Condoms for HIV prevention

An analysis of the scientific literature

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Executive summary

This report was commissioned by UNAIDS to review experience over the past two decades with condom promotion as a strategy for HIV prevention, especially in developing countries. At times, condoms have been controversial. The goal of this review is to present current state-of-the-art knowledge based on the published scientific and public health literature, to learn from successful HIV/AIDS prevention programmes, and to make recommendations for condom promotion programmes in the future.

The report begins by examining the question of how well condoms work to prevent transmission of HIV during sex. The efficacy (or theoretical effectiveness) of condoms should be more or less constant but is nearly impossible to measure. Many studies have measured effectiveness (or use effectiveness), but results vary, depending on a number of factors, including how consistently and correctly condoms are used, the population being studied, and the period of time over which effectiveness is evaluated. The best evidence regarding the effectiveness of condoms comes from studies of couples known to include one seropositive and one seronegative partner. Results from these studies also vary, though all show that condoms provide at least some protection.

Several attempts have been made to pool the results of these studies to produce one overall estimate of condom effectiveness, but the results depend on the procedures followed. Keeping in mind the limitations of the data, the best estimate is that condoms, when used consistently and properly, reduce the risk of transmission by about 90%. There is little convincing evidence that inconsistent condom use provides any protection.

Another key question regarding condoms has been whether people can be convinced of the need to use them. Evidence has steadily accumulated that often they can. High rates of condom use were first reported among some groups at especially high risk of HIV infection, such as men who have sex with men, and sex workers and their clients. More recently, a number of countries have achieved substantial increases in condom use among the general population. The strategy of condom social marketing has been especially successful at rapidly and dramatically increasing condom distribution in some developing countries.

For condom promotion to be successful in HIV prevention, condoms must be effective and people must use them. But this is not all that is necessary. Large numbers of condoms may be distributed yet have minimal public health impact if they are not used correctly, if people use them only some of the time, or if the people using them are not the ones at highest risk. Especially in the setting of generalized heterosexual transmission, it is unknown what level of condom use in the population is necessary in order to have a substantial impact on HIV transmission. Indeed, there are no definite examples yet of generalized epidemics that have been turned back by prevention programmes based primarily on condom promotion.

Some developing countries have achieved substantial success in HIV prevention. It is especially important to learn from these successes and to examine what role condoms have
played. The two most outstanding examples—Thailand and Uganda—have much in common but also have many differences.

In Thailand, condom promotion has been the centerpiece of a successful HIV/AIDS prevention programme. Thailand’s ‘100% Condom Use Programme’ has achieved nearly universal use of condoms in Thailand’s large commercial sex industry. As a result, HIV incidence and prevalence have fallen substantially in various segments of the population. Although the Thai programme emphasized condoms, it has also had other important aspects. It is especially notable that, in addition to high condom use in commercial sex, the proportion of Thai men patronizing sex workers has fallen sharply.

Uganda is another outstanding example of a country where HIV incidence and prevalence have fallen substantially since their peak in the late 1980s. But, unlike in Thailand, condom promotion played a less prominent role in Uganda’s HIV/AIDS control efforts until relatively recently. The evidence clearly indicates that Uganda’s success was mainly due to changes in sexual behaviour among the population, especially a large reduction in the number of casual partnerships. Although condom use has increased in recent years, the timing of this increase makes it implausible that condoms were a major factor in declines in HIV incidence in the late 80s and early 90s.

An area of great importance that has received surprisingly little scientific attention is the interaction between condom promotion and other strategies to reduce HIV transmission. These interactions can be either positive or negative. The Thai experience with commercial sex is a good example of a positive interaction: the 100% Condom Programme resulted in the unexpected benefit of large numbers of men refraining from engaging in commercial sex. On the other hand, the fear of negative interactions (for example, that condom promotion might increase sexual activity) has been a major source of opposition to condom promotion, especially for the young. There is little evidence for such negative interactions, but this is less reassuring than it might be, because few condom promotion programmes collect the data necessary to determine whether their efforts are producing either positive or negative changes in sexual behaviour other than condom use.

The available evidence strongly suggests that condom promotion should be part of the HIV/AIDS control programmes of most, if not all, developing countries. This is especially true for identifiable groups at highest risk of HIV infection that may have few or no other options for reducing risk. These almost always include sex workers and often include men who have sex with men, drug users, and other groups of heterosexuals with multiple partners. Consistent condom use is obviously essential for known HIV-positive persons who choose to remain sexually active, especially in the context of known discordant couples.

Condom promotion for the general population would also be expected to be beneficial, but, so far, there is less evidence for this being an effective public health strategy. To avoid the potential for doing harm and to guard against unfair criticism, programmes aimed at the general population should pay careful attention, in their design and in the outcomes that they measure, to potential interactions—both positive and negative—with other HIV prevention strategies. They should measure their impact not only in numbers of condoms distributed but,
more importantly, in levels of consistent condom use with different categories of partners. Wherever possible, they should also examine trends in numbers of casual partners and what effect, if any (positive or negative) condom promotion seems to be having on this.

Part of avoiding doing harm is to tell the truth about condoms: that they are effective but not 100% effective. This includes referring to sex with condoms as ‘safer sex’ rather than ‘safe sex’ and not telling people that they can only get HIV from unprotected sex. Family planning programmes around the world have successfully achieved a similar balance in promoting contraception. Another aspect of avoiding harm is ensuring that condom promotion is accompanied by a steady and affordable supply of condoms; anything less is bound to result in inconsistent condom use.

Condoms will play an important role in HIV prevention for years to come. The question is not whether to promote condoms but how to make the best use of condoms as part of an overall strategy. The priority placed on condom promotion should depend on local epidemiology and the particular group being targeted. Condom promotion and other strategies must be carefully deployed to work in synergy rather than competition. Much will depend on how well we are able to realize the potential for prevention that condoms clearly offer.
Condoms for HIV prevention
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INTRODUCTION

This literature review was commissioned by UNAIDS to examine condoms as an HIV prevention strategy in developing countries. Several factors make this an opportune time for such a review. As we enter the third decade of HIV/AIDS prevention and care efforts, it is appropriate to reassess what we have learned from experience. Condom promotion has often been controversial, with strong opinions pro and con. Too often, these opinions are based on ideology rather than evidence. But evidence has accumulated steadily. While many questions remain about condoms as a public health strategy for HIV prevention, we certainly know a great deal more than we did two decades ago.

Based on experience with other sexually transmitted infections, condoms were advocated for HIV prevention even before the causative agent, the human immunodeficiency virus, was discovered. Since then, numerous studies have examined how well condoms work to prevent HIV transmission between sexual partners when one is infected and the other is not. This research clearly demonstrates that condoms are effective, though controversy remains about exactly how effective. This report begins with a review of current knowledge regarding condom effectiveness.

Another area of doubt regarding condoms as an HIV prevention strategy has been whether people can be persuaded to use them. Here too, the past two decades provide a wealth of experience regarding the success of condom promotion efforts in various cultures, groups and contexts. Some countries have achieved substantial success in their efforts to prevent HIV transmission. It is especially valuable to examine the role of condom promotion in these success stories.

Despite a few bright spots, the global experience with HIV prevention has not been an overwhelming success. HIV continues to spread at an alarming rate in much of the developing world with a substantial proportion of the population already infected in many countries. It is therefore appropriate to re-examine prevention strategies and to question approaches taken so far. As the mainstay of many HIV prevention programmes, condom promotion deserves such scrutiny. Rightly or wrongly, some donors have recently backed away from condom promotion as the primary tool for reducing sexual transmission of HIV and are instead emphasizing an approach in which condoms are one of multiple elements.

This review provides an overview of current knowledge regarding condoms for HIV prevention in developing countries. Sources of information include the peer-reviewed scientific literature, publications of international organizations, and other relevant documents. The goal is to present state-of-the-art information in a form accessible both to expert and general readers, providing ample references for those who wish to obtain further details. Interpretations and recommendations are those of the authors and do not necessarily reflect the views of UNAIDS.
HOW EFFECTIVE ARE CONDOMS?

How effective are condoms? This seems like a simple question and one that is almost certain to come up sooner or later in any serious discussion about condoms for HIV prevention. Unfortunately, it is impossible to give a single, definitive answer to this question, despite conclusive evidence that wearing a condom reduces the probability of HIV transmission during penetrative sex between HIV-positive and HIV-negative partners.

So why is it so difficult to answer what seems like an important and straightforward question? Part of the problem is lack of information. Even after 20 years of studying the HIV/AIDS epidemic, the data on which to base estimates of the effectiveness of condoms are much more limited than one might expect. It turns out to be a very difficult issue to study, for a number of practical and ethical reasons. Beyond lack of data, the main obstacle to answering this question has to do with ambiguities within the question itself. The question, “How effective are condoms?” actually includes many different questions, each with a somewhat different answer. People asking the question can hardly be expected to realize the subtleties involved. Those who are called upon to give the answer should at least be aware of them.

Definitions

To quantify how well a medical treatment or preventive intervention works, the two terms most commonly used are efficacy and effectiveness [1]. Efficacy (sometimes called ‘theoretical effectiveness’) refers to the ideal ability of an intervention to treat or prevent a condition, when used perfectly. Effectiveness (sometimes called ‘use effectiveness’) refers to how well it works in actual practice. Similar terms used to quantify how well contraceptive methods work are ‘method effectiveness’ and ‘use effectiveness’ [2].

For medical interventions, we measure efficacy by comparing outcomes among persons to whom investigators carefully provide the treatment, with a control group that does not receive the treatment. If the intervention is a drug treatment, efficacy studies will often include pill counts and analysis of drug levels in blood to be sure that individuals in the treatment group are actually receiving the treatment. Effectiveness, on the other hand, is usually measured after a treatment is in general use. Effectiveness studies include everyone given the intervention, regardless of whether this was done in an ideal fashion or how well they complied with it. The idea here is to see how the intervention works in ‘real world’ settings. Effectiveness is therefore almost always less than efficacy.

Various parameters can be used to describe efficacy and effectiveness. For condoms, this is usually expressed in terms of a percentage. If the probability of HIV transmission were reduced by 100-fold when condoms are used perfectly, then condoms would have an efficacy of 99%. If condoms, as typically used in practice, cut HIV transmission by a factor of 10, they would have an effectiveness of 90%.

While this concept may seem clear, real numbers can be hard to come by. For condoms, it is nearly impossible to measure efficacy. In theory, this could be done by monitoring
sexual encounters between discordant couples (one HIV-positive and one HIV-negative) in a laboratory situation so that investigators could be sure that condoms were used completely correctly. Presumably, there would also have to be a randomly allocated control group of discordant couples who would be told not to use condoms. New infections among the HIV-negative partners would be carefully measured.

