



The intention to use HIV-pre-exposure prophylaxis (PrEP) among men who have sex with men in Switzerland: testing an extended explanatory model drawing on the unified theory of acceptance and use of technology (UTAUT)

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Abstract

Aim The aim of this study was to determine the intention to use pre-exposure prophylaxis (PrEP) when available and to identify predictors of the intention to use PrEP among men who have sex with men (MSM) living in Switzerland. The theoretical model drew on the Unified Theory of Acceptance and Use of Technology and considered additional variables related specifically to PrEP, HIV protection and the resources of MSM.

Subject and methods For data collection, we used an anonymous, standardized self-administered online questionnaire. In 2015, we gathered a convenience sample of 556 HIV-negative MSM living in Switzerland. We analyzed the data using descriptive and bivariate statistics and used structural equation modeling to test the hypothesized model.

Results Predictors of respondents' moderate intention to use PrEP were performance expectancy, effort expectancy, perceived social influence, concerns about using PrEP, attitudes toward condom use, negative experiences of condom use and age. These variables were predicted by HIV protection-related aspects and resources.

Conclusion The findings provide insights into the complex dynamic underlying the intention to use PrEP.

Keywords HIV/AIDS · Pre-exposure prophylaxis (PrEP) · Men having sex with men (MSM) · Acceptability · Unified theory of acceptance and use of technology · Switzerland

Introduction

As in other countries, and since the beginning of the HIV epidemic, in Switzerland men having sex with men (MSM) have been the group most affected by HIV infections. After a rebound from 2003 to 2008, the number of newly diagnosed HIV infections in MSM declined, plateauing at a level still higher than 2003 (Bundesamt für Gesundheit 2010). Also, in recent years, between 40% and 50% of new HIV diagnoses continued to be in MSM. This reflects the finding that globally MSM are disproportionately affected by HIV (Beyrer et al. 2012). In 2015, 65% of the newly detected infections among

MSM were classified as recent (Bundesamt für Gesundheit 2016), which is interpreted as an expression of an ongoing epidemic in this population (Bundesamt für Gesundheit 2008).

For populations most at risk for HIV infection, such as MSM, pre-exposure prophylaxis (PrEP) is considered an additional new option in combination HIV prevention. A number of trials have shown the efficacy of daily oral PrEP with tenofovir/emtricitabine (Truvada®) in significantly reducing the HIV infection risk among those adhering to the prescription, both among MSM (Grant et al. 2010; Liu et al. 2016; Yang et al. 2013) and other groups (Baeten et al. 2012; Riddell and Cohn 2016; Thigpen et al. 2012). More recent trials showed that 'on-demand' or 'event-based dosing' (oral use of PrEP before and after sex) also yielded high levels of efficacy among MSM (McCormack et al. 2016; Molina et al. 2015). Findings from demonstration projects in the USA suggest that the effectiveness of PrEP in MSM can also be assumed when dispensed in the settings of STI clinics and community health services (Liu et al. 2016).

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The demonstrated efficacy prompted the call to fully embrace PrEP and scale up the use of this prevention method (Beyrer et al. 2015). In 2012, the USA was the first country to approve PrEP and to issue guidelines for daily oral use of tenofovir/emtricitabine. The World Health Organization (WHO) included PrEP for MSM in the guidelines on HIV prevention in 2014 (World Health Organization 2014). Since then, a growing number of countries including France, Kenya, South Africa, Canada, Australia and, more recently, the European Union have approved the prescription of tenofovir/emtricitabine for PrEP while not necessarily integrating PrEP in their public insurance schemes or providing public cost cover.

However, the uptake of PrEP seems to be slow, also among MSM who are considered to benefit most from this new prevention option (Kirby and Thornber-Dunwell 2014). Data from the USA where PrEP was available first strengthen the assumption that HIV-negative MSM seem to be reluctant to adopt PrEP. In 2012, among a sample of black MSM living in Atlanta (USA), 7% reported currently taking PrEP (Eaton et al. 2014). The Annual American Men's Internet Survey suggests that only 2.8% of eligible MSM reported ever having used PrEP (Groves et al. 2015). A more recent study showed that in late 2014 and early 2015 a proportion of 4.9% of the participating MSM largely living in major US cities had used PrEP in the previous 12 months (Delaney et al. 2016). Studies from other countries seem to point in the same direction (Hugo et al. 2016).

Apparently, there is a gap between the use and the reported willingness to use PrEP. The reported proportion of MSM willing to use PrEP is markedly higher. Although it varies considerably among studies, the reported willingness to use PrEP ranges from 19.1% (Ding et al. 2016) to 96.2% (Peinado et al. 2013). The heterogeneity of findings seems to be due to methods, region, population and recruitment venue. A recent comprehensive meta-analysis found that the global overall acceptability among MSM was 57.8%. This proportion was assessed as moderate (Peng et al. 2017). Studies on the motivation and willingness to use PrEP among MSM living in Australia that were carried out before PrEP was approved found that, in 2011, 28.2% of the respondents were willing to use PrEP (Holt et al. 2012) and, in late 2012, 26% of the participants were likely and 10.7% very likely to use PrEP as soon as it would become available in Australia (Prestage et al. 2014). Regarding Europe, there was scant knowledge about the acceptability of PrEP among MSM as evidenced by the overview by Young and McDaid (Young and McDaid 2014). However, recent studies on the intention to use daily oral PrEP among MSM revealed that 50.3% of a sample of MSM living in London (Aghaizu et al. 2013) and 47.8% of a sample of MSM living in Scotland reported that they would likely use PrEP if it were available (Frankis et al. 2016).

