

HIV testing services

Key points

- **Studies have found that many individuals who undergo HIV testing and counselling (HTC) and discover they are HIV-positive change their risk behaviours to avoid transmitting HIV to others. People living with HIV have fewer sexual partners on average and make greater use of condoms after their diagnosis than before.**
- **Programmes where couples test and are counselled together help couples adopt HIV preventive behaviours.**
- **The effect of HTC may be more pronounced for those who learn that they are in a serodiscordant partnership. Nonetheless, some of these changes may still be modest or temporary.**
- **Most studies have been unable to detect large changes in risk behaviours or decreased incidence of new infections for individuals who receive an HIV-negative test result. Nevertheless, some studies have reported positive effects of HTC on sexual risk reduction. The impact may vary according to the population, setting, style of counselling and modality of the testing intervention.**

The majority of HTC followed the voluntary counselling and testing (VCT) model until 2007, when the World Health Organization (WHO) published guidelines on provider-initiated testing and counselling (PITC) (3). Both models will be discussed below.

Further discussion will highlight evidence on the specific contribution that pretest and post-test counselling make to behaviour change beyond providing a test and results. After that, the emerging evidence for HIV self-testing and the effects of HIV-positive test results on behaviour will be discussed, followed by operational and population-specific evidence.

In 2015, WHO launched consolidated guidance on HTS (4). The term has since been used as the overarching name for this field of work, describing the full range of services that should be provided together with HIV testing. “HTC” is used to refer to modalities that provide both testing and counselling.

For the purposes of this document, the term “HTS” will be used unless reference is made to specific types of HIV testing interventions, in which case the appropriate term will be used.

The effect of voluntary HIV counselling and testing on sexual behaviour

What does the evidence say about the effect of VCT on sexual behaviour?

- It can contribute to reductions in the number of sexual partners.
- It increases the odds of condom use among those testing HIV-positive.
- It is associated with fewer sexual partners and increased use of condoms in serodiscordant couples.
- Couples testing in serodiscordant couples shows decreases in unprotected sex.
- Community-based HTC programmes can affect prevention outcomes if they are focused on populations where positivity in HIV testing is high.

The voluntary counselling and testing model

VCT consists of the provision of counselling and risk evaluation by a trained counsellor prior to HIV testing. It requires an individual to seek testing, either at a VCT facility or a mobile VCT site. An HIV test is then administered and the result is delivered by the counsellor.

The next step in VCT is post-test counselling, which contains an element of risk reduction counselling. The duration of counselling may vary, and the test result may either be given on the same day (rapid testing) or individuals may return to the clinic another day to receive their test result. While post-test counselling is intended to be used both for those who are HIV-negative and those who are HIV-positive, it is often truncated or less intense for people who test HIV-negative.

One of the main intentions of VCT has been preventive: it can help people change their sexual behaviour to avoid acquiring or transmitting HIV, and it can help to keep HIV-negative partners in serodiscordant couples from acquiring HIV. Studies have reported a reduction in the number of sexual partners and an increase in condom use, including among serodiscordant couples, following couples testing (5).

A 2012 meta-analysis updating a previous meta-analysis from 1990–2005 identified 17 studies conducted in low- or middle-income countries that reported on behavioural outcomes following a VCT intervention (5). In the systematic review, the analysis focused on a number of reported outcomes: HIV incidence, STI incidence or prevalence, and positive and negative life events. A meta-analysis of eight of these studies was conducted on two outcomes: condom use/protected sex and number of sex partners.

Main findings from the meta-analysis showed that the participants who received VCT were approximately 30% less likely to report an increased number of sexual partners compared to those who did not receive the intervention (odds ratio [OR] = 0.69; 95% confidence interval [CI]: 0.53–0.90; $P < 0.01$). There was a significant increase in the odds of condom use/protected sex among participants receiving a VCT intervention after stratification by HIV status, with HIV-positive participants having 3.24 times higher odds of reporting condom use/protected sex compared to HIV-negative participants (95% CI: 2.29–4.58; $P < 0.001$).

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A previous meta-analysis included many of the earlier studies in the 2012 review, but it reached partially different conclusions (6). Similar to the 2012 analysis, findings showed that study participants receiving VCT interventions were less likely to report unprotected sex compared to participants who had not received VCT. This finding was not stratified by HIV status (OR = 1.69; 95% CI: 1.25–2.31; $P < 0.01$). Unlike the 2012 analysis, however, VCT had no significant effect on the number of sex partners (OR 1.22; 95% CI: 0.89–1.67; $P > 0.05$). However, the analysis in the earlier review included VCT interventions covering researcher-, client- and provider-initiated methods, as the distinction between those models of HTS delivery had not yet been made so clearly.

