RETHINKHIV

Perspective Paper

Prevention of Sexual Transmission of HIV

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COPENHAGEN CONSENSUS CENTER

RUSH
FUNDING DISRUPTIVE IDEAS AGAINST HIV

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Prevention of Sexual Transmission of HIV

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RethinkHIV: The Project

2011 marks the 30-year anniversary since the Centers for Disease Control and Prevention introduced the world to the disease that became known as AIDS. Despite 30 years of increasing knowledge about transmission, prevention, and treatment, and current annual spending of $15 billion, every day around 7,000 people are infected with the HIV virus and two million die each year. The HIV/AIDS epidemic has had its most profound impact in sub- Saharan Africa, which accounts for 70 percent of new worldwide infections and 70 percent of HIV-related deaths, 1.8 million new infections in children each year, and has 14 million AIDS orphans.

Humanitarian organizations warn that the fight against HIV/Aids has slowed, amid a funding shortfall and donor fatigue. Yet HIV is still the biggest killer of women of reproductive age in the world, and of men aged 15-59 in sub-Saharan Africa. Time is ripe for a reassessment of current policy and expenditure.

The Rush Foundation has asked the Copenhagen Consensus Center to commission a group of leading health academics to analyze HIV policy choices and identify the most effective ways to tackle the pandemic across sub-Saharan Africa.

RethinkHIV identifies effective interventions in the fight against HIV/Aids across sub-Saharan Africa. It applies cost-benefit analysis to highlight investments and actions that can make a significant difference.

The Copenhagen Consensus Center has commissioned eighteen research papers by teams of top health economists, epidemiologists, and demographers who examine the cost-effectiveness of a range of responses to HIV/AIDS in sub- Saharan Africa under the following topics:

- Efforts to Prevent Sexual Transmission
- Efforts to Prevent Non-Sexual Transmission
- Treatment and Initiatives to Reduce the Impact of the HIV/AIDS Epidemic
- Research and Development Efforts
- Social Policy Levers
- Initiatives to Strengthen Health Systems

A panel of five eminent economists, including recipients of the Nobel Prize, convenes in the fall of 2011 to carefully consider the research and engage with the authors. The Expert Panel is tasked with answering the question:

If we successfully raised an additional US$10 billion over the next 5 years to combat HIV/AIDS in sub-Saharan Africa, how could it best be spent?

After deliberating in a closed-door meeting, the Nobel Laureate Expert Panel provides their answer, highlighting investments and actions that could be most effective avenues for additional funding. Their findings and reasoning are released in the fall of 2011, and published in full alongside all of the research in a collated volume in 2012.

RethinkHIV will generate global discussion regarding responses to HIV/AIDS in sub-Saharan Africa. To participate in a dialogue on the research and findings within sub-Saharan Africa, a Civil Society Conference and forums for youth are held following the Expert Panel meeting in late 2011.

The Civil Society Conference is a means of creating a dialogue with African civil society and to agree on a set of bold new actionable priorities with society politicians, civil society organizations, influential thought-leaders, and others within sub-Saharan Africa.

It is hoped that the project will motivate donors to direct more money to the investments and actions that are demonstrated to be most effective to curtail the pandemic in sub-Saharan Africa.

All of the research papers, and many different perspectives on priorities can be found online at the project's website:
www.rethinkhiv.com

You are invited to join the dialogue and provide your own perspective on priorities for action in Africa.

The Copenhagen Consensus Center

The Copenhagen Consensus Center is a Danish state-funded think- tank that commissions and promotes research highlighting the most effective responses to global challenges. The Center is led by author Bjorn Lomborg, named 'one of the 100 Top Global Thinkers' by Foreign Policy in 2010, 'one of the world's 75 most influential people of the 21st century' by Esquire in 2008, and 'one of the 50 people who could save the planet' by the Guardian in 2008. The Copenhagen Consensus Center is implementing the project, which follows the format of past projects such as Copenhagen Consensus 2004, Consulta de San José in 2007, Copenhagen Consensus 2008, and Copenhagen Consensus on Climate in 2009.
www.copenhagenconsensus.com

The Rush Foundation

The Rush Foundation, based in Lausanne, is dedicated to providing fast, effective funding for innovative thinking addressing the HIV/AIDS epidemic in sub-Saharan Africa. The Rush Foundation is the sponsor of the project. The Rush Foundation was launched in 2010 to fund sustainable projects in sub-Saharan Africa focused on alleviating the pandemic through innovative thinking, and to shake up the status quo in HIV thinking by spearheading thought leadership projects and debates that will help reframe HIV policy. Among other initiatives, the Rush Foundation is currently designing a grant programme with ActionAid in Africa aimed at generating new, sustainable HIV initiatives on the ground.
www.rushfoundation.org

The Papers

The body of research for RethinkHIV comprises 18 research papers. The series of papers is divided into Assessment Papers and Perspective Papers. Each Assessment Paper outlines the costs and benefits of at least three of the most promising responses, interventions, or investments to HIV/AIDS in Sub-Saharan Africa within the respective category. Each Perspective Paper reviews the assumptions and analyses made within the Assessment Paper. In this way, a range of informed perspectives are provided on the topic.

