



Awareness of, Willingness to Take PrEP and Its Actual Use Among Belgian MSM at High Risk of HIV Infection: Secondary Analysis of the Belgian European MSM Internet Survey

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Accepted: 1 November 2021

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Abstract

We examined PrEP awareness, willingness to take it and early PrEP use among men who have sex with men (MSM) at increased risk of HIV acquisition in Belgium. This analysis of the Belgian EMIS online data of 2017–2018 adopts a cascade approach, with the following steps quantified as conditional probabilities: being eligible for, aware of, willing to take PrEP, and PrEP use. One out of three MSM was eligible to use PrEP according to the operationalized Belgian reimbursement criteria. PrEP awareness was lower among socioeconomically vulnerable MSM, MSM living outside large cities, MSM who were less open about their sexuality and those who did not identify as gay or homosexual. A lack of PrEP knowledge, a higher self-efficacy regarding safe sex, having a steady partner and reporting more symptoms of depression were related to unwillingness to use PrEP. Among those willing to take PrEP, less than one third were actually using PrEP. Not using PrEP was associated with living in small cities and experiencing financial problems.

Keywords Pre-exposure prophylaxis (PrEP) use · Cascade approach · Men who have sex with men (MSM) · Eligibility criteria · Awareness of and willingness to use PrEP

Introduction

Oral pre-exposure prophylaxis (PrEP) is the use of antiretrovirals for HIV prevention, recommended for HIV negative individuals at substantial risk of HIV infection [1]. The World Health Organization recommends PrEP to be provided as part of a comprehensive approach including biomedical, behavioral, and structural interventions designed to meet the HIV prevention needs of specific people and communities [1]. There is a decreasing trend in new HIV diagnoses among men who have sex with men (MSM) in the

European Union (EU). However, sex between men remains the predominant mode of HIV transmission, accounting for about 39% of all diagnoses in 2019 [2]. In Belgium, the yearly incidence of HIV diagnoses per 100,000 inhabitants is relatively high (8.1 in 2019) [3] when compared to the EU average (5.4 in 2019) [2]. The uptake of PrEP as novel HIV prevention method may be crucial to further reduce the number of HIV infections [4, 5].

For PrEP to be effective in reducing the number of HIV infections at population level, uptake needs to be ensured among those who are at highest risk of HIV infection [6]. Therefore, PrEP guidelines usually include eligibility criteria for PrEP initiation based on factors known to be associated with an increased risk for HIV acquisition [7, 8]. These eligibility criteria are country specific, tailored according to the local context, HIV epidemiology, groups most at risk of HIV acquisition and strategic planning and program focus [8]. In Belgium, PrEP was made available in June 2017, and the current criteria for MSM include condomless anal intercourse with at least two partners in the last 6 months, multiple use of post exposure prophylaxis (PEP), or multiple episodes of STIs last 12 months [9].

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In Belgium, PrEP is delivered through 12 HIV reference centers (HRC). HRCs are specialized outpatient clinics providing multidisciplinary HIV and PrEP care. PrEP is partially reimbursed for individuals at increased risk for HIV infection, identified through the national eligibility criteria [9, 10]. An online survey conducted from November 2016 to February 2017 demonstrated that the awareness of PrEP among HIV negative Belgian MSM was high (about 92%) and that about 70% of them were willing to take it [11]. However, this survey took place right before PrEP reimbursement was introduced in Belgium [11]. Before that, PrEP was only available through a PrEP demonstration project (i.e. 200 MSM included in the Be-PrEP-ared study, or through informal use such as purchasing PrEP online [12]). Hence, we do not yet know to what extent the high demonstrated theoretical willingness to use PrEP has actually translated into its high uptake when made formally available. By December 2019, HRCs registered approximately 4,000 PrEP users, 99% men and 98% MSM [3]. However, there may be a large group of MSM not yet using PrEP, while being eligible and willing to use it. We lack insights into their specific barriers preventing them from actual use. Measuring these gaps and identifying associated factors will help to inform targeted HIV prevention strategies and increase PrEP uptake among those most in need.

To optimize the effectiveness of PrEP in reducing HIV infections, PrEP uptake must be ensured among those with high risk for HIV acquisition along all steps of the PrEP cascade, which lends itself particularly well to identify critical factors that could improve uptake [13–17]. We therefore need to know how many MSM among those who are eligible to use PrEP are aware of it, are willing to use it, and are actually using it. Insights into the drops at each stage of this PrEP cascade will help to prioritize targeted interventions in the Belgian context. In addition, assessing the structural, cognitive or psychosocial factors related to the respective drops from awareness to willingness to actual use will increase our understanding which steps of the PrEP cascade need to be targeted with specific interventions.

The first aim of this study was to examine PrEP awareness, willingness to use PrEP and actual PrEP use among Belgian MSM eligible for PrEP. We used the above-mentioned cascade approach, in line with similar research on PrEP uptake [13–17]. The study's second aim was to explore which sociodemographic, structural, cognitive and psychosocial factors were related to the drops in this cascade, i.e. associations with 'being unaware of PrEP', 'being unwilling to use PrEP' and 'not using PrEP'. These insights will be particularly useful to tailor strategies for improving PrEP uptake among those at highest risk of HIV acquisition.

Methods

Data

We conducted a secondary analysis of the European MSM Internet Survey (EMIS) [18]. EMIS is a cross-sectional online survey conducted among gay, bisexual, and other MSM to understand their sexual health needs and to direct prevention programs at a country level. Respondents across 50 countries were recruited through promotion on websites of supportive organizations, social network services and MSM targeted geo-spatial dating smartphone applications and websites. Data were collected between 01/11/2017 and 31/01/2018, which is shortly after roll-out and reimbursement of PrEP in Belgium (1/06/2017). The data included sociodemographic characteristics, morbidities, drug use, sexual risk behaviors, HIV-related prevention needs and health inequalities.

