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Who Participates in Which Health Promotion Programs? A Meta-Analysis of Motivations Underlying Enrollment and Retention in HIV-Prevention Interventions

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This meta-analysis examines whether exposure to HIV-prevention interventions follows self-validation or risk-reduction motives. The dependent measures used in the study were enrolling in an HIV-prevention program and completing the program. Results indicated that first samples with low prior condom use were less likely to enroll than samples with high prior condom use. Second, samples with high knowledge were less likely to stay in an intervention than were those with low knowledge. Third, samples with medium levels of motivation to use condoms and condom use were more likely to complete an intervention than were those with low or high levels. Importantly, those patterns were sensitive to the interventions' inclusions of information-, motivation-, and behavioral-skills strategies. The influence of characteristics of participants, the intervention, and the recruit procedure are reported.

Keywords: HIV prevention, behavioral interventions, retention, recruitment, attitudes

The need to develop behavioral interventions to reduce infection with HIV and other sexually transmitted infections (Centers for Disease Control [CDC], 2005) has resulted in many evidence-based interventions that attempt to increase HIV-relevant knowledge, motivation, and behavioral skills (J. D. Fisher & Fisher, 1992). Although these programs have been shown to be efficacious in meta-analytic syntheses and multisite trials (e.g., Albarracín et al., 2005; Albarracín et al., 2003; B. T. Johnson, Carey, Marsh, Levin, & Scott-Sheldon, 2003; Kim, Stanton, Li, Dickersin, & Galbraith, 1997; Mize, Robinson, Bockting, & Scheltema, 2002; Prendergast, Urada, & Podus, 2001), there is a surprising lack of understanding of the programs' outreach. However, it is important to determine if the programs reach and retain audiences that lack appropriate knowledge, motivation, and behavioral practice, and if specific aspects of these programs increase outreach and retention.

The limitations in our knowledge about outreach may be due in part to the researchers' needs to test programs under conditions that increase participation and reduce attrition. In doing so, researchers provide strong incentives for participation and perceive low retention as a serious threat to be minimized. Despite the value of these practices to assess intervention efficacy, an informed take on outreach requires understanding natural variability in intervention acceptance and retention rather than conceptualizing attrition as a rate that must be constant and low. For this reason, we meta-analyzed the HIV-prevention intervention literature with a focus on variations in the sample sizes within included studies. From sample sizes at different study points, acceptance and retention rates were calculated and then examined as a function of participants' knowledge, motivation, and behavioral practice, as well as the intervention's content.[1]

Self-Validation and Risk Reduction as Guides of Participation in HIV-Prevention Programs

For condom-use-promoting interventions to have a positive public-health impact, they must attract individuals who are not yet using condoms consistently. Nonetheless, previous research on selective exposure implies that only people who already use condoms may participate in prevention programs. According to Festinger (1957, 1964), people have a tendency to seek information that confirms their points of view because they feel well in these situations (Clore & Byrne, 1974). Importantly, then, if people participate in health-behavior interventions with the goal of validating their current behavior, individuals who are already in compliance with the health recommendation would be the most likely to participate. For example, individuals who already use condoms may enroll in and complete the interventions more than will individuals who do not yet use condoms.

An alternative, more encouraging, possibility is that interventions attract audiences that most need the programs. For instance,

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[1] The present meta-analysis is not part of earlier ones (Albarracín et al., 2005). Rather, a new literature search and a new coding scheme were designed, and the overall coverage was limited due to the need to extract precise information on sample size and means of knowledge, motivation, or past behavior for all participants entering the intervention.

risk perception and risk-reduction goals have been proposed to underlie health-care seeking (Floyd, Prentice-Dunn, & Rogers, 2000; Rosenstock, Strecher, & Becker, 1994). Hence, people who do not use condoms may be most interested in condom-use interventions that fit with their risk-reduction goals. Another possibility, of course, is that the self-validation and risk-reduction motives operate in tandem. In this case, when condom use increases, the self-validation goal should increase, whereas the risk-reduction goal should decrease. Thus, these two patterns could produce an inverted-U relation between past condom use and exposure to the intervention. That is, high condom users may not participate because they have no risk to reduce, and low-condom users may not participate because the intervention invalidates what they do. In contrast, moderate condom users may participate because the interventions can help them to reduce their risk and do not severely invalidate what they do.

Factors other than the audience's condom use may also play a role. In particular, prior knowledge about HIV and motivation may influence participation in health promotion programs (see J. D. Fisher & Fisher, 1992; W. A. Fisher, Fisher, & Harman, 2003). Thus, our meta-analysis included knowledge about protection; how to recognize safe partners, and so on (W. A. Fisher et al., 2003); and a motivation component that includes attitudes, intentions, norms, perceived threat, and perceived behavioral control (Ajzen & Fishbein, 2005; Bandura, 1994; Rosenstock, Strecher, & Becker, 1994; for a meta-analysis, see Albarracín, Johnson, Fishbein, & Muellerleile, 2001).[2] These factors may correlate with exposure to HIV-prevention interventions, whether guided by the goal of self-validation, the goal of reducing one's risk, or both. Self-validation should result in a positive association of knowledge and motivation with exposure; risk reduction should yield a negative association of knowledge and motivation with exposure; a combination of self-validation and risk reduction should yield an inverted-U association.

The Role of Intervention Content

On the basis of J. D. Fisher and Fisher (1992, 2000), Albarracín et al. (2001, 2005) classified three types of interventions to induce condom use. Each intervention type respectively targets information, motivation, or behavioral skills and can be used in combination with the other two (see J. D. Fisher & Fisher, 2000). An information communication typically conveys information on the nature of HIV, modes of transmission, mechanisms of the disease, and methods of prevention (e.g., Borgia et al., 1997; Gerrard & Reis, 1989; Gillmore et al., 1997; Huszti, Clopton, & Mason, 1989; Johnson et al., 1988; Kelly, McAuliffe, et al., 1997; Kelly, Murphy, et al., 1997; O'Leary, Jemmott, Goodhart, & Gebelt, 1996; Sherr, 1987; Solomon & DeJong, 1989). Motivation interventions attempt to induce favorable attitudes, perceived vulnerability to HIV, and social norms in support of the behavior. These strategies usually consist of assertions that the behavior being advocated has personally or socially beneficial consequences (see Ajzen & Fishbein, 1980; CDC Community Demonstration Projects Research Group, 1997; Kamb et al., 1998). Other motivation interventions consist of normative appeals (e.g., appeals that peer group members have low HIV-risk behavior) for college students (Reeder, Pryor, & Harsh, 1997) or men who have sex with men (Kelly et al., 1991; Kelly, McAuliffe, et al., 1997; Kelly, Murphy, et al., 1997) as well as interventions to convince a variety of higher risk populations that their social network supports condom use (see CDC Community Demonstration Projects Research Group, 1997; Kamb et al., 1998).

According to the information–motivation–behavioral-skills model, however, HIV-prevention programs are generally not successful unless they manage to increase behavioral skills as well. Thus, interventions based on this model often contain behavioral scripts about strategies that yield successful performance of the behavior. For example, an intervention may not only recommend condom use and mention its advantages but also may describe how success in condom use depends on preparatory actions, such as carrying condoms around all the time or discussing condom use with potential partners. As another example, a widely accepted strategy is to have participants role-play condom-use negotiation or application, with the idea that the behavioral practice and the instructional feedback will facilitate the acquisition of behavioral skills. In addition to teaching behavioral skills, interventions of this type presumably increase perceptions of control (i.e., perceived behavioral control and self-efficacy), which have proven to be a critical element for behavior change (Ajzen, 1985, 1991; Albarracín et al., 2005).

Importantly, if J. D. Fisher and Fisher's (1992) model is plausible, it should have implications for participation and retention in HIV-prevention interventions. Specifically, approaches to interventions that emphasize knowledge, motivation, or behavior skills may be moderated by the audience's level of knowledge, motivation, or behavior. For example, low condom users may drop out when the intervention emphasizes behavioral skills training because the intervention invalidates their past behavior. Likewise, audiences with high knowledge or motivation may prefer interventions respectively emphasizing knowledge and motivation, presumably because these interventions support their current beliefs and motives. Alternatively, rather than seeking self-confirming interventions, audiences may stay in interventions perceived as effective at compensating for their own deficiencies. For instance, low condom users may drop out when the intervention does not include behavioral-skills training. Similarly, those who have high knowledge or motivation may prefer interventions that do not emphasize knowledge or motivation but provide them with something new. These two possibilities, one reflecting a self-validation motivation and the other reflecting a risk-reduction motivation, are explored in this meta-analysis.

The Present Meta-Analysis

A meta-analysis of the existing condom-use-intervention literature was performed to observe the associations of knowledge, motivation, and condom-use behavior with participation in different types of HIV-prevention programs. For this purpose, we calculated the acceptance and retention rates in each report. Acceptance involved the percentage of target participants who agreed to participate. Retention concerned the percentage of commencers completing the intervention. In addition, from each condition, we

[2] J. D. Fisher and Fisher (1992) also included behavioral skills. However, measures of baseline behavioral skills were almost nonexistent in our database. Thus, we focused on condom use, knowledge, and motivation.

retrieved the commencers' levels of knowledge, motivation, and condom-use behavior as well as the types of intervention strategies (i.e., information-, motivation-, or behavioral-skills training). Analyses considered how baseline knowledge, motivation, and behavior influenced participation, both alone and in interaction with the intervention strategies. Controls for intervention duration and other potential confounds were introduced in all relevant analyses.

