Published in final edited form as:

Health Psychol. 2013 September ; 32(9): 932–940. doi:10.1037/a0032760.

Conditional Economic Incentives for Reducing HIV Risk Behaviors: Integration of Psychology and Behavioral Economics

Don Operario, PhD.^{a,*}, Caroline C. Kuo, DPhil^a, Sandra G. Sosa-Rubí, PhD.^b, and Omar Gálarraga, PhD.^c

^aCenter for Alcohol and Addiction Studies, Brown University

^bDivision of Health Economics, National Institute for Public Health, Cuernavaca, Mexico

^cHealth Services Policy and Practice, Brown University

Abstract

Objective—This paper reviews psychology and behavioral economic approaches to HIV prevention, and examines the integration and application of these approaches in conditional economic incentive (CEI) programs for reducing HIV risk behavior.

Methods—We discuss the history of HIV prevention approaches, highlighting the important insights and limitations of psychological theories. We provide an overview of the theoretical tenets of behavioral economics that are relevant to HIV prevention, and utilize CEIs as an illustrative example of how traditional psychological theories and behavioral economics can be combined into new approaches for HIV prevention.

Results—Behavioral economic interventions can complement psychological frameworks for reducing HIV risk by introducing unique theoretical understandings about the conditions under which risky decisions are amenable to intervention. Findings from illustrative CEI programs show mixed but generally promising effects of economic interventions on HIV and STI prevalence, HIV testing, HIV medication adherence, and drug use.

Conclusion—CEI programs can complement psychological interventions for HIV prevention and behavioral risk reduction. To maximize program effectiveness, CEI programs must be designed according to contextual and population-specific factors that may determine intervention applicability and success.

Keywords

HIV/AIDS; behavioral economics; conditional economic incentives

For three decades, psychological science has been the foundation for public health efforts to prevent human immunodeficiency virus (HIV) infection and acquired immunodeficiency syndrome (AIDS) cases (Coates, Temoshok, Mandel, 1984). In the absence of biomedical interventions, especially in the early phases of HIV/AIDS, public health programs relied on

*corresponding author: Don Operario, Ph.D., Box G-S-121-4, Department of Behavioral and Social Sciences, Center for Alcohol and Addiction Studies, Brown University, (401) 863-6657, Don_Operario@Brown.edu.

psychological theories of behavior change to design strategies for reducing HIV risk behaviors (Fishbein, 2000). Previous literature reviews have summarized the evidence for the efficacy of behavioral HIV prevention programs (Noar, 2007; Pequegnat & Stover, 2000), showing that interventions based on psychological theory have contributed to significant increases in condom use, reductions in number of partners, reduction in incidence of sexually transmitted infections (STIs) other than HIV, and increases in knowledge and attitudes that favor safer sex.

Despite these successes, the number of new HIV infections has continued to rise in the past decade, revealing limitations to psychological approaches to HIV prevention. In 2009 alone, there were an estimated 2.6 million new HIV infections globally, primarily in settings characterized by poverty (UNAIDS, 2010). An estimated 56,000 new infections occurred annually in the United States since 2006, with sexual and ethnic minority populations disproportionately at risk for infection (White House Office of National AIDS Policy, 2010). The burden of HIV/AIDS in disadvantaged groups brings attention to structural and economic factors that might elude psychological theories of behavior change. Criticism of the body of existing behavioral interventions highlights a need for new approaches to HIV prevention that extend beyond psychology-focused frameworks (Philipps & Pirkle, 2011).

HIV prevention research has recently become energized by insights from behavioral economics. As a hybrid of economics and psychology, behavioral economics introduces unique theoretical understandings about the conditions under which risky decisions are amenable to intervention. A notable contribution of behavioral economics to HIV prevention is the emergence of conditional economic incentive (CEI) programs for changing HIV-related behavioral outcomes. Similar to contingency management (CM) programs developed by psychologists for treating individual-level substance use problems, CEIs operate as policy and structural-level interventions by providing financial rewards to individuals who engage in behaviors that facilitate positive health outcomes - such as school attendance, clinic visits, and proper nutrition. Community-level effects of CEI programs on child and family health have been observed in many parts of the world (Attanasio, Meghir, & Santiago, 2011). Providing economic incentives to individuals for changing sexual risk behaviors associated with HIV transmission presents a compelling extension of this framework. The aims of this paper are twofold. First, we briefly describe the literature on psychological and behavioral economics approaches to HIV prevention. Second, we describe the convergence of theoretical orientations through the example of CEI programs for addressing HIV, and we explore the empirical evidence for the effects of illustrative CEI programs on HIV prevention outcomes.

HIV Prevention and Psychological Theories

Efforts to mobilize the initial public health response to HIV were challenged by the paucity of research during the 1980s about sexual behavior, condom use, and strategies for altering the ways in which people engage in sexual intercourse (Pequegnat & Stover, 2009). Public health scientists turned to theories used in other behavioral health interventions, such as for heart disease, smoking, and diet, and applied these theories to sexual risk behavior (Coates et al., 1984). Some of the theories used most frequently in HIV prevention came from

psychology laboratories, and included the health belief model (Janz & Becker, 1984), social cognitive theory (Bandura, 1977), the theory of reasoned action (Fishbein & Azjen, 1975), theory of planned behavior (Azjen, 1991), and the transtheoretical model (Prochaska & DiClemente, 1983). Frameworks developed specially to explain HIV/AIDS behaviors also emerged, including the information-motivation-behavior (IMB) model (Fisher & Fisher, 1992) and AIDS risk reduction model (Catania, Kegeles, & Coates, 1990). Proof-of-concept studies testing individual, small-group, and community-level HIV prevention programs demonstrated the efficacy of psychology-based intervention models in reducing HIV risk behaviors among high-risk populations (see Pequegnat & Stover, 2009 for a review).

