

# Sexual Risk Reduction Interventions Do Not Inadvertently Increase the Overall Frequency of Sexual Behavior: A Meta-analysis of 174 Studies With 116,735 Participants

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**Abstract:** A meta-analytic review of the influence of HIV risk reduction interventions on sexual occasions, number of partners, and abstinence was conducted to assess whether condom-related interventions inadvertently undermine sexual risk reduction efforts by increasing the frequency of sexual behavior. Included studies examined sexual risk reduction strategies and used a controlled design. Data from 174 studies (206 interventions,  $N = 116,735$  participants) were included. In general, HIV risk reduction interventions neither increased nor decreased sexual occasions or number of partners reported. Participants in intervention conditions were less likely to be sexually active than those in control conditions. When samples included more black participants, interventions reduced the number of sexual occasions; interventions were more successful at reducing the number of partners in samples that included more men who have sex with men (MSM) or individuals engaged in sex trading. Samples that included more MSM were more likely to adopt abstinence as a risk reduction strategy. Interventions that included more information, motivational enhancement, and skills training also led to greater risk reduction. HIV risk reduction interventions do not increase the overall frequency of sexual activity. To the contrary, for some subgroups, interventions that include components recommended by behavioral science theory reduce the frequency of sexual events and partners.

**Key Words:** sexual frequency, meta-analysis, research synthesis, HIV risk reduction intervention, number of partners, abstinence

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Over the last 2 decades, numerous studies evaluating the efficacy of HIV risk reduction interventions have focused on condom use or drug-related risk behaviors (eg, needle sharing) as key outcome variables. For example, the

review by Semann et al<sup>1</sup> focused on unprotected sex and use of male condoms and concluded that the proportion of drug users who reduced their risk behavior was 13% greater in intervention groups compared with controls. Although condom use is clearly an important marker of risk reduction, transmission risk can also be measured by outcomes involving sexual frequency indicators, including number of sexual partners, total number of sexual occasions, and sexual activity status (ie, active vs. abstinent). When individuals are part of a risky sexual network, HIV and STI transmission risk increases as sexual frequencies increase.<sup>2–6</sup> In other words, if each act of intercourse is viewed as a potential transmission episode, then fewer acts (with fewer partners) will reduce the likelihood that HIV will be transmitted. Thus, examining frequency-related outcomes is an important yet neglected outcome of risk reduction interventions.

Some authors have called for increasing attention to frequency-related outcomes, noting that focusing solely on condom use as a sexual risk indicator ignores a critical dimension of sexual behavior (eg, reference 7). In addition, experts have mentioned how increased intercourse frequency and numbers of partners lead to increased potential for STI exposure.<sup>8,9</sup> As an illustration, Project RESPECT found more STIs in those with more sexual partners.<sup>10</sup> Similarly, another study estimated preintervention to postintervention changes in participants' STI risk and found that reduced intercourse frequency was a superior marker of decreased risk for less infectious STIs such as HIV, but change in the number of sexual partners was preferable for highly infectious STIs such as gonorrhea.<sup>11</sup> In this analysis, increased condom use was not strongly correlated with changes in STI risk under most conditions.

Although researchers appear to believe that interventions can reduce the frequency of sexual behavior<sup>12</sup> and although their studies routinely assess sexual frequency outcomes, their reports tend to focus their reports on condom use, perhaps because frequency-related effects are often too small to detect in a typical single study. If so, using meta-analytic techniques to synthesize frequency-related outcomes could help determine whether interventions modify frequency-related sexual outcomes and, if so, the size of their impact. To our knowledge, frequency-related outcomes have not been systematically reviewed.

Evaluation of frequency outcomes is especially important because organizations, such as the Family Research Council,<sup>13</sup> Focus on the Family,<sup>14</sup> and the Rutherford

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Institute,<sup>15,16</sup> have expressed concern that risk reduction interventions (especially those including condom promotion) will encourage more frequent sexual activity, thereby increasing transmission risk if a person engages in penetrative sex with infected partners. Thus, even if behavioral interventions increase condom use, they may inadvertently enhance risk because of increased sexual occasions or increased numbers of sexual partners or because condoms do not provide perfect protection against all STIs (eg, human papillomavirus). For adolescents, some policy makers worry that learning about or possessing condoms may encourage sexual debut at an earlier age, also potentially increasing transmission risk. The potential unintended effects of condom-based risk reduction interventions have not been systematically examined across samples.

