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Factors Associated with Never Testing for HIV: Directions for Targeted Testing Interventions Among Men Who Have Sex with Men

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Abstract

Men who have sex with men (MSM) and who are unaware of their HIV infection contribute to onward HIV transmission and are more likely to progress to severe illness. We therefore assessed determinants of never testing for HIV among MSM living in the Netherlands. Between April and July 2019, 950 HIV-negative and 122 never-tested MSM completed a cross-sectional survey on sociodemographics, HIV testing behavior, and sexual risk taking, which was distributed through gay networking sites/apps. In never-tested MSM, median age was 37 (interquartile range = 22–51) years and 37 (30%) reported recent sexual risk behavior. Never testing was associated with younger age [adjusted odds ratio (aOR) per year increase = 0.98, 95% confidence interval (CI) = 0.97–1.00, $p = 0.015$], having sex with men and women (aOR = 2.85, 95% CI = 1.57–5.62, $p = 0.001$), and not knowing others living with HIV (aOR = 3.85, 95% CI = 2.35–6.32, $p < 0.001$) in multi-variable logistic regression analysis. A significant interaction effect between education level and residential area was observed ($p = 0.001$). Among higher-educated MSM, those living outside a large urban area had higher odds of never testing compared to those living in an urban area (aOR = 6.26, 95% CI = 2.42–16.24, $p < 0.001$). Lower-educated MSM had higher odds of never testing irrespective of residential area (large urban area: aOR = 12.06, 95% CI = 4.00–36.38; outside large urban area: aOR 9.29, 95% CI = 3.64–23.76; $p < 0.001$ for both). Among MSM recently exposed to sexual risk, never testing was associated with having sex with men and women (aOR = 2.80, 95% CI = 1.09–7.18, $p = 0.032$) and not knowing others with HIV (aOR = 4.91, 95% CI = 1.97–12.24, $p = 0.001$). To conclude, testing interventions for those never tested should be tailored to residential area and education level, and inclusive of bisexuality.

Keywords: HIV, sexual risk behavior, men who have sex with men, Amsterdam, the Netherlands

Introduction

In most high-income countries, HIV disproportionately affects men who have sex with men (MSM).[1] Several HIV prevention strategies have been implemented in this group since the beginning of the AIDS epidemic. Studies have shown that once HIV-positive individuals on treatment have a sustained undetectable HIV viral load (HIV VL), the risk of transmitting HIV to others is negligible (''Undetectable = Untransmittable'').[2–4] This strategy has been termed treatment as prevention,[5] but it necessitates awareness of HIV status in order for treatment to be initiated. Increased testing and treating have also shown individual benefits, in that, early HIV diagnosis and treatment initiation have been associated with more favorable clinical outcomes.[6,7]

In the Netherlands, current guidelines recommend testing sexually active MSM for HIV every 3–6 months.[8] Nevertheless, recent estimates have shown that around 7% of MSM living with HIV in 2018 are undiagnosed.[9] Among MSM diagnosed with HIV in 2016 or later, 40% had advanced HIV

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infection at the time of diagnosis.[9] National and international studies have identified several individual and contextual factors that result in delayed HIV testing for some MSM and include lack of risk perception, fear of a positive test result, stigma, difficulties in discussing sexual behavior, (perceived) limited access to HIV testing, and lack of provider-initiated testing.[10–13] Given the number of undiagnosed individuals and those diagnosed at advanced stages of HIV infection, testing measures are needed that specifically address the previously described barriers for HIV testing. Up-to-date knowledge of the specific subgroups of never-tested MSM who should be targeted for such measures is, however, lacking. In this study, we explore the characteristics and determinants of MSM living in the Netherlands, who have never been tested for HIV during their lifetime. Specifically, mobilizing this group of never-tested MSM to test for HIV has the potential to increase early detection of HIV infections, which might reduce onward HIV transmission among MSM in the Netherlands.

Methods

Study design and population

Data were used from a nationwide, cross-sectional, web-based study among MSM living in the Netherlands.[14] The primary aim of the study was to investigate perceptions on the severity and (anticipated) consequences of living with HIV among HIV-positive and HIV-negative MSM using an online survey. Men who reported sex with other men and who were living in the Netherlands were eligible for study participation. The survey was distributed online through social media (e.g., Instagram, Facebook) and at gay dating sites/apps (e.g., Grindr, Planet Romeo) between April and July 2019.

