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PrEP Product Acceptability and Dual Process Decision-Making Among Men Who Have Sex with Men

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Abstract

Purpose of Review Advances in short- and long-acting pre-exposure prophylaxis (PrEP) technologies have incentivized the need to understand how individuals make trade-offs and competing decisions regarding PrEP modalities. The purpose of this review was to examine how researchers have conceptualized and measured attributes that are either intuitive and emotional (System 1) or deliberative and cognitive (System 2) in conjoint analysis or discrete choice experiments focused on diverse PrEP technologies among men who have sex with men (MSM).

Recent Findings Across the 9 studies meeting inclusion criteria, 5 included oral PrEP, 3 included topical rectal microbicides, 4 included PrEP injectables, and 1 study focused on an HIV prevention vaccine. Studies have not used uniform metrics, making comparisons difficult. Researchers measured attributes linked to System 2 processing (e.g., cost, efficacy), yet none examined System 1 processing.

Summary There is not one product or attribute preferable to all groups. Prevention products will need to be developed and promoted to reflect that diversity. Given that PrEP technologies have been solely informed by System 2 attributes, efforts to integrate System 1 attributes into ongoing and future PrEP choice experiments are pivotal to advance PrEP acceptability research and interventions to support their implementation.

Keywords Decision-making · Acceptability · Dual process · Conjoint analysis · Discrete choice

Introduction

Increasing clinical advances in the success of short- and long-acting prevention and care technologies have incentivized researchers and policy makers to better recognize and understand how individuals make decisions regarding their preferred choice of HIV prevention or care technologies. Appropriate positioning of products may increase the acceptability and perceived value of current and emerging HIV prevention technologies including daily and intermittent oral PrEP, long-acting injectables, drug-eluting rings, films for topical drug delivery, subcutaneous implants, monoclonal antibodies, vaccines, and rectal microbicides [1, 2]. For example, daily oral pre-exposure prophylaxis (PrEP) substantially improves protection against HIV, but uptake and sustained use has not been observed equitably in key segments of the population at greatest risk for HIV infection [3–5]. As efforts to increase daily oral PrEP uptake and adherence across the highest risk segments of the population continue, a wave of new technologies will face similar challenges in uptake and adherence, all of which would benefit from better integration into the kinds of decisions that a wide variety of people will be making about their health [6]. At their core, research and implementation science efforts seek to address two fundamental questions: How do individuals evaluate the attributes of different HIV prevention products and decide on their preferred prevention method? How might understanding users' decision-making help clinicians support their uptake and adherence to HIV prevention technologies?

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HIV prevention researchers have often sought to answer these questions through the use of conjoint analysis (CJA) to evaluate a product's independent attributes on choice preference or through discrete choice experiments (DCE) to compare choices based on product bundles or scenarios. These two methods offer an approach to identify what features vulnerable populations identify as important in next-generation prevention products and to inform drug developers and policymakers of prospective users' acceptability trade-offs across HIV prevention products and regimens. Emergent from consumer psychology and marketing research [7], CJA and DCE are methods used to design new products or propose modifications to an existing product, to ascertain what attributes (i.e., elements linked to a product's acceptability) are the most influential in consumers' decision-making, and to decide on the best price point based on the most and least desirable product profiles emerging from different attribute combinations. We briefly introduce these two methods to the reader below (see Rao [8] for an in-depth discussion of these issues).

In CJA, product profiles are created that vary systematically across various attributes, in this case for antiretroviral therapies (e.g., side effects, medication failure, development of drug resistance, and regimen convenience). Respondents are asked to evaluate each profile independently using rating scales (e.g., appeal, importance, willingness-to-pay). By comparing how ratings change across profiles, researchers can estimate the relative importance and strength of each attribute. Beusterien and colleagues [9], for example, found that participants ranked the likelihood of medication-associated rashes as the key feature in selecting new ART treatment when posed as a traditional survey question. When presented with different attributes in their CJA, however, concerns regarding drug resistance, regimen convenience, sleep disturbance, and drug failure had the greatest perceived value when participants had to trade off features. Interestingly, these attributes were predictive of participants' actual HIV medication choice 75% of the time, illustrating the importance of integrating CJA or other advanced decision science methodologies when trying to predict consumer actions.

