Using the COM-B model to characterize the barriers and facilitators of pre-exposure prophylaxis (PrEP) uptake in men who have sex with men.

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ARTICLE

Using the COM-B model to characterize the barriers and facilitators of pre-exposure prophylaxis (PrEP) uptake in men who have sex with men

Adam Madhani[1] | **Katherine A. Finlay**[2]

[1]School of Psychology, University of Buckingham, Buckingham, UK

[2]School of Psychology and Clinical Language Sciences, University of Reading, Reading, UK

Correspondence
Katherine A. Finlay, University of Reading, Reading RG6 7BE, UK.
Email: katherine.finlay@reading.ac.uk

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Abstract

Objectives: Using the COM-B model, this study aimed to characterize barriers and facilitators to pre-exposure prophylaxis (PrEP) uptake amongst men who have sex with men (MSM).

Design and Method: Semistructured interviews with 13 MSM who were non-PrEP users were conducted with a specific focus on barriers and facilitators to PrEP uptake. A 15-item interview schedule was created informed by the COM-B model. Transcripts were transcribed verbatim and inductively analysed using thematic analysis. To illustrate pathways for intervention design, inductive themes were then deductively mapped onto COM-B constructs.

Results: Results demonstrated that barriers to PrEP uptake were closely aligned with five (of six) COM-B components: *psychological capability, physical opportunity, social opportunity, reflective motivation and automatic motivation*. These COM-B subcomponents reflected seven thematized barriers: (1) limited information about PrEP, (2) restricted access to PrEP, (3) gay identity and sexual stigmatization, (4) social and cultural stigmatization, (5) capabilities in treatment adherence, (6) optimistic bias about sexual behaviours and (7) calculating risk. No facilitators or physical capability concerns were demonstrated.

Conclusion: This study adopted a novel behaviour change-informed approach to understanding barriers and facilitators

to PrEP uptake amongst MSM. Unrealistic optimism about self-protective individual behaviours, the physical accessibility of PrEP and (mis)information together interacted closely with perceptions of personal and social stigmatization to dynamically impact PrEP uptake decisions. Barriers to PrEP uptake mapped clearly to the COM-B; therefore, these results provide the foundation for Behaviour Change Wheel intervention development to improve rates of PrEP uptake and its acceptability for MSM.

KEYWORDS
behaviour change, COM-B, HIV prevention, MSM, PrEP

Statement of contribution

What is already known on this subject?

- Efforts to reduce levels of HIV transmission are a priority globally.
- PrEP is effective as a preventative method to reduce new HIV infections.
- HIV acquisition has been most prevalent amongst MSM, yet there is a resistance to using PrEP as a preventative method amongst this population.
- The COM-B model is a useful theoretical framework to understand behaviours and provide methods to facilitate behaviour change.

What does this study add?

- The COM-B components of *Psychological Capability, Physical Opportunity, Social Opportunity, Reflective Motivation and Automatic Motivation* are crucial to PrEP uptake decisions amongst MSM.
- Barriers are more salient than facilitators to MSM in explaining their PrEP uptake likelihood
- Unrealistic optimism in individual sexual risk behaviours, stigmatization of gay sex, limited information about PrEP and restricted physical access to PrEP all limit PrEP uptake willingness.
- Behaviour change-informed interventions targeted towards barriers to PrEP usage should be developed to promote PrEP uptake amongst a demographic that is considered at high risk for HIV acquisition.

BACKGROUND

UNAIDS (2020) estimates that 38 million people live with Human Immunodeficiency Virus (HIV) worldwide, with 1.7 million new infections and 690,000 related mortalities in 2019 alone. Since its first clinical observation in 1981, the HIV/AIDS epidemic has seen 75 million infections and AIDS-related deaths of 32.7 million people (UNAIDS, 2020). Though also impacting heterosexual populations, HIV acquisition has been most prevalent amongst gay men, bisexual men and other men who have sex with men (MSM; Flowers et al., 2017). Despite rates of HIV diagnosis amongst MSM significantly decreasing in the UK (Nwokolo et al., 2017), one in eleven MSM were HIV positive in 2014 (Public Health England, 2015) and 2019 statistics suggest approximately 4200 MSM living with undiagnosed HIV in

the UK (Miners et al., 2019). The ongoing challenge of HIV requires public health decision makers to continue to innovate in their delivery of infection prevention methods and messages, particularly in the context of this heightened prevalence amongst MSM.

Prevention of new HIV infections remains the most effective strategy to contain the virus in the absence of a cure or vaccine (Jaspal & Daramilas, 2016). Pre-exposure prophylaxis (PrEP) has emerged as an effective bio-behavioural tool in HIV intervention and prevention strategy (Felsher & Koku, 2018). By the end of 2018, approximately 40 countries around the world had approved TDF/FTC (tenofovir disproxil and emtricitabine) for HIV PrEP (Hodges-Mameletzis et al., 2018). The efficacy of PrEP is extremely high, with HIV acquisition in adherent PrEP users reduced by 99% when taken daily (Marcus et al., 2017; McCormack et al., 2016). Global trends demonstrate more countries accepting PrEP as an HIV prevention tool, for example, England announced an HIV PrEP grant, allowing for the distribution of PrEP through the National Health Services (NHS) in the last quarter of 2020.

England is not the first country in the United Kingdom to make PrEP available nationwide; Scotland and Wales both implemented a national state-funded PrEP program for those individuals at the highest risk of HIV seroconversion (the 'window period' from acquisition of the virus to a clear and established stable viral load; Cohen et al., 2010) in 2017 (Couzens, 2017; Estcourt et al., 2021; Nandwani, 2017). The distribution of PrEP in Scotland demonstrated positive results amongst MSM in the first year, with 99% of individuals who received PrEP being MSM (Health Protection Scotland, 2018). Data showed that incidence rates of HIV infection reduced from 11/1000 to 2/1000 person-years for MSM who were exposed to PrEP, which related to an 83% reduced risk (Estcourt et al., 2021). Indeed, Scotland's success is an exemplar of the distribution of PrEP uptake amongst MSM in the United Kingdom. Given the recent changes in PrEP availability in England, the success in Scotland is promising for public health decision makers, sexual health services and clinicians developing interventions to promote the adoption of PrEP in England.

However, despite proven infection-prevention efficacy, availability and accessibility alone may not improve PrEP uptake and associated infection prevention. PrEP uptake amongst MSM is inconsistent (Jaspal, Lopes, Bayley, & Papaloukas, 2019; Jaspal, Lopes, & Maatouk, 2019). Even though awareness of PrEP is increasing, medication initiation remains low amongst MSM with previous studies showing less than 5% of sampled MSM take PrEP (Hood et al., 2016; Mayer et al., 2016). To explain such patterns, it is possible that MSM may be facing potential barriers and resistance to PrEP uptake on an individual and social level. In order to understand the challenges of PrEP implementation in various PrEP consumer groups, research has attempted to identify potential barriers and facilitators of uptake. Key barriers include lack of knowledge about PrEP (Ayala et al., 2013), concerns about the level of self-motivation required to remember to take daily medication (Bourne et al., 2017), perceived individual risk of HIV acquisition (Zhang et al., 2013) and worries about the effectiveness of PrEP (Chakrapani et al., 2015).