Study variables

The content of the survey has been published previously.[14] For this study, we included variables on sociodemographics, HIV testing behavior, recent sexual behavior, use of HIV pre-exposure prophylaxis (PrEP), and the general perceived severity of HIV. Sociodemographic characteristics included age, gender (male/female/other), residency in one of the four cities in the Netherlands with the most MSM inhabitants (i.e., Amsterdam, Rotterdam, The Hague and Utrecht)[15] (based on the first two numbers of the participant's zipcode), education status (no college degree/at least college degree), country of birth, gender of sex partner(s) (male/female/other), having a steady partner (yes/no), presence of any chronic disease other than HIV (yes/no), and having HIV-positive friends or family (yes/no). Participants were additionally asked if they had ever been tested for HIV during their lifetime (yes/no). If tested for HIV, we asked for the most recent HIV test result (positive/negative). Sexual behavior was assessed for the preceding 6 months and included questions on condomless anal sex (CAS) and HIV status of sex partners. If sex with an HIV-positive partner was reported, we asked about the HIV VL of the sex partner (detectable/undetectable). PrEP use was explored by asking about current or past use of PrEP. We used two definitions to classify sexual risk behavior (*definition A* and *definition B*). In both definitions, having engaged in CAS with a casual partner who was HIV positive with a detectable HIV VL or of unknown HIV status was considered risky. In *definition A*, CAS with a casual partner with a self-reported HIV-negative status was considered risky, since the confirmed validity of a self-reported HIV-negative status of a casual, often anonymous, partner is limited. In *definition B*, the face value of the self-reported HIV-negative status was accepted, and this sexual act was not considered risky. In both definitions, sexual behavior was not considered risky with respect to HIV if current PrEP use was reported or if CAS was reported with an HIV-positive partner with an undetectable HIV VL. Casual sex partners included both anonymous (one-night stands) and known, regular sex partners (fuck buddies). The general perceived severity of HIV infection was assessed by a 7-point Likert item, based on Chard et al.[16]: ''How serious would it be for you if you contracted HIV?,'' which could be answered from not serious at all (1) to very serious (7).

Statistical analyses

For this analysis, we included MSM who reported to be HIV negative at their last HIV test and MSM who had never been tested for HIV. HIV-positive MSM were not included in this analysis as there is no rationale for them to test for HIV at the time of the study. Sociodemographic characteristics and sexual risk behavior were compared between tested HIV-negative MSM and MSM who were never tested for HIV using Pearson's χ^2 test or Fisher's exact test for categorical data and Mann–Whitney U test for continuous data. Unadjusted odds ratios (OR) comparing odds of never having been tested for HIV across levels of determinants, alongside their 95% confidence intervals (95% CI), were estimated using univariable logistic regression. We tested interaction terms of residential area with age, education status, and knowing others with HIV. We then constructed a multivariable model, in which variables associated with a p-value <0.2 in univariable analysis were included. All nonsignificant variables were subsequently removed from the model in a backward-stepwise manner. A sensitivity analysis was performed and included only MSM with recent sexual risk behavior, as MSM without recent HIV risk might have had no reason to test for HIV at the time of the study. We estimated stratum-specific unadjusted and adjusted ORs (aORs) and corresponding 95% CIs directly from the interaction models and calculated p-values using the Wald χ^2 test.

STATA v15.0 was used for all analyses. A p-value <0.05 was defined as statistically significant.

Ethical considerations

The study was reviewed and approved by the Amsterdam University Medical Center ethics board and received an exemption for extended protocol review. Study participation was voluntary and anonymous.