Most of the studies in the 2012 review were conducted in clinic-based settings, although a few reported on testing conducted in a workplace, by mobile outreach teams or at home. Eleven of these studies were conducted in African countries, with the remainder in the Asia-Pacific region and the Caribbean. Generally, follow-up was for a year or less, so the findings reflect risk behaviours in the short term (5).

Little measurable effect of voluntary counselling and testing on HIV or STI incidence or prevalence

Three studies included in the 2012 review attempted to measure changes in HIV incidence before and after HIV testing, or by contrasting those who received HTC in different venues or under different circumstances (5). Corbett et al. compared participants in Zimbabwe receiving rapid on-site HIV tests through places of employment to those receiving vouchers for HIV testing through an external provider (7). No difference in HIV incidence was found, although the uptake of VCT was much higher in the on-site testing group than in the group receiving vouchers (70.7% versus 5.2%).

In Uganda, Matovu et al. found no difference in HIV incidence between those accepting VCT (incidence rate [IR] = 1.6 per 100 person-years [PY]) and those refusing it (IR = 1.4 per 100 PY; $P = 0.6$) (8). In another study in Zimbabwe, Machekano et al. followed a cohort of male factory workers (9). They discovered that men who completed VCT and chose to get their test results had higher HIV incidence (IR = 3.29 per 100 PY; 95% CI: 2.31–4.56) than those who chose not to receive their results (IR = 1.76 per 100 PY; 95% CI: 1.01–2.86). Among those who did receive their test results, however, HIV incidence was lower in the period after obtaining the results (IR = 3.04 per 100 PY; 95% CI: 1.86–4.70) than the period before (IR = 4.82 per 100 PY; 95% CI: 2.75–7.81) (9).

Five studies included in the review also assessed changes in STI incidence or prevalence. Arthur et al. found that reported STI symptoms were 60% lower across all clinics six months after individuals received VCT compared to the baseline (10). Other studies generally found no difference, except Machekano et al., who reported an increase in STI incidence among those who went through HCT and received their test results compared to those who did not receive their test results (9).

In addition, three studies included in the 2012 review by Fonner et al. measured the effects of VCT on subsequent positive and negative life events (5). All three studies found that the effects on life events were limited, that positive life events were more common and that negative life events were rare. Disclosure of negative test results was more common than disclosure of positive test results in all three studies.

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A systematic review in sub-Saharan Africa found that there was no consistent evidence for the effect of individual HTC on HIV acquisition, but that couples testing and counselling was more effective (11).

Voluntary counselling and testing reduces sexual partners

Although none of the studies in the 2012 Fonner et al. review were able to show reductions in HIV incidence, other changes in preventive behaviours were found (5). Changes in both the number of sexual partners and condom use were examined in the meta-analysis.

Six studies in the review reported on changes in the number of sexual partners following VCT, either comparing the same individual over time or comparing those receiving VCT to those who did not (5). Five of these studies were meta-analysed and the pooled random effects OR was 0.69 (95% CI: 0.53–0.90; $P = 0.007$). This indicates that individuals who did not receive VCT in these studies had more sexual partners than those who did. When the effect was stratified by serostatus, the pooled random effects OR was 0.61 (95% CI: 0.37–0.997; $P = 0.048$) for those who were HIV-positive, and 0.90 (95% CI: 0.77–1.10; $P = 0.195$) for those who were HIV-negative. No statistically significant difference was found between males and females. All studies showed a trend towards a reduced number of partners following VCT; none showed the opposite effect (5).

Voluntary counselling and testing increases the odds of condom use, especially for people who are HIV-positive

Thirteen of the studies analysed in the Fonner et al. review reported changes in condom use or protected sex following VCT (5). Seven reported on similar measures, allowing for a meta-analysis.

The overall effect across all studies was positive but not statistically significant. No effect was found by gender: men and women were equally likely to use condoms following VCT. When stratified by HIV status, however, the overall effect of VCT on condom use was positive and statistically significant (OR = 3.24; 95% CI: 2.29–4.58; $P < 0.49$). Individuals who received VCT and a positive test result had a greater chance of using condoms than HIV-positive individuals who did not receive VCT, although Fonner et al. caution that this finding is based on only two studies. One study in the meta-analysis found that condom use decreased, but self-selection bias appears to be a factor (8).

The authors of the Fonner et al. review conclude that “results from this review and meta-analysis bolster the growing evidence that VCT reduces risky behaviors related to HIV by significantly reducing the number of sex partners of participants” (5). They further observed that “people living with HIV who received VCT exhibited increased odds of using condoms and engaging in protected sex than people living with HIV who did not receive VCT” (5). As summarized in the conclusions for HTS below, results are more consistent for people who test HIV-positive than for those who do not.