Contents

Introduction

In their assessment paper, Jere R. Behrman and Hans-Peter Kohler (2011) have identified three possible interventions for the prevention of sexual transmission of HIV: 1) male circumcision, 2) voluntary counseling and testing and 3) information campaigns through mass media and peer groups. They identified those solutions based on an extensive and updated literature review building on the review of cost effectiveness of HIV prevention interventions performed by Galárraga et al (2009).

They selected those three solutions based on their assessment that the current empirical evidence clearly points to male circumcision as a promising intervention, with possible additional effective interventions being comprehensive testing and counseling and effective information and peer group campaigns. They stress that the information about the effectiveness of those HIV prevention interventions and others is limited and that the challenges of estimating benefits and costs within an appropriate dynamic life-cycle framework are considerable. They show that the benefit-cost ratios they obtained are sensitive to critical assumptions related to the value of life, the discount rate, the HIV prevalence rate and the costs of interventions. Nevertheless their benefit-cost estimates suggest that under most plausible conditions the benefit-costs ratios for these interventions in high-prevalence and medium-prevalence countries are likely to be large, particularly for male circumcision and probably for HIV testing and counseling (HTC). They obtain smaller estimates for information campaigns which in part reflect the greater uncertainty in the underlying information available for the estimates. They conclude that interventions to reduce the spread of HIV/AIDS in sub-Saharan Africa through reducing sexual infection rates seem to have considerable promise – and greater promise where prevalence rates and DALYs are higher and resource costs of interventions and discount rates are lower. Their estimates also show that cost-effectiveness estimates per HIV infection averted and per DALY in a broad general sense reveal similar patterns, but also differ importantly from benefit-cost estimates in specific respects because they do not incorporate some critical factors that are incorporated in the benefit-cost estimates such as inter-temporal trade-offs that require discounting, life-cycle considerations, and impacts on production and consumption.

The assessment paper by Behrman and Kohler (2011) is comprehensive, clear and supported by a strong analysis. Their selection of three interventions makes sense based on the current evidence. The role of this perspective paper is, using the assessment paper as a starting point, to propose a discussion of the assessment paper findings and offer further perspectives on the topics, possibly on the basis of more recent or more tentative evidence. This perspective paper will start by stressing the need for more and better impact evaluations of HIV/AIDS prevention interventions. Next, it will argue that cost-effectiveness calculations should better integrate potential behavioral responses to prevention interventions. Further, it will discuss implications for cost-effectiveness of scaling-up interventions, especially male circumcision. It will also argue in favor of more targeted approaches. Finally, it will review three other possible solutions mentioned but not thoroughly analyzed in the assessment paper because they have been proposed and tested only recently and the evidence about their efficacy and effectiveness remains very limited: a) treatment as prevention b) pre-exposure chemoprophylaxis for HIV prevention and c) conditional cash transfers.

The need for more and better impact evaluations of HIV/AIDS prevention interventions

Behrman and Kohler (2011) make clear that the evidence on the efficacy and cost-effectiveness of prevention intervention is limited. First, too few impact evaluations have been conducted and too few have been conducted rigorously. As pointed out by Bertozzi (2009), "we need to stop spending billions implementing large-scale interventions without measuring effectiveness". Bertozzi (2009) follows by giving as example the billions spent on abstinence campaigns without any measure of whether these campaigns held any value in preventing HIV[2]. As pointed out by Behrman and Kohler (2011), it also seems that there is very limited evidence availble about the effectiveness of condom distribution.

When impact evaluations have been conducted, they are often not rigorous enough. HIV/AIDS prevention is a field where impact evaluation is challenging because evaluators are confronted with endogenous behavioral choices, unobserved variables, selectivity of samples and response bias, in particular when measuring self-reported sexual behaviors. Only few of the studies presented as evaluating the impact of HIV prevention information have research designs that allow them to overcome those challenges.