Noar (2007) identified areas of overlap among psychological theories used in HIV prevention, most notably in their emphasis on social-cognitive mechanisms of health behavior change. Cross-cutting theoretical variables that determine health behavior change include perceptions of risk and vulnerability, attitudes and beliefs, perceived norms, motivation to change, self-efficacy, behavioral intentions, and social reinforcement. A subset of theories emphasizes the role of incremental changes and temporality in influencing the adoption of new health behaviors. The theoretical insights derived from psychology have been crucial to our HIV response. However, these insights have not been sufficiently adequate. For example, although there is some acknowledgment of environmental influences on sexual behavior - e.g., the role of external reinforcement described in social cognitive theory and perceived behavioral control in the theory of planned behavior - most HIV behavioral theories lack such specificity.

As the number of psychological studies of HIV risk expanded, limitations became more salient. Attempts to scale-up behavioral interventions tested in clinical trials have been met with challenges transporting programs to real-world settings, suggesting problems in ecological validity of theory-based interventions (Morrison et al., 2009). Complex social epidemiological models of the determinants of HIV transmission brought attention to macro-level factors beyond the scope of psychology that influence sexual and reproductive health decisions (Poundstone, Strathdee, & Celentano, 2004). Moreover, no behavior change intervention has yet proven to have a causal effect on HIV incidence in a clinical trial (Padian, McCoy, Balkus, & Wasserheit, 2010).

Psychology-based HIV intervention programs have been especially criticized for overlooking the restrictions on sexual autonomy experienced by many of the most-at-risk populations including women in traditional cultures, sex workers, and members of socioeconomically disadvantaged groups (Amaro, 1995). Diaz and Ayala (2001) argued that "HIV is being transmitted precisely in those contexts and circumstances ... where individuals are not able to exercise power and control, or self-determine at will their own behavior" (p. 4). Behavior-change HIV programs based on psychological principles have been generally agnostic to the effects of poverty, gender roles, and life opportunities on the sexual and reproductive health behaviors among the communities most vulnerable for HIV infection. Responding to this disciplinary myopia, researchers have called for multi-level HIV prevention frameworks that enhance the meaningful yet modest effects of psychological interventions.

HIV Prevention and Behavioral Economics

Behavioral economics represents the integration of psychological and economic principles to understand individual decision making (Bickel, Green, & Vuchinich, 1995). Behavioral economics extends the basic premise of traditional microeconomic theory, which assumes that individual agents make rational decisions in order to maximize the *utility*, or personal benefits, derived from their behavioral choices (e.g., whether to engage in unprotected or protected sex with a new partner). A traditional economic viewpoint assumes that utility is an objective concept representing the optimization of personal gain relative to costs. By contrast, behavioral economics recognizes the systematic biases inherent in decision making and the notion of “bounded rationality” (Simon, 1955), and posits that utility is a subjective concept representing the individual agent’s personal satisfaction with the decision (Kahneman, 2003). The concept of “subjective utility” acknowledges the tendency for decisions to be based on perceived benefit and “good-enough” cognitive processes (Fiske & Taylor, 2008), rather than consistently rational and accurate calculations of personal gain.

The decision of a female sex worker to engage in unprotected versus protected sex with a paying partner provides a simple demonstration of these principles. In this scenario, the individual agent (female sex worker) may derive utility from using a condom because this protects her against HIV and other STIs. On the other hand, insofar as customers may pay more for having sex without a condom, the agent can derive utility from having unprotected sex because this results in higher wages which can be used to meet basic needs (Gertler, Shah, & Bertozzi, 2005; Rao, Gupta, Lokshin, & Jana, 2003). Traditional economic theory posits that, if appropriately informed of the relative costs and benefits of the behavioral choice, the agent should calculate utility by weighing the total costs and benefits of condom use in comparison to the alternative choice, i.e., unprotected sex. If utility is based on the total value of the behavior, then choosing to use a condom represents the rational decision of this sex worker.

The behavioral economics argument provides additional nuance to the traditional microeconomic theory. Behavioral economics proposes that rational models are unrealistic to most human agents (Kahneman, 2003). Behavioral decisions are typically not consistently rationale, but are rather strongly influenced by contextual factors, personal beliefs, competing demands, emotions, and multiple other social-cognitive and affective factors that shape risk-benefit calculations (Fiske & Taylor, 2008). For example, despite having sufficient information about HIV transmission and its consequences, a female sex worker may decide to engage in unprotected sex with a paying partner because of immediate economic needs, gender roles that undermine her stated preferences, fear of violence, competing disease risk, and perceptions about the customer’s risk for HIV transmission (e.g., the belief that customers who appear clean or attractive pose lower risk for HIV) (Basuki et al., 2002). Although her decision to engage in unprotected sex might indeed confer potential HIV risk, especially in a generalized prevalence setting with high base-rate probability of HIV exposure, this decision is not necessarily irrational. Thus, the behavioral economics viewpoint proposes that subjective utility is the product of an intuitive judgment process that considers immediate preferences while discounting long-term benefits, even if the total long-term benefits to health exceed immediate benefits to income. This

phenomenon, known among economists as temporal discounting (or delay of gratification to psychologists), poses a challenge to HIV promotion strategies that prioritize future outcomes over present needs.

Thus, behavioral economics recognizes two issues that are not explicit in most psychological theories that guide HIV prevention – first, that people’s preferred outcomes, or their subjective utility, are largely determined by salient contextual needs; second, that decision making favors immediate rewards and heavily discounts future outcomes. At a more general level, economic perspectives (both traditional microeconomics and behavioral economics) emphasize that HIV risk behaviors are frequently motivated by economic reasons and must be understood in economic context. HIV-related behaviors such as condom use are equally influenced by supply-side factors such as provision of HIV prevention resources, as well as by demand-side factors such as ability and willingness to use HIV prevention resources among members of high-risk populations. Introduction of supply-side HIV prevention factors, such as new clinical and social services or biomedical technologies, cannot reduce new infections in the absence of strategies that address demand side factors. That is, HIV prevention must provide new strategies for prevention as well as increase the willingness of individuals to consume these products. Because supply and demand factors are related, policies and programs can strategically increase demand for HIV prevention based on behavioral economic principles.