Such a study has never been done and probably never will be. In fact, all studies of how well condoms prevent HIV transmission measure effectiveness rather than efficacy. For practical and ethical reasons, these are not laboratory studies but ‘real world’ studies in which couples may have been encouraged to use condoms, but whether or not they actually did and whether they did so correctly can only be assessed by self-report.

A further methodological issue in assessing the effectiveness of condoms is that HIV transmission only can take place between discordant couples. Unless an HIV-negative person has sex with an HIV-positive person, there is no possibility of transmission, so it is impossible to measure the effectiveness of condoms. In fact, the term has no meaning. Studies of condom effectiveness therefore have been limited mainly to cohorts of known HIV serodiscordant couples. Prospective studies of known discordant couples provide the best data from a scientific point of view, but it would be unethical to follow such couples as part of a research study without urging all of them to use condoms. Random assignment is impossible. Instead, investigators compare seroconversion rates between serodiscordant couples who report that they use condoms and other couples who report not using them even though they were urged to do so. These two groups of couples are likely to differ in more ways than their condom use. No government regulatory agency would approve a new drug based on non-randomized, non-blinded studies. But this is all we have for condoms.

**Effectiveness for whom?**

Efficacy (theoretical effectiveness) depends on biology and the physical properties of condoms. There is no convincing evidence that the efficacy of condoms differs from one population to another. Effectiveness refers to how well condoms work in typical use. But what is ‘typical’? Typical use (and therefore the effectiveness of condoms) may vary among cultural groups and settings. How closely actual use approximates ideal use is likely to be highly dependent on motivation and many other factors. Thus, there is no single ‘right’ answer for effectiveness.

**Effectiveness over what period?**

When most people think about the effectiveness of condoms, they are likely to be thinking of their effectiveness for preventing infection in a single sexual exposure to an HIV-infected partner. This is the ‘single-use effectiveness’ [3]. As mentioned above, most studies of the effectiveness of condoms involve discordant couples who have multiple sexual exposures to their partner, typically over years of follow-up. They thus measure ‘period effectiveness’. As shown in the simulation presented here, period effectiveness may be considerably less than single-use effectiveness.
Vignette # 1
Why is period effectiveness less than single-use effectiveness?

The following hypothetical example demonstrates that the observed effectiveness of condoms depends on the period of time observed. Readers who are less interested in the mathematical fine points may wish to skip to the results: effectiveness of condoms over a prolonged period will generally be less than their single-use effectiveness. The assumptions used in this example are not necessarily intended to represent what one would expect in typical experience. Instead, they were deliberately chosen to demonstrate how effectiveness can vary, based on the period of observation.

Suppose you have two cohorts of 1000 serodiscordant couples each. One cohort uses condoms always, the other never. Suppose that all the seroconversions in each cohort will be among 100 ‘high-risk’ couples who were the most likely to seroconvert without condoms. Heterogeneity in risk of transmission occurs for a variety of reasons, including viral load, differing sexual practices, male circumcision, and others. The assumption that all seroconversion will take place in the 10% of couples at highest risk is an exaggeration, but it simplifies the numbers for this example.

Suppose, for this example, that half of these couples at high risk would experience HIV transmission to the originally seronegative partner within six months in the absence of any intervention. Suppose condoms are 90% effective over each six-month period (the differences observed below would be even greater if calculated based on efficacy per act of intercourse, but the mathematics get much more complicated). Suppose that the study lasts two years (about average for published follow-up studies of serodiscordant couples).

After six months, you would expect to observe 50 seroconversions among the 100 high-risk couples in the cohort that never uses condoms and 5 in the cohort that always uses them. The cumulative estimate of effectiveness would be 90%. So far, so good.

In the second six-month period, you would expect to observe 25 seroconversions in the cohort that doesn’t use condoms (remember that there are only 50 high-risk serodiscordant couples left to seroconvert), and 5 more in the cohort that uses condoms (actually 4.75, because 95 couples are left).

In the third six-month period, you would expect 12.5 seroconversions in the cohort that doesn’t use condoms and 4.5 in the cohort that does. In the fourth six-month period, you would expect 6.25 seroconversions in the cohort that doesn’t use condoms and 4.3 in the cohort that does.

Adding all this up, you would observe (about) 94 seroconversions in the cohort that doesn’t use condoms and 19 in the cohort that does. Your overall seroconversion rate would be 94/1000 = 9.4% in the first cohort (remember, you don’t know who the 100 high-risk couples are, so all 1000 couples are in the observed denominator), and 1.9% in the second cohort. The ratio of seroconversion rates between the
condom users and non-users will be 1.9/9.4 = 20.2%, so you will calculate a 79.8% cumulative effectiveness estimate for condoms. This result will not be wrong. But it must be interpreted properly. The two-year effectiveness is different from the six-month effectiveness (which was 90%) and even more different from the effectiveness per sexual act.

It turns out that this phenomenon of lower observed effectiveness with longer follow-up is inevitable whenever there is heterogeneity in risk of transmission and whenever the period of follow-up is long enough that a substantial proportion of those who do not use condoms and are at highest risk become infected. This need not be a problem, as long as results are properly presented and interpreted. But it is one of the reasons why it may never be possible to come up with a single ‘correct’ answer for the effectiveness of condoms to prevent HIV infection.

The importance of specifying a standard time period to measure effectiveness is well accepted in the family planning literature, where contraceptive effectiveness is expressed in terms of the percentage of women who become pregnant in one year. The difference between period effectiveness and single-use effectiveness has not been nearly so well understood in the literature on the effectiveness of condoms for prevention of HIV infection. Since most studies measure period effectiveness, they are probably underestimating single-use effectiveness. Before we take too much consolation in this, however, we need to remember that single-use effectiveness might greatly overestimate the effectiveness of condoms to prevent HIV infection over a prolonged period with multiple exposures to one or more HIV-positive partners. This would occur most often in populations with high HIV prevalence and high rates of sexual mixing – just the situation in which one would most like condoms to be reliable.

**Partner studies**

As mentioned above, the best data on the effectiveness of condoms come from prospective studies of sexually active discordant couples who are followed by researchers over time. Researchers have an ethical obligation to encourage such couples to use condoms always, but not all couples follow such advice. This creates a quasi-experiment in which researchers can compare the risk of seroconversion in the initially HIV-negative partners between the couples who use condoms and those who do not. Condom users and non-users may differ in other ways, so this is not an ideal study design. But it is the best available.

A crucial factor in such studies is accurate assessment of condom use. This is always based primarily on self-report. The quality of these self-reported data depends on a number of factors, including how well and how frequently study participants are asked about their condom use and what, if any, biological measures (such as pregnancy and incidence of other STIs) are used to validate these data [4]. Some of the better studies have asked both members of couples separately and compared their answers as a reliability check [5–10]. Many published studies are disappointingly vague about how condom use was ascertained.

Both self-selection and misreporting of condom use will tend to make condoms look less effective than they really are. Couples that choose not to use condoms even though they know
that they are serodiscordant are likely to be at higher risk of transmission than other couples, for a variety of reasons. For example, they are more likely to use drugs and alcohol [11, 12], more likely to have additional partners [12], and might be younger or more likely to engage in practices such as anal intercourse, which carry a higher risk of HIV transmission [13–15]. Any misreporting of condom use in either direction will dilute the difference between comparison groups, making condoms look less effective. This may be a serious design flaw if couples who are known to be discordant and who are presumably being urged to use condoms feel uncomfortable in acknowledging that they are not doing so. If only a small percentage of couples who say that they always use condoms are lying, this can result in a substantial underestimate of condom effectiveness. Furthermore, as described above, partner studies measure the period effectiveness of condoms, which will be an underestimate of their single-use effectiveness.

On the other hand, it might be argued that known discordant couples have the strongest possible motivation to use condoms correctly. Condom effectiveness may therefore be higher for discordant couples than for someone using a condom just in case he happens to run across an HIV-infected partner. The latter person might be less careful about checking for expiration dates, using a condom from beginning to end, proper condom placement and removal, etc. If this is true, partner studies might overestimate the effectiveness (but not the efficacy) of condoms in the wider population. Which of these biases are stronger and how well they do or do not balance each other is unknown.

The best estimates

Despite these limitations, a number of partner studies have been conducted all over the world [11, 16]. Estimates of condom effectiveness range from a low of 46% [11, 17] to a high of 100% in one large study combining data from several European countries [11, 18]. Some of this difference is due to random variation. Some may be explained by differences in study methodology, differences in how well condoms were used, or other differences in the populations being studied. Table 1 summarizes the results of several of these studies.
### Table 1. Seroconversion rates in cohort studies of HIV transmission within serodiscordant couples

<table>
<thead>
<tr>
<th>Study</th>
<th>Study site</th>
<th>Direction of transmission</th>
<th>Condom use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Always</td>
</tr>
<tr>
<td>Fischl 1987</td>
<td>USA</td>
<td>Not specified</td>
<td>1/10</td>
</tr>
<tr>
<td>Goedert 1987</td>
<td>USA</td>
<td>M+ F-</td>
<td>0/6</td>
</tr>
<tr>
<td>Peterman 1988</td>
<td>USA</td>
<td>M+ F- M- F+</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Roumeliotou 1988</td>
<td>Greece</td>
<td>M+ F-</td>
<td>0/37</td>
</tr>
<tr>
<td>Kamenga 1991</td>
<td>Zaire</td>
<td>M+ F- M- F+</td>
<td>1/50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3/56</td>
</tr>
<tr>
<td>Aluminum 1992</td>
<td>Rwanda</td>
<td>M+ F- M- F+</td>
<td>0/4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0/5</td>
</tr>
<tr>
<td>European Study Group 1992</td>
<td>6 countries in European Community</td>
<td>M+ F- M- F+</td>
<td>0/83</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0/41</td>
</tr>
<tr>
<td>Saracco 1993</td>
<td>Italy</td>
<td>M+ F-</td>
<td>3/171</td>
</tr>
<tr>
<td>Deschamps 1996</td>
<td>Haiti</td>
<td>Not specified</td>
<td>1/42</td>
</tr>
<tr>
<td>Hira 1997</td>
<td>Zambia</td>
<td>M+ F-</td>
<td>0/30</td>
</tr>
</tbody>
</table>

*seroconversion rates for non- and occasional condom users. M+ F- indicates transmission from an infected man to a female partner; M- F+ indicates transmission from an infected woman to a male partner.