Nevertheless, these findings confirm certain reservations regarding PrEP. To fully integrate this new prevention option into the public health response to HIV and AIDS and to have it play the intended substantial role in future HIV prevention (Simpson and Gumel 2017), it will be crucial to gain knowledge not only about the awareness of PrEP (see, for example, Eaton et al. 2015), but also about the intention to use this new HIV prevention option in key populations; it will be important to understand the decision making of potential users and to elicit the dynamics influencing the intention to use PrEP (Auerbach and Hoppe 2015; UNAIDS 2014).

Since PrEP is globally discussed as an additional HIV prevention method, its acceptability among different target groups has been the subject of numerous studies (see, for example, Barash and Golden 2010; Krakower et al. 2012; Leonardi et al. 2011; Mimiaga et al. 2009). Some qualitative studies explored the reasoning regarding using PrEP of people supposed to take advantage of PrEP, such as MSM (Brooks et al. 2011; Pérez-Figueroa et al. 2015). To obtain an in-depth understanding of the dynamics underlying the decision-making of MSM in favor or against the use of PrEP, however, comprehensive explanatory models will be essential.

In Switzerland, where PrEP has not yet been approved and has only been used in an off-label trial with serodiscordant heterosexual couples (Vernazza et al. 2011), little is known about the intention to use PrEP in MSM. In 2015, a qualitative focus group study provided initial insights, showing that the acceptability of PrEP varied considerably among the participants (Gredig et al. 2016). However, the study design did not allow for conclusions on the prevalence of these conceptions of PrEP use or for identifying the contribution the identified factors might make to the explanation of the participants' stated intention to use PrEP. In 2017, a brief survey of a sample of MSM with a profile on the online dating platform Grindr® established that 4.3% of the participants were using PrEP and 49.9% reported that they would consider using PrEP in the next 6 months (Hampel et al. 2017). However, this survey did not explore respondents' reasons for using PrEP. Therefore, it did not add to the understanding of the dynamics underlying the intention to use this prevention option. Before implementing PrEP in Switzerland, knowledge about its acceptability and factors influencing the intention to use it are of interest from a public health and community perspective as well as from an economic and political point of view.

Against this background, the objectives of the study were (1) to determine the intention to use PrEP among HIV-negative MSM living in Switzerland, (2) to explain their intention to use PrEP, when available, and, therefore, (3) test an explanatory model of the intention to use PrEP.

Modeling acceptance and intention to use PrEP: The theoretical framework

When we set out to model the intention to use PrEP among MSM, we chose to draw on specific models proven to be empirically effective in explaining the acceptance and use of other new technologies available. Thus, in defining the theoretical framework of this study, we built on the *Unified Theory of Acceptance and Use of Technology* (UTAUT) (Venkatesh et al. 2003). This model, developed by Venkatesh et al. (2003), combines elements of the theory of planned behavior (Ajzen 1991) and variables from previous technology acceptance models (Davis 1989). The UTAUT posits that the use of a specific technology is directly predicted by the intention to use this technology and facilitating conditions. The intention, in turn, is directly predicted by both performance expectancy and effort expectancy toward the technology in question and by social influence. Moreover, age, gender, experience and voluntariness of use act as moderators.

For this study, we specified and modified this model to fit the Swiss context: As PrEP is not available in Switzerland, we specified the model to explain the intention to use PrEP and excluded the variable ‘experiences’ in using PrEP. Given that the study focused exclusively on men, we dismissed the variable ‘gender.’ At the same time, we included variables that had proved to be predictors of PrEP use in previous studies and were corroborated by the findings of a qualitative focus group study regarding the intention to use PrEP in MSM living in Switzerland (Gredig et al. 2016). Thus, costs (Galea et al. 2011; Golub et al. 2013; Mimiaga et al. 2009; Smith et al. 2012) were integrated into effort expectancy, and the expected effectiveness of PrEP (Galea et al. 2011; Nodin et al. 2008; Smith et al. 2012) was considered in the performance expectancy. We added concerns, which included worries about possible negative side effects (Galea et al. 2011; Golub et al. 2013; Mimiaga et al. 2009; Saberi et al. 2012; Smith et al. 2012) and anticipated PrEP-related stigma (Ayala et al. 2013; Elst et al. 2013; Smith et al. 2012). Furthermore, we considered HIV-protection-related aspects as HIV risk behavior, negative experiences of condom use, attitudes toward condom use (Brooks et al. 2012; Eisingerich et al. 2012; Holt et al. 2012; Leonardi et al. 2011) and having been treated for a sexually transmitted infection (STI). We also kept age (Eisingerich et al. 2012; Holt et al. 2012; Krakower et al. 2012) and included further resources as income (Barash and Golden 2010; Eisingerich et al. 2012; Holt et al. 2012), education (Khawcharoenporn et al. 2012; Mimiaga et al. 2009; Zhang et al. 2013) and another aspect known to influence HIV-protective behavior, namely the type of somatic culture men have adopted (Gredig et al. 2007). Somatic culture refers to a system of deeply internalized rules and implicit schemata adopted in the socialization process that mold a person’s relationship, perception, thinking and acting regarding his or her own body (Boltanski 1976).

The variables were systematized and configured in three groups: PrEP-related aspects, HIV protection-related aspects and the resources of MSM. This model is shown in Fig. 1.

Drawing on this model, we hypothesized that (1) the intention to use PrEP would be predicted directly by PrEP-related aspects, including performance expectancy, effort expectancy, social influence and concerns about using PrEP. We further hypothesized that (2) these variables would, in turn, be predicted by HIV protection-related aspects, including HIV-related risk behavior, negative experiences of condom use, attitudes toward condom use and STI diagnoses, and treatment in the previous 6 months, which might also have direct effects on the intention to use PrEP. Finally, we surmised that (3) the resources of MSM, namely, somatic culture, education, age and income, would predict HIV and PrEP-related aspects and might also have a direct effect on the intention to use PrEP.