In DCE, on the other hand, respondents are asked to evaluate multiple product profiles simultaneously and to select the profile, if any, that they would be most likely to choose in real life. Similar to CJA, researchers using DCE are then able to measure the relative influence of each attribute listed in the profiles and to estimate the preferred choice scenario for different subgroups of the populations. Hauber and colleagues [10], for example, used a DCE with ART-naïve African Americans living with HIV to compare how participants considered medication adverse events in their decision-making. In comparing drug profiles, participants preferred therapies that had short-term adverse events with clear treatment management outcomes to therapies that had long-term adverse events where the outcomes were uncertain. In fact, respondents preferred therapies that had a greater number of treatable adverse events if it meant the therapy would have a lower risk of virologic failure. Thus, CJA is often more suitable as an approach when researchers are trying to understand the contribution of each attribute to a hypothetical product's acceptability, whereas DCE are preferable when researchers need to configure and optimize a new product so that it competes against existing products.

Research from cognitive psychology and decision science tells us that people's decision processes can be well characterized as a dual process model, including both intuitive and deliberative processes [11, 12•, 13]. Notably, people's emotional reactions to the choices they make are driven by their intuitive processes, what many cognitive researchers identify as a more evolutionarily basic, associative, "System 1" processing [14]. Evans and Stanovich [13, 15] more precisely define these as rapid autonomous processes. This System 1 processing is characterized as fast, unintentional, and associative, not involving the use of logic or conscious processing of inputs. Conversely, "System 2" is a deliberative, reflective style of thinking, and this is the type of processing more typically evoked in studies asking for systematic product comparisons. This kind of thinking requires attention and working memory [15] and is characterized as slow, intentional, and propositional, involving logical thinking and deliberate evaluation of inputs.

As cognitive psychology has increased its focus on autonomous, intuitive processes in recent decades, consumer research has tended to focus more on conscious processing [16–18]. Although the role of emotion in product preference is well established [16], the psychological mechanisms associated with emotion may be muted by the more deliberative elicitations inherent in conjoint and discrete choice methodologies. The importance and prominence of emotion in real-world decisions about reducing risk of HIV infection makes these considerations crucial as we advance the research and scale-up of acceptable HIV prevention products for MSM. Considering intuitive and emotional processes may offer new ways of examining MSM's decision-making in product uptake and adherence and inform interventions that acknowledge and leverage both systems (i.e., which product will give an individual the best outcome based on their goals?) rather than pitting one system against the other (i.e., which product feels right for the individual vs which product is the logical choice for the individual?).

In this review, we examine how researchers have used CJA and DCE to understand MSM's decision-making regarding diverse PrEP technologies (e.g., PrEP oral regimens, injectables, microbicides, vaccines) over the 7 years since FDA approval (see Beymer and colleagues [1] for a review of these technologies). Specifically, we describe how researchers have *conceptualized* and *measured* attributes linked to PrEP-related decision-making among MSM in CJA and DCE. Using a dual

process model as a framework, we pay particular attention to the extent to which HIV researchers are conceptualizing product attributes in a way that captures both the emotional (System 1) and deliberative (System 2) aspects of decision-making when examining MSM's acceptability of different biomedical prevention products. Based on our findings, we offer recommendations to fill gaps emergent from the current literature and propose recommendations to advance decision-making research during product development and clinical implementation.

Methods

We reviewed PubMed using a combined controlled vocabulary (e.g., Medical Subject Headings) and search strategy of keywords in the publication title or abstract describing the aforementioned HIV prevention products and mention of CJA or DCE. Although some relevant content may have been published in gray literature, local publications, bulletins of international, regional and national organizations, and conference proceedings, we restricted our search to studies that had been peer reviewed and published in the academic literature. After removing duplicate entries, we identified 50 citations from our search. Two of the authors (JB & DK) independently screened these abstracts for potential inclusion.

This review included published studies from the previous 7 years (2012–2019) that analyzed the acceptability of HIV prevention products using CJA or DCE. This 7-year time frame aligns with the FDA approval of daily oral PrEP as an efficacious prevention product, anchoring our review on researchers' examination of PrEP-related acceptability and decision-making since its roll-out in the USA. Recognizing anatomical, behavioral, and sex/gender differences in the technologies being considered as potential PrEP technologies, we focused our attention on MSM in this review. Therefore, our inclusion criteria were: MSM as a sample or subsample, evaluation of one or more HIV prevention products (daily or intermittent oral PrEP, long-acting injectable PrEP, rectal microbicides, PrEP infusions such as monoclonal antibodies or vaccines), and methodology including CJA or discrete choice experiment.