Couples testing can decrease unprotected sex if couples are serodiscordant

Couples testing programmes invite couples to be counselled and tested together; they also promote mutual disclosure of test results and allow the counsellor to explore the implications of test results with the couple (12). The available evidence shows that this approach may be more effective than individual VCT.

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In one study, those who were tested as couples had less unprotected sex with their partner if they were serodiscordant (OR = 0.72; 95% CI: 0.53–0.99) (13). For those testing as individuals, however, no differences in condom use were found, but a weak effect was found in the intervention communities for individuals living with HIV who reported fewer sexual partners and a lower likelihood of having multiple partners than individuals without HIV. These effects were more pronounced among men.

A similar effect can be seen in data from a programme in Zambia that followed 963 heterosexual couples after couples testing revealed that the partnership was serodiscordant (14). Before testing, less than 3% of couples reported current condom use with each other. While the frequency of sex did not change one year after VCT exposure, the proportion reporting condom use was greater than 80%, and it remained stable at that level over one year of follow-up. In contrast, among couples where both partners were HIV-negative, reported condom use was lower (28%). A biological measure (testing of vaginal smears for sperm), however, suggests that condom use among serodiscordant couples was partially inconsistent.

A study in South Africa found that behaviour change among serodiscordant couples occurred as rapidly as within a week of diagnosis (15).

Community-based HIV testing can modestly affect prevention outcomes

Two large cluster randomized trials of community-based testing interventions in low- and middle-income countries have appeared since the publication of the 2012 Fonner et al. review (5). Both suggest that intensive, community-based HIV testing interventions can have a modest impact on prevention outcomes (15, 16). Importantly, both trials assessed the diffusion of testing behaviours, measuring their outcomes through community surveys once the interventions were over. People taking part in the surveys had not necessarily had any prior contact with the intervention, but they had lived in a community where it had been provided and promoted.

Project Accept—a multisite effort that enrolled 48 communities in South Africa, Thailand, the United Republic of Tanzania and Zimbabwe—provided community-based mobile VCT as part of a wide-ranging package of activities focused on the whole community (16). The services provided included community mobilization and post-test support services. Communities were randomized to receive either the package of community-based VCT that included support services after testing (the intervention group) or the standard clinic-based counselling and testing (the control group). A post-intervention behavioural survey was conducted with 56 683 people aged 18 to 32 years (the peak age range for HIV infection in those settings).

The intervention's primary outcome measure was HIV incidence, estimated through anonymous testing during the behavioural survey. In the intervention groups, it was 1.52% per year, compared to 1.81% in the control communities (16). The relative risk (RR) of infection was 14% lower, although the difference was not statistically significant (RR = 0.86; 95% CI: 0.73–1.02).

In sub-group analysis, the intervention had the greatest impact on women aged 25 to 32 years: their incidence was 30% lower, a significant difference (RR = 0.70; 95% CI: 0.54–0.90). HIV infections did not decrease in younger women or men (those aged 18 to 24 years) (16).

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Project Accept also found no differences in condom use, but individuals living with HIV in the intervention communities did report fewer sexual partners, and they were less likely to have multiple partners (16). These effects were most pronounced among men.

The second study was a cluster randomized controlled trial of a home-based counselling and testing intervention in rural South Africa (17). This trial was conducted in a low-income district where many men had left in order to seek work, leaving most households headed by women. Clusters of households were randomized and offered either home-based testing (intervention group) or clinical-based HTC (control group).

The impact was measured through a household survey, which was conducted at the end of the project with 4154 local residents, two thirds of whom were female (17). The researchers reported an overall beneficial impact on sexual behaviour and HIV testing rates. Individuals in intervention communities were 45% less likely to report having had a casual partner in the past three months (prevalence ratio [PR] = 0.55; 95% CI: 0.42–0.73). Moreover, they were 55% less likely to report multiple partners (PR = 0.45; 95% CI: 0.33–0.62). The intervention had no measurable effect on condom use or HIV knowledge, which were similar in both arms of the study after the intervention. The effect of the intervention on HIV incidence was not measured in this study.

The effect of provider-initiated testing and counselling on sexual behaviour

What does the evidence say about the effect of PITC?

- It results in increased testing coverage by a large degree.
- It led to a modest increase in condom use in some studies.
- It encourages women to discuss sexual health with partners.
- It leads to participants minimizing high-risk sexual behaviour (i.e., unprotected sex with a partner of different or unknown HIV status).

Since 2007, a clear distinction has been made between the VCT model discussed above and PITC (3). In PITC, HIV testing is included as part of the clinical services that individuals may receive when seeking care. Seeking out a testing facility is no longer a necessary step, so facilitating individual decision-making to be tested also may not be needed. Provider-initiated testing is more commonly provided in regions or among populations where HIV prevalence is high. As a result, the effects of PITC are likely to differ from those of standard VCT.