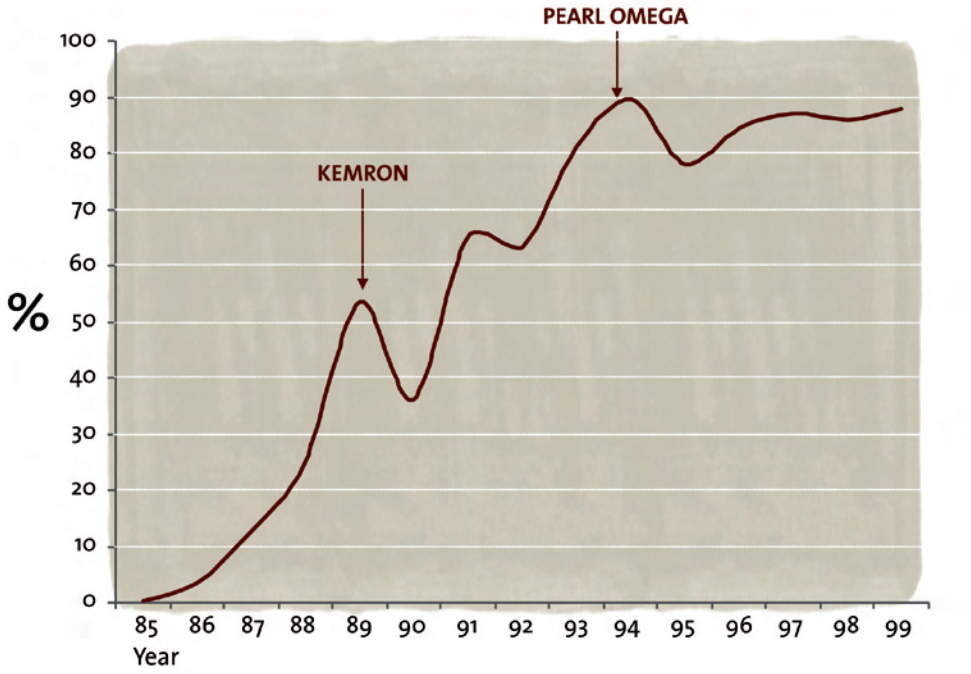
Even when rigorous impact evaluations have been used, the results are not always clear evidence on the efficacy and cost-effectiveness of the intervention. Padian et al. (2010) review 37 randomized controlled trials of HIV prevention interventions and find only six demonstrating effects in reducing HIV incidence. The review suggests that lack of statistical power, poor adherence, and diluted versions of the intervention in comparison groups may have been important issues in some of the trials that did not show any results.

An example of such divergence in the impact evaluation results for an HIV prevention intervention is the treatment of other sexually transmitted infections (STIs). As summarized in Galárraga et al. (2009), the earliest study of the efficacy of treating other STIs on HIV incidence conducted in Mwanza, Tanzania suggested that when STIs are treated, HIV infection declined by almost 40% over a two year period (Grosskurth et al. 1995). Following this result, STI treatment was included in the catalogue of HIV prevention measures endorsed by the WHO and UNAIDS. However, another randomized control trial in Rakai Uganda showed contradictory results (Wawer et al. 1998) and other studies have not replicated the Mwanza level of efficacy. The treatment of other STIs is not included in the solutions identified in the assessment paper probably because of the divergence in the results from those impact evaluations.

With the current amount and level of evidence, as acknowledged by Behrman and Kohler (2011), identifying the most cost-effective interventions for preventing sexual infections is already a challenge. With, as discussed further in this perspective paper, new solutions for HIV prevention being currently advocated and tested, it is crucial that the development of these new solutions goes hand-in-hand with rigorous impact evaluations having enough statistical power and using biomarkers as endpoints.

2 Zikusooka (2010) provides very useful information about the cost of abstinence and faithfulness interventions in Uganda but without providing any evidence of impact on HIV prevention.

Figure 1: Percent condom use in a cohort of sex workers: Nairobi, 1985-1999



Source: Jha et al. (2001)

Considering potential behavioral responses to prevention interventions

Part of the economics literature on HIV/AIDS has investigated disinhibition - or risk compensation - behaviors. The main proposition of this literature is that people may alter their behavior in response to perceived changes in risk3. In the specific case of HIV/AIDS, the focus has been mainly related to the increased access to ART. The concern is that increased access to ART may lead to a decrease in the perceived risk and costs of contracting HIV and , as a consequence, may lead to an increase of risky sexual behaviors (e.g. Eaton and Kalichman, 2007). Such disinhibition behaviors, if large enough, may (at least partially) offset the benefits of scaling up access to ART. This conjecture is supported by several studies in the United States and Europe which have identified an upward trend in risky sexual behaviors since the introduction of ART in 1996 (e.g. Gremy and Beltzer, 2004; Lakdawalla, Sood, and Goldman, 2006). More specifically, an association has been identified between decreased concern about HIV due to ART availability and unprotected sex, and in particular among men who have sex with men (e.g. Dukers et al. 2001; Kalichman, 1998; Lakdawalla, Sood, and Goldman, 2006; Mechoulan, 2007).

