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Short communication

The HIV prevention decision-making cascade: Integrating behavioural insights into HIV prevention efforts

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ABSTRACT

The syndemic of HIV, sexually transmitted infections (STIs), and early pregnancy remain a key challenge to global public health. Decision-making around sexual and reproductive health (SRH) behaviours is critical to ensuring the uptake of biomedical technologies. Drawing from behavioural science theories, we propose a novel conceptual framework—the Decision Cascade—to describe the decision-making process that a user will go through as they navigate these decisions. Analogous to the HIV prevention and treatment cascade, this model describes key steps individuals go through when deciding to use HIV prevention technologies. Each step (being cued/triggered to act, reacting to the behaviour, evaluating the behaviour, assessing the feasibility of acting and the timing and final execution of the action), is influenced by a myriad of individual and socio-cultural factors, shaping the ultimate decision and behaviour outcome in a continual cycle. This framework has applications beyond HIV prevention, extending to other SRH technologies and treatments. By prioritizing human-centered design and understanding user decision-making intricacies, interventions can enhance effectiveness and address the complexities of SRH service uptake across diverse populations. The Decision Cascade framework offers a comprehensive lens to inform intervention design, emphasizing the need for nuanced approaches that resonate with the realities of decision-makers. Adopting such approaches is essential to achieving meaningful impact in HIV prevention and broader SRH initiatives.

The syndemic of HIV, sexually transmitted infections (STIs), and early pregnancy continues to pose a critical challenge to global public health (Unaids. in danger, 2022). Biomedical sexual and reproductive health (SRH) technologies and their uptake are essential to reducing these negative SRH outcomes, and there is a push to develop products with attributes better suited to user preference (Bekker et al., 2022). To overcome issues of accessibility, new interventions to increase service uptake have been developed with varying degrees of success (Rapaport et al., 2023; Goldstein et al., 2023; Vanhamel et al., 2020).

While better tailored technologies and increased modes of access are critical for HIV prevention (Vanhamel et al., 2020; Eisinger et al., 2019), more engagement is required with the decision-making process mediating product and service use. This process impacts whether a person decides to engage with a technology – regardless of its accessibility, usability, acceptability, or design. The behavioural sciences offer a strong theoretical and research evidence base to support the importance of decision-making in affecting behaviour change, but this is seldom meaningfully adopted in HIV and public health interventions (Kelly et al., 2023). When used, broad overarching theories justify or explain any range of factors selected as influencing target behaviours, while the role of decision-making and behavioural factors impact are descriptive (Kelly et al., 2023). Further, most interventions assume that people are interested in their health, that health is a priority, and that they will rationally (from the perspective of the interventionist) perceive the need to act when it is explained to them (Kippax, 2012; Hallsworth, 2023; Van Heerden et al., 2022). Interventions therefore target those who have assessed a need for behaviour change, already engaged in health services, nudging those already in the system to start other services or those

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prevented by structural barriers (Rapaport et al., 2023; Hartmann et al., 2024).

The decision-making process for using HIV prevention technologies is critical to understanding service engagement. While decision-making is individual, socio-cultural processes determine whether an individual will enact a behaviour (Hallsworth, 2023; Johnson, 2021; Petit, 2019). We propose using an analogy from the field of HIV prevention and treatment, building on previous seminal work (Hargreaves et al., 2016; Skovdal, 2019; Schaefer et al., 2019; Garnett et al., 2016), to think about the decision-making process. We envision this process as a cascade of decision-making with steps that a person needs to navigate, to execute the behaviours required to decide-on, and use an HIV prevention technology (Fig. 1). Like the HIV cascade, people will fall out at each stage of the process, needing to reengage repeatedly over time, and from their changing reference points (the baseline people use as a benchmark for assessing potential gains, losses, and outcomes) (Kahneman and Tversky, 1979). This cascade of decision-making is informed by established behavioural science theories and frameworks (Hargreaves et al., 2016; Skovdal, 2019; Schaefer et al., 2019; Garnett et al., 2016) and adapted from the useful and simple CREATE framework (Wendel, 2020). These frameworks provide a simple heuristic for understanding the applied decision-making process that potential HIV prevention users go through as they go about their lives, filled with other (often more) urgent issues that compete for their attention (Wendel, 2020). A brief overview of the proposed cascade is provided below, simplified for the purpose of this report.

