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Barriers and Facilitators of PrEP uptake among MSM in Europe: a systematic review and evidence synthesis using the COM-B model

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Abstract

Background. After 6 years since PrEP's approval in Europe, its uptake among eligible MSM continues to be well below the "zero transmission" targets set by the UNAIDS. This study gathers the reported motivators and barriers that influence the intention of PrEP use by eligible HIV-negative MSM in Europe. The findings are contrasted to the COM-B model, which is the core of the Behaviour Change Wheel, a theory widely used to design social interventions. The objective is to test the COM-B viability for this social key issue for potential further implementation research. **Methods.** A systematic search through PubMed and Scopus databases was conducted to find relevant studies published from 2016 onwards. Thematic analysis was used to fit the results into the COM-B model. **Results.** 191 studies found through databases were assessed for eligibility, of which 17 full text were included in the final analysis plus three additional studies from grey literature. Most findings could be categorized into the COM-B factors (psychological capability, physical capability, physical opportunity, social opportunity, reflective motivation, automatic motivation). However, some categories fell outside of the COM-B model therefore two additional factors were added (behavioural and demographic). **Conclusions.**The COM-B model is an effective behavioural theory to analyse this particular issue and it could be a starting point for further research on how to design theory-informed interventions, however it is incomplete. Specific behavioural and demographic characteristics of different groups within the MSM population should be considered in intervention design.

Keywords. Preexposure prophylaxis; MSM; use; facilitators and barriers; COM-B

Introduction

Problem statement and relevance

Since its discovery 40 years ago, HIV has continued to be a pandemic with no cure, resulting in 79.3 million infections and 36.3 million deaths around the world and an estimated 37.7 million people globally living with HIV in 2020 (UNAIDS, 2021; WHO, 2021). HIV transmission affects over two million people in the European region (ECDC, 2020) where new diagnoses continue to increase, particularly among men who have sex with men [MSM] (ECDC, 2020).

Pre-exposure prophylaxis (PrEP) is a promising new HIV prevention option that, when used consistently, protects people not infected with the virus against HIV acquisition and could drastically lower the number of new HIV infections (Grant et al., 2010; Fonner et al., 2016; Baeten et al., 2012; Calabrese, 2020). PrEP is taken as a pill that consists of a combination of

two antiretroviral drugs: emtricitabine and tenofovir disoproxil fumarate (FTC-TDF) (Grant et al., 2010), it is proven to reduce HIV risk of infection up to 92% and is prescribed for people at high risk for HIV acquisition: having had sex with a partner with HIV infection, bacterial STIs or inconsistent use of condoms (CDC, 2022; Underhill et al., 2015).

Upon PrEP's approval in Europe in 2016 (EMA Press release, 2016), the World Health Organization [WHO] and the European Centre for Disease Prevention and Control [ECDC[1]] recommended it to be integrated in EU member states and to be offered as additional prevention for those at substantial risk, starting with prescriptions to MSM (ECDC, 2015; WHO, 2016) as it is a community with higher disease prevalence compared to other groups and has behavioural and biologic factors that can increase the risk for STIs (CDC, 2020). However, the expansion of access to PrEP in Europe remains slow, and the uptake is especially low among the populations at high risk (ECDC, 2021). For instance, it has been estimated that in 2018 only 54% of targeted people were using PrEP (Dubov, 2018). In Europe up to 67% of PrEP users were obtaining it via informal channels (van Dijk et al., 2020), and approximately 500.000 eligible MSM that would be likely to use PrEP could not access it (Hayes et al., 2019), which shows there are needs in the European MSM community that are not being met. The scale-up of PrEP programs has become a priority to end the AIDS epidemic by the year 2030 (UNAIDS, 2021) for which the UNAIDS had set the following targets: that 90% of young people have access to PrEP, as well as the skills and capacity to protect themselves from HIV and zero discrimination by 2020 (UNAIDS, 2020). However, this goal is yet to be met in Europe.

Despite of the UNAIDS, the WHO and the ECDC efforts to implement PrEP this complex problem persists: There is a drug currently available that can, with almost 100% of efficacy, prevent of HIV transmission -potentially capable of ending HIV epidemic- and there is a population in need but choosing not to use this method. The question is: Why?

The act of using a drug (or not) is a behaviour, and individual behaviour is complex and simultaneously influenced by different factors and to different levels: individual, interpersonal, and social/structural. This multifactor makes behaviour a difficult target for intervention and policymakers, who need to know what causes a problem to attempt solving it. For this reason, it is needed to know what makes eligible MSM to not use PrEP.

Research has identified several barriers that may be affecting both PrEP uptake and adherence among MSM which include lack of awareness, HIV-related stigma and homonegativity, geographical isolation and misinterpretation of prevention campaigns

[1] Abbreviation list is available at the appendix section.

(Matacotta et al., 2020). This suggests that a possible explanation for the low success of PrEP implementation could be the inefficient or insufficient use of theory informed interventions.

This study will combine aspects of different disciplines: public health (promoting the use of a drug to prevent and reduce the spread of HIV), social psychology (studying the behaviour of a vulnerable population through evidence-based theory), and social policy (as it aims at contributing to evidence-based interventions for a target group). With the intention of shining a new light on the potential gaps in existing research from a theoretical approach using a well-known model (COM-B) which could be a start to design more effective interventions by policymakers in the future.

Existing research

A recent global scoping review by Kamitani et al. (2019) that included 561 citations mapped the topics and characteristics of the studies on PrEP up until 2019. The review demonstrates that after 2012, when the WHO released the first PrEP guidance, studies about PrEP increased rapidly. Almost half of these studies were conducted in non-US countries (46.7%). MSM is the most frequently studied population (47.4%), significantly more than other vulnerable minorities such as sex workers (3.7%) or substance users (5.5%). This is likely due to the WHO's recommendation of PrEP use in 2012 that was focusing especially on MSM. It's important to note that research on the role of health providers is scarce even though it may play a key role in PrEP uptake as authors indicate (Kamitani et al., 2019).

The study by Kamitani et al. (2019) shows that there are research gaps in topics that could address key aspects that influence PrEP use in each respective area. Most of the studies conducted in the US revolved around behaviours related to PrEP uptake (52.6%) and adherence (46.8%), while there is less focus on efficacy and economic evaluation, factors that especially have a big impact in poor resource settings (Yi et al., 2017). Similarly, most studies conducted in non-US countries were about Efficacy and Safety (55.8%), while having fewer studies on PrEP awareness by potential PrEP users and providers (Kamitani et al., 2019). It has been cited that a lack of knowledge about PrEP -and HIV-related stigma are often associated with PrEP non-use as well as not prescribing (Grace et al., 2018; Pleuhs et al., 2020) becoming a major barrier to PrEP uptake among a vulnerable population.

Since the discovery of PrEP, the first step was to test its efficacy and safety. Thus, studies on PrEP efficacy and safety formed the first category, which made up 20.9% of the total studies reviewed by Kamitani et al (2019). Thereafter, researchers started assessing the cost-effectiveness and economic evaluation of the drug, which accounted for 5.2% of the

studies. Studies that discuss the ethical issues of conducting PrEP trials and report the experiences and reactions of participants make up third the category, which constitutes 4.2% of the total PrEP research literature reviewed by Kamitani et al. (2019). Many studies focused on the considerations, issues, and experiences of users while on PrEP; This included concerns about risk compensation or side effects, studies assessing the adherence to PrEP, the incidence of STIs while on PrEP, and judgements about risk perception or the experiences of sero-discordant couples desiring a child, among others. This fourth category regarding considerations while on PrEP stacks up to 28.2% of the total reviewed studies. The most studied category however, which accounted for 41.3% of the PrEP research literature at the time, existed of studies discussing potential PrEP users or prescribers. This fifth category has been studied disproportionately more than the other categories in PrEP research, as it takes up almost half of the existing studies. These studies look into the behavioural aspects and experiences of potential PrEP users and the criteria of health providers considering prescribing PrEP, but who finally decide to not do so.