The current meta-analysis addressed these issues and had 3 purposes. First, we examined whether condom-related interventions affected 3 frequency-related outcomes, namely, (1) number of sexual occasions, (2) number of sexual partners, and (3) sexual activity status. We also characterized the associations among these 3 sexual frequency indicators and condom use. The overarching goal was to evaluate the possibility that condom-related interventions may inadvertently undermine sexual health promotion efforts by increasing the frequency of sexual behavior.

Because investigators have used many different intervention strategies and population subgroups, we expected intervention effects to vary across studies. Therefore, we examined participant and intervention characteristics that might influence the magnitude of observed effects. We first evaluated the differential impact of HIV-related interventions as a function of demographic characteristics such as sex, race/ethnicity, and age. In addition, many studies have investigated groups that the HIV epidemic has disproportionately impacted,<sup>17</sup> including injection drug users (IDUs), commercial sex workers (CSWs), alcohol users, and men who have sex with men (MSM), and these were also systematically examined. If these subgroups of individuals are at elevated risk for HIV, one way in which their risk can be lessened is by the reduction of number of sexual occasions and number of sexual partners. Thus, we were particularly interested in how interventions affected frequency outcomes in high-risk groups.

A final goal of this review was to evaluate the predictive utility of Fisher and Fisher's<sup>18-21</sup> information-motivation-behavioral (IMB) skills model, a meta-theoretical account of HIV risk behavior. In a direct test of this model, St. Lawrence and colleagues<sup>23</sup> systematically tested and found that the inclusion of all 3 IMB components was more successful at reducing sexual frequency-related behavior than information alone. Because individual studies vary in the extent to which they include or exclude IMB components, we were able to provide a test of this model across the literature of sexual frequency outcomes, something that no prior meta-analysis has done.<sup>22</sup>

## METHOD

### Sample of Studies and Selection Criteria

We searched for studies through the simultaneous use of several strategies. First, we searched electronic reference

databases (Medline, PsycINFO, AIDSearch, CINAHL, Dissertation Abstracts Online, ERIC) using search terms related to HIV and other sexually transmitted diseases (ie, human or acquired and immu\* and syndrome or virus or AIDS or HIV; sexually and transmitted and disease\* or infection or STD or STI), intervention (intervene\* or prevent\*), and sexuality (sex\*, condom\*, or intercourse). Second, we checked HIV-related listservs, the NIH database of grant awardees, and conference proceedings. We also requested papers from individual researchers conducting HIV interventions and searched the reference lists of relevant, obtained papers. Finally, we manually searched journals likely to publish intervention results (eg, *American Journal of Public Health*, *Health Psychology*, *JAMA*). These supplemental strategies ensured the comprehensiveness of the reference database searches. Studies that fulfilled the search criteria and that were available as of May 2003 were included.

Studies were included if they (1) examined a deliberate HIV risk reduction strategy in a nonperinatal context; (2) used a randomized controlled trial or a quasi-experimental design with rigorous controls (eg, participants did not self-select into conditions); (3) measured a frequency-related marker (ie, presence of sexual activity, frequency of intercourse, and number of partners) following the intervention; and (4) provided sufficient information to calculate effect size estimates. For the purposes of this review, a deliberate HIV risk reduction strategy was defined as at least 15 minutes of HIV-relevant instruction. Of the initially relevant articles, 22 had insufficient information for the calculation of effect sizes, and these study authors were contacted. Twelve authors (55%) sent requested information, and their studies were included.

The use of these criteria yielded 174 studies, which investigated 206 separate interventions (see references 23-123 and MJ Rotheram-Borus et al, unpublished data, 1998, for included manuscripts, some of which included more than 1 study). Of the 174 studies, 32 were not published at the time the search was closed (May 2003). In total, the interventions began with a total of 149,660 participants; the average retention rate was 78%, leaving 116,735 participants for analysis. Consistent with meta-analytic convention,<sup>124-126</sup> each intervention was treated as an individual study during analysis.