Firstly, in the cascade of executing an HIV prevention target behaviour (i.e., deciding to use PrEP), a person is triggered or cued to think about the action, through an external (environmental) or internal (own thought) trigger (Wendel, 2020). Many current educational and information informed interventions focus on triggers to initiate behaviour changes (Andrawis et al., 2022). They anticipate that rational explanations and health focused cues highlighting the importance and benefits of PrEP will motivate individual's use (Rapaport et al., 2023; Vanhamel et al., 2020; Hartmann et al., 2024). However, our minds have limited capacity to process information, and attentional blindness may filter out triggers perceived as unimportant (Johnson, 2021; Kahneman and Tversky, 1979; Wendel, 2020). Therefore, if HIV prevention is not prioritised or has low perceived probability of happening, related cues and messaging may be filtered out (Kahneman and Tversky, 1979) and people may fail to act, regardless of what HIV prevention product is presented to them. Interventions should be designed with triggers for broader appeal or use external motivation to focus attention, highlighting the relevance of the behaviour long enough to retain the person in the decision cascade. For instance, messaging appealing to better sex ("have great sex"), are risqué ("I swallow daily") (Apicha Community Health Center, https://www.apicha.org/) or linked to goals ("I am making sure I take over the world") could catch attention and challenge the perception that HIV prevention technologies are only for "at-risk people," engaging a broader potential user base (Philpott et al., 2006; Brown-Bowers et al., 2015; Macintyre et al., 2015).

In the second step of the cascade, potential users have a reaction to thinking about something (Wendel, 2020; Michie et al., 2011). This response is fast, and often not conscious to us – our *system one* thinking (Kahneman and Tversky, 1979). This process is affected by the associations our brains make with the action and determine how we think about it (Johnson, 2021). In HIV prevention, unconscious, negative associations with HIV cause discomfort – linked to negative outcomes, relational problems or perceptions of mistrust and stigmatisation (Unaids. in danger, 2022; Hartmann et al., 2024; Humphries et al., 2022). While these could be overcome by conscious, more deliberative thought, it may make the action feel wrong and therefore unsustainable. These negative reactions and their impact on behaviour change, which may include an early exit from the cascade, are key when designing interventions. Further, cognitive biases and heuristics mediate how people process information (Kahneman and Tversky, 1979; Gilovich et al., 2002). For instance, people may recall negative associations with HIV most easily (availability bias), seek out or use information to confirm their low risk (confirmation bias), or underestimate the likelihood of acquisition because they do not perceive themselves as their prototype of an "at-risk" person (representativeness heuristics) (Hallsworth, 2023; Gilovich et al., 2002). These may lead to apathetic, or negative reactions to HIV prevention messaging, regardless of information availability or delivery.

In the third step, the decision to execute a behaviour, is a conscious process, especially for novel situations like deciding to use HIV prevention technologies. Reaching this stage requires overcoming the barriers of steps one and two. Here then, more deliberative processes enable the individual evaluation about action, given potential costs and benefits (Wendel, 2020). This process is complex and mediated by numerous subjective evaluations made from the individual's reference point and is affected by biases and beliefs, possibly making their decisions and actions appear irrational to health care professionals. However, 1) the costs and benefits of acting are subjective, may not be fully understood by the decision-maker and the magnitude of importance is personal, 2) the information informing the evaluation is mediated by its source, perceived bias and trustworthiness, 3) the need for further information is also subjective and 4) the evaluation is affected by currently relevant motivations (Kahneman and Tversky, 1979; Wendel, 2020). Critically, if the action is evaluated to be worth the effort, and better than the subjectively valued available alternatives, they will move along in the decision cascade (Wendel, 2020). However, if a person assesses that PrEP use could potentially jeopardise an important relationship, and believes their partner is HIV negative (based on phenotypic characteristics, conversations with the partner or trust (Humphries et al., 2022), the alternative of accepting the trustworthiness of a partner and avoiding any relational strife is preferable to seeking HIV prevention services.