Conditional Economic Incentives and HIV Prevention

CEI is a demand-side intervention that provides economic incentives to an individual contingent upon achievement of a behavioral goal. The premise of CEI is consistent with contingency management (CM) programs used frequently in substance use treatments that modify behaviors through operant reinforcements, such as conditional cash or vouchers, in exchange for reducing drug or alcohol use. In this way, CEI programs capitalize on behavioral economic and behavioral psychology principles. CEI programs recognize that economic rewards can motivate individual behavioral initiation and repetition. CEI programs also recognize the tendency for individuals to focus on immediate payoffs and discount long-term gains. Providing economic incentives to individuals contingent on satisfying a concrete behavioral goal (e.g., clinic attendance or getting an HIV test) helps to decrease the temporal horizon of health promotion programs, allowing recipients to experience immediately the tangible benefits of the health behavior rather than imagine a positive health outcome in the distant future.

CEI programs have been successfully used in clinic settings to increase retention in treatment programs and encourage abstinence among methadone (Petry, Weinstock, & Alessi, 2011), methamphetamine (Roll et al., 2006), and marijuana users (Kamon, Budney, & Stanger, 2005). Similarly, CEI programs have been used to improve adherence to health treatments including medication adherence (Morisky et al., 1990), attendance at healthcare appointments (Mayer & Kellogg, 1989), and uptake of health interventions (Lagarde, Haines, & Palmer, 2007).

At the policy level, CEI programs have been associated with population-level changes in health compared with no-treatment controls. A notable example is the *Oportunidades* program in Mexico which provides “conditional cash transfers” (CCT) or financial incentives to economically disadvantaged families contingent upon meeting behavioral objectives such as health service utilization and regular school attendance for children (Attanasio et al., 2011; Lagarde, Haines, & Palmer, 2007).

The use of CEI to induce individual and population-level changes in HIV infection represents a bold application of this experimental paradigm. As noted, many of the populations at highest risk for HIV are also economically disadvantaged. For these populations, unprotected sex may provide a necessary source of income in the context of financial worry or a source of hedonic reinforcement in the context of general life distress, in addition to providing other forms of subjective utility. CEIs can alter the motivation to engage in protected sex, if the incentives are salient enough to counteract the subjective utility of unprotected sex. If CEIs enable individuals to experience the immediate consequences of health behavior, *vis-à-vis* gaining or losing an expected reward contingent on a concrete behavioral goal, then they can reframe subjective utility and effectively change the behavior.

A challenging consideration when designing CEI programs to prevent HIV is deciding the appropriate behavior to incentivize. Although condom use is one of the most effective behaviors for reducing HIV transmission, incentivizing condom use is difficult because this behavior is not an observable outcome but dependent upon self-report, which can be unreliable. CEI programs can also reduce HIV transmission by incentivizing co-factors that determine sexual behaviors, such as school attendance, HIV testing, and reduction of alcohol and drug use. Epidemiological studies show that each of these variables is predictive of sexual risk and HIV prevalence (Poundstone et al., 2004). Notably, CEI programs are unlikely to be effective for HIV prevention in contexts where individuals have little volitional control over their sexual behaviors and in settings where forced sex and gender inequality are common. As is the case for psychological frameworks for HIV prevention, CEI assumes a substantial amount of behavioral autonomy.

It is important to note that CEI programs represent just one of several possible demand-side economic approaches to HIV prevention. Another approach is micro-finance, which refers to the provision of small-scale financial investments or loans (which must be re-paid) to economically disadvantaged people who are at risk for HIV, in order to stimulate outcomes distally associated with HIV risk reduction such as entrepreneurship and asset building (Pronyk, et al., 2006). In contrast to the specificity of CEI programs on targeted behavioral outcomes, micro-finance programs are primarily regarded as poverty reduction interventions that may yield collateral effects on HIV as one of many possible outcomes. Other demand-side interventions include price adjustment efforts that increase demand for and accessibility of HIV prevention resources by lowering the price of goods such as condoms, injection needles, or HIV test services. This latter approach represents a traditional market-based economic strategy for inducing behavior change, contrasting with CEI programs that invoke both psychological and behavioral economics principles.

Illustrative Evidence for Effects of CEI on HIV Prevention

There is an increasing body of research testing the effects of CEI programs for HIV prevention. Much of this research has been conducted by psychological scientists using CM approaches to elicit HIV risk reduction for members of high-risk populations (e.g., drug users and MSM), whereas a subset of recent studies conducted by behavioral economists using economic incentives as a population-level strategy for reducing HIV risk. Common among these studies is the provision of economic incentives to participants if they satisfy a behavioral goal related to reduction of HIV risk - including school attendance, reducing substance use, and remaining free of curable STIs. To survey the body of relevant research, we searched PubMed for CEI programs addressing HIV-related outcomes; our search strategy included keywords *conditional economic incentives*, *contingency management*, and *HIV (AIDS) prevention*. We also examined bibliographies of identified studies for additional published reports. Although this was not a comprehensive, systematic search, our goal was to identify relevant studies addressing this topic and summarize trends from illustrative studies. Studies were included in this review if they (i) provided program participants an economic incentive contingent on an *a priori* HIV prevention goal; (ii) assessed program effects on at least one HIV-related outcome, including HIV-infection, STI-infection, or sexual risk behavior; (iii) compared program effects with a comparison group or within-group using at least one follow-up assessment. We identified 18 studies meeting these criteria (see Table 1).

