Current HIV/AIDS Reports (2022) 19:409–414
https://doi.org/10.1007/s11904-022-00624-y

THE SCIENCE OF PREVENTION (R HEFFRON AND K NGURE, SECTION EDITORS)

Using Behavioral Economics to Support PrEP Adherence for HIV Prevention

Unmesha Roy Paladhi[1,2] · David A. Katz[2] · Carey Farquhar[1,2,3] · Harsha Thirumurthy[4]

Accepted: 22 August 2022 / Published online: 31 August 2022

Abstract

Purpose of Review We explored different behavioral economics (BE) mechanisms through which pre-exposure prophylaxis (PrEP) initiation and adherence could be impacted and examined recent work using BE principles to further HIV prevention efforts. We also generated new intervention ideas based on existing HIV testing and ART adherence literature.

Recent Findings There is limited work that uses BE principles to design interventions to increase PrEP initiation and adherence, mostly involving financial incentives. The recent works highlighted involve financial incentives and demonstrate that key populations are open to accepting monetary incentives to increase PrEP initiation and improve adherence. However, there are mixed results on the long-term impacts of using incentives to modify behavior.

Summary While there are a few ongoing studies that utilize BE principles to increase PrEP use, there is need to develop studies that test these concepts, to promote PrEP initiation and adherence. We suggest methods of exploring non-incentives-based ideas to increase PrEP use in key populations.

Keywords PrEP initiation · PrEP adherence · Behavioral economics · Financial incentives · HIV prevention

Introduction

Behavioral economics (BE) combines insights from the fields of economics and psychology to understand the complicated underpinnings of the human decision-making process [1]. BE research has shown that there are a number of biases and heuristics that influence human behavior and ultimately affect the likelihood that individuals make health-promoting choices for themselves and their families [1]. Financial and non-financial incentives have been widely studied as a simple and potentially low-cost way to counter present bias, a common bias that affects health behaviors in which there are immediate costs but delayed benefits. Specifically, several studies have found that financial incentives are effective in promoting health behaviors such as exercise and physical fitness, weight loss, tobacco smoking cessation, pediatric immunizations, and blood donations [2–6]. Within human immunodeficiency virus (HIV) research, studies of incentives have focused on promoting HIV testing, voluntary medical male circumcision (VMMC), linkage to care, antiretroviral therapy (ART) adherence, and retention in care. In this review, we assess recent studies that have specifically sought to promote pre-exposure prophylaxis (PrEP) initiation and adherence. We then propose intervention ideas based on existing literature from studies of behavioral economics interventions to promote HIV testing and ART adherence.

This article is part of the Topical Collection on *The Science of Prevention*

✉ Unmesha Roy Paladhi
uroy@uw.edu

[1] Department of Epidemiology, School of Public Health, University of Washington, UW Box # 351619, Seattle, WA 98195, USA

[2] Department of Global Health, School of Public Health, University of Washington, Seattle, WA, USA

[3] Department of Medicine, School of Medicine, University of Washington, Seattle, USA

[4] Department of Medical Ethics and Health Policy, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, USA

Potential Mechanisms of Incentives

There is one main reason why financial incentives may be effective in promoting health behavior. By itself, a financial incentive whether monetary or non-monetary may reduce the cost of engaging in a healthy behavior like taking PrEP

for HIV prevention by removing a financial barrier to engaging in that healthy behavior resulting in a price change effect for taking PrEP. However, based on BE insights, we know that many individuals also have *present biased preferences*, whereby they place more emphasis on current benefits and costs associated with a behavior as opposed to costs (or benefit) that are realize in the future. In the case of PrEP initiation and adherence for HIV prevention, burdens like the physical effort to visit a health clinic and obtain PrEP or the mental labor of remembering to take an oral medication every day tend to be more heavily weighted, as opposed to the potential long-term benefits of HIV prevention or a generally higher standard of living [7].

Another potential mechanism of decision-making for PrEP initiation or adherence is *salience bias*, where people are more likely to focus on ideas and events occurring in their sphere of influence as opposed to information that does not immediately grab their attention [8, 9••, 10••]. An example would be when individuals see others engaging in risky behaviors or they themselves engage in risky sexual contact and test negative for HIV, leading to an altered perception of the behaviors being less risky.