### Study Information

Two raters independently coded each study for descriptive purposes and to determine whether variation in effect sizes can be attributed to features of the studies. The following dimensions were coded: (1) sample demographics (eg, ethnicity, sex), (2) risk characteristics (eg, sex trade, drug or alcohol use, MSM), (3) HIV serostatus, (4) design and measurement specifics (eg, number of follow-ups), and (5) content of control and intervention condition(s) (eg, total amount of time spent across all sessions). Finally, we also coded studies according to whether they provide IMB skills components, consistent with the IMB model.<sup>18,19</sup>

Across the study- and intervention-level categorical dimensions, coders agreed on the majority of judgments (mean agreement, 83%). Disagreements were resolved

through discussion. Effective reliability for the continuous variables was calculated by the Spearman-Brown result, which takes into account the mean interjudge correlation as well as the number of judges. For these variables, the effective reliability ranged from 0.60 to 1.00 (mean, 0.86).

When studies did not include sufficient data regarding the moderators of interest, values were imputed. When only an age range or category was given (and not the mean age of the sample), we used the midpoint of the age category as the mean age of the sample. In addition, if authors did not report that their sample included MSM, IDUs, sex traders or CSWs, and/or excessive alcohol users, we imputed a zero value for these characteristics, assuming no prevalence.

### Frequency-related Study Outcomes and Effect Size Derivation

We calculated individual effect sizes for all frequency-related measures reported in each of the 206 separate interventions examined across the 174 included studies. Specifically, we analyzed self- or partner-reported sexual frequency measures including (1) number of sexual occasions, defined as the number of episodes of penetrative intercourse (vaginal or anal); (2) number of sexual partners, defined as the number of unique partners an individual had in a given amount of time; and (3) sexual activity status, defined as having or not having some type of intercourse.

The number of sexual occasions and partners were continuous “counts,” whereas sexual activity status was dichotomous. Because 2 of the 3 outcomes were continuous rather than dichotomous, the effect size calculated was the standardized mean difference ( $d$ ); odds ratios are meant for cases in which both the independent and the dependent variable are categorical. We represented the third dimension in  $d$  for ease of comparison between the categories. The pooled SD served as the denominator in the effect size calculation, when it was available, or, in a minority of cases, another form of SD (eg, the SD of the paired comparisons) was used because the pooled SD was not available and could not be calculated from the report. Other available statistical information (eg,  $F$  or  $t$  values) was used instead or as a supplement to means and SDs.<sup>128</sup> In calculating the effect sizes, we used statistics that controlled for baseline differences. If a study reported a significant difference on an outcome between the studied groups at baseline and did not control for this difference in analyses of the postintervention outcomes, we omitted the outcome in question. When studies reported odds ratios, we transformed them to  $d$  using the Cox transformation.<sup>128</sup> Within a follow-up measurement assessment, when the questions implied different intervals (eg, previous week vs previous month), we used the data from the interval that best matched the period since the end of the intervention.

The sign of each effect size was set so that it was positive when the outcome favored risk reduction, and effect sizes were corrected for sample size bias.<sup>129</sup> Forty-eight reports provided statistics separately by different groupings (eg, by sex or race); in these instances, effect sizes from each grouping were included in the analysis. As such, some studies

contributed more than one effect size for the same outcome. Effect sizes were calculated on the measures provided at the first available follow-up after the intervention. When available, we also calculated  $d$  for condom use, following the same procedures as above. Analyses followed fixed- and random-effects assumptions<sup>130</sup> to evaluate the mean tendencies for each outcome variable and fixed-effects assumptions to test whether features of the studies could explain variability in the magnitude of effect sizes.<sup>131</sup>

## RESULTS

### Description of Studies

#### Participants

The included studies appeared between 1989 and 2003. On average, samples were 50% men, 54% black (including Africans and Americans), and 24.8 years old. Most studies (84%) were conducted in the United States, with the majority (70%) of these studies conducted in medium to large cities. Across studies, 76% of participants were sexually active.

#### Design

The majority of studies (59%) involved random assignment of individuals, whereas 18% involved random assignment of groups. The remaining studies (23%) matched participants in the intervention and control conditions on at least 1 variable. The majority of studies (98%) used a pretest and posttest design and included an average of 2.1 ( $SD = 1.4$ ) follow-ups after baseline data collection. The present analyses used measures taken at the first follow-up, which occurred at a mean of 15.2 weeks (range, 0–104 weeks) from the intervention (0 weeks implies the first follow-up was <7 days postintervention). Generally, the first follow-up occurred less than 1 week after the intervention in lengthier interventions for which behavior change was occurring during the intervention.