This category could be divided into two subcategories: barriers for potential PrEP users and barriers for potential PrEP prescribers. Most of the studies (80%) that belong to this category focus on factors that are associated with the willingness to use or prescribe PrEP: stigma, risk perception, insurance, etc. Only 36% of these studies were about the awareness of PrEP and the safety perception. The remainder of the reviewed studies on willingness to use or prescribe PrEP (64%) explored the risk behaviours of candidates and the structural issues that prevent access to PrEP, such as transportation issues or lack of medical providers.

There are multiple factors intervening in the uptake and adherence of PrEP. The weight of each factor depends on the needs of the population in a particular location, but for the most part, the barriers could be roughly summarized into three factors across the literature: cost, knowledge, and stigma.

Firstly, the cost of the drug has been cited to be one of the biggest barriers for PrEP uptake and distribution. This factor has an important influence at multiple levels, for both access and availability. In fact, access can only be measured in a context of availability and PrEP is not yet available in all countries. Where PrEP is not available, this is mostly due to a lack of funding (ECDC, 2020). Other factors impeding its availability are limited resources for screening and monitoring, a limited number of qualified healthcare workers for PrEP distribution and administration (Jackson-Gibson et al., 2021), the need for LGBTIQ+ friendly doctors or specialized staff and the promotion of the same. According to the ECDC, the

countries in the EU where PrEP is not available have reported that the most important barrier to implementation is the cost of the drug (Hayes et al., 2019; ECDC, 2016).

Related to the cost, even when the healthcare system can make it available and the eligible individual is willing to use it, the individual also need to be able to purchase it. In the United States, the cost of PrEP has high levels of cost-sharing for the insured which poses a barrier to accessibility (Kay & Pinto, 2020), but the financial burden may be especially problematic for those uninsured and underinsured, often with relatively lower socioeconomic status, and who are often the most in need of the drug (Mayer et al., 2020). Other times, it is the perceived unaffordability that impedes PrEP use. Some people think they might have to pay for it fully themselves which affects their decision-making, even if the drug may be reimbursed by their healthcare system. In addition, the limited availability and/or affordability in some cases has led users to acquire PrEP via informal channels and consume PrEP unsupervised, potentially putting themselves at risk and other people too (Tan et al., 2018; Brisson, 2017; van Dijk et al., 2020).

Secondly, a lack of PrEP knowledge and awareness by both healthcare providers and eligible individuals has been reported to be limiting uptake, which could be partially related to a lack of funding for information campaigns. At an individual level, eligible people cannot request PrEP when they do not know about its existence. A systematic review of multiple populations of potential PrEP users globally showed that although the majority of participants would consider using PrEP when presented with this information about PrEP the initial awareness about PrEP was low (Koechlin et al., 2016). Additionally, individuals eligible for PrEP use do not perceive themselves to be at high risk of HIV, such as MSM, black women, women experiencing gender-based violence and young transgender men and women (Meyer et al., 2020).

In a similar fashion, most healthcare providers also do not have enough knowledge about PrEP to prescribe it accordingly (Meyer et al., 2020). Despite PrEP's proven efficacy, the concerns about risk compensation and side effects have also been a source of controversy. One argument being that the use of PrEP would lead to increased sexual risk behaviour (Pleuhs et al., 2020; Sidebottom et al., 2018) to a point in which PrEP users were labelled as "Truvada whores" in media outlets (Duran, 2012). This term was accusing PrEP – Truvada, by its brand name – users of using it as an excuse to engage in unsafe sex.

Finally, HIV stigma has been pointed out to be a remarkable barrier interfering with PrEP uptake and adherence. This stigma is expressed in diverse forms and experienced at different levels, especially impacting disadvantaged groups (Golub, 2018; Chakrapani et al., 2021).

Some health providers feel uncomfortable prescribing PrEP and have ethical complaints because of the assumption that the patient would engage in reckless behaviour as a result of PrEP prescription (Brooks et al., 2019). These prejudices decrease the patients' trust in healthcare professionals. At a community level, HIV and PrEP related stigma is often experienced as rejection by potential sexual/romantic partners, lack of social support and non-acceptance by family and friends (Sidebottom et al., 2018; Calabrese & Underhill, 2015; Babel et al., 2021; Calabrese, 2020). In some cases, these experiences of stigma lead to self-stigmatizing beliefs and anticipated stigma, which influence the decision making of eligible people to start or continue PrEP use (Duvob et al., 2018).

In conclusion, PrEP cannot be used or prescribed in areas where PrEP is not available. In those areas where PrEP is available instead, PrEP knowledge and awareness are paramount for its use and prescription, and finally it seems like financial concern and individual and structural forms of stigma, like homophobia, racism, and poverty, are compelling reasons preventing eligible at-risk individuals with PrEP awareness from seeking treatment (Mayer et al., 2020). Although the general barriers have been shown repeatedly and clearly identified, it is not clear yet to what extent each of these factors are influencing PrEP uptake in Europe, specifically among MSM as a highly affected population. This study will not only collect the barriers and facilitators experienced by MSM to PrEP use, but on top of it the results will be matched to one of the most complete behavioural change theories used by social scientists and policy makers to tailor effective theory-based interventions.

Theoretical approach and relevance

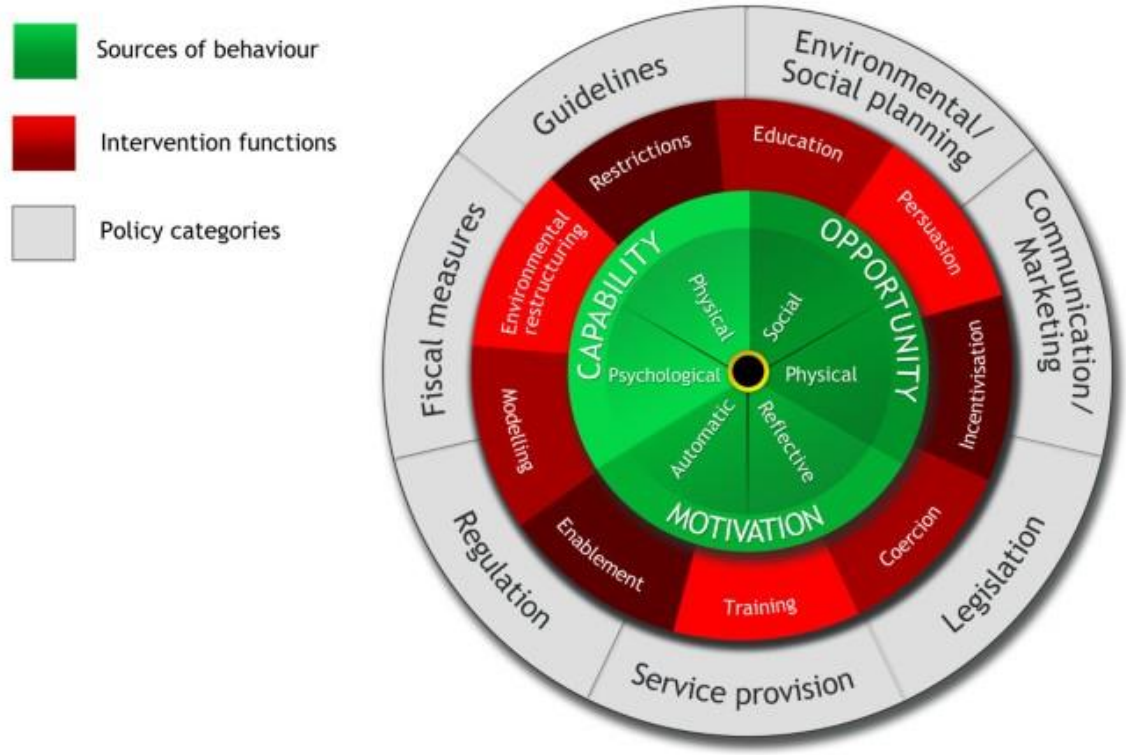
When designing interventions for behaviour change, especially in relation to health, it is important to know what drives people's behaviour whether to seek treatment or not (Atkins et al., 2017; Fishbein, 2000). Scientific research and theories about behaviour can be used to guide behaviour change programs and make them more likely to succeed and be more effective than interventions that are not theory informed (Atkins et al., 2017; Cane et al., 2012; Fishbein, 2008). However, Davies et al. (2010) found that only 22.5% of guidelines for the design and implementation of behaviour change programs are based on behaviour theories.