Lastly, a key insight of BE is that *affect* has a strong influence on our decision-making, especially when it comes to preventive behaviors like PrEP initiation and adherence [11]. Affect is the idea that we are influenced by our emotional state when making important decisions, with a "cold" state being a moment where our emotional state is calm and more logical and a "hot" state being a moment where we are emotionally charged and less likely to make rational decisions. For example, while condom use can be an effective HIV prevention method, individuals are less likely to use them in a hot state. However, since the decision to initiate or adhere to PrEP is made in a cold state, individuals can therefore make more informed decisions about their sexual health in a manner that mitigates the negative role of affect in this process.

Recent Literature

There have been relatively few recent studies that have sought to use BE principles to promote PrEP initiation and adherence. The few studies that have been conducted have focused on financial incentives [12••, 13••, 14••]. A discrete choice experiment (DCE), which is a quantitative technique by which hypothetical scenarios are presented to participants to elicit general preferences on a topic, by Salinas-Rodriguez et al. found that while male sex workers (MSWs) in Mexico preferred higher ($45 compared to $30 or $15), fixed incentives, they would be willing to sacrifice the dollar amount to avoid a lottery-based incentive structure [12••]. The study found that MSWs were willing to accept a conditional economic incentive program dependent on PrEP adherence verified by hair sampling, provided fixed payments were provided instead of lottery-structured payouts as part of the package.

A randomized control trial RCT) conducted in South Africa among adolescent girls and young women (AGYW) tested whether the provision of a 200 Rand ($13) shopping voucher at 3 timepoints during a 12-month period was effective in encouraging tenofovir-based PrEP adherence [13••]. Results indicated that while the incentivized group did have higher PrEP adherence at month 3 compared to the unincentivized group, the difference was not statistically significant. Adherence decreased after the 3-month timepoint for both arms and incentives were also only provided for the first 3 months, i.e., the primary endpoint.

A novel app-based intervention study of PrEP adherence is described by LeGrand et al. where minimal incentives of $0.50 are provided for daily app usage as a way to record PrEP adherence [14••]. While the results of the study have not yet been published, the integration of a financial incentives component to this mHealth study of PrEP adherence being conducted across six US cities is promising to understand the effectiveness of using financial incentives to encourage PrEP adherence. Another ongoing study rooted in the principles of BE are the Phase 2 DOT Mobile app developed for young adult men who have sex with men (YMSM) in Cambridge, MA [15]. The study builds on a previously successful app, the Phase 1 DOT Mobile app, by adding features like daily PrEP intake reminders, supportive messages, calendars for pharmacy refills and clinic appointments, and adherence graphs among other features, all of which are rooted in BE principles like increasing salience and decreasing present bias to encourage PrEP adherence.

Ideas for Interventions That Use Incentives to Promote PrEP Initiation and Adherence

A systematic review in addition to many individual studies of incentivizing HIV/STI testing in different contexts and among different populations found that incentives, defined as either monetary rewards, non-monetary rewards, or free-of-charge testing vouchers, are effective in the area of HIV/STI testing uptake [16–21]. While similar interventions for PrEP initiation and adherence are lacking in the literature, lessons from HIV testing and ART adherence can be applied to PrEP initiation and adherence to focus on key populations that could most benefit from engaging in this behavior.

A study in Uganda that tested multiple types of non-monetary incentives, including a gain-framed incentive (participants received a prize, such as a washbasin or hoe, upon testing), loss-framed incentive (participants chose a prize and lost it if they did not test), and a lottery-based incentive (participants who tested were entered to win a higher valued

prize between ~ 1USD and 5USD prize, such as a bicycle or mobile phone), found that the lottery-based incentive was more effective than the gain-framed incentive to increase HIV testing uptake in low-cost groups [22]. However, the results from this HIV testing study contradict the DCE in Mexico of MSWs on PrEP adherence, which indicated that lotteries were not as favorably viewed as fixed payment structures [12••], indicating a need to conduct intervention-based or implementation studies among other key populations in different settings with PrEP initiation and adherence as primary outcomes.