Upon abstract review based on our search criteria, 30 studies were excluded because they did not fit the parameters of study inclusion (e.g., focused solely on women in their sample, measured decision-making linked to sexual or reproductive health technologies, or focused solely on vaginal microbicides) and/or were published before 2012. Full-text versions of the remaining articles were extracted for further review, 11 of which were then excluded review because they focused on HIV testing as the sole study outcome ($n = 2$), were a published conference abstract ($n = 1$), did not provide sociodemographic data from participants to assess MSM inclusion ($n = 1$), or examined ART products for people living with HIV ($n = 7$). We briefly describe the studies in Table 1 based on chronological order of publication, followed by a synthesis table of the main findings (Table 2) from the 9 quantitative articles included in this review.

Results

We abstracted the PrEP products being examined in each study, the attributes included in each study, and the major findings associated with these indicators into a database. Sample sizes across studies varied widely in range ($n = 143$ to $n = 1790$), reflecting multi-country participation across studies [19, 20] and inclusion of multiple risk groups (e.g., MSM, women, transwomen, injection drug users) in the sampling frame of four studies [19, 23, 24, 26]. Across the 9 studies reviewed, oral PrEP was included in 5 of the studies reviewed, 3 included topical rectal microbicides, 4 included PrEP injectables, and 1 study focused on an HIV preventive vaccine. All studies included attributes that would elicit System 2 processing to evaluate (e.g., cost, efficacy). In contrast, there was no evidence that System 1 attributes such as emotional reactions or experiential impressions had been measured or included in any of the conjoint or DCE reviewed here. To facilitate synthesis studies, we summarize study findings by type(s) of PrEP formulations: (1) oral, (2) rectal, (3) vaccination, and (4) multiple or combination.

Oral PrEP Daily oral PrEP is the only efficacious, FDA-approved biomedical HIV prevention method, with efforts examining the effectiveness of intermittent, on-demand oral PrEP underway. One study restricted the products being evaluated to oral PrEP. Shrestha and colleagues [26] sampled 400 HIV-negative people who inject drugs (MSM inclusive) and asked them to rate 8 hypothetical oral PrEP programs using a discrete choice experiment with 6 attributes (*cost*, insurance covered vs out-of-pocket; *dosing frequency*, daily vs on demand; *efficacy*, 95% vs 75%; *side effects,* none vs nausea/dizziness; *treatment setting*, HIV clinic vs drug treatment clinic; and *frequency of PrEP-related HIV testing,* every 6 months vs every 3 months). The preferred program scenario was 95% efficacious and insurance covered, required daily dosing and semiannual HIV testing, and did not cause any side effects. Cost was the most important attribute noted across scenarios, followed by PrEP efficacy and side-effect profile. The other attributes had smaller relative contributions to PrEP program scenarios.

Rectal Microbicides Rectal microbicides in the form of topical gels applied to the rectum as intermittent or daily dosing are under investigation. To date, drug candidates have had limited HIV prevention efficacy in phase I and II trials. In our review,

Table 1 Synthesis of HIV prevention publications ($n = 9$) included in our review (2012–2019)

Citation	Product of interest	Sample size	Location	Attributes explored	Methodology
Eisingerich et al. [19]	Diverse PrEP methods	$N = 1790$	Peru, Ukraine, India, Kenya, Botswana, Uganda, and South Africa	Route of administration, dispensing site, time spent obtaining PrEP, frequency of pickup, and frequency of HIV testing associated with PrEP	Conjoint analysis
Kinsler et al. [20]	Rectal microbicides	$N = 128$	Peru and Brazil	Cost, formulation, prescription, frequency of use, effectiveness, side effectiveness, dosage/volume	Conjoint analysis
Cameron et al. [21]	HIV vaccine	$N = 326$	Thailand	Efficacy, side effects, duration of protection, vaccine-induced seropositivity, private vs public hospital, proportion of population already vaccinated, and cost	Discrete choice experiment
Wheelock et al. [22]	Diverse PrEP methods	$N = 260$	Thailand	Route of administration, dispensing site, time spent obtaining PrEP, frequency of pickup, and frequency of HIV testing associated with PrEP	Conjoint analysis
Newman et al. [23]	Rectal microbicides	$N = 143$	USA	Efficacy, duration of protection, cross-clade protection, doses, route, side effects, and cost	Discrete choice experiment
Tang et al. [24]	Rectal microbicides	$N = 1008$	Peru	Effectiveness, frequency of use, side effects, costs, prescription needed, applicator reusability	Conjoint analysis
Dubov et al. [25]	Diverse PrEP methods	$N = 1184$	Ukraine	Dosing frequency, dispensing venue, prescription, adherence support, and cost	Conjoint analysis
Shrestha et al. [26]	Diverse PrEP methods	$N = 400$	USA	Cost, dosing, efficacy, side effects, treatment setting, and frequency of HIV testing	Conjoint analysis
Dubov et al. [27]	Diverse PrEP methods	$N = 554$	USA	Dosing frequency, dispensing venue, prescription, adherence support, and cost	Discrete choice experiment