As the prevailing HIV pandemic can be largely attributed to behaviour it is paramount to review behavioural theories, specifically for the aim of reducing the spread of HIV, behaviour change programs based on scientific theories are key (Fishbein 2000). So far, the barriers for PrEP uptake have been widely summarized and clearly identified in numerous studies, however the existing research has not yet been contrasted to applied behavioural

science theories, this is precisely what this thesis will be looking at and it could help to gain clarity on what needs to change to make future PrEP interventions more effective.

One scientific lens through which to look at behaviour is the COM-B model, developed by West and Michie (2011), based on the limitations of earlier frameworks of behaviour change interventions that, although some earlier frameworks were successful, most were found to be ineffective. The COM-B model is widely recognised, evidence-based and simple yet complete in describing what produces behaviour (West & Michie, 2020). The authors concluded that Capability (psychological or physical skill), Opportunity (social or physical context) and Motivation (automatic or reflective) are the three factors that needed to interact with each other to produce any given behaviour. The COM-B model by West and Michie (2020), identifies *what* needs to change, and it sits at the core of the Behaviour Change Wheel [BCW] which shows *how* to change it, as shown in Figure 1. Therefore, the analysis in this study could serve as the first step to designing more effective theory-informed interventions and policies. This theory has been proven to be successfully applied to health behaviours and used for implementation research and policy makers (Atkins et al., 2017), but not yet for PrEP use.

Figure 1 COM-B model at the core of the Behaviour Change Wheel [BCW] (Michie et al., 2011).



This study is using the core of the BCW shown in figure 1: *Capability* refers to the individual's capacity to engage in a certain activity. The psychological, understood as the ability of knowing or comprehending something (for instance, knowing what PrEP is) and the physical being the skill, strength, or stamina to do something (for example, being able to reach a healthcare centre). *Motivation* refers to the brain processes that direct individual behaviour and it's subdivided into reflective (the internal thought process that makes us foresee risks and evaluate consequences) and automatic (the instinctive emotions related to our needs and wants, like for instance feeling anticipated pleasure or aversion) (Michie et al., 2011). Motivation is moreover a factor highly influenced by our interpersonal interactions, given that our environment can hinder or encourage our will and possibilities to engage in a certain behaviour. *Opportunity*, the last factor, defines the context in which the behaviour can take place. The physical side refers to factors afforded by the environment, such as resources, time, and locations (for instance, PrEP cost and availability). And the social side, which refers to the social pressure or influences that shape the way we think about things (for instance, knowing if a certain behaviour will be accepted or not by a group of people).

According to this theory, both Capability and Opportunity influence Motivation; and all three factors influence behaviour simultaneously. These factors configure the internal, social, and environmental conditions that need to take place to produce a behavioural target. Thus, the COM-B model, is a multidisciplinary theoretical lens through which one can look at complex behaviour, given that it covers intrapersonal, interpersonal and community levels.

Research question and hypotheses or expectations

The aim of this study is to better understand why MSM who are eligible to use PrEP ultimately do not use PrEP. This study will map and examine the barriers and facilitators for PrEP uptake experienced by MSM in Europe published in the last five years, since it's approval. The behaviour theory of the COM-B model will be used as a framework to shine a new, conceptual light on the existing scientific research, and assess to what extent there is evidence that the behavioural factors play a role according to literature and vice versa. Moreover, this study will aim to identify whether there are understudied areas in the literature on PrEP uptake barriers by determining the prevalence of different categories of studies in PrEP research. This leads to the following research question:

"Which PrEP uptake barriers and facilitators amongst MSM in Europe have been reported in research and how do they match to the COM-B model?"

From this research question, two sub-questions can be derived:

1. What has been reported about PrEP uptake barriers and facilitators for MSM in Europe in the scientific literature since it became available (from 2016 to 2021)?
2. How do the PrEP uptake barriers relate to the different aspects of the COM-B model that shape behaviour, namely Capability, Opportunity, and Motivation?

A substantial amount of research has been published that examines the barriers to PrEP use and therefore it is expected that the reported barriers so far are enough to cover all three factors: Capability, Opportunity, and Motivation. Based on the scoping review of barriers to PrEP use in general conducted by Kamitani et al. (2020), it is anticipated that factors concerned with capabilities and opportunities, such as a notable lack of awareness or geographical isolation, have been repeatedly reported. However, it remains unclear to what extent these identified barriers reflect the breadth of the potential influences on PrEP use among MSM. It is further expected that conceptually synthesizing research on barriers to PrEP use among MSM identifies potential types of barriers that have been understudied, suggesting a direction for future research to address current knowledge gaps and provide a more comprehensive overview of factors that may need to be addressed to effectively promote PrEP use among MSM.

Methods

Study design and overall procedures

This study consists of two blocks:

First, a systematic search of the existing scientific literature on PrEP uptake barriers including the latest relevant studies conducted according to Khan et al. (2003) five-step approach method and the PRISMA guidelines (PRISMA, 2020) for the flow chart, which can be found at the end of the methods section. Briefly, the five steps of Khan et al. composed of: 1) Framing the question (already defined in the previous section), 2) Identifying relevant work, 3) Assessing the quality of studies, 4) Summarizing the evidence, and 5) Interpreting the findings (Khan et al., 2003).

Second, the results from the systematic search are synthesized and then analysed from the perspective of an overarching behaviour change theory, namely COM-B model from Susan Michie.

