Behavioural interventions to prevent HIV infection: rapid evolution, increasing rigour, moderate success

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Behavioural interventions aim to alter behaviours that make individuals more vulnerable to becoming infected or infecting others with HIV. Research in this field has developed rapidly in recent years. Increased rigour in the design and conduct of evaluations and moderate successes in bringing about behaviour change in target populations are the key achievements so far. This paper reflects on these developments, addresses recent innovations and highlights likely areas for future work. Discussion focuses on maximising the potential effectiveness of new interventions, methodological issues relating to evaluation and implementation of interventions into practice. The paper concludes there is evidence that interventions deemed effective under evaluation conditions can be implemented in HIV prevention services and that this is the next major challenge. The immediate goal should be consolidation of the learning that has occurred, particularly efforts to maintain theoretical and evaluative rigour whilst encouraging increased collaborative partnerships between researchers, service providers and affected communities.

The lack of an effective HIV vaccine means prevention through behaviour change is the most important available strategy to reduce new infections. It is well established that behaviour rather than identity determines risk of HIV infection and certain social groups are more vulnerable to infection than others. Effective HIV prevention programmes need to include interventions that target identified groups at increased risk, as well as the general population, with the balance between these being determined by current epidemiology and future projections

Behavioural interventions aim to reduce behaviours that make individuals more vulnerable to becoming infected, or infecting others, with HIV. These interventions have generally aimed to increase use of condoms or reduce numbers of partners. More recently, ‘negotiated safety’ interventions have sought to promote condom protected sex
between individuals of different HIV sero-status, acknowledging that partners who know themselves to be of the same status may have unprotected sex, but have suggested this is only an adequate risk reduction strategy if both partners agree to have no unprotected sex with others\textsuperscript{7}. Sexual behaviour is not a static phenomenon, but is influenced by many factors, including characteristics of the individual as well as their social and economic context. Thus, while the aim of behavioural interventions is relatively simple, the circumstances in which they operate often necessitates their being complex and multi-dimensional. To date, there has been a huge diversity of interventions, employing methods that variously focus on the individual (e.g. counselling), the community (e.g. community development) and society (e.g. changes in legislation and public policy).

Research into behavioural interventions for HIV prevention has rapidly developed in the course of the last ten or so years. This development is characterized by increasing rigour and moderate success. This paper reflects on developments, addressing recent innovations and highlighting some important areas for future work. The paper is structured around: maximizing the potential effectiveness of new interventions; evaluating interventions; and implementing interventions more widely. The discussion is largely confined to interventions targeting the prevention of HIV, and other poor sexual health outcomes such as sexually transmitted infections (STIs) and unwanted pregnancies in industrialised countries. Although non-industrialised and middle-income countries are hardest hit by the HIV epidemic, the reality of behavioural intervention research so far is that it has been disproportionately situated in the richer countries. This is, however, slowly changing, and there is an emerging literature concerned with behavioural interventions in resource-poor countries.

**Maximising the likely effectiveness of interventions**

**Use of theory**

There is widespread agreement that the use of theory is central to developing effective behavioural interventions\textsuperscript{8–10}. Theory in this context refers to either a formal theory of individual or social behaviour (see below), or evidence regarding the social or individual constraints that either promote or inhibit behaviour change\textsuperscript{10}. Nearly all behavioural interventions for HIV prevention can broadly be classified as complex interventions – that is they consist of separate elements that are combined in order for the intervention to function as intended and to deliver the desired outcome\textsuperscript{9,10}. People may respond differently to singular components and what constitutes the ‘active ingredient’ may be different for each person. One of the great attractions of theoretical
approaches is they can serve as an explicit framework to enable a thorough consideration of what factors must be addressed to bring about the desired behaviour change, and how. At the same time, this framework will guide evaluators’ identification of process and outcome measures to be examined.