Provider-initiated testing and counselling increases testing coverage

A systematic review of PITC was published in 2012 by Kennedy et al. (18). This review considered whether testing provided in health-care settings at the initiative of providers had an effect on subsequent preventive behaviours (compared to testing sought at the initiative of the person being tested). The authors concluded that PITC increased the coverage of testing, often by a large degree, and that it also had a high positivity in HIV testing. As PITC is a gateway into extended treatment, care and prevention services, this outcome is valuable in and of itself.

Provider-initiated testing and counselling has modest effects on behaviour change

As with VCT, however, the evidence of the effect of PITC on other outcomes is mixed. Rates of reported condom use appeared to increase in some studies analysed, but not all of them (18). Acceptance of nevirapine (for the prevention of mother-to-child transmission of HIV) improved in one study (19), but not in two others that followed PITC (20, 21). Rates of partner testing apparently did not change.

Despite these mixed outcomes, few negative effects were found, making PITC on balance seem like a valuable way to increase testing coverage. This led Kennedy et al. to conclude that “in general, PITC appears to lead to at least as much behavior change as VCT” (18).

Some evidence of lower incidence of HIV and increased condom use, and more discussion among partners concerning sexual health

Much of the evidence for PITC comes from antenatal and reproductive clinics. An early study from Rwanda in the 1980s found that providing testing, an educational video and group discussion to women recruited from prenatal and paediatric clinics led to a significant

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reduction of HIV incidence in women whose male partners also tested. There were also improvements in terms of gonorrhoea rates and condom use (22).

A programme offering testing to pregnant women in Côte d'Ivoire found that condom use with regular partners rose among both HIV-negative women (from 36.4% to 58.7%) and HIV-positive women (from 23.2% to 48.8%) after a postpartum period of 18 months (23). Those who chose not to test showed no such differences over time. The study also found that tested women were more likely to discuss sexual health with their partners after being tested, regardless of the test result.

However, changes in condom use may not always be durable, as shown by a study that offered testing and counselling to women in family planning clinics and a postpartum ward in Thailand. The proportion of women reporting any condom use was 6% prior to HIV testing, 41% six months later and 21% at 12 months total follow-up period (24).

A study examining sexual behaviour before and after PITC in a rural Ugandan outpatient clinic found that high-risk sex (unprotected sex with a partner of a different or unknown HIV status) was reported by fewer people three months after testing (25). Increased condom use appeared to play little role, most often because couples shared test results and found that they had the same HIV status, or because people newly diagnosed with HIV were not having sex at all.

As already highlighted, STI clinics may raise awareness among clients on ways to minimize high-risk sexual behaviour. PITC may be especially important in STI clinics. In a non-randomized study conducted among 1628 heterosexual men attending an STI clinic in Pune, India, men received pretest counselling that included the demonstration of correct methods of condom use. After the counselling, the study observed a decline in visits to female sex workers and an increase in consistent condom use among those who did visit sex workers (26).

The effect of pre-test and post-test counselling on sexual behaviour

What does the evidence say about pretest and post-test counselling on sexual behaviour?

- There are modest changes in sexual behaviour, especially among gay men and other men who have sex with men.

As the PITC model has spread and increased the coverage of HIV testing, it offers the opportunity to unpack the effects that testing, knowledge of test results, and pretest and post-test counselling have on subsequent behaviour. Disentangling the effects and benefits of the two key components of HTC would be useful, and it perhaps may provide a basis for a rational allocation of effort and expense in providing this intervention.

As the preceding review of the evidence indicates, HTC approaches have a stronger effect on the behaviour of those who test positive than on those who test negative. However, definitive studies that conclusively answer the question of whether it is the knowledge of the test result, the counselling or a combination of the two that most affects post-test behaviour have not—and probably cannot—be conducted due to ethical concerns. As a result, the best answer to this question may come from examining the few studies that have experimented with pretest and post-test counselling. Due to the very heterogeneous quality and intensity of counselling, the findings presented here need to be interpreted cautiously, with consideration of the types of counselling provided in the respective studies.

Prevention counselling at the time of HIV testing has increased condom use and lowered STI incidence—but not always

In the 1990s, the Project Respect trial in the United States of America showed that prevention counselling at the time of HIV testing can have a positive impact on sexual risk behaviours and the incidence of new STIs (27). In this trial, more than 5700 self-reported heterosexual individuals who were HIV negative and attended STI clinics in the United States were randomized to one of three interventions: brief didactic messages, brief prevention counselling (two 20-minute sessions before and after the test) or more intensive prevention counselling (four sessions with a total duration of more than three hours).