Source: Weller S et al., Pinkerton SD et al., Davis KR et al. [11, 16, 17]

There is a temptation to say that the studies reporting the highest effectiveness must be the best studies—i.e., that the couples in these studies used condoms more correctly and/or reported their condom use more accurately. This may be true, to some extent, especially insofar as one is interested in measuring efficacy (theoretical effectiveness), as opposed to effectiveness in typical use. But this is a slippery slope. If one assumes that the study yielding the highest estimate of effectiveness is the best, one will eventually find a study showing 100% effectiveness, such as the European multicountry study mentioned above. This is hardly a valid approach to combining the available data.
Meta-analysis

Meta-analysis is a rigorous, standardized methodology for combining data from multiple studies of the same research question to yield a single, overall estimate of an effect size [1, 19, 20]. This technique has been applied to systematically analyse research on a variety of topics, ranging from comparing different treatments for heart attack [21], to examining the risk of uterine cancer in postmenopausal women who receive hormone supplements [22]. Meta-analysis uses established procedures that must be followed exactly if the conclusions are to be valid. Strict criteria for which studies will be eligible for inclusion must be established in advance and an exhaustive search conducted for all such studies, whether or not they have been published in the medical literature. This careful search is necessary to avoid publication bias: studies with more dramatic results are more likely to be published.

Once a set of studies has been identified for inclusion, standardized analytic techniques must be applied to combine all of their results into a single summary estimate of the parameter to be estimated—in this case, the effectiveness of condoms for preventing HIV transmission between serodiscordant couples. The basis for these techniques is that a separate estimate of the parameter of interest is calculated for each study and an average is then determined for all of the studies combined. This average is weighted by the size of each study.

At least four such meta-analyses of condom effectiveness have been conducted [11, 16, 17, 23, 24]. Overall estimates of condom effectiveness range in these meta-analyses from 69% to 94%. At first glance, this wide variation is confusing and frustrating, especially since these meta-analyses all use data from many of the same underlying original studies. But much of the difference can be explained by differences in technique. The earliest meta-analysis, for example, included couples who sometimes (but not always) used condoms in the ‘condom user’ group and thus included many couples who, by their own report, were not using condoms consistently [23]. It therefore is not surprising that their estimate of 69% effectiveness is lower than the other analyses. This estimate should thus be interpreted as a lower limit for the effectiveness of condoms [16].
Vignette # 2

Why can't the experts agree on the best estimate for condom effectiveness?

As described in this report, the best data on the effectiveness of condoms to prevent HIV transmission come from studies of serodiscordant couples with one partner seropositive and the other seronegative for HIV. Following these couples over time and comparing the rate of infection between couples that use condoms and couples that don't provides an estimate of the effectiveness of condoms.

This may seem simple in practice, but practical difficulties abound. Infection of the partner who was originally HIV-negative is not such a frequent outcome, especially in couples who always use condoms. Assembling cohorts of serodiscordant couples and following them over time is no simple matter. A study starting with dozens or even hundreds of couples will not yield a high enough number of seroconversions to give a precise estimate of condom effectiveness.

The obvious solution to this problem of small numbers is to pool data from all available studies to compute a summary estimate of effectiveness. But here again are practical difficulties. Which studies should be included? Ideally, one would include only prospective studies judged to have done an excellent job of following couples over time, accurately measuring their condom use, and ascertaining seroconversion. Measuring condom use is especially problematic. Aside from the fact that this always relies on self-report is the problem that different studies have aggregated these data in different ways. Some lump couples who sometimes use condoms with those who always use them, thereby comparing couples who have used condoms with those that never do. Others lump the sometimes users with the never users, thereby comparing those who always use condoms with those that use them inconsistently or not at all. Any such lumping can produce spuriously low estimates for condom effectiveness, especially if occasional condom use (which probably provides little or no protection) is lumped together with consistent condom use. Pooling multiple studies does nothing to solve this problem if many of the studies suffer from the same bias.

The most rigorous approach to this problem is to include only studies that report separate data for couples that always use condoms and those who never do. This approach was taken in the most recent major meta-analysis of partner studies, but resulted in eliminating the vast majority of published studies from consideration, with only 14 studies remaining from the entire world literature [11]. Even among these studies, there was a great deal of variability in methods used to ascertain condom use in the couples studied. Often these methods were not clearly specified in the original studies.

A basic premise of the established methodology for meta-analysis is that one must compare apples to apples and oranges to oranges, not apples to oranges [1, 19, 20]. In other words, seroconversion rates of condom users in the Congo should be compared to seroconversion rates of non-condom-users in the Congo, and seroconversion rates of condom users in the United States of America (USA) should be compared to those of non-condom-users in the same population. It makes no sense to compare condom users in the USA to couples who don't use condoms in the Congo or vice versa. This principle is especially important for studies of condom effectiveness because the underlying likelihood of transmission may vary greatly from population to population, based on viral load, prevalence of other STIs, male circumcision, sexual practices, and many other known and
unknown confounders. The correct approach is to calculate a separate estimate of condom effectiveness for each study and then to average these, based on each study’s size, to produce a single summary estimate. This means that studies that don’t include data in the same population for at least some couples that always use condoms and some that never use them provide no useful data for a meta-analysis and must be discarded.

While this may seem obvious, some published meta-analyses of condom effectiveness have broken this basic rule. For example, the most recent major meta-analysis combined all couple-years of follow-up among couples using condoms and all couple-years for non-users and then calculated a single estimate of condom effectiveness. [11]. The authors thus compared apples to oranges in the sense that 10 of the 11 total seroconversions among couples who reported always using condoms took place in studies that included no data for couples who never used condoms. A meta-analysis following the normal rules (apples to apples and oranges to oranges) would have excluded all of these studies from consideration and resulted in an estimate of condom effectiveness of about 90% instead of the 80% effectiveness reported by the authors.

Why did the authors take this approach? The problem is that excluding all studies not meeting their rigorous entry criteria as well as all studies without groups of both consistent users and non-users of condoms would reduce the entire world literature to the experience of only 180 couples, with 132 of these coming from a single study in Haiti [8]. In all these studies together, there was only a single seroconversion among couples claiming to always use condoms. So, while the estimate of condom effectiveness produced by such an approach would be methodologically pure, the sample size remaining would be so small and the confidence interval so wide that the result would not be terribly useful. Although they do not state this, the authors’ choice of methodology may have come from a realization that they did not have enough numbers to do the analysis the right way.

It is tempting to say that we will have to wait for the results of more studies to get a better answer to the question of condom effectiveness. Unfortunately, we cannot count on ever having better data. As stated by Weller and Davis, “Condom use is now inextricably confounded with HIV risk factors” [11], such as sexual practices, transmission category, and access and adherence to antiretroviral drugs. Ethical concerns would now make it difficult or impossible to follow a cohort of serodiscordant couples without giving antiretroviral drugs to treat the infected partner's HIV disease and protect the uninfected partner from transmission by reducing viral load. Such co-interventions make measuring the effectiveness of condoms even more difficult. We may never be able to do much better than to say that condoms are about 90% effective. Perhaps this is good enough.

Of the published meta-analyses, the one by Pinkerton and Abramson in 1997 probably did the best job of combining the available data. It produced a combined estimate of 94% for condom effectiveness. The main criticism of this study has been that it lumped together couples who reported sometimes using condoms with the couples who never used them [11]. Any bias this may have caused, however, would have been in the direction of underestimating (not overestimating) condom effectiveness.
The bottom line

So what answer should health professionals give when asked by patients or policy-makers how effective condoms really are? In most cases, they should not launch into a lengthy theoretical discussion about the methodological subtleties of the question. A good, simple answer may be to say that condoms appear to be about 90% effective when used consistently and properly. With perfect use, effectiveness may be even higher, though not 100%. With inconsistent or improper use, condom effectiveness is certainly lower. In fact, there is little convincing evidence that sometimes using condoms provides any protection at all [8, 25–29].

These results should come as no great surprise, as they closely match data on the effectiveness of condoms for preventing pregnancy [11, 30]. Although there is some evidence that condoms might occasionally be permeable to virus-size particles [25, 31–35], the vast majority of condom failures result not from leakage through latex but from ‘flow’ factors, such as breakage, slippage, or improper use [36]. There is no reason to expect that these should be any more or less frequent whether condoms are used to prevent HIV infection or pregnancy.
CAN PEOPLE BE PERSUADED TO USE CONDOMS?

No matter how effective condoms may be, they can have little impact in the fight against HIV/AIDS if people don’t use them. Even before HIV was discovered as the cause of AIDS, epidemiologic evidence made clear that the virus was sexually transmitted. Condom promotion thus quickly became one of the few options available for HIV/AIDS prevention programmes. But the question was: “Can people be persuaded to use them?”

Men who have sex with men

The first clear evidence that condoms could be a successful public health strategy for HIV/AIDS prevention came not from the developing world but from men who have sex with men (MSM) in places such as San Francisco. Condoms were heavily promoted from the beginning of the epidemic by public health officials and by leaders of the local gay community [37]. By all accounts, condom use among MSM in San Francisco increased dramatically in the early and mid-1980s [38] and became the norm in this population. Incidence rates for all STIs fell substantially. Annual HIV incidence rates fell from double digits in the early 1980s to less than 1% after 1985 [39].

HIV incidence among men who have sex with men in San Francisco, 1978-88

![HIV incidence graph]

Source: Hessol N et al. [39]

*The denominator is men beginning each year seronegative.

Many places in industrialized countries have seen similar increases in condom use among MSM, but this has not necessarily been true in developing countries. Where condom use among MSM remains low, this has more often been because of lack of effort rather than failure of condom promotion campaigns. HIV/AIDS control programmes in many countries have not given prevention among MSM the attention that the epidemiologic data suggest it deserves, either because of outright discrimination and stigmatization or because of a belief that MSM are hard to reach. In fact, concerted efforts targeting MSM have usually been successful in increasing condom use.
In Salvador, Brazil, for example, consistent condom use during anal sex increased from 81% to 97% among MSM following their participation in safer sex workshops [40]. In a survey in Rio de Janeiro, 73% of MSM reported consistent condom use while engaging in insertive anal intercourse and 58% for receptive anal intercourse [41]; HIV incidence was lower for men who consistently used condoms. A survey of MSM in Mexico found that 45% reported consistent condom use in their last 10 sexual encounters [42].

Commercial sex

Another high-risk setting in which condom promotion efforts have met with success is commercial sex. Probably the most notable example of this has been the ‘100% Condom Use Programme’ in Thailand. After an intensive campaign of condom promotion and distribution in commercial sex establishments, a survey by Hanenberg et al. found that the proportion of female sex workers who said that they always used condoms during commercial sex increased from 14% in 1989 to over 90% in 1994 [43–45]. Several other studies have shown similar results. In one cohort study of female sex workers, 94% reported consistent condom use with clients [46]. Among military conscripts visiting commercial sex establishments, 87% reported always using condoms [43]. Another study found that consistent condom use among brothel-based sex workers rose from 87% in 1993 to 97% in 1996 [47]. One study validated self-reports of consistent condom use by confirming that women refused trained volunteers who posed as clients offering to pay three times the customary fee if they didn't have to use a condom [48].