Search strategy

To identify the relevant work, a systematic search has been conducted for the citations that contain the target population and key words or phrases in online resources: PubMed and Scopus. The key words were adapted to the PICOC search method: population, intervention, comparison, outcome, and context (Petticrew & Roberts, 2006) and combined to find the relevant studies:

- P (Population): Men who have sex with men, including bisexual men and transgender women, that are eligible for PrEP use but are not using it. Search terms include: MSM, "men who have sex with men", "bisexual men", "transgender women". All ages will be included.
- I (Intervention): PrEP uptake to prevent HIV in a context of availability. Studies containing the words: PrEP, "Pre-exposure prophylaxis", "chemoprophylaxis", "chemoprevention", "preexposure prophylaxis", "pre-exposure prophylaxis".
- C (Comparison): PrEP uptake barriers or facilitators. Any words that refer to factors related to use, whether they promote or hinder, and any synonym. The search includes the following words: uptake, intake, use, facilitators, barriers, attitudes, willingness.
- O (Outcome): The willingness or intention to use of PrEP
- C (Context): In a context of availability of PrEP in Europe, meaning the search was restricted to studies published after its approval in 2016 onwards.

Eligibility criteria

All peer-reviewed studies assessing barriers and facilitators for PrEP uptake among MSM were included regardless of their methods. The results of the searches were downloaded and uploaded to Rayyan in two separate lists: one for PubMed (113 results) and one for Scopus (58 results) for a first screening according to inclusion/exclusion criteria to select the relevant studies. Table 1 summarizes the study selection criteria:

Table 1 Inclusion and Exclusion criteria list

Inclusion criteria	Exclusion criteria
• Studies exploring barriers and facilitators to PrEP use • Population: HIV negative MSM eligible for PrEP use, that are *not* taking PrEP, no age limit.	• Wrong population: PrEP users • Wrong territory: Studies conducted outside of Europe • Wrong topic: Studies focusing on chemsex / compensation / risk behaviour / cost-

• Territory: Conducted in European countries • Language: English, Spanish or French	effectiveness analysis / studies about hepatitis / sexual behaviour / HIV diagnoses / adherence (related to PrEP users)

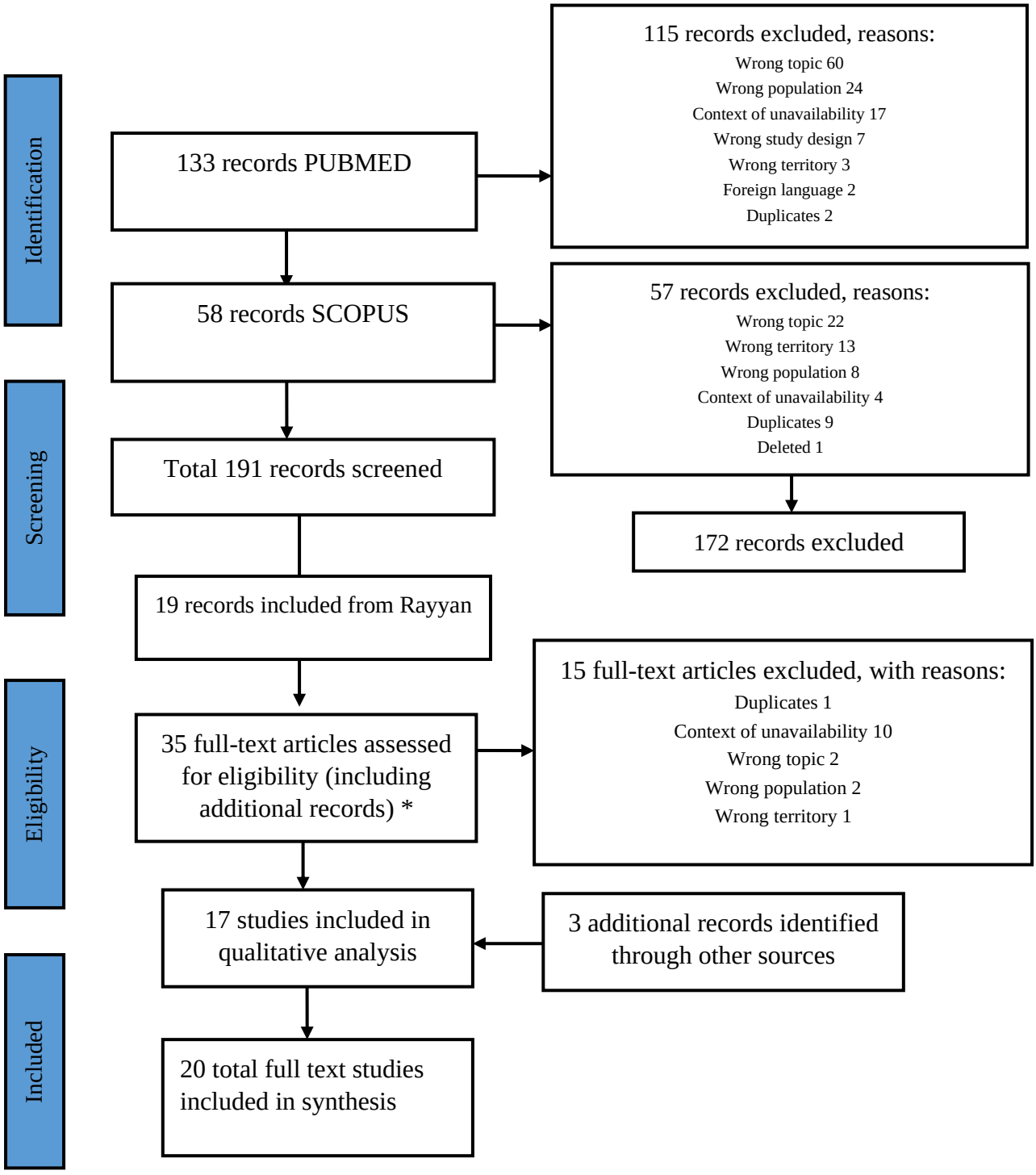
Data extraction

A total of 191 studies were assessed for eligibility, and the studies meeting the inclusion criteria were pulled into an excel sheet and listed for quality assessment (Khan et al., 2003) including the following: author names, database of access, publication year, country and language, study design or methods used, number of participants, population characteristics and the findings on factors related to PrEP use. The list is available upon request.

Figure 2, in the next page, shows the PRISMA flowchart adapted to the actual process of inclusion undertaken for this review. According to PRISMA guidelines the exclusion of duplicates is one of the first stages. However, due to keeping two separate lists in Rayyan (one for each database), the inclusion/exclusion criteria had to be run separately in each list, and duplicates between lists could not be identified at this point. When all the eligible studies were pulled to a single excel sheet, the duplicates were manually identified and excluded, and the status of the studies was later updated in Rayyan for clarity. For this reason, the original number of studies screened (39) is higher than the eventually added from Rayyan (19), some were duplicates or both included/excluded for different reasons. The second cleavage on the Excel sheet helped to clean out the studies falling into the exclusion bin:

- Excluded (17 articles), reasons:
    - The data was collected in a context of unavailability of PrEP: 9
    - Wrong population: 2
    - Wrong topic: 2
    - Wrong country: 1
    - Duplicates deleted: 3
- Included grey literature: 3
- Included from PubMed: 17
- Included from Scopus: 2

Figure 2 Adapted PRISMA flowchart illustrating the process of inclusion/exclusion of studies



Data management and analysis

The next steps of this review consisted of summarizing and interpreting the findings (Khan et al., 2003) for which the Braun & Clarke (2006) thematic analysis method was used. The thematic analysis is especially useful when dealing with large amounts of repeated

subjective information, such as experiences, or opinions, as it allows to cluster together repeated patterns and concepts to facilitate analysis (Caulfield, 2019).