we found three studies restricting the evaluated products to rectal microbicides. Kinsler and colleagues [20] examined eight different hypothetical rectal microbicide scenarios with 128 MSM in two cities in Peru (Lima and Iquitos), a city in Ecuador (Guayaquil), and a city in Brazil (Rio de Janeiro). Using CJA, respondents were shown scenarios bundling 7 attributes (*formulation*, gel vs liquid; *cost*, 0.30 USD vs 5.00 USD; *effectiveness*, 40% vs 80%; *side effects*, none vs some itching, burning, or bloating; *dosage*, 15 mL vs 35 mL; *prescription*, over-the-counter without prescription vs prescription only; *frequency of use*, just before sex vs daily regardless of sex). The preferred attribute levels across the four cities were, in descending order of importance, low cost, high effectiveness, low dosage, requiring a prescription, and no side effects. Interestingly, the MSM subsample ranked the attributes differently when estimated based on relative importance, with effectiveness as the leading attribute, followed by side effects, frequency of use, formulation type, cost, and prescription. The relative importance of each attribute differed across cities, however. For example, MSM in Iquitos reported greater microbicide acceptability if the product required a prescription (as compared with over the counter), whereas this attribute had limited importance to MSM in the other three cities. This variability highlights the need to examine how social and contextual characteristics may affect trade-offs in product decision-making.

Newman and colleagues [23] evaluated hypothetical rectal microbicides among MSM and transgender women in Thailand. Using a discrete choice experiment, respondents were shown 32 hypothetical scenarios based on 5 attributes (*formulation*, gel vs suppository; *cost*, 0.60 USD vs 7.60 USD per month; *effectiveness*, 99% vs 50%; *prescription*, over-the-counter vs prescription only; and *frequency of use*, just before sex vs daily regardless of sex). The preferred attribute levels, in descending order, were prescription required, high 99% efficacy, gel formulation, and used prior to sex. Using a willingness-to-pay (WTP) metric, on average participants noted being willing to pay 45 USD more for the more effective product, 15 USD more for intermittent relative to daily use, and 20 USD more for a gel than suppository formulation. Differences by gender revealed that MSM placed greater weight on intermittent dosing than transgender women. When compared with sex work history, MSM and transgender women who engaged in sex work were more accepting of a rectal microbicide with lower efficacy than peers who did not engage in sex work. These findings underscore the allowable trade-offs that are considered by sexual and gender minority populations who exhibit diverse risk profiles, and suggest that for some groups (e.g., sex workers) an imperfect product (e.g., 50% efficacious) may still be acceptable.

Tang and colleagues [24] evaluated gel-based rectal microbicides across 8 scenarios in a large sample of Peruvian MSM and transgender women. Using CJA,

Table 2 Main findings from HIV prevention publications ($n = 9$) included in our review (2012–2019)

