine, mephedrone, MDMA/ecstasy, methamphetamine/ice (during sex, 12 months). b. Rectal chlamydia, rectal gonorrhea or syphilis (12 months). P-value for goodness-of-fit of multivariable model (Hosmer-Lemeshow): 0.421

Table 7. Univariable and Multivariable logistic regression for willingness to pay for HIVST among those interested in using HIVST. (N=436)

Characteristics	Univariable analysis Crude OR (CI 95%)		Multivariable analysis* Adjusted OR (CI 95%)	
Age group				
18-24	ref		ref	
25-34	**1.96**	**(1.05-3.62)**	1.73	(0.89-3.36)
35-44	**2.96**	**(1.52-5.75)**	**2.94**	**(1.40-6.21)**
45-54	**3.75**	**(1.67-8.42)**	**2.82**	**(1.16-6.90)**
= >55	**4.69**	**(1.69-12.97)**	**3.90**	**(1.19-12.81)**
University education				
No	ref		ref	
Yes	1.39	(0.94-2.05)	1.06	(0.65-1.71)
Born outside Sweden				
No	ref			
Yes	1.06	(0.72-1.56)		
New residents in Sweden, lived in Sweden up to 5 years				
No	ref		ref	
Yes	1.35	(0.85-2.14)	1.31	(0.73-2.34)
Non-heterosexual sexual orientation				
No	ref		ref	
Yes	0.76	(0.25-2.30)	0.91	(0.26-3.19)
Being single				
No	ref		ref	
Yes	**0.45**	**(0.31-0.68)**	**0.56**	**(0.36-0.88)**
Seven partners or more, 12 months				
No	ref		ref	
Yes	0.73	(0.49-1.07)	0.90	(0.56-1.45)
Receptive condomless anal intercourse, 12 months				
No	ref		ref	
Yes	0.75	(0.51-1.09)	0.83	(0.52-1.34)
Hard drug use during sex, 12 months [a]				
No	ref		ref	
Yes	0.61	(0.36-1.06)	0.90	(0.48-1.70)
Poppers use during sex, 12 months				
No	ref			
Yes	0.97	(0.66-1.44)		
Combined risk STI, 12 months [b]				
No	ref		ref	
Yes	**0.33**	**(0.17-0.66)**	0.45	(0.20-1.02)
Sex abroad, 12 months				
No	ref		ref	
Yes	0.91	(0.61-1.35)	0.91	(0.56-1.47)
Moderate to high self-assessed HIV risk				
No	ref		ref	
Yes	0.91	(0.53-1.55)	0.98	(0.52-1.83)
First-time tester				
No	ref			
Yes	0.71	(0.35-1.48)		
High frequency tester, twice a year or more				
No	ref		ref	
Yes	**0.63**	**(0.43-0.92)**	0.71	(0.45-1.13)
Used a self-sampling kit for chlamydia and/or gonorrhea, 12 months				
No	ref			
Yes	0.76	(0.35-1.68)		
Tested at NGO, 12 months				
No	ref			
Yes	1.37	(0.94-2.02)		

* For the multivariable analysis, all included variables in the analysis were mutually adjusted for each other and for venue. Bold font indicates statistical significance, CI 95%. a. Amphetamine, GHB/GBL, heroin, ketamine, cocaine, mephedrone, MDMA/ecstasy, methamphetamine/ice (during sex, 12 months). b. Rectal chlamydia, rectal gonorrhea or syphilis (12 months). P-value for goodness-of-fit of multivariable model (Hosmer-Lemeshow): 0.657

Paper IV

Paper IV analyzes the full sample of 669 MSM not living with HIV. Based on the eight variables included in the latent class analysis, a five class LCA model was deemed as optimal based on the lowest BIC of the models (5730), an entropy of 0.8642, as well as the interpretability of classes.

Based on the item response probabilities for each class, as shown in **Table 8**, the five identified classes were given meaningful labels. Class 1 was labeled *Seldom community testers*, class 2 *Routine community testers*, class 3 *Seldom health care testers,* class 4 *Frequent health care testers,* and class 5 *Medically motivated testers.*

Table 8. Class and item response probabilities by class (N=669)

	Class 1	Class 2	Class 3	Class 4	Class 5
Class probability	0.14	0.19	0.23	0.38	0.05
Item					
Attending drop-in for testing	0.89	0.91	0.40	0.43	0.14
Attended community-based HIV/STI testing, 12 months	**1.00**	**1.00**	0.03	0.18	0.08
Attended public health care clinic HIV/STI testing, 12 months	0.23	0.47	**1.00**	**1.00**	**1.00**
Routine tester	0.14	**0.91**	0.41	0.89	0.00
Medical motivation of seeking HIV/STI testing	0.12	0.05	0.31	0.13	**1.00**
Event initiated HIV/STI testing	**0.83**	0.37	0.48	0.40	0.09
Frequent tester bacterial STI (twice a year or more)	0.03	0.25	0.04	**0.98**	0.92
Frequent tester HIV (twice a year or more)	0.05	0.66	0.03	**0.98**	0.95
Attending drop-in for testing	0.89	0.91	0.40	0.43	0.14

Class probability is the probability of a random person from the sampled population belonging to a class. Item response probability is the probability of a member of a certain class having a "yes" answer to a certain item.

In the multinomial regression models, class 1 was selected as the base outcome, the outcome which all other classes are compared to. The final models were adjusted for city, age, university education, and being born outside Sweden. The results from the final adjusted models are presented in detail as adjusted relative risk ratios (aRRR) with 95% confidence intervals in **Table 9**.

