Male and female condoms

Key points

- **Male condoms were the first mass intervention adopted for HIV prevention. Robust evidence gathered over three decades confirms that they remain a highly cost-effective method of preventing HIV. Condoms are an essential component of HIV prevention.**
- **Despite their effectiveness, condoms do not offer perfect protection. They can be used incorrectly, causing them to slip or tear; they also are used inconsistently, meaning people have unprotected sex. But studies show that the use of male condoms for vaginal sex effectively reduced HIV transmission by 80% (50). For anal sex, there are fewer studies, but the most recent meta-analysis found that male condoms had an efficacy of 70% (51).**
- **For female condoms, limited evidence suggests that they are 80% effective (52). While their use is low across all groups in developed countries, female condom use has been shown to be more common in certain countries, including Brazil, Ghana, South Africa and Zimbabwe.**
- **Condom acceptance in key populations rises sharply after media and counselling promote condom use (53). This happens even in populations with strong cultural objections and low historical use. Usage rates may decline in some settings after the initial sharp rise, but they remain significantly higher than historical levels.**
- **Studies confirm that HIV incidence drops when condoms are combined with other changes (such as frequency of sexual relations) (50). Modelling has shown that condom use was a key factor in containing the spread of the epidemic.**
- **Programmes that provide access to free or subsidized condoms increase condom use (54). Condoms also protect against unwanted pregnancy and STIs. Where HIV stigma is an issue, the contraceptive benefits can be emphasized to increase usage.**
- **Promoting condom use through counselling and media interventions has (on average) a neutral impact on incidence, but it is more effective when directed at specific populations. Key populations in which HIV is spread primarily through casual and commercial sex respond well to condom provision and promotion. Compared to the general population, rates of male condom use are higher among gay men and other men who have sex with men, people in casual sexual relationships and people involved in commercial sex.**
- **The cost per disability-adjusted life year (DALY) averted has been estimated as slightly more than US$ 100 for male condoms and just less than US$ 200 for female condoms (55). This compares favourably with the cost of approximately US$ 550 per DALY averted for first-line antiretroviral therapy.**

Male condoms were the first tool adopted for HIV prevention in the early 1980s; the female condom was first launched in the early 1990s. They are inexpensive and cost-effective, and their use does not require the assistance of health-care workers. Together, they remain the most frequently used intervention to prevent HIV infection in many settings.

Condoms have also found a place in combination HIV prevention. Several models have shown that condoms can have a strong impact on disease incidence when used alongside other interventions. For example, modelling in South Africa suggests that from 2000 to 2008, HIV-incidence in adults declined by approximately 31%, with between 23% and 37% of this decline attributed to condom use *(56)*. Models from the United Kingdom of Great Britain and Northern Ireland also credit condoms with preventing a quadrupling of cases that would have otherwise occurred *(57)*.

What follows is an examination of the effectiveness of condom protection against HIV among heterosexual couples and gay men and other men who have sex with men. Both male and female condoms are covered. After that, a summary of the effectiveness of condom programmes on enhancing the acceptability, availability and accessibility of condoms is presented.

A note on outcome measures for condoms

The specific measurable amount of protection that condoms provide against HIV infection can only be estimated—it is not possible to run randomized controlled trials *(51)*. While efficacy and effectiveness are ideally tested in a randomized controlled trial with strong measures adopted to capture adherence levels, ethical considerations prohibit the exposure of infection-free people to a serious illness like HIV. It is therefore necessary to use observational studies where condom use (or the lack thereof) is examined alongside observed HIV prevalence and incidence rates that are confirmed by serology.

Biological rationale for effectiveness

What does the evidence say about the biological efficacy of condoms?

- Condoms made of latex or polyurethane form an impermeable barrier for HIV.

Condoms are made from latex or polyurethane, and they are required to meet manufacturing standards that make them impermeable to microorganisms *(58)*. WHO and the United Nations Population Fund (UNFPA) operate a prequalification and specification scheme for male condoms. The United States Food and Drug Administration (FDA) and the European Medicines Agency have comparable specifications for female condoms.

It is beyond doubt that condoms act as an effective and reliable barrier. Laboratory studies and product testing have shown that condoms from recognized suppliers are completely impermeable to microorganisms as small as viruses when tested in the laboratory *(59)*. The risk of exposure to semen due to condom breakage is 1 per 166 sex acts, a physical reliability of 99.4% *(60)*.

Condoms are therefore highly effective in preventing unintended pregnancy and the transmission of microorganisms. When they fail, it is either because of device failure or user failure. Objections to condom use frequently conflate these two characteristics. User failure takes two forms: either condoms are used inconsistently, which leads to episodes of unprotected sex, or they are used incorrectly, which leads to slippage or breakage. Such device failure is uncommon on its own; it is usually an outcome of user failure. Around 75% of users fail to use condoms for every penetrative sex act, but when they are used consistently and correctly, they are highly effective.

Efficacy of condoms in preventing HIV infection

What does the evidence say about the effectiveness of condoms when they are self-reported to be used consistently?

- Male condoms used consistently for all acts of penetrative sex are 80% effective in preventing HIV transmission through vaginal sex and 70% effective for anal sex.

Considerations in determining condom efficacy

The efficacy of an intervention describes how well it works in a scientific trial or when used as indicated (i.e., consistently). Its effectiveness indicates how well it works to prevent disease or infection in a particular population given actual levels of use.

Studies of condom efficacy have compared HIV incidence or prevalence among people who claim 100% consistent use of condoms against people who use them inconsistently or not at all *(50)*. Because these studies involve private behaviours that investigators cannot observe directly, it is difficult to determine accurately whether an individual is a condom user and whether condoms are used consistently and correctly.

The evidence we have is based on three types of trials, and each has potential weaknesses.

- For the efficacy of condoms against HIV and other chronic STIs, prospective studies of the incidence of HIV—or human papillomavirus (HPV) or herpes simplex (HSV)—in monogamous serodiscordant couples provide the best evidence. Large or long-lasting studies provide more reliable estimates of efficacy.
- Evidence also has been derived from prospective cohort studies that look at the association between self-reported condom use and HIV incidence over time.
- Retrospective cohort studies have correlated levels of reported condom use and other behavioural data with HIV prevalence to determine the association between condom use and HIV infection.

All of these methods are prone to bias due to their reliance on self-reported condom use. Research early in the epidemic showed that 40–70% of men falsely claimed they always use condoms *(61)*. Similarly, one study found that 77% of female sex workers reported consistent condom use with clients, but a prostate-specific antigen (PSA) test established that only 52% actually used condoms consistently *(62)*. These findings indicate that people overestimate condom usage and find it difficult to sustain 100% use.

Condom efficacy: heterosexuals

The most comprehensive meta-analysis of the efficacy of condoms in heterosexuals was issued as one of the Cochrane Collaboration series of meta-analyses *(50)*. The meta-analysis evaluated 14 longitudinal cohort studies that contained 13 groups of serodiscordant heterosexual couples who said they “always” used condoms and 10 groups who said they “never” used them. There were 587 HIV-negative partners in the “always” group and 276 in the “never” group. The average length of follow-up in the studies was 2.17 years.

The annual incidence of HIV infection in the HIV-negative partners was 6.68% in partners who said they “never” used condoms (40 infections in 276 people) and 1.14% in partners who said they “always” used them (11 HIV infections in 587 people) *(50)*. This represents an 83% reduction in the risk of HIV transmission.

Among the “always” users, the 95% CI for annual HIV incidence was 0.56–2.04%; among those who “never” used condoms, 95% CI for annual incidence was estimated at 3.16–9.66% *(50)*.

Condom efficacy: anal intercourse between men

There have been limited data on the efficacy of condom use in preventing HIV transmission through anal intercourse. A study conducted in 1989 and a meta-analysis of two longitudinal studies published in 2013 each estimated an efficacy of 70% for reported condom use during anal intercourse between gay men and other men who have sex with men: men who said they used condoms 100% of the time were 70% less likely to acquire HIV than men who never used condoms, and they were 68% less likely than men who said they sometimes used them *(51, 63)*. This is somewhat lower than the rates seen in studies among heterosexuals, probably because the risk of transmission through anal intercourse is higher than it is through vaginal intercourse, and because there is a higher risk of condom breakage during anal intercourse.

The 1989 study was part of the Multicenter-AIDS Cohort Study (MACS), the oldest HIV cohort study in the world. The study found that the six-month IR among 2914 initially HIV-negative gay men and other men who have sex with men was 0.7% among those who claimed 100% condom use and 2.9% among those who never used condoms. This also yields a condom efficacy of approximately 70%.

A recent systematic review, published in 2018, found that HIV incidence was 91% lower among gay men and other men who have sex with men who used condoms consistently, contributing to the evidence base of condom effectiveness against HIV *(64)*.

Condom efficacy: anal intercourse in heterosexual couples

The only analysis of condom efficacy for anal intercourse in heterosexuals was a small one published in 1994 *(65)*. There were no seroconversions in 124 couples who always used condoms for vaginal and anal intercourse, compared to 12 in the group of 132 people who used condoms inconsistently.

Anal intercourse was already a minority behaviour among heterosexual couples, and unprotected anal intercourse was even rarer, so the researchers could not directly compare seroconversion rates between women who used condoms for anal sex and those who did not.

Condom efficacy: male and female condoms

Available data reviewed by the CDC in a recent meta-study suggest that female condoms (or an alternating mixture of female and male condoms) may provide degrees of protection against pregnancy and STIs that are similar to those of latex male condoms alone *(51)*. According to the authors, however, this conclusion has not been demonstrated to a level that can lead to an unequivocal recommendation. The uncertainty of this conclusion is reflected in

the FDA labelling for female condoms, which supports their use for disease protection only in mitigating circumstances (i.e., when a latex male condom will not be used). Data from randomized trials designed to quantify the equivalence between the two condom types are not available *(52)*.

The key benefit of the female condom is that it provides women with an option over which they have control. In most settings, uptake of female condoms has been very low, and female condom use globally is less than 1% of male condom use, with notable exceptions (such as Brazil, Ghana, South Africa and Zimbabwe). In light of the uncertainty surrounding their effectiveness and low usage rates, the female condom will be a tool in well-defined settings. Male and female condoms should not be used at the same time. This is because friction between the condoms can increase the likelihood that the condoms will split *(66)*.

Condom failure or misuse: recommended actions and efficacy

In a case of condom failure or misuse where one partner is HIV-positive, the recommendation is to visit a health-care professional, who should prescribe a one-month course of post-exposure prophylaxis (PEP) *(66)*. Where the serostatus of one or both sexual partners is unknown, HIV testing is recommended.

The relationship between consistent use and efficacy

Condoms protect against HIV when used, provided that they do not slip off or break. As soon as attempted condom use falls from 100%, then the degree of protection they offer rapidly declines.