First, on the Excel sheet used for the data extraction, a new column was created for the raw findings, followed by six columns representing the COM-B factors and two additional columns for those factors that were falling off the COM-B structure (behavioural and demographic). The raw findings were first allocated to the according column/factor. Then the allocated findings were split into barriers (red) and facilitators (green). In a new Excel document with two sheets and following the same previous column structure with an additional column to enumerating from 1 to 20 the included studies, the facilitators and barriers were again split. This facilitated the identification of results by filtering the factors. Both Excel files are available upon request.

Using the thematic analysis method (Braun & Clarke, 2006) the key concepts described in the literature that were found repeatedly were clustered and given a *code*, making sure that the codes were singular and reflecting properly the material. For example: 5 studies were mentioning lack of knowledge and information about PrEP, these have been clustered into the "knowledge" code. Then, the codes have been related to the *themes*, deductively predefined by the COM-B factors. For instance, the code "knowledge" belongs to the Psychological Capability factor or *theme*, as it fits into its description[2]. The code trees resulting from the thematic analysis are explained in the results section and available in Table 1 and Table 2 at the appendix section.

Results

Twenty full-text studies were included for synthesis. The outcome from the data analysis on Excel was converted into two descriptive tables that support this section, and which have been added to the appendix section. Only four studies (20%) used theory: interdisciplinary theoretical approach [14], Health belief model (HBM) [17] and Intersectionality theory [19, 20]. Fourteen studies used online surveys or questionnaires, three used in-depth, semi-structured or focus group interviews. The results are drawn from studies conducted in 8 European countries: Germany, France, Italy, UK, Netherlands, Spain, Sweden, and Switzerland.

This section resolves the research question: "Which PrEP uptake barriers and facilitators amongst MSM in Europe have been reported in research and how do they match to

[2] Check Figure 1 at the Theoretical approach section where the COM-B model factors (used as themes at this stage) are described in more detail.

the COM-B model?". Findings on barriers and facilitators are listed below and categorized by themes according to the *Capability*, *Opportunity*, and *Motivation* factors with two additional themes being *Socio-demographic* and *Behavioural*:

Barriers

Capability

- **Psychological capability**

Lack of information is often mentioned as a barrier to PrEP uptake. MSM say not having enough information about PrEP [1, 7, 18], especially among less informed groups such as migrants and sex workers [11]. In some PrEP cannot be a topic of conversation due to stigma in social groups [20], which is closely related to social opportunity.

***Memory*.** Some MSM in London have concerns about their capability of remembering to take a pill daily or to keep a visit follow-up with their doctors [5].

- **Physical capability**

Self-efficacy with condom use. Despite of more frequent condom use with non-steady partners, non-PrEP-users in France said sex was not as safe as they would like it to be (failing to use condoms always) more often than PrEP users [1]. Some, instead, don't think they would benefit of using PrEP as they already adopt safe sex practices or don't have problems using condoms consistently [6] or simply prefer to use condoms over PrEP [10].

Opportunity

- **Physical Opportunity**

Cost. According to the theory[3], resource-related findings belong to this category. The high cost of PrEP has been found to be a barrier in Switzerland, Italy, Germany, UK [7, 17, 18, 20], also expressed as unfavourable perceived financial situation [16]. In Spain two participants mentioned economic reasons as a barrier, although PrEP is funded by the healthcare system [10].

[3] Check theoretical approach section for detailed descriptions of the COM-B factors.

Access. Limited access [3] has been mentioned in several cases due to 1) *location issues* such as living in smaller cities, having fewer PrEP access points and/or being inconveniently located [1, 11, 19] and 2) due to a *lack of providers* who would prescribe PrEP [18]. Even though this review focused only on studies which's data was collected in a context of availability of PrEP, lack of access [10] persists as a barrier the literature.

- **Social Opportunity**

Stigma. Having experienced discrimination and homophobia by health providers [19], the fear of feeling judged by others for using PrEP [5] especially stressed within the black community at the intersection of ethnic background, family history and religion and often due to black men hypersexualization stereotypes [19, 20], as well as the fear of being seen as reckless and promiscuous ("Truvada whores"), are forms of social pressure that are preventing eligible MSM to use PrEP. Even the idea of CAI is stigmatized in some circles which prevents the opportunity to open a discussion about PrEP use [20] thereafter preventing the spread of knowledge as seen previously.

Lack of anonymity. Being recognized by neighbours, especially when living in smaller cities, has been reported in Spain to be a barrier preventing MSM from seeking PrEP [19].

Marginalization. Not feeling proportionally represented in gay culture and spaces is an impediment for black MSM in the UK [20]

Motivation

- **Reflective Motivation**

Risk perception. Has been shown that low perceived risk for acquiring HIV [5, 8] and beliefs of not being at risk for HIV [17, 20] are reasons for MSM to reject PrEP use. On the other hand, concerns about the potential increase of other STI's due to the condomless sex during PrEP use [7, 18] are also reasons to reject PrEP.

Moral concerns [7] is a factor mentioned in Switzerland but not further developed in the study. It's assumed it could relate to internalized homonegativity.

Side effects. Concerns or fear about side effects [5, 7, 17, 18] were reported in UK, Switzerland, Italy, and Germany.

- **Automatic Motivation**

Fear is a term used repeatedly throughout the literature. The fear of being discriminated by peers [5, 17] or feeling judged by doctor/provider [5, 19], the fear of being labelled reckless and promiscuous [19, 20], as stated in "social opportunity", as well as the fear of potential side effects [5, 7, 17, 18] seen in "reflective motivation". Are emotions rooted on social influences.

Risk analysis. The lack of prevention for other STI [10] is mentioned however not explained in the original study. It has been placed in automatic motivation under the assumption that MSM wouldn't use PrEP anticipating they could still get infected with other STI's.

Two additional factors

- **Socio demographic:**

Age: Younger age [1] and older age in some cases [15].

Financial and administrative status: Student status [1], sex workers and migrants [11], wealthier participants [15].

Educational level: University education [10] Secondary school or higher [14]. In the Netherlands it was found that PrEP interest was in general lower among those MSM that were older, more educated, wealthier, and often in a relationship (members of AmsterdamPinkPanel) compared to the convenience sample in the same study [15].

Relationship status: having a steady partner [10], in a relationship [15].

Level of outness. Low level of outness [1], greater outness [11] and not being open about one's sexuality [20] also affected the interest in PrEP use.

- **Behavioural**

Condom use. Consistent condom use [1] is significantly associated with non-uptake of PrEP in France. As well as preference for condom use in Spain [10].

Safe or no group sex. Not engaging in group sex, having group sex with condoms or less recent group sex [3] has been connected to lower interest in PrEP among French participants.

Drug use. Participants using party drugs like amphetamine, GHB, ketamine were less willing to use PrEP in Germany [14]. The reasons are not explained in the study.

Facilitators

Capability

- **Psychological capability**

HIV risk awareness. Being aware of the risk of HIV acquisition from unprotected RAI [2, 12], as well as high levels of HIV knowledge [13] are factors that have been shown to motivate the use of PrEP.

Correct knowledge about PrEP. In Italy, most of the participants (91%) had already heard about PrEP before, and most of them (52.1%) stated they would be more willing to use it if they had more information about it [17]. In the Netherlands those MSM interested in PrEP were proven to have correct prior knowledge [15].

- **Physical capability**

Proximity. BMSM in London said that PrEP services being conveniently located would promote PrEP use but clarify without being in "black areas" (due to confidentiality concerns related to homophobia in black communities) [19]. At first seems that making PrEP services more reachable would facilitate PrEP use, but the underlying fear of stigma would in fact prevent this population from using the services.