Method

The Literature Search

A critical factor in conducting a literature search is the selection of descriptive terms for use in computerized searches. To capture interventions designed to increase condom use, we combined the key words *STD, AIDS,* and *HIV* with *intervention, behavior, knowledge, education, prevention, condoms, communication, attitudes,* and *message*. The search included the period between 1988 and 2005. We electronically searched PubMed, PsycINFO, Medline, Cambridge, Education Resources Information Center (ERIC), and Dissertations Database as well as relevant conference databases. We also manually searched all available issues appearing during or after 1980 of the journals *AIDS, AIDS Education and Prevention, AIDS and Behavior, American Journal of Public Health, Basic and Applied Social Psychology, Health Psychology, Journal of the American Medical Association, Journal of Applied Social Psychology, Journal of Consulting and Clinical Psychology,* and *Journal of Personality and Social Psychology*. Finally, we checked prior meta-analyses, examined cross-references in the obtained reports, and requested reports from researchers in this area.

The Selection Criteria

The selection criteria were strict because of the need to identify studies that had baseline measures of knowledge, motivation, or condom use along with precise reports of the sample sizes at the beginning and end of the intervention. Various other criteria were relevant as well.

Presence of measures of knowledge, motivation, or condom use. Given our hypotheses, we synthesized studies that provided information on the levels of baseline knowledge, motivation, or condom use of the audience on entering the intervention. These measures could be retrieved only when researchers reported the baseline levels of one of these measures for all commencers rather than only posttest completers.

Presence of a standardized condom-use-promotion intervention. To be eligible, studies had to include at least one standardized intervention designed to increase condom use among recipients. In addition, reports often included comparison and control conditions. Groups that researchers treated as "comparison" conditions but that participated in an intervention were considered treatment groups. We considered control groups only those not exposed to any kind of HIV-related intervention at the time of the study (e.g., waiting list groups, education programs on other health topics; for similar criteria in a different meta-analysis, see Albarracín et al., 2003, 2005). These control groups provide an estimate of the change that occurs in the absence of systematic exposure to an HIV-prevention intervention.

Presence of the number of commencers and completers of the intervention. Studies were eligible only when they provided statistics to calculate either or both acceptance or retention. In practice, however, all studies reporting acceptance also reported retention. Retention rates required the initial number of participants and the number of completers of the intervention or the immediate posttest. Acceptance rates required initial number of participants and the number of people targeted for recruitment.

Within-subject design. The measures of retention excluded reports containing pre- and posttest information from different audiences.

Partitioning of Studies

For each article, we retrieved each available intervention and control condition. In addition, whenever the report distinguished samples, we attempted to treat each sample separately. In three articles, however, interventions were collapsed into a single group. Hence, all statistics for these reports represent an average. In no case did we merge interventions and control groups.

Record of and Effect Sizes for Acceptance and Retention

To obtain measures of initial acceptance, we retrieved the number of target participants and also the numbers of participants who were invited, who accepted, and who were excluded by the experimenter. As measures of retention, we recorded the number of commencers and completers of the intervention. When available, these data allowed us to compute the proportion of acceptance and retention in a sample. These indices were then converted into odds (proportion of acceptance/proportion of declinations). Odds of 1 correspond to equal probability of acceptance–retention and declination–drop out. Odds greater than 1 correspond to more likely acceptance–retention than declination–drop out. Odds smaller than 1 correspond to more likely declination–dropout than acceptance–retention.

Change Measures

When possible, we also calculated effect sizes for use in supplementary analyses to ensure that our sample of interventions was similar to broader samples. To represent change from pretest to posttest measures, we used Becker's (1988) g, which is calculated by subtracting the mean at the posttest from the mean at the pretest and dividing the difference by the standard deviation of the pretest measure. This measure controls for the inflation in the standard deviation following treatment (for an excellent analysis of the problem, see Carlson & Schmidt, 1999). Effect sizes were also derived from exact reports of t tests, F ratios, proportions, p values, and confidence intervals (CIs). Within-subject studies can be more precisely derived by estimating the correlation between posttest and pretest measures. Because some reports did not offer this information, we adopted procedures recommended by Becker (1988) as well as by Dunlap, Cortina, Vaslow, and Burke (1996). These procedures were used by Albarracín et al. (2003, 2005) in the same context.

Coding of Moderators

Independent raters coded relevant characteristics of the reports and methods used in the study. After the initial training, the overall intercoder agreement was 95%. Occasional disagreements were resolved by discussion and further examination of the studies. For all variables, reliabilities were superior to correlations, and kappa was .70.

Past knowledge, motivation, and condom use. Assessment of knowledge about HIV or AIDS typically comprises a series of statements that the participant evaluates as true or false (e.g., "The AIDS virus can be caught through ordinary close social contact, such as sitting next to an infected person"; Rigby, Brown, Anagnostou, Ross, & Rosser, 1989, p. 149). Knowledge scores in all cases were calculated by computing the percentage of questions a participant answered correctly.

On the basis of the information–motivation–behavioral-skills framework, we created an average motivation index and used it in analyses (r among variables = .77). This index included measures of intentions, attitudes, norms, and self-efficacy.[3] We included self-efficacy as part of motivation skills instead of behavioral skills on the basis of past research showing high associations of self-efficacy with intentions (r = .59 and .60 in Glasman & Albarracín, 2003). Measures of intentions assessed the intent or willingness to use condoms in the future. Typical items were "In the future, do you plan to use condoms?" (Eldridge et al., 1997, p. 67) or "In the next six months, how likely do you think it is that you will start using a condom every time you have vaginal sex with your main partner?" (CDC Community Demonstration Projects Research Group, 1993, p. 11). In terms of attitudes, we included only attitudes toward condom use rather than attitudes toward HIV. Attitudes toward condom use were typically measured with semantic-differential types of scales, for example, "Do you think using a condom every time you have vaginal sex with your main partner would be pleasant or unpleasant? And would you say it would be *extremely*, *quite*, or *slightly* (*pleasant/unpleasant*)?" (CDC Community Demonstration Projects Research Group, 1993, p. 12). With respect to measures of norms, subjective norms are influenced by a set of salient beliefs about the normative prescriptions of specific (salient) referents, weighted by the motivation to comply with each of those referents (Fishbein & Ajzen, 1975). For example, a man may perceive social pressure to use condoms if he believes that his partner thinks that he should use condoms and if he is motivated to comply with the partner. Subjective norms were typically measured with probability scales in response to statements like "Would you say that most of the people who are important to you think that you should or should not use a condom for vaginal sex with your main partner?" (CDC Community Demonstration Projects Research Group, 1993, p. 12). Measures of self-efficacy comprised items that relate control to specific events. For example, the CDC Community Demonstration Projects Research Group (1993) included items like "How sure are you that you can use condoms every time for vaginal sex with your main partner when your partner doesn't feel like using them?" or "When there aren't any condoms around, how sure are you that you can wait until you get one every time before having vaginal sex with your main partner?" (p. 7).

Condom-use measures included assessments on subjective frequency scales as well as reports of the percentage and number of times participants used condoms over a period of time. For example, the CDC Community Demonstration Projects Research Group (1993) asked participants "When you have vaginal sex with your main partner, how often do you use a condom?" (p. 11), and participants provided their response on a scale ranging from 1 (*every time*) to 5 (*never*). To obtain a more precise report of condom use, Ploem and Byers (1997) asked participants to report the frequency of sexual intercourse over the previous 4 weeks as well as the number of occasions of sexual intercourse for which condoms were used. The researchers then derived the percentage of condom use for each participant. Similarly, Belcher et al. (1998) asked participants to list the first name of all of their sex partners in the previous 90 days. For each name listed, participants were then asked to identify the partner's gender, the partner type (*regular, casual,* or *new*), the total frequency of vaginal sex, the frequency of condom-protected vaginal sex, the total frequency of anal sex, and the frequency of condom-protected anal sex.

Importantly, to establish baseline levels of knowledge, motivation, and condom use, it was necessary to standardize measures that used many different scales. For this purpose, we converted all these measures to proportions. Specifically, the lowest possible score of a measure was subtracted from the mean score in a given group. This number was divided by the highest possible score minus the lowest possible score plus one. With these procedures, we derived ranks for the various indices and then created overall measures of knowledge, motivation, and behavior.

Intervention content. We recorded the presence or absence of the different intervention components. For this purpose, each intervention was categorized as entailing information, motivation, or active behavioral strategies. Information strategies included (a) information about HIV and/or (b) information about condom use. Motivation strategies included (c) attitudinal arguments, such as statements about the positive implications of using condoms for the health of the partners and for the romantic relationship; (d) normative arguments asserting support for condom use on the part of friends, family members, or partners; and/or (e) threat arguments, such as discussions about the recipient's personal risk of contracting HIV or other sexually transmitted infections. Behavioral strategies included (f) negotiation skills (e.g., role-playing condom-use negotiation), (g) condom-use behavioral skills (e.g., opening wrapper without tearing it, unrolling condom in proper direction), (h) HIV counseling and testing, and/or (i) provision of condoms.

Overall indices were calculated to have general measures of information-, motivation-, and behavioral-skills strategies. For that purpose, we counted the number of target components (e.g., information) addressed by the intervention and divided that by the total number of components of that intervention. For information, the maximum number of coded components was two. For motivation, the maximum number of coded components was three. For behavioral skills, the maximum number of coded components was four. The maximum total number of components used to calculate these proportions was nine. When the resulting number was multiplied by 100, this procedure yielded percentages of information-, motivation-, and behavioral-skills emphasis of each intervention.