Results

We included 1072 MSM, of whom 950 (89%) were HIV negative and 122 (11%) had never been tested for HIV. Median age of HIV-negative MSM was 43 years (interquartile range, IQR 30–55), which was significantly higher compared with never-tested MSM [median 37 years (IQR 22–51); $p < 0.001$; Table 1]. The majority of participants was born in the Netherlands (HIV-negative MSM: $n = 843$, 89% and never-tested MSM: $n = 115$, 94%; $p = 0.062$). In total, 43

Table 1. Sociodemographics, Sexual Behavior, and General Perceived Severity of HIV Infection and Their Association with Never Being Tested for HIV Among 1072 Men Who Have Sex with Men Living in the Netherlands, April–July 2019

	HIV-negative MSM (N = *950*)		*Never tested MSM* (N = *122*)		*Univariable*			*Multi-variable*		
	N	%	N	%	*OR*	*95% CI*	p	*aOR*	*95% CI*	p
Sociodemographics										
Age, median (IQR)	43	[30–55]	37	[22–51]	0.97	0.96–0.98	<0.001	0.98	0.97–1.00	.015
Born in the Netherlands[a]	843	89	115	94	2.09	0.95–4.59	.068			
Sex with women	43	5	21	17	4.39	2.50–7.68	<0.001	2.85	1.57–5.62	.001
Residence area[b] and education level[c,d]										
Urban residency and high educated	285	30	5	4	1 (ref.)			1 (ref.)		
Urban residency and low educated	57	6	12	10	12.00	4.07–35.38	<0.001	12.06	4.00–36.38	<0.001
Rural residency and high educated	325	34	43	35	7.54	2.95–19.30	<0.001	6.26	2.42–16.24	<0.001
Rural residency and low educated	283	30	62	51	12.49	4.95–31.52	<0.001	9.29	3.64–23.76	<0.001
In a steady relationship	445	47	50	41	0.79	0.54–1.16	.223			
Medical comorbidity other than HIV	150	16	16	13	0.81	0.46–1.40	.443			
Not having HIV-positive relatives/friends	521	55	23	19	5.23	3.26–8.37	<0.001	3.85	2.35–6.32	<0.001
Sexual behavior										
HIV risk in the preceding 6 months (*definition A*)[e]	262	28	37	30	1.14	0.76–1.72	.524			
HIV risk in the preceding 6 months (*definition B*)[f]	154	16	24	20	1.27	0.78–2.04	.343			
General perceived severity of HIV										
Severity perception of HIV infection,[g] median (IQR)	7	[6–7]	7	[6–7]	1.34	0.90–2.01	.152			

[a]In multi-variable analysis, being born in the Netherlands was no longer significant and hence was removed from the multi-variable model;
[b]Urban area includes Amsterdam, Rotterdam, The Hague, and Utrecht;
[c]Included those who are educated lower than college degree;
[d]Estimates were obtained by including an interaction term between residence area and education level in the multi-variable model, while anchoring ORs on the urban residency and highly educated group;
[e]*Definition A*: Sexual risk behavior was defined as having CAS with a casual partner who was HIV negative or HIV positive with a detectable HIV VL, or a partner whose HIV status was unknown. Sexual behavior was not considered risky if use of PrEP was reported or if condomless sex was reported within a steady relationship or with an HIV-positive partner with an undetectable VL;
[f]*Definition B*: Sexual risk behavior was defined as having CAS with a casual partner who was HIV positive with a detectable HIV VL, or a partner whose HIV status was unknown. Sexual behavior was not considered risky if use of PrEP was reported or if condomless sex was reported within a steady relationship, with an HIV-negative casual partner or with an HIV-positive partner with an undetectable VL;
[g]Measured on a 7-point Likert scale item.
aOR, adjusted odds ratio; CAS, condomless anal sex; CI, confidence interval; IQR, interquartile range; MSM, men who have sex with men; OR, odds ratio; PrEP, pre-exposure prophylaxis; VL, viral load.