In some studies, inconsistent condom use appears to be even less effective against HIV than not using condoms at all *(68).* Inconsistent users had 44% more gonorrhoea and chlamydia than non-users, and this was statistically significant and broadly in line with other studies (see below) *(69)*.

The apparent ineffectiveness of intermittent condom use may be due to the fact that such use is associated with settings that have a higher risk of HIV infection: longitudinal studies suggest that intermittent users are likely to have behavioural characteristics that put them at higher risk of HIV infection (such as greater numbers of partners). Researchers also hypothesize that men who never use condoms might be more likely to be in monogamous relationships and therefore generally at less risk of HIV *(69)*.

The effectiveness of condoms in key regions and among key populations

What does the evidence say about the effectiveness of condoms when they are delivered as part of prevention packages in different settings?

- Condoms are effective alongside other interventions in reducing HIV incidence in different regional and epidemic settings.

Heterosexuals in sub-Saharan Africa

The earliest population-level decline in HIV prevalence in sub-Saharan Africa, which occurred in Uganda, has been attributed to behavioural and epidemiological changes that occurred alongside increases in condom use *(70)*. Evidence from population-level declines in HIV prevalence is derived from population-based surveys, routine HIV testing data and study cohorts. While these types of data are suitable to document trends, they cannot be linked directly to interventions in the same way as experimental studies. Mathematical models and ecological analyses have therefore been used to assess the contributions that programmes such as condom promotion have made to HIV declines.

In Uganda, the incidence and prevalence of HIV started falling in the late 1980s, well before condoms started to be used widely *(70)*. Similarly, the decline in HIV incidence in Zimbabwe after 1991 has been attributed to a combination of factors, including a decline in multiple or concurrent sexual partnerships, a reduction in men paying for sex and changes in social attitudes towards casual sex. Condom use with nonregular partners, which increased during the 1980s and 1990s, has been cited as another plausible contributing factor to HIV prevalence decline in Zimbabwe *(71)*.

Subsequent increases in condom use may have made more direct contributions to reductions in HIV incidence and prevalence in some countries. For example, South Africa experienced a 35% decline in the rate of new HIV infections between 2002 and 2008, and by comparing data from three consecutive national prevalence surveys, researchers were able to estimate changes in incidence and link the improvements to condom use (among other factors) *(56)*.

Heterosexuals in Asia: Cambodia, India and Thailand

National promotion of condom use in brothels in Thailand during the 1990s—the 100% Condom Use Programme—was associated with a rapid and substantial reduction in HIV incidence *(72)*. As part of the programme, police informally licensed brothels and ensured that sex workers had regular health checks to pressure owners to ensure that clients demanding unsafe sex would be turned away. Following the launch of the campaign in 1989, condom use in sex establishments increased from less than 20% in 1990 to above 90% in 1994; it was sustained at that level thereafter. HIV prevalence among male military conscripts fell from 4% in 1993 to 1% in 2004. A similar decline in HIV prevalence was observed in Cambodia, which also used the programme *(72)*.

In India, a decline in HIV prevalence among women especially in southern states, among those aged 15 to 24 years, has been attributed to the widespread adoption of condoms by sex workers and their clients, and to a subsequent reduction in transmission of HIV from male clients to other female partners *(73)*. The researchers also credited a 35% decline in HIV

prevalence among young people to an increase in condom use among commercial sex workers and their clients.

Latin America

While the incidence of HIV (0.4%) is much lower in Latin America than in sub-Saharan Africa or parts of Asia, the total number of people infected is nonetheless substantial *(74)*. Incidence rates are high among key populations such as gay men and other men who have sex with men, sex workers (especially male sex workers) and transgender women. Antiretroviral therapy is widely available across the region, but its uptake is far below 100%, varying between 20% in the Plurinational State of Bolivia and 60% in Argentina. As a result, condoms are a critical intervention.

There is a lack of condom effectiveness studies for this region. One reason for this is that certain key populations often falsely identify themselves as heterosexual or hide their HIV status, because gay men and other men who have sex with men and people living with HIV are highly stigmatized in the region *(75)*.

Key populations

What does the evidence say about the effectiveness of condoms when they are delivered as part of prevention packages for key populations?

- Condoms used alongside other interventions reduce HIV incidence in all key populations, and they need to be part of all programmes reaching those populations.

Gay men and other men who have sex with men

The first instance of a substantial increase in condom use in a key population was among gay men and other men who have sex with men early in the epidemic.

Condom use among gay men and other men who have sex with men in San Francisco quadrupled between 1984 and 1987 *(76)*. Because of this increase—and because of reductions in the number of sexual partners—HIV incidence dropped precipitously in 1983–84 after peaking at 7–8% in 1980–82. It has remained at 0.5–3.0% ever since.

An early survey by Sigma Research in the United Kingdom found that about 90% of gay men and other men who have sex with men consistently did not use condoms for anal intercourse before 1980, but that by 1988, the proportion of "rarely or never" users was down to 22% *(77)*.

Young people

A systematic review of 31 controlled studies conducted in sub-Saharan Africa found that behavioural HIV prevention interventions were associated with an increase in condom use at last sexual episode among males aged 10 to 25 years *(78)*. It also found, however, that intervention and study design were commonly weak. Condom use at last sex was 1.46 times higher among males who received behavioural interventions; any use of condoms also increased in males (RR = 1.32; 95% CI 1.25–1.40). No consistent impact of interventions on condom use was seen in young women, and there was great diversity in the range of behaviour change interventions studied *(78)*.

Integrating condom promotion into programmes focused on sexual behaviour change is advantageous because decisions around condom use are directly affected by issues such as relationship status, gender-based power disparities and denial of HIV risk. Condom programming, like all behaviour change communication, must be locally relevant and culturally specific in order to be effective.

Linkages that facilitate the integration of condom education, promotion and distribution into existing medical, educational and social services programming can serve to expand their uptake by communities at high risk of HIV, particularly in developing countries.

Sex workers

Interventions to promote condom use among sex workers and their clients are highly effective. A systematic review of interventions to improve condom use in Africa and Asia, for instance, found that of 19 studies that assessed condom use among female sex workers, 15 reported a significant increase in condom use (versus four that did not) *(79)*.

As noted above, Thailand's national 100% Condom Use Programme resulted in a change in reported condom use at sex establishments, with the rate increasing from less than 20% in 1990 to above 90% in 1994, a level that was reportedly sustained thereafter *(72)*.

In India, sex worker outreach projects integrating condom promotion succeeded by using very different techniques *(80)*. In 2004, 70–80% of female sex workers in Karnataka reported using a condom with their last client. This was a sharp increase from prior levels, and it was attributed to the activities of a peer-led female sex worker collective that offered an array of services, including literacy programs, medical care, legal assistance, HIV prevention education and condom promotion. A survey of women and men attending antenatal and STI clinics found a 35% decrease in HIV prevalence *(73)*. The researchers credited these declines to an increase in condom use among commercial sex workers and their clients.

People who inject drugs

Condom promotion can be integrated effectively into harm reduction services for sex workers and people who inject drugs via programmes focused on these key populations. Such integrated programmes are the mainstay of HIV and STI prevention programmes in many countries, and they have been shown to be highly effective in preventing HIV *(73)*.

Prisoners

People in prison settings are another population that is largely deprived of condom access. Most countries still treat condoms as contraband in prisons and jails, despite: (a) clear guidance from the European Court of Human Rights and the UN on the human rights aspect of preventing serious illness; and (b) analysis from WHO, the UN and UNAIDS on the feasibility and benefits of condom provision *(84)*. The political will to reverse these bans is required to create an enabling environment for condom use among people in prison settings.

The overall impact of condom provision and education on HIV risk

What does the evidence say about the effectiveness of condom distribution and promotion?

- Condom distribution and promotion schemes are highly efficacious in increasing condom use, and they deliver additional benefits, such as reductions in STI incidence.
- Condom promotion and use do not increase other high-risk sexual behaviours.

A meta-analysis published in 2011 looked at the impact of condom distribution schemes on condom use and risk behaviours, both in the United States and internationally *(54)*. It covered programmes aiming to increase the following:

- Condom availability through the provision of free or subsidized condoms to individuals practising high-risk behaviours and in high-risk venues.
- Condom accessibility, which uses broader general schemes, such as condom provision at music festivals or to students.
- Condom acceptability through media campaigns, safer-sex posters and information, and peer-group interventions.

The analysis showed that condom distribution and promotion schemes are highly efficacious in getting people to carry and use condoms. It also documented a substantial reduction in STI incidence and delayed sexual debut in young people *(54)*.

The overall effect on condom use in 20 studies was an 81% increase in condom use. In a subset of five youth studies, there was a 43% increase in delayed sexual debut or abstinence, which suggests that condom promotion does not lead to risk compensation in the form of earlier sexual debut. In a subset of five studies that measured STI incidence, there was a 31% decrease in STIs *(54)*.

The increasing integration of condom promotion into services focused on women, couples and young people has also shown success. Women accessing HIV-related services in family planning clinics have demonstrably higher rates of condom use than their peers in the general population *(81)*. Emphasis on the contraceptive value of male and female condoms can also counteract potential stigma by drawing attention away from their association with HIV prevention *(82, 83)*.

Another systematic review found variability between populations and partnership types in the effects of promotion on condom use *(79)*. The review identified 62 studies that had evaluated the effects of condom promotion in Asia or sub-Saharan Africa. Positive impacts were reported for sex workers and serodiscordant couples.

A subsequent systematic review and meta-analysis of studies published between 1990 and 2006 on behavioural interventions for people living with HIV in developing countries found those interventions had a very strong effect on condom use in serodiscordant couples *(85)*. The study found that counselling couples together had a significant and substantial effect, whereas individual counselling alone had no impact. This is in keeping with the findings

discussed in the previous section on the effectiveness of HIV testing of couples (see “The effect of voluntary HIV counselling and testing on sexual behaviour”).

A large 2006 meta-analysis of 174 studies published between 1989 and 2003 of any interpersonal (individual or group) sexual risk reduction intervention (not just condoms or condom promotion) found no evidence that, taken as a whole, those interventions increased sexual risk behaviour or the amount of sexual activity *(86)*. These findings contradict assertions that condom promotion encourages risk behaviour, and they support the inclusion of focused condom promotion in all HIV prevention programmes.

Operational considerations

The UNFPA publication *Comprehensive condom programming: a guide for resource mobilization and country programming* has guidance that applies to both male and female condoms *(87)*. It outlines a 10-step strategic approach:

1. Establish a national condom support team.
2. Undertake a situation analysis.
3. Develop a comprehensive and integrated national strategy for male and female condoms.
4. Develop a multi-year operational plan and budget.
5. Link the multi-year operational plan with the national commodity security plan.
6. Mobilize financial resources.
7. Strengthen human resources and institutional capacity.
8. Create and sustain demand for condoms.
9. Strengthen advocacy and engage the media.
10. Monitor the programme routinely, conduct research and evaluate outcomes *(87)*.