Investigations of disinhibition behaviors in sub-Saharan Africa are limited. One of the earliest studies looked at change in the use of condom by sex workers in Nairobi, Kenya (Jha et al., 2001). The findings are summarized in Figure 1 above.

This figure provides at least some suggestive evidence that condom use by sex workers decreased when "fake" cures of AIDS ("Kemron" and "Pearl Omega") were announced. Such a pattern is consistent with disinhibition behaviors, although the result may not be generalizable to the general population since it uses a very selected segment of the population. Cohen et al. (2009) is one of the few studies

3 See Peltzman (1975) for an early study on the introduction of mandatory car seat belts in the US.

which use population based surveys to test risk compensation behavior in a sub-Saharan African context. The authors found that in Kisimu (Kenya), ART-related risk compensation, and the belief that ART cures HIV were associated with an increased HIV sero-prevalence in men but not women.

Behrman and Kohler (2011)'s analysis does not explicitly allow for behavioral changes in responses to interventions that would in part reduce the effectiveness of the intervention (e.g. increases in risky sex in response to the reduced HIV infection risks after circumcision are not explicitly modeled) even though they briefly consider such compensating behaviors when looking at the evidence on the efficacy of HIV/AIDS testing and counseling, referring to the analysis conducted by Ross (2010) who advances that HIV testing and counseling might be effective in persuading HIV-positive individuals to reduce their risky behaviors and the risk of transmission of HIV to their partners, but potentially leads to disinhibition among those who receive an HIV-negative test result.

This perspective paper is not focused on HIV/AIDS treatment, but disinhibition behaviors could also be present as a consequence of HIV prevention interventions for HIV testing, as suggested by Ross (2010). I would also think it should be considered and investigated especially in the case of male circumcision. It is possible that as a consequence of male circumcision – which is protective, but only to a certain extent-, male individuals and their partners opt for less safe sexual practices and for example become less likely to use condoms or more likely to engage in concurrent partnerships. Such a compensatory behavior would tend to diminish the benefits from male circumcision.

An additional and related problem might be caused by so-called "bush" circumcisions, i.e. circumcisions performed outside health care settings, for example during traditional initiation ceremonies. For example, Corno and de Walque (2007) report that a particular type of traditional circumcision is performed in Lesotho. In the Basotho culture, many young males are sent by their parents to so called "initiation schools" that represent a passage from adolescence to adulthood. Traditionally, initiation schools are places where young people are given information about sexual relations and reproductive health. During their stay at the initiation school, these boys are circumcised. This circumcision has a symbolic meaning and the procedure is very different from the circumcision adopted in most other African countries, especially by those in the Muslim tradition. It is not a complete removal of the foreskin but rather a more symbolic incision. It is also likely to be performed in unhygienic conditions. Moreover, after the initiation school, boys consider themselves adults and may engage more readily in sexual intercourse. It is also possible that their recent "circumcision" makes them more vulnerable to infection. These traditional practices combined with the dissemination of the message that male circumcision is proven to be protective might lead to disinhibition behavior even among males who are not properly circumcised, unless information campaigns clearly identify the type of circumcision which is actually protective and efforts are made to scale-up circumcision in health care settings.

The evidence on disinhibition behaviors is limited and inconclusive. Crepaz, Hart and Marks (2004) have provided a comprehensive review, with studies finding evidence of disinhibition and others not. The evidence is even more limited in sub-Saharan Africa. This is probably a good reason for not modeling it explicitly in the assessment paper as chosen by Behrman and Kohler (2011). But the potential risks associated with disinhibition on a large scale are important enough to be discussed in the perspective paper. As much as possible future impact evaluations of HIV prevention interventions should consider and measure possible risk compensating behaviors, in particular in the case of male circumcision.