(5%) of HIV-negative MSM reported sex with women, compared to 21 (17%) never-tested MSM ($p < 0.001$). A steady relationship was reported by 445 (47%) HIV-negative MSM and 50 (41%) never-tested MSM ($p = 0.222$). Medical comorbidity was reported by 150 (16%) HIV-negative MSM and 16 (13%) never-tested MSM ($p = 0.442$). Having HIV-positive friends or relatives was reported by 521 (55%) HIV-negative MSM and 23 (19%) never-tested MSM ($p < 0.001$). According to *definition A* of sexual risk behavior, almost one-third of tested and never-tested MSM had engaged in sexual risk behavior in the past 6 months (tested MSM: $n = 262$, 28% and never-tested MSM: $n = 37$, 30%; $p = 0.524$). When CAS with HIV-negative casual partners was not considered sexual risk (*definition B*), the proportion of HIV-negative and never-tested MSM who engaged in sexual risk behavior in the past 6 months was 16% ($n = 154$) and 20% ($n = 24$), respectively ($p = 0.333$). Both HIV-negative and never-tested MSM reported a high perceived severity of HIV [median 7 (IQR 6–7), $p = 0.177$].

Unadjusted OR comparing odds of never being tested for HIV across levels of sociodemographic determinants and sexual behavior can be found in Table 1. In multi-variable analysis, never having been tested for HIV was associated with younger age (aOR = 0.98 per year, 95% CI = 0.97–1.00, $p = 0.015$), reporting sex with women (aOR = 2.85, 95% CI = 1.57–5.17, $p = 0.001$), and not having HIV-positive friends or relatives (aOR = 3.85, 95% CI = 2.35–6.32, $p < 0.001$). We observed a significant interaction between residential area and education level ($p = 0.001$); hence, we included strata of urban area and education in the multi-

Table 2. Sociodemographics and Sexual Behavior Determinants and Their Association with Never Being Tested for HIV Among Men Who Have Sex with Men with Recent Sexual Risk Behavior (Univariable and Multi-Variable Logistic Regression Analysis)

	Sexual risk behavior according to definition A[a] (n = *299*)						*Sexual risk behavior according to definition B*[b] (n = *178*)					
	Univariable			*Multi-variable*			*Univariable*			*Multi-variable*		
	OR	*95% CI*	p	*aOR*	*95% CI*	p	*OR*	*95% CI*	p	*aOR*	*95% CI*	p
Age per year increase	0.97	0.95–1.00	0.030				0.97	0.94–1.00	0.078			
Born in the Netherlands[c]	NA	NA	NA				NA	NA	NA			
Sex with women	3.53	1.42–8.78	0.011	2.80	1.09–7.18	0.032	3.42	1.07–10.92	0.052			
Living outside a large urban area[d]	3.07	1.16–8.17	0.012				4.13	0.93–18.31	0.028			
Lower educated[e]	2.17	1.07–4.40	0.030				1.71	0.71–4.14	0.228			
Having a steady partner	0.87	0.42–1.82	0.713				0.85	0.34–2.11	0.726			
Medical comorbidity other than HIV	0.29	0.07–1.26	0.051				0.26	0.04–2.03	0.122			
Not having HIV-positive relatives/friends	5.33	2.15–13.20	<.001	4.91	1.97–12.24	0.001	5.55	1.81–16.99	<.001	5.55	1.81–6.99	0.001
Residence area and education level[f]												
Urban residency and high educated	1 (ref.)						NA	NA	NA			
Urban residency and low educated	2.48	0.39–15.99	0.339				NA	NA	NA			
Rural residency and high educated	3.00	0.80–11.18	0.102				NA	NA	NA			
Rural residency and low educated	4.94	1.42–17.22	0.012				NA	NA	NA			

[a]*Definition A*: Sexual risk behavior was defined as having CAS with a casual partner who was HIV negative or HIV positive with a detectable HIV VL, or a partner whose HIV status was unknown. Sexual behavior was not considered risky if use of PrEP was reported or if condomless sex was reported within a steady relationship or with an HIV-positive partner with an undetectable VL.

[b]*Definition B*: Sexual risk behavior was defined as having CAS with a casual partner who was HIV positive with a detectable HIV VL, or a partner whose HIV status was unknown. Sexual behavior was not considered risky if use of PrEP was reported or if condomless sex was reported within a steady relationship, with an HIV-negative casual partner or with an HIV-positive partner with an undetectable VL.

[c]All never-tested MSM with sexual risk behavior were born in the Netherlands.

[d]Urban area includes Amsterdam, Rotterdam, The Hague, and Utrecht.

[e]Not obtained a college or university degree.