For this analysis we selected the Belgian EMIS data [19]. Men were eligible to answer the questionnaire if they lived in Belgium, were older than 16 years (i.e. the age at which one can provide sexual consent) identified as a man or transman, and were sexually attracted to men and/or having sex with men. The total number of respondents in Belgium was 2,746. All respondents provided consent to participate. Detailed study procedures are published elsewhere [18, 20]. We excluded persons younger than 18 years ($N = 12$) or living with HIV ($N = 338$; 12.4%) from the sample, since they are not eligible to use PrEP according to Belgian criteria [8, 9]. This resulted in a sample size of 2396 respondents.

Measures and Definitions

Eligibility for PrEP Use

We considered HIV negative MSM eligible to use PrEP if they were at high risk of HIV infection according to the Belgian PrEP eligibility criteria [9] (Table 1). We operationalized seven eligibility criteria based on the available information in EMIS [18] (see more detailed information in Appendix 1). Participants were considered eligible if at least one of these 7 criteria was met. Two participants with missing data on more than 3 criteria were excluded.

Awareness

Participants were considered to be *aware of PrEP* if they answered 'yes' to the question 'Have you heard about PrEP'.

Table 1 Eligibility criteria for PrEP reimbursement in Belgium (issued by the National institute for Health and Disability Insurance as of June 1, 2017) and their operationalization based on the EMIS data

Belgian criteria for PrEP reimbursement	EMIS data and operationalization of this criteria
I. MSM (men who have sex with men):	
who have had unprotected anal sex with at least 2 partners in the last 6 months	Having had condomless intercourse w with at least two different non-steady partners during the last 12 months
who have had multiple Sexually Transmitted Infections (STIs) (Syphilis, Chlamydia, Gonococcus or a primary infection with hepatitis B or C) during the last 12 months	Diagnosed with at least 1 STI (syphilis, gonorrhoea, chlamydia or LGV, or a primary infection with hepatitis C) during last 12 months
who needed Post exposure Prophylaxis (PEP) more than once during the last 12 months	Taken more than one course of PEP pills
who use psychoactive substances during sexual activities	Taken stimulant drugs during sex to make it more intense or last longer in the last 12 months
II. People at high risk of HIV acquisition:	
People who inject drugs (PWID) who share needles	Injected drugs with a used needle last 12 months
People in sex work who are exposed to unprotected sex	Having been paid to have sex in the last 12 months
People in general who are exposed to unprotected sex with a high risk of HIV infection	Not applicable (MSM with a high risk of HIV infection are already identified by the other criteria)
Partners of people living with HIV (PLWH) without viral suppression (recently started on treatment or no viral suppression with adequate treatment)	Having had condomless intercourse with (a) HIV positive partner(s), who has (have) no undetectable viral suppression or without knowing whether he (they) have undetectable viral load

Willingness

A participant was considered *willing to take PrEP* when responding ‘likely’ or ‘very likely’ on a 5-point Likert scale to the question ‘If PrEP was available and affordable to you, how likely would you be to use it?’.

Current PrEP Use

Current PrEP use is based on the question ‘Have you ever taken PrEP?’ and operationalized as a dichotomous variable: [1] ‘currently using PrEP on a daily basis or on demand’ versus [2] ‘never used PrEP or used PrEP on a daily basis or on demand but no longer taking it’. Formal channels for obtaining PrEP included ‘a physical pharmacy’, ‘a general practitioner or other physician’, ‘a hospital, institute, clinic, community or drop in center’, and ‘participation in a study’. ‘PrEP pills from an online pharmacy’ and ‘PEP or ART as PrEP’ were considered informal circuits.

Factors Potentially Associated to PrEP Awareness, Willingness to Take PrEP and PrEP Use

Sociodemographic factors included: *age* (‘less than 30’, ‘31 thru 50’, ‘above 51’), *years of education* (since age 16: ‘0 to 4 years’, ‘5 to 6 years’, ‘7 years or more’), *relationship status* (‘single’, ‘steady partner’, ‘not sure/complicated’), *sexual orientation* (‘self-identifying as gay or homosexual’, ‘bisexual’, ‘other’), *migrant status* (‘no migration background’, ‘EU/EFTA migrant’, ‘non-EU/EFTA migrant’)

and *employment situation* (‘employed’, ‘unemployed’, ‘student’, ‘non-employed which included retired or inactive due to disability/sickness’).

Structural barriers such as financial hardship and geographical distance to the PrEP facility may occur and potentially reduce the PrEP accessibility (and thus effective PrEP use). HRCs in Belgium are geographically distributed across the entire country and mostly connected to University hospitals in medium or large cities, which may limit the geographical accessibility for people living in (semi)-urban areas. In the analysis we included *struggling on present income* (feelings about present income using a 5-point Likert scale from ‘really struggling on present income’ to ‘living really comfortable on present income’), and *size of the city of residence* (‘large/medium city’, ‘small city/town’, and ‘village/countryside’) as proxies for financial and geographical barriers. For more information about the measurement of the sociodemographic and -economic factors, we refer to EMIS [18, 20].

We hypothesized specific cognitive factors to be related to PrEP awareness, PrEP use and in particular willingness to use PrEP [11, 21]. Hence, we included in the analysis *self-efficacy regarding safe sex*, and *prior knowledge on PrEP and HIV transmission*, similar to the French study about PrEP using the EMIS data [21]. *Self-efficacy regarding safe sex* was assessed using a 5-point Likert scale from ‘strongly disagree’ to ‘strongly agree’ to the statement ‘The sex I have, is always as safe as I want it to be’. *Prior PrEP and HIV transmission knowledge* were based on previous knowledge of two statements: ‘PrEP can be taken as a single daily pill if

someone does not know in advance when they will have sex' and 'A person with HIV who is on effective treatment (called 'undetectable viral load') cannot pass their virus to someone else during sex'. The five answers categories were dichotomized: yes ('I knew this already') versus no ('I wasn't sure about this', 'I didn't already know this', 'I don't understand this', 'I do not believe this').