[3] Ten conditions had reports of threat. However, threat had very low correlations with the other variables and was therefore excluded.

Other descriptive moderators. We coded the following information with regard to the reports: (a) publication year, (b) country of intervention (i.e., United States vs. other countries), and (c) state of intervention for studies in the United States. We also recorded demographics of the participants as well as specific characteristics and behaviors that are associated with HIV-infection risk. These characteristics were recorded for the commencers and completers of the intervention or of the immediate follow-up. Specifically, we retrieved (a) sample size; (b) percentage of female participants in each group; (c) mean or median age; (d) percentage of participants of European, African, Latin American, Asian, and Native North American descent; (e) education (i.e., years of education and/or percentage of participants who completed at least high school); (f) percentage of married participants; (g) mean number of sexual partners; and (h) mean HIV rates. Further, we registered the inclusion of various behaviorally at-risk groups in each sample (i.e., men who have sex with men, partners of infection-drug users, commercial sex workers, multiple-partner heterosexuals, college students, participants with severe mental illness, and disadvantaged women).

We also recorded information on recruitment procedures. We classified each treatment group according to whether (a) the setting of the recruitment and intervention included hospitals or clinics, community settings, streets, bars, work settings, or schools; and (b) whether audiences were recruited via letters, by fliers, by personal contact, as patients, in community services, or by other forms of media. We also recorded if the recruiter was a risk-group peer, an outreach worker, a physician, a member of the research team, or a member of hospital staff. Further, we recorded (a) the planned number of sessions, (b) the number of minutes per session, (c) the percentage of completed sessions, and (d) the *M* and *Mdn* number of days between the treatment and the posttest.

Finally, we recorded the incentives and facilitators used to increase participation. Incentives were the amount of money paid for the study as well as the reception of services such as free health care and HIV counseling and testing. Facilitators involved the provision of child care and transportation to the intervention site.

Analytic Strategy

We first calculated weighted-mean odds as estimates of the degree of acceptance and retention and performed corrections for sample-size bias. As described before, proportions of acceptance and retention were converted into odds, and then the odds were log transformed (see Haddock, Rindskopf, & Shadish, 1998). We used Hedges and Olkin's (1985) procedures to correct the effects for sample-size bias[4] as well as to calculate weighted-mean effect sizes, CIs, and homogeneity statistics. Calculations of the between-subjects variance followed procedures developed by Hedges and Olkin (1985).

Computations of effect sizes were performed with fixed- and random-effects procedures (Hedges & Olkin, 1985; Hedges & Vevea, 1998; Rosenthal, 1995; Wang & Bushman, 1999; but see Hunter & Schmidt, 2000; Raudenbush, 1994). The weights for fixed-effects models followed Hedges and Olkin's (1985) computational formulas, whereas the weights for random-effects models followed Lipsey and Wilson's (2001) approach. Unless otherwise indicated, for display purposes we present back-transformed proportions rather than log odds. However, odds can be easily calculated by dividing the proportion of participants accepting or staying in the intervention by 1 minus that proportion.

The moderator analyses also included regressions and analyses of variance by using either the fixed-effects or the random-effects weights. The analyses of variance yield *QB* statistics, which are similar to *F* ratios reflecting between-groups differences. Further, the continuous moderators of prior knowledge, motivation, and behavior were centered and included in regression equations. Interaction terms were used to model differences across groups, and beta weights were obtained for each group when differences were found. Also, both linear and quadratic models were tested when prior individual difference variables were examined. The error of the beta weights was corrected on the basis of Hedges and Olkin's (1985) recommendations.

In the moderator analyses of prior knowledge, motivation, and behavior, both the control and the intervention groups were included. The results excluding the control groups were similar to the overall results, and hence the control groups were retained in these analyses. However, the control groups were excluded in the analyses of the effects of intervention strategies. All analyses of intervention strategies covaried out the number of intervention sessions and were conducted with fixed and random effects. Some of the random-effects models for the intervention effects were nonsignificant, which led us to report only fixed effects.

Results

Sample of Intervention Groups and Control Groups

We included 59 reports, which provided 105 independent intervention groups and 27 independent control groups. Of the 59 reports, 15 provided a single data set, 28 provided two data sets, 7 provided three data sets, 7 provided four data sets, and 2 provided five data sets. Studies were published around 1998 ($SD = 4$ years). Although most studies were conducted in the United States (69%), 12 countries were represented. Of the American studies, 19 states were represented, with New York providing more groups than any other state. Table 1 summarizes information about prior knowledge, motivation, and condom use as well as intervention strategies, participants, and method.

The mean of the baseline standardized score of past knowledge was .59 based on 55 groups. The mean of the standardized score of motivation was .58 based on 46 groups. The mean of the standardized score of past condom use was .51 based on 95 groups. Forty-three percent of the commencers used a condom over total sexual intercourses, 45% used a condom during last intercourse, 29% always used a condom, and 42% had never used a condom.

With respect to intervention strategies, 81% of the interventions contained HIV-relevant information, 56% contained information about condom use, 20% of the interventions contained arguments designed to induce a positive attitude about condom-use outcomes, 11% contained normative arguments in support of condom use, 43% included persuasive arguments designed to increase perceptions of threat among recipients, 31% included arguments designed to promote recipients' negotiation skills, 17% administered an HIV test, and an average of 20% trained participants in condom-use

[4] When the *N* at the pretest differed from the *N* at the posttest, the smaller *N* was used.

Table 1
Summary of Descriptive Statistics From Studies of HIV-Prevention Interventions

Variable	*M*	%	*k*	*SD*	*Mdn*
		Baseline measure			
Prior knowledge (standardized *M* score; range = .05–.94)	.59			.18	
Prior motivation (standardized *M* score; range = .04–.88)	.58			.18	
Prior condom use					
Standardized score of past condom use	.51		95		
Condom use over total sexual intercourse	.43		34		
Participants using condoms during last intercourse	.45		29		
Participants who always used condoms	.29		42		
Participants who never used condoms	.42		24		
		Type of intervention strategy			
Information strategy					
Information about HIV					
Yes		81	85		
No		19	20		
Information about condom use					
Yes		56	59		
No		44	46		
Motivational strategy					
Attitudinal argument					
Yes		20	21		
No		80	84		
Normative argument					
Yes		11	11		
No		89	94		
Threat-inducing argument					
Yes		43	45		
No		57	60		
Behavioral strategy					
Negotiation-skills training					
Yes		31	32		
No		69	73		
HIV counseling and testing					
Yes		17	18		
No		83	87		
Condom-use-skills training					
Yes		20	21		
No		80	84		
Condom provision					
Yes		20	21		
No		80	84		
		Participant characteristic			
Sample size (number of commencers = 26,780)	202.88		132	430.02	86
% female	58.54		124	40.41	54
% male	41.46		124	40.41	46
Age in years	23.38		97	7.55	23
Ethnicity					
% European background	23.16		106	30.65	6
% African background	54.67		99	39.54	59.00
% Latin American background	11.61		90	20.79	3.7
% Asian background	10.93		87	30.52	0
% Native North American background	0.16		87	0.70	0
% high school graduate	39.07		69	37.86	43.70
% married	21.23		42	24.27	14.75
Sexual behavior					
Mean number of sexual partners	1.28		42	0.95	1.3
% HIV+	7.70		56	19.53	0
Characteristics or behaviors associated with HIV-infection risk					
Inclusion of men who have sex with men		8.3	11		
Inclusion of partners of infection-drug users		1.5	2		
Inclusion of commercial sex workers		7.6	10		
Inclusion of multiple-partner heterosexuals		2.3	3		
Inclusion of college students		7.6	10		
Inclusion of participants with severe mental illness		3.0	4		
Inclusion of disadvantaged women		19.7	26		

Table 1 (*continued*)

Variable	*M*	%	*k*	*SD*	*Mdn*
Recruitment procedure					
Setting of recruitment					
Recruited at hospital or clinic		37.7	49		
Recruited at community service		23.1	30		
Recruited on the street		4.6	6		
Recruited in bars		7.7	10		
Recruited in work settings		9.2	12		
Recruited at school		26.2	34		
Recruitment method					
n of groups recruited by letters		3.9	5		
n of groups recruited by fliers		11.8	15		
n of groups recruited by personal contact		78.7	100		
n of groups recruited as patients		37	47		
n of groups recruited in community services		15	19		
n of groups recruited through the media		6.3	8		
Characteristics of recruiters					
Recruited by risk group peer		2.7	2		
Recruited by outreach worker		16	12		
Recruited by physicians		1.3	1		
Recruited by university or research team		44	33		
Recruited by hospital staff		18.7	14		
Research design and implementation					
Planned number of sessions	3.55		109	3.92	2
Number of minutes per session	70.68		84	61.57	60
% completed sessions	91.20		67	17.76	100
Days between baseline and last posttest	148.78		100	172.62	90
Incentives and facilitators					
Payment (US$)	25.16		114	52.47	0
Free health care					
Yes		14.9	17		
No		85.1	97		
HIV testing					
Yes		5.3	6		
No		94.7	108		
Child care					
Yes		18.2	4		
No		81.8	18		
Provision of transportation					
Yes		8.7	2		
No		91.3	21		

Note. k = number of intervention and control groups.

skills. Researchers distributed condoms to 20% of the groups. As global measures of information, motivation, and behavioral strategies, we calculated percentages of information, motivation, and behavioral strategies within each intervention by dividing the number of information, motivation, and behavioral strategies each over the total number of intervention strategies and multiplying that by 100. The mean percentage of information strategies was 50, the mean percentage of motivation strategies was 29, and the mean percentage of behavioral strategies was 16.