So far, there is little in the way of clear guidance on deciding which theory is most appropriate, or how best to apply it. Examining the results of reported research is rarely helpful. Reported intervention studies seldom provide explanations for the choice of theory. Equally, they rarely describe how a chosen theory guided development of the intervention or choice of outcome measures. Furthermore, evidence to support the specific application of many theories is limited and of varying quality. Application of the theory of the social construction of sexuality, for example, has little basis in research. The application of other theories, such as the theory of planned behaviour, has been extensively investigated. Most of these studies have used observational designs; there have been remarkably few attempts to test the theories experimentally.

Health promotion theory

Health promotion theory, unlike the other theories discussed below, does not attempt to determine how various factors affect health outcome, but rather it attempts to categorise and prescribe health promotion approaches. Nevertheless, it is often central in determining what factors interventions target and identifying the most appropriate modalities of delivery. Caplan categorises health promotion in terms of two dimensions. The first dimension focuses on whether health promotion aims to affect the individual’s actions or to modify the environment (material or social) within which they live. For example, HIV prevention programmes might, on the one hand, try to improve gay men’s sexual assertiveness, or on the other, try to encourage the development of a less homophobic society. Caplan’s second dimension focuses on the extent to which health promotion is driven by the priorities articulated by affected individuals and communities, or by those of ‘experts’.

Health promotion theory is often prescriptive, encouraging interventions that focus on the societal determinants of health, and activities developed and delivered in partnership with affected communities, to redress a perceived existing bias towards individualistic and ‘top-down’ interventions. This prescriptive element is stressed in documents such as the World Health Organization’s Global Strategy of Health for All by the Year 2000. In practice, however, most health promotion, including that addressing HIV infection, remains individual-focused and expert-driven. To date, some interventions have sought the involvement of affected communities, and a few have addressed the environmental...
determinants of risk\textsuperscript{3,20}. Recognition of the need for this collaborative approach, particularly in dealing with the most vulnerable groups, is slowly being reflected in the literature\textsuperscript{3,4}.

**Social psychological theories**

The growing commitment to using theory in intervention development stems partly from the evidence that nearly all sexual health and HIV prevention programmes that have demonstrated some impact on sexual risk behaviour have drawn on social psychological models\textsuperscript{6,8,9,11}. These theories relate behaviour to individual cognitions (i.e. thoughts, attitudes or beliefs). If these cognitions can be modified, and there is a demonstrable corresponding shift in behaviour, then there is good reason to target these cognitions in behavioural interventions.

There are a number of different models; these have mostly evolved from the Health Belief Model\textsuperscript{21}. Only one of these, the AIDS Risk Reduction Model, has been specifically designed to address behavioural change in relation to HIV\textsuperscript{22}. The rest have been borrowed from other areas of behavioural research and adapted to meet the needs of HIV prevention. There is substantial overlap between the various theories with regard to the cognitions on which they focus. The theories do, however, differ from one another in a number of ways, including their range of application, formal structure, and complexity. Table 1 summarises the main cognitions that these models focus on, theories with which they are associated, and examples from the recent literature of interventions employing them.

A critique that has emerged in the literature is that social psychological models often overlook the situational factors that might shape sexual behaviour, such as the effects of recreational drugs, and negotiation with one’s sexual partner\textsuperscript{23}. Others have argued that the more sophisticated models do take into account how situational factors might impact at the individual level\textsuperscript{24}. Theoretically-based behavioural interventions should be able to overcome any such difficulties by employing modelling and qualitative testing prior to application\textsuperscript{10}.