When comparing to class 1, members of class 2 were more likely to have had 7 partners or more and have an interest in taking PrEP. Members of class 3 were more likely to have used hard drugs during sex than members of class 1. When comparing class 4 to class 1, members were more likely to have had 7 partners or more, have had condomless anal intercourse, have had receptive condomless anal intercourse, have had sex abroad, have used hard drugs during sex, have reported an STI, have reported a risk STI, have a self-perceived STI risk as moderate to high, and have an interest in taking PrEP. Finally, members in class 5 were more likely to have had 7 partners or more, have had receptive condomless anal intercourse, have used hard drugs during sex, have reported an STI, have reported a risk STI, and have an self-perceive their STI risk as moderate to high, and have an interest in taking PrEP.

Table 9. Adjusted multinomial logistic regressions of latent classes with Class 1 as base outcome, presented as adjusted relative risk ratios with 95% confidence intervals (N=669)

	Class 2		Class 3		Class 4		Class 5	
	aRRR	(CI 95%)	aRRR	(CI 95%)	aRRR	(CI 95%)	aRRR	(CI 95%)
Item								
7 partners or more, 12 months	**3.03**	**(1.67 - 5.51)**	1.45	(0.80 - 2.62)	**5.65**	**(3.29 - 9.71)**	**5.65**	**(2.45 - 13.04)**
Condomless anal intercourse, 12 months	1.21	(0.67 - 2.17)	1.25	(0.70 - 2.24)	**2.02**	**(1.19 - 3.44)**	2.46	(0.91 - 6.64)
Condomless receptive anal intercourse, 12 months	1.38	(0.78 - 2.43)	1.45	(0.83 - 2.51)	**2.40**	**(1.46 - 3.96)**	**2.29**	**(1.00 - 5.25)**
Sex abroad, 12 months	1.56	(0.87 - 2.79)	0.69	(0.40 - 1.21)	**1.67**	**(1.01 - 2.77)**	1.70	(0.76 - 3.82)
Hard drug use during sex, 12 months	2.64	(0.82 - 8.46)	**5.35**	**(1.77 - 16.17)**	**4.11**	**(1.41 - 11.97)**	**7.17**	**(2.04 - 25.23)**
Self-reported STI*, 12 months	1.45	(0.54 - 3.86)	2.14	(0.85 - 5.37)	**7.69**	**(3.38 - 17.49)**	**12.96**	**(4.69 - 35.82)**
Self-reported risk STI**, 12 months	0.94	(0.28 - 3.22)	2.12	(0.72 - 6.27)	**4.44**	**(1.68 - 11.72)**	**6.38**	**(1.96 - 20.76)**
Moderate to high self-perceived HIV risk	1.30	(0.61 - 2.75)	0.73	(0.33 - 1.62)	1.14	(0.58 - 2.24)	2.27	(0.89 - 5.82)
Moderate to high self-perceived STI* risk	1.51	(0.80 - 2.83)	1.75	(0.96 - 3.21)	**4.10**	**(2.37 - 7.08)**	**6.60**	**(2.81 - 15.49)**
Interest in HIVST	1.05	(0.59 - 1.88)	0.97	(0.56 - 1.69)	0.89	(0.54 - 1.47)	1.62	(0.68 - 3.86)
Interest in taking PrEP	**1.81**	**(1.01 - 3.23)**	1.12	(0.65 - 1.92)	**2.00**	**(1.21 - 3.29)**	**3.29**	**(1.24 - 8.74)**

Bivariate associations adjusted for city, age, university education, and being born outside Sweden. **Bold font indicate p-value <0.05**
*Syphilis, chlamydia, or gonorrhea. *Syphilis, rectal gonorrhea, or rectal chlamydia.

Discussion

General discussion

The overall aim of this thesis was to get a better understanding of experiences and perceptions regarding factors relevant to primary and secondary prevention of HIV among MSM in Sweden. In the planning and development of the included studies, we adopted and further expanded the model of cyclical processes of primary and secondary HIV prevention, where testing and retention in the cycles present opportunities for individually adapted and needs based interventions.

This thesis identified challenges as well as opportunities for strengthened primary and secondary HIV prevention among MSM in Sweden. We found examples that show that testing practices among MSM can follow specific profiles which is highly relevant when assessing individual needs. Furthermore, we found that the perceived interest for both PrEP and HIVST was high. We also found that MSM living with HIV experienced challenges based on the inconsistencies in information they received.

Paper I is the only included paper focusing on factors concerning what we call the secondary HIV prevention cycle, situated in the lower right corner of the prevention model, but as it deals with knowledge transfer and information, the findings might contribute to also inform efforts also in primary HIV prevention. The paper highlighted that MSM living with HIV met challenges concerning communication and information from staff at their assigned infectious disease clinics. At the same time, the clinics and the staff contributed to create a safe and trusted environment. Nevertheless, challenges with getting conflicted information, for example regarding condom use obligation and infectiousness, caused frustration and left the participants to rely on their own ability to access information and make decisions based on their own judgement. We also found that not all participants had been given or were aware of the specific rules of conducts they were obliged to follow. While some did not recall being given the rules of conduct, some participants also described these early stages after being diagnosed as a time in crisis, which might contribute to how information was received. Therefore, even if the information might have been available, it was not accessible due to the condition of the recipient. It is well established that a HIV diagnosis can negatively affect mental health [109, 110]. In a country that, at the time of data collection, still persecuted individuals living with HIV for not following the rules of conduct, the findings suggest evident

risks for MSM living with HIV, both regarding well-being and safety. These findings further highlight the importance of continuous needs assessment and information in the secondary HIV prevention cycle, ensuring that mental health needs are met, and correct information and knowledge received over time, at needs-based intervals. This would contribute to strengthening the opportunities for health and well-being among MSM living with HIV.