Opportunity

- **Physical Opportunity**

Context. Regular STI testing was shown in the UK to increase PrEP acceptability as it constitutes an ideal context for promoting PrEP to at-risk patients [13]. For this same reason, doctors that prescribe PrEP [18] are needed to provide the opportunity as we have seen previously in Physical Opportunity barriers.

Resources. Better perceived financial situations and the price drop that happened in the Netherlands (from 500€ to 50€ per month) increased MSM interest about PrEP [16]. Italian participants said would be more willing to use PrEP if it were free [17] and the UK the perceived affordability also plays a role in interest [20]

Access. Some would consider PrEP if it was purchasable without medical prescription [17], showing once again that MSM don't always feel comfortable displaying the intention of PrEP use with their healthcare providers.

- **Social Opportunity**

Anticipated HIV-stigma. In Germany, the fear of being discriminated if acquiring HIV is a factor shown to promote willingness to use PrEP, which shows how crucial are social norms for individual choices [14].

Anonymity. Being able to acquire certain medicines without the pressure of meeting a pharmacist, or healthcare providers, or other, is valued especially by Black MSM [19], due to fear of stigma as we have seen previously in barriers.

Healthcare staff. The need of having doctors who prescribe PrEP [18], as we have seen before as well in barriers, is significant to create the opportunity of a context that facilitates PrEP use. Especially when the healthcare staff is high quality: empathetic, efficient, reassuring and understanding as it reduces anxiety [19] and even better if this staff is from similar cultural backgrounds [19] which reinforces the connection and trust patient-provider.

Motivation

- **Reflective Motivation**

Effectiveness. Believing in the effectiveness of PrEP [2].

Efficacy. It is mentioned to be a facilitator for British participants [20] but not developed in the study. Has been added to reflective motivation under the assumption that it could be connected to the feeling of being protected.

Engaging in SRB. Having been diagnosed with STI [3, 5, 9, 11], engaging in sexual risk behaviour [12, 14, 18], recent condomless anal group sex (<3 months ago) [3], having RAI without condoms [2, 9, 14, 15] or intending/preferring CAI [4, 18, 20], having an increasing number of sex partners [9, 10] and engaging in chemsex [9, 15], are all situations that motivate MSM to seek for PrEP.

Quality of life. Swiss and German participants have expressed that they would most likely use PrEP as an alternative to condoms and be protected independently of sexual partner's protective behaviour [6]. Peace of mind, improved quality of sexual

life, reduced anxiety [4] and worry-free sex or more pleasurable sex [4, 6] have also been stated to be motivators.

Perceived risk: awareness about potential sickness [12, 13, 14] and having friends or acquaintances living with HIV [18] also makes them reflect on the potential use of PrEP.

- **Automatic Motivation**

Safety. 80% of MSM in Berlin agreed that would use PrEP for general safety as an additional protection against HIV [4]

Two additional factors

- **Socio-demographic**

Age. higher [9] and younger [14] age has been associated with PrEP willingness.

Origin/residency. Non-Dutch origin [9], having one or two parents born outside Germany [18], having born in Latin American-Caribbean (LAC) or non-western Europe countries [11] as characteristics of those more inclined to PrEP use.

Educational level. Having a higher educational level [9] like a university degree [18] is also associated with higher interest.

Relationship status. Single [14, 15] MSM were found to be more interested in PrEP use.

- **Behavioural**

Eligibility based on sexual activity. Meeting PrEP criteria/being eligible [10, 11] is associated with willingness to use PrEP such as: engaging in CAI [2, 14], group sex [3] and the use of drugs for sexual performance [14, 15].

Discussion

Overview of main findings

The results section just answered the research question in detail: “Which PrEP uptake barriers and facilitators amongst MSM in Europe have been reported in research and how do they match to the COM-B model?”. Looking at the results the following could be reasoned:

The combination of the total selected studies is enough to cover all the COM-B factors, which serves as evidence that the COM-B model works for this issue, as expected. However,

some of the study findings were not exactly fitting within the COM-B aspects although are determinant for the results: *Socio-demographic factors* such as age, origin, or level of outness, and *Behavioural factors* like eligibility, which is mostly defined by researchers/providers/policy makers more than by the target participant. Reflecting on the results could be argued that there are four groups of factors: 1) Consequent, 2) Polyvalent, 3) Motivations and behaviour and 4) Socio-demographic.

Most of the findings seem to have a direct effect: the contrary to a barrier automatically becomes a facilitator, and vice-versa. For instance, the lack of providers prescribing PrEP impede its use while the existence of providers prescribing PrEP facilitates its use. This is applicable especially to structural and contextual barriers, such as affordability, availability, awareness, stigma, and discrimination. In these cases, should be relatively easy to promote PrEP by simply reducing barriers. The following table shows the factors that are directly linked to both barriers and facilitators:

Table 2 Consequent factors

COM-B factors	Barriers	Facilitators
Psychological capability	Lack of knowledge and forgetfulness [1, 7, 11, 18, 20, 5]	Correct knowledge and high awareness [2, 12, 13, 15, 17]
Physical capability	Regular condom use [1], proximity [19]	Proximity [19]
Social opportunity	Lack of providers prescribing, stigma and stereotypes, fear of discrimination, anonymity concerns, marginalized from gay culture [19, 5, 20]	Doctors prescribing PrEP, understanding healthcare staff, choice to anonymity [14, 19, 18]
Physical opportunity	Low perceived affordability, lack of access, geographical isolation [7, 16, 10, 17, 18, 20, 19, 11, 1, 3]	High perceived affordability, availability and easier access, right context and distance [16, 17, 20, 13, 18]

Polyvalent factors are those that belong to more than one category at the same time. For instance, the lack of access to PrEP due to living in small cities or inconvenient distance have aspects of physical opportunity (location) and social opportunity (lack of anonymity). Rejecting PrEP because of the fear of being discriminated requires thought (reflective motivation) but is clearly influenced by the perceived social acceptance (social opportunity). The lack of safe environments to talk about sexuality because of homophobia by peers and providers is a social pressure (social opportunity) that hinders knowledge (psychological capability). And the lack of exposure to environments that enable these conversations like STI testing venues and providers who would prescribe PrEP (physical opportunity) is influenced by shame and discomfort from MSM (automatic motivation). This shows that Capabilities and

Opportunities are heavily influenced by Motivations: Stigma, shame and discrimination provoke situations in which sexuality cannot be displayed or spoken about.

Thirdly, can be discussed that motivations and behaviours can be somewhat linked against in barriers and facilitators but are far more diverse than capabilities and opportunities, as they depend on individual priorities. Reasons to not use PrEP are heterogeneously distributed along the findings: some mention not believing in PrEP, others don't think they need it, others just prefer condoms. The distribution of these factors is heterogeneous and therefore specific strategies, based on the needs and priorities of the different groups within the broad population, would be necessary.