Acceptability and effectiveness

While there may be many reasons why people do not use condoms, two main themes stand out when people are asked why they do not use them: intimacy and pleasure. Condoms are sometimes equated with a lack of trust or with relationships that have not yet been firmly established. They can even be taken as proof of unfaithfulness.

Surveys such as those based on the Demographic and Health Surveys (DHS) programme almost invariably find that condom use in long-term relationships is much lower than in casual sex. This applies to both heterosexual men and gay men and other men who have sex with men: men in steady relationships, irrespective of the serostatus of their partner, are far less likely to use condoms.

Condom breakage and slippage

What has been called “fit” and “feel” may be crucial when it comes to the decisions that men make about whether or not to continue to use condoms. Failure to supply condoms that fit varying sizes of penis, for instance, may make a difference, as might lubrication and smell. One study, for instance, found that although most men do not have problems with condom fit and feel, men with shorter or larger penile dimensions (length or circumference) were more likely to have negative attitudes and perceptions of condom fit and feel *(88)*.

Unsatisfactory fit and feel also were associated with condom breakage. In one study, condom breakage was twice as likely to be reported by men who felt their condoms did not fit properly *(89)*. Other predictors of condom breakage were, unsurprisingly, letting sharp objects near the condom and previous experiences of condom slippage. STIs were significantly higher with condom breakage, suggesting a similar risk for HIV.

In resource-rich countries, condom manufacturers offer a range of condoms in different sizes and fits. However, the choice of condoms tends to be much more limited when they are supplied free of charge in developing countries. More work is needed to identify what range of condoms must be supplied in different settings in order to increase men’s comfort and satisfaction when using them.

In 2013, the Bill & Melinda Gates Foundation identified the development of new and easier-to-use condoms for resource-poor countries as one of its development priorities *(90)*.

The role of lubricants in condom breakage, slippage, reliability and safety

A woman produces natural lubricating fluids during vaginal sex, but these may not be enough for safer condom use. Women also may need additional lubrication for comfort. A survey of women's lubricating practices in nine countries in Asia, Africa and Latin America found that the use of substances that increased vaginal lubrication was widespread *(91)*. Lubricants also are used by the majority of gay men and other men who have sex with men and by female sex workers *(92)*.

A more recent survey covered lubricant use during anal sex among both men and women *(93)*. In this international survey of 6124 individuals who reported anal sex in the last six months, only 35% used condoms consistently, but 59% always used lubricants.
It is recommended that condoms be used with silicone- or water-based lubricant for anal sex. Use of water-based lubricant is associated with a lower male condom failure rate during anal intercourse. In one study, condom breakage was significantly less frequent when used with water-based lubricant compared to no lubricant (3.0% vs 21.4%) *(94)*.

Using oil-based substances, cooking oil and other oily substances as lubricant with latex condoms is not regarded as safe. Oils and greases weaken condoms within minutes: one study found that a condom's resistance to being punctured decreased by 47% and 59%, respectively, after 15 and 30 minutes of exposure to mineral oil *(95)*.

Lubricants are manufactured to a range of specifications according to market requirements. As a result, they differ in their chemical constituents and safety profile. Lubricants may cause harm to the vaginal or anal mucosa, or they may cause damage to male or female condoms *(96)*. In either instance, they would increase the risk of HIV infection.

Lubricants are not subject to uniform regulation; in some cases, they are not regulated. There is an advisory note on lubricants from WHO, UNFPA and FHI 360, but additional evidence on the effects of lubricants is required *(97)*. If no local regulation exists or if regulation is weak, then it is advisable to recommend products that have already been approved in highly regulated markets, such as Europe (products with the "CE" marking) and other developed markets.

Since condom use in many settings is increased by making condoms available for free or at highly subsidized prices, it is advisable to make lubricants available in a similar manner. In these contexts, it should be emphasized that there is no evidence to suggest that lubricants on their own are protective against HIV.

Structural-level condom interventions

Programmes exist that distribute condoms free of charge on a large scale to individuals and communities at high risk of HIV infection. These structural-level condom interventions often are combined with individual or group behaviour change interventions, and they often are supported by community-based social marketing activities. A systematic review and meta-analysis published in 2011 reviewed 21 studies of structural-level interventions in which HIV-related risk behaviours and STIs were measured as relevant outcomes *(54)*. The overall effect of the interventions was an 81% increase in condom use, and in a subset of five youth studies, investigators found a 43% increase in abstinence or delayed sexual debut. In another subset of five studies—this time measuring STI incidence—researchers documented a 31% decrease in STIs *(54)*.

The meta-analysis found that interventions addressing any one of the three parameters—acceptability, accessibility or availability—had a similar magnitude of effect. Interventions to improve availability, such as requiring saunas or sex work premises to make condoms available, had the greatest impact when combined with measures to improve accessibility (such as large-scale condom distribution). Interventions that combined structural-level condom distribution with individual, small group or community interpersonal communication components had significantly greater efficacy than interventions that solely implemented a structural-level component *(54)*.

Social marketing

Condom social marketing (not to be confused with communication that uses social media, such as Facebook) refers to activities that seek to build demand for condoms that are made available at a subsidized price. It was first initiated in the 1980s by international family planning organizations, and it broadened in the 1990s as epidemic rates of HIV highlighted the urgent need to increase condom use.

Social marketing may be combined with free access to condoms through health facilities, family planning clinics or community outreach. It applies the tools and concepts of commercial marketing to noncommercial goals, such as promoting healthy behaviours, and it is generally used to address issues affecting low-income populations that have high morbidity and mortality rates.

In 2012, a systematic review and meta-analysis by Sweat et al. examined six studies of social marketing interventions to increase condom use in developing countries *(98)*. Five of the six studies were conducted in sub-Saharan Africa. The review found that exposure to a social marketing intervention approximately doubled the likelihood that respondents reported condom use at their last sexual encounter. It also confirmed that social marketing only has a moderately positive effect on increasing condom use. Among those exposed to social marketing, overall condom use was slightly more likely among men than women; the effect of social marketing remained significant only for men when the analysis was restricted to casual partners.

Condom social marketers sometimes pave the way for governmental HIV prevention efforts by introducing new condoms and creating public demand for them. That introduction then facilitates the wider distribution of condoms by public health services. In Brazil, for example, DKT (a private-sector social marketer) introduced female condoms in 1997 at a subsidized price. The government subsequently joined the effort by making the condoms available for free for those unable to buy them. By 2004, four million female condoms were being distributed annually through a mix of public and private (social marketing) channels, a figure that the government estimated as one fifth of the actual number needed *(100, 101)*.

The total market approach

The term “total market approach” was first applied to social marketing in 2004 *(102)*. Since then, it has come to be applied to a framework that harmonizes social, private and public market forces to address public health needs. Under such an approach, all sectors (public sector, private sector and social marketing) are integrated within one market that is segmented by willingness to pay *(103)*.

With regard to condoms, the division of labour is generally as follows:

- Commercial businesses sell a range of brands to buyers who can pay retail prices.
- Non-profit, community-based organizations provide branded and unbranded condoms at subsidized prices.
- Public sector workers (e.g., clinics, hospitals and health educators) distribute free condoms.

A 2012 evaluation of work in African countries found that social marketing using a total market approach resulted in significantly increased condom use by women in nonmarital, non-cohabiting relationships in seven countries, and by their male peers in five countries *(104)*.

Cost-effectiveness

Are condoms cost-effective?

- Condoms are likely among the most cost-effective HIV prevention interventions available in most settings.

Evidence of the cost-effectiveness of condom distribution and marketing is necessary to sustain political support for its continuation. While it is intuitively apparent that investment in preventing new HIV infections is less expensive than lifelong treatment costs and other expenses associated with HIV acquisition, cost-effectiveness studies have not evaluated male condom promotion as a stand-alone intervention. Instead, it is evaluated as part of an intervention package that also includes HIV education, support and STI prevention. For instance, mathematical modelling to estimate the cost-effectiveness of various HIV prevention interventions in sub-Saharan Africa suggests that male condom provision (with its appropriate ancillary programming) costs only US$ 181 per HIV infection prevented, making it "the most economically efficient of HIV prevention strategies in sub-Saharan Africa" *(105)*.

A 2014 analysis of the cost-effectiveness of female condoms showed that, despite a higher price, female condoms are nevertheless highly cost-effective compared to other HIV prevention tools when measured by DALY averted *(55)*. As the only dual prevention method (i.e., it blocks STIs and HIV and acts as a contraceptive) that women can initiate when male condom use has been rejected, female condoms are an important complement to the larger HIV prevention intervention package.

Risk compensation: the potential for a decline in condom use

What is the role of condoms in the age of antiretroviral therapy?

- When antiretroviral therapy is available, condoms are still needed to prevent rising HIV incidence.
- In the majority of countries, less than half of people living with HIV had a suppressed viral load in 2016. Even if the 90–90–90 targets are achieved, more than a quarter of people living with HIV would not be virally suppressed, and people who are virally suppressed at the time of a viral load test may not be constantly virally suppressed.

It has been questioned whether condom use in resource-rich countries has declined since the advent of antiretroviral therapy in the mid-1990s. The evidence is conflicting, varies between countries and depends on what measures are taken of risk behaviour. Potential different factors include whether condom use and unprotected sex (including unprotected sex between definitely or possibly serodiscordant partners) is counted, and whether the question is asked positively (e.g., “Have you always used a condom during intercourse in the last year?”) or negatively (e.g., “Have you had intercourse without a condom over the last year?”).

Following the advent of antiretroviral therapy in 1996, the proportion of gay men and other men who have sex with men who sometimes did not use condoms started to increase. A survey in San Francisco, for instance, found that the proportion of gay men and other men who have sex with men who reported that they did not always use condoms increased from 31% in 1994 to 47% in 1999 (106).

In the United States, the proportion of gay men and other men who have sex with men who had anal sex without a condom at least once in the previous year increased by nearly 20% between 2005 and 2011 (107). Among men in 2011 who tested HIV-positive but did not know their status, a third had high-risk sex the last time they had sex; this rate had not changed from 2008. This does not imply that not knowing one’s status leads to high-risk sex; rather, it shows that people living HIV who don’t know their status are more likely to have taken sexual risks recently and are more likely to have been recently infected.

Limited data on increasing trends in some STIs may suggest reduced condom use with increased availability of antiretroviral therapy. Despite that, there is not enough evidence to make a definitive statement to that effect.

Conclusion: male and female condoms

Condoms were the first successful mass intervention to prevent the spread of HIV. Their role in containing and reducing HIV incidence alongside other interventions is well-documented, even though the exact level of their effectiveness remains unknown. High effectiveness depends on consistent and correct use, which is not easy to reach, but evidence confirms that increased and sustained condom usage can be achieved following a process such as that outlined in the UNFPA guide, Comprehensive condom programming (87).