[f]Only two participants with recent sexual risk behavior according to *definition B* lived in a large urban area.

variable model: compared to higher-educated MSM living in a large urban area, the odds for never testing was higher among higher-educated MSM living outside a large urban area (aOR = 6.26, 95% CI = 2.42–16.24, $p < 0.001$) and among lower-educated MSM living outside a large urban area (aOR = 12.06, 95% CI = 4.00–36.38, $p < 0.001$) or in a large urban area (aOR = 9.29, 95% CI = 3.64–23.76, $p < 0.001$). Lower-educated MSM were thus more likely to have never been tested, irrespective of residing in a large urban area ($p = 0.447$). There was no significant association between never testing and being born in the Netherlands, medical comorbidity, relationship status, or recent sexual risk behavior. When restricting analysis to MSM with recent sexual risk behavior according to *definition A*, never testing was only associated with not having HIV-positive friends or relatives (aOR = 4.91, 95% CI = 1.97–12.24, $p = 0.001$) and reporting sex with women (aOR = 2.80, 95% CI = 1.09–7.18, $p = 0.032$; Table 2). When not considering CAS with self-reported HIV-negative casual partners as sexual risk (*definition B*), the association between reporting sex with women and not testing for HIV among MSM with recent sexual risk behavior was no longer statistically significant (Table 2).

Discussion

In this study, over one-tenth of our sample reported never having been tested for HIV, despite almost one-fifth to one-third, depending on the risk definition used, of these men reporting recent risk of HIV. Consistent with a previous national study conducted in 2010[17] and other international literature,[18–21] never testing was associated with younger age, reporting sex with women, residing outside of the larger urban cities and lower education, and not knowing others with HIV. When restricting analysis to those engaging in activities at risk of HIV, never testing for HIV was associated with not knowing others with HIV, and, according to a less strict definition of risk, reporting sex with women. Taken together, our findings suggest that measures to increase testing continue to be needed among certain subgroups of MSM to increase timely diagnosis of HIV infection.

The proportion of never-tested MSM in our study was substantially lower than previous reports in other online surveys of participants residing in the Netherlands, namely 20% in the 2010 European MSM Internet survey (EMIS)[17] and 21% in the 2018 MSM survey.[15] This difference could be due to a general increase in testing uptake in the population, as also suggested by decreases in the estimated proportions of undiagnosed MSM from 30% in 2008[22] and 2010[23] to 9% in 2017 and 7% in 2018,[9] according to national surveillance data. It should, however, be noted that our lower proportion of never-tested MSM may have also resulted from variations in sampling methods. For example, the MSM survey recruited participants using respondent-driven sampling and other offline strategies, while we restricted recruitment to online channels. The distribution of sociodemographic factors associated with never having been tested for HIV in our study was nonetheless similar to those found in earlier studies.[15,17] This might suggest that the same subgroups have remained largely underserved and are still not well reached by HIV testing measures.

A novel finding of our study was the significant interaction between nonurban residential area and educational level. We found that lower-educated MSM were especially more likely to be never tested for HIV, regardless of residential area, while among higher-educated MSM, living outside large cities significantly increased the odds for never testing. These findings are illustrative of the complex interplay between sociodemographic characteristics that may co-exist and reinforce nontesting. The fact that never testing among lower-educated MSM or those living outside large cities is relatively higher suggests that current HIV testing measures are not as effective for these MSM. This calls for innovative approaches outside the usual routes of communication. For example, past research has shown that more simple and directive communication regarding HIV prevention are more effective for individuals with lower education.[24] It could be helpful to revisit such strategies when communicating current messages of HIV prevention. In addition, ways are needed to increase outreach to nonurban areas; internet-based interventions have previously shown promising results in reducing HIV risk behaviour among rural MSM[25,26] and can possibly be combined with home-based HIV testing, which was found to double HIV testing rates in some settings.[27] In nonurban areas, health care provider-initiated testing and counseling based on disease indicators might help to increase HIV testing.[28,29]