The last section of Table 1 summarizes participant characteristics, recruitment of participants, and research design and implementation. The mean sample size was 202.88. Samples comprised both female and male participants and were relatively young in age (*Mdn* = 23 years). On average, 39% of participants were high school graduates, 21% were married, and the average number of partners was 1.28. Studies included various behavioral risk groups such as men who have sex with men and commercial sex workers. Recruitment varied along recruitment method, type of recruiter, and location of recruitment. Recruitment was conducted at hospitals, community services, streets, bars, work settings, and schools. Many groups were recruited by personal contact, some by fliers, and many from the clinics in which they were patients. Recruiters were mostly members of universities and research teams. With respect to research design and implementation, on average, 3.55 sessions were planned, 71 minutes were spent per session, 91% of the sessions were completed, and 149 days passed between the baseline and last posttest. With respect to incentives and facilitators, on average, participants received $25 in exchange for the intervention, 15% of participants received free health care, 5% received HIV testing, 18% received child care, and 9% were provided transportation.

Examining Biases in Report Selection

In our integration, we excluded studies that did not describe the baseline sample sizes or any baseline measures of knowledge,

motivation, or condom use. These restrictions could have produced a nonrepresentative sample of studies. To assess biases in our selection, sample characteristics and changes on knowledge, motivation, and condom use were examined. If the sample is representative, the findings should replicate the findings of a broader, independent meta-analysis. Further, we analyzed the normality of the distribution of effect sizes (the odds) to gauge potential biases in study selection.

Sample characteristics and change. The data obtained for this meta-analysis were similar to those from the past meta-analysis involving a more complete sample of studies (Albarracín et al., 2005). For example, across the present and previous syntheses, the mean percentages of female participants were 59% and 58% and of male participants 41% and 42%; the age means were 23 and 25 years; the mean percentages of participants from European backgrounds were 23% and 36%, from African background 55% and 44%, from Latin American backgrounds 12% and 14%, from Asian backgrounds 11% and 7%, and from Native North American backgrounds 0.2% and 0.4% (percentages for ethnicities have been rounded); the mean percentages of high school graduates were 39% and 35%; the percentages of inclusion of normative arguments were 11% and 12%; the percentages of inclusion of HIV counseling and testing were 17% and 14%; and the percentages of inclusion of condom-use-skills training were 20% and 18%, respectively.

We also compared our control and the intervention groups on changes on knowledge, motivation, and condom use. The weighted-mean effect sizes for intervention and control groups appear in Table 2, along with CIs. The last column of Table 2 presents *QB* statistics, which in this case are analogous to *F* ratios comparing change across intervention and control groups. As shown, changes were greater for the intervention groups than for the control groups. This finding is similar to Albarracín et al. (2005) and thus establishes generalizability of the findings from the current data set.

Normality of effect size distribution. Another way of testing for biases is to use the normal-quantile-plot method (Wang & Bushman, 1999). In a normal-quantile plot, the observed values of a variable are plotted against the expected values given normality. If the sample of effect sizes is from a normal distribution, data points cluster around the diagonal; if the sample of effect sizes is biased by publication practices or eligibility criteria, data points deviate from the diagonal (Wang & Bushman, 1999). As can be seen from Figure 1, the standardized log odds followed a straight line and generally fell within the 95% CIs of the normality line. Moreover, our findings remained unaltered after excluding the most extreme outliers from the sample of conditions (see the two extreme observations in Figure 1, Panel B). These data imply that inclusion of different studies would be unlikely to alter the conclusions of this meta-analysis.

Average acceptance and retention. Because many reports did not describe the number of persons targeted for a study, only 22 groups were identified for the acceptance measure. Acceptance was calculated by dividing the number of commencers by the number of target persons. The stem-and-leaf plot of acceptance appears in the left panel of Figure 2. On average, the proportion of participation was .53 (fixed-effects CI = .53, .53). Within control groups, the average proportion of participation was .53 (fixed-effects CI = .53, .53). (Random-effects models could not be obtained because of the low number of total effect sizes.)

Retention in the intervention was calculated by dividing the number of completers by the number of commencers. The stem-and-leaf plot of retention appears in the right panel of Figure 2. On average, the proportions of retention were .74 (fixed-effects CI = .74, .74) and .72 (random-effects CI = .71, .72). Within control groups, the average proportions of retention were .75 (fixed-effects CI = .75, .75) and .74 (random-effects CI = .74, .74) based on fixed- and random-effects models.

Exploratory Moderator Analyses

First, change in behavior did not correlate with acceptance ($r = -.11$, *ns*, $k = 6$, in change in knowledge; $r = -.44$, *ns*, $k = 6$, in change in motivation; and no observation in change in condom

Table 2
General Effects of Interventions by Information, Motivation, and Behavioral Skill

	Intervention group		Control group		Cross-group comparison
Skill	*d*	95% CI	*d*	95% CI	*QB*
Knowledge					
Fixed effects	0.47	0.36, 0.59	0.10	−0.09, 0.30	57.39***
Random effects	0.58	0.45, 0.71	0.07	−0.13, 0.28	21.82***
Motivation					
Fixed effects	0.22	0.15, 0.28	0.02	−0.09, 0.13	27.42***
Random effects	0.22	0.15, 0.28	0.02	−0.09, 0.13	27.42***
Condom use					
Fixed effects	0.19	0.03, 0.36	−0.05	−0.28, 0.18	24.48***
Random effects	0.13	−0.10, 0.36	−0.11	−0.40, 0.17	2.68

Note. *d*s are Becker's g ($M_{posttest} - M_{pretest}/SD_{pre}$) adjusted for sample size. Significant *QB*s indicate significant effects of the intervention groups relative to control groups. *d* = weighted mean effect sizes; CI = confidence interval; *QB* = between-categories homogeneity index, distributed as a chi square with number of categories − 1 degrees of freedom.
*** $p < .001$.

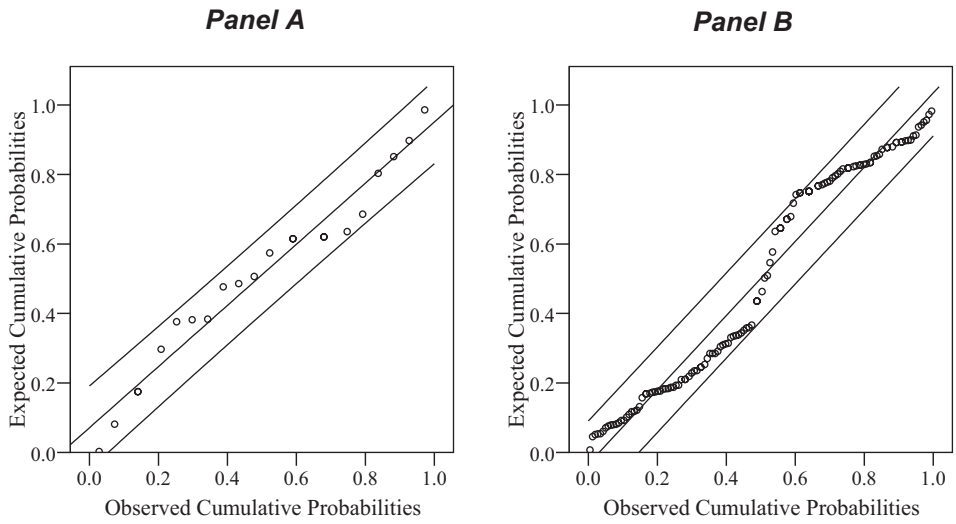

Figure 1. Normal probability plots. A: Normal probability plots of log-transformed odds of acceptance. B: Normal probability plots of log-transformed odds of retention.

use). Also, Table 3 presents various moderator analyses yielding important information. Control groups had slightly higher acceptance and retention rates than those of intervention groups. This finding suggests that participation and retention in interventions were unique and different from general participation in research. Second, conditions including larger percentages of individuals from African backgrounds, high school graduates, married persons, and HIV-positive people had lower acceptance rates than did conditions including smaller percentages of these groups. With respect to recruitment procedures, acceptance rates were lower when samples were recruited at hospitals or clinics and when recruited as patients than when they were not. In contrast, acceptance rates were higher when samples were recruited in work and school settings and through personal contact than those when they were not.