Citation	Results
Eisingerich et al. [19]	A bimonthly injection was preferred route of administration, followed by monthly arm injection. Daily or intermittent regimens were least preferred across the sample. HIV testing every 6 months was preferred to monthly. Time spent obtaining PrEP and frequency of PrEP pickup were least influential. These trends, however, varied based on sociodemographic characteristics (e.g., gender, risk group, and region).
Kinsler et al. [20]	Efficacy had the greatest influence on RM acceptability, with all other attributes except dosage also contributing to acceptability. Attributes' impact on RM acceptability varied based on region (e.g., side effects, prescription, dosage).
Cameron et al. [21]	Biomedical attributes (efficacy, risk of vaccine induced seropositivity, side effects, and duration of protection) were the most important attributes to respondents.
Wheelock et al. [22]	Frequency of HIV testing was the most influential attribute of the PrEP program, followed by time it would take to uptake PrEP. Daily pill and bimonthly injection were preferred over pill pre/post sex or monthly injection in the arm.
Newman et al. [23]	Efficacy followed by cross-clade protection, side effects, and duration of protection had the greatest contribution to vaccine acceptability. Route of administration, costs, and dose number did not contribute to vaccine acceptability.
Tang et al. [24]	Efficacy and side effects were the most influential in RM acceptability, followed by a prescription requirement. The most acceptable scenario was a RM with 90% effectiveness, used before and after sex, without side effects, costing about US $0.30, used as a single-use applicator, and not requiring a prescription.
Dubov et al. [25]	PrEP affordability and delivery were the two influential attributes in the sample. In latent class analyses, however, five groups emerged with each profile assigning different values to the products' attributes.
Shrestha et al. [26]	The most acceptable scenario had lower cost (covered by insurance), required daily dosing, was 95% effective, had no side effects, was prescribed at a HIV clinic, and required testing every 6 months. Cost was the most important attribute to participants, followed by efficacy. Side effects, dosing, treatment location, and HIV testing needed were also moderately influential.
Dubov et al. [27]	Cost is the most important factor across attributes. Daily oral PrEP was the preferred dosing strategy. In latent class analyses, however, five groups emerged with each profile weighing daily, intermittent, and injectable PrEP differently.

scenarios were bundled using 6 attributes (*effectiveness*, 90% vs 50%; *frequency of use*, before and after sex vs daily regardless of sex; *side effects*, none vs some distension, urgency, or diarrhea; *cost*, 0.30 USD vs 4.50 USD; *prescription*, over-the-counter without prescription vs prescription only; and *applicator administration*, single use vs reusable). Preferred attributes, in descending order, were higher effectiveness, no side effects, no prescription, used before and after sex, single-use application, and low cost. Participants with greater perceived HIV susceptibility particularly preferred the before/after regimen, less educated participants more strongly preferred the non-prescribed microbicide as did participants who played the "pasivo" (i.e., receptive) role in their sexual relationship, and "pasivo" participants were also less likely to prefer a single-use applicator. These findings demonstrate variability in preferences along factors like education and sexual role.

HIV Prevention Vaccine Vaccines remain a potential strategy for HIV prevention in the future. Similar to microbicides, efficacy for HIV prevention vaccines has failed to yield success. In our review, Cameron and colleagues [21] restricted their product evaluation to vaccines among MSM, transwomen, and sex workers in Bangkok and Chiang Mai. Using the WTP metric in a discrete choice experiment, respondents were shown scenarios bundling 7 attributes (*efficacy*, 50% vs 99%; *side effects*, none vs temporary body aches, skin rash, and fever; *protection duration*, 1 year vs 10 years; *vaccine-induced seropositivity*, no vs yes; *clinical setting*, public hospital vs private hospital; *prevalence of vaccination in population*, low vs high; and *cost*, 3 USD vs 75 USD). Participants were three times more likely to prefer scenarios with higher efficacy, followed by absence of side effects, vaccine-induced seropositivity, and duration of protection, and were willing to pay more than US $380 for these attributes, a substantial investment relative to the sample's monthly income of US $375 per month.

Multiple PrEP Options In addition to oral PrEP, microbicides, and vaccines, researchers are exploring the efficacy of other methods including long-acting injectables for HIV prevention. We found four studies that included the aforementioned PrEP products in comparison with different HIV prevention methods. Using CJA, Eisingerich and colleagues [19] examined willingness to use PrEP in 7 countries, selected for diverse HIV epidemics and potential user groups (e.g., MSM, sex workers, injection drug users), comparing five attributes (*dosing frequency*, daily PrEP pill, a PrEP pill before and after sex, a PrEP injection in the arm once a month, or an injection in the buttocks every 2 months; *dispensing venue*, pharmacy, family planning clinic, health clinic, ARV clinics, or NGOs; *time spent obtaining PrEP*, 2 h vs 4 h; *pick-up frequency*, monthly vs every 2 months; and *frequency of PrEP-related HIV testing*, monthly or semiannually). Overall, participants' preferred attribute levels, in descending order, were bimonthly

injection in the buttocks (followed by a monthly injection in the arm). Daily and intermittent PrEPs were the least preferred options. Participants also preferred semiannual HIV testing, with limited variability observed across other product attributes. Regional differences emerged in attribute weighting, however, with Peruvian MSM emphasizing dosing frequency (over 40% of the variance) and frequency of HIV testing (35%), Indian MSM primarily focusing on dosing frequency (80% of the variance), and South African MSM emphasizing site location (over 45%), HIV testing frequency (30%) and dosing frequency (20%). When taken together, these findings suggest that MSM's product decision-making may vary by country, suggesting a need to tailor implementation programs to local culture.