The importance of measuring efficiency of prevention intervention at scale

In the current literature, most interventions have been evaluated in randomized controlled trials or other type of pilot projects. As RethinkHIV is aiming at identifying the most promising prevention interventions, it is important to stress the difference between efficacy and efficiency studies (Gertler et al. 2010) and note that interventions who have demonstrated impact under closely managed conditions may not necessarily be as successful under normal, at scale, conditions. In other words, the external validity of efficacy studies needs to be investigated.

This is especially true for male circumcision, as advocated in Over (2010). Currently, the evidence showing the protective effect of male circumcision relies on three closely managed randomized control trials (Auvert et al. 2005; Bailey et al. 2007; Gray et al. 2007) showing a strong protective effect. But to date, to the best of my knowledge, there is no rigorous impact evaluation of male circumcision at scale. Those would be important studies to carry out, not only to confirm the external validity of the randomized control trials, but also to learn, for example, what are the most effective delivery mechanisms for scaling-up male circumcision. Obviously, such impact evaluations at scale could also help in investigating the issue of disinhibition behaviors discussed in the previous section.

The two other interventions identified by Behrman and Kohler (2011), HIV testing and counseling and information campaigns through mass media and peer groups have been, to-date, scaled-up to a larger extent than male circumcision, although it is not always obvious that the limited evidence available on their impact comes from efficiency rather than efficacy studies. Given the fragmentary evidence and sometimes contradictory evidence about the impact of those interventions, it would also be beneficial to conduct impact evaluations of those interventions at scale. It must be said, however, that evaluating the impact of information campaigns through mass media is particularly difficult precisely because most media campaigns are conducted on a large scale and it is therefore difficult to identify control groups and estimate the counterfactual.

Considering more targeted approaches

Behrman and Kohler (2011) have mainly considered approaches that can be scaled-up to the general population as they consider those as more likely to have a broad impact in reducing the overall sexual transmission of HIV. While this is a valid point, it is also true that interventions targeted at high risk groups such as men who have sex with men (MSM) or sex workers can be very effective and have a significant impact on HIV transmission. Thailand's success in stemming its HIV epidemic has generally been attributed to a vigorous prevention strategy aimed at high risk groups. Such targeted interventions might be more adequate in countries with moderate to low HIV epidemics, but as evidenced in table 1 and figure 1 of Behrman and Kohler (2011) many African countries fall in that category. Ainsworth, Vaillancourt and Gaubatz (2005) have among others argued that the limited efficacy of interventions such as information campaigns through peer groups might, in part, be due to the fact that they were not targeted well enough to people really at risk of being infected by or of transmitting the HIV virus.

New solutions for the prevention of sexual transmission of HIV might offer new perspectives

Behrman and Kohler (2011) explicitly analyze the cost effectiveness of three existing prevention interventions but they also briefly discuss other more recent approaches without analyzing their cost-effectiveness. In this perspective paper, I will devote more attention to these new approaches which at this stage appear promising and might – or might not – play an important role for the prevention of sexual transmission of HIV in the future. Those three approaches are "treatment for prevention" or "test-and-treat", pre-exposure chemoprophylaxis for HIV prevention and conditional cash transfers.

Treatment for Prevention

The "treatment for prevention" approach proposes to test regularly a large fraction of the population and treat immediately with antiretroviral therapies those who have tested positive without waiting for the AIDS symptoms to develop. By treating HIV positives immediately after they have tested, the objective is to reduce the viral load of HIV positives and therefore their infectiousness. While earlier studies advocating this approach were based on modeling (Granich et al. 2009), recent results from the HPTN 052 study (NIAID, 2011) indicate that treatment for prevention is efficacious (Padian et al., 2011). The treatment for prevention approach, however, needs further efficacy and efficiency trials and the implications and obstacles to bringing it up to scale need to be further investigated and tested. This approach is discussed in more detail in the assessment paper of AIDS treatment and I will therefore not comment further on it.