Since the study was conducted, a number of positive developments have occurred in Sweden. As described in the introduction, the disease control sheets have been updated and a person who is having stable undetectable (<20 or <50 HIV-RNA copies/ml plasma) viral load, who is deemed to have high treatment adherence, and who has regular follow-up with the physician [38] no longer has a condom obligation or disclosure obligation to sexual partners [37]. The Public Health Agency of Sweden also updated their information about infectiousness and now clearly state that:

> There is no risk of transmission of HIV during vaginal or anal intercourse if the HIV positive person fulfils the criteria for effective treatment. This includes intercourse where a condom is not used. [111]

These are positive developments, addressing some of the issues described in Paper I. For this new way of communication infectiousness to have a positive effect for the individual it however requires sound routines and knowledge transfer between policy and clinical practice, and from clinical practitioners to individuals affected. It is important that health care personnel receive updated and correct information about HIV, also extending outside of HIV and STI care, as this might not be a topic regularly encountered. A recent survey of primary health care personnel in Sweden showed differences in both knowledge and attitudes regarding HIV, and the report emphasizes the importance of information campaigns aimed at health care personnel [112].

This information and knowledge transfer is, of course, not only relevant and important for reaching MSM living with HIV, but is also relevant for the primary prevention cycle. With the global U=U campaign working to raise awareness and minimize stigma against people living with HIV [113], it is also important that staff who meet people in contexts where HIV is discussed, such as the testing opportunity, take this opportunity to contribute to increasing the knowledge among MSM not living with HIV.

Paper II mainly concerns the services offered in the primary prevention cycle, more specifically PrEP eligibility following an individual needs assessment, and interest in taking PrEP among MSM. In accordance with a number of previous studies conducted in similar contexts [114-116] we found that a large proportion of the MSM responding to the survey were interested in using PrEP. Moreover, interest in using PrEP was associated with several factors such as knowledge about PrEP,

higher self-assessed risk for HIV, higher numbers of male partners for receptive condomless anal intercourse, and hard drug use during sex. These findings are not unique to our study and are in accordance with previous studies on other MSM populations outside of Sweden [117-120]. The finding that interest is associated with knowledge further highlights the importance of information dissemination and making sure that correct and updated information also about available preventive services reaches MSM. Informed decisions regarding individual preventive strategies are only possible when having access to correct and full information about the options.

Linking the finding that interest in taking PrEP correlates with behaviors that are likely to contribute to increased risk for HIV is highly relevant to the primary prevention cycle, as it indicates the importance of self-expressed interest and not only relying on clinical indications for PrEP assessment. This was further supported by the lack of independent association between interest in PrEP and self-reported rectal gonorrhea, rectal chlamydia or syphilis, which are indicators of increased risk for HIV and assessment for PrEP eligibility in Sweden [121]. Recently presented results from the PrEP Impact Trials (UK) further show the limitations of strict indications for HIV risk and PrEP, as one third of new HIV infections among non-PrEP users occurred among participants that did not have, what they call, markers of high risk [122]. Ensuring conversations on risk perceptions and PrEP interest following an HIV or bacterial STI test would benefit a large group of MSM, regardless of if they have these markers of high risk or clear clinical indictors of HIV risk.

The data collection for Paper II started before PrEP had been introduced widely in Sweden and during the fall of 2018, while data was collected, PrEP was becoming increasingly available. Demand has become larger than availability in many places, and queues to access and assessment for eligibility grew [123]. Over the last two years access can be assumed to have been further limited by Covid-19, which in other countries has been met with innovative approaches such as telemedicine [124]. New approaches to PrEP assessment and access might be considered also in a Swedish context, such as task-shifting of assessment and prescription of PrEP to nurses [125]. This has recently been initiated to some extent in Sweden, where nurses in some cases make the first assessment. A full task-shifting demand further training of nurses but would shorten the processing time and make it possible to initiate the process by taking the opportunity when MSM seek HIV-testing at clinics where tests are performed by nurses, as the need for further referral to a physician then might be eliminated.

In summary, the testing event is an opportunity for individually adapted HIV preventive measures, such as PrEP assessment. The preventive measures offered also vary depending on the type of HIV testing venue, and for community-based venues one important measure is referrals to STI testing services if this is not offered at the site. MSM might also benefit from individual assessments regarding needs

concerning psychosocial support, access to free condoms, counselling, and information. However, not all HIV tests offers this opportunity and there are challenges regarding lost opportunities for additional preventive measures when considering the availability of self-tests for HIV. This topic was studied in Paper III, situated in the upper left corner of the prevention model, concerning interest for HIVST among MSM.

Interest for HIVST was found to be high among MSM attending HIV testing venues. The only previous data available on this from a Swedish context was found in a report about HIV in Sweden published by the Public Health Agency of Sweden in 2017. Among the respondents from the general population 62 % answered that they would be interested in taking a HIVST if they needed an HIV test, and if those tests were reliable [126]. In Paper III, almost 66 % of the respondents answered that they would be interested in HIVST, regardless of whether it was free or came with a fee. The lack of clear associations between interest in using HIVST and many of the examined covariates indicates a broad interest across sub-groups of MSM. The negative association between reported rectal STI or syphilis and interest in HIVST, however might indicate a slightly lower interest among a group of MSM with higher relevance for HIV prevention, as these infections have been found to be associated with increased HIV risk [9, 11]. This might suggest that MSM with higher relevance for prevention prefer to seek comprehensive services. A similar pattern of few correlations was found when further exploring the sub-sample of MSM who were interested in HIVST. The fact that 47 % of those interested were willing to pay for their HIVST, however, indicates that introducing HIVST at cost would have a negative effect on uptake, initially indicating that socioeconomic status might influence uptake of services. Interpretations of the results of associations with higher odds of willingness to pay among older age groups further supports this, as income often increases with age. The finding that the odds of willingness to pay was lower among those being single is a bit harder to interpret but a plausible contributing factor could be socioeconomic position also here. The fact that no associations between willingness to pay and examined HIV risk characteristics could be established suggests that the cost-prohibitive effect would not specifically affect sub-groups of MSM based on HIV risk characteristics.