#### Interventions

Most interventions (74%) provided HIV counseling and testing, and 97% provided HIV education. Forty-five percent provided condom information, 41% taught condom use skills, and 74% distributed condoms to participants. A majority of the interventions included interpersonal skills training (eg, negotiation skills, 66%) and intrapersonal skills training (eg, self-management to avoid risky sex, 58%). Interventions averaged 8 participants per session, and met for 3 sessions of 75 minutes each, for a total of approximately 4 hours.

#### Frequency Markers and Condom Use

Because previous meta-analyses have found an intervention effect on condom use, we examined the links among the sexual frequency outcomes and condom use. Interventions that improved condom use also reduced the number of partners ( $r = 0.22$ ,  $P = 0.035$ ) and number of sexual occasions ( $r = 0.49$ ,  $P = 0.003$ ). There was no significant link between effect sizes for sexual activity status and condom use ( $r = -0.14$ ,  $P = 0.382$ ).

**TABLE 1.** Overall Efficacy of Interventions to Promote Risk Reduction at Studies' First Follow-up Assessments

Outcome	k	Weighted Mean $d_+$ (95% Confidence Interval)		Homogeneity of Effect Sizes	
		Fixed Effects	Random Effects	Q	P
Number of sexual occasions	42	-0.004 (-0.033, 0.025)	0.010 (-0.042, 0.061)	92.07	<0.001
Number of sexual partners	107	0.008 (-0.012, 0.028)	0.009 (-0.020, 0.039)	185.79	<0.001
Sexual activity status	49	0.026 (0.002, 0.050)	0.044 (0.003, 0.084)	103.92	<0.001

Each effect size ( $d$ ) was weighted by the inverse of its variance. Confidence intervals not including zero reflect significant intervention effects.  $k$  indicates the number of studies;  $P$ , probability (when statistically significant, implies differences within the distribution of effect sizes);  $Q$ , homogeneity within categories.

### Intervention Impact on Sexual Frequency Outcomes

The first set of analyses examined whether the behavioral interventions impacted the 3 markers of sexual frequency. As Table 1 depicts, these analyses indicated that, overall, intervention programs neither increased nor decreased participants' number of sexual occasions or number of partners relative to the control conditions, but that the interventions did decrease risk for the outcome of sexual activity status ( $d_+ = 0.026$  fixed effects;  $d_+ = 0.044$  random effects). For all 3 categories of sexual frequency, the hypothesis of effect size homogeneity was rejected, as hypothesized. Therefore, moderator tests were conducted on each effect separately to examine our hypotheses that study features related to this variability.

### Moderators of Intervention Impact on Number of Occasions

We first investigated moderators of the impact of interventions on number of sexual occasions. All demographic characteristics were individually entered into a regression analysis as predictors of number of sexual occasions. The number of sexual occasions increased less when samples included more blacks ( $\beta = 0.434$ ,  $P < 0.0001$ ).

Intervention effectiveness within samples containing various HIV risk groups was also examined. Of particular interest were MSM, IDUs, those known to engage in sex trading or prostitution, and alcohol users. None of these

sample characteristics moderated intervention impact on number of sexual occasions.

We also examined intervention content variables as moderators of intervention impact on number of sexual occasions, including the amount of HIV-related information, condom use, interpersonal and intrapersonal skills, and motivational enhancement. Of these, motivational enhancement and intrapersonal skills moderated the impact of interventions on number of sexual occasions ( $\beta = 0.527$ ,  $P < 0.0001$ , and  $\beta = 0.235$ ,  $P < 0.05$ , respectively).

### Multivariate Model

We then entered each significant univariate moderator mentioned above into a multiple predictor model. In this multiple predictor model, mean effect sizes for each variable were assessed at the mean level of the other predictors. This analysis revealed that proportion of blacks within a sample remained a significant moderator of the impact of interventions on number of sexual occasions. As before, when samples included more blacks, interventions decreased the number of sexual occasions. The amount of motivational enhancement included in an intervention also remained a significant moderator. As the duration of the motivational component increased, interventions became more effective at reducing the number of sexual occasions (Table 2).

### Moderators of Intervention Impact on Number of Sexual Partners

The same analytic strategy was used to examine moderators of intervention impact on number of partners.