Wheelock and colleagues [22] examined the acceptability of diverse PrEP products using CJA scenarios bundled by five attributes (*dosing frequency*, daily PrEP pill, a PrEP pill before and after sex, a PrEP injection in the arm once a month, or an injection in the buttocks every 2 months; *dispensing venue*, pharmacy, family planning clinic, health clinic, or ARV clinics; *time spent obtaining PrEP*, 2 h vs 4 h; pick-up frequency, monthly vs every 2 months; and *frequency of PrEP-related HIV testing*, monthly or semiannually). Thai MSM weighted the relative importance of HIV testing frequency most heavily, followed by time required to obtain PrEP. Participants preferred a pharmacy as the favorite dispensing site. The preferred PrEP product was a daily pill, followed by a monthly injection in the arm. These findings are in sharp contrast to the findings in Eisingerich et al.'s [19] study. Even when using the same attributes and levels, the differences between studies further underscores the need to consider how diverse PrEP modalities may be valued differently by MSM living in different countries and settings and perhaps could even vary in specific populations over time and with direct product experiences.

Dubov and colleagues [25] recruited MSM in Ukraine through social networking applications and asked them to complete a choice-based conjoint survey. Their analyses employed five attributes (*dosing frequency*, daily PrEP pill, intermittent PrEP, or long-lasting injectable PrEP; *dispensing venue*, provider at a healthcare facility, STI clinic, LGBT agency, or pharmacy pick-up/home delivery; *prescription practices*, HIV test and kidney function test, HIV/STI panels with renal functioning, or HIV/STI panels with renal functioning assessment and safer sex counseling; *adherence support*, self-management, peer support, or text/interactive voice messages; and *cost*, well-subsidized and easily affordable vs partially subsidized and moderately affordable). In their analysis, the relative importance of each attribute was estimated, followed by a latent class analysis examining preferences across 9 different hypothetical PrEP scenarios (as compared with a no PrEP scenario). In relative importance, participants noted cost as the driving attribute, followed by dosing frequency—with over 61% of the sample noting that they would prefer intermittent PrEP to daily oral PrEP or a monthly injectable. Interestingly, Dubov et al. found five latent classes emerge, each group presenting a diverse risk profile and weighing the relative value and utility of the attributes studied differently. Thus, individualized approaches to product selection will likely be needed to optimize implementation of PrEP options.

In a follow-up study, Dubov et al. [27] recruited MSM across the USA using the same attributes as their Ukraine study. Following the same analysis strategy, MSM completed 14 PrEP scenarios and were clustered into five latent class groups. Similar to the Ukraine study, MSM in the USA placed greater importance to cost; however, unlike the Ukraine MSM sample, the majority of participants in the USA preferred daily oral PrEP as a dosing strategy. Interestingly, two of the five latent class groups identified preferred injectable PrEP. These two groups were more likely to be younger and have greater educational attainment, a pattern they noted to be similar to young women's preference for injectable, long-acting contraception. Taken together, these findings are meaningful as they indicate that a "one-size-fits-all" strategy would be both insufficient and inefficient as new PrEP products become available for scale-up in Ukraine or in the USA.

Conclusions

Researchers employing CJA and DCE to understand diverse PrEP technologies (e.g., pills, injectables, microbicides, vaccines) over the past 7 years have conceptualized product-related decision-making as a trade-off between different attributes informed primarily by a more reflective, deliberative System 2 style of processing. Thus, the current literature may be neglecting the impact of emotion and more intuitive, experiential processes on choices of HIV-prevention product formulations by over-relying on cognition-driven decision-making processes.