Not only has condom use among sex workers reached high levels, but there is clear evidence that this has had the expected effect of reducing HIV transmission. One cohort study in Northern Thailand, for example, found HIV incidence rates of 1.7% per year among sex workers who reported consistent condom use, versus 23.8% for those who did not [49]. Nevertheless, the Thai experience with promoting condom use in commercial sex has not been a complete success. Condom use is lower for ‘indirect’ (non brothel-based) sex workers than for those based in brothels and much lower with sex workers’ non-paying partners [47], and sex workers continue to be at substantial risk of HIV and other STIs, even after implementation of the 100% Condom Use Programme [46, 49, 50].

Examples demonstrating that high rates of condom use can be achieved in commercial sex and that this can reduce HIV transmission are not limited to Thailand. A randomized trial in Mumbai (Bombay), India, measured the impact of an intervention with sex workers and madams to increase condom use. After the intervention, 70% of women reported using condoms at least sometimes, and 28% always, compared to 53% and 0% respectively for women in control brothels who did not receive the intervention. HIV incidence was 5% per year in the intervention group, versus 16% per year in the control group, with similar differences in the incidence of other STIs [51]. In Zaire, an HIV/AIDS prevention programme for sex workers increased consistent condom use from 11% to 68% and decreased HIV incidence from 11.7% per year to 4.4% per year, with parallel decreases in other STIs [52].

Experience from throughout the developing world confirms that sex workers and their clients are willing to use condoms. Consistent condom use increased to 73% among sex workers in Bolivia after a clinic-based intervention [53]. In Senegal, 94% of sex workers reported using a condom during their last sexual act with a regular client and 98% with a new client [54].
Kampala, Uganda, 99% of female sex workers reported using a condom the last time they had sexual intercourse in 2001 [55]. Unfortunately, these success stories are by no means typical of the whole developing world, but they do demonstrate that very high rates of condom use in commercial sex are achievable.

General population

Encouraging condom use in special situations, such as in commercial sex and among men who have sex with men, is not easy. But promoting widespread condom use in the general population is even more of a challenge. While some Asian countries, including Thailand, have a history of condom use for contraception, condom promotion efforts in most of the countries of the developing world with the highest rates of HIV had to start from scratch. Consistent condom use requires not only a long-term commitment to a behaviour that many might view as unnatural; it also requires a reliable supply and distribution system that can provide what is usually an imported product to people who may have little or no income or access to other health-related services [56]. As stated by President Yoweri Museveni of Uganda, a leader in the fight against HIV/AIDS, “In countries like ours, where a mother often has to walk 20 miles to get an aspirin for her sick child or five miles to get any water at all, the question of getting a constant supply of condoms may never be resolved” [57].

Nevertheless, many governments, nongovernmental organizations, and international donor agencies have taken on this challenge with remarkable energy. Progress was slow initially. At times, the task may have seemed like filling a bottomless pit with a teaspoon. Yet, overall, the world has seen a remarkable increase in condom use over the past 20 years.

Measuring the success of condom promotion efforts directed at the general population is not simple. Statistics of the number of condoms distributed give some idea of the scope of effort, but do not indicate what proportion of the population (particularly those at highest risk) is consistently using condoms. Instead, we must look to population-based surveys of self-reported sexual behaviour. While self-reported behaviour may not be reliable for every individual, its validity is generally accepted for groups, especially for tracking changes in behaviour over time. Self-report of consistent condom use has been validated by various biological outcomes, including HIV infection [11, 38].

Beyond the challenges of measuring condom use is the question of what exactly we should be measuring. From an epidemiologic point of view, we are most interested in rates of condom use in situations with the highest risk of HIV transmission. These include sex between new, ‘non-regular’, or ‘casual’ partners. This involves an inherent contradiction between common condom promotion strategies and the outcomes used to measure impact. Most condom promotion programmes emphasize the need to use condoms all the time with all partners; few would say that it is necessary to use condoms only with casual partners. Condom use statistics, on the other hand, tend to focus on rates of condom use with non-regular partners.

Currently, the most commonly used indicator of condom use is the one included in the Demographic and Health Surveys (DHS) that are conducted on a regular basis in many developing countries. Respondents are asked about their sexual partners of the previous 12 months. If they had sex with a non-cohabiting partner, they are asked if they used a condom
**figure 2a.**

**Condom use during last high-risk sex in past year among 15-24 year old females in Africa, 2001**

<table>
<thead>
<tr>
<th>Country</th>
<th>% of condom use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ghana*</td>
<td>20</td>
</tr>
<tr>
<td>Uganda</td>
<td>20</td>
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<tr>
<td>Zimbabwe</td>
<td>20</td>
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<td>Burkina Faso</td>
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<td>Gabon</td>
<td>20</td>
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<tr>
<td>Malawi</td>
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<td>Cote d’Ivoire</td>
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<tr>
<td>Rwanda</td>
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<td>Togo</td>
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<td>Tanzania</td>
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<td>South Africa</td>
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<tr>
<td>Zambia*</td>
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<tr>
<td>Guinea</td>
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<td>Ethiopia</td>
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<td>Cameroon</td>
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<td>Kenya</td>
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<tr>
<td>Chad*</td>
<td>20</td>
</tr>
<tr>
<td>Niger*</td>
<td>20</td>
</tr>
</tbody>
</table>

* Indicates data that refer to years other than 2001, differ from the standard definition, or are based on only part of a country.

Source: UNICEF [58]

**figure 2b.**

**Condom use during last high-risk sex in past year among 15-24 year old males in Africa, 2001**

<table>
<thead>
<tr>
<th>Country</th>
<th>% of condom use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zimbabwe</td>
<td>40</td>
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<tr>
<td>Uganda</td>
<td>40</td>
</tr>
<tr>
<td>Ghana*</td>
<td>40</td>
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<tr>
<td>Cote d’Ivoire</td>
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<td>Burkina Faso</td>
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<td>Rwanda</td>
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<td>Gabon</td>
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<td>Kenya</td>
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<td>Togo</td>
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<td>Tanzania</td>
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<td>South Africa</td>
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<td>Zambia*</td>
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<td>Guinea</td>
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<td>Ethiopia</td>
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<td>Cameroon</td>
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<td>Chad*</td>
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<tr>
<td>Eritrea*</td>
<td>40</td>
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<tr>
<td>Niger*</td>
<td>40</td>
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</tbody>
</table>

Source: UNICEF [58]
the most recent time. This produces an indicator that approximates the percentage of times that condoms are used in high-risk sexual encounters. Figure 2 shows results from DHS surveys conducted between 1998 and 2001 in 19 African countries for males and females ages 15 to 24.

Uganda had the highest rates of condom use with non-cohabiting partners for young women at 44%, followed by Zimbabwe at 42% and Burkina Faso at 41%. Among young men, Zimbabwe had the highest rate at 69%, followed by Uganda (62%), Côte d’Ivoire (56%), and Burkina Faso and Rwanda (both 55%) [58].

Condom use among young people is especially important, because this group is often at greatest risk of HIV infection. Furthermore, young people are establishing patterns of sexual behaviour that may last a lifetime. One indicator often used to examine condom use among the youngest of the sexually active is to ask whether a condom was used during their first lifetime sexual encounter. Rates as high as 77% are reported in France and 68% in England. But developing countries such as Brazil (48%) and Mexico (43%) also have a high proportion of young people who use a condom the first time they have sex [59].

Experience from around the world indicates higher rates of condom use among young people than older people. Recent DHS data from 27 countries in Africa and Latin America, for example, showed higher rates of condom use among 15–24 year-olds than among 25–49 year-olds, in every country, the last time they had had sex [60]. Numerous other studies in both developed and developing countries have shown similar results [61–63]; in fact, younger age seems to be one of the strongest predictors of condom use. The only possible exception may be among men who have sex with men, for whom condom use may be lower among young men, in some places [64, 65].

Numerous studies have confirmed high rates of condom use in the general population of various developing countries. Data collected by the Brazilian Ministry of Health showed that 63% of men and 69% of women reported using a condom the last time they had sex with a casual partner [59]. In a 1999 study in Zimbabwe, over 70% of men reported using a condom the last time they had unsafe sex [66]. In the urban Kampala and Jinja districts of Uganda, 66% of men and 49% of women reported using a condom the last time they engaged in risky sexual behaviour [67].

Various approaches have been used to promote condoms. These range from health education to encourage demand, to cutting taxes on condoms to lower prices [56]. Many HIV/AIDS control programmes have distributed large numbers of free condoms. This is most effective when targeted at highest-risk groups, such as sex workers. Free condoms distributed in a less targeted fashion may be a good tool for increasing HIV/AIDS awareness, but a high proportion of such condoms is likely to go unused [68]. One of the most successful strategies for rapidly increasing distribution is condom social marketing [69–74]. Heavily subsidized condoms are sold through existing or alternative distribution channels at a price that is affordable for the local population even after retail mark-up. These condoms are promoted through various media under one or more brand names that use the same advertising strategies as other consumer products.
Data on the sheer number of condoms distributed in many countries appear impressive. In Uganda, the number of condoms distributed increased from 4 million in 1996 to 120 million in 2001 [75]. In South Africa, condom distribution increased from 6 million in 1994 to 198 million in 1999 [76]. In Senegal, condom distribution increased from 800 000 to 7 million between 1988 and 1997 [54]. Condom sales in India have been increasing by 13% per year since the 1970s [77].

Yet while these numbers are impressive, on the one hand, they can just as easily be used to argue that the glass is more than half-empty. Back-of-the-envelope calculations easily demonstrate that even the greatly increased numbers of condoms cited in the examples above are only enough to cover a tiny fraction of all sexual encounters in any of these countries. Condom use is often much lower outside of major cities. For example, condom use during last intercourse with a casual partner was 68% for urban men and 15% for rural men in Zambia between 1995 and 1999 [78]. In addition, high rates of reported condom use with casual partners can coexist with a situation in which most adults never use condoms. This is because only a minority of individuals will have casual partners in a given time period. Despite the high rates of condom use with casual partners reported above for Uganda, 60% of men and 84% of women have never used a condom in their life [79].

Such numbers point out an important aspect of the global experience with condom promotion: there has been little success in persuading people to use condoms in the context of a steady sexual relationship. In Nigeria, for example, despite the fact that 65 million condoms were distributed to the public in 1999, only 2% of sexually active respondents reported always using condoms with a spouse or ‘concubine’ in the previous two months, compared to 33% for boyfriends and girlfriends and 67% for casual partners [80]. This might be seen as good; limited numbers of condoms are best used in casual sex, which carries the highest risk of transmission of HIV and other STIs. But lack of condom use with steady partners can also be seen as a major problem, especially in high-prevalence settings where even a single partner may well be infected and where a high proportion of transmission takes place between steady partners.