Recent studies in sub-Saharan Africa have examined the effects of economic incentives on HIV and STIs. Baird et al. (2012) conducted a randomized controlled trial testing effects of cash transfers on HIV risk among young women in Malawi. In the experimental group, participants received monthly cash amounts, whereas in the control group participants received no cash. The experimental group was further stratified. For half of the experimental-group participants, receipt of cash was contingent on regular school attendance; for the other half, receipt of cash was not contingent on school attendance. Overall findings indicated that receipt of monthly cash amounts was associated with a significantly lower prevalence of HIV, herpes simplex virus-2, pregnancy, weekly sexual intercourse, and sex with a partner older than 25 years of age. However, the effects differed between the conditional versus unconditional cash transfer groups. Participants who received the conditional cash transfers had significantly lower odds of HIV prevalence and sex with a male partner older than 25, compared with the control group. By contrast, participants who received unconditional cash transfers had lower odds of current pregnancy, HSV-2 prevalence, and sexual intercourse once per week, compared with the control group. Additional research by this team found that cash transfers for school attendance led to lower rates of pregnancy, early marriage, and early sexual debut (Baird et al., 2010a), and that conditional incentives do not confer greater protective effects on schooling or marriage beyond the protective effects of unconditional incentives (Baird et al., 2010b). These counterintuitive findings illuminate distinctions between conditional versus unconditional economic incentives, which might be equally effective in different economic contexts.

A related study conducted in Tanzania by de Walque et al. (2012) tested the effects of cash incentives contingent on testing negative of curable STIs. In this randomized trial,

participants received STI tests every 4 months for 1 year. In the control group, participants received no incentives for testing STI negative. In the experimental group, participants received either a low conditional cash amount (approximately \$10) or a high conditional cash amount (approximately \$30) for each negative STI test. At the 1-year assessment, participants who received the high conditional cash amount were significantly less likely than those in the low-cash and the no-cash groups to test STI positive. No intervention effects on HIV or herpes simplex virus-2 incidence were found.

A cohort study by Kohler and Thornton (2011) in Malawi offered participants a cash transfer if they maintained their HIV status for one year. Findings indicated that this incentive strategy had no effect on self-reported HIV sexual risk behavior at 12-month follow-up. Reasons for this null finding are unclear, but participants might have discounted long-term financial rewards and been influenced instead by the immediate benefits of sexual risk behavior.

We identified eight studies that tested the effects of economic incentives on HIV-risk in drug using populations. These studies were based on epidemiological data showing a strong co-occurrence between drug use and sexual risk behavior, and examined whether interventions using CM principles to reduce drug use could also reduce HIV-related sexual risk. Results across studies show a mixed pattern of effects. Three studies provided evidence that offering incentives to high-risk individuals contingent on drug-free urine specimens can decrease both drug use and sexual risk. Landovitz et al. (2012) found that conditional incentives led to significantly lower drug use, fewer sex partners, and fewer unprotected anal sex episodes in a sample of MSM; economic incentive recipients also increased use of pre-exposure prophylaxis – a pharmacological intervention for reducing the likelihood of HIV seroconversion after possible exposure to HIV. Petry et al. (2010) found that conditional incentives led to significantly lower drug use, lower sexual risk behavior, and lower HIV viral load in a sample of HIV-positive individuals; however, effects were not sustained at a 1-year follow-up assessment. Schroeder et al. (2006) found that conditional incentives led to significantly lower unprotected sex and needle sharing in a sample of heroin and cocaine dependent individuals. However, 4 studies showed that conditional incentives contingent on drug-free urine specimens led to significantly lower drug use but did not affect sexual risk behavior (Barry et al., 2008; Ghitza et al., 2008; Hanson et al., 2008; Shoptaw et al., 2005), despite framing these programs as HIV-prevention interventions. One study found that conditional economic incentives contingent on drug-free urine specimens was associated with increased drug use and had no effects on sexual behavior at follow-up (Menza et al., 2010); reasons for this iatrogenic effect are unclear. Notably, these eight studies involving drug using populations had small sample sizes, potentially affecting power to detect significant behavior changes, compared to the international studies described earlier.

Additional studies have used CEIs to increase demand for biomedical strategies that can bring about reductions in HIV transmission. Haukoos et al., (2005) and Thornton (2008) both found that CEI programs significantly increased demand for and completion of HIV testing. Given recent studies showing the importance of HIV-testing as a population-level intervention for HIV prevention, these effects are highly promising. Javanbakht et al. (2006), Rigby et al. (2000), Rosen et al. (2007), and Sorensen et al. (2007) found that CEI

programs significantly improved adherence to antiretroviral medications among HIV-positive patients; Javanbakht et al. and Rosen et al. also found lower HIV viral load among CEI recipients. These findings are noteworthy in light of clinical evidence showing that adherence to antiretroviral medication and lower viral load can substantially lower HIV transmission from an infected to an uninfected partner (Cohen et al., 2011). However, in three of these studies, effects of CEI on adherence were attenuated after incentives were removed (Rigby et al., 2000; Rosen et al., 2007; Sorensen et al., 2007), indicating a need to explore long-term sustainability of CEI programs for promoting adherence.