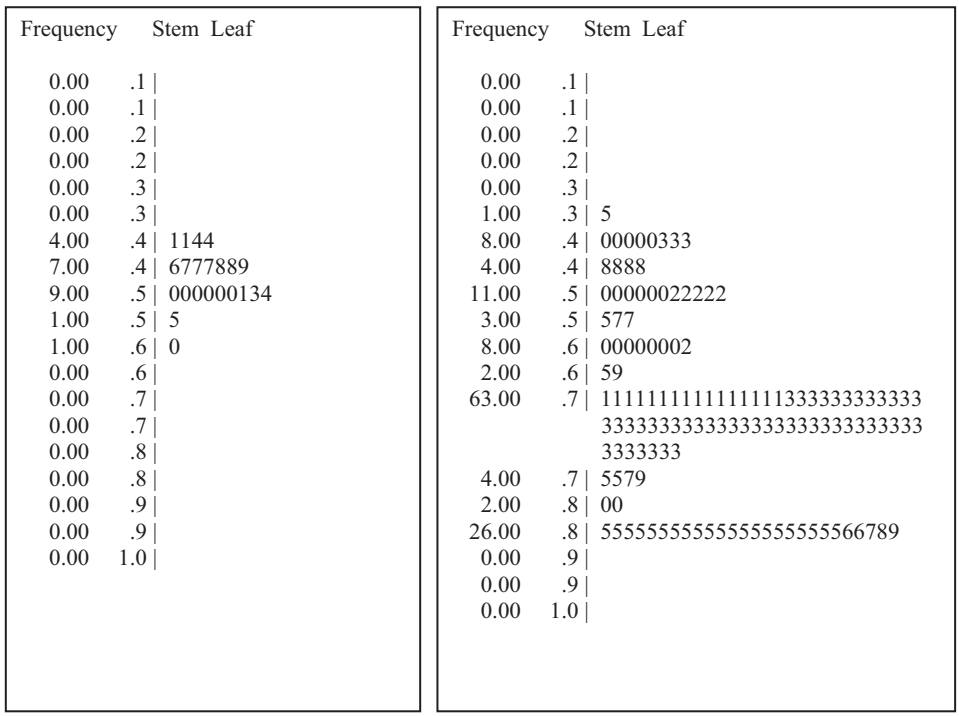

Figure 2. Stem-and-leaf plots of acceptance and retention. Each leaf corresponds to one group.

Table 3
Exploratory Moderator Analyses of Acceptance and Retention

Group	Proportion 1	Proportion 2	Cross-group comparisons: *QB*	Cross-group comparisons: β
Acceptance				
Intervention vs. control group (intervention/control)				
Fixed effects	.45	.52	20.46***	
Random effects	.47	.49	0.28	
Gender (more than 56% female participants/more than 44% male participants)				
Fixed effects	.47	.47		0.36
Random effects	.47	.47		0.18
Age (mean over 23 years/mean under 23 years)				
Fixed effects	.49	.50		−0.33
Random effects	.49	.46		0.04
European background (more than 21%/less than 21%)				
Fixed effects	.51	.48		0.14
Random effects	.46	.48		−0.27
African background (more than 50%/less than 50%)				
Fixed effects	.45	.53		−0.76***
Random effects	.46	.51		−0.67**
Latin American background (more than 10%/less than 10%)				
Fixed effects	.53	.53		0.45**
Random effects	.52	.52		0.17
Asian background (more than 6%/less than 6%)				
Fixed effects	.54	.45		0.28
Random effects	.55	.45		0.48
High-school graduates (more than 51%/less than 51%)				
Fixed effects	.47	.53		−0.97*
Random effects	.47	.53		−0.97*
Married participants (more than 15%/less than 15%)				
Fixed effects	.46	.47		−0.72**
Random effects	.44	.47		−0.70**
HIV+ participants (more than 0%/0%)				
Fixed effects	.43	.48		−0.60*
Random effects	.45	.48		−0.53
Men who have sex with men (included/not included)				
Fixed effects	.49	.47	0.02	
Random effects	.49	.47	0.02	
Female sex workers (included/not included)				
Fixed effects	.54	.47	5.21*	
Random effects	.55	.46	2.74	
Multiple-partner participants (included/not included)				
Fixed effects	.42	.47	0.81	
Random effects	.49	.47	0.17	
College students (included/not included)				
Fixed effects	.51	.47	0.09	
Random effects	.51	.47	0.08	
Participants with severe mental illness (included/not included)				
Fixed effects	.48	.47	0	
Random effects	.48	.47	0	
Disadvantaged women (included/not included)				
Fixed effects	.48	.47	0.07	
Random effects	.48	.47	0.08	
Recruited at hospital or clinic (yes/no)				
Fixed effects	.43	.52	45.33***	
Random effects	.44	.51	6.22*	
Recruited at community service (yes/no)				
Fixed effects	.50	.47	0.82	
Random effects	.50	.47	0.41	
Recruited in work settings (yes/no)				
Fixed effects	.51	.47	4.63*	
Random effects	.52	.46	2.57	
Recruited at school (yes/no)				
Fixed effects	.53	.45	25.68***	
Random effects	.53	.47	1.45	
Recruited by fliers (yes/no)				
Fixed effects	.50	.47	0.82	
Random effects	.50	.47	0.40	

Table 3 (*continued*)

Group	Proportion 1	Proportion 2	Cross-group comparisons *QB*	Cross-group comparisons β
Recruited by personal contact (yes/no)				
Fixed effects	.48	.43	8.94**	
Random effects	.50	.43	3.83	
Recruited as patients (yes/no)				
Fixed effects	.43	.52	42.33***	
Random effects	.44	.51	6.21*	
Recruited by outreach workers (yes/no)				
Fixed effects	.50	.44	3.80	
Random effects	.50	.45	1.14	
Recruited by university or research team (yes/no)				
Fixed effects	.47	.44	0.60	
Random effects	.47	.45	0.10	
Recruited by hospital staff (yes/no)				
Fixed effects	.41	.45	3.63	
Random effects	.42	.47	2.05	
Retention				
Intervention vs. control group (intervention/control)				
Fixed effects	.71	.76	38.51***	
Random effects	.73	.81	18.38***	
Gender (more than 56% female participants/more than 44% male participants)				
Fixed effects	.60	.75		−0.31***
Random effects	.69	.76		−0.01
Age (mean over 23 years/mean under 23 years)				
Fixed effects	.63	.72		−0.11***
Random effects	.69	.74		−0.31**
European background (more than 21%/less than 21%)				
Fixed effects	.74	.72		0.29***
Random effects	.78	.71		0.28**
African background (more than 59%/less than 59%)				
Fixed effects	.73	.70		0.16***
Random effects	.73	.71		−0.14
Latin American background (more than 10%/less than 10%)				
Fixed effects	.75	.54		0.40***
Random effects	.82	.53		0.04
Asian background (more than 6%/less than 6%)				
Fixed effects	.50	.72		−0.48***
Random effects	.51	.74		−0.19
Native North American background (more than 0%/0%)				
Fixed effects	.99	.72		0.16***
Random effects	.99	.72		0.29**
High-school graduates (more than 51%/less than 51%)				
Fixed effects	.74	.73		−0.05
Random effects	.77	.77		−0.11
Married participants (more than 15%/less than 15%)				
Fixed effects	.74	.68		0.39***
Random effects	.76	.70		0.25
HIV+ participants (more than 0%/0%)				
Fixed effects	.66	.73		−0.20***
Random effects	.74	.70		0.03
Men who have sex with men (included/not included)				
Fixed effects	.77	.72	5.36*	
Random effects	.80	.74	5.63*	
Female sex workers (included/not included)				
Fixed effects	.44	.74	477.39***	
Random effects	.49	.78	122.75***	
Partners of infection-drug users (included/not included)				
Fixed effects	.78	.72	1.47	
Random effects	.78	.74	0.41	
Multiple-partner participants (included/not included)				
Fixed effects	.90	.72	130.53***	
Random effects	.92	.74	26.66***	
College students (included/not included)				
Fixed effects	.87	.72	34.92***	
Random effects	.89	.74	26.36	

(*table continues*)

Table 3 (*continued*)

Group	Proportion 1	Proportion 2	Cross-group comparisons: *QB*	Cross-group comparisons: β
Participants with severe mental illness (included/not included)				
Fixed effects	.99	.72	20.40***	
Random effects	.99	.74	18.46***	
Disadvantaged women (included/not included)				
Fixed effects	.67	.73	29.17***	
Random effects	.72	.75	3.57	
Number of sessions (multiple/one)				
Fixed effects	.73	.73		−0.14***
Random effects	.71	.86		−0.39***
Minutes per session (more than 60 min/less than 60 min)				
Fixed effects	.65	.74		−0.26***
Random effects	.73	.77		−0.04
Days between sessions (more than zero/zero)				
Fixed effects	.69	.75		−0.17***
Random effects	.75	.79		−0.09
Number of strategies (more than three/less than three)				
Fixed effects	.70	.73		−0.02
Random effects	.72	.74		−0.16
Payment (US$) (yes/no)				
Fixed effects	.78	.72		0.18***
Random effects	.78	.76		−0.22*
Free health care (provided/not provided)				
Fixed effects	.59	.76	297.90***	
Random effects	.67	.78	34.07***	
HIV testing (provided/not provided)				
Fixed effects	.53	.76	240.16***	
Random effects	.61	.77	20.58***	
Child care (provided/not provided)				
Fixed effects	.57	.73	22.64***	
Random effects	.58	.81	26.34***	
Transportation (provided/not provided)				
Fixed effects	.60	.61	0.05	
Random effects	.60	.66	0.78	

Note. Proportions are described in parentheses as (Proportion 1/Proportion 2). Table entries are acceptance and retention rates. Acceptance was calculated by dividing the number of targets by the number of commencers. Retention was calculated by dividing the number of commencers by the number of completers. For the weighted analyses of variance reported in this table, the acceptance and retention proportions were converted into odds (proportion of acceptance/proportion of declinations). For display purposes, the proportions in the table are back transformed from log odds. Dichotomous independent variables were analyzed with analysis of variance. Continuous independent variables were analyzed with regression, but scores for median splits are presented for display purposes. Other descriptive variables present in Table 1 could not be analyzed due to low representation in the data. *QB* = between-categories homogeneity index, distributed as a chi square with number of categories − 1 degrees of freedom; β = standardized regression coefficient.