Level of outness, alcohol dependency and depression and anxiety were included as psychosocial factors, as they are known to be negatively related to PrEP use [21]. *Level of outness* can be considered a potential emotional barrier of PrEP use, reflecting internalized homonegativity, and was based on an item analyzed in previous studies [21, 23–25]: 'Thinking about all the people who know you (including family, friends, and work or study colleagues), what proportion knows that you are attracted to men?' Possible options were: 'no one'; 'few'; 'less than half'; 'more than half'; 'all or almost all'. In line with previous research on outness [25], the variable was dichotomized as follows: those out to 'no one,' or 'few' of the people they know (defined as 'in the closet' or 'having a low level of outness') versus those out to 'less than half,' 'more than half' or to 'all or almost all' of the people they know (defined as 'out' or 'having a medium to high level of outness'). The CAGE-4 screening measure was used to assess possible alcohol dependency. The CAGE-4 questionnaire for alcohol misuse has been previously validated for use in the general population [26]. The relatively low Cronbach's alpha we found (0.6) is comparable to other studies [27, 28]. Self-reported depression and anxiety were measured by the validated Patient Health Questionnaire-4 (PHQ-4), which is a brief and accurate measurement of core symptoms/signs of depression and anxiety [29]. The Cronbach alpha in our sample was 0.9.

Analyses

We used a cascade approach with the following steps (bars): among *MSM eligible for PrEP* (Bar 1), we examined the proportions being *aware of PrEP* (Bar 2), *willing to use PrEP* (Bar 3) and actually *using PrEP* (Bar 4). In an unconditional approach, each step was quantified with a fixed denominator, i.e. all MSM being eligible for PrEP in the sample. In the conditional approach, the denominator of each step was equal to the nominator of the previous step, implying for example that willingness to take PrEP only needs to be examined among those being aware of it, or that PrEP use only needs to be examined among those being willing to take it.

The drops in the cascade were then quantified (conditionally) as outcome variables in the bivariate and multivariable logistic regression analyses: i.e. unaware vs. aware (among eligible MSM, Sample 1); unwilling vs. willing (among those eligible for and aware of PrEP, Sample 2); and not

using PrEP vs. using (among those eligible for, aware of and willing to use PrEP, Sample 3). We determined the relationships between the drops and the potentially associated factors using bivariate statistics resulting in a contingency table (Table 3) and bivariate logistic regressions (Table 4). Wald Chi-square tests were used to determine whether the associations between these variables were significant (with a p value < 0.05) and the strength of the associations were measured by unadjusted (or crude) odds ratio's (OR). Next, we performed multivariable logistic regression analyses to investigate which factors were independently associated with the drops in the cascade, including the factors that were significant in the bivariate analyses. Strengths of associations were measured using adjusted odds ratio's (AOR) (Table 4).

Results

PrEP Cascade: Awareness of and Willingness to Take PrEP and PrEP Use

Figure 1 shows the PrEP cascade using both a conditional and unconditional approach. The corresponding numbers of the PrEP cascade are presented in Table 2. One among three MSM (33.2%; 795/2,396) in this sample were *eligible for PrEP use* according the Belgian criteria (Bar 1). Around seventy percent of all MSM (70.7%; 1,659/2,346) were *aware of PrEP* (Bar 2). For PrEP eligible MSM, the proportion being aware of PrEP was 82.1% (641/781). Nearly half of the MSM (43.3%; 1,037/2,396) indicated to be *willing to use PrEP* and among PrEP eligible MSM who were aware about its existence this proportion was more than half (66.1%; 424/641) (Bar 3). About 22.5% of those willing to use PrEP were not eligible.

The proportion of MSM currently using PrEP was 6.9% (164/2,376) in the whole sample, 18.0% (142/791) among MSM eligible to use PrEP and 30.7% (130/424) among PrEP eligible MSM who are aware of PrEP and willing to use it (Bar 4). The majority of them (90%; 117/130) were using PrEP via the formal circuit and 2.1% (6/130) informally. Twenty-two MSM were using PrEP while being ineligible according the criteria, representing 0.9% (22/2,376) of all the MSM or 13.4% (22/164) of all PrEP users. Among eligible PrEP users 87.7% (114/130) had received a medical prescription for PrEP, the majority (81.5%) from a HRC or primary health care center (e.g. drop-in center).

Factors Associated with the Drops in the PrEP Cascade

Table 3 shows the distribution of each factor for every subsample. The results of the logistic regression analyses with