Similarly, a study in Zimbabwe found that when offered a choice of common grocery items as an incentive, specifically either a bar of laundry soap, 750 ml of cooking oil, or 200 g of petroleum jelly, each valued at 1.50 USD, compared to no incentive, individuals were more likely to complete couples HIV testing, and importantly, reported no increased social harms or relationship unrest [23]. If lessons from this HIV testing–based intervention were translated to target PrEP initiation and adherence, it would be prudent to understand which non-monetary items would make the action of not only visiting a health center to obtain PrEP worthwhile, but if recurring incentives would be necessary to maintain adherence long-term. This type of intervention would also be important to understand if non-monetary versus monetary incentives yield similar results to interventions studying HIV testing uptake.

Another study in South Africa found that a mobile HTS clinic that provided incentivized (men received food vouchers valued at 10.30USD [or 80R] upon testing, excluding use for alcohol or tobacco products) versus unincentivized services found that HIV testing was not only higher in the incentives arm, but that arm also had a higher HIV positivity rate and more severe disease [19]. If these results could be replicated using PrEP initiation and adherence as primary outcomes, we may be able to develop programs that focus on key populations who would be more likely to seroconvert without PrEP.

A three-arm parallel RCT in Tanzania assessed the effect of different sized monetary incentives on ART adherence via viral suppression and found that smaller incentives were as affective as larger incentives (10,000 TZS/$4.50 vs. 22,500 TZS/$10) compared to no incentives in improving ART adherence after 6 months [24]. Incentives were delivered to those newly initiating ART using the study's mHealth application and conditional on monthly clinical assessment and monitoring visits. While the study shows promising effects for initial ART initiation and adherence, there remain questions of adherence once monthly follow-up is no longer required to satisfy national and global guidelines and whether incentives in the first months of initiation are effective in developing a long-term habit. Since PrEP initiation does not have the same monitoring requirements, it is critical to know if this monitoring schedule is important for PrEP initiation and adherence to induce the behavioral change demonstrated by this study.

Another RCT in Tanzania among food insecure PLWH that recently initiated ART found that monthly incentives of cash (22,500 TZS/$11 per month) and food baskets (of equivalent value) had similar levels of ART adherence compared to a control group at 6 months of follow-up as measured by medication possession ratio, i.e., the proportion of days per month an individual was in possession of ≥ 1 ART dose [25]. However, at 12 months, the effect was only sustained in the cash group compared to the control group, indicating that cash incentives might be more effective to sustain long-term behavior change compared to non-monetary incentives.

Lastly, a lottery-based incentive study in Uganda testing whether incentivizing PLWH to attend their clinic visits (treatment 1) versus incentivizing them to maintain ART adherence to at least 90% (treatment 2) over a 3-month period found that while mean adherence was higher in the treatment 1 group, it was not statistically significant [26]. However, adherence improvement in the treatment 2 group was statistically significant. Moreover, those that had particularly low adherence in the treatment 2 group experienced the highest adherence improvement, further emphasizing the importance of tailoring BE interventions to the appropriate population.

However, an RCT in Uganda testing the effect of incentive amounts escalating from $4 to $12.5 at 6, 12, and 24 weeks on ART adherence measured via viral suppression found there was no significant difference between the incentive and non-incentive groups at 24 weeks or on long-term suppression at 48 weeks [27]. The authors attributed these null results to the high levels of viral suppression (77%) at baseline, which highlights the need to identify the specific population among which similar interventions may be effective on.

A main distinction between the studies described are that the interventions to increase HIV testing uptake are attempting to promote a one-time behavior versus those to influence ART adherence are attempting to promote a daily behavior. Using financial incentives for sustained behavior change may be much harder than promoting a one-time behavior change, especially provision of incentives long-term is not a sustainable or practical solution. Furthermore, perhaps it is also important to consider at which point we are intervening, as those initiating ART or testing for the first time may be more likely to develop a new and sustainable habit versus those that have already tried to build the habit previously and been unsuccessful.