Table 3 Motivations and behaviours

COM-B factors	Barriers	Facilitators
Reflective motivation	Fear of side effects, low risk perception, moral concerns, confidentiality concerns [5, 6, 8, 17, 19, 18, 7]	Believing in the effectiveness of PrEP, reflecting about one's sexual activity and preferences, quality of life, perceived risk [2, 12, 14, 9, 15, 18, 4, 20, 6, 9, 10,3, 13]
Automatic motivation	Fear, risk analysis, preference [17, 19, 10]	Safety [4]
Behaviour	Consistent condom use, drug use, safe or no group sex [1, 10, 14, 3]	Inconsistent use of condoms, chemsex, group sex [10, 11, 14, 15, 2, 3]

Finally, socio-demographic factors might seem relevant to a country level but don't seem to be indicatory to a European level. For instance, younger age and student status are barriers in France [1], as well as low level of outness as seen in the UK [20]. In the Netherlands has been found the opposite: older, wealthier, highly educated MSM and often in a relationship were less likely to be interested about PrEP [15], while in Spain a greater outness was rather associated to be a barrier for PrEP use [11]. On the facilitators side, being single, specifically the younger in Germany [14] and the higher aged in the Netherlands [15] seem to be connected to higher PrEP use interest. Therefore, according to the results, PrEP strategies should be directed to concrete target populations based on their socio-demographic status.

Table 4 Socio-demographic factors

COM-B factors	Barriers	Facilitators
Socio-demographic factors	Older, younger, stronger/weaker financial and administrative situations, educational level, in a relationship, lower and greater level of outness, consistent condom use [1, 15, 11, 10, 14, 20]	Older, younger, being single, having multiple partners, higher education, being born in non-western EU countries or in Latin America [9, 14, 15, 18]

Similarities and differences

The results of this systematic review are for the most part comparable to findings from other studies assessing PrEP use barriers. The main difference is that this study went one step further by comparing the findings to a well-known behaviour theory framework thus reaching a new level of analysis not done before. The following table shows the number of times finding related to COM-B factors have been mentioned, and to which study number has been found:

Capability	Psychological	Knowledge, memory	1, 7, 18, 11, 20, 5	6
	Physical	Self-efficacy of condom use	1	1
Opportunity	Physical	Cost, access, geographical isolation	7, 17, 18, 20, 16, 10, 3, 1, 11, 19	10
	Social	Stigma	9, 5, 20	3
Motivation	Reflective	Reasoning	5, 8, 17, 20, 7	5
	Automatic	Emotions	5, 17, 19, 20, 7, 18, 10	7

According to findings, in Europe the resources afforded by the environment (physical opportunity) such as: cost and access, have been mentioned the most: in 10 of 20 studies. This is comparable to US findings where cost is also a top barrier (Matacotta, 2020), mainly due to obstacles related to insurance policies (Mayer et al., 2020), posing a big financial burden for the user (Kamitani et al., 2018), especially for those in low-resource settings (Yi et al., 2017). However, the result is striking as the EU and the US manage their healthcare systems differently, but the perceived affordability by MSM is shared regardless. In fact, PrEP funding and availability in Europe depend on each country: In the Netherlands the price was reduced from 500€ to 50€ in 2018, in Italy the price is 60€ and paid by the user, in Belgium PrEP cost is fully reimbursed, in Germany is covered by the health insurance, while in France and Italy PrEP is free for the patient and covered by the healthcare system.

Shame and stigma, related to social opportunity, automatic and rational motivation, have been mentioned in 8 studies. However, it has been seen previously that fear is an underlying emotion influencing other factors, therefore implied even if not mentioned. For example, men needing PrEP services close enough but not too much to avoid any shaming. Fear of discrimination and stigma is also strongly influenced by social norms and context and has been mentioned multiple times as a barrier in other high-income countries (Matacotta et al., 2020; Mayer et al., 2020).

Within the Opportunity: lack of knowledge and awareness are the most reported barriers in the EU (6/20) and widely known obstacle also in the US. This includes the need for

better information about PrEP (Hampel et al., 2017; Werner et al., 2018; Witzel et al., 2019; van Dijk et al., 2020; Voglino et al., 2021; Gupta et al., 2017), especially for those MSM more isolated, migrants, living in small cities, with lower participation in sex education or less in contact with testing sites and community-based organizations (Frankis et al., 2016; Iniesta et al., 2022; Garnett et al., 2017; Hubach et al., 2017; Matacotta, 2020), as well as higher awareness about HIV and the risks of CAI (Bull et al., 2017; Jaspal et al., 2018), and the need for better informed healthcare providers that by not knowing about PrEP could be pushing some MSM to informal PrEP acquisition (van Dijk et al., 2020).

Low perception of HIV risk despite of disproportionate risk (Goedel et al., 2019; Herder et al., 2020; Voglino et al., 2020; Witzel et al., 2019) and lack of awareness about STI infections during CAI while on PrEP (Werner et al., 2018) is found to prevent eligible european MSM of seeking PrEP use. In contrast, higher perceived risk, engaging in sexual risk behaviour and chemsex and having been diagnosed with STIs (Jaspal et al., 2018; van Dijk et al., 2020; Bourne et al., 2019) have been related to higher PrEP use intention in Europe, central Asia, and the US (Matacotta et al., 2020; Mayer et al., 2020).

Socio-demographic are relevant although this form of analysing data makes seem this factor as too heterogeneous. The level of outness, and social status doesn't seem to be significant to a large scale. Those with less resources and knowledge have in general lower opportunities to access PrEP, but people aware and with higher socio-economic status also decide not to use PrEP. Even the level of outness and openness about one's sexuality is a facilitator to some and a barrier to others. The reasons are varied and dependent on individual priorities and contexts.

Strenghts and limitations

The strengths of this study include having citations from a varied range of samples, with populations from different backgrounds and socio-demo-economic statuses, as well as both qualitative and quantitative methods. The fact that some barriers and facilitators match transversally across the different population demographics and countries validates the importance of the findings.

However, risk of bias due small samples of population on the studies and/or data being often collected in capital cities (Paris, Berlin, Amsterdam, London) where population is rather not representative for the rest of the country. Most Italian participants were local students that already knew about PrEP (Voglino et al., 2021), most Dutch participants were highly educated

(van Dijk et al., 2021), recruited exclusively through dating apps (Iniesta et al., 2018; Callander et al., 2019) or only in cities where HIV prevalence is double the national average (Jaspal et al., 2019). The main characteristics of the population in the studies affect the results to not be fully representative, supposing a weakness.

Another limitation would relate to the difficulties to combine the thematic analysis with the COM-B model. The thematic analysis method is used to cluster codes together, so they are mentioned a single time. And the COM-B model requires having to split the codes again depending on the origin to fit them into the categories. For example, all findings related to stigma could be clumped together, but the origin of the stigma makes it a factor that belongs simultaneously to several COM-B categories.

Third limitation has to do with the quality and availability of studies. This study only included free full-text studies, given that as a student I am not subscribed to peer reviewed journals to access studies that require payment (there were only a couple excluded for this reason). And on the other hand, some studies mention barriers and facilitators without developing a description of the findings making it difficult to categorize them and having to guess in occasions.

Finally, systematic reviews and thematic analysis are meant to be done at least by two researchers given the amount of data collected and need to take decisions (Charrois, 2015). In this case, every decision was made based on my own criteria and at times would have been very helpful to have a second thinking head to discuss some topics. For instance, sometimes was hard to draw a line that separates findings into automatic or reflective Motivation given that one doesn't know to what extent participant thoughts were more or less emotional (such as risk perception or concerns about side effects).

Implications of findings for theory and policy and interventions

This study has shown that the key factors influencing eligible MSM PrEP use intention (fear, lack of knowledge and access) match with the COM-B factors (capability, motivation, and opportunity), which also match with the UNAIDS targets for 2020 (zero discrimination, skills, and capacity to protect oneself, and access).