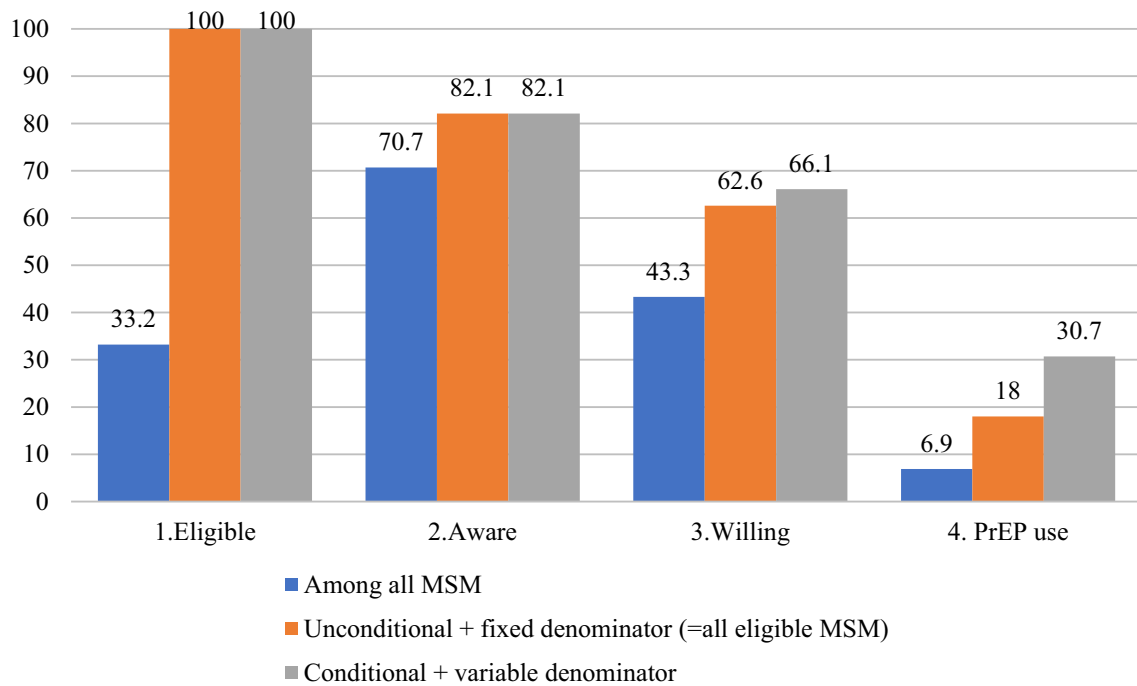


Fig. 1 The Belgian PrEP cascade, using an unconditional and conditional approach

Table 2 Percentage of MSM who were eligible to use PrEP, aware of PrEP, willing to use PrEP and use PrEP (via the formal and informal circuit)

	Among all MSM		Unconditional + fixed denominator (= all eligible MSM)		Conditional + variable denominator	
	%	N/N total (Excl. missing)	%	N/N total (Excl. missing)	%	N/N total (Excl. missing)
1. Eligible	33,2	795/2396	100	795	100	795
2. Aware ^a	70,7	1659/2346	82,1	641/781	82,1	641/782
3. Willing	43,3	1037/2396	62,6	498/795	66,1	424/641
4. PrEP use	6,9	164/2376	18,0	142/791	30,7	130/424
a. Formal use	6,2	146/2370	16,3	128/787	27,9	117/420
b. Informal use	0,5	12/2370	1,3	10/787	2,1	9/420

^aRespondents who have answered ‘uncertain’ on the question ‘have you ever heard about PrEP?’ are considered as ‘unaware’

the drops in the cascade as dichotomous outcomes are presented in Table 4.

Eligible MSM who were 51 years or older were more likely to be unaware of PrEP as compared with those below 30 years old, even after controlling for other factors. Being unaware of PrEP was also significantly associated with lower educational level, unemployment, living in a small city, low level of outness, self-identifying as bisexual and reporting no prior HIV knowledge on ‘undetectable = untransmittable’.

Among PrEP eligible MSM who were aware about PrEP, unwillingness to use PrEP was higher among those with a migration background (in particular non-EU/EFTA migrants), those who did not identify as homosexual, who

were unemployed, who scored higher on the anxiety and depression scale, who lacked PrEP knowledge and who had higher scores on self-efficacy regarding safe sex, when compared with their respective counterparts. After adding the confounding factors, MSM with a steady partner were also more likely to be unwilling to use PrEP compared to single MSM.

Among those who were eligible for, aware of, and willing to use PrEP, not using PrEP was significantly associated with struggling financially, being a student, living in a small city/town, and lack of prior knowledge about PrEP and HIV transmission. In the multivariate analysis, struggling

Table 3 Results of the bivariate analyses with the drops in the conditional PrEP cascade as outcome variable ‘unaware’, ‘unwilling’ and ‘no PrEP use’