*$p < .05$. **$p < .01$. ***$p < .001$.

Furthermore, there were also effects of the sample's characteristics on retention. Change in behavior did not correlate with retention ($r = –.11$, *ns,* $k = 48$, in change in knowledge; $r = .01$, *ns,* $k = 39$, in change in motivation; and $r = –.17$, *ns,* $k = 20$, in change in condom use). Samples with more male participants; more younger age groups; more people from European, African, Latin American, and Native North American backgrounds; fewer people from Asian backgrounds; more married participants; fewer HIV-positive participants; more men who have sex with men; fewer female sex workers; more multiple partner participants; more college students; more participants with mental illness; and fewer disadvantaged women were retained more often than were samples without these characteristics.[5] Retention was larger when the intervention contained fewer (vs. more) number of sessions, when sessions were shorter (vs. longer), and when days between sessions were shorter (vs. longer). Monetary incentives retained participants, whereas other incentives and facilitators did not. In fact, several incentives and facilitators were probably offered when samples were hard to retain, resulting in negative associations with retention.

Test of Hypotheses

Associations with past knowledge, motivation, and condom use. We examined the relation of acceptance and retention with baseline knowledge, motivation, and condom use by using regression analyses with linear and quadratic terms. For this purpose, knowledge, motivation, and condom use were centered prior to processing. The linear term was examined alone. The quadratic term was

[5] There is a separate article that deals with predicted effects of ethnicity. These effects represent more complex interactions and the introduction of a different conceptualization. Thus, they could not be treated here.

always entered with the linear term. Table 4 presents *QR*s (*QR* = homogeneity accounted for by the regression model), regression weights, and *k* (*k* = number of effect sizes in the model) for acceptance and retention as a function of knowledge, motivation, and condom use. These analyses included both intervention groups and control groups. However, an analysis of interventions alone produced the same results.

As shown in Table 4, neither knowledge nor motivation was associated with acceptance rates. However, the linear model of condom use showed significant associations with acceptance. Figure 3 presents the scatter plot for these data. As shown, samples with higher condom use had higher enrollment rates than did samples with lower condom use.

In terms of retention, several of the linear and the quadratic models were significant with fixed-effects models. A significant linear term indicated that samples with high knowledge were more likely to drop out than were samples with low knowledge (Figure 4, Panel A). The quadratic terms of prior motivation and condom use were significant. These suggested that samples with moderate motivation and condom use were more likely to stay in the intervention than were samples with high and low motivation and condom use (see Figure 4, Panels B and C).[6] Thus, encouragingly, samples with greater knowledge deficiencies were more likely to stay in HIV-prevention programs than were those with lesser deficiencies; however, samples with low motivation and condom use were less likely to stay than were samples with moderate levels of these measures. The curvilinear tendencies of motivation and condom use might be due to the combined effect of risk-reduction and self-validation motives.

Table 4
Effects of Knowledge, Motivation, and Condom Use on Acceptance and Retention (Fixed Effects)

	QR				
Skill	Model	Term		β	*k*
		Acceptance			
Knowledge	Linear	3.64	Linear	−0.95	6
	Quadratic	4.00	Linear	1.81	
			Quadratic	2.77	
Motivation	Linear	0.63	Linear	−0.73	6
	Quadratic	0.67	Linear	−1.20	
			Quadratic	0.50	
Condom use	Linear	8.37**	Linear	0.49**	20
	Quadratic	10.21**	Linear	0.74**	
			Quadratic	0.34	
		Retention			
Knowledge	Linear	245.53***	Linear	−0.59***	55
	Quadratic	246.58***	Linear	−0.59***	
			Quadratic	−0.04	
Motivation	Linear	9.55**	Linear	−0.14**	46
	Quadratic	187.87***	Linear	−0.35***	
			Quadratic	−0.65***	
Condom use	Linear	69.00***	Linear	−0.18***	95
	Quadratic	213.47***	Linear	−0.18***	
			Quadratic	−0.26***	

Note. *QR* = homogeneity accounted for by the regression model; β = standardized regression coefficient; *k* = number of effect sizes in the model.
** $p < .01$. *** $p < .001$.

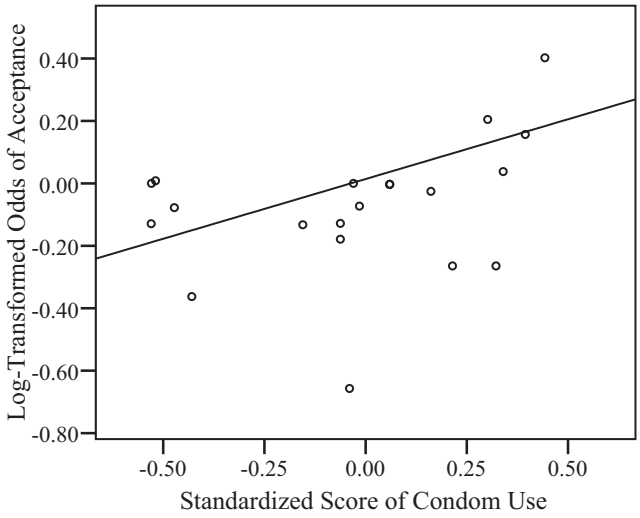

Figure 3. Effects of prior condom use on acceptance.

Influence of intervention contents. We next conducted analyses of the effects of the intervention content. In these tests, the control condition was excluded. Also, behavioral-training interventions typically involve more sessions than merely information strategies. Thus, the number of intervention sessions was included as a covariate representing duration. Table 5 presents the effects of intervention strategies on retention. As can be seen, participants were less likely to stay when interventions included greater percentages of motivation strategies. There were no main effects of other strategies on retention.

Interactions of intervention strategies with prior knowledge, motivation, and condom use. We predicted that the content of the intervention might interact with prior knowledge, motivation, and condom use. Thus, we analyzed retention as a function of (a) the indices of information, motivation, or behavioral strategies; (b) the relevant baseline levels of knowledge, motivation, or condom use; and (c) the corresponding interactions with both linear and quadratic terms. Specifically, models included the linear term for a baseline measure, the quadratic term for this same measure, the linear term for intervention content, the interaction between the intervention content and the linear term for the baseline measure, the interaction between the intervention content and the quadratic term for the baseline measure, and the linear term for the number of sessions. A summary of the results from these analyses appears in Table 6.

[6] The interactions of condom use with knowledge and motivation were also examined for retention. Interactions were conducted only for the linear component. The interactions of condom use with both knowledge and motivation were significant at .001 (*QR* = 76.26, β = –1.44; and *QR* = 48.66, β = –1.98, respectively). With respect to knowledge, both low and high condom users showed negative correlations between prior knowledge and retention (low condom users, $r = –.62$, $p = .001$; and high condom users, $r = –.44$, $p = .001$). However, the tendency was stronger for low condom users ($z = 2.48$, $p < .05$). In terms of motivation, when condom use was low, those with higher motivation were more likely to drop out than those with lower motivation ($r = –.44$, $p = .001$). In contrast, when condom use was high, there was no difference in retention between low and high motivation individuals ($r = .16$, *ns*).

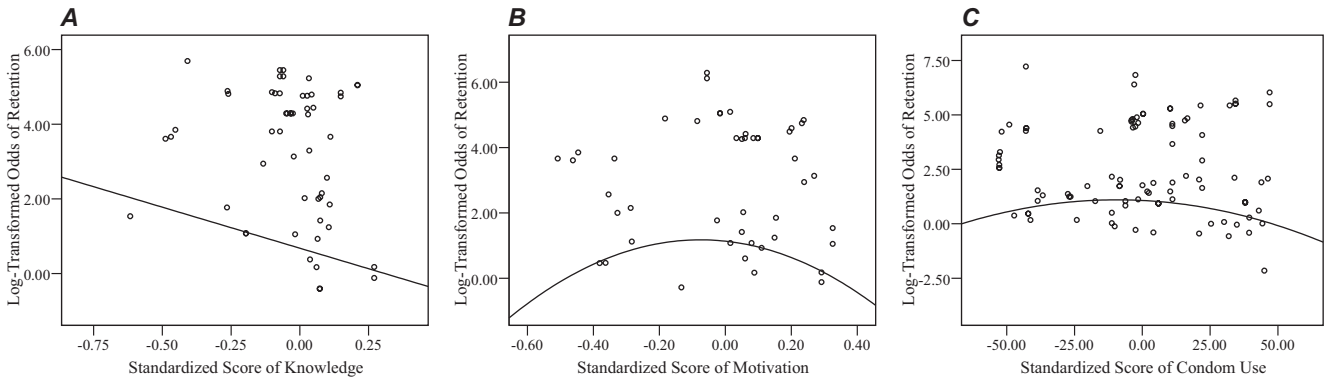

Figure 4. Effects of prior knowledge, motivation, and condom use on retention. A: Effects of prior knowledge. B: Effects of prior motivation. C: Effects of prior condom use.

All interaction terms involving the quadratic components were statistically significant. To interpret these interactions, we median split the intervention groups into high and low percentages of information, motivation, and behavioral strategies. We then regressed retention on the linear and quadratic components of knowledge, motivation, or condom use for each of the levels of the relevant intervention variable. A summary of these analyses appears in Table 7.