An extreme example of the difficulty in persuading people to use condoms in stable partnerships is seen in the experience with known serodiscordant couples. One might think there could be no greater incentive to use condoms consistently than wanting to avoid infecting or being infected by a known serodiscordant partner. As described earlier in this report, numerous studies have followed serodiscordant couples to examine factors, including condom use, that might affect risk of transmission. For ethical reasons, these studies have made every effort to encourage condom use among the couples that they study. Nevertheless, most studies revealed that only a minority of such couples consistently used condoms; only 17% reported regular condom use in Rwanda [12], 24% in Haiti [8], and 33% in Zambia [5]. Many barriers to condom use by stable couples have been identified. They include a desire for intimacy, gender inequality, and wanting to have children [81, 82]. These factors and the experience to date suggest major obstacles to condoms being a widely accepted strategy for preventing HIV infection in the context of stable partnerships, although they should certainly be promoted for known serodiscordant couples.
Despite these caveats and the measurement issues described above, the available evidence clearly demonstrates a dramatic increase in condom use over the past two decades. This has occurred in a wide variety of geographic regions and cultures and has far exceeded what many sceptics would have believed possible even a few years ago. Serious questions remain about how effective condoms have been as a public health strategy for the control of HIV/AIDS in the general population, and these will be discussed in subsequent sections of this report. But it is no longer plausible to dismiss condoms as a strategy for HIV/AIDS control because of an assumption that people cannot be persuaded to use them.

Figure 1. HIV incidence among men who have sex with men in San Francisco, 1978–88
WHAT ELSE IS NECESSARY FOR SUCCESS?

As discussed in the previous sections of this report, there is overwhelming evidence that condoms are effective (though not 100% effective) in preventing the sexual transmission of HIV. Furthermore, it has proven possible to achieve substantial rates of condom use in a wide variety of populations throughout the developing world. At first glance, it might seem that this is all one needs to know to conclude that condom promotion should be the strategy of choice for HIV/AIDS prevention in the developing world. Unfortunately, it is not that simple. Condom effectiveness and people’s willingness to use condoms are necessary conditions for condoms to be a successful public health strategy against the spread of HIV, but they are not sufficient. To understand how this can be true, one must consider more carefully the dynamics of the sexual transmission of HIV.

Even in a setting of extremely high incidence of sexually transmitted HIV and even if condoms are not used, only a tiny minority of sexual contacts will result in transmission of HIV. Since it is impossible to prevent something that wouldn’t have occurred anyway, these few contacts (certainly much less than 1% of all contacts) are the only ones for which it matters whether a condom is used or not. Of course, it is impossible to know exactly which contacts these are. Overall data on condom use might therefore be very misleading. One could imagine a situation in which overall condom use is high but condom use is low in those few encounters where it could make a difference. This could occur, for example, if those at highest risk of infection (such as the poor, the uneducated, or drug users) have lower rates of condom use while people at low risk have higher rates of condom use.

On the other hand, the converse might be true. Condoms can potentially make a great difference even if overall condom use is low. This could occur if risk of HIV infection is concentrated in specific settings, such as among men who have sex with men, in commercial sex work, or in another segment of the population with multiple partners. If condom use is high in these particular groups, it could make a substantial difference, regardless of the rate of condom use in the general population. Unfortunately, most surveys of condom use do not identify groups at highest risk, nor are they designed to ask specifically about condom use in encounters with the highest risk of HIV transmission. And respondents would not necessarily even know which encounters these are. One therefore must be very careful in drawing conclusions based on overall condom use in the general population.

Another problem has to do with consistency of condom use. A population can use large numbers of condoms with limited impact if most of these condoms are used by people who do not use condoms consistently. There is little evidence that sometimes (but not always) using condoms provides any protection as compared to not using condoms at all. In fact, one study from Uganda found that individuals who sometimes use condoms were at higher risk of infection than those who never used them, perhaps because they take more risks in other aspects of their sexual behaviour, such as the number of partners [25].

One also must keep in mind the difference between single-use effectiveness and long-term effectiveness discussed earlier. Even 90% effectiveness may do little good in the long run
for those at highest risk. For example, consistent use of condoms might increase the average time to infection from 6 months to 60 months for female sex workers in settings where a high proportion of clients are HIV-positive. This would be small consolation for these women if a high proportion of them eventually get infected anyway. Unfortunately, there is evidence that this may be exactly what is happening in Thailand [50]. The same might be true over the course of a lifetime for some groups of men who have sex with men or for young people with multiple partners in high-HIV-prevalence settings.

The biggest questions about condoms for HIV prevention have less to do with their effectiveness for individuals than they do with their effectiveness as a public health strategy. As discussed earlier, high rates of condom use have been achieved, at least for casual partnerships, in some of the countries hardest hit by HIV/AIDS. Unfortunately, this has not yet produced a demonstrable decrease in the rate of HIV infection. As shown in Figure 3, HIV seroprevalence has continued to rise along with condom use in many of these countries [83].

**Figure 3**

**HIV prevalence among pregnant women, and condom sales by year**

a. Kenya

b. Botswana
Of course, it is quite possible that HIV prevalence would have risen even faster in these countries were it not for increasing rates of condom use. But the current situation raises many questions. What level of condom use is necessary to control and roll back a generalized heterosexual epidemic? In settings reporting high rates of condom use, are condoms being used consistently and correctly enough to have the desired impact? Is condom use only with casual partners good enough? Or is it also necessary to achieve high rates of condom use in steady partnerships? If so, is this possible?

The point of these questions is not to say that condoms cannot make a difference. In fact, the evidence is that they can and have made a difference in a variety of settings. But we need to be more thoughtful in our approach and avoid the trap of equating the number of condoms distributed with the success of an HIV control programme. Anyone doubting this need look no further than some of the sub-Saharan African countries that currently report high rates of condom use with little evidence that their HIV/AIDS epidemics are being brought under control.

Source: AIDSMARK [83]
LEARNING FROM SUCCESS

HIV/AIDS is spreading rapidly in the developing world. The 2002 UNAIDS Report on the Global HIV/AIDS Epidemic estimates that over 60 million people have been infected with HIV. Of these, over 20 million have died and about 40 million are living with HIV/AIDS. Over 95% of the 5 million new HIV infections each year take place in the developing world. The vast majority of these are through sexual transmission [84].

These sobering figures show a global HIV/AIDS pandemic worse than what might have been considered a pessimistic projection just a few years ago. A third or more of the adult population is now infected with HIV in several sub-Saharan African countries, and there is little evidence of the epidemic leveling off in the majority of these countries. In addition, HIV is spreading to new geographic areas, both in Africa and elsewhere. Many experts project that the number of HIV/AIDS cases in Asia will soon surpass the number in Africa [85, 86].

Given this grim reality, it might seem presumptuous to speak of success in the struggle against HIV/AIDS. Nevertheless, at least some countries in the developing world have achieved notable success in HIV prevention. The experience of these countries stands in sharp contrast to that of the rest of the world, where the epidemic has continued to grow. This contrast makes it all the more important that we learn everything we can from these successes.

The two countries most often cited as examples of successful programmes to prevent the sexual transmission of HIV are Uganda and Thailand [87]. In both of these countries, there is convincing evidence that the epidemic has not only leveled off but the incidence and prevalence of HIV are actually in decline. There are other countries that also might be considered success stories in terms of HIV/AIDS prevention, but this report will focus on the experiences of these two countries and some of their neighbours, examining the role of condoms in the HIV/AIDS control programmes of these countries and what can be learned from their experience.

Thailand

Thailand was the first Asian country to experience a large epidemic of HIV/AIDS. In the African countries with the earliest HIV/AIDS epidemics, the initial phases of the epidemic took place unrecognized and remained shrouded in mystery. Thailand, on the other hand, took full advantage of experience gained elsewhere to set up a sophisticated surveillance system almost from the beginning of its epidemic [87]. This allowed for rapid recognition of the extent of the problem at an early stage. Thailand was probably the first country in which many thousands of HIV-infected persons were identified even before the first handful of AIDS cases were diagnosed.

The HIV/AIDS epidemic started in Thailand with a burst of HIV transmission among injecting drug users in the late 1980s. This pattern quickly changed, however; by the early 1990s, approximately 90% of adult cases were due to heterosexual transmission [45, 88]. Furthermore, studies showed a clear link between HIV infection among men and contact with commercial sex workers. Public health officials quickly became aware that Thailand’s large commercial sex industry was playing a central role in the spread of the epidemic.
The Thai Government responded with the 100% Condom Use Programme. This innovative approach was possible because commercial sex in Thailand is largely concentrated in identifiable establishments. The programme mandated brothel owners to enforce condom use in every paid sexual act between sex workers and their clients. The programme was first piloted in selected brothels in Ratchaburi province in 1989.

An initial problem in the pilot programme was that participating brothels lost some customers who did not want to use condoms and took their business elsewhere. This was addressed by expanding the programme to include all brothels in the province. Uncooperative brothel owners received sanctions and were identified through STI surveillance among sex workers and clients. Other essential components of the programme included health education and STI screening and treatment. By 1991, the programme had been implemented on a national level.

The first evidence of the programme’s effectiveness, both in Ratchaburi province and, subsequently, in the country as a whole, came from a rapid and dramatic decrease in rates of STIs [45]. The total number of STIs reported at government clinics fell from 361 000 in 1989 to 95 000 in 1993 [89]. As shown in Figure 4, this drop followed lockstep with a decrease in the proportion of commercial sexual acts that were not protected by condoms. Subsequent studies have confirmed that this is a real decline, not just a matter of STI patients no longer seeking care from government clinics [89].

**Figure 4**

Male STIs, and commercial sex without condoms in Thailand

![Graph showing reported male STIs and condom non-use percentage](image)

Source: Brown T [89]
The 100% Condom Use Programme and other HIV/AIDS control efforts have had a substantial impact on the HIV/AIDS epidemic in Thailand. The best evidence for this comes from studies of male military conscripts, a fairly representative sample of men in their late teens. In the northern provinces, where HIV prevalence is highest, rates fell from 11.9% in 1991 to 5.4% in 1997 [89, 90]. Prevalence among these young men might be expected to closely follow incidence, and this indeed appears to be the case. Studies in similar populations of conscripts show that incidence decreased from 2.48% per year in 1991–1993 to 0.55% per year in 1993–1995 [43]. Fortunately, the HIV/AIDS epidemic in Thailand has not seen anything like the exponential growth that almost all experts had predicted.