Today HIV self-tests are available through a number of online shops in Sweden, but the Public Health agency of Sweden does not recommend HIVST, arguing that the accessibility of HIV testing within the health care system and though community-based organizations is plentiful and free, and that there might be a need for additional bacterial STI testing among those tested. In a document from 2016 they state:

> The Public Health Agency of Sweden therefore recommend those who want to get tested for HIV to primarily turn to the public health care or community-based organizations offering testing. This enables adequate counselling and ensured quality of the tests. [127]

This puts the focus on the challenge of HIVST concerning the potential need for additional services, counselling, and referrals, as illustrated by a crossed line in the prevention model. At the same time, WHO has a so called "strong recommendation" that HIVST should be offered as a complement to other HIV testing services [128]. They further argue that HIVST can increase uptake, which has been supported by studies showing that HIVST reach under tested and never before tested individuals [88, 129, 130], and that HIVST can perform as accurately as tests performed by trained personnel [128].

In Sweden, there are today no specific policies or guidelines regarding HIVST, and this shows how the overarching policy landscape of HIV prevention can be related to the services available. A risk with the lack of policies or guidelines is that the barriers to additional services and referrals, as mentioned by the Public Health Agency of Sweden, cannot be properly dealt with. These linkages could be strengthened by different means, such as ensuring what information is provided together with the HIVST or offering HIVST with additional guidance and counseling from trained personnel via telemedicine or video link [124, 131, 132]. From the US, CDC recently published the results from the TakeMeHome initiative, a public-private partnership established in 2020 to distribute HIV self-test kits for free to MSM. Through the program they reached never-before tested MSM, consisting of 36 % of the recipients. A total of 76 232 HIVST kits were ordered though the initiative and the CDC concluded that HIVST has the potential to engage MSM who never have been tested and might increase HIV testing frequencies. Around 10% of the service users had sought other prevention services such as STI tests and PrEP services after receiving their HIVST [129]. This shows that there is room for improvement regarding referrals to additional preventive services. However, it is worth considering whether a lack of policies or guidelines, together with recommendations against HIVST, improve the situation when self-tests are already available through online shops. Possible strategies for introducing HIVST together with additional services needs to be further explored and studied. Nevertheless, the fact that HIVST has shown to improve uptake of HIV testing is a strong argument in line with the second goal of the Swedish *National strategy against HIV/AIDS* which is "To early identify and treat HIV infection".

Finally, in Paper IV, to gain a better understanding of the entry point of the model and the primary prevention cycle, we examined if there were identifiable sub-groups of MSM based on their testing behaviors and motivations.

We could identify five distinct sub-groups of MSM based on their HIV and STI testing behaviors and motivations. These five sub-groups differed regarding

where they got tested predominantly, how often they got tested, and their motivation for seeking testing. It is, however, important to note that belonging to a specific sub-group is not necessarily stable over time, and testing behaviors are likely to change over time, which has been observed in previous studies [133, 134]. Understanding the mechanisms behind decisions regarding HIV testing would open up for possibilities to encourage individuals to change their testing behaviors to better optimize them to their individual needs. As shown in Paper IV, MSM with higher probabilities of behaviors previously associated with HIV risk or seroconversion, such as STI:s [9, 11, 135], drug use [12, 135, 136], and higher numbers of male sexual partners [135, 136], were more prevalent among two sub-groups predominantly getting tested within the public health care system. This finding suggests that MSM with increased risk of HIV more commonly seek the comprehensive sexual health services available at clinics within the public health care system in Sweden. Another relevant finding was that the sub-groups predominantly testing at the community-based venues had lower probabilities of being frequent testers for bacterial STI. Part of this might be explained by the services offered at the venue, and this further emphasizes the importance of a well-functioning referral system for additional services that are not being offered at the venue when individual needs assessments are done in the primary HIV prevention cycle of the model, as mentioned previously. Another strategy that might be worth exploring would be expanding the services to include full STI testing services also at all community-based venues, which has been suggested as a feasible strategy [137].

In this discussion I have chosen to focus mainly on practical implications of the findings by linking the four papers to the prevention model and previous research. This can be further developed also for policy and monitoring, by revisiting the source of the cyclical model. In their article Horn and colleagues discuss how their model can establish a framework for monitoring progress by setting up indicators for each step of the model [78]. This would also be possible in a Swedish context and could offer a systematic approach for monitoring progress in, and challenges related to, prevention over time. By doing so, resources would be invested in areas based on needs that have emerged. Repeated and comparable studies of the target populations, such as the national MSM survey, would be one feasible way to contribute to the necessary data, by for example measuring the proportion of MSM who have taken an HIV test in the preceding 12 months, or the proportion of MSM who chose to take HIV tests at community-based venues, within the health care system, or through HIV self-testing. Further, it would be feasible to develop indicators for individual assessments, referrals to STI testing, PrEP assessments, and frequency of testing. For the secondary prevention cycle, some central indicators are already being montored and could be included in the monitoring system, such as proportion of PLHIV that have achieved viral suppression. This could be further expanded and, for example, one could measure quality of life among PLHIV over time. This would be a holistic systematic approach to monitor,

ensure and develop effective primary and secondary HIV prevention for MSM in Sweden, by linking together information from several sources of data.

Methodological considerations

In this thesis both qualitative and quantitative methodology have been utilized to achieve the overall aim. By combining qualitative method in Paper I with quantitative methods in Papers II and III, and LCA in Paper IV, a quantitative method that might be regarded as having qualitative elements, this thesis explored different aspects relevant to primary and secondary HIV prevention for MSM. By the application of different methods in this thesis, a wider understanding of methods has been achieved, although the width might limit the in-depth knowledge.

For Paper I, the use of qualitative content analysis enabled a deeper understanding of how communication with clinical staff at HIV clinics regarding the rules of conduct and infectiousness was experienced and perceived by MSM living with HIV in Sweden, and several measures were taken to enhance the trustworthiness of the findings [138, 139].