References

1. UNAIDS 2018 HIV estimates.

2. Combination HIV prevention: tailoring and coordinating biomedical, behavioural and structural strategies to reduce new HIV infections. A UNAIDS discussion paper. Geneva: UNAIDS; 2010.

3. Guidelines on provider-initiated HIV testing and counselling in health facilities. Geneva: World Health Organization; 2007.

4. Consolidated guidelines on HIV testing services. Geneva: World Health Organization; 2015.

5. Fonner V, Denison J, Kennedy CE, O'Reilly K, Sweat M. Voluntary counseling and testing (VCT) for changing HIV-related risk behavior in developing countries. Cochrane Database Syst Rev. 2012;9:CD001224.

6. Denison JA, O'Reilly KR, Schmid GP, Kennedy CE, Sweat MD. HIV voluntary counselling and testing and behavioral risk reduction in developing countries: a meta-analysis, 1990–2005. AIDS Behav. 2008 May;12(3):363-73. Epub 2007 Dec 27.

7. Corbett E, Makamure B, Cheung YB, Dauya E, Matambo R, Bandason T et al. HIV incidence during a cluster-randomized trial of two strategies providing voluntary counselling and testing at a workplace, Zimbabwe. AIDS. 2007;21(4):483-9.

8. Matuvo JK, Gray RH, Makumbi F, Wawer MJ, Serwadda D, Kigozi G et al. Voluntary HIV counselling and testing acceptance, sexual risk behavior and HIV incidence in Rakai, Uganda. AIDS. 2005;19(5):503-11.

9. Machekano RW, McFarland W, Mbizvo MT, Bassett MT, Katzenstein D, Latif AS et al. Impact of HIV counselling and testing on HIV seroconversion and reported STD incidence among male factory workers in Harare, Zimbabwe. Cent Afr J Med. 1998;44(4):98-102.

10. Arthur GV, Nduba V, Forsythe S, Mutemi R, Odhiambo J, Gilks C et al. Behaviour change in clients of health centre-based voluntary counselling and testing services in Kenya. Sex Transm Infect. 2007;83(7):541-6.

11. Rosenberg NE, Hauser BM, Ryan J, Miller WC. The effect of HIV counselling and testing on HIV acquisition in sub-Saharan Africa: a systematic review. Sex Transm Infect. 2016 Aug 16. pii: sextrans-2016-052651. doi: 10.1136/sextrans-2016-052651

12. Guidelines on couples HIV testing and counseling—including antiretroviral therapy for treatment and prevention in serodiscordant couples. Geneva: World Health Organization; 2012.

13. The Voluntary HIV-1 Counseling and Testing Efficacy Study Group. Efficacy of voluntary HIV-1 counselling and testing in individuals and couples in Kenya, Tanzania, and Trinidad: a randomised trial. Lancet. 2000;356:103-12.

14. Allen S, Meinzen-Derr J, Kautzman M, Zulu I, Trask S, Fideli U et al. Sexual behavior of HIV discordant couples after HIV counseling and testing. AIDS. 2003;17(5):733-40.

15. Rosenberg NE, Pettifor AE, De Bruyn G, Westreich D, Delany-Moretlwe S, Behets F et al. HIV testing and counseling leads to immediate consistent condom use among South African stable HIV-discordant couples. J Acquir Immune Defic Syndr. 2013;62(2):226-33.

16. Coates TJ, Kulich M, Celentano DD, Zelaya CE, Chariyalertsak S, Chingono A et al. Effect of community-based voluntary counselling and testing on HIV incidence and social and behavioural outcomes (NIMH Project Accept; HPTN 043): a cluster-randomised trial. Lancet Glob Health. 2014;2(5):e267-77.

17. Doherty T, Tabana H, Jackson D, Naik R, Zembe W, Lombard C et al. Effect of home based HIV counselling and testing intervention in rural South Africa: cluster randomised trial. BMJ. 2013;346:f3481. doi: https://doi.org/10.1136/bmj.f3481

18. Kennedy C, Fonner VA, Sweat MD, Okero FA, Baggaley R, O'Reilly KR et al. Provider-initiated HIV testing and counseling in low- and middle-income countries: a systematic review. AIDS Behav. 2013;17:1571-90.

19. van't Hoog AH, Mbori-Ngacha DA, Marum LH, Otieno JA, Misore AO, Nganga LW et al. Preventing mother-to-child transmission of HIV in Western Kenya: operational issues. J Acquir Immune Defic Syndr. 2005 Nov 1;40(3):344-9.

20. Chandisarewa W, Stranix-Chibanda L, Chirapa E, Miller A, Simoyi M, Mahomva A et al. Routine offer of antenatal HIV testing (‘‘opt-out’’ approach) to prevent mother-to-child transmission of HIV in urban Zimbabwe. Bull World Health Organ. 2007;85(11):843-50.

21. Stringer JSA, Sinkala M, Stout JP, Goldenberg RL, Acosta EP, Chapman V et al. Comparison of two strategies for administering nevirapine to prevent perinatal HIV transmission in high-prevalence, resource-poor settings. J Acquir Immune Defic Syndr. 2003;32(5):506-13.

22. Allen S, Serufilira A, Bogaerts J, Van de Perre P, Nsengumuremyi F, Lindan C et al. Confidential HIV testing and condom promotion in Africa. Impact on HIV and gonorrhea rates. JAMA. 1992;268:3338-43.

23. Desgrées-Du-Loû A, Brou H, Djohan G, Becquet R, Ekouevi DK, Zanou B et al. Beneficial effects of offering prenatal HIV counselling and testing on developing a HIV preventive attitude among couples. Abidjan, 2002–2005. AIDS Behav. 2009;13(2):348-55.

24. Xu F, Kilmarx PH, Supawitkul S, Manopaiboon C, Yanpaisarn S, Limpakarnjanarat K et al. Incidence of HIV-1 infection and effects of clinic-based counseling on HIV preventive behaviors among married women in northern Thailand. J Acquir Immun Defic Syndr. 2002;29(3):284-8.

25. Kiene SM, Bateganya M, Wanyenze R, Lule H, Nantaba H, Stein MD et al. Initial outcomes of provider-initiated routine HIV testing and counseling during outpatient care at a rural Ugandan hospital: risky sexual behavior, partner HIV testing, disclosure and HIV care seeking. AIDS Patient Care STDS. 2010;24:117-26.

26. Bentley ME, Spratt K, Shepherd ME, Gangakhedkar RR, Thilikavathi S, Bollinger RC et al. HIV testing and counseling among men attending sexually transmitted disease clinics in Pune, India: changes in condom use and sexual behavior over time. AIDS. 1998;12:1869-77.

27. Kamb ML, Fishbein M, Douglas JM Jr, Rhodes F, Rogers J, Bolan G et al. Efficacy of risk-reduction counseling to prevent human immunodeficiency virus and sexually transmitted diseases. JAMA. 1998;280(13):1161-7.

28. Metsch LR, Feaster DJ, Gooden L, Schackman BR, Matheson T, Das M et al. Effect of risk-reduction counseling with rapid HIV testing on risk of acquiring sexually transmitted infections: the AWARE randomized clinical trial. JAMA. 2013;310:1701-10.

29. Dilley JW, Woods WJ, Sabatino J, Lihatsh T, Adler B, Casey S et al. Changing sexual behavior among gay male repeat testers for HIV: a randomized, controlled trial of a single-session intervention. J Acquir Immune Defic Syndr. 2002;30(2):177-86.

30. Koblin B, Chesney M, Coates T; EXPLORE Study Team. Effects of a behavioral intervention to reduce acquisition of HIV infection among men who have sex with men: the EXPLORE randomised controlled study. Lancet. 2004;364:41-50.

31. Metsch LR, Feaster DJ, Gooden L, Matheson T, Mandler RN, Haynes L et al. Implementing rapid HIV testing with or without risk-reduction counseling in drug treatment centers: results of a randomized trial. Am J Public Health. 2012;102:1160-7.

32. Schackman BR, Metsch LR, Colfax GN, Leff JA, Wong A, Scott CA et al. The cost-effectiveness of rapid HIV testing in substance abuse treatment: results of a randomized trial. Drug Alcohol Depend. 2013;128:90-7.

33. Anaya HD, Hoang T, Golden JF, Goetz MB, Gifford A, Bowman C et al. Improving HIV screening and receipt of results by nurse-initiated streamlined counseling and rapid testing. J Gen Intern Med. 2008;23(6):800-7.

34. Figueroa C, Johnson C, Verster A, Baggaley R. Attitudes and acceptability on HIV self-testing among key populations: a literature review. AIDS Behav. 2015 Nov;19(11):1949-65.

35. Johnson CC, Kennedy C, Fonner V, Siegfried N, Figueroa C, Dalal S et al. Examining the effects of HIV self-testing compared to standard HIV testing services: a systematic review and meta-analysis. J Int AIDS Soc. 2017;20(1):21594.

36. Masters SH, Agot K, Obonyo B, Napierala Mavedzenge S, Maman S, Thirumurthy H. Promoting partner testing and couples testing through secondary distribution of HIV self-tests: a randomized clinical trial. Plos Med. 2016;13(11):e1002166.

37. Wang Z, Lau J, Ip M, Ho S. A randomized controlled trial evaluating efficacy of promoting a home-based HIV self-testing with online counseling on increasing HIV testing among men who have sex with men. AIDS Behav. 2018;22(1):190-201.

38. Jamil MS, Prestage G, Fairley CK, Grulich AE, Smith KS, Chen M et al. Effect of availability of HIV self-testing on HIV testing frequency in gay and bisexual men at high risk of infection (FORTH): a waiting-list randomised controlled trial. Lancet HIV. 2017;4(6):e241-50.

39. Katz D, Golden M, Hughes J, Farquhar C, Stekler J. HIV self-testing increases HIV testing frequency in high-risk men who have sex with men: a randomized controlled trial. J Acquir Immune Defic Syndr. 2018;78(5):505-12.

40. Balan IC, Carballo-Diéguez A, Frasca T, Dolezal C, Ibitoye M. The impact of rapid HIV home test use with sexual partners on subsequent sexual behavior among men who have sex with men. AIDS Behav. 2014;18:254-62.

41. Kumwenda M, Munthali A, Phiri M, Mwale D, Gutteberg T, MacPherson E et al. Factors shaping initial decision-making to self-test amongst cohabiting couples in urban Blantyre, Malawi. AIDS Behav. 2014;18(Suppl 4):S396-404.

42. Marks G, Crepaz N, Senterfitt JW, Janssen RS. Meta-analysis of high-risk sexual behaviour in persons aware and unaware they are infected with HIV in the United States. J Acquir Immune Defic Syndr. 2005;39:446-53.

43. Turner A, Miller WC, Padian NS, Kaufman JS, Behets FM, Chipato T et al. Unprotected sex following HIV testing among women in Uganda and Zimbabwe: short- and long-term comparisons with pre-test behaviour. Int J Epidemiol. 2009;38:997-1007.