Unfortunately, universal or near-universal condom use in commercial sex seems to be more effective in protecting male clients (and their other partners) from HIV than in protecting the sex workers themselves. At least one study found that seroconversion rates for sex workers were practically the same before and after implementation of the programme [50]. This may be because of inconsistent condom use with clients, condom failure, and/or unprotected sex with non-commercial partners [91]. Furthermore, as mentioned earlier, condom use has not been as high for ‘indirect’ sex workers as for those based in brothels [47].

What lessons can be learned from the Thai experience? As the name of the 100% Condom Use Programme implies, condoms played a key role in HIV/AIDS control efforts in Thailand. But it would be a mistake to think of the Thai HIV/AIDS control programme as being based only on condom promotion. It also included substantial components of health education, STI control, HIV testing, harm reduction for drug users, and clinical care for persons with HIV. Increased condom use was not the only behavioural change that took place in Thailand. The percentage of men who reported visiting sex workers in the past year fell from 57% in 1991 to 24% in 1995 [92]. Although the programme did not seek directly to discourage commercial sex or to drive it underground, the awareness of risk that it created apparently caused large numbers of men to voluntarily give up the practice.

Thailand’s success would not have been possible without strong political commitment on all levels. This included cooperation among government officials, local health workers, nongovernmental organizations, the media, brothel owners, and the general public. It involved a rapid acceptance of the threat posed by HIV, rather than efforts to deny the problem or sweep it under the carpet. This acceptance was followed by quick and determined action designed to fit local circumstances. Condom promotion, especially in the context of commercial sex, was a key part of this action.

Among Thailand’s neighbours, Cambodia has so far been hardest hit, with the highest prevalence of HIV in the Asia-Pacific region [93, 94]. HIV prevalence among sex workers in Cambodia increased from 37% in 1995 to 49% in 1998 [95]. In contrast to Thailand’s relative prosperity and substantial health infrastructure, Cambodia must grapple with high rates of migration, extreme poverty, and other sequelae of decades of civil war [96]. Nevertheless, there are hopeful signs that Cambodia may be following the Thai example in its HIV/AIDS control efforts. Cambodia has also implemented a 100% Condom Use Programme, and condom distribution increased from 99 000 in 1994 to 16 million in 2001 [84]. The prevalence of STIs has fallen substantially among sex workers [93, 97], and HIV prevalence in the general population also seems to be
falling. For example, among pregnant women, HIV prevalence decreased from 3.2% in 1996 to 2.7% in 2000 [98] and, more recently, unpublished data indicate further declines.

The Cambodian experience demonstrates that HIV/AIDS control efforts can make a difference, even in difficult circumstances. In this case, Cambodia was able to learn from the experience of neighbouring Thailand and successfully apply similar interventions targeting transmission through commercial sex. But approaches that work well in one country will not always work as well elsewhere, especially if the situation is different. Vietnam, for example, has also made substantial efforts to increase condom use in commercial sex. Most sex workers now report consistent condom use, but there is little evidence so far that the spread of HIV is slowing. This may be related to the continuing major role of injecting drug use in HIV transmission in that country, including a substantial prevalence of injecting drug use among sex workers [93].

Uganda

Uganda is “now considered to be one of the world’s earliest and best success stories in overcoming HIV” [79]. Few would have predicted this 15 years ago. In 1986, Uganda had one of the highest rates of HIV/AIDS in the world and was just emerging from a prolonged period of civil strife. The country seemed ill prepared to face the challenge of HIV/AIDS. But the evidence now demonstrates that Uganda not only faced the challenge but did so successfully.

Uganda responded to its HIV/AIDS epidemic with a multisectoral approach backed by full commitment at all levels. Support and leadership of these efforts from the President and other high government officials were key, but it would be a mistake to consider the Ugandan HIV/AIDS control effort a highly centralized programme whereby all initiative flowed from the top to the bottom. On the contrary, the emphasis from the beginning was on encouraging involvement and discussion among all sectors of society. As of 2001, there were reportedly over 700 agencies—governmental and nongovernmental—working on HIV prevention in Uganda [79]. These ranged from religious groups to NGOs and the military.

A key aspect of the Ugandan response to HIV/AIDS has been destigmatization and open communication. Several prominent Ugandans went public with their HIV-positive status in the early stages of the epidemic. An active support organization for persons with HIV/AIDS, combined with an attitude of openness from the President on down, have made it possible for many ordinary Ugandans not to feel the need to hide their HIV-positive status and have encouraged others to opt for voluntary HIV counselling and testing. This had the important result that a much larger proportion of Ugandans report that they know someone with HIV/AIDS than do the populations in other African countries [79]. Personally knowing someone with HIV/AIDS is one of the strongest predictors of behavioural change to prevent HIV infection [99].

The results of HIV/AIDS control efforts in Uganda appear to have been substantial. Sentinel surveillance among pregnant women, which has been in place since 1991, tells a clear story. Prevalence among women in Kampala fell from a high of about 30% in 1992 to about 10% in 2000 [100]. Similar declines, though starting from a lower initial prevalence, were observed elsewhere in the country [101].
As discussed earlier in this report, prevalence represents incidence over several preceding years, except among the youngest sexually active age groups, for whom it is a better measure of recent incidence. HIV prevalence among the youngest group of pregnant women is thus of special interest, and this has shown the greatest decline in Uganda. HIV prevalence among 15–19-year-old pregnant women was about 30% when first measured in 1991 and steadily fell to about 5% by the late 1990s. Indirect data from other sources indicate that HIV incidence peaked even before antenatal surveillance began—probably in the late 1980s [79, 102].

Recently, questions have been raised as to whether Ugandan antenatal surveillance data have been over-interpreted and whether the selected sites where data are collected truly represent the country as a whole. Even these critics, however, agree that Uganda has seen declines in seroprevalence and that “the Uganda experience can provide valuable information to assist other nations in their prevention efforts” [103]. Furthermore, data from antenatal surveillance have been confirmed by results of other studies. For example, HIV incidence fell by 58% in the Masaka district from 1990 to 1998, with even greater declines among younger women [92]. HIV prevalence among young men entering the military in Uganda fell from 18.5% in 1991 to 8% in 1996 [104].

It is therefore of great interest to examine the role of condoms in Ugandan HIV control efforts. Unlike the experience in Thailand, condom promotion did not play a central role in the initial response to HIV/AIDS. The Ugandan Government never opposed condoms, but it did not emphasize them in its HIV/AIDS control messages. Instead, prevention efforts focused on delaying sexual début for young people, abstinence, being faithful to a single partner (often referred to as ‘zero grazing’), and using condoms—roughly in that order [79, 105].


Source: Ugandan Ministry of Health, 2001 [100]
Condom promotion did not start receiving greater emphasis in Uganda until the early 1990s. When it did, this was handled in a fashion typical of the Ugandan HIV/AIDS control programme. Initially, the President and some religious leaders were resistant to condom promotion. The issue received widespread debate, which probably played a constructive role by encouraging people to think and talk about HIV/AIDS. Eventually, the controversy faded, and condom promotion won general acceptance as a necessary part of HIV prevention efforts.

An objective review of the data indicates that the major declines in HIV incidence in Uganda clearly preceded the incorporation of large-scale condom promotion into HIV control efforts [92]. Condom social marketing did not get off the ground on any large scale until the mid-1990s, after the major decline in HIV incidence described above [106]. By 1995, only 6% of Ugandan women and 16% of Ugandan men had ever used a condom, with consistent condom use being much lower [79]. As described earlier in this report, Ugandans now report much higher rates of condom use, particularly with casual partners. This may be helping to keep incidence rates down since the late 90s but cannot be given major credit for the larger fall in incidence that took place before then.

So what did cause HIV incidence rates to fall in Uganda in the late 80s and early 90s? The available evidence suggests that the main cause was a substantial change in sexual behaviour, particularly a reduction in non-regular partnerships [93, 107]. For example, in 1995, only about 12% of Ugandan males and 5% of Ugandan females between 15 and 19 years of age reported having sex with a non-regular partner in the previous 12 months. This compares with about 50% and 30% respectively in neighbouring countries [108]. Other age groups showed similar differences in comparison to neighbouring countries. In contrast, population-based surveys in Uganda in 1989 found that the proportion of adults reporting casual sex in the past 12 months more closely matched the higher levels that continue to be reported in neighbouring countries [79].

Whether as a result of individual rational decision-making or through a more complex process of redefining community norms of behaviour, Ugandans seem to have reduced their level of risky sexual behaviour from what was once a level typical of their region to what is now a much lower level [109]. Comparisons with neighbouring countries suggest that changes in numbers and types of partners have much more to do with the decline in HIV incidence in Uganda than do rates of condom use [110], which were lower in Uganda than in neighbouring countries in the mid-1990s [111]. Simulation models confirm the decline in HIV incidence observed in Uganda to be consistent with what would be predicted from a roughly 50% decrease in casual partnerships [112].

This does not mean that condoms had no role in the Ugandan success story. Such a conclusion would probably be no more correct than to say that condoms were completely responsible for the Thai success story. Although overall rates of condom use were comparatively low at the time that incidence rates were declining, even low levels of condom use in the general population can still make a difference if condom use is higher among population groups at highest risk. This may apply in Uganda, where condom use in commercial sex is very
high [55]. Also, condom use may have been higher among the young than among adults in
general and thus may have contributed to the decreased HIV incidence observed in that age
group [107]. Furthermore, as noted above, the public debate about condoms that took place
in Uganda in the early 1990s may have contributed to the general level of awareness and
communication about HIV/AIDS and thereby contributed to the process of risk reduction even
before large numbers of condoms were used.

Evidence now suggests that positive changes such as those in Uganda are also taking place in
at least some other parts of the region. These include the neighbouring Bukoba district of the
United Republic of Tanzania, where HIV incidence declined from 4.8% per year in 1987–1989
to 0.6% per year in 1993–1996 [92]. In Lusaka, Zambia, HIV prevalence among 15–19-year-
old pregnant women fell from about 30% to about 15% between 1993 and 1998 [113, 114]. As
in Uganda, the apparent decline in HIV incidence probably has more to do with reductions
in casual partners than with increased condom use [115, 116]. Comparison of population-
based interview studies using similar methods in 1996 and 1999 shows that the proportion of
men and women in all age groups reporting sex with casual partners fell substantially [117].
Condom use also increased, but only modestly.

Lessons from success

As discussed above, the experiences of Thailand and Uganda have many differences. In
particular, condoms appear to have played a more central role in the success of HIV prevention
efforts in Thailand (and Cambodia) than in Uganda (and Zambia). These represent differences
of degree and circumstances rather than a fundamental difference in approach. In fact, the
Thai and Ugandan experiences are much more similar than they are dissimilar.