Methods

Design and procedure

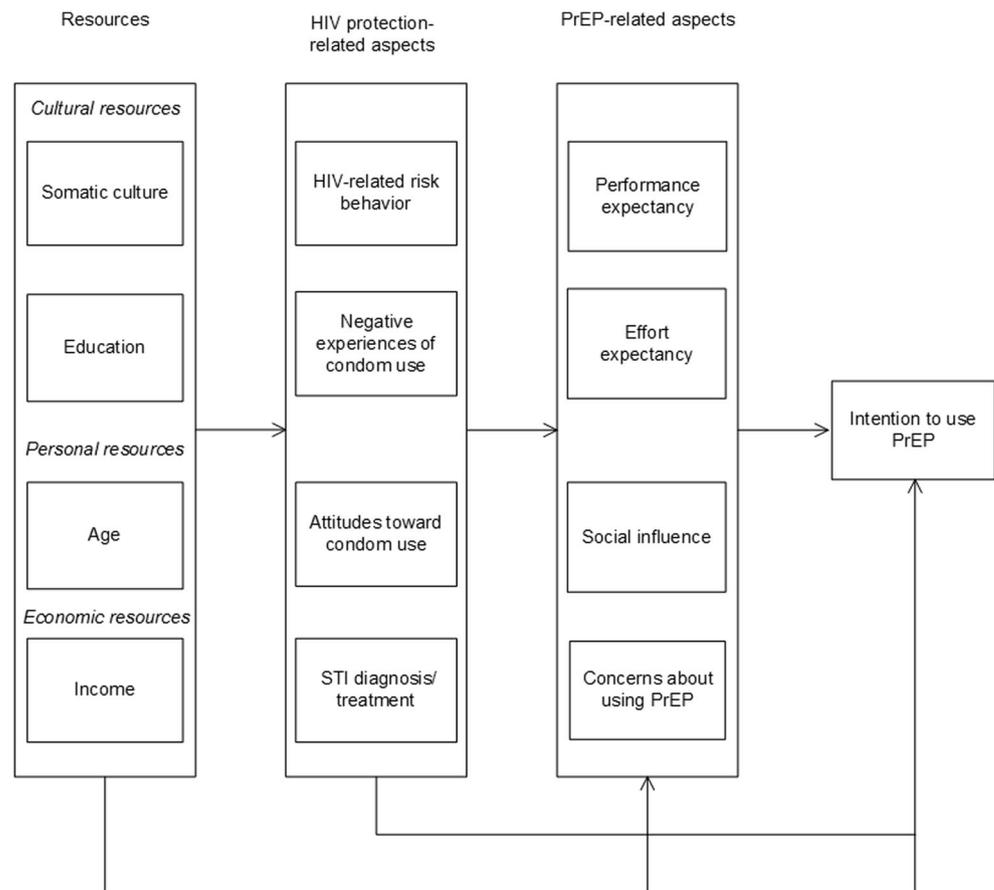
The study design was cross-sectional. We collected the data by means of an anonymous, standardized self-administered questionnaire. The questionnaire was made available either online or in a paper-and-pencil format. The online version was constructed using ‘EFS Survey’ (Quest Back AG) and made accessible with an open access link that could be distributed and redistributed using any communication media. The paper-and-pencil version was made available through the study-specific website.

The questionnaire included a short description of PrEP drawing on the publications of the US Centers of Disease Control and Prevention (2014). It provided information on the application, effectiveness and potential side effects of a regime of daily oral PrEP and provided a picture of the tablet alongside a scale bar. Two experts reviewed the description: the manufacturer’s local Senior Medical Manager and an HIV specialist involved in the Swiss HIV Cohort Study.

We tested the questionnaire in a pre-test with 32 MSM to verify its comprehensibility and usability and gathered feedback from survey experts and medical professionals. As a result of the feedback, we slightly adjusted the wording of the questionnaire. The internal consistency of all scales proved to be acceptable.

Three identical versions of the questionnaire (German, French and Italian) were prepared. The first version was in German. To obtain equivalent French and Italian versions, the German questionnaire was translated into French and Italian, with the outcome being verified using a back-translation procedure. It took approximately 25 min to complete.

Fig. 1 The hypothetical model explaining the intention to use PrEP in MSM



Informed consent was obtained from all individual participants included in the study. The questionnaire included information about the study and instructions, the affirmation that participation was voluntary, a confirmation of anonymity and the participant's consent that they agreed to the inclusion of their data in the analysis. We also set up a website providing information about the study and offered the opportunity to contact the research team if there were any questions or a need for further information. All data were treated confidentially; only the research team had access to the data.

We recruited participants through different channels: We set up profiles on several online dating platforms designed for MSM, posted on social media, distributed flyers and posters in bars and saunas where MSM meet, displayed material at events and parties organized by and for gay and bisexual men and placed information in gay-specific sexual health clinics. In addition, we drew attention to our study by publishing interviews about the project in local gay magazines and newspapers. From May 2015 to December 2015, we gathered a convenience sample of 659 HIV-negative MSM living in Switzerland. Participants who reported being HIV-positive or of unknown HIV status, those who were not living in Switzerland, did not answer the question about the intention to use PrEP or did not give their consent were excluded from

the sample. In total, 556 participants were included into the final analyses.