44. Venkatesh K, de Bruyn G, Mayer KH, Cheng H, Blanchard K, Ramjee G et al. Changes in sexual risk behavior before and after HIV seroconversion in southern African women enrolled in a HIV prevention trial. J Acquir Immune Defic Syndr. 2011;57:435-41.

45. McClelland R, Hassan WM, Lavreys L, Richardson BA, Mandaliya K, Ndinya-Achola J et al. HIV-1 acquisition and disease progression are associated with decreased high-risk sexual behaviour among Kenyan female sex workers. AIDS. 2006;20:1969-73.

46. Rietmeijer CA. Risk reduction counselling for prevention of sexually transmitted infections: how it works and how to make it work. Sex Transm Infect. 2007;83:2-9.

47. Hao C, Huan X, Yan H, Yang H, Guan W, Xu X et al. A randomized controlled trial to evaluate the relative efficacy of enhanced versus standard voluntary counseling and testing on promoting condom use among men who have sex with men in China. AIDS Behav. 2012;16(5):1138-48.

48. Yang C, Tobin K, Latkin C. Perceived serosorting of injection paraphernalia sharing networks among injection drug users in Baltimore, MD. AIDS Behav. 2001;15:16-21.

49. Smith B, Jewett A, Burt RD, Zibbell JE, Yartel AK, DiNenno E. “To share or not to share?” Serosorting by hepatitis C status in the sharing of drug injection equipment among NHBS-IDU2 participants. J Infect Dis. 2013;208:1934-42.

50. Weller SC, Davis-Beaty K. Condom effectiveness in reducing heterosexual HIV transmission. Cochrane Database Syst Rev. 2002;1:CD003255.

51. Smith DK, Herbst JH, Zhang X, Rose CE. Condom effectiveness for HIV prevention by consistency of use among men who have sex with men in the United States. J Acquir Immune Defic Syndr. 2015;68(3):337-44.

52. Gallo M, Kilbourne-Brook M, Coffey PS. A review of the effectiveness and acceptability of the female condom for dual protection. Sexual Health. 2012;9:18-26.

53. Rehle TM, Hallett TB, Shisana O, Pillay-van Wyk V, Zuma K, Carrara H et al. A decline in new HIV infections in South Africa: estimating HIV incidence from three national HIV surveys in 2002, 2005 and 2008. PLoS One. 2010;5(6):e11094.

54. Charania MR, Crepaz N, Guenther-Gray C, Henny K, Liau A, Willis LA et al. Efficacy of structural-level condom distribution interventions: a meta-analysis of U.S. and international studies, 1998–2007. AIDS Behav. 2011;15(7):1283-97.

55. The business case for female condoms. Global Health Visions: New York; 2014.

56. Johnson LJ, Hallett TB, Rehle TM, Dorrington RE. The effect of changes in condom usage and antiretroviral treatment coverage on human immunodeficiency virus incidence in South Africa: a model-based analysis. J R Soc Interface. 2012;9(72):1544-54.

57. Phillips AN, Cambiano V, Nakagawa F, Brown AE, Lampe F, Rodger A et al. Increased HIV incidence in men who have sex with men despite high levels of ART-induced viral suppression: analysis of an extensively documented epidemic. PLoS ONE. 2013;8(2):e55312.

58. World Health Organization, United Nations Population Fund. Male latex condom: specification, prequalification and guidelines for procurement. Geneva: World Health Organization; 2013.

59. Carey F, Lytle CD, Cyr WH. Implications of laboratory tests of condom integrity. Sex Transm Dis. 1999;26(4):216-20.

60. Scientific evidence on condom effectiveness for sexually transmitted disease (STD) prevention. Bethesda (MD): National Institute of Allergy and Infectious Diseases; 2000.

61. Worth D. Sexual decision-making and AIDS: why condom promotion among vulnerable women is likely to fail. Stud Fam Plan. 1989;20:297-307.

62. Liu H, Morisky DE, Lin X, Ma E, Jiang B, Yin Y. Bias in self-reported condom use: association between over-reported condom use and syphilis in a three-site study in China. AIDS Behav. 2016;20(6):1343-52.

63. Detels R, English P, Visscher BR, Jacobson L, Kingsley LA, Chmiel JS et al. Seroconversion, sexual activity, and condom use among 2915 HIV seronegative men followed for up to 2 years. J Acquir Immune Defic Syndr. 1989;2:77-83.

64. Johnson WD, O'Leary A, Flores SA. Per-partner condom effectiveness against HIV for men who have sex with men. AIDS. 2018;32(11):1499-505).

65. De Vincenzi I. A longitudinal study of human immunodeficiency virus transmission by heterosexual partners. European Study Group on Heterosexual Transmission of HIV. N Engl J Med. 1994;331:341-6.

66. How to use a femidom. In: Terrance Higgins Trust [website]. London (UK): Terrence Higgins Trust; 8 June 2016 (http://www.tht.org.uk/sexual-health/Improving-your-sexual-health/Condoms/Using-a-femidom, accessed 3 April 2018).

67. Post-exposure prophylaxis. In: Terrance Higgins Trust [website]. London (UK): Terrence Higgins Trust; 7 April 2016 (http://www.tht.org.uk/sexual-health/about-hiv/post-exposure-prophylaxis, accessed 3 April 2018).

68. Pinkerton SD, Abramson PR. Effectiveness of condoms in preventing HIV transmission. Soc Sci Med. 1997;44(9):1303-12.

69. Ahmed S, Lutalo T, Wawer M, Serwadda D, Sewankambo NK, Nalugoda F et al. HIV incidence and sexually transmitted disease prevalence associated with condom use: a population study in Rakai, Uganda. AIDS. 2001 Nov 9;15(16):2171-9.

70. Stoneburner RL, Low-Beer D. Population-level HIV declines and behavioural risk avoidance in Uganda. Science. 2004;304(5671):714-8.

71. Halperin D, Mugurungi O, Hallett TB, Muchini B, Campbell B, Magure T et al. A surprising prevention success: why did the HIV epidemic decline in Zimbabwe? PLoS Med. 2011;8(2):e1000414.

72. Rojanapithayakorn W. The 100% condom use programme in Asia. Reprod Health Matters. 2008;14(28):41-52.

73. Kumar R, Jha P, Arora P, Mony P, Bhatia P, Millson P et al. Trends in HIV-1 in young adults in South India from 2000 to 2004: a prevalence study. Lancet. 2006;367:1164-72.

74. The gap report. Geneva: UNAIDS; 2014.

75. Frasca T. AIDS in Latin America. New York: Palgrave Macmillan (US); 2005.

76. Catania J, Coates TJ, Stall R, Bye L, Kegeles SM, Capell F et al. Changes in condom use among homosexual men in San Francisco. Health Psychol. 1991;10(3):190-9.

77. Hunt AJ, Weatherburn P, Hickson FC, Davies PM, McManus TJ, Coxon AP. Changes in condom use by MSM. AIDS Care. 1993;5(4):439-48.

78. Michielsen K, Chersich MF, Luchters S, De Koker P, Van Rossem R, Temmerman M. Effectiveness of HIV prevention for youth in sub-Saharan Africa: a systematic review of randomized and non-randomized studies. AIDS. 2010;25(4):1193-1202.

79. Foss AM, Hossain M, Vickerman PT, Watts CH. A systematic review of published evidence on intervention impact on condom use in sub-Saharan Africa and Asia. Sex Transm Infect. 2007:83(7):510-6.

80. Halli SS, Ramesh BM, O'Neil J, Moses S, Blanchard JF. The role of collectives in STI and HIV/AIDS prevention work among female sex workers in Karnataka, India. AIDS Care. 2006;18(7):739-49.

81. Adamchak S, Janowitz B, Liku J, Munyambanza E, Grey T, Keyes E. Study of family planning and HIV integrated services in five countries: final report. Research Triangle Park (NC): Family Health International; 2010.

82. Penman-Aguilar A, Hall J, Artz L, Crawford MA, Peacock N, van Olphen J et al. Presenting the female condom to men: a dyadic analysis of effect of the woman's approach. Women Health. 2002;35(1):37-51.

83. Ankrah EM, Attika SA. Adopting the female condom in Kenya and Brazil: perspectives of women and men. A synthesis. Arlington (VA): Family Health International; 1997.

84. World Health Organization, United Nations Office for Disarmament Affairs, UNAIDS. Effectiveness of interventions to manage HIV in prisons—provision of condoms and other measures to decrease sexual transmission. Geneva: World Health Organization; 2007.

85. Kennedy C, Medley AM, Sweat MD, O'Reilly KR. Behavioural interventions for HIV-positive prevention in developing countries: a systematic review and meta-analysis. Bull World Health Org. 2010;88:615-23.

86. Smoak ND, Scott-Sheldon LA, Johnson BT, Carey MP. Sexual risk reduction interventions do not inadvertently increase the overall frequency of sexual behavior: a meta-analysis of 174 studies with 116,735 participants. J Acquir Immune Defic Syndr. 2006;41(3):374-84.

87. Comprehensive condom programming: a guide for resource mobilization and country programming. New York: United Nations Population Fund; 2011.

88. Reece M, Herbenick D, Dodge B. Penile dimensions and men’s perceptions of condom fit and feel. Sex Transm Infect. 2009;85:127-31.

89. Crosby RA, Yarber WL, Sanders SA, Graham CA, McBride K, Milhausen RR et al. Men with broken condoms. Who and why? Sex Transm Infect. 2007 Feb;83(1):71-5.

90. Schiller B. 8 amazing condom concepts that actually feel good, funded by the Gates Foundation. In: Fast Company [Internet]. 20 November 2013 (https://www.fastcompany.com/3021941/8-amazing-condom-concepts-that-actually-feel-good-funded-by-the-gates-foundation, accessed 3 April 2018).

91. Braunstein S, Van de Wijgert J. Preferences and practices related to vaginal lubrication: implications for microbicide acceptability and clinical testing. J Womens Health (Larchmt). 2005;14(5):324-33.

92. Albert AE, Warner DL, Hatcher RA, Trussell J, Bennett C. Condom use among female commercial sex workers in Nevada's legal brothels. Am J Public Health. 1995;85:1514-20.

93. Javanbakht M, Murphy R, Gorbach P, LeBlanc MA, Pickett J. Preference and practices relating to lubricant use during anal intercourse: implications for rectal microbicides. Sex Health. 2010;7:193-8.

94. Golombok S, Harding R, Sheldon J. An evaluation of a thicker versus a standard condom with MSM. AIDS. 2001;15(2):245-50.

95. Wang L, Schnaare RL, Dezzutti C, Anton PA, Rohan LC. Rectal microbicides: clinically relevant approach to the design of rectal specific placebo formulations. AIDS Res Ther. 2011;8:12.