**Sociological theories**

Sociological theories also offer considerable potential for guiding the design of behavioural interventions. These theories relate the actions of individuals to the societies in which they live. Unfortunately, one weakness of some potentially useful sociological theories is that there is as yet little empirical support for their application in interventions. One example is the social construction of sexual identity\textsuperscript{12}. This theory suggests that sexual identities develop in the course of social interaction with same-sex peers during adolescence, generally being based on prior, non-sexual gender identities. Where conventional gender roles predominate, interactionists suggest that young women view sexual activity as a service to men, while
| Table 1 Overview of the main social psychological theories used in behavioural interventions for HIV prevention with examples of evaluated theory-based interventions |
|---------------------------------|-----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| **Model or theory**              | **Psychological and behavioural determinants**                                              | **Examples of target thoughts, attitudes or beliefs**                                         | **Examples of evaluated theory-based interventions**                                                             |
| **Health belief model**          | Perceived susceptibility                                                                     | Am I really at risk of HIV?                                                                     | Intervention with female sex workers®. Seriæes of 3 sessions that aimed to increase knowledge about HIV and sexually transmitted infections, increased perceived susceptibility to HIV and improve skills related to condom use and condom negotiation with partners. Another intervention using outreach workers targeted clients of the sex workers and the sex workers' pimps and focused on similar points. |
|                                 | Perceived seriousness of illness                                                             | Getting HIV would mean health issues would dominate all aspects of my life.                  |                                                                                                                |
|                                 | Belief in the effectiveness of proposed behaviour                                            | Proper use of condoms reduces the chance of HIV being passed on to me.                       |                                                                                                                |
|                                 | Perceived benefit of adopting behaviour                                                     | Using condoms all the time, I could avoid HIV.                                                |                                                                                                                |
|                                 | Cues to action                                                                              | I don't like the feel of wearing a condom                                                     |                                                                                                                |
| **Theory of planned behaviour**  | Attitudes                                                                                  | Sex is just as enjoyable if we use condoms as without condoms.                               | Clinic-based trial of counselling approaches®. Compared 3 strategies. Enhances counselling (i.e. more sessions) focused on addressing misconceptions about behaviour, developing individualised risk reduction strategies by improving behavioural intentions and skills training to improve self-efficacy. |
|                                 | Perceived norms                                                                             | My friends all use condoms and would expect me to as well.                                   |                                                                                                                |
|                                 | Behaviour intentions                                                                        | I intend to make my sexual behaviour less risky by using condoms all the time.               |                                                                                                                |
| **Social cognitive theory**      | Expected outcomes                                                                           | Using condoms all the time, I could avoid HIV.                                                | Inner-city African American adolescents®. Black male adolescents randomly assigned to receive an AIDS risk reduction intervention aimed at increasing AIDS-related knowledge and address problematic attitudes toward high risk sexual behaviour. |
|                                 | Self-efficacy                                                                              | I know I can get my partner to use condoms                                                     |                                                                                                                |
| **Stages of change**             | Pre-contemplation                                                                          | People like me don't need to use condoms                                                       | Clinic-based intervention with gay men®. Single session (7 h) small-group workshop. Exercises addressed relevance of personal goals, setting goals, assessing motivations for behaviour change, coping strategies, body image and self-esteem, condom skills and lifestyle balance. |
|                                 | Contemplation                                                                              | Using condoms can reduce the chances of getting HIV.                                          |                                                                                                                |
|                                 | Preparation                                                                                | I want to reduce my chances of getting HIV                                                    |                                                                                                                |
|                                 | Action                                                                                    | I am only going to have sex if we use condoms.                                                |                                                                                                                |
|                                 | Maintenance                                                                               | Always using condoms is worthwhile because it reduces my chances of getting HIV              |                                                                                                                |
| **AIDS risk reduction model (ARRM)** | Self-labeling                                                                            | I didn't think so before, but I know what I do puts me at risk of HIV infection               | Intervention with minority women®. Three small-group sessions of 3-4 h meeting weekly over 3 weeks. Each session helped women to recognise personal susceptibility, identify ways of reducing risk, building commitment to change behaviours and developing necessary skills to do so (e.g. condom negotiation). |
|                                 | Commitment                                                                                | My sex life can be enjoyable if I use condoms.                                                |                                                                                                                |
|                                 | Taking action                                                                              | I can do it. Condoms are easily available and I know that people will help me.                |                                                                                                                |
|                                 | Maintenance                                                                               | This was a good decision that I'm going to keep to it                                        |                                                                                                                |
young men see it as a form of personal achievement, and homosexual activity is viewed as antithetical to conventional gender self-identity. Behavioural interventions informed by this theory can encourage people to explore how their understanding of sexuality has been formed predominantly through interaction with their peers, influenced by wider society, so that negative views of one’s identity, or stereotypical behaviour can be challenged.