In MSM, the decision to use PrEP is also strongly impacted by unique social contexts (Young & McDaid, 2014). Stigma on a social, cultural and structural level associated with PrEP in MSM has been identified in research as a prominent issue affecting uptake decisions. The stigma that is most socially and personally impactful is associated with homosexuality and gay sex practices (Galea et al., 2011), alongside shame and embarrassment about using PrEP (Ayala et al., 2013; Dubov et al., 2018). Additionally, perceptions that antiretroviral medications are only for HIV-positive individuals (Karuga et al., 2016) or that PrEP encourages risky sexual activity through risk compensation (behavioral risk increasing as perceived biological risk decreases; Milam et al., 2019; Gafos et al., 2019), remain prominent issues in MSM. Although previous research has identified these barriers and facilitators to uptake, there is a lack of understanding regarding how best to target barriers and facilitators in intervention planning to ensure positive uptake of PrEP. It is evident that public health policies and interventions need to target these barriers and facilitators to promote the uptake of PrEP. However, as yet, there is no coherence in the strategy that should be taken. To promote uptake of PrEP, characterizing barriers and facilitators to PrEP using behaviour science frameworks allows for theoretically based assessments of what can be done to encourage MSM to use PrEP as a preventative method.

There is a requirement to look more widely at the interplay between social, cultural and personal factors and their theoretical underpinning. Specifically, there is a particular need to better understand the psychosocial factors that are influencing and impacting the psychosocial stigma and shame associated with PrEP use. Research also has not yet attempted to clarify how PrEP uptake barriers and facilitators can be addressed through the development of behaviour change interventions (Brug et al., 2005). Given that there is a lack of coherence in strategy to promote PrEP uptake, conceptualizing PrEP uptake behaviour and initiation decision making is potentially most effective when interpretations of behavioural adoption are based on a theoretical framework (Hanbury & Wood, 2018). Theoretically driven interventions are more likely to lead to successful, long-lasting change (Michie et al., 2014).

The Behaviour Change Wheel (BCW; Michie et al., 2011) was developed as a layered framework with the COM-B model at the centre to specify behavioural factors that can be targeted as part of behaviour change intervention development (Ojo et al., 2019). The primary principle of the COM-B model is understanding that the interaction of *Capability*, *Opportunity* and *Motivation* can impact the likelihood of a desired behaviour (Handley et al., 2016). The *Capability* domain in the COM-B model refers to the physical and psychological capability an individual has to engage in or perform a certain behaviour. *Opportunity* highlights possible external physical and social factors that may prompt or make a behaviour possible. Finally, *Motivation* is a broader construct that incorporates automatic processes, basic drives and reflective processes that can affect the willingness to perform a behaviour (Michie et al., 2014). The model allows for the identification of the various components that need to be addressed in order to achieve a desired behaviour among a target group.

Michie et al. (2014) developed a 3-stage Step-by-Step Method for Designing Behaviour Change Interventions: First, understand the behaviours; second, identify intervention options; third, identify content and implementation options. Stage one of this method includes four steps: (i) define the problem in behavioural terms, (ii) select target behaviour, (iii) specify the target behaviour and (iv) identify what needs to be changed. Understanding PrEP uptake barriers and facilitators in relation to the COM-B provides a foundation for identifying intervention options (Stage 2) and specifying the content and implementation options (Stage 3) for developing future interventions in HIV intervention-prevention (Michie et al., 2014). Establishing PrEP uptake as the target behaviour and MSM as the target group, this research aimed to interrogate barriers and facilitators to PrEP uptake using a behavioural approach, therefore providing an evidence-based and theory-driven foundation for future interventions. This research employs Stage one of the Step-by-Step Method (Michie et al., 2014) and was intended to answer the research question: In men who have sex with men, what are the barriers and facilitators to PrEP uptake and how can they be conceptualized via the COM-B model?

METHOD

Design

A semi-structured qualitative interview design was used, employing thematic analysis (Braun & Clarke, 2021) and COM-B mapping (Michie et al., 2011; Ojo et al., 2019).

Participants

A purposive sampling technique was used to recruit thirteen MSM residing in England who were non-PrEP users aged between 21 and 64 years ($M = 32.15$, $SD = 10.84$). The inclusion criteria for participant sampling in this study were: participants aged 18 years or older, able to provide informed consent, self-identifying as a man who has sex with men, not currently taking PrEP, had not taken PrEP in the past

12 months and had been sexually active with other men in the past two years. Only two participants had previously used PrEP (mean length of PrEP usage time = 7 months, *SD* = 1.41). Participant demographics are presented in Table 1.

Materials

A 15-item semi-structured interview schedule (see Table 2) was created to identify barriers to and facilitators of PrEP uptake amongst MSM informed by the COM-B model. The schedule was created to address previous research that has demonstrated both individual-level factors such as knowledge (Ayala et al., 2013) and social-cultural factors such as stigmatization (Dubov et al., 2018) and risk compensation (Milam et al., 2019).

Procedure

Participants were identified using snowballing sampling whereby initial participants were recruited through convenience sampling from an LGBTQ+ community sample, and those participants were asked to identify other potential participants (Handcock & Gile, 2011). This method of sampling has been suggested to be effective in recruitment for research where participants are not easily accessible (hidden populations) or are a part of a vulnerable group (Naderifar et al., 2017). Therefore, participants were given the opportunity to become 'informants' and reach out to other eligible participants (Noy, 2008). To ensure recruitment consistency and minimize selection bias, informants were given full information about the study and the inclusion criteria for participants. Where informants identified potential participants, these new participants were able to contact the researchers to take part in the study.

One-to-one semistructured interviews were conducted face-to-face or online via Zoom. Participants were provided with information sheets via email, written consent was obtained before commencement of the interviews, and participants were informed about their right to withdraw at any point and up to 48-hours after participation without giving a reason. All identifiable features were anonymized during transcription and participants were asked to select their own pseudonyms (Allen & Wiles, 2016). Signposts to support and information about PrEP were provided in a postinterview debrief. The

TABLE 1 Participant demographic table

Participant pseudonym	Age	Sexual orientation	Relationship status
Michael	32	Gay	Single
Noah	30	Gay	Single
James	38	Bisexual	Committed
Patrick	37	Gay	Single
Brandon	21	Gay	Single
Samuel	64	Bisexual	Committed
Nathan	27	Gay	Single
Sean	29	Bisexual	Committed
Mr. X	24	Gay	Single
Charlie	23	Gay	Single
Morgan	31	Other	Single
Jonah	28	Gay	Single
Alexander	34	Gay	Single

duration of the interviews ranged between 28 and 65 min (M = 43.25, SD = 10.04). The study was approved by the University of Buckingham School of Psychology research ethics committee (Ethical approval no: PWEC2020/87U).