	Total sample 1		Unaware of PrEP		Total sample 2		Unwilling to take PrEP		Total sample 3		Not using PrEP	
	N	%	%	p ^a	N	%	%	p ^a	N	%	%	p ^a
Total	795		17.9		641		33.9		425		69.3	
Age (in years)	795			0.001	641			0.519	425			0.665
Less than 30	194	24.4	15.7		172	26.8	28.6		111	26.1	27.5	
31 thru 50	429	54.0	52.9		351	54.8	55.3		231	54.4	53.2	
Above 51	172	21.6	31.4	0.004	118	18.4	16.1		83	19.5	19.3	
Migration status	795				641			0.014	425			0.163
Native	638	80.3	90.0		500	78.0	71.4		345	81.4	81.0	
EU/EFTA-migrant	92	11.6	4.3		85	13.3	16.6		49	11.6	10.5	
Non EU/EFTA-migrant	65	8.2	5.7		56	8.7	12.0		30	7.1	8.5	
Sexual orientation (identify themselves as)	795			0.001	641			0.050	425			0.635
Homosexual	675	84.9	67.9		568	88.6	85.7		382	89.9	89.8	
Bisexual	83	10.4	25.7		46	7.2	7.4		31	7.3	7.8	
Other	37	4.7	6.4		27	4.2	6.9		12	2.8	2.4	
Relationship status	795			0.578	641			0.531	425			0.804
Single	435	54.7	52.1		355	55.4	52.5		242	56.9	57.3	
Steady partner	314	39.5	40.7		253	39.5	41.5		163	38.4	37.6	
Not sure/complicated	46	5.8	7.1		33	5.1	6.0		20	4.7	5.1	
Education (years since 16)	795			0.001	641			0.208	425			0.928
0–4 years	168	21.1	27.9		128	20.0	16.1		94	22.1	22.7	
5–6 years	170	21.4	35.7		117	18.3	18.4		77	18.1	18.0	
7 years or more	457	57.5	36.4		396	61.8	65.4		254	59.8	59.3	
Employment status	794			0.001	640			0.106	424			0.097
Employed	624	78.5	72.1		515	80.5	76.5		350	82.5	79.9	
Unemployed	48	6.0	10.7		33	5.2	6.0		20	4.7	4.8	
Student	66	8.3	5.0		59	9.2	12.9		31	7.3	9.2	
Non-employed	56	7.1	12.1		33	5.2	4.6		23	5.4	6.1	
Subjective income	795			0.020	641			0.568	425			0.025
Not struggling	702	88.3	82.1		574	89.5	88.5		383	90.1	88.1	
Struggling	93	11.7	17.9		67	10.5	11.5		42	9.9	11.9	
Degree of urbanization	788			0.001	638			0.211	425			0.003
Large/medium city	447	56.7	35.7		389	61.0	65.0		160	37.9	84.4	
Small city/town	212	26.9	36.4		157	24.6	23.0		88	20.9	36.4	
Village/countryside	129	16.4	25.0		92	14.4	11.5		44	10.4	22.8	
Level of outness	781			0.001	632			0.508	421			0.067
Low	167	21.4	35.0		112	17.7	15.7		79	18.8	20.9	
Medium to high	614	78.6	61.4		520	82.3	82.0		342	81.2	79.1	
Alcohol dependency	790			0.907	637			0.050	424			0.218
No	631	79.9	18.2		509	79.9	75.1		347	81.8	83.0	
Yes	159	20.1	17.4		128	20.1	23.5		77	18.2	17.0	
Prior HIV knowledge on “undetectable = untransmittable”				0.001								
Yes	531	68.1	42.9		471	73.5	68.5		323	76.0	68.8	
No	249	31.9	57.1		170	26.5	31.5		102	24.0	31.2	
Prior PrEP knowledge that “PrEP on event-based regimen is possible”												

Table 3 (continued)

	Total sample 1		Unaware of PrEP		Total sample 2		Unwilling to take PrEP		Total sample 3		Not using PrEP	
	N	%	%	p ^a	N	%	%	p ^a	N	%	%	p ^a
Total	795		17.9		641		33.9		425		69.3	
Yes	484	62.1			533	83.2	79.3		362	85.2	79.0	
No	295	37.9			108	16.8	20.7		63	14.8	21.0	
	N	x(sd)	x(sd)	p ^b	N	x(sd)	x(sd)		N	x(sd)	x(sd)	p ^b
Anxiety & depression (1–4)	788	1.8(0.9)	1.8(0.9)	0.537	638	1.8(0.9)	1.9(1.0)	0.039	421	1.8(0.9)	1.8(0.9)	0.483
Self-efficacy (1–5)	794	3.8(1.2)	3.7(1.2)	0.280	641	3.8(1.1)	3.9(1.1)	0.019	423	3.7(1.2)	3.7(1.2)	0.443
“Sex is as safe as I would like”												

^aChi-square test^bAnova test

financially was no longer significantly associated with not using PrEP.

Discussion

In this study we examined PrEP awareness, willingness to use PrEP and PrEP use among PrEP eligible MSM soon after the implementation of PrEP in Belgium. We found that 82.1% of the eligible MSM were aware of PrEP, 62.6% were willing to take it and 18% were actually using it. Different sociodemographic, structural, cognitive and psychosocial factors were related to the respective drops in the cascade, i.e. unaware, unwilling and not using PrEP.

In our sample of Belgian MSM, 70% were *aware of PrEP*, and among those eligible to use PrEP the proportion was 82%. This figure is comparable to other studies performed in Australia and France around the same period [13, 21]. Socioeconomic vulnerability, living outside urbanized areas, being older than 50 years, being bisexual or less open about sexuality were related to poor awareness of PrEP. These findings are in line with previous research on PrEP awareness [14, 30–32] and call for tailored interventions. Lack of PrEP awareness was shown to be an important barrier to PrEP use, especially among groups most vulnerable groups for HIV [33]. There is a need for more inclusive awareness campaigns that can reach larger groups of MSM, in particular those who are less directly connected to the gay communities or groups with a lower socioeconomic status.

About 43% of MSM in our total sample was *willing to use PrEP*. This proportion is similar to what has been demonstrated in other studies conducted in high income countries (i.e. between 40 and 60%) [11, 21, 32, 34, 35]. Among MSM eligible for PrEP use, we found that more than one third were not willing to use PrEP. Such low levels of willingness to use PrEP among those who would benefit from it raise

concerns from a public health point-of-view, as the benefits of PrEP cannot be fully exploited. As found elsewhere [36], we observed that unwillingness to use PrEP is higher among MSM who did not self-identify as gay or homosexual and among those with a migration background. This can be possibly explained by the fact that initial PrEP in Europe recruited mostly white homosexual men, and also promotion campaigns focused mainly on this group [37]. Furthermore, perceived PrEP stigma due to its associations with homosexuality, HIV and promiscuity may present a strong barrier for PrEP uptake, especially among MSM with a migration background [38]. There is a need to further study how uptake of PrEP can be increased among migrant communities [37]. We also found that lack of correct PrEP knowledge, scoring high on depression and anxiety scales, a stronger belief that the sex they have is always as safe as they wanted and having a steady partner, were all related to unwillingness to use PrEP. From other studies [31, 36], we know that a lack of PrEP knowledge is one of the most frequent reported barriers to PrEP uptake. Previously, it was reported that a poor assessment of HIV risk resulted in a lower awareness, acceptability and uptake of PrEP [14]. Such assessments may be poorer among MSM reporting depressive symptoms, and subsequently they may be less likely to take up self-care or prevention [39, 40]. This may contribute to their lower willingness to use PrEP, despite their higher HIV infection risk.