Pre-exposure chemoprophylaxis for HIV prevention

Padian et al. (2011) also report on recent trials evaluating pre-exposure chemoprophylaxis for HIV prevention. In the Caprisa Study in South Africa, high-risk women used an applicator that delivered 1% tenofovir gel into the vaginal vault up to 12 hours before, and within 12 hours after intercourse. Investigators reported a 39% reduction in overall acquisition of HIV, and maximum reduction was 54% among the most adherent women (Abdool Karim et al., 2010). In the iPrEx study in 2010 (Grant et al. 2010), HIV-negative men who have sex with men were given daily an antiretroviral combination, emtricitabine and tenofivir disoproxil fumarate (TDF plus FTC) for up to 2.8 years. The study recorded a 44% reduction in HIV acquisition and, as with the CAPRISA study, efficacy was strongly associated with concentrations of antiretroviral drugs, a direct marker of adherence. By contrast, the FEM-PrEP trial of TDF plus FTC offered to high-risk women was discontinued because an equal number of infections occurred in both the placebo and treatment groups. As with treatment for prevention, the efficacy and efficiency of pre-exposure chemoprophylaxis for HIV patients needs to be further established and confirmed, but if they are confirmed it would open very promising perspectives for the prevention of sexual transmission. Compared to treatment as prevention, pre-exposure chemoprophylaxis offers two advantages. First, there is no need for frequent and widespread testing in order to identify HIV positive individuals. This is logistically challenging in most settings in sub-Saharan Africa, especially if one of the objectives is to detect individuals with recent HIV infections which are more infectious, but more difficult to detect with accurcy. Second, pre-exposure chemoprophylaxis for HIV prevention can be self-targeted by individuals who feel they are most at risk. However, both approaches require a high level of adherence in the absence of symptoms and both have the potential to trigger risk compensating or disinhibition behaviors described earlier.

Conditional cash transfers

I will focus more extensively, among the potentially promising new solutions, on conditional cash transfers as I have more experience in that field. I will first lay-out the rationale for applying the conditional cash transfer logic to the prevention of the sexual transmission of HIV, summarizing the argument in Medlin and de Walque (2008). Then, I will briefly present the current evidence which has also been discussed by Behrman and Kohler (2011).

Rationale for applying conditional cash transfers to HIV prevention

Conditional cash transfer (CCT) programs which provide cash to poor households in exchange for their active participation in educational and health care services have proven very popular among developing country governments, sweeping the globe from Mexico to other parts of Latin America and much more recently, to Africa. The principle of conditionality – which may be applied differently in practice, but generally requires families to send their children to school or to receive a range of health care services, such as nutritional counseling, childhood vaccination programs, etc. – distinguishes CCT programs from more traditional social assistance programs which provide cash or vouchers directly to poor or otherwise distressed families with no conditions attached. The CCT programs emphasize the use of market-oriented "demand-side" interventions provide incentives for longer-term human capital investments (Rawlings and Rubio, 2005, Fiszbein and Schady, 2008).

The CCT programs that have received the most attention are those having an explicit orientation toward poverty alleviation, involving both education and health components as part of a broader, long-term strategy of human capital investments. Such programs have been rigorously evaluated, and, on the whole, have been found to be effective at increasing levels of household consumption and improving uptake rates of a wide-range of education and preventive health care services. Specifically with regard to health outcomes, several studies have shown an impact on anthropometric outcomes, such as improvement in the nutritional status of newborns and infants (Colombia), height gains among children aged 12 to 36 months (Mexico), and decreases in stunting and the proportion of underweight children aged 0 to 5 years (Nicaragua).

The substantial evidence demonstrating positive effects on the uptake of health care services and a range of critical health outcomes in different countries and socioeconomic settings has triggered significant interest in exploring potential applications of CCTs to other areas of health, including HIV prevention. This is certainly the case in sub-Saharan Africa, where interest in replicating the results of such programs has led to pilot projects to support the care of AIDS orphans , and the uptake of HIV testing services (Thornton 2008). These experiments, observed in combination with programs in other countries seeking to use CCTs to increase contraceptive use and to discourage pregnancies, particularly among adolescent girls, raise the question of whether CCTs may be usefully applied to improve outcomes in sexual and reproductive health, generally, and in particular as a tool to prevent STI/HIV transmission.

Existing CCT programs provide powerful evidence into the linkages between financial incentives and behavior change. In addition, they provide compelling evidence that such programs can have a direct impact on selected health outcomes at a large-scale, and over an extended period of many years. However, there remain questions about the importance of the conditionality to the effectiveness of such programs. For a richer exploration of this issue, it is also useful to turn to the contingency management (CM) literature which addresses risky health behaviors such as substance abuse, smoking, and over-eating.

In a similar manner as for the CCT poverty alleviation programs, CM relies on the mechanism of conditionality to elicit behaviors that are viewed to be in one's long-term interest (or, those of society's), and to discourage those behaviors that may ultimately be detrimental to one's own health and well-being but that may not be easily perceived or experienced as such in the short term. However, while traditional CCT programs, or, those focused on improving uptake rates, require a "simple" behavioral response (e.g. involving a single finite action, such as attending a health clinic), the latter require a "complex" change (e.g. abstaining from a behavior that may be desirable, and habit-forming, in the short run, but in the long run is detrimental to one's health) (Kane et al. 2004). Thus, with regard to the importance of the conditionality and in the domain of sexual and reproductive health, per se, more might be gleaned from an examination of the evidence from contingency management rather than the CCTs.