Step four in the decision cascade takes place after the evaluation of

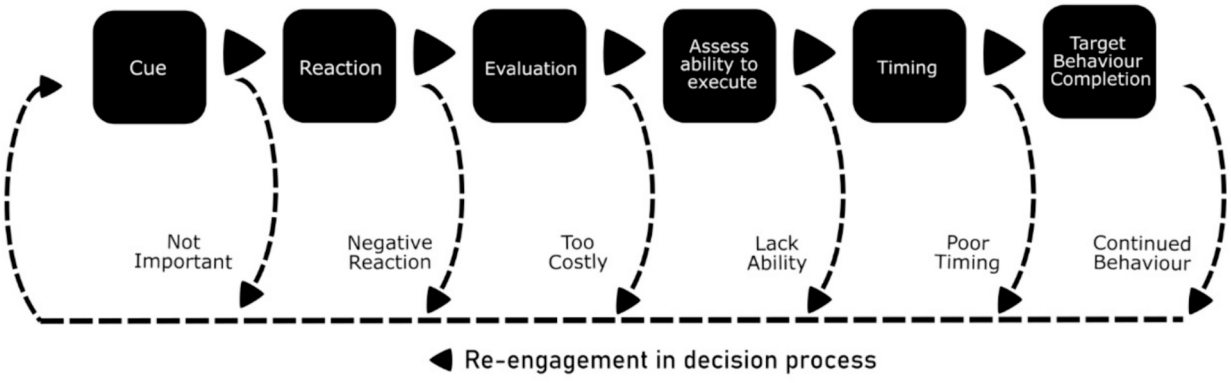


Fig. 1. HIV Decision Cascade (adapted from the CREATE framework).

the decision to act and involves the assessment about the actual feasibility of doing so (Wendel, 2020; Michie et al., 2011). At this step, there are several concrete steps to take. Firstly, one needs knowledge of what is required, here, knowing where, when and how to access HIV prevention services is critical. Issues of access will likely mediate this assessment of ability. Secondly, resources are critical for action and even where a need is considered worthwhile, without resources it will be unfeasible. Issues assessed during the cost-benefit evaluation may still serve to mediate ability here or may change the reference point for the decision. Interventions that increase access to services and cash-incentivised programmes can help to improve individual's ability to act (Rapaport et al., 2023; Goldstein et al., 2023; Vanhamel et al., 2020; Hartmann et al., 2024; Nagai et al., 2024). Finally, they must perceive themself to have the skills and self-efficacy to act successfully (Petit, 2019; Wendel, 2020; Prochaska et al., 2008). Many HIV prevention interventions have a strong focus on improving a person's ability to use HIV services (Rapaport et al., 2023; Goldstein et al., 2023; Vanhamel et al., 2020; Van Heerden et al., 2022; Hartmann et al., 2024; Nagai et al., 2024), however by focusing on barriers to ability we exclude potential users who dropped out earlier in the cascade.

The fifth step relates to timing– an issue often absent from HIV prevention efforts, but a critical element in the CREATE framework (Wendel, 2020). If a potential user feels a need for HIV prevention services, the action is appealing and assessed as feasible – they will still need to decide *when* to act (Wendel, 2020). This is often mediated by feelings of urgency and may explain why people delay HIV prevention service engagement. If HIV services are not perceived as urgent, people may delay service engagement, rather initiating a new decision-making process when next prompted to do so. Using commitment devices, supporting motivation to act/continue to act, and supporting habit formation is critical at this stage. If all these decisions are made and the action is considered important, feasible, and correctly timed, then a person will execute the behaviour (Wendel, 2020). It is important that each step is viewed from the perspective of the decision-maker and they will only continue if an action is more effective or preferred to available alternatives.