To enhance credibility, quotes were used to anchor the results in the expressed words of the participants when presenting results. The results and the discussion have also been reviewed by representatives of the study population through several member checks throughout the analysis. The sampling of a heterogeneous group of MSM living with HIV and the use of videocalls to ensure wider geographic distribution [140, 141] ensured that almost as many HIV clinics as participants were represented in the study. This, in combination with providing a thorough contextual description of HIV policy in Sweden, was done to increase the transferability of the study. To strengthen confirmability of the study, the researchers' presuppositions about the studied topic were bracketed [142], contributing to an objective approach to the specific topic explored throughout the research process. Throughout the process of analysis, the research team members have discussed the codes, categories, and the theme. When discrepancies in interpretations of the material emerged, the analysis was revisited and discussed. In an attempt to enhance the dependability of the study we have provided a thorough description of the methodology and presented examples of the analytical process. The limited scope of the study aim and a defined study population contributed to reaching sufficient information power and saturation at ten interviews [95, 143]. We can, however, not exclude the possibility that additional participants would not have provided additional perspectives.

For Papers II to IV, which were all based on the same quantitative data set, some limitations need to be considered. The first aspect needing to be considered concerns external validity and the study sample. Participants were recruited at HIV and STI

testing venues in the three largest cities in Sweden, during the fall 2018. Due to the sampling method, we can expect some under- and over-representation of sub-groups of MSM. As an example, it is not unlikely that younger MSM are underrepresented due to the services offered by youth clinics. Youth clinics are specific clinics for youth up to their early 20's in Sweden, with a special focus on sexual and reproductive health [144]. It is also important to note that due to the sampling strategy, MSM who are more frequent testers have been more likely to be invited to participate, as they can be expected to frequent the venues more often. This might result in certain overreporting of frequencies of, for example, behaviors associated with increased HIV risk. The sample thus consists of MSM predominantly living in urban areas, who go and get tested for HIV and/or bacterial STIs at clinics with specific MSM competence. The survey was conducted in the three largest cities in Sweden, where 1.9 million people reside, which is close to 20% of the population in Sweden [29]. While 50% of all men live in the larger city regions we can expect a higher proportion of adult MSM due to urbanization and in MSM2013 65% of respondents resided in the major city regions [100]. This is important to keep in mind, and even if the sample is likely to represent a large proportion of MSM in Sweden with high relevance from a HIV preventive perspective, it should not be interpreted as representative for all MSM in Sweden as MSM getting tested in rural areas have not been sampled.

Regarding internal validity we should also consider the cross-sectional nature of the data, with limitations regarding inferring causation. In addition, different forms of biases in the responses might be present. While the survey had a comparatively high response rate, available data did not make it possible to conduct an analysis of non-responders. Limiting measurement errors was addressed in a number of ways, such as by piloting the questionnaire carefully, providing clear definitions of included concepts, such as PrEP and HIVST, and carefully considering how questions were asked. For example, those questions with binary measures such as having had condomless receptive anal intercourse would be less likely to be affected by measurement error due to recall bias than measures of exact numbers of sexual partners. It is also important to remember that all answers were self-reported, and recall bias is likely present to some extent even if the questionnaire was designed to limit the effects of this by focusing on the preceding 12 months. While a shorter period might have further minimized the measurement error [145], the selected time period offered some comparability to previous surveys of Swedish MSM, even if comparisons should be made with caution. Finally social desirability biases [99] cannot be excluded, but efforts were taken to limit these, as described in the methods section. We still have to take possible effects of social desirability biases into consideration, as under-reporting of for example use of certain drugs has been highlighted and attributed to the stigma of certain drug use among groups of MSM [146]. All in all, this needs to be considered when interpreting the results in the papers based on the self-administered questionnaire.

The scope of the survey itself also needs to be considered. Included items were carefully considered, both in relation to earlier literature and the feasibility of data collection at the venues. We can therefore not exclude that additional confounding factors, not included in the data, could have effects on the examined associations presented in the papers.

Considering these limitations, this thesis still contributes with new knowledge and understanding of value for future developments regarding further research and preventive measures for MSM in Sweden, and might be relevant also to other similar contexts.

Finally, it is worth mentioning why venue-based sampling was selected as the method for data collection. Previous larger MSM surveys in Sweden have been collected through online platforms such as a large online queer community (MSM2013 [100]) or through multiple web-based channels (EMIS [103, 147]), and one study has explored web-based respondent driven sampling as a method [148]. While MSM2013 invited a stratified random sample of online community members, EMIS was a self-selected web survey [100, 103]. A challenge with studying populations such as MSM is the lack of a gold standard for sampling, and different sampling strategies are likely to capture different compositions of MSM samples. At the same time, population-based studies might not capture sufficiently large samples for intended analysis. As an example, in the latest SRHR survey from the Public Health Agency of Sweden, 1.4% self-identified as homosexual and 3.1% as bisexual in a sample of 14 303 individuals from the general population [149]. We wanted to complement these studies by utilizing venue-based sampling, allowing us to target MSM with high relevance for HIV preventive measures, which has recently been done for at least one other recent study of MSM in Sweden [80]. Given the results of data collection and the response rate, this method was found to be useful and feasible for future studies. One potential to further explore would be to also include journal data such as history of STI diagnoses from the clinics, instead of relying on only self-reported data, and link it to survey data and evaluate if this would affect participation. This would however not be possible for the community-based venues, as availability of such data would be limited to the results of the tests taken at that occasion.