Both countries responded to the HIV/AIDS epidemic quickly and decisively. Both HIV control
programmes had leadership from the highest levels. Both were multisectoral and achieved a
broad public consensus of support. Both avoided stigmatization and included important
aspects of care for the HIV-infected. Both the Thai and Ugandan efforts were endogenous
responses to a locally perceived threat. Both countries benefited from international public
health and scientific collaboration, and international donors played essential roles in
programme financing. But, in both cases, the impetus behind prevention efforts was local.

While efforts in Thailand emphasized condom use, particularly in sex work, they did not
discourage reducing one’s number of sexual partners. In fact, Thais responded with a substantial
reduction in their number of partners, particularly in the context of sex work. While efforts in
Uganda emphasized partner reduction, they did not discourage condom use. In fact, condom
use has recently reached high levels in the general population of Uganda and has probably
been high for much longer in sex work. The public promotion and debate regarding condoms
ended up encouraging not only condom use but also decreased numbers of partners in both
countries. The difference in emphasis between condoms and partner reduction probably had
more to do with differences in local epidemiology, particularly differences in the prominence
of commercial sex in HIV transmission, than with underlying differences in philosophy.

In both cases, the result was a response to the HIV/AIDS epidemic that seemed to work, better than
a cookbook approach based on generic international recommendations. A Thai-style programme
emphasizing condom use in commercial sex and prevention for injecting drug users would not have worked in Uganda, where these are not the main factors driving the epidemic. A Ugandan-style programme emphasizing partner reduction for the general population probably would not have worked well in Thailand. In both cases, what did work was a determined, multisectoral effort enlisting broad public support and responding to local realities.

**Other success stories**

The examples of Thailand and Uganda were chosen for this report because of their documented success in reducing HIV transmission and because the role of condom promotion was fairly clear. Other developing countries may also have achieved success, but it is often difficult to be sure. Several countries that responded to the epidemic relatively early with vigorous prevention programmes have experienced stable HIV prevalence rates or, at least, more gradual increases than had been projected. While this may indicate a successful prevention programme, one never knows what would have happened otherwise. It is therefore difficult to draw conclusions from such countries regarding the impact of HIV prevention programmes, in general, and condom promotion efforts, in particular.

Senegal is a good example. Vigorous HIV prevention efforts started in the mid-1980s. This resulted in high levels of knowledge regarding HIV prevention among the general population and high rates of condom use with non-regular partners in the capital, Dakar [118], though not necessarily in rural areas [119]. Condom use reached especially high levels in commercial sex—an important factor in the HIV/AIDS epidemic in Senegal. In one study, 94% of sex workers reported using a condom when they last had sex with a regular client and 98% with a new client [54]. Condoms are promoted during regular medical examinations and health education programmes that are part of a system of legalized commercial sex in place since 1969 [120].

During the 1990s, STI rates fell substantially in Dakar, while HIV prevalence in four sentinel urban sites remained stable among pregnant women (1.2%) and male STI patients (3%) [54]. HIV prevalence in female sex workers, however, continued to rise. A recent review concluded that it is impossible to know what course the epidemic would have taken in Senegal in the absence of prevention efforts, but that data from a number of sources indicate that prevention has been “successful” [54]. If this is correct, the experience of Senegal may tend to confirm the example of Thailand and its neighbours regarding the importance of condom promotion in commercial sex whenever this plays a central role in the epidemic.

Brazil is another developing country that responded to the HIV/AIDS epidemic with early and persistent prevention efforts. As noted in this report, relatively high rates of condom use have been achieved, both among high-risk groups [40, 41] and in the general population [59, 61]. Despite a worrisome recent trend towards ‘heterosexualization’ of the Brazilian epidemic, the overall incidence of HIV has stabilized [121]. One can only speculate as to how things would have been different without prevention efforts, and it is impossible to say how much of a difference condoms have made. The same might be said for several other countries where the epidemic appears to have stabilized, such as Honduras and the Dominican Republic [122, 123].
INTERACTIONS BETWEEN CONDOM PROMOTION AND OTHER PREVENTION STRATEGIES

As described in earlier sections of this report, condom use is a prevention strategy with the potential to reduce sexual transmission of HIV. But it is not the only such strategy. Examining condoms in isolation from other approaches gives, at best, a narrow view of HIV prevention. Both positive and negative interactions with other strategies to prevent the sexual transmission of HIV must also be considered. Strategies to prevent nonsexual transmission of HIV, such as needle exchange, screening of blood products, and prevention of mother-to-child transmission, are also important. But they are less likely to interact with condom promotion than are other strategies to prevent the sexual transmission of HIV.

Interactions can be simple or complex. The simplest sorts of interactions are easiest to grasp and least controversial. They are inescapable consequences of the laws of probability and economics. They are easier to consider because they do not require insight into the complexities of human behaviour. Nevertheless, they are important to remember.

The first of these is the concept of multiple layers of protection. Prevention strategies that work by different mechanisms can have an additive or multiplicative effect. For example, if smoking cessation and treatment of hypertension both reduce the risk of heart disease, doing both together will likely produce an even greater benefit. This can be applied to either an individual or a population. One might imagine, for example, that a certain level of reduction in the average number of sexual partners in a given population would cut the rate of HIV transmission in half. One might also imagine that a certain level of condom use would do the same. If both of these changes could be achieved simultaneously, the rate of transmission would be cut by more than half. Exactly how much more would depend on complex assumptions regarding which population groups are reducing partners and which are using condoms. Everything else being equal, however, the reduction in transmission from both changes simultaneously might be on the order of 75%. Of course, not everything else is necessarily equal, as will be discussed later in this section.

This sort of interaction between preventive strategies always works out for the best. Two strategies will always be better than one, and more strategies will be better still. This principle casts different prevention strategies as complementary forces all pushing in the same positive direction. It argues for including all possible strategies in HIV prevention programmes so as to achieve the greatest overall impact.

Running in direct conflict with this line of reasoning is the economic law of opportunity cost. Assuming finite resources (and resources are always finite), a dollar spent on one intervention is a dollar that cannot be spent on another. This principle pitches different strategies for HIV prevention in competition with each other. It argues for placing most or all of one’s resources behind the prevention strategy with the best cost-benefit ratio. Furthermore, the principle extends beyond HIV/AIDS prevention, so that HIV prevention efforts in general need to be considered in competition with other potential uses for the same resources.
The interplay between these two imperatives is difficult to quantify. Unfortunately, we seldom have all the information required to draw a rigorous balance sheet giving the best possible mix of interventions. But even if this were possible, it might still be a great oversimplification. This is because more complex interactions must also be considered. Different interventions can interact with each other in ways that are even stronger than shifting money from one programme to another or multiple layers of protection. Such interactions can be either positive of negative, and they have received far less attention than they should.

Although not labeled as such, interactions of this type have already been described in the previous section of this report dealing with examples of success in HIV prevention. The 100% Condom Use Programme in Thailand was aimed at promoting condom use in commercial sex, and a great deal of its impact came from its success in achieving this goal. The programme did not specifically attempt to discourage men from participating in commercial sex. Nevertheless, it had this effect. The percentage of Thai men visiting sex workers fell dramatically [92]. In other words, an intervention aimed at reducing one aspect of sexual risk had an unintended (and, in this case, positive) impact on another aspect of sexual risk.

Such interactions have been observed in diverse populations around the world. For example, a condom promotion campaign directed at male port workers in Brazil had the unexpected result of not only increasing condom use but also decreasing the proportion of men who reported having sex with casual partners [124]. The same was true of a condom promotion intervention for men who have sex with men in another Brazilian city [40]. Numerous studies on female condoms have concluded that they are a valuable strategy for prevention programmes, not because many women will consistently use them but because they encourage thought and discussion about risk reduction, thereby facilitating other prevention strategies [125]. These are all examples of interactions that go beyond the simple mathematical interplay between independent intervention strategies. The examples given above are all positive. This is not necessarily surprising given that all come from examples of HIV prevention success stories. In theory, however, such interactions could just as well be negative. Promotion of one strategy for preventing HIV transmission might have a negative effect on another.

The international scientific literature gives fewer concrete examples of such negative interactions. One might be the recently observed rise in incidence of STIs (including new HIV infection) among men who have sex with men, which appears to have been the result in some communities of success in HIV treatment with antiretroviral drugs. Apparently, a decreased perception of the severity of HIV infection has been enough to cause some men to stop using condoms [126]. In theory, antiretroviral treatment would be expected to prevent HIV transmission by reducing the viral load of persons with HIV and thereby reducing their likelihood of transmitting the virus to their partners [127]. Unfortunately, any such benefit appears to have been outweighed, at least in some settings, by a negative interaction between antiretroviral treatment and condom use. If nothing else, this example shows that unintended negative consequences are possible in the struggle against HIV/AIDS.

The potential negative interaction that has caused the greatest concern is the possibility that condom promotion might somehow increase sexual activity [128–130]. For example, a recent
effort to model the impact of various HIV prevention strategies estimated that outreach programmes for men who have sex with men would increase their condom use by 33% but also increase their number of high-risk partners by 17% [131]. Even though opponents might not put it in these terms, worries about potential interactions are a major source of opposition to condom promotion efforts. This is often especially true regarding condom promotion for young people. Opponents of condom promotion often express the concern that it may encourage young people to initiate sexual activity at a younger age or to have more partners. It could certainly do more harm than good if large numbers of young people were to switch from abstinence to sexual activity with condom use, especially if such condom use were inconsistent, and especially in settings with widespread sexual transmission of HIV.

Debates over this issue are common around the world. One example was a recent television spot aired in Kenya, described in Vignette #3, that was aimed at condom promotion for young people. Opponents claimed that the ad encouraged promiscuity. The purpose of this example is not to criticize the advertisement in question. In fact, it was part of an excellent series of television spots, most of which were aimed at de-stigmatizing HIV/AIDS and countering myths about casual transmission. The point is that the controversy caused by the ad boils down to a debate over interactions that this particular approach to condom promotion might (or might not) have with other determinants of sexual risk of HIV transmission. Viewing the controversy as such is far more constructive than stereotyping it as an argument between rigid conservatism and enlightened health promotion. The former is a researchable question that can be answered; the latter never can be resolved.

VIGNETTE #3
A controversial condom advertisement

A ‘racy’ television ad for socially marketed condoms made Kenyan “adults fume and adolescents squirm,” according to the Associated Press [134]. In the ad, two young women who appear to be teenagers are waiting at a train station on a sunny day. A handsome young man walks in from the heat to a water faucet and pours water on his head and chest, taking off his shirt. The two women stare, licking their lips; one drops her plastic water bottle, which cracks and starts leaking. The young man walks over, takes a condom from his pocket, and puts it on the water bottle, stopping the leak. The television spot was well made and conveyed a high level of sexual energy.
This advertisement created a great deal of controversy. Opponents claimed that it encouraged promiscuity among young people. Proponents countered that it encouraged condom use among at-risk young people and demonstrated, among other things, that condoms are strong and waterproof [134]. Neither side could base their opinion on any objective data as to whether the advertisement did or did not encourage sexual activity among young people.