Measures

The measures of the model variables are listed in Table 1. Drawing from previous tests of the UTAUT (Holden and Karsh 2010; Oye et al. 2014; Venkatesh et al. 2003), we used the intention to use PrEP to assess the acceptability of PrEP. To measure the PrEP-related aspects stemming from the UTAUT, validated instruments were used (Holden and Karsh 2010; Oye et al. 2014; Venkatesh et al. 2003). The concerns about PrEP were assessed using a formative measure (Ayala et al. 2013; Golub et al. 2013). HIV risk behavior was measured by the proportion of unprotected anal intercourse with casual partners during the previous 6 months ranging from 0 to 100% (Kalichman et al. 2005; Nideröst et al. 2011). To assess the negative experiences of condom use, six items were used in accordance with the results from a previous study (Gredig et al. 2016). Attitudes toward condoms were measured drawing on Reece et al. (2010), using ten items on a 7-point semantic differential scale (Porst 2011). Having experienced sexually transmitted infections (STI) was operationalized as having been diagnosed and treated for an STI during the previous 6 months

Table 1 Measures of the model variables

Variable	Number of items	Response scale	Range of calculated scores	Cronbach's alpha	Source
Acceptability					
Intention to use PrEP 'How likely are you to use PrEP when available in Switzerland?'	1	Seven-point Likert scale ranging from 1 = 'very unlikely' to 7 = 'very likely'	1–7		
PrEP-related aspects					
Performance expectancy e.g., 'I could live my sexuality in a less complicated way'	11	Seven-point Likert scale ranging from 1 = 'completely disagree' to 7 = 'completely agree'	1–7	0.91	(Holden and Karsh 2010; Oye et al. 2014; Venkatesh et al. 2003)
Effort expectancy e.g., 'Taking a pill every day would be easy for me'	8	Seven-point Likert scale ranging from 1 = 'completely disagree' to 7 = 'completely agree'	1–7	0.75	(Holden and Karsh 2010; Oye et al. 2014; Venkatesh et al. 2003)
Social influence e.g., 'People who are important to me would recommend that I use PrEP'	4	Seven-point Likert scale ranging from 1 = 'completely disagree' to 7 = 'completely agree'	1–7	0.92	(Holden and Karsh 2010; Oye et al. 2014; Venkatesh et al. 2003)
Concerns about using PrEP e.g., 'I'm worried about negative long-term effects' or 'People in my environment could think I was HIV positive'	17	Seven-point Likert scale ranging from 1 = 'completely disagree' to 7 = 'completely agree'	1–7	0.86	(Ayala et al. 2013; Golub et al. 2013)
HIV protection-related aspects					
Proportion of unprotected anal intercourse with casual partners 6 months prior to survey	1		0–100		(Kalichman et al. 2005; Nideröst et al. 2011)
Negative experiences of condom use e.g., 'The condom slipped off'	6	Seven-point Likert scale ranging from 1 = 'never' to 7 = 'always'	1–7	0.64	(Gredig et al. 2016)
Attitudes toward condoms e.g., 'It is a relief to use a condom' and 'Using a condom is boring'	10	Seven-point semantic differential scale ranging from -3 to +3	1–7	0.89	(Reece et al. 2010)
Being diagnosed and treated for an STI 6 months prior to survey	1	Yes/no	0–1		(Nideröst et al. 2011)
Resources					
Age in years	1		15–78		
University or University of Applied Sciences Degree	1	Yes/no	0–1		(Federal Statistical Office 2008)
Personal income in CHF	1	1 = Less than 13,000 2 = 13,001–26,000 3 = 26,001–39,000 4 = 39,001–52,000 5 = 52,001–65,000 7 = 78,001–91,000 8 = 91,001–104,000 9 = 104,001–127,000 10 = 127,001–150,000 11 = 150,001–175,000 12 = more than 175,001	1–12		(Federal Statistical Office 2015)
Somatic culture	1	1 = visionary type 2 = ambivalent type 3 = functionalistic type 4 = easy-going type	–		(Gredig et al. 2007; Gredig et al. 2002)

(Nideröst et al. 2011). Resources included the respondents' age, their formal level of education, their personal income per month and the type of somatic culture they had adopted. We used measures adapted to the Swiss context to capture formal levels of education and income (Federal Statistical Office 2008, 2015). To identify the type of somatic culture, we used a

formative index including 22 items expressing orientations in dealing with the body that had been validated in prior research (Gredig et al. 2007). In men living in Switzerland, four types of somatic cultures have been identified: the visionary, ambivalent, functionalistic and 'easy-going' type of somatic culture (see Gredig et al. (2002) for a detailed description).

Data analysis

Data were imported from the EFS-Survey into IBM SPSS 22. First, we performed descriptive statistics by conducting frequency analysis and described the results using central tendency, dispersion (M, SD) and distribution where appropriate. Second, we determined the correlations of model variables using bivariate and multivariate analyses. Third, the hypothesized causal paths were analyzed using structural equation modeling. Variables that were measured on a nominal level, such as the type of somatic culture adopted and the level of formal education, were transformed into dummy variables. As structural equation modeling requires complete data sets and given that 14 variables were implied, missing data could have entailed the exclusion of a number of participants and potential bias. To avoid exclusions, we performed a multiple imputation as suggested by Lüdtke et al. (2007). Structural equation modeling was performed using the Generalized Least Square Estimates method in AMOS 22. All variables were entered into the equation at once and paths were considered according to the results of the previous multivariate analyses.

Results

Sample description

The mean age of the participants was 40.5 years ($SD = 11.9$) ranging from 15 to 81 years. About 43.7% ($n = 243$) of the respondents reported being single, while 50.9% ($n = 283$) were in a steady relationship with a man and 5.7% ($n = 32$) were in a steady relationship with a woman. The mean duration of these relationships was 8.6 years ($SD = 7.6$), ranging from 1 month to 35 years. A proportion of 13.5% ($n = 38$) of the participants reported having a seropositive steady partner; 82.6% ($n = 232$) reported having a seronegative partner, and 3.9% ($n = 11$) reported being unaware of their partner's serostatus. Regarding the type of somatic culture adopted, 30.1% ($n = 167$) of the participants identified with a visionary, 22.7% ($n = 126$) with an ambivalent, 24.3% ($n = 135$) with a functionalistic and 22.9% ($n = 127$) with an 'easy-going' type of somatic culture. Table 2 displays further sociodemographic characteristics and resources of the sample.