Data analysis

All interviews were audio-recorded online and transcribed verbatim using the encrypted artificial intelligence system Otter.ai, and checked/corrected for accuracy by the first author. The transcribed data were analysed using NVivo data analysis software. Francis et al. (2010) suggested an initial analysis sample of 10 participants for thematic analysis and a stopping criterion of 3 people. During analysis, saturation was reached at 10 participants with no new themes emerging and the stopping criterion was tested for each consecutive interview.

This study adopted a two-phase analysis approach (see Figure 1). In Phase 1, inductive thematic analysis was conducted (in accordance with Braun & Clarke, 2021). Following inductive thematic analysis, themes were deductively mapped onto the COM-B model (Phase 2; Michie et al., 2011). This two-phase approach is an increasingly used qualitative approach for informing behaviour change intervention development (see Courtenay et al., 2019; Ojo et al., 2019). Using this method allows for naturally emerging themes to be identified and elucidated further through application to theoretically driven models, informing the future implementation of evidence-based behaviour change interventions.

Phase 1

Using an inductive thematic approach, transcripts were coded using Braun and Clarke's (2021) phases of thematic analysis: (1) familiarization with the data; (2) coding; (3) generating initial themes; (4) developing and reviewing themes; (5) refining, defining and naming the themes; and (6) writing up. Initial codes, which represented individual barriers and facilitators, were clustered together where they demonstrated semantic or conceptual similarity, to develop initial and then higher-order themes. Inter-coder reliability of the inductive thematic analysis (Phase 1) was performed by triangulating coded quotes with the second author. Using Miles and Huberman's (1994) inter-rater reliability formula, dividing the number of agreements by the total number of agreements plus disagreements, there was a high interrater agreement at 85% between authors. Disagreements were resolved through in-depth discussion within the research team and in close consultation with the transcripts.

Phase 2

Each inductive theme was then individually and deductively mapped onto the COM-B model. This deductive mapping process was carried out by the first author in keeping with the definition of each COM-B component (Michie et al., 2011). Triangulation of the deductive mapping was carried out with the second author (a qualitative researcher with significant experience in using the BCW in practice) with discrepancies over component mapping resolved through discussion, and in close consultation with the transcripts and coding framework until a consensus was reached.

RESULTS

Results (from Phase 1 of the analysis) demonstrated that seven thematized barriers were represented in the data: (1) Limited information about PrEP; (2) Restricted access to PrEP; (3) Gay identity and sexual stigmatization; (4) Social and cultural stigmatization; (5) Capabilities in treatment adherence;

TABLE 2 Interview schedule

	Interview questions
1	There are many different ways of engaging in safe sex behaviours. What are your views on protection?
2	Can you tell me what kind of factors affect your decisions around safe and unsafe sex?
	2a. Can you talk me through the steps you take when thinking about sexual activity?
3	What specifically informs your choices to engage in safe sex?
4	How do you think mood, feelings or psychological mind-frame at a particular time can affect choices about protection/no protection?
5	How do you think being in a relationship might influence choices about protection?
6	Sometimes what we intend to do and what we do end up doing is different. In research, we call this the intention-behaviour gap. That is where intention to *plan* for protection does not always happen when people actually *have* sex. Can you talk me through your experiences with this?
	a. How do you think different protection methods might affect this process for you?
7	Tell me a little bit about what you know about PrEP?
	7a. What are your thoughts and opinions about PrEP?
8	You've chosen not to taken PrEP. Can you tell me a little bit about that choice?
	8a. What, if anything might change your decision?
	8b. Why do you think people do or don't take PrEP?
9	What, for you, do you think are the risks and benefits of using PrEP?
	9a. What do you think influences your perspectives?
10	What do you think the perception is around PrEP in the community?
	10a. How do you think the LGBTQ+ community influences your decisions about PrEP, if at all?
11	Some people believe there is stigma around PrEP
	11a. To what extent do you believe this is true?
	11b. To what extent are you influenced by such views
12	What kind of cultural factors might influence your decisions to use PrEP, if any?
13	If you knew your partner was a PrEP user, how do you think your choices around sexual behaviours would be impacted?
14	Previous research has suggested that PrEP might promote risky sexual behaviours
	14a. What are your personal views on that?
	14b. What do you think the community perspective is on this?
15	Having reviewed your thoughts and opinions about PrEP and sexual behaviours, what are your thoughts about protection in the future?

(6) Optimistic bias about sexual behaviours; and (7) Calculating risk. All themes represented barriers to PrEP uptake and no facilitators were demonstrated. From Phase 2 of the analysis, the results demonstrated that barriers to PrEP uptake were closely aligned with the core components of the COM-B model. Five (of six) COM-B subcomponents were represented: *Psychological Capability, Physical Opportunity, Social Opportunity, Reflective Motivation and Automatic Motivation* (see Figure 1). The COM-B subcomponent of *Physical Capability* was not evidenced in the data. Thematic occurrence across participants for COM-B components and thematized barriers is shown in Table 3. The COM-B components and nested barriers are presented in results with exemplar quotes. Additional quotations are provided in Table 4.

COM-B component: capability

Capability, reflecting an individual's capacity to engage in the behaviour concerned (Michie et al., 2011), was demonstrated only through the subcomponent of *psychological capability* and it directly mapped to the

