

PROVEN HIV PREVENTION STRATEGIES

Since the AIDS epidemic first appeared nearly three decades ago, scientific research and detailed observation of epidemiological trends have identified a range of effective strategies for preventing all routes of HIV transmission—sexual, blood borne, and mother-to-child.

However, most people at high risk of HIV exposure currently lack meaningful access to effective prevention.¹ According to an analysis by UNAIDS and the World Health Organization, expanded access to proven prevention strategies could avert half of the 62 million new HIV infections projected to occur between 2005 and 2015.² Another analysis found that in Sub-Saharan Africa alone, expanded prevention could prevent 55% of the 53 million new infections projected to occur in the region between 2003 and 2020.³

Preventing new HIV infections is an urgent global priority. Already, HIV has resulted in history's single sharpest reversal in international development.⁴ In Asia—where infection levels are a mere fraction of those reported in Africa—experts project that the epidemic will push an additional 6 million people into poverty by 2015 unless greater success is achieved in curbing the spread of HIV.⁵ Globally, an estimated 7,000 new HIV infections occur each day, and the number of new HIV infections in 2007 was more than 2.5 times greater than the increase in the number of people receiving antiretroviral medications.⁶

There is no single solution—no “magic bullet”—to prevent HIV. However, experience in diverse settings—in all regions and in different national income strata—indicate that sharp reductions in HIV infection rates are feasible if evidence-based prevention measures are implemented. The most effective prevention programs are those that use a combination of strategies to achieve maximum impact.⁷ Following are descriptions of the major strategies that, when used in combination, are effective in preventing sexual, blood borne, and mother-to-child transmission.

WHAT IS EVIDENCE OF EFFECTIVENESS?

Assessing the effectiveness of HIV prevention programs is inherently difficult. Determining what causes an event never to occur is intrinsically more complicated than discerning the cause of something that can be readily observed.

For drugs, vaccines and medical devices, the randomized controlled trial (RCT) is universally regarded as the gold standard for evaluating efficacy of a new product. RCTs have similarly demonstrated the

efficacy of a wide range of HIV-prevention interventions, although demonstrating that an intervention has efficacy under the controlled conditions of a clinical trial does not automatically indicate that the approach will be effective in the real world. Ideally, RCTs for experimental HIV-prevention strategies should be complemented by effectiveness studies in the field, particularly studies that gauge the impact of multiple prevention strategies used in combination.

Observational data on national responses and epidemiological and behavioral impact often provide the best information on prevention effectiveness.⁸ Although observational data are often difficult to interpret and cannot tie behavioral or epidemiological trends to particular actions, such evidence can help clarify the array of factors that contribute to population-wide shifts in behaviors.

PREVENTING SEXUAL TRANSMISSION – What Works

Globally, sexual transmission is responsible for the majority of new HIV infections.

Behavior Change Programs

Numerous randomized controlled trials—in both high-income⁹ and developing countries¹⁰ and extensive observational research¹¹ have demonstrated that behavioral interventions can be highly effective in reducing sexual risk behaviors and associated HIV infections. To date, most studies of behavioral interventions have been carefully controlled efficacy trials in well-defined populations; less information is available regarding population-level effectiveness of these strategies, although observational and historical studies in diverse settings have documented a positive public health impact from various behavioral strategies. Studies have documented the efficacy of behavior change programs among a broad range of populations at risk of HIV infection, including:

- Sex workers¹²
- Men who have sex with men¹³
- Substance users¹⁴
- Heterosexual adults¹⁵
- Women¹⁶
- Young people¹⁷

Most efficacy studies have followed participants for limited periods—typically for no more than 12-18 months.