One sociological theory for which there is some empirical evidence in relation to HIV prevention is the theory of ‘diffusion of innovations’. This theory describes how material or cultural innovations come to be adopted by communities. Through analysis of the take-up of innovations in different fields, Rogers identified factors that influence the rate of adoption. These include: the characteristics of the social system; the innovation itself; and the characteristics of early and later adopters. According to this theory, early adopters might influence key opinion leaders who in effect become peer-educators within their communities. One limitation is that the theory assumes innovations remain unchanged as a result of their diffusion. While this might be true of physical products, it is easy to imagine that cultural products, such as health promotion messages, might become modified and even distorted in the process of diffusion. This model has been used to inform several carefully evaluated peer-education programmes, including at least two targeting gay men. The contrasting findings of these two studies are discussed below.

Sociological analyses also have much to offer behavioural intervention research in explaining socio-economic and cultural factors that can contribute to a population’s vulnerability to infection. Such theorizing has been an important influence in the targeting of HIV prevention interventions, and in the focus on social and personal empowerment.

Use of formative research

Theories can offer general guidance concerning factors addressed by interventions, but there are other aspects they cannot inform. For example, social psychological theory cannot provide guidance on the ideal number and schedule of intervention sessions. Additional research is required to determine which factors need most attention with a specific audience and setting. ‘Formative research’, often in the form of qualitative inquiry, should occur prior to the development of an intervention. Such research can be analogous to phase I development of interventions in clinical medicine, but also has the added benefit of allowing exploration of acceptability, appropriateness and feasibility of the modes of deployment of an intervention.

Despite growing recognition of the important contribution of formative research prior to deployment and evaluation of an intervention, findings
from this important research phase are often not widely disseminated in the published literature\(^{11}\). Shain et al report on the formative research they conducted prior to the development and evaluation of an HIV prevention intervention\(^{5,27}\). Their 18 month study involved 25 focus groups and 102 in-depth interviews with both men and women to collect background information on values and beliefs, behaviours, strategies to motivate behavioural change and barriers to change as well as the logistics of intervention\(^{27}\). They also specify how the background behaviours and beliefs identified, were directly addressed through the intervention\(^{27}\). Subsequently, the researchers demonstrated links between the adoption of risk reduction strategies that targeted these behaviours and a decrease in the acquisition of sexually transmitted infections\(^{30}\). Funders have recognised the value of these research processes\(^{6,10}\). In future, they will need to demonstrate their commitment to funding formative research processes, which in reality are not optional bolt-ons, but central to the development of successful interventions\(^{10}\).

**Evaluating interventions**

*Rigorous evaluation of effectiveness*

While there is little disagreement about the importance of evaluating behavioural interventions, there is still on-going controversy about the most appropriate evaluation methodologies. Evaluation is important to ensure implementation of effective interventions in appropriate settings with appropriate target groups; to stop ineffective or harmful interventions being further deployed\(^{26,31,32}\), and to determine the cost-effectiveness of interventions\(^{33}\). In order to conclude that an intervention is effective, we need to establish a significant association between positive outcomes and exposure to the intervention in question. This requires minimising the possibility that such an association reflects the effects of some unacknowledged factor (*i.e.* confounding), or underlying differences between those who received the intervention and those who do not (*i.e.* bias).