Value of BE Interventions

The incorporation of BE insights to tailor PrEP initiation and adherence interventions have many benefits including being low-cost (for non-financial incentives) and effective when the intervention is designed appropriately for the population and setting. Importantly, the value of the incentive itself needs to be both high enough to actually serve as an incentive without being so high that it becomes coercive to individuals. Conversely, offering too high a value of incentives could have counterintuitive results as it may give the impression that PrEP can cause harms to participants and work as a disincentive to taking PrEP. A qualitative study in Uganda found that incentives were effective as they addressed the structural, inter-personal, and individual-level barriers of getting HIV tested [28]. Convenience of HIV testing locations and offsetting testing costs, including lost days wages, were some of the structural barriers overcome by providing incentives. Similar barriers of financial and physical access to PrEP could be overcome if incentives within interventions were tailored carefully.

While there are also often concerns of expense and sustainability of financial incentives, prior work has shown that the long-term economic benefits of incentives far outweigh the cost of providing financial incentives to target multiple steps of the HIV treatment and care cascade through current and new programs [29–31]. While there is limited evidence for the cost-effectiveness of incentives for PrEP initiation or adherence, research in ART adherence generally supports the provision of incentives in this domain. A clinical trial testing the effectiveness of providing a financial incentive versus standard of care conducted in New York and Washington D.C., USA, found that financial incentives were beneficial from both a societal and healthcare system perspective by increasing quality-adjusted life years (QALYs) by 0.6 and saving discounted lifetime costs by $4210 per patient [29]. Another study of viral suppression in Baltimore, USA, found that provision of significant monetary incentives of up to $3650 per year (or $10 per day) was not only successful in increasing undetectable viral loads in PLWH [30], but that the difference in average health costs between those in the incentive arm and those in standard of care was only $8664 while the estimated cost per QALY gained was only $28,888, which was significantly below the accepted cost-per-QALY threshold in the USA [31]. While studies using PrEP adherence as the primary outcome are still needed to truly asses the cost-effectiveness of using incentives for PrEP programs, these results are important to demonstrate the potential long-term economic benefits of utilizing financial incentives to complement other strategies of HIV prevention and care.

Gaps in the Literature

In high HIV burden areas across the world, at any given time, there are many ongoing HIV prevention and treatment campaigns and research studies because of the worldwide effort to fight the HIV epidemic. We would assume that as a direct result of this, *salience bias* would work in the favor of public health to encourage HIV prevention practices like PrEP use, condom use, circumcision, and testing as recommended by local health authorities. However, this is not the trend being observed as HIV incidence continues to be high in countries with historically high HIV prevalence. Salience bias, even with so many HIV testing programs and PrEP campaigns, are sometimes rendered ineffective due to the pure length of time that the HIV epidemic has endured. As recently observed in the COVID-19 pandemic (32), those living in high HIV burden areas are psychologically fatigued by the duration and severity of the HIV epidemic, accepting it as part of life. Therefore, a potential route of impact may be to focus on increasing salience of PrEP for HIV, among key populations and those at increased risk as identified by social network programs, beyond standard posters displayed in health clinics.

Similar to salience bias, interventions studying *affect* has also been scarce in the literature of PrEP adherence. Since we know that individuals are more likely to make healthier choices in a "cold" state, perhaps attempting to engage individuals for PrEP initiation during regular clinic visits is not ideal, which are understandably "hot" states. Additional work could investigate ideal situations or "cold" states that would most likely encourage individuals to make the logical decision to initiate PrEP use.

Conclusions

When BE work was starting to take off in the field of HIV a few decades ago, there were many BE insights and concepts described as potential pathways to influence behavior change, including present-bias, salience bias, affect, and financial incentives, among others. While HIV testing and ART initiation and adherence have received more attention from BE researchers, PrEP initiation and adherence research has been lagging. However, formative work in these adjacent fields holds promise for translation into PrEP adherence work. As discussed in this review, financial incentives may be effective, safe, and sustainable tools to offer as part of modern and comprehensive HIV prevention programs.

However, since other BE principles are relatively untested in the HIV care cascade, perhaps applying novel and effective BE concepts within PrEP dissemination programs could be valuable as part of a toolkit to target key populations and

tailor programs and studies to populations and settings of high HIV burden areas and encourage PrEP adherence to prevent new HIV infections.