At follow-up, self-reported condom use was somewhat higher among those who received counselling than those who received the brief didactic messages. After one year of follow-up, STI incidence was lower in the counselling groups: the rate was 11.5% among those who received enhanced counselling and 12.0% among those who received brief counselling, as opposed to 14.6% among participants who received the didactic messages (RR = 0.81; 95% CI: 0.67–0.98) (27).

The two counselling interventions were of similar effectiveness, which lent support to the use of the briefer intervention, and this was the model of risk reduction counselling subsequently promoted by the Centers for Disease Control and Prevention (CDC). Lowering STI incidence offers an appropriate indication of protected sex practices, suggesting that STI clinics could be an ideal gateway for VCT to affect HIV incidence through STI incidence, but further research is needed.

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In a study conducted in the United States in 2010 and 2011, no apparent benefit of counselling was found (28). More than 5000 people attending STI clinics who took an HIV test were randomized to receive either a brief explanation of the HIV testing process or a 30-minute risk reduction counselling session, based on an evidence-informed model. Six months later, no statistically significant differences in STIs were found between the two groups, and new STI infections were actually higher among men who have sex with men who had received counselling. An analysis of the costs estimated that adding counselling more than doubled the per-patient costs (from US\$ 23 to US\$ 56).

The Voluntary HIV-1 Counselling and Testing Efficacy Study conducted in Kenya, Trinidad and the United Republic of Tanzania placed considerable emphasis on a similar model of risk reduction counselling in its intervention arm (13). Although it showed some benefits, especially for couples, it was not possible to separate the effects of testing and knowledge of serostatus from the effects of counselling in this study: those in the intervention arm received both, while those in the control arm received neither (13).

Two positive outcomes of pretest and post-test counselling, however, come from a pair of randomized studies among gay men and other men who have sex with men in the United States. These studies provided men in control groups with the more intensive counselling used in Project Respect; the intervention groups received an even more intensive approach. Both studies observed changes in sexual behaviour, and one of the studies reported a short-term reduction in HIV incidence in the intervention group (29, 30).

Similarly, a study of different models of HIV testing provision in drug and alcohol treatment centres found counselling had no impact on sexual risk behaviours, but that it was effective in reducing multiperson use of injecting equipment (31). A cost-effectiveness analysis found that the streamlined testing procedure increased life expectancy for people with HIV at a cost of US \$60 300 per quality-adjusted life year (QALY), which is cost-effective in the United States. Another study found that adding risk reduction counselling increased testing costs without bringing additional benefits (32).

A trial conducted in primary care clinics in the United States found that streamlined counselling procedures (typically providing seven minutes of pretest counselling) facilitated a greater uptake of HIV testing than provision of more in-depth counselling, but that they made no difference to self-reported sexual risk behaviours four weeks after the test (33).

While certainly not definitive, these two studies suggest that in a setting in the United States, greater investment in counselling could achieve a larger effect than no counselling (32, 33). Evidence on the required level of intensity of counselling is not conclusive, however, and it may vary between settings.

Self-testing

What does the evidence say about the effect of self-testing on sexual behaviour?

- Self-testing may increase uptake of HTS and increase knowledge of HIV status.
- There is no indication of harm attributable to self-testing.
- Potential increases in risk-taking behaviours appear to be minimal.
- More research is needed on the effect of self-testing on sexual behaviour.

Self-testing technologies allow people to take a sample of blood or oral fluid, use a test kit and interpret the result themselves. Limited data are available on the impact that self-test use has on sexual behaviour, but some initial data indicate that the method could be preferred by some populations (34). It is possible that self-testing will be used by potential sexual partners or within established couples to see if the partners have the same HIV status.

In a 2017 meta-analysis, it was found from three randomized controlled trials that self-testing doubled uptake of HIV testing among men (RR = 2.12; 95% CI: 1.51–2.98) (35–37). Consideration of two randomized controlled trials among men who have sex with men showed that the frequency of testing nearly doubled (rate ratio = 1.88; 95% CI: 1.17–3.01), resulting in two more tests over a period of 12 to 15 months (mean difference = 2.13; 95% CI: 1.59–2.66) (38, 39). The same meta-analysis of two randomized controlled trials showed HIV self-testing also doubled the likelihood of an HIV-positive diagnosis (rate ratio = 2.02; 95% CI: 0.76–5.32). Across all randomized controlled trials, there was no indication of harm attributable to HIV self-testing, and potential increases in risk-taking behaviour appeared to be minimal.