96. Dezzutti CS, Brown ER, Moncla B, Russo J, Cost M, Wang L et al. Is wetter better? An evaluation of over-the-counter lubricant gels for safety and anti-HIV-1 activity. PLoS ONE. 2012;7(11):e48328.

97. Use and procurement of additional lubricants for male and female condoms: WHO/UNFPA/FHI360. Advisory note. Geneva: WHO; 2012.

98. Sweat MD, Denison J, Kennedy C, Tedrow V, O'Reilly K. Effects of condom social marketing on condom use in developing countries: a systematic review and meta-analysis, 1990–2010. Bull World Health Organ. 2012;90:613-22A.

99. Babalola S, Figueroa ME, Krenn S. Association of mass media communication with contraceptive use in sub-Saharan Africa: a meta-analysis of Demographic and Health Surveys. J Health Commun. 2017;22:11:885-95.

100. Telles Dias PR, Souto K, Page-Shafer K. Long-term female condom use among vulnerable populations in Brazil. AIDS Behav. 2006;10:S67-75.

101. Dowdy DW, Sweat MD, Holtgrave DR. Country-wide distribution of the nitrile female condom (FC2) in Brazil and South Africa: a cost-effectiveness analysis. AIDS. 2006;20(16):2091-8.

102. UK Department for International Development (DfID). Making markets for health services work better: the contribution of social marketing. Notes of a meeting, April 22–23, 2004. London: DfID Health Systems Resource Centre; 2004.

103. Honeyman SW. One size doesn't fit all: why different implementation models are needed for different social marketing health interventions. PSP-One Online Social Marketing Conference, 10–17 March 2008.

104. Chapman S, Jafa K, Longfield K, Vielot N, Buszin J, Ngamkitpaiboon L et al. Condom social marketing in sub-Saharan Africa and the total market approach. Sex Health. 2012;9(1):44-50.

105. Creese A, Floyd K, Alban A, Guinness L. Cost-effectiveness of HIV/AIDS interventions in Africa: a systematic review of the evidence. Lancet. 2002;359(9318):1635-43.

106. Katz MH, Schwarcz SK, Kellogg TA, Klausner JD, Dilley JW, Gibson S et al. Impact of highly active antiretroviral treatment on HIV seroincidence among men who have sex with men: San Francisco. Am J Public Health. 2002;92(3):388-94.

107. Centers for Disease Control and Prevention. HIV testing and risk behaviours among gay, bisexual and other men who have sex with men—United States. MMWR. 2013;62(47):958-62.

108. Wellings K. Evaluating AIDS public education in Europe: a cross-national comparison. In: Hornik RC, editor. Public health communication: evidence for behavior change. Hillsdale (NJ): Lawrence Erlbaum Associates; 2002:131-46.

109. Noar SM, Zimmerman RS. Health behavior theory and cumulative knowledge regarding health behaviours: are we moving in the right direction? Health Educ Res. 2005;20(3):275-90.

110. Bertrand JT, O'Reilly K, Denison J, Anhang R, Sweat M. Systematic review of the effectiveness of mass communication programs to change HIV/AIDS-related behaviors in developing countries. Health Educ Res. 2006;21:567-97.

111. Freimuth VS, Hammond SL, Edgar T, Monahan JL. Reaching those at risk: a content-analytic study of AIDS PSAs. Communication Research. 1990;17(6):775-91.

112. Green EC, Halperin DT, Nantulya V, Hogle JA. Uganda's HIV prevention success: the role of sexual behavior change and the national response. AIDS Behav. 2006;10(4):335-46.

113. Slavin S, Batrouney C, Murphy D. Fear appeals and treatment side-effects: an effective combination for HIV prevention? AIDS Care. 2007 Jan;19(1):130-7.

114. LaCroix JM, Snyder LB, Huedo-Medina TB, Johnson BT. Effectiveness of mass media interventions for HIV prevention, 1986–2013: a meta-analysis. J Acquir Immune Defic Syndr. 2014;66:S329-40.

115. Piotrow PT, Kincaid DL, Rimon JG II, Rinehart W, Cline RJ. Health communication: lessons from family planning and reproductive health. Westport (CT): Praeger; 1997.

116. Noar S, Palmgreen P, Chabot M, Dobransky N, Zimmerman RS. A 10-year systematic review of HIV/AIDS mass communication campaigns: have we made progress? J Health Commun. 2009;14:15-42.

117. Bekalu MA, Eggermont S. Advancing HIV/AIDS combination prevention through mass media: a review practices in sub-Saharan Africa. Information Development. 2012;28(3):189-98.

118. Head R, Murray J, Sarrassat S, Snell W, Meda N, Ouedraogo M et al. Can mass media interventions reduce child mortality? Lancet. 2015;386(9988):97-100.

119. Hutton G, Wyss K, Diekhor YN. Prioritization of prevention activities to combat the spread of HIV/AIDS in resource constrained settings: a cost-effectiveness analysis from Chad, Central Africa. Int J Health Plann Manage. 2003;18:117-36.

120. Hogan DR, Baltussen R, Hayashi C, Lauer JA, Salomon JA. Achieving the millennium development goals for health: cost effectiveness analysis of strategies to combat HIV/AIDS in developing countries. BMJ. 2005. doi:10.1136/bmj.38643.368692.68

121. Kim YM, Kols A, Nyakauru R, Marangwanda C, Chibatamoto P. Promoting sexual responsibility among young people in Zimbabwe. International Family Planning Perspectives. 2001;27:11-19.

122. Ross MW, Chatterjee NS, Leonard L. A community level syphilis prevention programme: outcome data from a controlled trial. Sex Transm Infect. 2004;80:100-4.

123. Vaughan PW, Rogers EM, Singhal A, Swalehe RM. Entertainment–education and HIV/AIDS preventions: a field experiment in Tanzania. J Health Commun. 2000;5(Suppl):81-100.

124. Xiaoming S, Yong W, Choi K, Lurie P, Mandel J. Integrating HIV prevention education into existing family planning services: results of a controlled trial of a community-level intervention for young adults in rural China. AIDS Behav. 2000;4:103-10.

125. Zimmerman RS, Palmgreen P, Noar SM, Lustria MLA, Lu HY, Horosewski ML. Effects of a televised two-city safer sex mass media campaign targeting high sensation-seeking and impulsive decision-making young adults. Health Educ Behav. 2007;34:810-26.

126. Schopper D, Doussantousse S, Ayiga N, Ezatirale G, Idro WJ, Homsy J. Village-based AIDS prevention in a rural district in Uganda. Health Policy Plan. 1995;10:171-80.

127. Vernon R, Ojeda G, Murad R. Incorporating AIDS prevention activities into family planning organization in Colombia. Stud Fam Plann. 1990;21:335-43.

128. Post-intervention survey report: HIV/AIDS/STI knowledge, attitudes and practice (KAP) survey among commercial sex workers, military and youth in Port Loko, Sierra Leone. Refugee Studies Centre. Freetown (Sierra Leone) and Minneapolis: American Refugee Committee International; 2003.

129. The One Love campaign in southern Africa. What has been achieved so far? Interim evaluation. Johannesburg: Soul City Institute; 2012.

130. Astatke H, Greiner K, Costenbader E, Meyanathan S. Multiple and concurrent sexual partnerships in generalized HIV epidemics in southern and East Africa: a desk review of communication interventions to identify lessons learned for strengthening future HIV behavioral prevention programs. Washington (DC): C-Change Project, FHI 360; 2012.

131. Figueroa ME, Kincaid DL. Evaluating the impact of a communication campaign on multiple sex partnerships in Mozambique. Final report. February 2014. Baltimore: USAID, Project SEARCH, Research to Prevention; 2013.

132. Sood S, Shefner-Rogers CL, Sengupta M. The impact of a mass media campaign on HIV/AIDS knowledge and behavior change in North India: results from a longitudinal study. Asian J Commun. 2006;16:231-50.

133. Tian L, Tang S, Cao W, Zhang K, Li V, Detels R. Evaluation of a web-based intervention for improving HIV/AIDS knowledge in rural Yunnan, China. AIDS. 2007;21(Suppl 8):S137-42.

134. Bekalu MA, Eggermont S, Ramanadhan S, Viswanath K. Effect of media use on HIV-related stigma in sub-Saharan Africa: a cross-sectional study. PLoS ONE. 2014;9(6):e100467.

135. Kerr JC, Valois RF, DiClemente RJ, Carey MP, Stanton B, Romer D et al. The effects of a mass media HIV-risk reduction strategy on HIV-related stigma and knowledge among African American adolescents. AIDS Patient Care STDS. 2015 Mar;29(3):150-6.

136. Vidanapathirana J, Abramson MJ, Forbes A, Fairley C. Mass media interventions for promoting HIV testing. Cochrane Database of Syst Rev. 2005;20:CD004775.

137. French RS, Bonell C, Wellings K, Weatherburn P. An exploratory review of HIV prevention mass media campaigns targeting men who have sex with men. BMC Public Health. 2014;14:616.

138. Hilliam A, Fraser L, Turner L. HIV Wake-Up campaign. Edinburgh: NHS Health Scotland; 2011.

139. Hartfield K, Burt R, Thiede H. “It’s the little prick you can deal with”—evaluation of an HIV testing promotion campaign. Washington State: Seattle and King County; 2009.

140. Katzman J, Gulati H, Higa DH, Welch Q, Wood RW. A “community manifesto” for gay and bisexual men: an appeal to control HIV/STDs. J Public Health Manage Pract. 2007;13(3):244-51.

141. McOwan A, Gilleece Y, Chislett L, Mandalia S. Can targeted HIV testing campaigns alter health-seeking behavior? AIDS Care. 2002;14:385-90.

142. Sherr L, Nardone A, Leaity S, Wells H, Mercey D, Elford J. “Try this HIV test”—an evaluation of a mass media campaign targeting homosexual men. Sex Transm Inf. 1999;75(4):273.

143. Griffith R, Mandalia S, Beck EJ, Kenny C, Watkins P, Claydon E et al. HIV media campaigns and HIV-1 testing trends at a London genitourinary medicine clinic, 1985–1993. AIDS. 1995;9(12):1367-72.

144. Sgaier SK, Reed JB, Thomas A, Njeuhmeli E. Achieving the HIV prevention impact of voluntary medical male circumcision: lessons and challenges for managing programs. PLoS Med. 2014;11(5):e1001641.

145. Wei C, Herrick A, Raymond HF, Anglemyer A, Gerbase A, Noar SM et al. Social marketing interventions to increase HIV/STI testing uptake among men who have sex with men and male-to-female transgender women. Cochrane Database of Syst Rev. 2011;9:CD009337.

146. Guy R, Goller J, Thorpe R, Grierson J, Batrouney C, Kennedy M et al. No increase in HIV or sexually transmissible infection testing following a social marketing campaign among men who have sex with men. J Epidemiol Community Health. 2009;63:391-6.