Many, including ourselves, would argue that experimental evaluations, and randomised controlled trials (RCTs) in particular, provide the best means to achieve these objectives. In an uncontrolled study, if an evaluator detects an improvement in the outcome measures compared with baseline measures this might reflect the effects of the intervention or of some other time-related confounding factor (*e.g.* secular trends). However, by comparing the outcomes of the intervention group with those of an equivalent control group, the researcher can take account of this confounding and thus make an assessment of the effects of the intervention itself.
Random allocation, and to a lesser extent matching, appear to offer the best means of ensuring that intervention and control groups resemble each other in terms of factors, for example, age and sexual behaviour that, if they varied between the two groups, could affect outcomes and so bias results. Randomisation should distribute both the known and unknown factors that influence outcomes equally between the groups. It is thus an elegantly simple device for taking account of the multiplicity of social influences on outcomes studied in research. The problem with matching is that it requires knowing about all the relevant factors that can influence outcome, and this is unlikely to be the case. For this reason, RCTs are generally regarded as the most rigorous evaluation design.

Increased rigour is a key development in recent behavioural intervention research. The quality of evidence obtained from an evaluation is now likely to be assessed on more than merely random allocation to intervention and control groups. Assessment requires the reporting of baseline characteristics of the intervention and control groups, the mode of randomization, attrition rates in each group at each follow-up, all of the outcomes of both these groups, and sample size calculations in relation to outcomes.

Acceptance of RCTs in the field of behavioural interventions for HIV prevention is still by no means unanimous. Critics have suggested that allocation (random or otherwise) of participants to interventions and control groups is impossible in certain interventions. This, they argue is particularly so in interventions where those from affected communities participate in planning and delivery; interventions delivered via community networks and structures; and interventions addressing the socio-economic or legislative environment. There are, however, examples of quasi-experimental evaluations of interventions in all these categories, including a group-work intervention developed collaboratively with local voluntary agencies; peer-education sexual health promotion interventions employing community networks; and interventions targeting societal determinants of risk among adolescents.

Another criticism of RCTs of sexual health promotion is that contamination between intervention and control groups will prevent adequate control of confounding. In other words, there is more chance that health promotion messages, as opposed to clinical interventions, will come to influence control as well as intervention-group participants. One methodological development that seeks to counter problems of contamination is cluster RCTs. In these, whole sites rather than individuals, are allocated to intervention or control, the belief being that intervention and control site participants are then less likely to interact. Examples of clusters used in experimental evaluations of sexual health promotion include: gyms and cities. However, the possibility exists that
an intervention aimed at an intervention cluster could still affect a control cluster, for example because residents of an ‘intervention’ city travel to a ‘control’ city, and have sex or otherwise interact with its residents. There is, however, evidence that well-designed studies can avoid problems of contamination between intervention and control clusters by employing clusters whose residents do not intermingle or by statistically controlling for the effects of contamination.

These counter-arguments regarding allocation and contamination are not meant to suggest that allocation and contamination difficulties never impede or prevent the use of experimental evaluations in the field of sexual health promotion. Certain interventions, especially those addressing socio-economic and legislative determinants of behaviour, may be difficult or impossible to trial. Allocation to control and intervention groups may be impossible for practical or ethical reasons. It would have been highly problematic, for example, to evaluate the HIV prevention effect of removing discrimination in the age of consent for male homosexual intercourse by doing so in some UK ‘clusters’, but not others. Where experimental evaluations genuinely are impossible, other methods, despite providing less clear evidence on effectiveness, must suffice.

Choice of outcome measures

To demonstrate with confidence the effectiveness of behavioural interventions, evaluators need to use outcome measures that reflect the objectives of the intervention and the aims of key stakeholders, including the affected communities. This makes the choice of outcome measures complex. For example, if the aim of an intervention is to reduce sexual risk taking behaviours among young heterosexual women, the choice of outcome measures is not necessarily clear. Should evaluators focus only on measures of behaviour (either the proportion or the actual number of episodes of sex that are deemed to be less risky)? Do indicators of morbidity and other negative sexual health outcomes (e.g. unplanned pregnancy) offer a better measure? The answer is rarely clear-cut and will depend partly on the behaviour of the target population and partly on the aims of the intervention. The most appropriate outcomes will therefore be specific to the intervention and the evaluation design, but should always be identified as such at the outset.