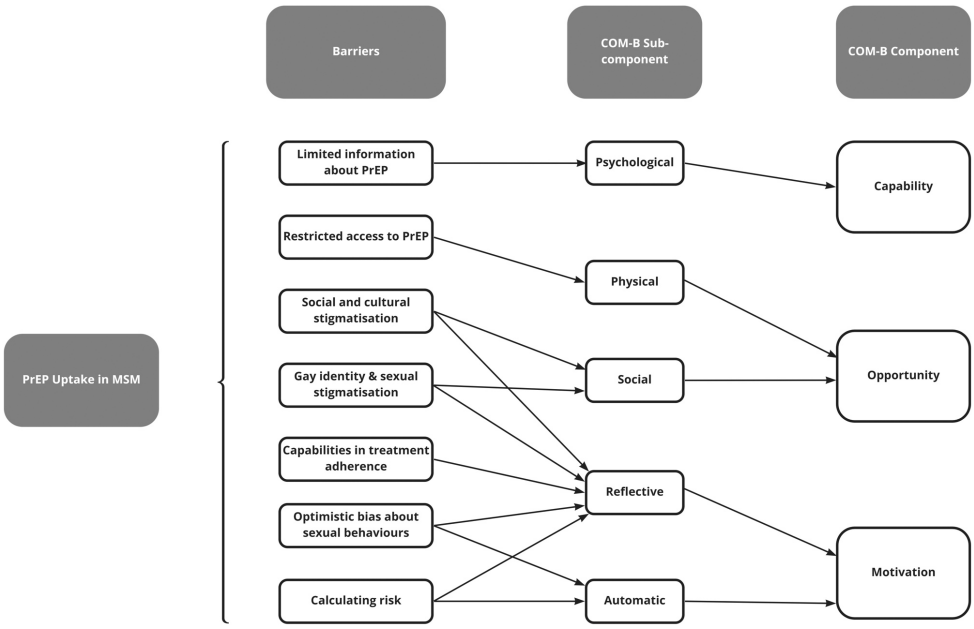

FIGURE 1 Outcomes map

first inductive theme, (1) Limited information about PrEP. Psychological capability refers to the capacity to engage in the thought processes integral to the development and maintenance of knowledge and understanding, for example via comprehension and reasoning (Michie et al., 2011).

COM-B subcomponent: psychological capability

(1) Limited information about PrEP

Participants' understanding of PrEP was a primary barrier to uptake. Participants indicated they had limited understanding about what PrEP was: "I just don't know enough… And that's the science in me talking, I just need to know, I just need to have information". (Noah)

In addition to knowledge, participants discussed how they felt they required wider networks for information gathering rather than relying on specialist sexual health service provisions:

> If it was easier to get more information, you could talk to any person about it rather than having to speak to a specialist. I feel like you talk to your GP about anything else that's wrong with you… So, I don't know why you can't talk to your GP about sex in the same way.
>
> (Alexander)

In assessing knowledge about PrEP, participants highlighted that prevailing misinformation, or a lack of information, can precipitate unprotected sex when taking PrEP:

> I think that the misconception is that as long as you take PrEP, you don't have to wear any form of protection. I think that's a very dangerous message that a lot of people have gotten into their heads.
>
> (Patrick).

TABLE 3 Occurrence of COM-B components by participants

COM B component	COM B sub-component	Inductive themes	Michael	Noah	James	Patrick	Brandon	Samuel	Nathan	Sean	Mr. X	Charlie	Morgan	Jonah	Alexander
Capability	Psychological	(1) Limited information about PrEP	■	■	■	■	■		■	■	■		■	■	■
Opportunity	Physical	(2) Restricted Access to PrEP	■	■	■	■	■	■		■	■				■
	Social	(3) Gay identity and sexual stigmatisation (4) Social and cultural stigmatisation	■	■	■	■	■	■	■	■	■	■	■	■	■
Motivation	Reflective	(3) Gay identity and sexual stigmatisation (4) Social and cultural stigmatisation (5) Capabilities in treatment adherence (6) Optimistic bias about sexual behaviours (7) Calculating Risk	■	■	■	■	■	■	■	■	■	■	■	■	■
	Automatic	(6) Optimistic bias about sexual behaviours (7) Calculating Risk	■	■	■	■	■	■	■	■	■	■	■	■	■

Note: Highlighted squares indicate occurrence by each participant.

TABLE 4 Sample quotes of barriers mapped onto the COM-B model

COM-B component	COM-B subcomponent	Inductive theme	Sample quote
Capability	Psychological capability	(1) Limited information about PrEP	'I don't know enough about it, or its effects on the body. But what else does it do? Does it interact with the other functions inside of your body? Do I need to change my diet at all? Do I need to increase the intake of a particular item as a supplement or whatever? How will it affect my body?' (Patrick, 37)
			'I feel like I'm not allowing myself to know what I need to know or to know the facts. So it's difficult for me to like, be able to say yes, because it's possible that in my research, I might be like, "What is this?" But yes, like, if all things are a okay, then yeah, I could definitely see myself being on it'. (Noah, 30)
			'I know it's become massively popular. But the I don't know like the real details, in depth details. I think there's two versions, there's one you take constantly and there's one that you can take for a short period of time. But I think both of them require you to take it before and you can't just take it after. It's not like a morning after pill. But yeah, other than the fact that it is a protection against HIV, and from what I gather HIV only, that's all I know'. (Morgan, 31)
Opportunity	Physical opportunity	(2) Restricted access to PrEP	'Maybe the accessibility to it [PrEP]. Okay, all over the world, can people get access to PrEP or not?' (Jonah,28)
			'Ah, well, part of it has to do with the lack of availability… I don't believe that it's readily available in our jurisdiction'. (Patrick, 37)
Opportunity	Social opportunity	(3) Gay identity and sexual stigmatization	'Maybe I'm scared of what people think if I take prep… I think I'd be nervous to be judged by the gay community…I think I'd feel a bit judged if I were taking PrEP because I feel like I'd be looked at as like one of these people who is just taking it to have unprotected sex all the time'. (Michael, 32)
			'And things like PrEP if I could just go and talk to my GP and say, "Can I have it, please?" And they say "yeah, that's fine." Like a women would do if she wanted the pill, a bit of a chat to start off with: "Why do you want it?" Because I'm having sex with men, and I'd rather not get HIV. I feel like it should be that straightforward. And I should be trusted to make that decision for myself, really'. (Alexander, 34)
		(4) Social and cultural stigmatization	'A majority of them [gay porn] have moved away from having their performers using condoms. I've noticed it and it's been a question in the back of my mind as far as, I get that porn is not real. I know it's not real. But some people cannot disassociate the fantasy of the scene and the reality where they would see these people just engaging in raw, bareback sex, and thinking that's how it's supposed to be done'. (Patrick, 37)

TABLE 4 (Continued)

COM-B component	COM-B subcomponent	Inductive theme	Sample quote
			'I think in certain communities, regional communities, or different religious or ethnic communities, I think there might be some barriers, certainly [to using PrEP]. I'll just put it bluntly for the guys that are married. The wife goes in the medicine cabinet and that will be a big problem'. (Samuel, 64).
			'I imagine if you grew up in like, if you live in a super religious household, and you're trying to take PrEP on the sly, that would be really difficult. I can't imagine how you would manage that really? Sort of sneak a glass of water up to your bedroom and hope that nobody knows. That's what you're doing every day? Because that must be hard thing to do in secret, I'd imagine'. (Alexander, 34)
		(3) Gay identity and sexual stigmatization	'So this sort of like gay slut shaming thing [….] But it reinforces this idea that gay sex is dangerous and dirty. So they feel bad about PrEP as well. It reinforces this idea that, like I need to take these additional measures because the sex that I'm engaging in is grosser, more gross, more dirty, more risky and less acceptable than the sex that other people are having. Like it does remind me that there's a social stigma around gay sex in general. And it reminds me that when I'm engaging in that, I'm part of the problem. It makes me feel like part of the problem almost'. (Michael, 32)
		(4) Social and cultural stigmatization	'Yes, because then I mean, you need to go to one of the centres [STD Clinics]. I mean, if you go to one of these centres, you're considered a sexual worker or a homosexual. So why would a married man with a family go there? You know, I mean, people talk, they see, they gossip'. (Jonah, 28)
			'If you have an umbrella, you will go into the rain, you know, it's that kind of behaviour. Like you will think you're protected, so why not? Do all kinds of things that you've always wanted to do?' (Charlie, 23)
Motivation	Reflective motivation	(5) Capabilities in treatment adherence	'Yeah, because I know myself. If I have to take a course of medication at a particular time every day, I will have to get into the habit and routine of taking that particular medication at the particular time that's supposed to be taken. Some people might find that to be a bit tedious'. (Patrick, 37)
			'But I tend to think that surely, if you miss a tablet, then surely your protection drops, even if it's a short-term thing. And I know people that go out on the weekend or even weeklong benders with drugs and alcohol, and I think "are you really remembering to take the tablets during all of that?" Because on a normal day, I forget to take [swears] vitamins'. (Morgan, 31)