Evidence-based behavior change programs typically have one or more aims—encouraging young people to remain sexually abstinent or delay initiating sexual activity, decreasing the number of sex partners, or using condoms consistently and correctly if sexually active. Studies in high-income countries indicate that comprehensive risk reduction programming is more effective in promoting safer sexual behaviors among young people than interventions that exclusively promote abstinence.¹⁸

Behavior change programs may focus on individuals, groups or entire communities. Strategies that affect social dynamics are especially important for individuals who engage in relatively low levels of risk behavior but nevertheless confront considerable risk of becoming infected.¹⁹ Increasingly, public health experts advise that individually-focused behavioral interventions ought to be complemented by structural interventions that aim to reduce risk by altering the social, legal or physical environments in which risk behavior may occur.²⁰

Condoms

Condoms are highly effective at preventing sexual transmission of HIV. An analysis by the U.S. National Institutes of Health of available studies concluded that consistent use of condoms can reduce an individual's risk of HIV transmission by 85%.²¹ Population-level data on the impact of condom promotion programs are more limited.

While most research has focused on the efficacy of male condoms, evidence also exists that female condoms are effective in the prevention of sexual HIV transmission as reflected by the 2009 approval by the US Food and Drug Administration of FC2, a low cost female condom.

HIV Testing

Timely diagnosis of HIV infection promotes HIV prevention. According to studies in the U.S., people with undiagnosed HIV infection are 3.5 times more likely to transmit HIV than individuals who have tested HIV-positive.²² Data do not clearly indicate that a negative test result is associated with sexual risk reduction. Currently, it is estimated that 80% of people living with HIV in low- and middle-income countries remain undiagnosed²³; non-governmental informants report that HIV counseling and testing services were not widely available in 70% of countries reporting data to UNAIDS.²⁴

Prompt Diagnosis and Treatment of Other STIs

Sexually transmitted infections (STIs) such as syphilis, gonorrhea and herpes simplex virus type 2 increase the risk of HIV acquisition and transmission by two to five times.²⁵ Prompt diagnosis and treatment of STIs plays a critical role in efforts to prevent sexual HIV transmission,²⁶ although studies aiming to document population-level benefits from STI treatment strategies have reached conflicting results. In particular, questions remain regarding the optimal timing and means of harvesting the potential of STI treatment to strengthen HIV-prevention efforts. Available data suggest that STI control efforts are most effective at lowering HIV incidence when they are initiated as early as possible in the course of a country's epidemic and when they are focused on people at highest risk.²⁷

Medical Male Circumcision

Clinical trials in Kenya, South Africa and Uganda indicate that medical male circumcision lowers by approximately 60% the risk of female-to-male sexual HIV transmission.²⁸ However, risk of transmission may actually increase if a newly-circumcised male engages in sexual intercourse before his circumcision wounds have healed. Whether medical male circumcision confers a prevention benefit for women during heterosexual intercourse remained unclear and was still being studied in early 2009.

ANTIRETROVIRAL-BASED HIV PREVENTION STRATEGIES

Emerging evidence suggests that antiretroviral agents may play a potentially potent role in preventing new HIV infections through sexual transmission. Such strategies have yet to be validated by clinical trials, although a number of studies are under way to test a range of antiretroviral-based prevention approaches. The feasibility of preventing HIV transmission through timely administration of antiretrovirals is premised on voluminous evidence linking the risk of transmission to viral load

in plasma.²⁹ As antiretrovirals dramatically reduce viral load when properly administered, it is assumed they may also lower the risk of HIV transmission.

Antiretrovirals may help slow the spread of HIV in several ways. Mathematical modeling suggests that universal knowledge of HIV serostatus and access to early HIV therapy could virtually eradicate HIV transmission.³⁰ As described below, timely administration of antiretrovirals significantly lowers the risk that an

HIV-infected mother will pass the virus to her newborn. In addition, studies are ongoing to evaluate the efficacy of pre-exposure antiretroviral prophylaxis. Post-exposure antiretroviral prophylaxis has long been standard practice following a potential HIV exposure in health care settings, and available evidence has led public health authorities to endorse the approach following sexual and injection-drug exposure, as well.³¹