The largest drop in the cascade was found between willingness to use PrEP and *actual PrEP use*, with less than one third of the MSM being aware and willing to use PrEP (30.7%) also using PrEP. This was expected as the gap between people who are likely to use PrEP but not using it, was also highlighted in previous European [41] and American research [42]. Interventions improving PrEP awareness and willingness to use PrEP may thus not be sufficient to improve PrEP uptake. This confirms that the theoretical

Table 4 Results of the logistic regression analyses with the drops in the conditional PrEP cascade as outcome variable ‘unaware’, ‘unwilling’ and ‘no PrEP use’

	Sample 1			Sample 2			Sample 3			
	Unaware of PrEP (0/1)			Unwilling to take PrEP (0/1)			Not using PrEP (0/1)			
	OR	CI-95%	AOR ^a CI-95%	OR	CI-95%	AOR ^b CI-95%	OR	CI-95%	AOR ^c CI-95%	
Age (in years)										
Less than 30	1		1	1		1	1		1	
31 thru 50	1.6	1.0 2.7 *	1.6	0.9 3.1	1.1 0.1	12.1	1.3	0.1 16.0	1.2 0.7 2.3	1.0 0.5 2.0
Above 51	2.9	1.7 5.1 ***	2.5	1.2 5.0 *	1.0 0.1	10.7	1.4	0.1 17.2	0.9 0.6 1.7	1.0 0.5 1.7
Migration status										
Native	1		1	1		1	1		1	
EU/EFTA-migrant	0.3	0.1 0.7 **	0.6	0.2 1.4	1.5 1.0	2.5 *	1.8	1.1 2.9 *	0.8 0.4 1.4	0.9 0.4 1.6
Non EU/EFTA-migrant	0.5	0.3 1.2	0.6	0.2 1.5	2.1 1.2	3.6 **	1.9	1.1 3.4 *	2.2 0.8 6.0	2.3 0.8 6.3
Sexual orientation (identify themselves as)										
Homosexual	1		1	1		1	1		1	
Bisexual	4.7	2.9 7.6 ***	3.1	1.7 6.0 ***	1.1 0.6	2.0	1.1	0.6 2.1	1.3 0.6 2.9	1.1 0.4 2.5
Other	2.0	0.9 4.4	1.2	0.5 3.2	2.6 1.2	5.6 *	2.3	1.0 5.2 *	0.6 0.2 2.0	0.5 0.1 1.7
Relationship status										
Single	1.0		1	1		1	1		1	
Steady partner	1.1	0.7 1.6	1.1	0.7 1.7	1.2 0.8	1.6	1.3	1.1 1.5 **	0.9 0.6 1.4	1.0 0.7 1.6
Not sure/complicated	1.5	0.7 3.1	1.1	0.5 2.6	1.4 0.7	2.9	1.3	1.0 1.8	1.3 0.5 3.7	1.4 0.5 4.1
Education (years since 16)										
0–4 years	2.4	1.5 3.8 ***	1.7	1.0 2.9 *	0.7 0.4	1.0	0.7	0.5 1.1	1.1 0.7 1.9	1.1 0.6 1.8
5–6 years	3.3	2.1 5.2 ***	2.3	1.4 3.9 ***	0.9 0.6	1.4	1.0	0.6 1.5	1.0 0.6 1.7	0.9 0.5 1.6
7 years or more	1		1	1		1	1		1	
Employment status										
Employed	1		1	1		1	1		1	
Unemployed	2.3	1.2 4.4 *	2.3	1.0 5.1 *	1.4 0.7	2.8	1.3	0.6 2.8	1.1 0.4 3.0	0.9 0.3 3.0
Student	0.6	0.3 1.4	0.9	0.3 2.4	1.9 1.1	3.3 *	1.7	1.0 3.0 *	3.3 1.1 9.7 *	3.3 1.1 9.9 *
Non-employed	2.6	1.4 4.9 **	1.4	0.7 3.0	0.9 0.4	2.0	0.8	0.4 1.9	1.8 0.6 4.9	1.2 0.4 3.8
Subjective income										
Not struggling	1		1	1		1	1		1	
Struggling	1.9	1.1 3.1 *	1.4	0.7 2.6	1.2 0.7	2.0	0.9	0.5 1.7	2.4 1.0 5.5 *	2.3 0.9 6.2
Degree of urbanization										
Large/medium city	1		1	1		1	1		1	
Small city/town	2.5	1.6 3.9 ***	1.7	1.0 2.7 *	0.8 0.6	1.2	0.9	0.6 1.3	2.5 1.4 4.4 *	2.4 1.3 4.3 **
Village/countryside	3.0	1.8 4.8 ***	1.7	1.0 3.0	0.7 0.4	1.1	0.7	0.4 1.2	1.0 0.6 1.8	0.9 0.5 1.7
Level of outness										

willingness to use PrEP strongly differs from actual PrEP use [32, 43]. As a result, action has to be taken to improve this last step of the PrEP cascade, by reducing health-care related and structural barriers and at individual level motivating people to take concrete steps towards actual use (e.g. making an appointment, getting a prescription, etc.). In previous research [21, 31], poor knowledge about PrEP, PrEP stigma, the related costs, and the poor accessibility of medical facilities where PrEP can be prescribed and followed up, were reported as potential barriers of PrEP use. Low accessibility of highly specialized PrEP care facilities may explain our finding that MSM living in small cities were less likely to use PrEP than MSM living in larger cities, where these HRCs are located. Our findings also suggest that financial barriers despite the reimbursement scheme in place restrain MSM from using PrEP. Indeed: MSM at increased risk of HIV acquisition and willing to use PrEP, but who struggled financially were less likely to use PrEP in our study.