(Continues)

TABLE 4 (Continued)

COM-B component	COM-B subcomponent	Inductive theme	Sample quote
		(6) Optimistic bias about sexual behaviours	'I just don't feel like I'm engaging in behaviour that needs to be protected by taking a pill'. (Michael, 32)
			'I'm incredibly low risk with compared to some people. But for me, I don't feel I fall into a category where I would need to use PrEP'. (Morgan, 31)
		(7) Calculating risk	'And so I think because of the benefits, and the risk becoming so marginal, the cost of an additional risk of catching one of the other STI's is outweighed by the benefit of not having to break the sexual experience, being able to just continuously move through and if you're feeling it, and he's feeling it, just have at it, however, you want to go at it'. (James, 38)
			'Definitely, I think it's the ability for people to think that they happen, as I said earlier, to have a god complex against all viruses, because they've defeated the killer virus and prevented the killer virus [referring to HIV]. It's, you know, generally accepted as a cure all, whereas things like these new forms of chlamydia and gonorrhea that have come out are very, very damaging'. (Mr X, 24)
			[After engaging in unprotected sex with someone on PrEP]: 'But then the second that everything is done, you start questioning everything you did, and you start blaming yourself and you start feeling anxiety until you make sure again that you're negative'. (Nathan, 27)
Motivation	Automatic motivation	(6) Optimistic bias about sexual behaviours	'I feel like there is some perception of "yeah, take this drug and I will never get anything, or I will be, you know, healed or I won't contract anything."'(Noah, 30)
		(7) Calculating risk	'I guess then PrEP would be just kind of like a comforting thing. But if you're like, if you're in a committed relationship, and one or two people are taking PrEP, it's kind of like an extra measure just to make you feel at ease and make your partner feel at ease'. (Brandon, 21).
			'And I think, you know, that there's that that age old saying that, an ounce of treatment is worth a pound of cure. So whatever that is, but prevention is really the key that right. I think back to the world in the 80s and early 90s and where we are now. Not just through retroviral drugs, but also through these sorts of prevention methods and, you know, being able to just nip it in the bud really before it's even there. I think, what I'm getting at that, it's important to have taken care of it before the problem'. (Sean, 29).
			'So you feel like all the older people are taking it more because they don't care what consequences it is going to have in 20 years. Rather, a 20 years old guy who might say, oh, when I'm 40 and this PrEP side effect that they didn't discover at the time is now kicking in me'. (Nathan, 27)

COM-B component: opportunity

Opportunity, encompasses the environmental context and systems, including resourcing and location (Michie et al., 2011). *Physical Opportunity,* specifically referencing availability and physical access, directly mapped to the second inductive theme (2) Restricted access to PrEP, with no further thematic co-occurrences. *Social Opportunity* highlights the opportunities that occur (or are limited) because of social factors, including cultural norms and social cues (Michie et al., 2011). In confirmation, *Social Opportunity* was strongly evident in the thematized barriers representing feelings of stigmatization: (3) Social and cultural stigmatization; and (4) Gay identity and sexual stigmatization.

COM-B subcomponent: physical opportunity

(2) Restricted access to PrEP

Restricted access to PrEP represented difficulties involved with physically gaining access to PrEP and the costs that may be involved in taking it. Ten participants acknowledged that access to PrEP is a factor that may affect uptake: "I know it's not accessible everywhere. Definitely not all over the world." (Brandon). Some participants highlighted that even where it is available, the steps required to access PrEP were off-putting:

> If it was easily available, and it wasn't a massive sort of faff… and I didn't have to convince someone that I deserved it.
>
> (Alexander)

Participants noted that if access were easier, this would facilitate uptake for them. For example: "if I had easier access to it, I probably would be on it" (Patrick). Even if physically gaining access was not a barrier, the financial cost of PrEP in the long run was considered a factor that influenced uptake. Sean, discussing barriers, added: "And then, you know, comes the real cost of money". Jonah supported this: "You can also be fully aware, and read everything, but then you don't have the money to pay for it." In this instance, physical access limitations therefore were more salient than psychological capability.

COM-B subcomponent: social opportunity

(3) Gay identity and sexual stigmatization

Participants described how perceptions of gay sex and the stigmatization of gay sex contributed to peoples' understanding of homosexual sexual behaviours and the associated social and sexual limitations that result:

> I think that sex has a tendency of being stigmatized and made to be a taboo subject, because of its sort of mystique. Particularly gay sex. It's not taught, it's not reinforced, and in many ways leaves—at least left me—with more questions than answers. (Sean).

This stigmatization was applied to those who take PrEP: the idea is that users are promiscuous proliferated, with PrEP seen as an excuse to practice unprotected sex, effectively increasing, but stigmatizing, sexual opportunities:

> [Gay sex] has maintained this really negative view of sexuality and sexual interests and perversion amongst gay people. This idea is that gay men are having too much sex and are overly sexualised and are being unsafe. So, I think sometimes it's easy to dismiss PrEP use as a license to just have sex with whoever you want.
>
> (Michael).