Incorporating System 1, Intuition and Emotion into Product Evaluation Methodologies

Although cognitive and consumer research has acknowledged the importance of integrating both intuitive and deliberative processes when examining product preferences, the absence of System 1 attributes in CJA and DCE examining PrEP products remains a missed opportunity. We recommend that future studies of product preferences for PrEP use conceptual frameworks that include System 1 and System 2 attributes in their experiments. Consumer research [16] has noted that individuals' emotional, System 1 reactions may contribute to choices regarding product selection (e.g., what *feels* like it will match a desired lifestyle and fit with personal goals, as opposed to

what has the best outcome). Thus, although consumers may indicate a preference for one type of product in the lab, their natural environment may favor choice of other products based on autonomous, associative connections (e.g., greater weight on certain attributes based on prior experiences and comfort level with similar products). Alongside product attributes (e.g., cost, efficacy), we recommend that studies include emotional trade-offs linked to the products' value (e.g., reduces general worry or fear about HIV; reduces anxiety about HIV status discussions with partners) or their associated outcomes (e.g., enhances pleasure or intimacy; promotes feelings of altruism and responsibility) in choice experiments. This integration, which incorporates the emotional processes that are known to influence decision-making in preventive healthcare decisions more generally, could facilitate the development of PrEP products that are more desirable, more frequently used, and more effective in practical use among MSM.

Decision-making and marketing methods may also help identify and refine the inclusion of System 1 contributors to PrEP decision-making experiments. McDonagh and colleagues [28], for example, have argued the importance of eliciting individuals' perceptions and emotional responses to potential products using user-centered design methods such as product personality profiles (i.e., individuals' perceptions of who they feel the particular product is meant for), mood boards (i.e., visual images used to elicit emotional responses to a product), and visual product evaluations (i.e., initial reactions to products based on appearance). These "empathic design" methods offer data collection processes that may elicit new or missed information about a product, including its symbolic meaning, and help researchers create persuasive strategies that accentuate how a given PrEP modality is a symbolic match to users' values. Future research in this area is warranted.

Diversity in Product Preferences

Findings from our review suggest diversity across the globe on what MSM would tolerate, accept, and desire in PrEP prevention products. These findings highlight that a one-size-fits-all approach will be insufficient to meet the needs of different communities and individuals [29•]. Thus, researchers should continually explore how prospective populations perceive and engage in trade-offs between attributes explored. Even when small, differentiations in attribute levels between HIV prevention products may result in clinically meaningful differences in the uptake and adherence to these products. Although researchers measured similar attributes across studies, there was limited consensus on the attribute levels (e.g., estimates of prevention effectiveness, financial costs) being proposed between studies. In addition, in most studies reviewed, researchers characterized the attributes as dichotomous levels; as a result, it is difficult to ascertain the critical threshold within an attribute that would make it more or less favorable. We need greater clarity on realistic and clinically informed benchmarks that may be used to measure attribute levels. Without a set of guiding benchmarks, it will remain difficult to pool data across studies and compare and contrast emergent evidence across PrEP formulations, product attributes, and diverse MSM populations across the globe. There might be benefit, therefore, to convening stakeholder panels that can develop consensus guidelines on ways to harmonize measures across studies. These panels could include experts in decision science, HIV prevention technologies, and community members, to provide scientifically robust measures that also resonate with community members who will ultimately benefit from PrEP product usage. We envision that a collaborative Delphi process, possibly organized by researchers or federal authorities (e.g., the National Institutes of Health), might be feasible and well suited to accomplishing this goal.

Social context, such as geography, cultural background, and education, also influences decision-making. For example, several studies reviewed used latent class analyses to identify subgroups based on sociodemographic characteristics and their preferred product attributes. Following these findings, we further recommend that conceptual frameworks include social factors that can affect product preferences. A study [30] of hypothetical product preferences for multipurpose prevention technologies (i.e., PrEP plus contraception) among women in Kenya and South Africa provides an example of a framework that integrates product attributes with social and personal factors. The study model posited that sociodemographic (e.g., age, education, religion), social context (e.g., geographic setting, sexual partnerships), HIV risk perception (e.g., "worry about getting HIV"), and product features (e.g., PrEP product attributes, prior experience with contraceptive formulations) all contribute to women's stated product preferences. Although this study used traditional survey assessments instead of CJA or DCE, the research illustrates how investigators can use integrated frameworks to improve their understanding of the many factors that influence product acceptability and selection.

Improving Patient Decisions

Involvement of patient preferences into clinical decision-making is a cornerstone of optimal medical care. Our review suggests that the best decisions about PrEP options are likely to occur when patients and their healthcare providers consider emotional and deliberative processes in addition to social context when approaching preference-sensitive decisions. Thus, practical tools to help patients and providers with decisions about PrEP options, such as clinical decision aids, will need to integrate these multiple domains into their content. A recent Cochrane review [31••], for example, found that decision aids

increased users' perceptions of autonomy, knowledge, and willingness to make value-congruent choices when engaging in screening and treatment decisions.