A project in New York offered self-testing kits to men who regularly have sex with casual male partners without condoms (40). Concordant negative results were associated with some occasions of sex without condoms, but participants said that using the tests made them more aware of HIV risks. Sexual encounters ended whenever a potential partner received an HIV-positive result, thus potentially reducing exposure to HIV.

A potential limitation associated with the use of self-tests to assess HIV risks is that in the absence of counselling, users who have just received a negative test result may not always know about the window period and the possibility of recent acute HIV infections. Some users who do not receive counselling or support through other channels might therefore not consider the possibility of acute infection in their interpretation of results.

Due to high viral load during the acute infection stage, the risk of transmission is relatively high.

In Malawi, interviews with couples who had used self-tests demonstrated that the use of the test was often motivated by questions about the couple's relationship and sexual behaviour (including suspicions of infidelity). Self-testing sometimes provided one partner with an opportunity to disclose a previously known but concealed HIV status (41).

One randomized controlled trial in Hong Kong evaluated the effect of promoting home-based HIV self-testing with online counselling on increasing HIV testing uptake among 430 gay men

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and other men who have sex with men. Among men in the intervention group who received home-based HIV self-testing with online counselling in the last six months, the prevalence of condomless anal intercourse (Month 6 vs. baseline: $P < 0.01$) and multiple male sexual partnerships (Month 6 vs. baseline: $P < 0.05$) declined significantly compared to the control group (which received standard testing) (37). More research on the effects of self-testing on sexual behaviour and the uptake of HIV services is required.

Cohort studies: sexual behaviour change after an HIV-positive diagnosis

What does the cohort study evidence say about observed changes in sexual behaviour after an HIV-positive diagnosis?

- It is associated with an increase in condom use, especially among women.
- It can decrease high-risk sexual behaviour.

Cohorts can provide useful context about the process of behaviour change after knowledge of HIV infection. These studies can describe the natural history of subsequent behaviours, but it would be incorrect to assume that the behaviour changes they describe were caused by the knowledge of HIV-positive serostatus. While the temporal correlation could lead to this conclusion, it is possible that other secular and temporal trends also affect the behaviour, meaning that causal relations cannot be established.

A number of cohort studies provide insight into patterns of behaviour after people have been diagnosed with HIV. These studies generally suggest that many individuals who learn that they are living with HIV make some modifications to their behaviour, even over several years, although it is unclear whether these changes are a result of learning their serostatus.

Trends toward reduced high-risk sexual behaviours

A meta-analysis identified eight studies that examined the behaviour of individuals in the United States, with most data collected in the 1980s and 1990s (42). The pooled analysis found that the frequency of unprotected anal sex was more than 53% lower in persons aware of their HIV-positive status than it was among those who were unaware. Once it was adjusted to rule out sex with other people living with HIV, the average reduction in serodiscordant (or possibly serodiscordant) unprotected intercourse was 68%.

Evidence of increased condom use in cohort studies

In Uganda and Zimbabwe, a cohort assessing risks for HIV infection included 151 women who seroconverted while in the cohort (43). Twelve to 16 months after diagnosis, the proportion reporting consistent condom use increased from 26% to 44% (OR = 1.99; 95% CI: 1.12–3.53). Women who seroconverted reported fewer sexual acts after diagnosis, although women who did not acquire HIV did not report similar changes.

A South African trial of an HIV prevention intervention provides data on 327 women before and after their diagnosis with HIV (44). Significant decreases in several measures of sexual risk behaviour after seroconversion were reported, and these differences were maintained for the average of 18 months that the women remained in the study. While these differences were statistically significant in a multivariate model, the changes in absolute figures were modest. The authors noted that the overall levels of risk behaviour remained high in this cohort, highlighting a need for more effective HIV prevention interventions.

A follow-up of around five years for a cohort of female sex workers in Kenya (265 of whom acquired HIV while in the study) allowed for observations on the durability of behaviour changes (45). Incidence of unsafe sex declined by 44% postdiagnosis; this decrease was

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maintained over time. After adjustment, the researchers found a long-lasting decline in unsafe sex of 31% postdiagnosis, independent of age. The proportion of women who maintained consistent condom use increased from 59% pre-diagnosis to 67% postdiagnosis.

Operational considerations

Balancing numbers tested and intensity of counselling

Some discussion or counselling is necessary in the context of HIV testing to ensure informed consent. However, counselling sessions also may actively be used to promote behaviour change in those tested. There are a number of different models of risk reduction counselling, but they frequently involve an individualized risk assessment, target behaviours the client is willing to disclose and change, and work with the client to develop an achievable risk reduction plan.