Discussion

CEI programs offer a promising addition to our current arsenal of HIV prevention strategies. However, questions still remain regarding the necessary conditions to optimize intervention effects. Studies by Baird et al. (2012) and de Walque et al. (2012) provide preliminary evidence that prevalence of HIV and other STIs can be reduced by offering cash payment to high-risk individuals who meet specific behavioral goals (e.g., staying in school). However, Baird et al. found that unconditional cash payments in highly impoverished settings might be just as effective as conditional cash payments, which underscores a need to consider the context in which economic HIV interventions are implemented - i.e., cash transfers might be equally or more beneficial compared to CEI programs in settings characterized by extreme poverty. Kohler and Thornton (2011) found that offering a future cash incentive for maintaining one's HIV-status over one year is ineffective at reducing risk behavior, and postulated that immediate rewards might be more effective than incentivizing behavior via long-term cash payoffs. Studies conducted in the United States in clinical settings with drug users, high-risk individuals, and HIV-positive patients provide some evidence that offering economic incentives contingent on health behavior change can reduce sexual risk and drug use behaviors, increase HIV testing completion, and increase rates of HIV medication adherence while incentives are offered. However, these clinical findings may not easily transfer into scaled-up programs, and might be difficult to implement in communities where HIV is more endemic.

Future HIV prevention programs will increasingly rely on biomedical strategies such as antiretroviral medications (Cohen et al., 2012), and CEI programs can potentially improve medication adherence and use of clinical services. However, studies reviewed here found that behavioral effects of CEI programs were temporally limited and generally ceased once economic incentives were terminated, suggesting challenges for long-term sustainability. Because suboptimal adherence to antiretroviral medications can have harmful clinical effects, use of CEI programs for biomedical HIV interventions should proceed with caution.

Inconsistencies in behavioral outcomes across studies indicate a need for further experimentation and replication of studies to identify the active program components that potentiate reductions in HIV risk and improved health outcomes. Due to the variability among CEI or CM programs and differences in findings across studies, this review cannot offer specific recommendations for future program implementation. Specific program components that might have variable effects on outcomes, and which require further investigation, include the amount of economic incentives, the length and dosage of the CEI

or CM program, participant characteristics such as level of economic need, contextual characteristics such as generalized levels of poverty, epidemiological factors such as HIV prevalence in the population, setting characteristics such as being in a clinic versus community setting, and supply-side characteristics such as cost and availability of condoms. Participant- and context-level characteristics for program implementation might determine the appropriateness and effectiveness of unconditional versus conditional cash transfer programs for improving HIV outcomes, and must be considered when designing CEI programs (Baird et al., 2010b).

Researchers have argued that CEI programs are meant to complement, but not replace, traditional approaches to HIV prevention that rely on behavioral counseling and health education (de Walque, 2008 et al., 2012). Economic incentives are unlikely to yield effects on HIV risk in the absence of psychological factors such as perceived susceptibility, attitudes, and self-efficacy. Future research is needed to identify ways to maximize the combined effects of psychological and behavioral economics principles on HIV prevention, as well as identify the contexts and populations in which different CEI programs might be most effective. In addition, assessing the cost-effectiveness of CEI programs will be important for ensuring the sustainability of programs in resource constrained settings. As this review has found, general CEI principles seem to affect HIV prevention outcomes across a range of different geographic settings (see Table 1), but specific programs designs will need to consider how to adapt CEI principles to local conditions.

This review of the literature on CEI programs for HIV prevention brings to light limitations in the application of behavioral economics and psychological principles to HIV risk reduction. Both disciplinary approaches tend to pay minimal attention to the role of emotions and physiological processes in sexual risk behavior, particularly how feelings such as love, trust, commitment, fear, and anxiety might undermine any programmatic attempts to alter the ways in which people have sex or seek health care. Mental health issues such as depression also affect people's ability to make safer sexual choices, and can challenge the effects of CEI interventions on HIV behavioral outcomes. CEI programs must consider how internal psychological states moderate people's ability to respond to contingent reinforcements. Another limitation to both behavioral economics and psychological principles is their focus on individual agents, which overlooks the act of sexual intercourse as a dyadic exchange between two partners, often in the context of a committed relationship. Interventions that aim to change the behavior of one partner might produce minimal effects if the other partner is impervious or hostile to change, as might be the case in settings where females exert little influence on their male partner's sexual behaviors. Consequently, CEI programs must consider the influence of *externalities* - i.e., variables or agents outside the scope of the direct intervention target that are affected by the intervention. CEI programs might introduce new forms of stigma to already stigmatized populations, and strategies are needed to minimize stigma associated with program participation - for example by ensuring private payments and maintaining confidentiality of program recipients. Finally, both behavioral economic and psychological interventions may be limited in their ability to produce sustained behavioral changes. Several studies reviewed in Table 1 showed significant immediate effects on HIV prevention and treatment outcomes while incentives

were offered, but most effects attenuated with time after incentives ended. CEI programs must consider ways to induce *habit formation* or the internalization of outcomes into agents' behavioral repertoires.

Limitations to this literature review must be considered. This is not a comprehensive or systematic review of the empirical literature on CEI for HIV prevention and behavioral risk reduction. We did not conduct an exhaustive search of the unpublished “gray” literature, and conclusions might be influenced by publication bias favoring successful studies. Studies described in this review varied in their design of CEI programs and in the control groups used for evaluation, which precludes specific recommendations about core components in the implementation of CEI programs. Studies reviewed here are geographically limited to high-prevalence and impoverished settings in sub-Saharan Africa and to clinical settings serving HIV patients and drug users in the United States. Findings might not be generalizable in low prevalence settings and in contexts lacking adequate clinical services for high-risk populations. In low prevalence settings, CEI programs might be appropriate for use with members of high-risk populations but are unlikely to yield observable effects in the general population.

Conclusion

In summary, behavioral economic interventions can be viewed as a valuable addition to, but not replacement of, existing psychological approaches to HIV prevention. Concepts and methods from each disciplinary approach offer unique perspectives – with psychology emphasizing the supply (i.e. design and development) of HIV prevention programs, and behavioral economics emphasizing the demand of prevention services vis-à-vis incentives to motivate user uptake and engagement. Even as new biomedical approaches to HIV prevention arise, there remains a continued public health need to modify demand-side behaviors - such as clinic attendance, medication adherence, and information seeking - that are required to potentiate intervention effectiveness. Advancing the theoretical and applied synergy of psychology and economics is essential for achieving this public health goal.