In HIV prevention research, the incidence of new HIV infections in intervention and control groups offers the most valid measure of effect of interventions. However, this has almost never been possible in evaluations of single interventions in industrialised country settings because of low incidence. Nevertheless, other biological outcomes may be suitable proxy indicators of reduced risk. These might, for example,
include incident sexually transmitted infections\textsuperscript{11}. However, the relationship between sexual behaviour and sexually transmitted infections is not direct or simple\textsuperscript{11,45,46}. Studies have shown that specific sexual behaviours cannot predict reductions in infections\textsuperscript{32,45,46}.

Biological measures can have their own validity problems, concerning definition and ascertainment. Definitions of sexually transmitted infections that are too broad can include infections acquired through less risky sex (e.g. oral sex). Ascertainment of cumulative diagnosed infections by record review at the end of an evaluation will yield more endpoints, but miss asymptomatic infections\textsuperscript{11,32}. Ascertainment of infections by screening at a given time post-intervention has the advantage of including asymptomatic infections, but requires large numbers to detect differences between trial groups\textsuperscript{47}. Bias in measurement of cumulative diagnosed infections is more likely if the intervention changes the probability that individuals will attend clinics. Another potential bias is that of missing infections diagnosed at other clinics\textsuperscript{32}. Within the context of an RCT, intervention group participants may be more likely than controls to ‘hide’ an infection acquired during the study from researchers by having it treated elsewhere\textsuperscript{11}.

The emphasis on biological endpoints here is not intended to undermine the importance of behavioural measures. However, empirical research has questioned the validity and the accuracy of self-reported sexual behaviour\textsuperscript{11,32,48,49}. Use of new technologies, such as computer-assisted self-interview (CASI), instead of traditional face-to-face interviews, are an important methodological advance that may go some way toward addressing the underlining problem\textsuperscript{50}. However, unblinded randomised evaluations of behavioural interventions will continue to be vulnerable to biased self-reporting. Even with careful explanation of equipoise, it is difficult to exclude the possibility that people who know they are receiving a certain intervention will feel obliged to under-report risk behaviours more than people who know they are in a control group. Stephenson et al’s review of rigorous behavioural intervention trials found that all reported some improvement in one or more self-reported behavioural outcomes, but only two interventions reported declines in sexually transmitted infection rates\textsuperscript{11}. It cannot, therefore, be assumed that interventions having a beneficial effect on reported sexual behaviour will have a similar effect on sexually acquired infections\textsuperscript{11,32}.

The question of which measures constitute the most appropriate outcomes in a given evaluation is unlikely to be resolved quickly, and continued research into the complex epidemiological relationship between behaviours and sexually transmitted infections is needed\textsuperscript{45,46,48}. However, as suggested at the outset, the key is that outcomes should be realistic and reflect the aims of the intervention. Where a complex intervention aims to address various determinants of risk in order to reduce
HIV transmission, it is perfectly reasonable to measure biological outcomes. Failure to measure biological measures means that, as evaluators, we will have no means to know whether ultimately we have affected them\textsuperscript{11}. However, more modest interventions, such as educational projects, may not in isolation hope to influence biological end-points and so including biological outcome measures might be unrealistic.

A number of behavioural interventions have been reported as effective in increasing rates of condom use, reducing numbers of partners and reducing incidence of STIs within a population\textsuperscript{3–5,51}. However, the outcomes of ‘negotiated safety’ interventions remain unevaluated. While the effects of these interventions have not been as dramatic as the reported effects of STI treatment programmes in reducing HIV infection\textsuperscript{52}, behavioural and STI treatment approaches to HIV prevention are complementary.

**Process evaluation**

All outcome evaluations, whether they employ control groups or not, should be conducted alongside process evaluations so that effective interventions can be carefully described, the processes by which an intervention exerts effects (or fails to do so) can be explored, and the context within which an intervention will and will not be effective can be examined\textsuperscript{53}. A recent example of such a study is a controlled trial of peer education for gay men in London, which had no apparent impact on HIV risk behaviours\textsuperscript{26}. Because the study had an integral process evaluation, the researchers were able to identify possible explanations for intervention ‘failure’, such as the unacceptability of the intervention to the peer educators who were asked to provide the it\textsuperscript{26}.