Samples with high knowledge were more likely to drop out from the interventions with high percentage of information strategies than were samples with low knowledge (see Figure 5, Panel A1). A similar tendency was found with low percentage of information strategies, although the slope was less steep (see Figure 5, Panel A2). Of note, although the significant interaction with the quadratic term (see Table 6) suggested different quadratic slopes, neither of the quadratic terms reached significance. However, both linear and quadratic lines were plotted in the figures for interpretational purposes (Figure 5, Panels A1 and A2).

When interventions had high percentage of motivation strategies, samples with low motivation had higher retention than did samples with high motivation, and samples with moderate motivation were similar to samples with high motivation (see Figure 5, Panel B1). In contrast, when the interventions had low percentage of motivation strategies, samples with moderate motivation had greater retention than did samples with both high and low motivation (see Figure 5, Panel B2). Thus, when the intervention was high in motivation strategies, the association between prior motivation and retention was negative in direction. However, when the intervention was low in motivation strategies, the inverted-U pattern (see Table 4 and Figure 4, Panel B) was present.

The association between past condom use and retention was curvilinear for interventions with high percentage of behavioral strategies but nonsignificant for interventions with low percentage of behavioral strategies (see Table 7). That is, for interventions

Table 5
Duration-Controlled Effects of Intervention Strategies on Retention (Fixed Effects)

Strategy	Percentage of strategies: High	Percentage of strategies: Low	*QR*	β	*k*
Information	.67	.76	32.78***	−0.02	114
N of sessions				−0.13***	
Motivation	.68	.75	42.19***	−0.07**	114
N of sessions				−0.14**	
Behavioral	.75	.68	33.76***	0.03	114
N of sessions				−0.13***	

Note. Continuous independent variables were analyzed with regression, but scores for median splits are presented for display purposes. *QR* = homogeneity accounted for by the regression model; β = standardized regression coefficient; *k* = number of effect sizes in model.
** $p < .01$. *** $p < .001$.

Table 6
Duration-Controlled Interactions Between Knowledge, Motivation, or Condom Use and Intervention Strategies on Retention (Fixed Effects)

Variable	*QR*	β	*k*
Knowledge × Information Strategies	257.35***		41
Knowledge (linear)		−0.75***	
Knowledge (quadratic)		0.48**	
Information strategies		0.49**	
Interaction (linear)		−0.31	
Interaction (quadratic)		−0.62**	
N of sessions		−0.58***	
Motivation × Motivation Strategies	156.43***		32
Motivation (linear)		−0.62***	
Motivation (quadratic)		−0.86***	
Motivational strategies		−0.06	
Interaction (linear)		−0.12	
Interaction (quadratic)		0.48***	
N of sessions		−0.03	
Condom Use × Behavioral Strategies	248.90***		72
Condom use (linear)		−0.24***	
Condom use (quadratic)		−0.38***	
Behavioral strategies		0.01	
Interaction (linear)		0.38***	
Interaction (quadratic)		0.21***	
N of sessions		−0.27***	

Note. *QR* = homogeneity accounted for by the regression model; β = standardized regression coefficient; *k* = number of effect sizes in the model.
** $p < .01$. *** $p < .001$.

Table 7
Effects of Knowledge, Motivation, and Condom Use on Retention as a Function of Percentage of Intervention Strategies (Fixed Effects)

Variable	High percentage			Low percentage		
	QR	β	*k*	*QR*	β	*k*
Interventions with information strategies						
Knowledge (linear)	148.30***	−1.41***	25	39.35***	−0.51***	16
Knowledge (quadratic)		0.13			0.20	
N of sessions		−0.85***			−0.50***	
Interventions with motivation strategies						
Motivation (linear)	37.20***	−0.60***	21	112.98***	−0.74***	11
Motivation (quadratic)		0.23*			−1.06***	
N of sessions		−0.03			0.02	
Interventions with behavioral strategies						
Condom use (linear)	57.74***	0.07*	47	18.08***	−0.14	27
Condom use (quadratic)		−0.13***			−0.03	
N of sessions		−0.18***			−0.33***	

Note. *QR* = homogeneity accounted for by the regression model; β = standardized regression coefficient; *k* = number of effect sizes in the model.
*$p < .05$. ***$p < .001$.

with a high percentage of behavioral-skills strategies, samples with high and low frequency of past condom use showed less retention than did samples with moderate past condom use (see Figure 5, Panel C1). In turn, interventions with high percentage of behavioral strategies did not increase retention of samples with low condom use.

In conclusion, people stayed in sessions when the interventions offered help to resolve deficiencies in knowledge and motivation. When samples contained people with low knowledge, retention was higher in predominantly information interventions. Likewise, when samples included participants with lower levels of motivation, retention was higher in predominantly motivation interventions. However, the tendency was not found in predominantly behavioral interventions. For behavioral interventions, the curvilinear pattern in Figure 4 persisted. That is, both people on the low and high ends of the behavioral continuum were likely to drop out from the interventions.

Discussion

Effects of Participants' Prior Characteristics on Retention in HIV-Prevention Intervention Programs

In this meta-analysis, we examined whether knowledge, motivation, and past behavior influence acceptance and retention in HIV-prevention intervention programs. We also examined how different intervention methods promote or hinder participation. Our findings were consistent with the possibility that self-validation and risk reduction both explained participants' attrition from HIV-prevention intervention programs. That is, in general, samples with lower need (i.e., high motivation or high condom use) were more likely to drop out from interventions than were samples with moderate or higher need (i.e., a step type of pattern).

The linear negative association between knowledge and retention suggested a risk-reduction motive, as did preferences for specific intervention strategies. Specifically, low-knowledge samples showed greater retention when the sample had a high proportion of information strategies. Similarly, low-motivation samples showed greater retention when the sample had a high proportion of motivation strategies. However, the pattern showed a curvilinear tendency for interventions with high behavioral content, with the greatest retention being achieved for samples with moderate past condom use. There is considerable risk reduction in the selection of information and motivation interventions, although both self-validation and risk-reduction patterns are apparent in the behavioral strategies.

Importantly, inclusion of some ethnic minorities and samples with higher risk correlated with lower retention rates. For example, samples with greater percentages of people from Asian backgrounds, as well as samples that included female sex workers and disadvantaged women, dropped out from the interventions more often than did samples with smaller percentages of these groups. Also, groups with greater percentages of women had lower retention than had groups with smaller percentages of women. On the basis of these findings, greater emphasis should be placed on reaching and retaining women, ethnic minorities, and other groups at disproportionate risk for HIV.

Correspondence With Information–Motivation–Behavioral-Skills Models and Stage Models of Preventive Behavior

The findings from our meta-analysis confirmed the usefulness of the information–motivation–behavioral-skills model in the area of HIV prevention. Extending this model, interventions were first divided into information-, motivation-, and behavioral-skill-based programs. Then, these components were shown to interact with

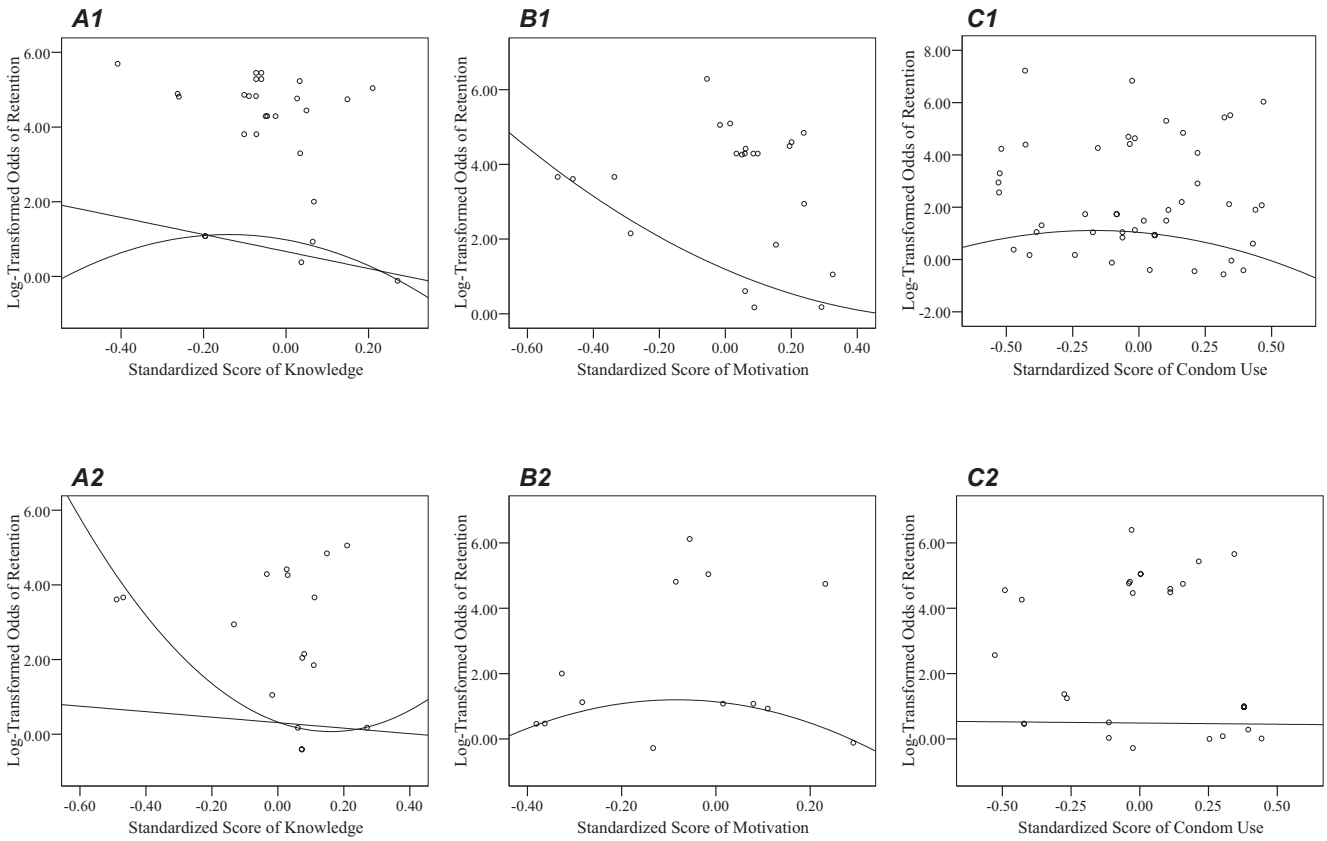

Figure 5. Effects of prior knowledge, motivation, and condom use on retention in the context of intervention contents. A1: High percentage of information strategies. A2: Low percentage of information strategies. B1: High percentage of motivation strategies. B2: Low percentage of motivation strategies. C1: High percentage of behavioral strategies. C2: Low percentage of behavioral strategies.