Consistent with our dual process model framework, we recommend that an optimized decision aid includes PrEP product attributes (e.g., dosing, cost, side effects) and features eliciting affective reactions to the product (e.g., decreasing PrEP stigma, desire to improve sexual pleasure) using interactive exercises or patient testimonials (e.g., video clips or quotations). Innovative ways to develop flexible decision support tools that can draw upon methods like CJA (to improve personal decision-making) and also evolve with changes in the landscape of PrEP options (to remain current) merit exploration. For example, similar to consumer-driven tools in other business markets, individuals seeking to adopt a PrEP modality (or switch between options as they become available in the coming years) could complete a clinic assessment that includes CJA-like questions to identify the HIV prevention technologies that would best "fit" their lives. Studies to test the effectiveness of PrEP decision aids will need to assess their impact on patient autonomy and decisional quality (i.e., the extent to which patients' choices match their deliberative and emotional preferences) and product uptake and adherence. In this way, researchers can expand our understanding of how the application of basic and clinical decision science principles to PrEP care can improve patient experiences, product use, and prevention effectiveness.

Beyond choices about PrEP medications, it remains crucial that we examine MSM's preferences in PrEP ancillary services (e.g., HIV/STI testing and counseling), including their frequency (e.g., trimesters, semiannual, annual) and preferred setting (e.g., home-based testing, private clinics, community agencies), as we roll-out these products. Bristow et al. [32], for example, recently used 8 hypothetical profiles regarding Peruvian MSM and transgender women's HIV and syphilis testing preferences. Using 6 attributes (cost, fear of potential false positive result, time-to-result, blood draw, type of test, and number of blood draws) to assess their likelihood to test for HIV and syphilis, participants prioritized accuracy above all attributes, followed by lower cost, a rapid test result, and access to a dual HIV/syphilis testing strategy. Similarly, Miners and colleagues [33] conducted a discrete choice experiment in the UK to examine MSM's preferences in HIV testing services. Cost was the key driver in MSM's HIV testing service decision-making, followed by the length of the testing window (4 weeks vs 12 weeks). Two groups of users emerged their analysis: The first group strongly preferred in-person testing with a healthcare provider, whereas the second group preferred remote testing. No other attribute linked to HIV testing services (e.g., HIV only vs HIV/STI panels) differed between these groups. Taken together, these findings underscore the need for ongoing efforts to optimize HIV/STI testing technologies, as loss to follow-up in repeated testing may compromise individuals' ability to be retained in PrEP care. Because rates of STIs are high among MSM who use PrEP, the provision of acceptable STI testing, counseling, and treatment services with PrEP remains an important goal in addition to optimizing HIV prevention.

Summary

Popular decision theories assume that individuals make probabilistic choices based on a value-expectancy calculation (e.g., choice is based on the probability of a behavior resulting in a desired outcome). However, researchers have noted that affect can influence individuals' judgments and choices and is not responsive to probabilistic decision-making [34, 35]. Within the decision-making literature, for example, paying differential attention to cognitive (perceived risk) versus emotional (negative affect) information determines which has a greater influence on choices [36]. Similarly, although people value price disproportionately in many decisions, increasing their emotional state tends to lead them to discount price in favor of quality [37] In the lab, absent of an emotional prime or manipulation, participants are likely to allow cognitive processes to dominate their choices, but this tendency may reverse in the real world of negotiation with sexual partners, anxiety about HIV, and sexual arousal.

Our review highlights the over-reliance of the scientific literature on cognition-driven (System 2) attributes (e.g., costs, efficacy, side effects) when measuring PrEP-related decision-making among MSM in CJA and DCE. Given advances in dual processing model frameworks, however, HIV researchers should include affect-driven (System 1) contexts and attributes when evaluating PrEP product acceptability and decision-making. Future research examining MSM's choices regarding PrEP products should include affective attributes in conjoint and DCE. These data may help characterize how users make decisions about HIV prevention products, inform market segmentation strategies to reach diverse types of potential users, and contribute to the development of more effective, user-centered clinical decision aids for PrEP product selection and counseling.

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Compliance with Ethical Standards

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