Thinking of the decision-making process as a cascade, highlights important characteristics of the process and links logically to existing HIV prevention metaphors. While earlier steps occur with little conscious thought, later steps require conscious deliberation, and different interventional components to support the decision process. It is possible that the steps may not always be sequential and may interact with one another. For example, automatic reactions may change or take place again after a choice has been consciously deliberated (Wendel, 2020) (i.e. initial negative reactions to oral PrEP use could be overcome with information about alternative PrEP formulations), while factors relating to ability and timing may inform the evaluation of taking the action (i.e. economic costs of accessing services may inform the cost-benefit evaluation). Criticism of the process may highlight its perceived individual focus, but this is not accurate. The process, and all decision-making steps as described above, are influenced, and informed by factors from across different ecological levels, however, the individual is ultimately required to both decide and eventually act.

This cascade highlights different types of decision-makers requiring, but not using these services, and unlike many other frameworks, does not focus only on users desiring services, but whose *engagement* is prevented by broader ecological factors (Hargreaves et al., 2016; Skovdal, 2019; Schaefer et al., 2019; Garnett et al., 2016). The decision cascade can be used to understand once-off decisions, decisions to initiate a complex behaviour as well as continual, simpler decisions. For continued decision-making, the process is quicker as it becomes more habitual, and some steps may become less important. For instance, oral PrEP tablet adherence may require support to develop cues to action as a reminder, but the reaction, evaluations, ability, and timing steps may become habitual. This may change if the decision-making context changes, for example, if someone starts experiencing medication side-effects, then the reaction and evaluation steps may become more important. The cascade of decision-making highlights the need for HIV prevention and public health researchers to design interventions tailored to support each step in the cascade, for distinct behaviours. Therefore, interventions that support 1) the deliberative thought processes required for completing complex, novel behaviours (i.e. deciding to use an HIV prevention technology), 2) once-off behaviours (i.e. VMMC), and 3) habit formation (i.e. oral PrEP adherence). For example, leveraging cash incentives to support simple, once-off behaviours, promoting ease and fluency of information and service use to make it simpler for users to understand and get HIV prevention products (Vlaev et al., 2019), promoting positive associations (Johnson, 2021) with HIV prevention technologies (i.e. sex positivity) (Apicha Community Health Center, xxxx; Philpott et al., 2006), using defaults and applying behavioural interventions to steer positive behaviours unconsciously and consciously (i.e. nudges, reinforcement) (Kelly et al., 2023; Petit, 2019), and creating dynamic segmentations of potential users (a role for artificial intelligence approaches) to improve our understanding about where users fall-out in the process, offering opportunities for developing new indicators for monitoring progress in HIV prevention at a policy level (Van Heerden et al., 2022; Humphries et al., 2018).

The decision cascade aligns with dominant thinking about HIV prevention. It is a useful research-supported visualisation, facilitating the conceptualisation of decision-making as a process, continuously happening for existing or potential users. There is scope to apply it beyond decision-making for HIV prevention technologies to other SRH technologies. It frames continued behavioural actions, recognising the difficulty users face each time they must engage in a particular and necessary behaviour. This can inform intervention design highlighting the need for true human-centred approaches, prioritising the decision-maker's realities. We challenge researchers to adopt such approaches, making explicit their underlying design, population, and user decision-making assumptions, to improve intervention success.

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CRediT authorship contribution statement

Hilton Humphries: Writing – review & editing, Writing – original draft, Resources, Methodology, Conceptualization. **Lucia Knight:** Writing – review & editing. **Alastair van Heerden:** Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

No data was used for the research described in the article.

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