Declarations

Conflict of Interest The authors declare no competing interests.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

References

Papers of particular interest, published recently, have been highlighted as:
• Of importance
•• Of major importance

1. Rice T. The behavioral economics of health and health care. Annu Rev Public Health. 2013;34(1):431–47.
2. Charness G, Gneezy U. Incentives to exercise. Econometrica. 2009;77(3):909–31.
3. Volpp KG, John LK, Troxel AB, Norton L, Fassbender J, Loewenstein G. Financial incentive-based approaches for weight loss: a randomized trial. JAMA. 2008;300(22):2631–7.
4. Volpp KG, Troxel AB, Pauly MV, Glick HA, Puig A, Asch DA, et al. A randomized, controlled trial of financial incentives for smoking cessation. N Engl J Med. 2009;360(7):699–709.
5. Banerjee AV, Duflo E, Glennerster R, Kothari D. Improving immunisation coverage in rural India: clustered randomised controlled evaluation of immunisation campaigns with and without incentives. The BMJ. 2010;17(340):c2220.
6. Lacetera N, Macis M, Slonim R. Economic rewards to motivate blood donations. Science. 2013;340(6135):927–8.
7. O'Donoghue T, Rabin M. Doing It Now or Later. Am Econ Rev. 1999;89(1):103–24.
8. Tiefenbeck V, Goette L, Degen K, Tasic V, Fleisch E, Lalive R, et al. Overcoming salience bias: how real-time feedback fosters resource conservation. Manag Sci. 2018;64(3):1458–76.
9. •• Linnemayr S. HIV prevention through the lens of behavioral economics. JAIDS J Acquir Immune Defic Syndr. 2015;68(4):e61. **This article forms an important base for the mechanisms through which BE principles can be effective for HIV prevention**.
10. •• Linnemayr S, MacCarthy S, Wagner Z, Barreras JL, Galvan FH. Using behavioral economics to promote HIV prevention for key populations. J AIDS Clin Res. 2018;9(11):780. **This short communication highlights important factors to consider when designing financial incentives, including non-monetary incentives, in order for them to be most effective.**
11. Loewenstein G. Hot-cold empathy gaps and medical decision making. Health Psychol Off J Div Health Psychol Am Psychol Assoc. 2005;24(4S):S49-56.
12. •• Salinas-Rodríguez A, Sosa-Rubí SG, Chivardi C, Rodríguez-Franco R, Gandhi M, Mayer KH, et al. Preferences for conditional economic incentives to improve pre-exposure prophylaxis adherence: a discrete choice experiment among male sex workers in Mexico. AIDS Behav. 2022;26(3):833–42. **This DCE demonstrated that key populations theoretically prefer a fixed-structure incentives payment compared to a lottery-based payment scheme.**
13. •• Celum CL, Gill K, Morton JF, Stein G, Myers L, Thomas KK, et al. Incentives conditioned on tenofovir levels to support PrEP adherence among young South African women: a randomized trial. J Int AIDS Soc. 2020;23(11):e25636. **This study showed that incentives may increase PrEP adherence for 3 months among adolescent girls and young women, though the trend may not be sustainable.**
14. •• LeGrand S, Knudtson K, Benkeser D, Muessig K, Mcgee A, Sullivan PS, et al. Testing the efficacy of a social networking gamification app to improve pre-exposure prophylaxis adherence (P3: Prepared, Protected, emPowered): protocol for a randomized controlled trial. JMIR Res Protoc. 2018;7(12):e10448. **This large-scale ongoing study of an app that dispenses incentives to encourage PrEP adherence is indicative of the possible uses and importance of using BE principles to design PrEP adherence studies.**
15. Garrison LE, Haberer JE. Pre-exposure prophylaxis uptake, adherence, and persistence: a narrative review of interventions in the US. Am J Prev Med. 2021;61(5, Supplement 1):S73-86.
16. Lee R, Cui RR, Muessig KE, Thirumurthy H, Tucker JD. Incentivizing HIV/STI testing: a systematic review of the literature. AIDS Behav. 2014;18(5):905–12.
17. Haukoos JS, Witt MD, Coil CJ, Lewis RJ. The effect of financial incentives on adherence with outpatient human immunodeficiency virus testing referrals from the emergency department. Acad Emerg Med Off J Soc Acad Emerg Med. 2005;12(7):617–21.
18. Thornton RL. The demand for, and impact of, learning HIV status. Am Econ Rev. 2008;98(5):1829–63.
19. Nglazi MD, van Schaik N, Kranzer K, Lawn SD, Wood R, Bekker LG. An incentivized HIV counseling and testing program targeting hard-to-reach unemployed men in Cape Town, South Africa. J Acquir Immune Defic Syndr 1999. 2012;59(3):e28-34.
20. Chamie G, Kwarisiima D, Ndyabakira A, Marson K, Camlin CS, Havlir DV, et al. Financial incentives and deposit contracts to promote HIV retesting in Uganda: a randomized trial. PLOS Med. 2021;18(5):e1003630.
21. Montoy JCC, Dow WH, Kaplan BC. Cash incentives versus defaults for HIV testing: a randomized clinical trial. PLoS ONE. 2018;13(7):e0199833.
22. Chamie G, Schaffer EM, Ndyabakira A, Emperador DM, Kwarisiima D, Camlin CS, et al. Comparative effectiveness of novel non-monetary incentives to promote HIV testing: a randomized trial. AIDS Lond Engl. 2018;32(11):1443–51.
23. Sibanda EL, Tumushime M, Mufuka J, Mavedzenge SN, Gudukeya S, Bautista-Arredondo S, et al. Effect of non-monetary incentives on uptake of couples' counselling and testing among clients attending mobile HIV services in rural Zimbabwe: a cluster-randomised trial. Lancet Glob Health. 2017;5(9):e907–15.
24. Fahey CA, Njau PF, Katabaro E, Mfaume RS, Ulenga N, Mwenda N, et al. Financial incentives to promote retention in care and viral suppression among HIV-positive adults initiating antiretroviral therapy in Tanzania: a three-arm randomised controlled trial. Lancet HIV. 2020;7(11):e762–71.
25. Mccoy SI, Njau PF, Fahey C, Kapologwe N, Kadiyala S, Jewell NP, et al. Cash versus food assistance to improve adherence to antiretroviral therapy among HIV-infected adults in Tanzania: a randomized trial. AIDS Lond Engl. 2017;31(6):815–25.
26. Stecher C, Mukasa B, Linnemayr S. Uncovering a behavioral strategy for establishing new habits: evidence from incentives for medication adherence in Uganda. J Health Econ. 2021;1(77):102443.