Limitations

The EMIS survey is based on convenience sampling, so the data used in this study may not be representative for all MSM in Belgium. As with other online MSM surveys, the EMIS dataset is likely to be biased towards more highly educated MSM and fewer older MSM, migrant MSM and those more distant from the gay community [21, 44, 45]. Thus, recruitment strategies may have had a substantial impact on our findings [46]. The use of sexual networking applications for recruiting participants may have led to a selection bias, i.e., participants with high levels of sexual activity, seeking sex partners on the internet, or with a particular interest in PrEP [7]. However, while the findings are not generalizable to the wider MSM population, this large group of respondents does represent the key population of highly sexually active and therefore most at-risk men.

Using an existing database comes also with inherent limitations: we were unable to directly measure each criterion of the Belgian PrEP eligibility criteria (e.g., PrEP use last 12 months). Lack of these data might have resulted in an underestimation or overestimation of the percentage of MSM eligible to use PrEP. In addition, no information was available about some frequent reported barriers of willingness and use of PrEP [31], such as attitudes towards PrEP, worries about PrEP stigma and side effects, poor HIV risk perception, not having a doctor to prescribe it, or being ashamed to ask medical professionals about PrEP. Self-reported and retrospective data may also lead to underreporting of sensitive subjects (e.g., condomless sex or PrEP use via informal channels) and be subject to recall bias.

Recommendations and Conclusions

Our study highlights that while there is a high number of MSM who may benefit from using PrEP, only a small number was actual using PrEP when PrEP implementation in Belgium has just started. More recent numbers of the HRCs suggested an increase in PrEP use among MSM thereafter [3]. We expect a further increase in PrEP awareness and willingness to take PrEP, as observed in Australia [13] and the US [42] after making PrEP available for some time. It should be noted that early PrEP adopters themselves may drive further uptake, by providing information and disclosing positive experiences to like-minded peers or sexual partners [47]. This may partially explain why PrEP mostly remains an MSM-specific HIV prevention tool in countries such as Belgium. While the data of this study pertain to the period 2017–2018, from our findings we cannot conclude to what extent the associated factors have determined actual uptake in the period thereafter. Therefore, we suggest continuous research in the future to monitor to which extent MSM at high risk for HIV acquisition are being reached.

We investigated PrEP awareness, willingness to take it and actual PrEP use among PrEP eligible MSM and found lower percentages in each step. Moreover, in each step we found associations that may be indicative for determining why PrEP eligible MSM would be less likely to be aware, willing or actually using PrEP. Such information can be used to tailor different interventions. The findings show that more investments are required to improve PrEP awareness among MSM at high risk for HIV acquisition. More specifically, PrEP awareness in Belgium may need to be differentiated promotion campaigns to reach socioeconomic vulnerable subgroups, and MSM who do not self-identify as homosexual or are less open about their sexuality. Promoting PrEP via community-based channels or primary care services may be a good alternative for improving PrEP awareness and willingness to take it [48]. The long-term and holistic patient-doctor relationship provided by primary care services lends itself to the provision of personalized sexual health information and opportunities. It may help reframe PrEP as sexual health promotion tool, irrespective of gender, sexual orientation, relationship status or ethnicity [49]. PrEP information and services could also be further and continuously distributed via community-based organizations, who are in close contact with the target group.

To increase willingness to use PrEP among MSM at high risk for HIV acquisition who are aware of PrEP, it is important to invest in improving PrEP knowledge and assessment of self-perceived HIV risk. Effective interventions to help at-risk individuals to better understand and act upon their HIV risk are required, especially among MSM with a non-European migration background, MSM who do not self-identify as homosexual and those who believe they have safe sex.

To ensure that MSM who are willing to use PrEP also actually use PrEP, further investments in the accessibility of PrEP are recommended. Although PrEP is reimbursed in Belgium, for people experiencing financial hardship, the out-of-pocket payment (i.e. approximately €11.9 for 30 pills) may still remain high [50]. Also, indirect costs such as transport costs and the costs of follow-up consultations may add to expenses for PrEP. Moreover, MSM at high risk for anxiety and depression related symptoms, may less accurately perceive their need for PrEP, and have a poorer PrEP adherence [51]. Hence, such MSM should be proactively approached and motivated to use PrEP, for example by health professionals and social workers. Future implementation research should explore how these services can be optimized to respond to key populations with unmet HIV prevention needs in different contextual settings [48].

Further research on PrEP, PrEP stigma and self-perceived HIV risk among MSM is needed in Belgium. Future studies should use a more representative sampling method such as a web-based respondent-driven sampling technique, which combines ‘snowball-sampling’ with a mathematical model that weights the sample to compensate for the fact that the sample was collected in a non-random way [52].