Intention to use PrEP

In our sample, the intention to use PrEP was moderate. About 12.9% ($n = 72$) of the participants reported that they were very likely to use PrEP when available, and 26.4% ($n = 147$) reported they were likely to somewhat likely to do so. Almost 20.5% ($n = 114$) were very unlikely to use it, and 30.4% ($n = 169$) were unlikely to somewhat unlikely to use it. Only 9.7% ($n = 54$) were undecided. The mean

score of intention to use PrEP was 3.7 ($SD = 2.1$) on a scale ranging from 1 to 7 (see also Table 3).

PrEP-related and HIV protection-related aspects

The means and standard deviations of PrEP-related and HIV protection-related aspects are shown in Table 3. A proportion of 83.5% of the participants ($n = 464$) reported a sexual encounter with at least one casual partner during the previous 6 months. The median number of casual partner in the previous 6 months reported was 7 ($IQR = 3-14$), the median number of occasions on which they had sexual intercourse with casual partners was 12 ($IQR = 5-24$). The HIV risk behavior (i.e., condomless sex) was moderate. Among those having had sex with a casual partner, 53% ($n = 239$) reported consistent condom use in all these encounters, while 9.5% ($n = 43$) reported no condom use at all. About 16.4% ($n = 91$) reported having been treated for an STI in the previous 6 months. The most frequent diagnoses were gonorrhea (31.9%; $n = 29$), chlamydia (28.6%; $n = 26$) and syphilis (20.9%; $n = 19$).

Regarding the negative experiences with condoms, only 16.8% ($n = 93$) reported having difficulties in the use of condoms (scores between 4 and 7). About 51% ($n = 282$) had a positive attitude toward condoms (scores between 5 and 7).

Test of the model

The analysis revealed that participants' intention to use PrEP was predicted by the four PrEP-related aspects: performance expectancy ($\beta = 0.25$), effort expectancy ($\beta = -0.19$), social influence ($\beta = 0.31$) and concerns ($\beta = -0.15$). Furthermore, it is, although less strongly, predicted by HIV protection-related aspects: attitudes toward condom use ($\beta = -0.07$) and negative experiences of condom use ($\beta = 0.09$). Additionally, one of the resources, respondents' age ($\beta = -0.09$) was a predictor of the intention to use PrEP. The strongest predictor, however, was social influence.

These variables, in turn, were predicted by variables conveying HIV protection-related aspects and resources. Thus, performance expectancy was predicted by negative experiences of condom use ($\beta = 0.18$), attitudes toward condom use ($\beta = -0.21$), age ($\beta = -0.08$) and income ($\beta = 0.14$). Having been treated for an STI in the previous 6 months ($\beta = 0.08$) was not a significant predictor. The strongest predictor was attitudes toward condom use. Effort expectancy was predicted by the income ($\beta = -0.15$), age ($\beta = -0.10$) and having adopted an ambivalent type of somatic culture ($\beta = -0.08$). The strongest predictor was income. Social influences were predicted by risk behavior in the 6 months prior to the survey ($\beta = 0.08$), negative experiences of condom use ($\beta = 0.23$) and income ($\beta = 0.10$). Attitudes toward condom use ($\beta = -0.07$) were not significant. The strongest predictor was

Table 2 Socio-demographic characteristics and resources of participants (N = 556)

Variable	N	%
Sexual orientation (N = 555)		
Homosexual, gay	489	88.1
Bisexual	62	11.2
Pansexual	2	0.4
Other	2	0.4
Formal education (N = 555)		
Primary school	1	0.2
Compulsory education	14	2.5
Grammar school, high school, vocational baccalaureate college	43	7.7
Teacher training college	5	0.9
Apprenticeship, college of trade and industry (full-time)	110	19.8
Advanced professional training	78	14.0
Higher professional college	58	10.4
University/university of applied sciences	246	44.3
Employment situation ^a (N = 556)		
Full-time employment	382	68.7
Part-time employment	93	16.7
University studies	48	8.6
Unemployed	14	2.5
Retired	20	3.6
Unable to work	10	1.8
Performing housework	3	0.5
Self-employed	7	1.3
Other	5	0.9
Income in CHF (N = 546)		
Less than 13,000	23	4.2
13,000–26,000	20	3.7
26,001–39,000	33	6.0
39,001–52,000	37	6.8
52,001–65,000	36	6.6
65,001–78,000	64	11.7
78,001–91,000	66	12.1
91,001–104,000	78	14.3
104,001–127,000	70	12.8
127,001–150,000	53	9.7
150,001–175,000	25	4.6
More than 175,000	41	7.5
Area of residence/population size (N = 555)		
Rural area	123	22.2
Small town (less than 20,000 inhabitants)	91	16.4
Town (21,000–100,000 inhabitants)	73	13.2
City (more than 100,000 inhabitants)	268	48.3
Language (N = 556)		
German speaking	441	79.3
French speaking	109	19.6
Italian speaking	6	1.1
Country of birth (N = 555)		
Switzerland	428	77.1
Other	127	22.9

Note: ^a multiple answers possible

negative experiences of condom use. Lastly, concerns were predicted by attitudes toward condom use ($\beta = -0.09$), having been treated for an STI in the previous 6 months ($\beta = -0.08$), having adopted a visionary type of somatic culture ($\beta = -0.08$) and the level of formal education ($\beta = -0.10$). All of these predictors were rather weak. The strongest was the level of formal education.