References

- Ajzen I. The theory of planned behavior. *Organizational Behavior and Human Decision Processes*. 1991; 50(2):179–211.
- Amaro H. Love, Sex, and Power. Considering Women's Realities in HIV Prevention. *American Psychologist*. 1995; 50(6):437–447. [PubMed: 7598292]
- Attanasio OP, Meghir C, Santiago A. Education choices in Mexico: Using a structural model and a randomized experiment to evaluate PROGRESA. *Review of Economic Studies*. 2011; 79(1):37–66.
- Baird S, Chirwa E, McIntosh C, Ozler B. The short-term impact of a schooling conditional cash transfer program on the sexual behavior of young women. *Health Economics*. 2010; 19(Suppl 1): 55–68. [PubMed: 19946887]
- Baird S, Garfein R, McIntosh C, Özler B. Effect of a cash transfer programme for schooling on prevalence of HIV and herpes simplex type 2 in Malawi: a cluster randomised trial. *The Lancet*. 2012; 379(9823):1320–1329.
- Baird, S.; McIntosh, C.; Özler, B. Policy Working Paper 5259. The World Bank Development Research Group Poverty and Inequality Team; 2010. Cash or condition: Evidence from a randomized cash transfer program.
- Bandura, A. Social learning theory. Englewood Cliffs, NJ: Prentice Hall; 1977.

- Barry D, Weinstock J, Petry NM. Ethnic differences in HIV risk behaviors among methadone-maintained women receiving contingency management for cocaine use disorders. *Drug and Alcohol Dependence*. 2008; 98(1–2):144–153. [PubMed: 18684571]
- Basuki E, Wolffers I, Deville W, Erlaini N, Luhpuri D, Hargono R, van Beelen N. Reasons for not using condoms among female sex workers in Indonesia. *AIDS Education and Prevention*. 2002; 14(2):102–116. [PubMed: 12000229]
- Bickel WK, Green L, Vuchinich RE. Behavioral economics. *Journal of the Experimental Analysis of Behavior*. 1995; 64(3):257–262. [PubMed: 16812771]
- Catania JA, Kegeles SM, Coates TJ. Towards an understanding of risk behavior: An AIDS risk-reduction model (ARRM). *Health Education Quarterly*. 1990; 17(1):53–72. [PubMed: 2318652]
- Coates TJ, Temoshok L, Mandel J. Psychosocial research is essential to understanding and treating AIDS. *American Psychologist*. 1984; 39(11):1309–1314. [PubMed: 6507995]
- Cohen MS, Ying YQ, McCauley M, Gamble T, Hosseinipour MC, Kumarasamy N, Fleming TR. Prevention of HIV-1 infection with early antiretroviral therapy. *New England Journal of Medicine*. 2011; 365(6):493–505. [PubMed: 21767103]
- de Walque D, Dow W, Nathan R, Abdul R, Abilahi F, Gong E, Medlin C. Incentivising safe sex: a randomised trial of conditional cash transfers for HIV and sexually transmitted infection prevention in rural Tanzania. *BMJ Open*. 2012; 2:e000747.
- Diaz, RM.; Ayala, G. Social discrimination and health: The case of Latino gay men and HIV risk. New York, NY: The Policy Institute of the National Gay and Lesbian Task Force; 2001.
- Fishbein M. The role of theory in HIV prevention. *AIDS Care*. 2000; 12(3):273–278. [PubMed: 10928203]
- Fishbein, M.; Ajzen, I. Belief, attitude, intention, and behavior: An introduction to theory and research. Reading, MA: Addison-Wesley; 1975.
- Fisher JD, Fisher WA. Changing AIDS-risk behavior. *Psychological Bulletin*. 1992; 111(3):455–474. [PubMed: 1594721]
- Fiske, ST.; Taylor, SE. Social cognition: From brains to culture. New York, NY: McGraw-Hill; 2008.
- Gertler P, Shah M, Bertozzi S. Risky business: The market for unprotected commercial sex. *Journal of Political Economy*. 2005; 113(3):518–550.
- Ghitza UE, Epstein DH, Preston KL. Contingency management reduces injection-related HIV risk behaviors in heroin and cocaine using outpatients. *Addictive Behaviors*. 2008; 33(4):593–604. [PubMed: 18068905]
- Hanson T, Alessi S, Petry N. Contingency management reduces drug-related human immunodeficiency virus risk behaviors in cocaine-abusing methadone patients. *Addiction*. 2008; 103(7):1187–1197. [PubMed: 18494842]
- 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. *Academic Emergency Medicine*. 12(7):617–621. [PubMed: 15995093]
- Janz NK, Becker MH. The health belief model: A decade later. *Health Education Quarterly*. 1984; 11(1):1–47. [PubMed: 6392204]
- Javanbakht M, Prosser P, Grimes T, Weinstein M, Farthing C. Efficacy of an individualized adherence support program with contingent reinforcement among nonadherence HIV-positive patients: Results from a randomized trial. *Journal of the International Association of Physicians in AIDS Care*. 2006; 5(4):143–150. [PubMed: 17101806]
- Kamon J, Budney A, Stanger C. A contingency management intervention for adolescent marijuana abuse and conduct problems. *Journal of the American Academy of Child and Adolescent Psychiatry*. 2005; 44(6):513–521. [PubMed: 15908833]
- Kahneman D. Maps of bounded rationality: Psychology for behavioral economics. *The American Economic Review*. 2003; 93(5):1449–1475.
- Kohler HP, Thornton RL. Conditional cash transfers and HIV/AIDS prevention: Unconditionally promising? *The World Bank Economic Review*. 2011; 26(2):165–190. [PubMed: 24319306]
- Lagarde M, Haines A, Palmer N. Conditional cash transfers for improving uptake of health interventions in low- and middle-income countries. *JAMA*. 2007; 298(16):1900–1910. [PubMed: 17954541]