The essential principles of CM, as outlined by Petry et al. (2000), are to reinforce the treatment goals by 1) closely monitoring the target behavior; 2) providing tangible, positive reinforcement of the target behavior; and 3) removing the positive reinforcement when the target behavior does not occur. CM techniques have been developed and tested in the context of clinical trials and settings, but have rarely, if ever, been implemented on a large scale in the manner of CCT programs. However, studies of the behavioral and health impacts of CM are valuable for their focus on different aspects of the conditionality that is expected to bring about the required behavioral changes in the domain of preventing the sexual transmission of HIV.

As with CCTs, CM interventions have been tied to participation and the uptake of services in several domains, although risk behaviors are the important determinant for participant selection, rather than income constraints. CM has been shown to increase uptake rates of counseling sessions for drug abuse; attendance at weight loss sessions; and attendance in smoking cessation clinics.4 Of particular interest, however, is the use of CM to trigger a complex behavioral change – usually, to discourage an unhealthy behavior by positively reinforcing the cessation of that activity (e.g. drug or alcohol abuse, smoking, or over-eating). The conceptual basis of CM and CCTs is thus largely similar, although advocates of CM impose no a priori assumptions about the effectiveness of the use of cash as the incentive or reinforcement device, and have experimented with a variety of reward mechanisms, including vouchers and prizes.5 In addition, many CM studies are designed to explore effect differences due to variations in the value of the incentives (known as the "dose-response" curve), the frequency of monitoring and payments, and the length of time that the elicited behavior change is sustained after the program has ended.

Conditional cash transfers and contingency management offer an innovative alternative to traditional behavioral strategies, and therefore may have important applications to sexual and reproductive health, and HIV prevention, in particular.

The conceptual foundations of conditional cash transfers are rooted in traditional economic theory, which is based on the assumption that individuals make rational decisions that maximize their own individual well-being or utility. The theory acknowledges that individuals face risky choices with benefits (e.g. personal enjoyment) and costs (e.g. health risks), and assumes that individuals will make sensible choices after taking these costs and benefits into careful consideration. The modeling of individual decision making in this manner has led to major new insights into apparently

4 See, for example, Higgins and others (1994); Petry (2000); and Emont (1992).
5 The findings of studies reviewed for this study suggested that cash is typically preferred by research subjects, and in some studies it has been shown to have a greater behavioral effect than the equivalent non-cash reward (Kamb et al., 1998), although the findings are hardly conclusive.

"irrational" risk-taking behavior, and has been used to explain risky occupational choices such as formal and informal sex work. For example, Gertler et al. (2005) found in a study of Mexican sex workers that "risky sex", i.e. unprotected sex, carries a 23 percent higher price tag than sex with condoms. In a study of informal sex workers in Western Kenya, Robinson and Yeh (2011) found that sex workers charge more for anal sex, and that risky sexual activity fluctuates in response to consumption expenditures and income shocks experienced within the household.

Another promising area of research in behavioral economics and decision theory offers an understanding of risk-taking behavior that may be radically and irreconcilably inconsistent with rational decision-making, such as the decision to engage in risky sex in a setting with high HIV prevalence. For example, O'Donoghue and Rabin (2000) have developed a behavioral model in which young people are assumed to make decisions by weighing costs and benefits, but they may also choose to act compulsively in certain instances. In this model, the benefits and costs incurred in the future are discounted in the same way that they would be in rational choice models, except that youth may place higher value on rewards received instantaneously. Behavioral economics refers to this as "hyperbolic time discounting" and it is a similar concept to that of "immediate gratification" used in developmental psychology.

The conceptual foundations of CCTs rest easily within either economic framework of decision-making, since cash payments can be used either to alter the cost-benefit parameters of the decision calculus of the rational individual, or it can be used to counter impulsive tendencies by rewarding, in the short term, behaviors that are likely to bring longer-term health benefits. Applied to poverty alleviation, the goal is to compensate individuals in the short term for the "costs" associated with investments in health and education that have a longer-term payoff. Applied to risky behavior, the goal is to shift potential future costs of weight gain, smoking, and substance abuse higher to the present, so they can be more immediately perceived. Clearly, some behavioral changes may be more "costly" than others. For example, the uptake of health and educational services likely places fewer demands on the individual than, for example, the decision to refrain from specific behaviors, particularly those that afford pleasurable short-term benefits. This has been described as a difference between "simple" behavioral change and "complex" change, and the latter may require a larger incentive to bring about the desired change (Kane et al. 2004).