(4) Social and cultural stigmatization

Multiple different social, cultural, family and religious factors were highlighted as potential barriers to the usage of sexual health services, including testing for sexually transmitted infections (STI) testing and uptake of PrEP. Participants indicated the risks inherent in health-seeking behaviour, notably being 'outed' as being gay before feeling ready to come out, limiting social opportunity/willingness to use PrEP:

> With a difficult, not necessarily family environment, just a cultural environment—it [PrEP] could bring a lot of stigma with it, for the fact that it would effectively 'out' someone if anyone knew what it was. So yeah, I suppose that would discourage someone from using it.
>
> (Morgan)

Further, participants described the stigma that is associated with sexual health clinics and the negative consequences and fear of being seen in one, similarly limiting social opportunity and access to PrEP:

> And certainly, if you live in an area that's super conservative, or very religious, if you live in a place [where] everybody knows that's the STI clinic and they see you going in it, you have to deal with that kind of embarrassment.
>
> (Alexander)

COM-B component: motivation

Motivation addresses the role of intrinsic internal and decision-making processes, which may be involved in behaviour (Michie et al., 2011). *Reflective motivation* incorporates reflective processes such as goal setting, planning and reflective evaluations of past events that motivate behaviours (Michie et al., 2011). *Reflective motivation* was demonstrated across five thematized barriers: (3) social and cultural stigmatization, (4) gay identity and sexual stigmatization, (5) capabilities in treatment adherence, (6) optimistic bias about sexual behaviours and (7) calculating risk. The COM-B subcomponent, *Automatic Motivation*, encompasses automatic processes, basic drives, desires and inhibitions (Michie et al., 2011). *Automatic Motivation* was identified in the inductive barriers associated with holding an: 6) optimistic bias about sexual behaviours and in (5) calculating risk.

COM-B subcomponent: reflective motivation

(3) Gay identity and sexual stigmatization

Perceptions of PrEP users were linked to the stigma surrounding gay sex during the height of the HIV/AIDS epidemic, showing how the novel preventative behaviours employed by PrEP users are being viewed through an old lens. This historical perspective alters contemporary reflective motivation to use PrEP:

> I feel like our 'ancestors' have shown us that it can be really dangerous to have unprotected sex…The stigmatization of having unprotected sex comes hand in hand with taking PrEP, because that's the first thing that gay men think of when it comes to PrEP. (Brandon).

(4) Social and cultural stigmatization

Regarding evaluations of the LGBTQ+ community, it was felt there was a divide in perceptions of the effectiveness of PrEP as an HIV prevention method: PrEP was closely associated with increased motivation to engage in risky sexual activity. This initiated personal reflection, which was closely tied to motivation towards or against PrEP:

> There's some dissent or disagreement in the community [LGBTQ+] about whether or not PrEP is a good thing. Because it does protect against HIV, but it can provide some sense of false security against other STIs, and it's not 100% effective. So, there's this idea that people are being reckless and overestimating their safety when using PrEP and I think some of the community basically think you're just being reckless, like you're taking this as being a cure-all pill. And you're behaving like this and so you're proliferating the transmission problem.
>
> (James).

(5) Capabilities in treatment adherence

Participants discussed taking a daily pill as a major barrier to uptake, reflecting on the requirement to take a pill daily as 'negative publicity': *"*Also, there is this negative publicity for PrEP… you have to take it once per day*"*. Reflections on this requirement altered participants' perceptions about PrEP users' abilities to adhere to a daily pill:

> And I know people that go out on the weekend or even weeklong benders with drugs and alcohol. And I think [to myself] 'Are you really remembering to take the tablets during all of that?' Because on a normal day, I forget to take vitamins.
>
> (Morgan)

Participants expressed doubt about their own ability and that of others not only to take a daily pill but also to attend the regular check-ups and testing required for PrEP users to refill their prescriptions. They described an inability to do so as 'lazy', reflecting negatively on the cumulative inconvenience(s) associated with PrEP.

> And then I thought maybe I—and a lot of other gay men, too—I think have been lazy when it comes to taking PrEP… You know, doing the tests every three months. And then it might seem like too much effort, which is just kind of like laziness.
>
> (Brandon)

(6) Optimistic bias about sexual behaviours

Participants spoke about their perceptions of the optimism that PrEP users had regarding their behaviours and outcomes. Respondents thought that PrEP users had an increased sense of optimism because they were on PrEP, and they reflected on the implications of that optimistic bias:

> Some people have been like 'Yeah, I'm on PrEP, that makes me immune to HIV. Effectively, I'm invincible'. And they forego using condoms, when actually, it's counterproductive in that sense.
>
> (Mr X)

Participants outlined how their decision-making processes are influenced by PrEP: they feel a sense of unrealistic optimism is initiated by PrEP and this is reflectively evaluated alongside their own safe sex practices, potentially impacting motivation to engage in riskier sexual behaviours:

> Being in a position where somebody says, 'Well I'm on PrEP', and then I'm in this position where I haven't had sex in however many months and so I know that I've been safe as well. I would make that decision [to have unsafe sex] differently.
>
> (Michael)

(7) Calculating risk

Participants thought some individuals might not take HIV as seriously as it used to be taken because of antiretroviral treatment. This is relevant to prophylactics such as PrEP, as antiretroviral existence was thought to provide a sense of security insulating individuals from the acquisition of HIV:

> There are people who probably don't even care about HIV anymore. Like 'Oh, there are antivirals, and you can now reduce the amount of HIV in your body, it would stop it from reproducing'.
>
> (Charlie)

Participants thought that PrEP users underestimated the threat of STI infections because they believe they are protected against HIV and other STIs are treatable, beliefs indicative of reflective motivation processes. As a result, participants thought PrEP users engaged in increased risky behaviour, including condom-less sex:

> There is definitely a consistency with people on PrEP and the forgoing of using extra protection like condoms. I think it's the ability for people to think that they happen to have, like I've said, a God complex against all other viruses, because they've defeated the killer virus, and prevented the killer virus.
>
> (Mr X)

Participants reflectively evaluated their risk by calculating it using perceptions of other PrEP users' behaviours and STI curability as risk-likelihood markers:

> I would say I understand the person who wants to take PrEP and just go bareback [engaging in condom-less sex] all the time. I understand that person's perspective and the idea that PrEP protects against HIV, but not necessarily against other STIs. I personally would probably write that off and say, well, other STIs are more likely to be curable and less likely to be deadly. There's lots of different risks that I'm already comfortable with, in entering into a sexual encounter. So, taking PrEP and going bare would not add considerable risk to the experience for me.
>
> (James)

COM-B subcomponent: automatic motivation

Automatic Motivation was identified in the inductively thematized barriers: (6) Optimistic bias about sexual behaviours and (7) Calculating Risk, both of which co-occurred in *Reflective Motivation*.

(6) Optimistic bias about sexual behaviours

Participants' optimism about their own sexual behaviours highlighted the existence of natural, automatic conclusions, which reflected low motivation to use PrEP. Participants felt they did not need PrEP because they were optimistic that the sexual behaviours they engaged in would not require additional protection. Noah expressed this: "I feel like I don't need it. I feel like I'm not engaging in so much casual or unprotected sex that I just feel like it's not on my radar." This demonstrates automatic motivation, where processing is not required for the bias to exist. Similarly, Morgan thought he was less at risk and categorically different from those who need to use PrEP: "But for me, I don't feel I fall into a category where I would need to use PrEP."