27. Thirumurthy H, Ndyabakira A, Marson K, Emperador D, Kamya M, Havlir D, et al. Financial incentives for achieving and maintaining viral suppression among HIV-positive adults in Uganda: a randomized trial. Lancet HIV. 2019;6(3):e155–63.
28. Ndyabakira A, Getahun M, Byamukama A, Emperador D, Kabageni S, Marson K, et al. Leveraging incentives to increase HIV testing uptake among men: qualitative insights from rural Uganda. BMC Public Health. 2019;19(1):1763.
29. Adamson B, El-Sadr W, Dimitrov D, Gamble T, Beauchamp G, Carlson JJ, et al. The cost-effectiveness of financial incentives for viral suppression: HPTN 065 Study. Value Health. 2019;22(2):194–202.
30. Silverman K, Holtyn AF, Rodewald AM, Siliciano RF, Jarvis BP, Subramaniam S, et al. Incentives for viral suppression in people living with HIV: a randomized clinical trial. AIDS Behav. 2019;23(9):2337–46.
31. Dunlap LJ, Orme S, Zarkin GA, Holtgrave DR, Maulsby C, Rodewald AM, et al. Cost and cost-effectiveness of incentives for viral suppression in people living with HIV. AIDS Behav [Internet]. 2021 Aug 26 [cited 2021 Oct 24]; Available from-https://doi.org/10.1007/s10461-021-03439-x.
32. World Health Organization. Regional Office for Europe. Pandemic fatigue: reinvigorating the public to prevent COVID-19: policy considerations for Member States in the WHO European Region [Internet]. World Health Organization. Regional Office for Europe; 2020 [cited 2021 Oct 24]. Report No.: WHO/EURO:2020–1160–40906–55390. Available from: https://apps.who.int/iris/handle/10665/335820. Accessed 24 Apr 2022.