In fact, surprisingly little is known about the effects of different approaches to condom promotion on other aspects of sexual risk behaviour. This is because research studies and programme evaluations that examine the effect of condom promotion strategies usually focus on condom use as their outcome. Seldom do they measure numbers and types of partners with sufficient rigour to determine to what extent a particular condom promotion strategy influences other aspects of sexual risk.

One area that has received more attention is the effect of reproductive health (sex education) programmes on the sexual behaviour of young people. A recent review identified 41 studies examining such programmes around the world [132]. More than half of these were school-based, though others were community-based or worked through the mass media, workplaces, or health facilities. Almost all resulted in improved knowledge and attitudes, and many produced an increase in contraceptive use. Fewer programmes had a demonstrable impact on either sexual initiation or number of sexual partners. For each of these two outcomes, only seven programmes had a significant impact. It is reassuring, however, that any such an impact was always in the direction of reduced sexual risk.

Reproductive health programmes for young people vary in their approach. Some may be fairly explicit—for example, in demonstrating the proper use of condoms. Most, however, are basically conservative in their approach and encourage postponing sexual initiation and limiting one’s number of partners. At least some studies indicate more explicit approaches that include skills training (i.e., how to correctly use condoms and negotiate their use with partners) may produce greater reductions in sexual risk than programmes that only provide information [129,133].

Even the more explicit condom promotion programmes for adolescents seldom emphasize ‘eroticizing safer sex’—an approach more commonly taken in prevention programmes aimed at higher risk populations, such as sex workers and their clients or men who have sex with men. In commercial sex, for example, it makes little sense to promote abstinence or reducing number of partners. There is little concern that interventions designed to promote condom use in commercial sex, no matter how explicit or sex-positive, might somehow do harm by encouraging people to engage in commercial sex. On the contrary, and as described earlier, condom promotion for commercial sex is more likely to do the opposite. The same argument might be made regarding prevention programmes for men who have sex with men, and other groups at especially high risk of sexual transmission.

Nevertheless, the possibility that interventions presenting casual sex with a condom as socially acceptable, enjoyable and safe might increase sexual risk cannot be discounted.
Among high-risk groups that are already engaging in such activities, it is appropriate that the main consideration be to find the approach that best promotes condom use. But priorities might be different for people not currently practising high-risk behaviour because the balance of risk versus benefit may be different, with greater potential to do harm. When viewed in this context, concerns about the Kenyan train station ad are not necessarily unreasonable.

HIV prevention programmes probably have not paid as much attention as they should to interactions between strategies that target different aspects of reducing the risk of sexual transmission. As described above, these interactions are often positive but might also, at times, be negative. Prevention programmes should try to maximize the positive interactions and minimize the negative ones. Too often, different prevention strategies are viewed as competing alternatives rather than being examined for how they might complement and reinforce each other. At the very least, different approaches should carefully avoid undercutting each other.

In this regard, HIV prevention programmes might learn from successful efforts in many countries to reduce traffic accidents over the past few decades. Strategies include safer roads and cars, driver education and restricted licences for new drivers, encouraging the use of seat belts, enforcing speed laws, and discouraging driving under the influence of alcohol and other drugs. Proponents of different strategies have argued about the best distribution of resources, but seldom have they worked at cross purposes to each other. An advertising campaign to promote seatbelt use would never consider implying that it’s safe to drive drunk as long as you wear a seatbelt. Driving instructors invariably tell their students to use seat belts rather than claiming that what they teach makes seat belts unnecessary.
RECOMMENDATIONS

As described in this report, consistent use of condoms is undoubtedly effective (although not 100% effective) in reducing the sexual transmission of HIV. Condom use has increased substantially in recent years in many parts of the world. Condom promotion has played an important though variable role in the available examples of successful national HIV prevention programmes in the developing world. Condoms have thus earned an important place in the arsenal of weapons for the fight against HIV/AIDS.

But despite the experience of the past two decades, many questions remain. How does the effectiveness of condoms vary in different groups and different settings? How consistent does condom use need to be before it provides protection for the individual? How high do rates of condom use need to be to provide protection for society? Is it possible to overcome a generalized HIV/AIDS epidemic primarily or entirely through condom use? How can condom promotion best be integrated into multifaceted approaches to reducing sexual transmission of HIV?

These questions will require a great deal of objective and unbiased research. The last question may be the most important—and the one that has been most neglected. Condom promotion does not take place in a vacuum. The question is not whether condom promotion interacts with other aspects of sexual risk (such as number of partners), but rather how better to understand these interactions and apply them to advantage. What strategies and messages for condom promotion will also encourage people to reduce their number of partners? How can programmes that encourage delayed sexual onset and ‘zero grazing’ be presented so that they also make people aware of the importance of condom use whenever they do not meet these ideals? Although we can and must learn from the experience of others, the answers to these questions are not necessarily universal. They will need to be examined many times over at the local level.

While there is much that is still unknown, it is possible to make informed recommendations based on the available evidence. First among these is that condom promotion should be part of most, if not all, national HIV/AIDS control programmes. Probably every country and culture in the world includes individuals for whom condoms are the best or even the only option to reduce their risk of contracting and/or transmitting HIV. An obvious example is commercial sex. This is not only a setting of high risk but also one wherein condom use has proven highly acceptable. Pregnancy is rarely a desired outcome of commercial sex, and issues of trust and intimacy that may be barriers to condom use are unlikely to apply. The world should follow Thailand’s example with a global 100% Condom Use Programme for commercial sex.

The best evidence for the effectiveness of condom promotion for HIV prevention is in groups or individuals who cannot or will not reduce their risk in other ways. This includes persons with HIV infection as well as HIV-negative persons with a known HIV-positive partner. Although lifelong sexual abstinence is a theoretical alternative, it is one that many such people will not choose to accept. Consistent condom use is essential for HIV-positive persons who choose to remain sexually active. Indeed, HIV testing as a prevention strategy makes little sense unless those who test positive can be guaranteed a reliable and affordable supply of condoms.
Another group for whom condom promotion is a proven prevention strategy is men who have sex with men. These men and their female partners continue to account for a substantial proportion of HIV transmission in many developing countries [135]. Sadly, they often do not receive the attention they deserve for condom promotion and other prevention strategies, either because society does not want to acknowledge them and deal with their needs or because of a belief (usually mistaken) that they are impossible to reach. There is conclusive evidence from around the world that condom-based prevention programmes for men who have sex with men are possible and effective.

Others that should receive high priority for condom promotion are groups known to have a high rate of HIV infection and/or with a high proportion of people with multiple sexual partners. This would include, for example, injecting drug users and individuals with sexually transmitted infections. Condom promotion probably should be part of any HIV prevention programme aimed at these groups. Heterosexuals with multiple sexual partners or a high turnover of partners may be harder to identify as a discreet group. But most countries have cultural and demographic groups that are likely to be at higher risk.

Many countries have gone beyond condom promotion targeting groups known to be at especially high risk and have invested substantial resources into condom promotion for the general population. Unless this were to produce unintended negative interactions with other prevention strategies (i.e., less abstinence and partner reduction), there are strong theoretical reasons to believe that it should help to reduce HIV transmission. Condom promotion for the general population can encourage people to think and talk about HIV prevention. It can also produce other benefits, such as preventing unintended pregnancy and reducing the transmission of other STIs. Nevertheless, the evidence to date is less convincing than might be wished regarding its effectiveness as a public health strategy for HIV prevention.

Condom promotion has tended to be more demonstrably effective, and certainly more cost-effective, insofar as it can target those at highest risk. While it might be argued that everyone is at high risk in a country with generalized heterosexual transmission of HIV, this is the very situation in which examples of successfully turning back an epidemic through programmes based mainly on condoms are sadly lacking. The success of condom-based programmes in Thailand and its neighbours seems to have been largely because of the key role of commercial sex in transmission and the ability to target condom promotion efforts towards this high-risk activity.

Regardless of the group being targeted, condom promotion programmes need to do a better job of measuring impact. Data on number of condoms distributed are important but not sufficient. Behavioral information on the proportion of people who consistently use condoms with various types of partners is also necessary. For condom promotion aimed at the general population, this should ideally include measuring trends in numbers of sexual partners—particularly casual partners—especially among the young.

Successful condom promotion programmes not only result in the distribution of large numbers of condoms but also in high rates of consistent condom use, especially among casual partners. Ideally, they should take place in a context where the number of such partnerships is stable.
or falling. Following trends in these parameters is necessary not only to look for potential interactions but also to protect successful condom promotion programmes from unfair criticism. For example, stagnation or a fall in condom distribution might be a sign of success if demand is falling because fewer men visit sex workers or have other casual partners, so long as the rate of consistent condom use in these situations is stable or increasing.

As with all health interventions, it is important in condom promotion to avoid doing harm. Condoms themselves are unlikely to be harmful, but the potential to harm still exists. This can occur if condom promotion takes resources away from other interventions or, worse yet, produces unintended negative behavioural consequences. Condom promotion might also do harm if not accompanied by a steady and affordable supply of condoms. Anything less would result in inconsistent condom use—certainly not an effective strategy for preventing HIV infection.

In striving to do no harm, is important to tell people the truth about condoms: that they are safe and effective, but not 100% effective. The common practices of calling sex with a condom ‘safe sex’ (instead of ‘safer sex’) and telling people they can only get HIV through unprotected sex are not accurate. Avoiding overstatements about condoms may go a long way towards eliminating any possible conflicts between condom promotion and other strategies for reducing sexual risk. Correctly informing people about the advantages of condoms without exaggeration should not be impossible. Family planning programmes around the world have successfully achieved a similar balance in promoting contraception.

Whatever the potential difficulties with condom promotion, it is a strategy that must be put to the best possible use. There are not so many weapons in the fight against HIV/AIDS that we can afford to forego any of them. Nor is any one strategy so effective that it makes the others superfluous. Barring a highly effective vaccine, condoms will be part of the mix for years to come. Much will depend on how well we are able to realize the potential for prevention that condoms clearly offer.
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UNAIDS, as a cosponsored programme, unites the responses to the epidemic of its eight cosponsoring organizations and supplements these efforts with special initiatives. Its purpose is to lead and assist an expansion of the international response to HIV/AIDS on all fronts. UNAIDS works with a broad range of partners—governmental and nongovernmental, business, scientific and lay—to share knowledge, skills and best practices across boundaries.