**Implementing effective behavioural interventions in HIV prevention practice**

The overarching goal of behavioural intervention research is to ensure interventions, particularly those for which there is good evidence of effectiveness, are implemented widely in HIV prevention services. A number of interventions have been identified as ‘effective’ and ready for implementation\textsuperscript{6}, yet service providers have been slow to take up these interventions and incorporate them into their services\textsuperscript{54}. This is an area where we feel there is likely to be intensified interest in the future\textsuperscript{55}. This section examines some of the obstacles to widespread implementation of evidence-based interventions and some of the potential responses.

One of the principal obstacles to wider implementation of interventions may be the degree to which they are targeted and developed for
a specific audience\textsuperscript{5}. As discussed above, theories used to develop interventions may not be directly transferred from one cultural setting to another. Kelly et al's application of the theory of diffusion of innovations with gay men in the US was demonstrably effective in reducing risk-taking behaviour, while Elford et al's application in the UK was not\textsuperscript{4,26}. A recent review of the most rigorously evaluated interventions concluded that an explicit understanding of behaviours, beliefs and risk perceptions seems to be key to developing successful interventions and that the generalisability of interventions may be determined by contextual specificities indicated in the formative research stage\textsuperscript{11}. If true, this suggests that an intervention shown to be effective with one target group, cannot be applied with another, or in different setting, with the same anticipated benefit without some new formative research to assess its appropriateness and viability. One strategy that avoids this is to develop interventions, informed by theory and formative research, and to conduct their subsequent evaluation, across diverse populations and in different geographical and possibly, cultural settings\textsuperscript{47,51,56}. However, evaluations on this scale are costly, require major personnel resources and are rarely financially or practically feasible for a single intervention.

A second obstacle, critics of randomised trials argue, is that the generalisability of interventions evaluated using trials is especially questionable because of the unusual level of control and care exercised by those conducting the evaluation\textsuperscript{37}. Rather than supporting arguments against trials, this suggests that, in order to maximise the likely generalisability of an intervention, similar development processes should be used for interventions that will undergo a trial evaluation as for those that would not. In other words, we should involve affected communities as well as the intended providers of behavioural interventions in the planning and undertaking of intervention studies from the outset\textsuperscript{55}. The involvement of affected communities and providers in the development and evaluation of interventions is not inimical either to the use of theory in developing interventions or the employment of rigorous methods of evaluation\textsuperscript{53}.

Finally, at the level of technology transfer, there are structural obstacles to the implementation of evidence-based interventions. Somlai et al's findings from a survey of community-based prevention organisations in the US showed that few offered workshops on risk self-appraisal and risk-reduction skills even though there was evidence to suggest these approaches were effective with some groups\textsuperscript{57}. In the US, a number of programmes are now in place to support and enhance technology transfer between researchers and prevention providers\textsuperscript{6,55}. There is also a very small but growing literature that provides the descriptions and evidence for the effectiveness of such work at the level of the HIV prevention providers\textsuperscript{53,58}. 

\textsuperscript{4,26}}
Conclusions

Development, evaluation and implementation of behavioural interventions has progressed rapidly in the last decade or so. Yet most critical reviews conclude that such interventions have only been modestly successful in reducing HIV transmission risk. However, this should not be a cause for despondency. The necessary rapidity of such developments, generally with limited funding, means that evidence of success should be celebrated. Moreover, the evidence that with appropriate support interventions demonstrated effective under evaluation conditions can be implemented into HIV prevention services suggests that there is real potential for success. What is now required is a consolidation of all the learning that has occurred, and in particular an effort to maintain and further develop theoretical and evaluative rigour, whilst encouraging a participative ethos and multidimensional focus within HIV prevention behavioural interventions.

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