Regarding these HIV protection-related aspects, analysis shows that the level of HIV risk behavior in the 6

months prior to the survey was predicted by formal education ($\beta = -0.10$) while negative experiences of condom use were predicted by having adopted a visionary type of somatic culture ($\beta = -0.11$) and by the level of formal education ($\beta = -0.10$). Having been treated for an STI in the previous 6 months was predicted by age ($\beta = -0.12$).

The model showed a good fit (GFI = 0.986, AGFI = 0.968) and proved to be satisfactorily parsimonious (PGFI = 0.423). The tested model explained 50.3% of

Table 3 Means and standard deviations of intention to use PrEP, PrEP-related and HIV protection-related aspects (N = 556)

	Mean	Standard deviation
Intention to use PrEP	3.7	2.11
PrEP-related aspects		
Performance expectancy (1–7)	4.4	1.41
Effort expectancy (1–7)	3.2	1.12
Social influence (1–7)	3.3	1.67
Concerns (1–7)	3.8	1.12
HIV protection-related aspects		
Negative experiences of condom use (1–7)	2.0	0.80
Attitudes toward condom use (1–7)	4.5	1.13
HIV risk behavior (0–100)	19.1	31.85
Treated for an STI (0/1)	0.2	0.37

the variance of the intention of MSM to use PrEP when available. The standardized regression weights implied are available in Table 4. Figure 2 shows the path diagram of the final model explaining the intention to use PrEP.

Discussion

These results can be discussed from various perspectives. First, from an HIV-prevention perspective, we acknowledge that the respondents’ intention to use PrEP was on a moderate level. This was also the case for the HIV-negative MSM with casual partners in our sample ($M = 3.81$, $SD = 2.12$). Overall, 12.9% were very likely and 26.4% were likely or somewhat likely to use PrEP when available. Thus, together, 39.3% reported some intention to use PrEP in the future.

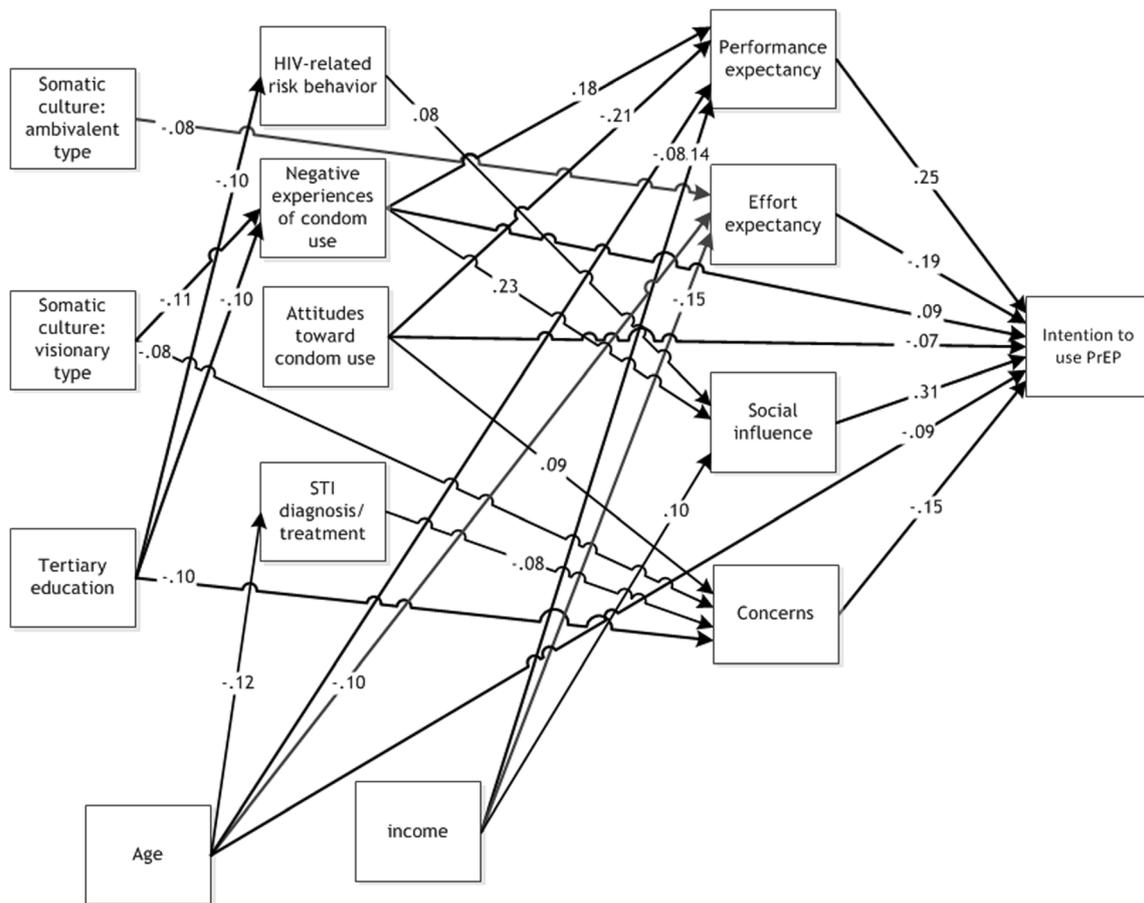
Thus, in our sample, the proportion of MSM intending to use PrEP was smaller than in the sample of the brief survey comprising MSM living in Switzerland with a profile on the online dating platform Grindr®. Among those MSM, 49.9% reported an intention to use PrEP (Hampel et al. 2017). Our findings approximate those on MSM living in Australia before PrEP became available. In 2012, 10.7% of the respondents of the Australian study were very likely and 26% likely to use PrEP when it became available (Prestage et al. 2014).