Most counselling is based on the premise that change is a dynamic process in which small steps may ultimately lead to the desired outcome. It is usually recognized that the progression through stages is influenced by factors that must be specific for each stage, and that they need to be tailored to each client's capabilities and circumstances (46). This process can be time-consuming and may pose operational challenges in busy clinics. At the same time, as discussed previously, there is no clear evidence that confirms that intensive counselling is more effective than streamlined counselling over the periods studied. Operational considerations of staff time therefore may influence testing approaches applied in a specific setting.

Programme managers may be motivated by a desire to maximize the potential behavioural impact of HIV testing, leading them to emphasize the provision of risk reduction counselling. However, extra counselling increases costs, and the evidence on its additional benefit is mixed at best. Furthermore, as many health-care providers see risk reduction counselling as difficult to provide, they may feel limited in expanding HTS due to constraints in providing counselling, thereby creating a barrier to increasing the number of people who test by a significant amount. Too much emphasis on counselling therefore may distract from the current primary purpose of HIV testing, which is to diagnose individuals living with HIV and link them to care, treatment and prevention services. At the same time, testing services remain an important entry point for reaching people engaging in higher risk practices, and opportunities for increasing risk perception for these populations through counselling and referral to other HIV prevention services need to be utilized.

Improving positivity rates in HIV testing: diagnosing serodiscordant couples and people who are HIV-positive

The more modest behavioural impact that testing has on people receiving an HIV-negative result reinforces the need for HIV testing programmes that focus on individuals who are at elevated risk of infection. Doing so would promote behaviour change in people who learn that they are living with HIV and allow them access to antiretroviral therapy.

In contexts where few people living with HIV know their status, testing modalities such as PITC can reach large numbers of people, particularly women, who are more likely to access other health services (such as contraception or maternal health services). In settings where the majority of people living with HIV already know their status, testing modalities need to focus on reaching groups that have not yet tested (such as adult men, who do not commonly seek health services).

Depending on local epidemiology, individuals at elevated risk of acquiring HIV may belong to specific key populations. In order to engage them effectively, it may be necessary to provide outreach or mobile testing services, locate services in suitable locations or involve community

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members in planning and delivery so that services are appropriate and accessible. The inclusion of this local knowledge in the provision HTC to those most at risk of acquiring HIV is a key component of the UNAIDS approach to Fast-Track combination prevention.

The promising data on couples testing programmes and the behavioural impact for people who learn that they are in a serodiscordant relationship suggest that HTC may have its greatest behavioural impact with couples. Programmes could capitalize on this by giving greater emphasis to interventions that help couples learn and discuss their status together. Although a substantial proportion of new infections occur within primary relationships in many settings, implementation of couples testing has generally been limited to heterosexual couples in African settings. Emerging data indicate that the approach is acceptable to gay men and other men who have sex with men in some settings, but the potential for couples-based testing has not been sufficiently explored for other populations. Furthermore, the partners of people diagnosed with HIV are a priority group for testing and behavioural support: programmes need to create mechanisms to promote repeat testing and help partners maintain risk reduction strategies.

It is vital that post-test counselling for people with HIV addresses their health needs in a holistic manner that challenges stigma, rather than being focused on concerns about onward transmission.

The 5 Cs: consent, confidentiality, counselling, correct test results and connection to care

Regardless of the model of service delivery, WHO has outlined the “five Cs” that all HTS must follow in all circumstances: consent, confidentiality, counselling, correct test results and connection to care (4).

- People taking an HIV test must give informed **consent** to be tested and counselled; they should be informed of the process involved and their right to decline testing. Services must be attentive to situations of coerced testing, especially among vulnerable populations or within couples.
- Services must be **confidential**, meaning that discussions between the person testing and the service provider are not disclosed to anyone else without the expressed consent of the client. Local laws, regulations and policies must protect the rights of individuals in relation to consent and confidentiality.
- HTS should be accompanied by appropriate, high-quality pretest information and post-test **counselling**. Quality assurance mechanisms and supportive supervision and mentoring systems should be in place to ensure the high quality of counselling. WHO and UNAIDS guidelines recommend that post-test counselling be provided regardless of test result, and that it should include an explanation of the test result, advice on risk reduction and the provision of condoms and referrals. For those testing HIV-positive, counselling also should include emotional support, discussion of the patient’s safe disclosure of his or her HIV status, and referral of the patient’s partners and children for testing.
- Quality assurance mechanisms should be in place to ensure the provision of **correct test results**. For example, services need a reliable supply of quality-assured test kits and a testing algorithm that outlines the confirmatory testing required before an individual is given an HIV-positive diagnosis. One of the key ways that HIV testing may encourage behaviour change is by giving people

information about their HIV status and that of their partners; that information must be accurate if it is not to be harmful.