**TABLE 2.** Multivariate Model of Intervention Impact on Number of Sexual Occasions ( $k = 42$ )

Variable	Level*	Adjusted Mean Effect Size (95% Confidence Interval)†	$\beta$	P
Proportion black within sample	0%	-0.025 (-0.072, 0.022)	0.276	0.033
	100%	0.116 (0.012, 0.221)		
Motivational enhancement component	0 hours	-0.005 (-0.042, 0.041)	0.470	<0.001
	1 hour	0.151 (0.073, 0.230)		
	2 hours	0.303 (0.148, 0.458)		
	3 hours	0.454 (0.220, 0.689)		

\*Levels symbolize representative values along the continuous levels observed.

†Each adjusted mean effect size is reported at the mean level of the other study dimension.

Effect sizes ( $d$  values) are positive for results that favor the intervention group. Analyses are based on fixed-effects assumptions; each effect size ( $d$ ) was weighted by the inverse of its variance. Number of sexual occasions was modeled as the dependent variable in a multiple regression model, with each listed study dimension simultaneously entered as an independent variable.

$\beta$  indicates standardized regression coefficient;  $k$ , number of studies;  $P$ , probability.

**TABLE 3.** Multivariate Model of Intervention Impact on Number of Sexual Partners ( $k = 107$ )

Variable	Level*	Adjusted Mean Effect Size (95% Confidence Interval)**	$\beta$	$P$
Proportion MSM	0%	0.001 (−0.023, 0.025)	0.277	<0.001
	100%	0.252 (0.121, 0.383)		
Proportion involved in sex trading	0%	−0.001 (−0.026, 0.025)	0.231	0.002
	100%	0.409 (0.151, 0.667)		
Interpersonal skills component	0 hours	−0.021 (−0.050, 0.009)	0.351	<0.001
	3 hours	0.008 (−0.016, 0.032)		
	6 hours	0.036 (0.012, 0.061)		
	9 hours	0.065 (0.034, 0.095)		
Intrapersonal skills component	0 hours	−0.009 (−0.034, 0.015)	0.272	<0.001
	3 hours	0.050 (0.016, 0.083)		
	6 hours	0.109 (0.048, 0.169)		
	9 hours	0.168 (0.077, 0.259)		

\*Levels symbolize representative values along the continuous levels observed.

\*\*Each adjusted mean effect size is reported at the mean level of each other study dimension.

Effect sizes ( $d$  values) are positive for results that favor the intervention group. Analyses are based on fixed-effects assumptions; each effect size ( $d$ ) was weighted by the inverse of its variance. Number of partners was modeled as the dependent variable in a multiple regression model, with each listed study dimension simultaneously entered as an independent variable.

$\beta$  indicates standardized regression coefficient;  $k$ , number of studies;  $P$ , probability.

When there were fewer women in the samples, interventions had a more positive impact ( $\beta = -0.155$ ,  $P < 0.04$ ). In addition, interventions were more successful at reducing numbers of partners in samples that included more MSM ( $\beta = 0.158$ ,  $P < 0.04$ ) and more individuals known to engage in sex trading ( $\beta = 0.153$ ,  $P < 0.04$ ). As before, intervention content also impacted intervention effectiveness. When interventions included a higher dosage of interpersonal or intrapersonal skills, participants were more likely to reduce the number of partners ( $\beta = 0.238$ ,  $P < 0.01$ , and  $\beta = 0.270$ ,  $P < 0.001$ , respectively).

### Multivariate Model

We then entered each significant univariate moderator into a multiple regression model. When all variables were considered simultaneously, sex and age were no longer significant moderators of the impact of interventions on number of sexual partners (Table 3); all other moderators remained significant. As before, interventions were more successful at reducing the numbers of partners in samples that included more MSM and more individuals known to engage in sex trading. The amount of skills training included in an intervention also remained a significant moderator. As the duration of either skills component increased, interventions became more effective at reducing the number of partners.

### Moderators of Intervention Impact on Sexual Activity Status

The final set of analyses examined moderators of intervention impact on sexual activity status. When samples included more whites, interventions had a larger, positive impact on sexual activity status ( $\beta = 0.259$ ,  $P < 0.02$ ). Sexual activity status was also more positively impacted when samples included more MSM ( $\beta = 0.217$ ,  $P < 0.03$ ), more IDUs ( $\beta = 0.317$ ,  $P < 0.01$ ), and more alcohol users ( $\beta = 0.372$ ,  $P < 0.001$ ). When interventions included more HIV information and intrapersonal skills training, sexual activity

status was more likely to reflect abstinence ( $\beta = 0.276$ ,  $P < 0.01$ , and  $\beta = 0.392$ ,  $P < 0.001$ , respectively).