Implications for future research

This thesis has highlighted both challenges to and opportunities for primary and secondary HIV prevention for MSM in Sweden. As described, a number of central factors have changed since or during the time when the studies were conducted. One such factor is the changes in policy regarding how infectiousness is communicated, and what rules of conduct that should be given to PLHIV. The extent to which these

changes have reached the individuals affected would be dependent on successful information dissemination. Given the findings of Paper I, it would be valuable to further study this, and the effects of the changes on the quality of life of MSM and other people living with HIV.

Papers II and III were studies concerning new tools for prevention in Sweden, PrEP and HIVST. As established in this thesis and the papers, interest for both were high in the sample, but more knowledge is needed regarding for example the PrEP care continuum in Sweden now that it has been introduced. Regarding HIVST it would be beneficial to further study means of strengthening access to additional services and care, to better understand how HIVST can be an integrated part of Swedish HIV prevention and examine which MSM would benefit from HIVST. Is self-testing, for example, more suitable for individuals with lower sexual risk, as it might negatively affect STI testing uptake?

These are some of the relevant topics for further study, but the overall implication of this thesis would be the importance of continuously following and studying developments over time. With an everchanging landscape of HIV prevention, with new tools being developed and introduced, and epidemiological changes such as increasing incidence of bacterial STIs, these long-term perspectives are important. Repeated studies that are comparable over time, such as the MSM-survey by the Public Health Agency of Sweden can play a crucial role in this. It would also be relevant to explore additional approaches such as establishing a larger Swedish MSM cohort which includes both MSM living with HIV and MSM not living with HIV.

In recent years, an evidence-informed tool kit, SEXIT, has been implemented at some youth clinics in Sweden. The tool kit consists of a standardized questionnaire and staff training for assessing youth sexual risk and facilitating conversation [150]. By developing and validating a similar tool for MSM in a Swedish context it would both be possible to strengthen the assessment for individual services, as well as to follow developments over time such as changes in preventive strategies adopted by MSM. While there are a number of risk assessment tools for MSM available, such as the HIV Incidence Risk Index for MSM (HIRI-MSM) [151] which has been used to assess PrEP eligibility [152], these tools might no longer be valid [153] and contextual factors might need to be considered in developing such a tool. The difference is also that for these tools a risk or prediction score is the focus, while SEXIT aims at assessing youth for risk, and facilitating conversations [154]. A similar approach at MSM-specific clinics in Sweden might be feasible and worth further study.

Conclusions

The infectious disease clinics were perceived as trusted spaces by MSM living with HIV, but inconsistencies in the information communicated to them were perceived as challenging concerning how to relate to the information and the rules of conduct. This stresses the importance of good information and knowledge transfer from policy level down to the individual affected.

The interest in taking PrEP was high among MSM attending HIV testing venues and associated with factors with known correlation to HIV risk and knowledge about PrEP. This again highlighted the importance of ensuring that continued and updated information about HIV and preventive strategies is available and accessible for MSM. Interest to use HIV self-testing was high among MSM attending HIV testing venues, but introducing HIVST with a cost for the user would likely negatively affect uptake among a broad group of MSM, regardless of HIV risk characteristics. These findings indicate a high interest among MSM for new technologies and tools in HIV prevention, but challenges regarding access to individual needs assessments and services need to be further studied to ensure also HIVST as an entrance point to the HIV prevention cycles.

It was possible to identify sub-groups of MSM based on their testing behaviors for bacterial STI and HIV. Groups that frequent HIV and STI testing at public health care clinics had higher probability of identified HIV risk characteristics, and MSM attending predominantly community-based venues might benefit from more frequent testing for bacterial STI.

Linking these findings to an integrated model of primary and secondary HIV prevention offers a possibility to have an integrated knowledge-based approach to HIV prevention for MSM in Sweden, with the additional opportunity to follow changes over time if suitable indicators are established and monitored.

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Appendix I

This questionnaire is anonymous and no answers will be able to be traced to you as an individual. The staff at this clinic will not be able to access or read your answers. If you do not want to, or cannot, answer a specific question then leave that question unmarked.

Did you book an appointment for testing or are you here during drop-in hours?

Drop-in means that you have not booked an appointment but have come to an open clinic to wait in line for your turn.

☐ I have a booked appointment ☐ I am here during drop-in

This questionnaire is distributed from august 2018 at some clinics in Sweden where you can get tested for HIV and other sexually transmitted infections (STI). Have you already answered this questionnaire before, when visiting a clinic to get tested?

☐ Yes, I have answered this questionnaire before ☐ No → *Go to Question 1*

→ **a) At which clinic did you answer the questionnaire?**

☐ Venhälsan at Södersjukhuset in Stockholm
☐ Gayhälsan/Könsmottagningen at Sahlgrenska in Göteborg
☐ Centrum för sexuell hälsa in Malmö
☐ Testpoint in Stockholm
☐ Checkpoint in Göteborg
☐ Checkpoint Skåne in Malmö
☐ Other clinic

Background

1. What sex where you assigned at birth?

All children are assigned a sex at birth, as either man (boy) or woman (girl). Mark the sex you were assigned.

☐ Man ☐ Woman

2. What is your gender identity today?

☐ Man ☐ Woman ☐ Neither man nor woman

This questionnaire is for men. If you <u>do not</u> identify as a man you are welcome to read the questionnaire, but your answers will not be used in the study.

3. How old are you?

☐ years

If you are **under 18 years** then you are too young to participate in this study. You are welcome to read the questionnaire, but your answers will not be used in the study.