PREVENTING BLOOD-BORNE TRANSMISSION – What Works

Subcutaneous exposure is the most efficient route of HIV transmission.³² Injection drug use is a primary driver of the epidemic in many parts of Asia and accounted for more than 60% of new reported HIV diagnoses in Eastern Europe and Central Asia in 2006.³³ Receiving one or more units of HIV-infected blood results in HIV infection nearly 90% of the time.³⁴

Harm Reduction Programs for Injection Drug Users

Harm reduction for injection drug users involves a package of essential services, including access to clean syringes and injection equipment, substitution drug treatment therapy, counseling, essential HIV and other health services, and evidence-based programs to reduce demand for drugs.³⁵ Extensive evidence demonstrates that harm reduction programs reduce the risk of HIV transmission without contributing to an increase in drug use.^{36, 37} According to the U.S. National Institute on Drug Abuse, harm reduction programs “serve as a bridge...by offering opportunities for HIV testing, and by providing referrals for drug abuse treatment.”³⁸

Observational studies underscore the potential HIV prevention impact of harm reduction services. An international analysis of 81 cities found that the number of people infected with HIV decreased an average of 6% in cities with needle and syringe programs, while HIV rates increased 6% in cities without these programs.³⁹

Blood Supply Safety

In developed countries, routine screening of the blood supply, combined with efforts to reduce unnecessary transfusions and to preclude high-risk donors, has virtually eliminated the risk of HIV transmission

through donated blood.⁴⁰ In the U.S., blood donations have been screened for HIV antibodies since 1985 and for the p24 antigen since 1996.⁴¹

The safety of blood supplies in low- and middle-income countries has improved in recent years. Through the President’s Emergency Plan for AIDS Relief, for example, the U.S. government provided more than \$74 million in assistance to 14 countries over a 14-month period in 2004-2005 to improve national blood control systems, with an additional \$51 million in funding in the pipeline.⁴² Nevertheless, at least 34 countries report that they fail to screen all donated blood for HIV in accordance with minimum quality standards, and the World Health Organization reports that more than 1 million units of blood were still not properly screened in 2008.⁴³

Infection Control in Health Care Settings

Countries that require health workers to adopt “universal precautions” have succeeded in making occupational HIV transmission extremely rare in health care settings.⁴⁴ This approach treats every patient as potentially infectious, requires workers to wear protective gear, and trains workers to use syringes properly and sterilize all equipment and surfaces. Under standard protocols for universal precautions, equipment used to administer injections are automatically disposed of safely. The feasibility of universal precautions depends on workers’ ready access to standard protective gear and safe technologies.

In 2000, unsafe injection practices were estimated to be responsible for 5% of new HIV infections.⁴⁵ Avoiding reuse of injection equipment and proper disposal of such devices are critical elements of comprehensive HIV prevention.

PREVENTING MOTHER-TO-CHILD TRANSMISSION – What Works

An estimated 370,000 children under age 15 became infected with HIV in 2007, with the vast majority contracting HIV during gestation or birth or as a result of breast-feeding. Nine out of 10 newborns who become infected with HIV live in Sub-Saharan Africa.⁴⁶ In the absence of prophylactic intervention or when breast-fed, children born to an HIV-infected mother stand a 15–30% chance of becoming infected; in the case of prolonged breast-feeding, the risk of transmission is as great as 45%.⁴⁷

Implementation of a comprehensive package of prevention services has reduced the risk of transmission to below 1% in high-income countries.⁴⁸ Where such services have been brought to scale in resource-limited settings, comparable success has been achieved.⁴⁹

Antiretroviral Drugs

A landmark clinical trial in 1999 and subsequent studies have shown that timely administration of short, inexpensive doses of antiretrovirals to HIV-infected mothers and their newborns sharply reduces the risk of

HIV transmission by nearly 50%.⁵⁰ Research advances suggest that even better antiretroviral regimens will soon be available to further reduce the risk of transmission, although results from these studies are unlikely to be available before mid- to late 2009.⁵¹