### Multivariate Model

Significant univariate predictors were then simultaneously entered into a multiple regression analysis. This analysis revealed that interventions were more successful at impacting sexual activity status when samples included more MSM, and when the total amount of HIV information and intrapersonal skills training was greater (Table 4).

### Intervention Characteristics and Sexual Frequency Outcomes

#### Condom-related Features

We investigated the impact of providing condoms to study participants and allowing participants to directly or indirectly learn condom use skills such as negotiation or proper use on sexual frequency, number of partners, and sexual activity status. None of these intervention features impacted any of the effects of interest, suggesting that teaching individuals about condoms does not result in more acts of intercourse, more sexual partners, or earlier intercourse (all  $P$ 's  $> 0.20$ ).

#### IMB Components

To examine the impact of the IMB components on the 3 frequency-related outcomes, all 3 components were entered simultaneously as predictors of each separate outcome. Consistently, interventions that included more of the IMB components were most successful at reducing number of sexual occasions and number of sexual partners (Fig. 1). The same pattern was not observed for sexual activity status.

#### COMMENT

This quantitative synthesis evaluated the extent to which HIV-related interventions influence 3 sexual frequency

**TABLE 4.** Multivariate Model of Intervention Impact on Sexual Activity Status ( $k = 49$ )

Variable	Level*	$d$ (95% Confidence Interval)**	$\beta$	$P$
Proportion MSM	0%	0.056 (0.026, 0.086)	0.222	0.024
	100%	0.235 (0.083, 0.388)		
Information component	0 hours	0.041 (0.008, 0.073)	0.302	0.002
	3 hours	0.047 (0.016, 0.078)		
	6 hours	0.053 (0.023, 0.083)		
	9 hours	0.059 (0.029, 0.088)		
	Intrapersonal skills component	0 hours		
1 hour	0.127 (0.072, 0.181)			
2 hours	0.232 (0.128, 0.336)			
3 hours	0.336 (0.181, 0.492)			

\*Levels symbolize representative values along the continuous levels observed.

\*\*Each adjusted mean effect size is reported at the mean level of each other study dimension.

Effect sizes ( $d$  values) are positive for results that favor the intervention group. Analyses are based on fixed-effects assumptions; each effect size ( $d$ ) was weighted by the inverse of its variance. Sexual activity status was modeled as the dependent variable in a multiple regression model, with each listed study dimension simultaneously entered as an independent variable.

$\beta$  indicates standardized regression coefficient;  $k$ , number of studies;  $P$ , probability.

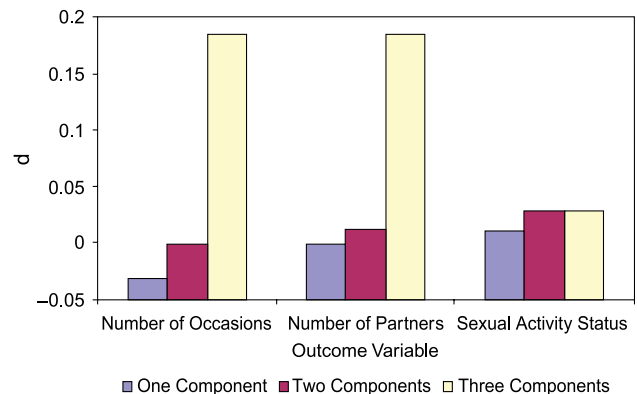
outcomes: number of sexual occasions, number of partners, and sexual activity status. We focused on studies with rigorous controls because such studies provide the strongest and most interpretable evidence regarding the effects of HIV risk reduction programs. In total, 174 studies, including 206 interventions and nearly 120,000 participants qualified for the review. With this large sample, analyses showed that, in general, interventions neither increased nor decreased the number of sexual occasions and the number of partners. These findings provide reassurance that, overall, HIV risk reduction interventions do not inadvertently increase the number of sexual occasions or sexual partners. Moreover, the results indicated that sexual activity was reduced overall (Table 1). It should also be noted that adolescents were no more likely than adults to increase sexual frequency as a result of interventions. As we expected, the overall average magnitude of intervention effects on each of these frequency dimensions was small ( $d_+$  range,  $-0.004$ – $0.044$ ) and much smaller than that observed in past meta-analyses of condom use and similar risk behaviors (eg,  $d_+$  range,  $0.07$ – $1.31$ ).<sup>125,126,132–136</sup> Yet, more important is the fact that the magnitude of studies' effects on frequency-related outcomes varied widely; when interventions included particular features or focused on particular risk groups, sexual risk reduction via number of sexual occasions, number of sexual partners, and sexual activity status was more likely.