147. Darrow WW, Biersteker S. Short-term impact evaluation of a social marketing campaign to prevent syphilis among men who have sex with men. Am J Public Health. 2008;98:337-43.

148. Guse K, Levine D, Martins S, Lira A, Gaarde J, Westmorland W et al. Interventions using new digital media to improve adolescent sexual health: a systematic review. J Adolesc Health. 2012;51(6):535-43.

149. Tortolero SR, Markham CM, Peskin MF, Shegog R, Addy RC, Escobar-Chaves SL et al. It's Your Game: Keep It Real: delaying sexual behavior with an effective middle school program. J Adolesc Health. 2010;46:169-79.

150. Schnall R, Travers J, Rojas M, Carballo-Diéguez A. eHealth interventions for HIV prevention in high-risk men who have sex with men: a systematic review. J Med Internet Res. 2014;16:e134.

151. Hirshfield S, Chiasson MA, Joseph H, Scheinmann R, Johnson WD, Remien RH et al. An online randomized controlled trial evaluating HIV prevention digital media interventions for men who have sex with men. PLoS ONE. 2012;7:e46252.

152. King E. Safety in numbers: safer sex and gay men. London (UK): Routledge; 1994.

153. Asiimwe-Okiror G, Opio A, Musinguzi J, Madraa E, Tembo G, Carael M. Change in sexual behaviour and decline in HIV infection among young pregnant women in urban Uganda. AIDS. 1997;11(14):1757-63.

154. Scott-Sheldon L, Huedo-Medina TB, Warren MR, Johnson BT, Carey MP. Efficacy of behavioral interventions to increase condom use and reduce sexually transmitted infections: a meta-analysis, 1991 to 2010. J Acquir Immune Defic Syndr. 2011;15:489-98.

155. Fonner VA, Kennedy CE, O'Reilly KR, Sweat MD. Systematic assessment of condom use measurement in evaluation of HIV prevention interventions: need for standardization of measures. AIDS Behav. 2014;18(22):2374-86.

156. Albarracin D, Gillette JC, Earl AN, Glasman LR, Durantini MR, Ho MH. A test of major assumptions about behavior change: a comprehensive look at the effects of passive and active HIV-prevention interventions since the beginning of the epidemic. Psychol Bull. 2005;131(6):856-97.

157. Jones D, Ross D, Weiss SM, Bhat G, Chitalu N. Influence of partner participation on sexual risk behavior reduction among HIV-positive Zambian women. J Urban Health. 2005;82(3 Suppl 4):iv92-100.

158. Townsend L, Matthews C, Zembe Y. A systematic review of behavioural interventions to prevent HIV infection and transmission among heterosexual adult men in low- and middle-income countries. Prev Sci. 2013;14(1):88-105.

159. Simbayi LC, Kalichman S, Skinner D, Jooste S, Cain D, Cherry C et al. Theory-based HIV risk reduction counselling for sexually transmitted infection clinic patients in Cape Town, South Africa. Sex Transm Dis. 2004;31:727-33.

160. Kalichman S, Simbayi LC, Vermaak R, Cain D, Jooste S, Peltzer K. HIV/AIDS risk reduction counselling for alcohol using sexually transmitted infections clinic patients in Cape Town, South Africa. J Acquir Immune Defic Syndr. 2007;44:594-600.

161. Fisher J, Fisher WA, Cornman DH, Amico RK, Bryan A, Friedland GH. Clinician-delivered intervention during routine clinical care reduces unprotected sexual behaviour among HIV-infected patients. J Acquir Immune Defic Syndr. 2006;41:44-52.

162. Cornman D, Kiene SM, Christie S, Fisher WA, Shuper PA, Pillay S et al. Clinic-based intervention reduces unprotected sexual behavior among HIV-infected patients in KwaZulu-Natal, South Africa: results of a pilot study. J Acquir Immune Defic Syndr. 2008;48:553-60.

163. Wong E, Roddy RE, Tucker H, Tamoufé U, Ryan K, Ngampoua F et al. Use of male condoms during and after randomized, controlled trial participation in Cameroon. Sex Transm Dis. 2005;32(5):300-07.

164. Bing EG, Cheng KG, Ortiz DJ, Ovalle-Bahamón RE, Ernesto F, Weiss RE et al. Evaluation of a prevention intervention to reduce HIV risk among Angolan soldiers. AIDS Behav. 2008;12(3):384-95.

165. Cornman D, Schmiege SJ, Bryan A, Benziger TJ, Fisher JD. An information–motivation–behavioral skills model-based HIV prevention intervention for truck drivers in India. Soc Sci Med. 2007;64(8):1572–84.

166. Jewkes R, Nduna M, Levin J, Jama N, Dunkle K, Puren A et al. Impact of Stepping Stones on incidence of HIV and HSV-2 and sexual behaviour in rural South Africa: cluster randomised control trial. BMJ. 2008;337:a506.

167. Crepaz N, Tungol-Ashmon MV, Higa DH, Vosburgh W, Mullins MM, Barham T et al. A systematic review of interventions for reducing HIV risk behaviors among people living with HIV in the United States, 1988–2012. AIDS. 2014;28(5):633-56.

168. Impact assessment of the expanded support programme: Zimbabwe. Harare: Health Partners International; 2011 (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/197475/ESP-Impact-Assessment-zimb-11.pdf, accessed 8 July 2016).

169. Solomon J, Card JJ, Malow RM. Adapting efficacious interventions: advancing translational research in HIV prevention. Eval Health Prof. 2006;29:162-94.

170. Behavior change and HIV prevention: (re)considerations for the 21st century. Global HIV Prevention Working Group; 2008.

171. Burton J, Darbes LA, Operario D. Couples-focused behavioral interventions for prevention of HIV: systematic review of the state of evidence. AIDS Behav. 2010;14(1):1–10.

172. Johnson TB, Carey MP, Chaudoir SR, Reid AE. Sexual risk reduction for persons living with HIV: research synthesis of randomized controlled trials, 1993–2004. J Acquir Immune Defic Syndr. 2006;41(5):642-50.

173. Carvalho FT, Gonçalves TR, Faria ER, Shoveller JA, Piccinini CA, Ramos MC et al. Behavioral interventions to promote condom use among women living with HIV. Cochrane Database Syst Rev. 2011;(9):CD007844.

174. Darbes L, Crepaz N, Lyles C, Kennedy G, Rutherford G. The efficacy of behavioral interventions in reducing HIV risk behaviors and incident sexually transmitted diseases in heterosexual African Americans. AIDS. 2008;22(10):1177–94.

175. Herbst J, Beeker C, Mathew A, McNally T, Passin WF, Kay LS et al. The effectiveness of individual-, group-, and community-level HIV behavioral risk-reduction interventions for adult men who have sex with men: a systematic review. Am J Prev Med. 2007;32(4 Suppl):S38-67.

176. Sullivan P, Carballo-Diéguez A, Coates T, Goodreau SM, McGowan I, Sanders EJ et al. Successes and challenges of HIV prevention in men who have sex with men. Lancet. 2012;380(9839):388-99.

177. Koblin B, Husnik MJ, Colfax G, Huang Y, Madison M, Mayer K et al. Risk factors for HIV infection among men who have sex with men. AIDS. 2006;20(5):731-9.

178. Shahmanesh M, Patel V, Mabey D, Cowan F. Effectiveness of interventions for the prevention of HIV and other sexually transmitted infections in female sex workers in resource poor setting: a systematic review. Trop Med Int Health. 2008;13(5):659-79.

179. Wariki W, Ota E, Mori R, Koyanagi A, Hori N, Shibuya K. Behavioral interventions to reduce the transmission of HIV infection among sex workers and their clients in low- and middle-income countries. Cochrane Database Syst Rev. 2012;2:CD005272.

180. Patterson T, Mausbach B, Lozada R, Staines-Orozco H, Semple SJ, Fraga-Vallejo M et al. Efficacy of a brief behavioral intervention to promote condom use among female sex workers in Tijuana and Ciudad Juarez, Mexico. Am J Public Health. 2008;98(11):2051-7.

181. Mavedzenge S, Luecke E, Ross DA. Effectiveness of HIV prevention, treatment and care interventions among adolescents: a systematic review of systematic reviews. New York: United Nations Children's Fund; 2013.

182. Underhill K, Montgomery P, Operario D. Sexual abstinence only programmes to prevent HIV infection in high income countries: systematic review. BMJ. 2007. ;335(7613):248.

183. Underhill K, Operario D, Montgomery P. Systematic review of abstinence-plus HIV prevention programs in high-income countries. PLoS Med. 2007;4(9):e275.

184. Ross DA, Changalucha J, Obasi AI, Todd J, Plummer ML, Cleophas-Mazige B et al. Biological and behavioural impact of an adolescent sexual health intervention in Tanzania: a community-randomized trial. AIDS. 2007;21(14):1943-55.

185. Doyle AM, Ross DA, Maganja K, Baisley K, Masesa C, Andreasen A et al. Long-term biological and behavioural impact of an adolescent sexual health intervention in Tanzania: follow-up survey of the community-based MEMA kwa Vijana trial. PLoS Med. 2010;7:e1000287.

186. Wight D, Plummer M, Ross D. The need to promote behaviour change at the cultural level: one factor explaining the limited impact of the MEMA kwa Vijana adolescent sexual health intervention in rural Tanzania. A process evaluation. BMC Public Health. 2012;12:788.

187. Dupas P. Do teenagers respond to HIV risk information? Evidence from a field experiment in Kenya. American Economic Journal: Applied Economics. 2011;3(1):1–34.

188. Fonner VA, Armstrong KS, Kennedy CE, O'Reilly KR, Sweat MD. School based sex education and HIV prevention in low- and middle-income countries: a systematic review and meta-analysis. PLoS ONE. 2014;9(3):e89692.

189. Medley A, Kennedy CE, O'Reilly KR, Sweat MD. Effectiveness of peer education interventions for HIV prevention in developing countries: a systematic review and meta-analysis. AIDS Educ Prev. 2009;21:181-206.

190. Simoni J, Nelson KM, Franks JC, Yard SS, Lehavot K. Are peer interventions for HIV efficacious? A systematic review. AIDS Behav. 2011;15:1589-95.

191. Tolli MV. Effectiveness of peer education interventions for HIV prevention, adolescent pregnancy prevention and sexual health promotion for young people: a systematic review of European studies. Health Educ Res. 2012:27;904-13.

192. Stephenson J, Strange V, Allen E, Copas A, Johnson A, Bonell C et al. The long-term effects of a peer-led sex education programme (RIPPLE): a cluster randomised trial in schools in England. PLoS Med. 2008;5(11):e224.

193. Sweat M, Morin S, Celentano D, Mulawa M, Singh B, Mbwambo J et al. Community-based intervention to increase HIV testing and case detection in people aged 16–32 years in Tanzania, Zimbabwe, and Thailand (NIMH Project Accept, HPTN 043): a randomised study. Lancet Infect Dis. 2011;11(7):525–32.