The same framework is useful in regards to sexual and reproductive health. As O'Donoghue and Rabin (2000) remind us, the decision to have sex involves a trade-off between the short-term benefit of sexual pleasure and intimacy, and the long-term (probabilistic) cost of getting pregnant, acquiring an STI, or contracting AIDS. Thus, risky decisions – such as whether or not to have unprotected sex – may be the result of a realistic assessment of trade-offs and probabilities, or may result from problems associated with undervaluing the future (or, excessive discounting, in economic parlance). Of course, this is a stylized view of the decision making process that may be conditioned and constrained by the cultural, social, and economic context. In fact, many studies have highlighted how poverty, lack of economic opportunity, and powerlessness close off options to the point that individuals (and especially, young girls) do not experience their engagement in risky sexual behavior as the outcome of a deliberate decision (Krishnan and others, 2007).

With regards to preventing HIV transmission, an added difficulty is that the "costs" of engaging in risky sexual behavior may not be perceived for many years, due to the lag between infectivity and presentation of acute and/or chronic symptoms of AIDS. Thus, one goal of the CCT intervention would be to shorten the horizon of the future by offering cash rewards at regular but more importantly

frequent intervals. The premise is that a system of rapid feedback and positive reinforcement using cash as an incentive to shape behavior can effectively discourage risky sexual activity and therefore contribute to reduced rates of HIV transmission.

Current evidence on applying conditional cash transfers to HIV prevention

The evidence on the efficacy of conditional cash transfers for STI or HIV prevention is still unfolding and remains limited. In Malawi, small financial incentives have been shown to increase the uptake of HIV testing and counseling (Thornton, 2008). Another study in Malawi, conducted a conditional cash transfer program for adolescents in which the cash transfer was conditional on school attendance but which, in addition to increased enrollment and attendance also caused a reduction in HIV and HSV-2 incidence (Baird et al. 2010b). The same program also led to a modification of self-reported sexual behaviors with adolescent girls having younger partners (Baird et al. 2010a).

To date, two studies evaluated conditional cash transfers in which the condition is attached to negative test results for sexually transmitted infections. In Malawi, Kohler and Thornton (forthcoming) tested an intervention promising a single cash reward in one year's time for individuals who remained HIV negative. This design had no measurable effect on HIV status, but the number of sero-conversions in the sample was very small and statistical power was therefore low. The RESPECT study (de Walque et al. 2010) evaluated a randomized intervention that used economic incentives to reduce risky sexual behavior among young people aged 18-30 and their spouses in rural Tanzania. The goal was to prevent HIV, and other sexually-transmitted infections (STIs) by linking cash rewards to negative STI test results assessed every 4 months. The study tested the hypothesis that a system of rapid feedback and positive reinforcement using cash as a primary incentive to reduce risky sexual behavior could be used to promote safer sexual activity among young people who are at high risk of HIV infection. Initial results of the randomized controlled trial after one year showed a significant reduction in STI incidence in the group that was eligible for the $20 quarterly payments, but no such reduction was found for the group receiving the $10 quarterly payments. Further, while the impact of the CCTs did not differ between males and females, the impact was larger among poorer households and in rural areas. While the RESPECT study results are important in showing that the idea of using financial incentives can be a useful tool for preventing HIV/STI transmission, this approach would need to be replicated elsewhere and implemented on a larger scale before it could be concluded that such conditional cash transfer programs (for which administrative and laboratory capacity requirements are significant) offer an efficient, scalable and sustainable HIV prevention strategy.

Conclusions

Using the assessment paper as a starting point, this perspective paper on the prevention of sexual transmission of HIV offers further perspectives on the basis of more recent or more tentative evidence. It stresses the need for more and better impact evaluations of HIV/AIDS prevention interventions. It also argues that cost-effectiveness calculations should better integrate potential behavioral responses to prevention interventions known as disinhibition behaviors. Further, it recommends considering the implications for cost-effectiveness of scaling-up interventions, especially in the case of male circumcision. It also argues in favor of not neglecting approaches more targeted towards vulnerable groups such as sex workers or men who have sex with men. Finally, it reviews three other possible solutions mentioned but not thoroughly analyzed in the assessment paper because they have been proposed and tested only recently and the evidence about their efficacy and effectiveness remains very limited: a) treatment as prevention b) pre-exposure chemoprophylaxis for HIV prevention and c) conditional cash transfers.

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