- Landovitz RJ, Fletcher JB, Inzhakova G, Lake JE, Shoptaw S, Reback CJ. A novel combination HIV prevention strategy: Post-exposure prophylaxis with contingency management for substance abuse treatment among methamphetamine-using men who have sex with men. *AIDS Patient Care and STDs*. 2012; 26(6):320–328. [PubMed: 22680280]
- Mayer J, Kellogg M. Promoting mammography appointment making. *Journal of Behavioral Medicine*. 1989; 12(6):605–611. [PubMed: 2634113]
- Menza T, Jameson D, Hughes J, Colfax G, Shoptaw S, Golden M. Contingency management to reduce methamphetamine use and sexual risk among men who have sex with men: a randomized controlled trial. *BMC Public Health*. 2010; 10:774. [PubMed: 21172026]
- Morisky D, Malotte C, Choi P, Davidson P, Rigler S, Sugland B. A patient education program to improve adherence rates with antituberculosis drug regimens. *Health Education Quarterly*. 1990; 17(3):253–267. [PubMed: 2228629]
- Morrison DM, Hoppe MH, Gillmore MR, Kluver C, Higa D, Wells EA. Replicating an intervention: The tension between fidelity and adaptation. *AIDS Education and Prevention*. 2009; 21(2):128–140. [PubMed: 19397435]
- Noar SM. An interventionist's guide to AIDS behavioral theories. *AIDS Care*. 2007; 19(3):392–402. [PubMed: 17453575]
- Padian NS, McCoy SI, Balkus JE, Wasserheit JN. Weighing the gold in the gold standard: Challenges in HIV prevention research. *AIDS*. 2010; 24(5):621–635. [PubMed: 20179575]
- Pequegnat W, Stover E. Behavioral prevention is today's AIDS vaccine! *AIDS*. 2000; 14(Suppl 2):S1–7. [PubMed: 11061636]
- Pequegnat, W.; Stover, E. Payoff from AIDS behavioral prevention research. In: Mayer, KM.; Pizer, HF., editors. *HIV prevention: A comprehensive approach*. London, UK: Elsevier; 2009. p. 169–202.
- Pettifor AE, Levandowski BA, Macphail C, Padian NS, Cohen MS, Rees HV. Keep them in school: The importance of education as a protective factor against HIV infection among young South African women. *International Journal of Epidemiology*. 2008; 37(6):1266–1273. [PubMed: 18614609]
- Petry N, Weinstock J, Alessi S, Lewis M, Dieckhaus K. Group-based randomized trial of contingencies for health and abstinence in HIV patients. *Journal of Consulting and Clinical Psychology*. 2010; 78(1):89–109. [PubMed: 20099954]
- Phillips AF, Pirkle CM. Moving beyond behaviour: Advancing HIV risk prevention epistemologies and interventions (A report on the state of the literature). *Global Public Health*. 2011; 6(6):577–592. [PubMed: 21790501]
- Poundstone KE, Strathdee SA, Celentano DD. The social epidemiology of human immunodeficiency virus/acquired immunodeficiency syndrome. *Epidemiologic Reviews*. 2004; 26(1):22–35. [PubMed: 15234945]
- Prochaska JO, DiClemente CC. Stages and processes of self-change of smoking: Toward an integrative model of change. *Journal of Consulting and Clinical Psychology*. 1983; 51(5):390–395. [PubMed: 6863699]
- Pronyk PM, Hargreaves JR, Kim JC, Morison LA, Phetla G, Watts C, Porter JDH. Effect of a structural intervention for the prevention of intimate-partner violence and HIV in rural South Africa: A cluster randomized trial. *Lancet*. 2006; 368(9551):1973–1983. [PubMed: 17141704]
- Rao V, Gupta I, Lokshin M, Jana S. Sex workers and the cost of safe sex: The compensating differential for condom use among Calcutta prostitutes. *Journal of Development Economics*. 2003; 71(2):585–603.
- Rigsby MO, Rosen MI, Beauvais JE, Cramer JA, Rainey PM, O'Malley SS, Rounsaville BJ. Cue-dose training with monetary reinforcement: Pilot study of an antiretroviral adherence intervention. *Journal of General Internal Medicine*. 2000; 15(12):841–847. [PubMed: 11119180]
- Roll J, Petry N, Stitzer M, Brecht M, Peirce J, McCann M, Kellogg S. Contingency management for the treatment of methamphetamine use disorders. *American Journal of Psychiatry*. 2006; 163(11):1994–1999.

- Rosen M, Dieckhaus K, McMahon T, Petry N, Valdes B, Cramer J, Rounsaville B. Improved adherence with contingency management. *AIDS Patient Care and STDs*. 2007; 21(1):30–40. [PubMed: 17263651]
- Schackman BR. Implementation science for the prevention and treatment of HIV/AIDS. *Journal of Acquired Immune Deficiency Syndromes*. 2010; 55(Suppl 1):S27–31. [PubMed: 21045596]
- Schroeder JR, Epstein DH, Umbricht A, Preston KL. Changes in HIV risk behaviors among patients receiving combined pharmacological and behavioral interventions for heroin and cocaine dependence. *Addictive Behaviors*. 2006; 31(5):868–879. [PubMed: 16085366]
- Shoptaw S, Reback CJ, Peck JA, Yang X, Rotheram-Fuller E, Larkins S, Hucks-Ortiz C. Behavioral treatment approaches for methamphetamine dependence and HIV-related sexual risk behaviors among urban gay and bisexual men. *Drug and Alcohol Dependence*. 2005; 78(2005):125–134. [PubMed: 15845315]
- Simon HA. A behavioral model of rational choice. *Quarterly Journal of Economics*. 1955; 69(1):99–118.
- Sorensen JL, Haug NA, Delucchi KL, Gruber V, Kletter E, Bakti SL, Hall S. Voucher reinforcement improved medication adherence in HIV-positive methadone patients: A randomized trial. *Drug and Alcohol Dependence*. 2007; 88(1):54–63. [PubMed: 17056206]
- Thornton R. The demand for, and impact of, learning HIV status. *American Economic Review*. 2008; 98(5):1829–1863. [PubMed: 21687831]
- UNAIDS. UN Report on the Global AIDS Epidemic. Geneva: Joint United Nations Programme on HIV and AIDS; 2010.
- White House Office of National AIDS Policy. National HIV/AIDS Strategy for the United States. Washington, DC: White House; 2010.