4. Where do you currently live?

☐ Stockholm-area ☐ Gothenburg-area ☐ Malmö-area
☐ Other city, village or countryside in Sweden ☐ Abroad

5. Were you born in Sweden?

☐ Yes → *Go to Question 6.* ☐ No **a) Which is your country of birth?**

b) How many years have you lived in Sweden? ☐ years

6. What is the highest education you have completed?

☐ Elementary school, primary school or similar ☐ 2-4 years of high school or upper secondary, or similar ☐ Vocational training or community college ☐ University

7. Are you currently single?

☐ Yes, I am single
☐ No, I am in a relationship with a woman
☐ No, I am in a relationship with a man
☐ No, I am in a relationship with a non-binary person who identify neither as man nor woman
☐ No, I have a relationship that does not fit the other options

8. Which of the following options best describes how you view yourself?

☐ Heterosexual or straight ☐ Bisexual or pansexual ☐ Homosexual or gay

Testing for HIV and STIs

9. Why do you want to get tested today?

More than one answer can be given

☐ Routine test, I get tested on a regular basis.
☐ I have been contact traced and have been asked to go and get tested
☐ I have symptoms or signs that might be a sexually transmitted infection
☐ I have entered a new relationship
☐ I have had unprotected sex with a new or unknown partner
☐ I have had sex abroad
☐ Other reason

Sexually transmitted infections (STIs)

We will now ask you about **Chlamydia, Gonorrhea** and **Syphilis.** Chlamydia and Gonorrhea are tested by urine sample and/or throat, vaginal or rectal swabs. Syphilis is tested by a blood sample.

When you answer these questions, do not include tests you plan to take or have already taken today.

10. How often do you get tested for Chlamydia and/or Gonorrhea?

☐ I have never been tested for Chlamydia or Gonorrhea. ☐ Less often than once a year
☐ Once a year ☐ Two to three times a year ☐ Four times a year or more

11. Have you been tested for Chlamydia, Gonorrhea or Syphilis during the previous 12 months?
Do not include tests you will do, or already have done today.

	Yes	No	Unsure/Do not know
Chlamydia	☐	☐	☐
Gonorrhea	☐	☐	☐
Syphilis	☐	☐	☐

*If you have answered **No** for all → Go to Question 13*

a) Where Have you been tested for Chlamydia, Gonorrhea and/or Syphilis during the previous 12 months?
Do not include todays visit. More than one answer can be given

- ☐ Centrum för sexuell hälsa in Malmö
- ☐ Könsmottagningen or Gayhälsan at Sahlgrenska in Gothenburg
- ☐ Venhälsan in Stockholm
- ☐ Other STI-clinic in Sweden (NOT community/NGO – run)
- ☐ Primary health care centre
- ☐ Youth clinic
- ☐ Other clinic in Sweden
- ☐ Other clinic abroad
- ☐ Free home-testing kit for Chlamydia/Gonorrhea by post from the health care services e.g. klamydia.se or 1177
- ☐ Self-test for Chlamydia/Gonorrhea bought at pharmacy or online in Sweden
- ☐ Test for syphilis at Testpoint in Stockholm
- ☐ Test for syphilis at Checkpoint in Gothenburg
- ☐ Test for syphilis at Checkpoint Skåne in Malmö

12. Have you been diagnosed with any of the following STIs during the previous 12 months?

More than one answer can be given

- ☐ Yes, Chlamydia *(Specify where you had the infection in question 12a)*
- ☐ Yes, Gonorrhea *(Specify where you had the infection in question 12a)*
- ☐ Yes, Syphilis
- ☐ Yes, I have had an STI during the last 12 months, but I am not sure which one
- ☐ No, I have not had any of these STIs during the last 12 months

12a) If you have had Chlamydia or Gonorrhea during the previous 12 months, where did you have the infection?
One can have these infections in the throat (oral), in the bottom/anus (rectal) and in the genitals. More than one answer can be given

	Oral (throat)	Genital	Rectal (bottom/anus)	Unsure/do not know
Chlamydia	☐	☐	☐	☐
Gonorrhea	☐	☐	☐	☐

13. What do you believe is your current risk of getting the following STIs?

	No risk	Low risk	Moderate risk	Large risk
Chlamydia	☐	☐	☐	☐
Gonorrhea	☐	☐	☐	☐
Syphilis	☐	☐	☐	☐

HIV

HIV is commonly tested by a blood sample sent to a lab where you receive your results in a couple of days. Rapid HIV tests give instant results. In these tests a drop of blood from the finger, or some saliva, is taken and put on a stick that will show your result within 1 to 20 minutes.

When you answer these questions, do not include tests you plan to take or have already taken today.

14. Have you been diagnosed with HIV?

☐ No ☐ Yes, I live with HIV → *Go to Question 20*

15. How often do you get tested for HIV?

☐ I have never been tested for HIV → *Go to Question 17* ☐ Less often than once a year
☐ Once a year ☐ Two to three times a year ☐ Four times a year or more

16. Have you been tested for HIV during the previous 12 months?

☐ Yes ☐ No → *Go to Question 17*

a) Where have you been tested for HIV during the previous 12 months?

Do not include today's visit. More than one answer can be given

☐ Centrum för sexuell hälsa in Malmö
☐ Könsmottagningen or Gayhälsan at Sahlgrenska in Gothenburg
☐ Venhälsan in Stockholm
☐ Other STI-clinic in Sweden (NOT community/NGO – run)
☐ Primary health care clinic
☐ Youth clinic
☐ Testpoint in Stockholm
☐ Checkpoint in Gothenburg
☐ Checkpoint Skåne in Malmö
☐ HIV-testing at Noaks Ark
☐ Other clinic in Sweden
☐ Other clinic abroad
☐ Self-test or home-test for HIV (test I have taken myself)

17. What do you believe your current risk of getting HIV is?

	No risk	Low risk	Moderate risk	Large risk
HIV	☐	☐	☐	☐

Self-tests for HIV

A self-test is an HIV test that you buy or get to take home. Sometimes they are called Home-tests. These tests use a drop of blood or saliva and show the test result within 1 to 20 minutes. The same kind of tests, rapid HIV tests, are sometimes used at clinics. The difference is that with a home-test you take the sample yourself and read the results yourself, without any clinic staff present.