Interestingly, the proportion of MSM with recent self-reported HIV risk behavior was comparable between HIV-negative and never-tested MSM. This is in contrast with the 2010 EMIS study and other earlier studies conducted outside the Netherlands, suggesting that lower sexual risk was associated with never testing.[17,18,30,31] The absence of an association between testing and risk behavior in our study suggests that other factors might play a more important role in the motivation behind whether or not to test for HIV, particularly in the current context of new biomedical developments around the prevention and treatment of HIV. In contrast to previous surveys, our study was conducted at a time where, in some high-income settings, HIV incidence is low and many partners are either on PrEP or undetectable, which likely reduced the perception of HIV risk. The lack of association between testing and risk behavior may therefore suggest that the actual risk of HIV acquisition may no longer be a clear motivator to test. Alternatively, our findings suggest that the motivation for testing is heavily influenced by more structural and environmental circumstances, such as living in a nonurban setting or having a lower level of education. These factors probably further interact with or are driven by social barriers, such as the perceived stigma associated with testing and fear of testing positive or lack of social support, all of which are known to be associated with avoiding HIV testing.[13,15,20,32] Our finding that not testing for HIV, including among those reporting recent risk, was associated with having sex with both women and men and not knowing others with HIV highlights the importance of contextual and social factors in the decision-making process around testing. Testing measures should address these factors by, for instance, using more inclusive communication channels for bisexual men.

None of the never-tested MSM reported current PrEP use, which would be expected since a negative HIV test result is required before obtaining a prescription for PrEP.[33] The fact that nontesting MSM were highly unlikely to have visited a sexual health clinic for HIV testing also indicates that there may be missed opportunities to discuss sexual health issues.

To be able to reach those currently untested, a more comprehensive sexual health approach that emphasizes HIV prevention options without solely focusing on HIV-testing should be offered. In other words, encouraging men to visit the sexual health clinic or other settings to talk about their sexual needs and preferences and to support them with their sexual wellbeing, in which effective HIV prevention options such as PrEP can be offered, might be more attractive.

This study has some limitations. First, our study population might differ from the overall HIV-negative and never-tested MSM population living in the Netherlands or in other countries, and our results should therefore be generalized with caution to other settings. Our survey was based on convenience sampling and was disseminated particularly within dating sites/apps, with MSM as target group, and not broader forms of media. While recruiting on gay networking sites/apps could have influenced the proportions of both tested HIV-negative and never-tested MSM, the determinants associated with never testing would have likely remained similar had other recruitment methods been added. Another limitation is that we only included sexual behavior during the past 6 months and did not have data on lifetime risk for HIV. Consequently, the proportion of MSM who had ever been at risk for HIV and had a reason to test was likely underestimated. Our 6-month period was based on the recommendation for sexually active MSM to be tested for HIV every 3–6 months.[8] Assessing sexual risk was additionally challenged by the lack of data whether the perceived HIV status of casual partners is valid. We therefore included two definitions of risk behavior in which CAS with a self-reported HIV-negative casual partner was either considered risky (*definition A*) or nonrisky (*definition B*). Using different definitions of sexual risk yielded different results with respect to the association between reporting sex with women and not testing for HIV among MSM with recent sexual risk behavior. Finally, some of the ORs had wide CIs, suggesting a low level of precision.

Based on this online sample of MSM, never testing for HIV is more common in those who were younger, had a lower level of education, resided in nonurban settings, reported sex with women, and did not know someone with HIV. Only the latter two factors were observed among those with recent sexual risk behavior. Our findings are suggestive of an interplay between sociodemographic factors that may relate to multiple co-existing barriers for seeking HIV testing services, other than risk perception alone, and call for innovative, tailored testing interventions. These interventions should be targeted toward geographical location, education level, and diverse MSM identities. Furthermore, it may be effective to embed HIV testing within a more comprehensive sexual health approach in which testing campaigns are combined with efforts to increase sexual well-being and PrEP use among at-risk individuals who do not make regular use of sexual health services.

Authors' Contributions

H.Z., W.v.B., and U.D. contributed to study concept and design. H.Z. and W.v.B. performed all data analyses. A.B. and U.D. supervised the data analysis. H.Z. and W.v.B. wrote the first draft of the report. All authors contributed to interpretation of data and critically revised the article and approved the final version for publication.

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