194. Cowan F, Pascoe SJ, Langhaug LF, Mavhu W, Chidiya S, Jaffar S et al. The Regai Dzive Shiri Project: results of a randomized trial of an HIV prevention intervention for youth. AIDS. 2010;24:2541-52.

195. Palmateer N, Kimber J, Hickman M, Hutchinson S, Rhodes T, Goldberg D. Evidence for the effectiveness of sterile injecting equipment provision in preventing hepatitis C and human immunodeficiency virus transmission among injecting drug users: a review of reviews. Addiction. 2010;105:844.

196. Haberland NA. The case for addressing gender and power in sexuality and HIV education: a comprehensive review of evaluation studies. Int Perspect Sex Reprod Health. 2015 Mar;41(1):31–42.

197. Hallett TB, Gregson S, Lewis JJ, Lopman BA, Garnett GP. Behaviour change in generalised HIV epidemics: impact of reducing cross-generational sex and delaying age at sexual debut. Sex Transm Infect. 2007 Aug;83(Suppl 1):i50-54.

198. Luke N. Confronting the “sugar daddy” stereotype: age and economic asymmetries and risky sexual behavior in urban Kenya. Int Fam Plan Perspect. 2005;31(1):6-14.

199. De Neve JW, Fink G, Subramanian SV, Moyo S, Bor J. Length of secondary schooling and risk of HIV infection in Botswana: evidence from a natural experiment. Lancet Glob Health. 2015;3(8):e470-7.

200. Pettifor A. Unpacking the results of HPTN 068: a randomized controlled cash transfer trial to prevent HIV infection in young women in South Africa [presentation] (http://strive.lshtm.ac.uk/sites/strive.lshtm.ac.uk/files/HIV%20prevention%20for%20young%20South%20African%20women%20Lessons%20from%20Swa%20Koteka.pdf, accessed 28 March 2018).

201. Hargreaves JR, Bonell CP, Boler T, Boccia D, Birdthistle I, Fletcher A et al. Systematic review exploring time trends in the association between educational attainment and risk of HIV infection in sub-Saharan Africa. AIDS. 2008 Jan 30;22(3):403-14.

202. Campbell C, Cornish F. Towards a "fourth generation" of approaches to HIV/AIDS management: creating contexts for effective community mobilisation. AIDS Care. 2010;22:1569-79.

203. Guidelines for second generation HIV surveillance: an update: Know Your Epidemic. Geneva: World Health Organization; 2013.

204. World Health Organization, UNAIDS. Prevention and treatment of HIV and other sexually transmitted infections for sex workers in low- and middle-income countries. Geneva: World Health Organization; 2012.

205. NIMH Collaborative HIV/STD Prevention Trial Group. Results of the NIMH collaborative HIV/sexually transmitted disease prevention trial of a community popular opinion leader intervention. J Acquir Immune Defic Syndr. 2010;54:204-14.

206. Kelly JA, St. Lawrence JS, Diaz YE, Stevenson LY, Hauth AC, Brasfield TL et al. HIV risk behavior reduction following intervention with key opinion leaders of population: an experimental analysis. Am J Public Health. 1991 Feb;81(2):168-71.

207. Rogers E. Diffusion of innovations, fourth edition. New York: The Free Press, 2010.

208. NIMH Collaborative HIV/STD Prevention Trial Group. Formative study conducted in five countries to adapt the community popular opinion leader intervention. AIDS. 2007;21:S91-8.

209. Cornish F, Priego-Hernandez J, Campbell C, Mburu G, McLean S. The impact of community mobilisation on HIV prevention in middle and low income countries: a systematic review and critique. AIDS Behav. 2014;18(11):2110-34.

210. Padian N, McCoy SI, Balkus JE, Wasserheit JN. Weighing the gold in the gold standard: challenges in HIV prevention research. AIDS. 2010;24:621-35.

211. Sweat MD, Denison JA. Reducing HIV incidence in developing countries with structural and environmental interventions. AIDS. 1995;9 Suppl A:S251-7.

212. Tawil O, Verster AD, O'Reilly KR. Enabling approaches in HIV/AIDS prevention: influencing the social and environmental determinants of risk. AIDS. 1995;9:1299-306.

213. Bastagli F, Hagen-Zanker J, Harman L, Sturge G, Barca V, Schmidt T, et al. Cash transfers: what does the evidence say? A rigorous review of impacts and the role of design and implementation features. London: Overseas Development Institute; 2016.

214. Pettifor A MacPhail C, Nguyen N, Rosenberg M. Can money prevent the spread of HIV? A review of cash payments for HIV prevention. AIDS Behav. 2012;16:1729-38.

215. Baird S, Garfein RS, McIntosh CT, Ozler B. Effect of a cash transfer programme for schooling on prevalence of HIV and herpes simplex type 2 in Malawi: a cluster randomised trial. Lancet. 2012;379:1320–1329.

216. Handa S, Halpern CT, Pettifor A, Thirumurthy H. The Government of Kenya's cash transfer program reduces the risk of sexual debut among young people age 15–25. PLoS ONE. 2014;9:e85473.

217. Cluver L, Boyes M, Orkin M, Pantelic M, Molwena T, Sherr L. Child-focused state cash transfers and adolescent risk of HIV infection in South Africa: a propensity-score-matched case-control study. Lancet Glob Health. 2013:1(6):e362-70.

218. Pettifor A, MacPhail C, Hughes JP, Selin A, Wang J, Gómez-Olivé F et al. The effect of a conditional cash transfer on HIV incidence in young women in rural South Africa (HPTN 068): a phase 3, randomised controlled trial. Lancet Glob Health. 2016;4(12):e978-88.

219. Abdool Karim Q, Leask K, Kharsany AB, Humphries H, Ntombela F, Samsunder N et al. Impact of conditional cash incentives on HSV-2 and HIV prevention in rural South African high school students: results of the CAPRISA 007 cluster randomized controlled trial. Eighth International AIDS Society Conference on HIV Pathogenesis, Treatment and Prevention. Vancouver, British Columbia, Canada, 19–22 July 2015. Abstract TUAC0101LB.

220. Björkman-Nyqvist M, Corno L, de Walque D, Svensson J. Using lotteries to incentivize safer sexual behavior evidence from a randomized controlled trial on HIV prevention. Policy research working paper 7215. Washington (DC): World Bank Group, Development Research Group; 2015.

221. de Walque D, Dow WH, Nathan R, Abdul R, Abilahi F, Gong E et al. 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.

222. de Walque D, Dow W, Nathan R, Abudl R, Abilahi F, Gong E et al. Evaluating conditional cash transfers for HIV/STI prevention in rural Tanzania: one-year post-intervention follow-up. Population Association of America 2012 Annual Meeting. San Francisco, United States, 2012.

223. Packel L, Keller A, Dow WH, de Walque D, Nathan R, Mtenga S. Evolving strategies, opportunistic implementation: HIV risk reduction in Tanzania in the context of an incentive-based HIV prevention intervention. PLoS One. 2012;7:e44058.

224. Practical guidelines for intensifying HIV prevention: towards universal access. Geneva: UNAIDS; 2007.

225. McCoy SI, Kangwende RA, Padian NS. Behavior change interventions to prevent HIV among women living in low and middle income countries. New Delhi: International Initiative for Impact Evaluation (3ie); 2009.

226. Jana S, Basu I, Rotheram-Borus MJ, Newman PA. The Sonagachi project: a sustainable community intervention program. AIDS Educ Prev. 2004;16(5):405–14.

227. Jana S, Singh S. Beyond medical model of STD intervention—lessons from Sonagachi. Indian J Public Health. 1995;39:125–31.

228. Campbell C. Letting them die: how HIV/AIDS prevention programmes often fail. London: James Currey; 2003.

229. Heise L, Lutz B, Ranganathan M, Watts C. Cash transfers for HIV prevention: considering their potential. J Int AIDS Soc. 2013;16:18615.

230. Lagarde M, Haines A, Palmer N. The impact of conditional cash transfers on health outcomes and use of health services in low and middle income countries. Cochrane Database Syst Rev. 2009;7:CD008137.

231. Prendergast M, Podus D, Finney J, Greenwell L, Roll J. Contingency management for treatment of substance use disorders: a meta-analysis. Addiction. 2006;101:1546–60.

232. Lee R, Cui RR, Muessig KE, Thirumurthy H, Tucker JD. Incentivizing HIV/STI testing: a systematic review of the literature. AIDS Behav. 2014;18:905–12.

233. Gregson S, Adamson S, Papaya S, Mundondo J, Nyamukapa CA, Mason PR et al. Impact and process evaluation of integrated community and clinic-based HIV-1 control: a cluster-randomised trial in eastern Zimbabwe. PLoS Med. 2007;4:e102.

234. Celentano D, Bond KC, Lyles CM, Eiumtrakul S, Go VF, Beyrer C et al. Preventive intervention to reduce sexually transmitted infections: a field trial in the Royal Thai Army. Arch Intern Med. 2000;160:535–40.

235. Chandrasekaran P, Dallabetta G, Loo V, Mills S, Saidel T, Adhikary R et al. Evaluation design for large-scale HIV prevention programmes: the case of Avahan, the India AIDS initiative. AIDS. 2008;22:S1-15.

236. Deering KN, Boily MC, Lowndes CM, Shoveller J, Tyndall MW, Vickerman P et al. A dose-response relationship between exposure to a large-scale HIV preventive intervention and consistent condom use with different sexual partners of female sex workers in southern India. BMC Public Health. 2011;11:S8.

237. Boily MC, Pickles M, Lowndes CM, Ramesh BM, Washington R, Moses S et al. Positive impact of a large-scale HIV prevention programme among female sex workers and clients in South India. AIDS. 2013:27;1449–60.

238. Rajaram SP, Banandur P, Thammattoor UK, Thomas T, Mainkar MK, Paranjape R et al. Two cross-sectional studies in South India assessing the effect of an HIV prevention programme for female sex workers on reducing syphilis among their clients. Sex Transm Infect. 2014;90:556-62.

239. Ng M, Gakidou E, Levin-Rector A, Khera A, Murray CJ, Dandona L. Assessment of population-level effect of Avahan, an HIV-prevention initiative in India. Lancet. 2011;378:1643–52.

240. Goswami P, Rachakulla HK, Ramakrishnan L, Mathew S, Ramanathan S, George B et al. An assessment of a large-scale HIV prevention programme for high-risk men who have sex with men and transgenders in Andhra Pradesh, India: using data from routine programme monitoring and repeated cross-sectional surveys. BMJ Open. 2013;3:e002183.

241. Subramanian T, Ramakrishnan L, Aridoss S, Goswami P, Kanguswami B, Shajan M et al. Increasing condom use and declining STI prevalence in high-risk MSM and TGs: evaluation of a large-scale prevention program in Tamil Nadu, India. BMC Public Health. 2013;17:857.