Second, we would like to draw attention to the model tested. Regarding the variables drawn from the Unified Theory of Acceptance and Use of Technology (UTAUT), the analysis confirmed the performance expectancy, effort expectancy

Table 4 Unstandardized, standardized and significance levels for model in Fig. 2 (standard errors in parentheses; N = 556)

Parameter estimate			Unstandardized	Standardized	p
Experiences of condom use	<---	Somatic culture: visionary type	-0.19 (0.07)	-0.11	0.004
Experiences of condom use	<---	Tertiary education	-0.15 (0.06)	-0.10	0.012
Risk behavior	<---	Tertiary education	-6.41 (2.57)	-0.10	0.012
Treated for an STI	<---	Age	-0.00 (0.00)	-0.12	0.004
Effort expectancy	<---	Age	-0.01 (0.00)	-0.10	0.011
Concerns	<---	Attitudes toward condom use	0.09 (0.04)	0.10	0.018
Social influence	<---	Attitudes toward condom use	-0.11 (0.06)	-0.08	0.077
Performance expectancy	<---	Attitudes toward condom use	-0.27 (0.05)	-0.21	≤0.001
Performance expectancy	<---	Negative experiences of condom use	0.33 (0.07)	0.18	≤0.001
Social influence	<---	Negative experiences of condom use	0.49 (0.09)	0.23	≤0.001
Performance expectancy	<---	Age	-0.01 (0.00)	-0.08	0.029
Social influence	<---	Risk behavior	0.00 (0.00)	0.08	0.036
Performance expectancy	<---	Treated for an STI	0.25 (0.14)	0.07	0.063
Concerns	<---	Treated for an STI	-0.25 (0.12)	-0.08	0.032
Performance expectancy	<---	Income	0.33 (0.07)	0.14	≤0.001
Effort expectancy	<---	Income	-0.06 (0.02)	-0.15	≤0.001
Social influence	<---	Income	0.06 (0.02)	0.10	0.015
Concerns	<---	Tertiary education	-0.23 (0.09)	-0.10	0.008
Effort expectancy	<---	Somatic culture: ambivalent type	-0.22 (0.10)	-0.08	0.025
Concerns	<---	Somatic culture: visionary type	-0.20 (0.10)	-0.08	0.043
Intention to use	<---	Performance expectancy	0.36 (0.06)	0.25	≤0.001
Intention to use	<---	Effort expectancy	-0.37 (0.07)	-0.19	≤0.001
Intention to use	<---	Social influence	0.39 (0.05)	0.31	≤0.001
Intention to use	<---	Concerns	-0.28 (0.06)	-0.15	≤0.001
Intention to use	<---	Attitudes toward condom use	-0.13 (0.06)	-0.07	0.039
Intention to use	<---	Age	-0.02 (0.01)	-0.10	0.003
Intention to use	<---	Negative experiences of condom use	0.23 (0.09)	0.09	0.013

Note: N = 556; method: generalized least squares estimates; GFI = 0.99, AGFI = 0.97, PGFI = 0.42; $\chi^2 = 54.05$, $p = 0.17$; CMIN/df = 1.21; SRMR = 0.04; adj. $R^2 = 0.50$



Note: N=556; Method: Generalized Least Squares Estimates; GFI = 0.986, AGFI = 0.968, PGFI = 0.423; $\chi^2 = 54.045$, $p = 0.167$; CMIN/df = 1.21; SRMR = 0.0359; adj. $R^2 = 0.50$. Non-significant standardized coefficients ($p > 0.050$) and correlations among the predictors are not illustrated.

Fig. 2 Visualization of the results of structural equation modeling. Note: N = 556; method: generalized least squares estimates; GFI = 0.986, AGFI = 0.968, PGFI = 0.423; $\chi^2 = 54.045$, $p = 0.167$; CMIN/df = 1.21;

SRMR = 0.0359; adj. $R^2 = 0.50$. Non-significant standardized coefficients ($p > 0.050$) and correlations among the predictors are not illustrated

and social influence as predictors of the intention to use the new prevention technology. Notably, social influence turned out to be the strongest predictor, clearly outperforming the others. The UTAUT posits that age moderates these variables. In our study, age predicted the intention to use PrEP directly.

The analysis also confirmed that concerns were a predictor of the intention to use PrEP. In this way, the data from this investigation found support for the inclusion of this variable drawn from research regarding the willingness to use PrEP. Finally, it is noteworthy that two HIV protection-related aspects—attitudes toward condom use and negative experiences of condom use—also directly predicted the intention to use PrEP. Although their effects were small, they draw attention to the fact that the intention to use the new option in HIV prevention is linked with attitudes toward and experience of the use of a preceding and concurrent method.

The subsequent analysis not only confirmed the inclusion of HIV protection-related aspects but also considered

participants' resources. Indeed, the PrEP-related aspects were largely determined by the HIV protection-related aspects and resources. The resources predicted variables on three tiers of the model: Age predicted not only an HIV protection-related aspect (having been treated for an STI in the previous 6 months) but also PrEP-related aspects (performance expectancy and effort expectancy) and, directly, the intention to use PrEP. Income predicted directly and exclusively PrEP-related aspects (performance expectancy, effort expectancy and social influence). The level of formal education predicted a PrEP-related aspect (concerns) and two HIV protection-related aspects (HIV risk behavior and negative experiences of condom use). Having adopted a visionary type of somatic culture predicted a PrEP-related aspect (concerns) and an HIV protection-related aspect (experiences of condom use) while having adopted an ambivalent type of somatic culture predicted a PrEP-related aspect (effort expectancy). This depicts findings of previous research evidencing that men having adopted

a visionary or ambivalent type of somatic culture were likely to integrate condom use: In both types condom use proved compatible with the orientations guiding the specific way to deal with their body (Gredig et al. 2002; Nideröst 2007). In sum, the data from this investigation support the hypothesis that all variables added to the model contribute to significant causal paths leading to the intention to use PrEP.