Breast-feeding Alternatives

The chance that an HIV-infected mother will transmit HIV to her newborns increases by at least 50% with prolonged breast-feeding. Ideally, HIV-infected mothers should have access to breast-feeding alternatives, such as infant formula, although the lack of access to safe water supplies impedes efforts to provide meaningful infant feeding alternatives in many resource-limited settings. Early weaning from breast-feeding may also help reduce HIV transmission⁵², although evidence suggests that early weaning does not increase HIV-free survival of infants.⁵³

Caesarean Delivery

Caesarean delivery also significantly reduces the risk of mother-to-child HIV transmission.⁵⁴ However, caesarean deliveries are often not available or practical in developing countries, where many women lack access to hospital birthing facilities.

STRUCTURAL INTERVENTIONS TO REDUCE VULNERABILITY TO HIV

While numerous studies have demonstrated the effectiveness of specific technical interventions to prevent new infections, HIV prevention is more than merely technical. To maximize the effectiveness of combination HIV prevention, prevention technologies should be complemented with approaches designed to address the social determinants of HIV risk and vulnerability.

Policy changes—such as Thailand’s 100% condom program, which mandated condom use in brothels, or more recent laws in numerous settings that permit pharmacies to sell sterile syringes—have long played a role in public health efforts to prevent new HIV infections.⁵⁵ In part due to the historic under-prioritization of social science research for HIV prevention, fewer rigorous studies have been undertaken on structural interventions than on experimental technical prevention approaches.

As the epidemic’s burden on women and girls has steadily increased over the last 10–15 years, it has become plain that gender inequity and women’s disempowerment are increasing the

vulnerability of women and girls to HIV infection. In a recent study in rural South Africa, each additional year of education was found to be associated with a 7% reduction in the risk of HIV infection⁵⁶, suggesting that initiatives to promote universal education beyond primary schooling may constitute a potent HIV-prevention strategy. As women’s risk of HIV infection is closely correlated with experience of gender-based violence⁵⁷, initiatives that prevent violence against women and alter the sexual norms of men and boys also play a role in reducing women’s vulnerability. According to information provided in 2009 by the International Center for Research on Women, 13 of 33 Sub-Saharan African countries for which information was available have laws in place restricting the ability of women to own or inherit property; revising laws to recognize and enforce women’s property rights represents a potentially potent structural intervention to empower women and thereby reduce their ability to abstain from sex or to insist that their male partners use a condom.

Legal and policy structures also perpetuate and reinforce the

vulnerability of populations most at risk. More than 80 countries (nearly all of them developing countries) impose criminal penalties for consensual sexual relations between the same sex, including seven countries that provide for the death penalty.⁵⁸ Offering or soliciting sex is illegal in more than 110 countries, and more than 50 countries provide for coercive or compulsory treatment or the death penalty for individuals convicted of using drugs.⁵⁹ Repeal of these and other discriminatory laws is needed to support evidence-based HIV prevention efforts.

Building the evidence base for structural interventions or social change strategies to prevent HIV infections will require researchers to pursue a broad range of research strategies. While randomized controlled trials may be suitable for certain well-defined structural interventions, they will be inappropriate for certain strategies or in certain contexts.⁶⁰ Significantly greater financial and institutional support is merited for social science research strategies that aid in expanding the evidence base for HIV prevention.

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ABOUT THE GLOBAL HIV PREVENTION WORKING GROUP: The Global HIV Prevention Working Group is a panel of more than 50 leading public health experts, clinicians, biomedical and behavioral researchers, and people affected by HIV/AIDS, convened by the Bill & Melinda Gates Foundation and the Henry J. Kaiser Family Foundation. The Working Group seeks to inform global policymaking, program planning, and donor decisions on HIV prevention, and to advocate for a comprehensive response to HIV/AIDS that integrates prevention, treatment, and care. Working Group publications are available at www.globalhivprevention.org.