18. Have you ever used a Self-test for HIV, sometimes called a home-test?

☐ Yes ☐ No → *Go to Question 19*

→ **b) If you have used a self-test for HIV, where did you get the test?**

☐ Bought online ☐ Bought abroad ☐ From a friend

☐ Other way → *Please describe in the text box below:*

Text box.

19. Do you believe you will use a self-test for HIV in the future?

☐ Yes, but only if it is free ☐ Yes, and I would be willing to pay for it ☐ No

Sexual practice

We will now ask questions about how you have had sex. Here, **oral sex** means mouth against genitals, **Vaginal intercourse** means penis in vagina, and **anal intercourse** means penis in rectum. There are other ways to have sex, but these are the three practices we focus on in this study.

20. Have you had sex abroad during the previous 12 months?

☐ Yes ☐ No

21. Have you, during the previous 12 months, had oral sex, vaginal or anal intercourse with any woman?

☐ Yes ☐ No → *Go to Question 23*

22. Have you done any of the following with any woman, during the previous 12 months?

	No	Yes	
Vaginal or anal intercourse **with a condom**	☐	☐	
Vaginal or anal intercourse **without a condom**	☐	☐ →	If **Yes,** with how many women have you had intercourse **without a condom** during the previous 12 months: ☐

Estimate if you are not certain

23. Have you, during the previous 12 months, had oral sex, vaginal or anal intercourse with any non-binary person, who does not identify as a man or a woman?

☐ Yes ☐ No → *Go to Question 25*

24. Have you done any of the following with a non-binary person, during the previous 12 months?

	No	Yes	
Vaginal or anal intercourse **with a condom**	☐	☐	
Vaginal or anal intercourse **without a condom**	☐	☐ →	If **Yes,** with how many non-binary persons have you had intercourse **without a condom** during the previous 12 months: ☐ *Estimate if you are not certain*

25. Have you ever had oral sex or anal intercourse with any man?

☐ Yes ☐ No → *Go to Question 31*

26. Have you, during the previous 12 months, had oral sex or anal intercourse with any man?

☐ Yes ☐ No → *Go to Question 28*

→ **b) With how many men have you had oral sex or anal intercourse during the previous 12 months?** *Estimate the number if you are not certain*

☐ men

27. Have you done any of the following with a man, during the previous 12 months?

	No	Yes	
Being bottom / Receiving anal intercourse **with a condom**	☐	☐	
Being top / Insertive anal intercourse **with a condom**	☐	☐	
Being bottom / Receiving anal intercourse **without a condom**	☐	☐	If **Yes**, answer 27.a)
Being top / Insertive anal intercourse **without a condom**	☐	☐	If **Yes**, answer 27.b)

27.a) With how many men have you been bottom (recieveing) without a condom, during the previous 12 months? *Estimate if you are not certain*

☐ men.

27.b) With how many men have you been top (insertive) without a condom, during the previous 12 months? *Estimate if you are not certain*

☐ men.

Pre-Exposure Prophylaxis against HIV (PrEP)

28. The following statements are TRUE. Did you know this already?

	Yes, I knew this already	No, I did **not** know this already
Pre-Exposure Prophylaxis (PrEP) involves someone who does not have HIV taking pills before as well as after sex to prevent them getting HIV.	☐	☐
PrEP can be taken as a single daily pill if someone does not know in advance when they will have sex.	☐	☐
PrEP taken as a daily pill is approved in Sweden and can be prescribed by physicians to people with increased risk of HIV.	☐	☐
If someone knows in advance when they will have sex, PrEP needs to be taken as a double dose approximately 24 hours before sex and then at both 24 and 48 hours after the double dose.	☐	☐

29. Have you ever taken PrEP as a preventive measure against HIV?

☐ Yes ☐ No → *Go to Question 30*

a) Are you currently taking PrEP?

☐ Yes, I take PrEP daily

☐ Yes, I take event-based PrEP, around the time of sex

☐ No, I have previously taken PrEP but am not currently taking it

b) How did you get PrEP?

More than one answer can be given

☐ On prescription from a physician in Sweden

☐ On prescription from a physician abroad

☐ From a friend/person who uses PrEP

☐ From a friend/person living with HIV

☐ Bought online without prescription

☐ Bought abroad without prescription

☐ Other way

30. Are you interested in taking PrEP as a preventive measure against HIV?

- ☐ Yes, to take PrEP daily
- ☐ Yes, to take PrEP event-based, around the time of sex
- ☐ No, I am not interested in taking PrEP / PrEP is not relevant for me

Drugs or intoxicants during sex

31. Have you, during the previous 12 months, used any drugs or other ways of intoxication during sex?

More than one answer can be given.

- ☐ **No,** I have not used any drugs or ways of intoxication during sex during the last 12 months.

- ☐ Alcohol
- ☐ Amphetamine
- ☐ Cannabis
- ☐ GBL or GHB
- ☐ Heroine
- ☐ Ketamine
- ☐ Cocaine
- ☐ Mephedrone
- ☐ MDMA / Ecstasy
- ☐ Methamphetamine / Ice
- ☐ Poppers
- ☐ Other, *please specify:*

Trust

The final two questions are about trust. It has been shown that trust affects health. We would like to understand if trust affects how we get tested for HIV and other STIs.

32. To what extent do you agree with the following statement?

	Fully agree	Agree	Disagree	Strongly disagree
Most people can be trusted.	☐	☐	☐	☐

33. How much trust do you have in the following societal institutions?

	Large	Moderate	Low	None
Health care	☐	☐	☐	☐
Social services	☐	☐	☐	☐
School	☐	☐	☐	☐
Police	☐	☐	☐	☐
Courts	☐	☐	☐	☐
Politicians	☐	☐	☐	☐
Mass media, TV, Newspapers	☐	☐	☐	☐
Non-governmental organizations, NGOs *(e.g. sports clubs and member organizations)*	☐	☐	☐	☐

Thank you for your participation!