Third, we reflect on the use of the UTAUT. As highlighted above, the variables from the UTAUT predicted the intention to use PrEP. This suggests that the basic assumption of this model designed to explain acceptance of technology in general is also applicable to HIV chemoprophylaxis. Concomitantly, the test of the expanded model showed that it was worth extending the model and including PrEP specific variables (specific concerns about PrEP) as well as variables that express issues specific to HIV protection. These variables directly contribute to the explained variance in the intention to use PrEP.

The advantage of extending and contextualizing the model was, however, that it permitted the identification of various causal paths leading (1) from personal and economic as well as socio-cultural resources formed in the socialization process, through (2) HIV protection-related attitudes, experiences, views and behaviors (implying risks and respondents' ways of forming relationships) and (3) the participants' rating of the new prevention methods, to (4) their intention to use PrEP.

The findings also demonstrated the importance of acknowledging and considering the complexities of decision making for MSM on PrEP use. Our tested model also took account of the fact that, in the present situation, PrEP would not only be made known and—in the future might be made available—to MSM who were at the onset of their active sexual life and would have to define a personal HIV protection strategy for the first time in their lives. Rather, PrEP would be introduced to MSM who largely began to define their ways of dealing with the challenge and risk of infection from HIV some time ago, often even decades ago. Against this background, the model implied—and was confirmed in this respect—that MSM, in particular those with a longer sexual biography, would gauge the new prevention option in the light of the personal HIV-protection strategies they adopted, consider their experiences and evaluate PrEP use against their sexual trajectories and perceived risks (regarding the latter see, for example, Imhof et al. (2014)). From the perspective of those with positive attitudes to condom use, who had experienced few problems with it, it might make sense to maintain the condom use with which they were comfortable and abstain from PrEP use.

Limitations

This study had several limitations. The data are self-reported, which may entail a bias regarding the reported levels of sexual risk behavior and condom use, although evidence has relativized this concern (Weinhardt et al. 1998). Regarding the scales

used, the internal consistency of the measure of negative experiences of condom use was not fully satisfactory (Cronbach's alpha = 0.64). Furthermore, the study was based on a convenience sample of MSM, and the findings can only be generalized with considerable caution. However, given that the size and the characteristics of the MSM population are not known (Marcus et al. 2009), more stringent sampling strategies are not applicable. Nevertheless, the high proportion of participants holding a higher educational degree could entail a bias although it parallels findings from other studies on MSM in Switzerland (Locicero et al. 2012). The number of respondents from the Italian-speaking area is small and reflects difficulties in reaching these MSM that is also known from prior research and prevention practice. Still, the sample was diverse and included MSM from various recruiting sites. Lastly, as PrEP is still unavailable in Switzerland, this study does not inform about the intention to use it under real-life conditions. Moreover, given the gap between intention and use, conclusions about future use would have to be drawn with caution.

Conclusion

As the first of its kind, the present study on the intention to use PrEP provides insight into the complex dynamic underlying the intention to use this new prevention option among MSM in Switzerland. It takes a significant step beyond describing those willing to use PrEP and contributes to the development of an explanatory model of PrEP uptake while connecting to the research on the acceptability of new technology in other fields.

The findings also provide a more tangible result as they provide clues to an advanced understanding of the decision making of MSM regarding PrEP. They provide health professionals, prevention providers, HIV/AIDS service organizations and activists with an idea of the backgrounds and dynamics within which the decision to use PrEP is embedded. When drawing on both the theoretical and practical conclusions from these findings, we have to be aware of the context the men under investigation are living in. In Switzerland, MSM have been addressed specifically by a prevention campaign with wide coverage that has continued to recommend condom use since its beginning 30 years ago (Kocher 1993). In a different context, the interplay of HIV protection-related and PrEP-related aspects could be different. Nevertheless, the present model may serve as a basis for further investigation into the explanation of the intention to use PrEP.

For health promotion and prevention, it would be important to make PrEP available for MSM at high risk for HIV infection. Considering that a supportive social influence, high performance expectancy as well as low effort expectancy and low concerns were the main predictors increasing the intention to use PrEP in the surveyed MSM, public health stakeholders should broader inform prospective users about this prevention

option. For example, PrEP could be promoted as an additional prevention method within a combined HIV-prevention approach (condom use and treatment as prevention) in prevention campaigns and personal counseling addressing especially HIV-negative MSM with a negative attitude toward condoms or who have experienced problems with condom use in the past. For those MSM who have had little problem with condom use, there might be good reasons to maintain the condom use with which they were comfortable and to abstain from PrEP use. Thus, the promotion of PrEP should be carefully worded so as not to withdraw the legitimacy of condom use within the MSM community and should continue supporting condom use as an eligible prevention option.

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Compliance with ethical standards

Ethical approval This study was fully evaluated and approved by the Swiss National Science Foundation. It did not have to be submitted to an additional formal external ethics committee. All procedures performed in studies involving human participants were in accordance with the ethical standards of the Swiss National Science Foundation and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

Conflict of interest The authors declare that they have no conflict of interest. The main granting institution is an independent foundation. The company producing the substance that plays a central role in the issue under investigation neither motivated this study nor was it involved in the elaboration of the study protocol or the course of investigation. There were also no conflicting loyalties. A representative of the company was consulted to phrase the brief product description used in the course of the questionnaire.

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