(7) Calculating risk

Closely related to the optimistic bias outlined above, participants described not taking PrEP as a process of rapid, automatized risk analysis, indicative of underlying, automatic motivations. For example, they identified feelings of comfort when taking PrEP, restricting the need to process personal risks further:

> I guess then PrEP would be just kind of like a comforting thing. But if you're like, if you're in a committed relationship, and one or two people are taking PrEP, it's kind of like an extra measure just to make you feel at ease and make your partner feel at ease.
>
> (Brandon)

For Sean, the need for any risk calculation can be mitigated entirely through preventative PrEP use. He sees early PrEP adoption as a way of automatizing infection prevention:

> Not just through retroviral drugs, but also through these sorts of prevention methods and, you know, being able to just nip it in the bud really before it's even there. I think, what I'm getting at that, it's important to have taken care of it before the problem.
>
> (Sean)

DISCUSSION

The current study identified salient barriers to PrEP uptake, conceptualizing the barriers by mapping the inductive thematic findings onto the COM-B model. Results demonstrated thematized barriers of: Limited information about PrEP; Restricted access to PrEP; Gay identity and sexual stigmatization; Social and cultural stigmatization; Capabilities in treatment adherence; Optimistic bias about sexual behaviours; and Calculating risk. The barriers demonstrated that five COM-B constructs were represented in the thematized barriers: *Psychological Capability, Physical Opportunity, Social Opportunity, Reflective Motivation and Automatic Motivation. Psychological Capability* and *Physical Opportunity* directly mapped to the thematized barriers of limited information about PrEP, and restricted access to PrEP, respectively. The *Social Opportunity* for PrEP uptake was clearly limited by experiences or expectations of stigma, represented in the thematized barriers of gay identity and sexual stigmatization and social and cultural stigmatization. The COM-B component of *Motivation* was highly salient in this study, with *Reflective Motivation* strongly embodying the viewpoints of participants through five thematized barriers: Gay identity and sexual stigmatization, Social and cultural stigmatization, Capabilities in treatment adherence, Optimistic bias and Calculating risk. Finally, this study demonstrated that *Automatic Motivation* operated either through the maintenance of an optimistic bias about sex, or an automatized calculation

of risk. The findings of this study clearly present the theoretical underpinning of barriers to PrEP uptake. This allows for public health decision makers to prioritize individual barriers in intervention design to promote the uptake of PrEP.

Psychological Capability was the underlying domain, which underpins PrEP uptake through limited information about PrEP. Participants felt that their knowledge base was weak and that they were subject to misinformation and information gathered from unreliable sources rather than informed healthcare professionals. In reference to the BCW, this highlights the need for education and knowledge-delivery to be incorporated in intervention design to ensure MSM are aware of PrEP, the benefits and consequences of using PrEP and how to administer PrEP safely and effectively. Previous research has demonstrated the negative impact that a lack of information on PrEP can have on PrEP uptake decisions (Ayala et al., 2013). Thus, ensuring adequate information is provided by credible sources to MSM could promote PrEP uptake. Using credible sources such as healthcare professionals allows for the delivery of tailored information and ensures the integrity of the information provided (Arlinghaus & Johnston, 2017). To help patients understand and navigate the health care systems, PrEP patient navigation services have been suggested as a model of care co-ordination (Felsher & Koku, 2018). In order to reduce patient worries and stigma and to provide counselling and education for high-risk patients (Bradford et al., 2007), PrEP patient navigation services can be included as a program within the NHS to promote uptake. The current study highlights that lack of PrEP knowledge limits MSMs' perceptions of psychological capability and informed self-management decision-making with regards to uptake and use of PrEP.

Social and *physical opportunity* took the form of restricted access to PrEP, social and cultural stigmatization and gay identity and sexual stigmatization. The potential environmental and logistical restrictions to physically accessing PrEP such as geographically identifying sexual health clinics that prescribe PrEP (Sullivan & Siegler, 2018) have been widely identified in previous research (Felsher & Koku, 2018) and are commonly cited barriers, but the current study demonstrated how accessibility combines with cultural, social, religious and family factors to limit uptake. This is consistent with stigma-based HIV research, which has identified interpersonal barriers to PrEP uptake, including factors such as fear of family rejection if one is discovered to be taking PrEP (Galea et al., 2011). Results demonstrated that perceptions within the LGBTQ+ community are that people on PrEP are using it to practice risky behaviours. This supports the negative sentiment common within the LGBTQ+ community that 'slut-shames' PrEP users and classifies them as 'PrEP/Truvada whores' (Belluz, 2014).

In the current study, individuals who chose to use PrEP were not seen as engaging in a conscientious preventative method against HIV. The opposite perspective presented: risk compensation associated with PrEP was viewed as providing a rationale for engagement in condom-less sex amongst MSM (Golub et al., 2010; Milam et al., 2019). To protect themselves from such negative judgements and perceptions, non-PrEP users avoided taking PrEP to distance themselves from these layers of stigma. Future interventions must use the BCW to navigate physical accessibility and personal/social/structural stigmatizing factors concurrently, as together they pose significant barriers to PrEP uptake amongst MSM. Educating MSM and society as a whole about PrEP, persuading individuals to reduce the negative sentiment associated with PrEP and providing support for MSM to overcome their individual barriers are key intervention functions to enable MSM to consider using PrEP preventatively.

Elements of both *Reflective* and *Automatic Motivation* were present across multiple barriers. Taking a daily pill was considered a barrier to uptake, supporting research by Xue et al. (2015) who found that 68.7% of their participants reported the inconvenience of daily medication to be a factor influencing their (un)willingness to take PrEP. Participants doubted that PrEP users regularly adhere to their treatment, especially if they were using alcohol and drugs. Indeed, users losing PrEP supplies and forgetting to take PrEP as prescribed due to being high on methamphetamine and alcohol have been reported (Storholm et al., 2017). Ensuring that the public health interventions that are selected consider training MSM through habit formation and self-monitoring behaviours could positively impact the barriers associated with low adherence self-efficacy.

The current research highlights the importance of personalizing behaviour change interventions to account for the strength of reflective motivation: interventions need to be dynamically responsive to participants' personal risk-benefit analyses. Educating MSM about the health and emotional consequences of HIV and other STIs should be considered in BCW intervention planning. As described in this study, unsafe sexual practices were strongly driven by reflective motivation and comparative unrealistic optimism: these factors need to be considered in conjunction with the need for education around health consequences to effectively promote PrEP uptake. Additionally, persuasion as an intervention function to induce positive sentiments around PrEP could be considered in intervention planning to reframe the stigmatization of gay sexual practices and PrEP, which impacts both automatic and reflective drives to use PrEP.