Table 1

Studies that test conditional economic incentive programs for HIV prevention

Study	Country	Participants and Setting	Intervention	Main Findings
Baird, Chirwa, McIntosh, & Ozer, 2010	Malawi	n=1,225 females, 13–22 years	Cash transfer contingent on regular school attendance.	↓ marriage rates ↓ incidence sexual debut
Baird, Garfein, McIntosh, and Ozer, 2012	Malawi	n= 1,289 females, 13–22 years	Cash transfers conditional on school attendance or unconditional on school attendance	↓ prevalence of HIV and HSV-2 No difference in HIV and HSV-2 prevalence for conditional versus unconditional intervention groups
Barry, Weinstock, & Petry, 2008	United States	n=123 females with cocaine dependence	Vouchers contingent on drug use abstinence and/or counseling attendance	↓ drug use No difference in sexual behaviors
De Walque, et al., 2012	Tanzania	n=2,399 adults, 18–30 years	Cash transfer contingent on negative STI tests. Compared a high- vs. low- vs. no-incentive groups.	↓ STI prevalence in high-incentive group compared low- and no-incentive groups
Ghirza, Epstein, & Preston, 2008	United States	n=116 adults with cocaine and opiate use/dependence	Vouchers contingent on drug-free tests	↓ drug use behaviors ↑ drug-free urine tests No differences in sexual risk behavior
Hanson, Alessi, & Petry, 2008	United States	n=165 adults on methadone maintenance	Vouchers contingent on drug-free tests	↓ injection drug use No differences in sexual risk behavior
Haukoos, Witt, Coil, & Lewis, 2005	United States	n= 372 adults in emergency room setting	CEI for completing HIV testing and follow-up post-test counseling	↑ 3-fold in completion of HIV testing and follow-up post counseling
Javanbakht et al., 2006	United States	n=90 adults living with HIV	Case management and cash incentive contingent on decreased HIV viral load	↓ HIV viral load ↑ increased CD4 cell count
Kohler & Thornton, 2011	Malawi	n=1,307 adults	CEI for maintaining HIV status	↓ in sexual risk behavior for women No effects of the conditional incentive on any sexual behavior at 12-month follow-up ↑ in sexual risk behavior for men one week after receiving CEI
Landovitz et al., 2012	United States	n=53 MSM with methamphetamine use	Vouchers contingent on reducing HIV risk behavior and drug use and to facilitate PEP initiation.	↓ methamphetamine use ↓ number of sex partners ↓ episodes of unprotected anal intercourse 35 of 53 participants initiated PEP, and 27 completed PEP course.
Menza et al., 2010	United States	n=127 MSM	Vouchers contingent on drug-free specimens	↓ methamphetamine use No differences in sexual risk behavior
Petry, Weinstock, Alessi, Lewis, & Dieckhaus, 2010	United States	n=170 adults living with HIV and with cocaine or opiod use	Lottery draws contingent on completing health activities	↑ number drug free tests ↓ viral loads ↓ HIV-risk behaviors from pre- to post-treatment compared to control. No maintenance of effects at 1-year follow-up
Rigsby et al., 2000	United States	N=55 adults living with HIV and taking antiretroviral medication	cue-dose training plus CEI contingent on medication adherence	↑ medication adherence Effects not sustained after the training period No effects of condition on viral load

Study	Country	Participants and Setting	Intervention	Main Findings
Rosen et al., 2007	United States	n=131 adults living with HIV and suboptimal adherence	Vouchers contingent on medication adherence	↑ medication adherence ↓ viral loads Effects not sustained at 32-week follow-up
Schroeder, Epstein, Umbrecht, & Preseton, 2006	United States	n=81 adults with cocaine and heroin dependence	Vouchers contingent on drug-free test	↓ unprotected sex episodes ↓ needle sharing Effects of CM on unprotected sex were mediated by reductions in drug use.
Shoptaw et al., 2005	United States	n=162 MSM methamphetamine dependence	CM plus CBT vs. culturally sensitive CBT vs. CBT only. CM participants received vouchers for drug-free specimens	↑ program retention for both CM groups ↑ number drug free tests for both CM groups ↑ effectiveness for both CM groups No effects for sexual behavior
Sorensen et al., 2007	United States	n=66 adults with HIV on methadone maintenance	Vouchers contingent on medication adherence	↑ adherence during 12-week program Effects not sustained at 4-week follow-up
Thomton, 2008	Malawi	n=2,812 adults	Voucher for receiving follow-up HIV/STI test results	↑ likelihood in receiving follow-up HIV/STI test results ↑ positive individuals who learned their results were three times more likely to purchase condoms two months later.

Note: CEI = conditional economic incentives; CM = contingency management; CBT = cognitive behavioral therapy; HIV = human immunodeficiency virus; STI = sexually transmitted infection(s); MSM = men who have sex with men; PEP = pre-exposure prophylaxis; (↑) refers to increase in outcome, (↓) refers to decrease in outcome.