Appendix

Appendix 1: Eligibility criteria for PrEP reimbursement in Belgium (issued by the National institute for Health and Disability Insurance as of June 1, 2017) and detailed information about its operationalization using the EMIS data

Belgian eligibility criteria	Available variables in the EMIS data relevant for the eligibility criteria	Operationalized eligibility criteria	Percentage MSM meeting this criteria
I. Specific criteria targeting MSM (men who have sex with men)			% (N/N total excl. missings)

	Belgian eligibility criteria	Available variables in the EMIS data relevant for the eligibility criteria	Operationalized eligibility criteria	Percentage MSM meeting this criteria
1	who have had unprotected anal sex with at least 2 partners in the last 6 months	<ul style="list-style-type: none"> How many non-steady male partners have you had intercourse without a condom within the last 12 months? (<i>number</i>) (<i>no information about the last six months</i>) When did you last have intercourse with a man (either with or without a condom)? 	Having intercourse without condom with at least two different non-steady male partners during the last 12 months (and having intercourse the last 6 months)	16,1% (371/2300)
2	who have had multiple Sexually Transmitted Infections (STIs) (Syphilis, Chlamydia, Gonococcus or a primary infection with hepatitis B or C) during the last 12 months	<ul style="list-style-type: none"> When were you last diagnosed with syphilis? gonorrhoea? Chlamydia or LGV? When were you first diagnosed with hepatitis C? (<i>no information about the number of infections per type of STI</i>) 	Diagnosed with at least 1 STI (syphilis, gonorrhoea, chlamydia or LGV, or a primary infection with hepatitis C) last 12 months	3,4% (82/2396)

	Belgian eligibility criteria	Available variables in the EMIS data relevant for the eligibility criteria	Operationalized eligibility criteria	Percentage MSM meeting this criteria		Belgian eligibility criteria	Available variables in the EMIS data relevant for the eligibility criteria	Operationalized eligibility criteria	Percentage MSM meeting this criteria
3	who needed Post exposure Prophylaxis (PEP) more than once during the last 12 months	<ul style="list-style-type: none"> • Have you ever taken PEP? - No, I could not get it - No, I had the opportunity but decided not to take it - Yes, I've taken one course of pills - Yes, I've taken more than one course of pills <p>(no information about when PeP was taken)</p>	Taken more than one course of PEP pills	2% (48/2396)	5	People who inject drugs (PWID) who share needles	<ul style="list-style-type: none"> • When was the last time you injected with a used needle or syringe given, lent, rented or sold to you by someone else? 	Injected drugs with a used needle last 12 months	0,7% (17/2371)
					6	People in sex work who are exposed to unprotected sex	<ul style="list-style-type: none"> • When was the last time you were paid by a man to have sex with him. By paid we mean he gave you money, gifts or favours in return for sex? 	Being paid to have sex in the last 12 months	4,5% (105/2348)
4	who use psychoactive substances during sexual activities	<ul style="list-style-type: none"> • When was the last time you used stimulant drugs to make sex more intense or last longer? <p>(The stimulant drugs include ecstasy or MDMA, cocaine, amphetamine (speed), crystal methamphetamine (Tina, Pervitin), mephedrone and ketamine.)</p>	Taken stimulant drugs during sex to make it more intense or last longer in the last 12 months	14,3% (338/2366)	7	People in general who are exposed to unprotected sex with a high risk of HIV infection	Not applicable (MSM with a high risk of HIV infection are already identified by the other criteria)		

II. General criteria for people at high-risk of HIV acquisition

	Belgian eligibility criteria	Available variables in the EMIS data relevant for the eligibility criteria	Operationalized eligibility criteria	Percentage MSM meeting this criteria
8	Partners of people living with HIV (PLWH) without viral suppression (recently started on treatment or no viral suppression with adequate treatment)	<ul style="list-style-type: none"> • In the last 12 months, have you had intercourse without a condom with a non-steady partner who you knew at the time was HIV positive? • Did that HIV-positive man or those HIV-positive men have undetectable viral load? • Does your steady male partner have HIV? (If you have more than one steady relationship with a man, please tell us about the longest) <ul style="list-style-type: none"> - No, he is HIV negative - Yes, and he has an undetectable viral load - Yes, and his viral load is detectable - Yes, and I do not know what his viral load is – - I don't know whether he has HIV or not 	Having condomless intercourse with (a) HIV positive partner(s), without knowing whether he (they) have undetectable viral load or knowing he (they) did not have	2,5% (59/2396)
Total	At least one of the criteria			33,2% (795/2396)

Acknowledgements We begin by thanking all of the men who took part in EMIS 2017 and the Belgian NGO partners. We also thank all the partners involved—Europe: PlanetRomeo, European AIDS Treatment Group (EATG), Eurasian Coalition on Male Health (ECOM), European Centre for Disease Prevention and Control (ECDC), European Monitoring Centre for Drugs & Drug Addiction (EMCDDA), European Commission (DG SANTE). BEL: Sensoa, Ex Aequo, Observatoire du SIDA et des sexualités, Sciensano.

Author Contributions Study concept and design: VB, TR, BV, CM, ET, EW, WVB, and JD. Analysis and interpretation of data: VB and TR. Drafting of the manuscript: VB and TR. Critical revision of the manuscript for important intellectual content: TR, CM, EW, CN, BV, ML, WVB and JD. Study supervision: EW and BV. All authors read and approved the final manuscript.

Funding This study is part of the Promise project 'Optimise PrEP to Maximise Impact', funded by FWO-SBO (Flemish Scientific Research – Strategic Basic Research). The data used stem from the EMIS project. EMIS-2017 was carried out as part of ESTICOM, under the service contract 2015 71 01 with The Consumers, Health, Agriculture and Food Executive Agency (Chafea), acting under powers delegated by the Commission of the European Union. EMIS-2017 was carried out under the service contract 2015 71 01. Funding was provided by FWO-SBO (Grant No. 58619).

Data Availability Individuals and organisations are welcome to use individual questions, question sets or whole EMIS-2017 questionnaires, on the understanding that they give due credit: Sigma Research @ London School of Hygiene & Tropical Medicine developed the EMIS-2017 questionnaire within the framework of the ESTICOM project funded by the EU Health Programme 2014–2020 under service contract 2015-71-01.

Declarations

Conflicts of interest No potential conflict of interest was reported by the author(s).

Ethics Approval Ethics approval was granted for the EMIS project by the Observational Research Ethics Committee at the London School of Hygiene and Tropical Medicine (reference 14421/RR/8805) on 31 July 2017.

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