Participants felt that perceptions of HIV severity have dropped because there are preventative and treatment approaches readily available, such that HIV is now conceptualized alongside other STIs as manageable and not requiring additional protection. Research has demonstrated that rates of chlamydia, gonorrhoea and syphilis have increased with the introduction of PrEP (Barreiro, 2018). This supported the hypothesis that the availability of effective antiretroviral treatment has facilitated the willingness to engage in risk-taking sexual behaviours (Boily et al., 2005). Additionally, this study demonstrated that participants held an optimistic bias, giving their own (positive) subjective evaluations of their safe sexual behaviours as a reason for not using PrEP. In confirmation, previous research found 90% of gay men believed that they were less likely to contract HIV compared with the average gay man, despite half of the sample reporting having engaged in risky sexual behaviours in the past six months (Gold & Aucote, 2003). Further, in the current research, participants highlighted a concern that PrEP users might gain a sense of false or unrealistic optimism when on PrEP: PrEP users may cognitively appraise their risk with an unrealistically optimistic lens because they are on prophylaxis that reduces their chance of contracting HIV (Gold, 2004). Therefore, individual behaviours, perceived through an optimistic lens undoubtedly impact PrEP uptake decisions and are strongly associated with changed sexual behaviours.

Theoretically informed interventions

To date, the Centers for Disease Control and Prevention (CDC) list five public health interventions as 'PrEP Best Practices' (Centers for Disease Control and Prevention, 2021): (1) iTab (Individualized Texting for Adherence Building; Fuchs et al., 2018), (2) iText (Moore et al., 2018), (3) LifeSteps for PrEP (Mayer et al., 2017), (4) PrEP Counselling Center (Desrosiers et al., 2019) and (5) PrEPmate (Liu et al., 2019). However, these interventions aim to address *adherence* to PrEP rather than *uptake*. Despite research commonly documenting the benefits of theoretically-driven interventions (Conn et al., 2016; Hanbury & Wood, 2018), a recent review found only two intervention designs targeting PrEP uptake utilized theory (Remy & Enriquez, 2019). Many Men, Many Voices (3MV; Hosek et al., 2013) was based on the Social Cognitive Theory (Bandura, 1986) and the Transtheoretical Model (Prochaska & DiClemente, 1994), and Life Steps for PrEP Intervention (Mayer et al., 2017) was based on the principles of Cognitive Behavioural Therapy, Problem Solving Therapy (Wade Taylor et al., 2014) and Motivational Interviewing (Rollnick & Miller, 2002). The COM-B, however, has broader utility: in this study, it has provided an indication of where the barriers to PrEP uptake fit within the BCW, evidencing, for example, important thematic co-occurrences across the *social opportunity* and *reflective* and *automatic motivation* COM-B components.

This behavioural foundation for intervention development is particularly important in the climate in which PrEP uptake is now more freely available across the United Kingdom (Couzens, 2017; Estcourt et al., 2021; Nandwani, 2017) and, increasingly, worldwide (Zhang et al., 2013). Though the worldwide variation in PrEP accessibility or unique cultural barriers may exist, it is likely that the barriers presented in this paper are broadly applicable to many different countries if viewed through the lens of the COM-B (sub)components. The overarching COM-B components can be contextually mapped against

the BCW to develop tailored, culturally sensitive and theoretically informed tailored interventions. The current findings demonstrated the salience of social opportunity, reflective motivation and automatic motivation in uptake decisions. Therefore, future interventions must address such COM-B domains concurrently to deliver holistic behavioural interventions. A further BCW analysis specifically employing the Behaviour Change Technique Taxonomy (Michie et al., 2013) is required to identify optimum intervention functions, policy categories, behaviour change techniques and modes of delivery for PrEP uptake interventions. The complex interplay between COM-B components and thematized barriers identified in this study clearly demonstrates the need for a multifaceted socio-structural stigma-focused intervention to promote the uptake of PrEP.

Limitations and future recommendations

Some limitations existed in this study: though perceptions of cultural, social and religious factors were raised as barriers, the study did not specifically aim to understand these perspectives by interviewing participants in comparative groups from diverse cultures. Lived experiences of different cultures might significantly alter perceptions and this would mean that differentiation is needed in the improvement of PrEP uptake programs in different populations (Quinn et al., 2019). Future studies could explore perceptions of different groups such as the Black, Asian and minority ethnic communities, or specific migrant communities from specific countries or regions as research demonstrated lower uptake of PrEP amongst these groups (see Kuhns et al., 2017; Quinn et al., 2019).

This study's inclusion criteria allowed participants who have previously been on PrEP to enrol, yet they may have different perceptions of PrEP formed via prior positive or negative biases/experiences towards/against PrEP. Given that opinions from previous PrEP users are important in understanding actual behaviours while on PrEP, future studies could evaluate the opinions of previous PrEP users and compare them with perceptions of those who have never taken PrEP. This study aimed to mitigate this limitation by excluding participants who had taken PrEP in the preceding 12 months; however, future research could extend this exclusion period further.

Finally, even though this study aimed to explore both barriers and facilitators of PrEP uptake, barriers of uptake emerged as most salient. Therefore, collectively the themes described the potential barriers restricting participants' desire to use PrEP as a preventative method to a greater extent than the facilitators. This was likely because the sample consisted of only non-PrEP users and they are more likely to express reasons stopping them from using PrEP. However, given the recent availability of PrEP in England, understanding barriers in relation to behaviour change is essential to address gaps and promote uptake at this crucial time. Future studies may choose to prioritize facilitators in ongoing work. This might be achieved by purposively recruiting PrEP users to determine factors, which positively influenced their decisions to take PrEP.

CONCLUSION

Using the COM-B model, this study adopted a novel approach to understand barriers and facilitators to PrEP uptake amongst MSM. Mapping the barriers to PrEP uptake against the COM-B provides a foundation for the use of these key qualitative research findings in future intervention development (Michie et al., 2014). This study demonstrated that *Psychological Capability, Physical and Social Opportunity, and Reflective and Automatic Motivation* are crucial for explaining PrEP uptake amongst MSM. In particular, Motivation is highly salient and combines with social and sexual stigma when making decisions to use PrEP as a prevention method. These findings extend knowledge of the primary behaviour change domains that must be targeted to increase PrEP uptake amongst MSM. As the threat of the HIV epidemic continues to have significant negative health impacts on the lives of MSM globally, specificity in the characterization of barriers related to preventative sexual health

behaviours amongst this key group has the power to reduce the health burdens associated with HIV worldwide.

AUTHOR CONTRIBUTIONS

Adam Madhani: Conceptualization; data curation; formal analysis; methodology; project administration; writing – original draft; writing – review and editing. **Katherine Anne Finlay:** Conceptualization; data curation; formal analysis; investigation; methodology; project administration; supervision; validation; writing – original draft; writing – review and editing.

CONFLICTS OF INTEREST

No conflicts of interest

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in "figshare" at http://doi.org/10.6084/m9.figshare.13551170.v1 reference number 13551170.

ORCID

Adam Madhani https://orcid.org/0000-0002-6957-9087
Katherine A. Finlay https://orcid.org/0000-0002-8997-2652

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