Given that the COM-B model is at the core of the BCW, used to design informed interventions, this study could serve as a start by indicating what needs to change. Further research is necessary to find the kind of interventions and policies that could work best for the needs of this specific population. Further research could also evaluate the reasons why UNAID

targets, despite fitting perfectly to key COM-B factors, have not yet been met and thus the interventions have been still ineffective.

A recommendation is to take socio-demographic and behavioural factors seriously into account in future research or new intervention planning. These are factors that the COM-B model does not include despite of highly importance as they shape the outcomes. A limited socio-demographic sample will most certainly not show the needs of all eligible MSM.

Conclusion

There were two sub questions within the research question, and it can be concluded:

1) The findings about barriers and facilitators of PrEP use among eligible MSM in European countries are comparable to main findings in existing studies conducted in other first world countries.
2) The use of the COM-B model as a theoretical framework was useful to identify the barriers and facilitators and could partially serve as a first step for further research on interventions and policies.

Even more: the COM-B model was not enough to cover the totality of findings described in the studies. The importance to take socio-demographic and behavioural factors into account is key for inclusive and effective interventions. The data found covered only 8 European countries meaning further research is needed to find more evidence about needs and wants of potential PrEP users in Europe.

Appendix

Code trees

Following the two tables resulting from the applied thematic analysis to the data extracted form the second excel list. Table 2 for Barriers; Table 3 for Facilitators.

Table 1: Code tree for barriers

Study number	Described in literature	Clusters/Codes	COM-B or other factors/Themes
1	no prior knowledge on "undetectable=untransmittable"	Knowledge	Psychological capability
7	need for better information about PrEP		
11	Low knowledge: less well-informed groups		
18	lack of information about PrEP		
20	Knowledge: discussions about sexual health and PrEP		
5	concerns about adhering to a schedule of follow-up visits with a physician	Memory	
5	concerns about remembering to take a pill daily		
1	Consistent condom use with non-steady partners, despite of low self-efficacy	Condom use	Physical capability
6	Not perceiving any benefit in PrEP as they adopted safer sex practices and no problem with condom use		
10	Preference for condom use		
7	High cost of PrEP	Cost	Physical Opportunity
16	Unfavourable financial situation		
10	Economic reasons		
17	Cost of the therapy		
18	Cost of PrEP		
20	Cost		
19	Inconvenient distance	Access	
11	Living in smaller cities		
1	Living in a small city or village		
1	Living in a department with few PrEP access points		
3	Limited access		
10	Lack of access		
18	Not having a doctor who prescribes PrEP		
19	Living in smaller cities, being recognized by others	Lack of anonymity	Social Opportunity
19	Confidentiality concerns		
5	being afraid of asking a doctor	Stigma (interpersonal level)	
19	Discrimination and experiences of homophobia by health providers		
5	Feeling judged by others		
19	Hypersexualization stereotypes in black community		
20	Promiscuity stereotypes, being seen as reckless		
20	Stigma around CAI preventing discussion about PrEP		
20	Black MSM not being represented in gay culture and spaces	Marginalization	
5	Low perceived risk for acquiring HIV	Risk perception	Reflective Motivation
6			
8	Low self-assessed risk of HIV		
17	the belief of not being at risk for HIV		
19	Lack of risk perception		

18	higher perceived risk of getting infected with other STIs		
7	concerns about the potential increase of other STIs in the context of PrEP		
7	Moral concerns	Moral concerns	
5	Concerns about PrEP-related side effects	Side effects	
7	Concerns about side effects		
17	Fear of side effects (23.8%)		
18	Worries about side effects		
17	Fear of being discriminated	Fear	Automatic Motivation
19	judged by provider		
5, 7, 17, 18	Fear of side effects		
10	lack of prevention for other STI	Risk analysis	
1	Younger	Age	Socio-demographic factors
15	Older age		
1	Student status	Financial and administrative status	
15	Wealthier		
11	sex workers and migrants		
10	University education	Educational level	
14	Secondary school or higher		
15	More educated in general		
10	Steady partner	Relationship status	
15	In a relationship		
1	Lower	Level of outness	
11	greater		
20	Not open about one's sexuality		
1	Consistent condom use with non-steady partners	Condom use	Behavioural factors
6	Consistent condom use		
10	Preference for condom use		
14	Recreational drug use	Drug use	
3	No group sex in the last 3 months, and group sex with condoms	Safe or no group sex	

Table 2: Code tree for facilitators:

Study number	Described in literature	Clusters/Codes	COM-B or other factors/Themes
2	having an awareness of the risk of unprotected RAI	HIV risk awareness	Psychological capability
12	Awareness about potential sickness		
13	high levels of HIV knowledge		
15	correct prior PrEP knowledge	Correct PrEP knowledge	
17	more willing to use PrEP if they had more information about it		
19	Proximity	Location	Physical capability
16	Better financial situation/Price drop	Resources	Physical Opportunity
17	If it were free		
20	perceived affordability		
17	If it were purchasable without medical prescription	Access	
13	Regular testing	Context	
18	Need of doctors that prescribe PrEP		

14	Anticipated HIV stigma	Anticipated HIV stigma	Social Opportunity
19	Anonymity	Anonymity	
18	Need of doctors who prescribe PrEP	Healthcare staff	
19	high quality healthcare staff, empathetic, efficient, reassuring and understanding		
19	Similar cultural backgrounds with provider		
2	Believing in the effectiveness of PrEP	Effectiveness	Reflective Motivation
20	Efficacy	Efficacy	
12, 14, 18	Engaging in SRB	Engaging in SRB	
2, 9, 14, 15	Recurring condomless anal intercourse		
4, 18, 20	Preference for CAI		
6	Alternative to condoms and to protective method of partner/s		
9, 10	Increased number of partners		
3	Group sex		
9, 15	Chemsex		
4	Peace of mind, quality of life, reduced anxiety	Quality of life	
6	Expectations about sexuality, including worry-free sex or more pleasurable sex		
12,13,14	awareness about potential sickness	Perceived risk	
18	Friends or acquaintances living with HIV		
4	Safety/protection against HIV additional to condoms	Safety	Automatic Motivation
9	higher	Age	Demographic factors
14	younger		
9	Non-Dutch origin	Origin/residence	
18	one or two parents born outside Germany		
11	Having born in Latin American-Caribbean (LAC) or non-western Europe countries		
14	Being single	Relationship status	
15	Being single		
9	Higher educational level	Educational level	
18	having university degree		
10	Meeting PrEP criteria	Eligibility	Behavioural factors
11	Being elegible		
14	Having unprotected anal sex and drugs in a sexual context		
15	Chemsex		
2	Receptive anal sex without condoms		
3	group sex		

Abbreviation list

AIDS: Acquired Immunodeficiency Syndrome

BMSM: Black Men who have sex with Men

CAI: Condomless Anal Intercourse

CDC: Centres for Disease Control and Prevention (national public health agency of the United States)

COM-B model: Capability, Opportunity, Motivation, Behaviour Model.

ECDC: European Centre of Disease Prevention and Control

EMA: European Medication Agency

HIV: Human Immunodeficiency Virus

LGBTIQ+: Lesbian Gay Bisexual Transexual Intersex Queer

MSM: Men who have sex with Men

PrEP: Pre-exposure Prophylaxis

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-analyses

RAI: Receptive Anal Intercourse

SRB: Sexual Risk Behaviour

STI: Sexually Transmitted Infection

UNAIDS: Joint United Nations Programme on HIV and AIDS

WHO: World Health Organization

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