- Testing services must provide adequate and robust **connections** to prevention, care and treatment services. Individuals who are informed that they may have HIV but who then disengage from care and lose contact with services may be having difficulty adjusting to their diagnosis in the absence of support. Moreover, while the treatment cascade is well-described for people who are diagnosed with HIV, many people who receive HIV-negative results might benefit from referrals to prevention services (such as VMMC or PrEP), reminders to repeat their test and ongoing monitoring.

These principles should also apply to self-testing technologies. The relationship between self-testing and behaviour change remains unclear at this early stage, and it likely will vary according to setting, population, delivery mechanism (e.g., through established health services or commercial outlets) and messages in social marketing. If studies do show that the use of self-tests help people make better-informed sexual decisions that are free from harms such as coercion, violence or misinterpretation of results, then the delivery and social marketing of self-tests could be focused on groups that are at the greatest risk of infection.

Population considerations

Due to the limited evidence available, the previously cited systematic reviews by Fonner et al., Kennedy et al. and Marks et al. were only able to compare outcomes by gender or serostatus (5, 18, 42). They were unable to compare outcomes among different key populations or to draw any conclusions about the impact of HTC in different groups. In almost all cases, the modality studied was VCT with pretest and post-test counselling.

Table 2 summarizes data from studies in specific populations.

Table 2

Evidence of the impact of HIV counselling and testing on sexual behaviour change, by population

Population group	Effects
People receiving positive results	Evidence from multiple settings of behavioural changes (condom use and fewer sexual partners) during the first year after diagnosis (5, 13, 42).
People in serodiscordant relationships	Behavioural changes following positive diagnosis, more so for people in serodiscordant relationships (13, 14).
People receiving negative results	No impact on behaviour or new infections in most studies (5, 13).
Women	Mixed evidence, but some data suggest more behaviour change in women than men (17, 52).
Men who have sex with men	Sexual behavioural changes following positive diagnosis, including selecting other partners living with HIV (serosorting) (42).
Other key populations	Data are limited and more research is needed.

Gender differences

Two reviews did analyse outcomes by gender and found no statistically significant differences (5, 42). Nonetheless, there are some suggestions that testing can sometimes have a greater impact on women than men. Fonner et al. did observe a nonsignificant trend for women to have a greater reduction in partner numbers than men (5). Two randomized trials of community-based HTC showed positive results on some key indicators, especially among women (16, 17). Some cohort studies among women in African countries suggest sustained behaviour change after HIV diagnosis through VCT (43–45).

Apart from these observations, the available evidence offers little insight into the effect of HTC, specifically on young women and adolescent girls.

Couples testing

The literature also suggests that VCT interventions for couples may have more impact than individual testing when it comes to effecting behaviour change for heterosexual couples, especially those learning that their relationship is serodiscordant (13–15, 22).

Gay men and other men who have sex with men

The only data concerning gay men and other men who have sex with men come from western countries and China. A few studies raise questions about the benefits of the

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established model of risk reduction counselling for gay men and other men who have sex with men, suggesting that alternative counselling approaches (29, 30) or information alone could possibly be more effective (28). A randomized study conducted in China that compared an enhanced counselling intervention (including use of video) with a standard counselling intervention observed a reduction in condomless anal intercourse six months after testing, regardless of HIV status, but there was no impact on HIV incidence (47).

People who inject drugs

For people who inject drugs, one study in the United States found that risk reduction counselling had no impact on sexual risk behaviour, but that it did lead to reduced multiperson use of injecting equipment (31). While more reliable studies are lacking, cross-sectional data suggest that some people who inject drugs may practise serosorting, avoiding multiperson use of injecting equipment with people who have a different HIV or hepatitis C status (48, 49). Testing could therefore have a behavioural impact on this population.

Sex workers

The three systematic reviews did not identify any studies specifically conducted with sex workers, although one of the cohort studies that suggested long-term behaviour change after diagnosis was conducted with female sex workers (45).

Conclusion: HIV testing services

HTC is an indispensable element of a combination HIV prevention approach. It plays a central role as the gateway into HIV services, both for those living with HIV and those who are HIV-negative, and it increasingly provides access to more enhanced biomedical prevention (including PrEP). As the review of the evidence has shown, HTC contributes to behaviour changes—particularly among people who test HIV-positive—that may decrease the risk of HIV transmission, but it is not sufficient on its own. It is therefore a necessary but not sufficient component of an HIV prevention response.

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.

References

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 gonorrhoea 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 Immune Defic Syndr*. 2002;29(3):284-8.

References

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, Lihathsh 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.

References

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.

References

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, Liao 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.

References

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: Terrence 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: Terrence 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.

References

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).

References

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.

References

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.

References

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.

References

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.

References

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.

References

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/SP-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.

References

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, Chagalucha 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.

References

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.

References

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.

References

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.

References

223. Packer 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.

References

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.