baseline knowledge, motivation, and condom use. In our findings, individuals appear sensitive to the content of the preventive interventions and the degree to which these interventions matched their needs as recipients. For example, individuals sought interventions that could provide the knowledge and motivation they were lacking. In this regard, our meta-analysis suggested that the effectiveness of preventive interventions depends on the recipients' stage of behavior change (see Albarracín, 2002; Bandura, 1997; Catania, Kegeles, & Coates, 1990; Prochaska, DiClemente, & Norcross, 1992; Prochaska, Redding, Harlow, Rossi, &Velicer, 1994). Presumably, information strategies (i.e., knowledge of HIV/AIDS or information about condom use) prompt the desire to change even though people are not yet considering change. Similarly, motivation strategies (i.e., inducing favorable attitudes and norms) may be important at the initial stages and hence may attract participants with low motivation. In contrast, behavioral strategies may be best when participants have moderate condom use but not when condom use is either high or low.

Findings About Acceptance

Our meta-analysis also estimated initial acceptance by target participants, which is an important but often overlooked aspect of intervention effectiveness. In particular, a significant linear association between condom use and acceptance suggested that audiences may seek interventions that validate what they are doing. Even when this result is provocative, it was based on the characteristics of samples of commencers rather than on the characteristics of target samples, which are unknown. In the future, research must be conducted to determine who in a target sample actually enrolls in behavioral interventions. For instance, recording information about targeted participants should be standard when active recruitment takes place (e.g., referral of clients of an existing health clinic). Registering the number of targets and some basic demographic and behavioral information (e.g., age, gender, ethnicity, behavioral risks) would provide critical information about the ultimate reach of preventive interventions.

The extent of clients' knowledge of an intervention characteristic when they agree to participate is not completely clear. On the one hand, potential participants may have no clear idea of the nature of the intervention before participating in it. On the other hand, the ethical procedures that are required for research with human participants include informed consent. As a result, individuals are normally aware of the types of procedures used in the intervention and control groups to which they may be assigned. In any case, future research should include direct observation and manipulation of the information available to potential clients. For

example, for participants enrolled in a study on health, researchers might observe whether the participants read HIV-relevant brochures, watch videos, or seek counseling during their visit. These various methods could be used to study acceptance as a function of the information with which the programs are introduced.

Strategies for People Who Do Not Attend Intervention Programs

This meta-analysis suggests various ways of retaining participants who start a preventive program. Knowledge-based interventions seem appropriate for people with low knowledge, and motivation-based interventions seem appropriate for people with low motivation. Importantly, however, low condom users dropped out from interventions with high behavioral content, increasing the need for retention strategies in this group.

One reason for the high attrition rate by low condom users may be low confidence in their ability to change. Thus, promoting their belief that they can change with the help of an intervention may increase retention. Another possibility is that low condom users actively resist change and require strategies that are not perceived as manipulative. For example, an audience with low condom use may be reminded that change is up to the participants and that interventions simply give them options. Such a strategy may be empowering and may signal respect for whatever decision the audience makes.

Implications for Future Research

To our knowledge, this study is the first to identify the influence of knowledge, motivation, and behavior on participation and retention in behavior change programs. In addition, the meta-analysis reveals that some disenfranchised groups, including women and behaviorally at-risk groups, are particularly unlikely to attend. Given the many inequalities that are associated with HIV transmission (del Rio, 2005; Quinn & Overbaugh, 2005), future research must be conducted to understand the barriers that reduce access of marginalized groups to efficacious HIV-prevention interventions.

Furthermore, in the synthesized studies, interventions were generally evaluated under conditions that reduced attrition and self-selection, usually by providing incentives for participation (e.g., money and other goods or the symbolic rewards of contributing to science; see Cook & Campbell, 1979). This situation implies that real acceptance and attrition may be even lower. In another meta-analysis of dropout rate on psychotherapy, the mean dropout rate was 47% (Wierzbicki & Pekarik, 1993). Thus, future work should address the behavior of potential participants when these incentives are not present.

One interesting finding of this meta-analysis is that, contrary to researchers' frequent concern, retention did not correlate with behavior change. This finding implies that samples that did change were as likely to drop out as samples that did not change, implying that attrition was unlikely to threaten detection of intervention efficacy. In addition, our meta-analysis clearly points to the need of paying attention to intervention effectiveness (see also Glasgow, Lichtenstein, & Marcus, 2003). Adequately addressing intervention reach, adoption, implementation, and maintenance will require analyzing acceptance and attrition as the main dependent measures in outcome studies.

Limitations of the Present Meta-Analysis

Despite the relevance of our findings for understanding participation and retention in HIV-prevention programs, this research integration has limitations. The most important limitation is the correlational nature of the analyses. Given this constraint, uncoded differences between studies and conditions may account for the effect of past experiences on participation and retention. For instance, individual differences other than prior condom use experiences (e.g., impulsivity) may explain the relation between prior experiences and retention. Other possible mediators may exist. Future research should further address whether self-validation and risk-reduction motives affect retention in HIV-prevention intervention programs.

Second, an assumption in the synthesized primary studies is that self-reported behaviors are accurate reflections of individuals' actual behaviors. The reliability of self-reports of sexual behavior has been established by the use of interpartner reports (Coates et al., 1986; Jaccard & Wan-Choi, 1995; McLaws, Oldenburg, Ross, & Cooper, 1990) and infection rates (CDC Community Demonstration Projects Research Group, 1997; Winkelstein et al., 1987). However, the accuracy of self-reports varies largely with the population and the behavior. For example, if groups have particularly high alcohol or drug consumption rates, reports by their members could be less reliable than reports by other persons. Similarly, self-reports could have different reliability for frequent or infrequent behaviors, depending on the standards people use to assess sexual events, or temporal factors, such as primacy or recency (for a review of such phenomena, see Wyer & Srull, 1989). In view of these possibilities, future work may include biological measures to gauge behavior.

Third, to test our hypotheses, we applied stringent exclusion criteria met by only 59 studies. This number of studies appears low compared with the 194 included in the most comprehensive past integration in this area (i.e., Albarracín et al., 2005). Although behavior change was comparable in both studies (see p. 8 of the present article; Albarracín et al., 2005), our results should be replicated as more reports accumulate. Moreover, we checked the composition of the sample and intervention characteristics in our study vis-à-vis those in Albarracín et al.'s (2005) study. These analyses revealed that the two meta-analyses are highly comparable and that the results of the present synthesis should be replicated with larger data sets when available. Nonetheless, the lower number of studies in the present meta-analysis implies that primary research should include more detailed reports of enrollment and attrition and characteristics of both commencers and completers.

Fourth, our analyses were based on sample-level correlations between the samples' characteristics and participation rates rather than on correlations between individual-level characteristics and participation. As mentioned before, future research should systematically study acceptance and retention at the individual level with methods that permit detecting biases that a global analysis of studies cannot detect. Nonetheless, until researchers study participation as an outcome, it appears that only a meta-analysis can determine if there are biases in acceptance and retention. For example, although dropout (a dichotomous variable that requires

large sample sizes) is routinely analyzed as a function of participants' characteristics, more sensitive measures such as number of attended sessions are not routinely examined. Hence, a change in practices will be necessary before individual-level correlations with participation can be meta-analyzed.

Conclusion

An impressive number of studies have demonstrated the efficacy of interventions to persuade and train people to use condoms (see CDC Community Demonstration Projects Research Group, 1999; Cottler et al., 1998; Fogarty et al., 2001; Healton & Messeri, 1993; Kalichman, Carey, & Johnson, 1996; Kegeles, Hays, & Coates, 1996; Kelly et al., 1991, 1992; Kelly, Murphy, et al., 1997; Lauby, Smith, Stark, Person, & Adams, 2000; MacLachlan, Chimombo, & Mpeba, 1997; McCusker, Stoddard, Hindin, Garfield, & Frost, 1996; National Institute of Mental Health Multisite HIV Prevention Trial Group, 1998; O'Leary et al., 1998; Rotheram-Borus et al., 2001). However, these studies have never considered the actual reach of these programs. Our meta-analysis shows that acceptance of and retention in HIV-prevention interventions are not random but systematic. On one hand, this finding is disappointing because current interventions may not be reaching all audiences in need. On the other hand, this finding is encouraging because systematic approaches may increase acceptance and retention of efficacious programs in the future.

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