### Conditions Related to Reduced Sexual Frequencies

Several sample and intervention features explained variability in sexual frequency outcomes. Our analysis revealed 2 significant moderators of intervention impact on number of sexual occasions: proportion of black participants within the sample and amount of motivational enhancement provided. Interventions were more successful at reducing the number of sexual occasions when samples included more black participants. One might wonder whether the explanation for this finding is that interventions occurring in African nations, where the threat of HIV is higher than in the United

States, have greater success at reducing number of sexual occasions. In our database, only 4 studies that targeted number of sexual occasions occurred in African nations, and, of those, 2 were highly successful at reducing the number of sexual occasions and 2 were not. Most of the studies targeting number of sexual occasions as an outcome occurred within the United States. As such, it does not appear that this is the sole explanation for this finding.

A second possible explanation for this finding involves the increased risk perception that may exist among blacks. It is now widely recognized that, in the United States, blacks have been disproportionately affected by HIV and AIDS; epidemiologic data indicate that approximately 50% of the new HIV infections in 2003 occurred among blacks,<sup>137</sup> although blacks made up only 12% of the United States population in the 2000 census. Moreover, research indicates that concern about HIV tends to be high among blacks,<sup>138</sup> and perceptions of the local prevalence of HIV/AIDS predicts number of sex partners, sexual risk practices, rates of STIs, and HIV testing history.<sup>139</sup> This phenomenon, referred to as "intuitive epidemiology," likely involves an increased vulnerability or risk perception, a construct implicated in



**FIGURE 1.** The impact of IMB components on number of occasions, number of partners, and sexual activity status.

many theoretical models of health behavior change.<sup>140</sup> This increased vulnerability to HIV among blacks may increase the relevance of HIV risk reduction programs for this population subgroup, partially explaining the greater intervention success.

Interventions that included larger motivational components were more successful at reducing the number of sexual occasions. This finding suggests that risk reduction interventions work, at least in part, by engaging intrinsic motivation for self-protection. This interpretation is consistent with a growing body of evidence indicating the motivational approaches to health behavior change can be more effective than traditional health education and psychotherapeutic interventions.<sup>141</sup> Indeed, motivational approaches have shown considerable promise as stand-alone or supplemental interventions for traditionally intractable problems such as smoking,<sup>142</sup> alcohol misuse,<sup>143</sup> and drug use.<sup>144,145</sup> Several studies have demonstrated the value of a motivational intervention in the context of HIV risk reduction as well.<sup>30,146,147</sup> Future research should more fully investigate the types of motivational enhancement that are most successful at reducing the number of sexual occasions and explore the psychological mechanisms by which motivational approaches influence behavior change.

Skills training was an important intervention feature when number of sexual partners was a targeted outcome. Interventions with longer interpersonal and intrapersonal skills training components were more effective at reducing the number of sexual partners. This meta-analytic finding corroborates earlier reviews of evidence obtained from primary level research<sup>132</sup> and demonstrates that negotiating a safe sexual relationship with a partner requires skill.<sup>148,149</sup> Individuals who lack the ability to skillfully decline a partner's advances may be at greater risk for unintended sexual advances, including unprotected sex. When individuals are actively taught how to handle a sexual proposition, they are better able to refuse intercourse with additional partners.<sup>58</sup>

Interventions were also more successful at reducing the number of sexual partners when samples included more MSM or individuals involved in sex trading, 2 groups traditionally viewed as high risk for HIV. One possible mechanism for this finding is the increased awareness of HIV in these subgroups, consistent with the explanation provided earlier for black participants. Overall, these results suggest that interventions are efficacious with those who recognize their vulnerability to HIV.

The amount of HIV information within an intervention also significantly influenced the interventions' impact on sexual activity status. When interventions included more information about HIV and more intrapersonal skills training, the risk reduction impact of interventions on sexual activity status was enhanced, consistent with the IMB model.<sup>18</sup> Self-management skills, a type of intrapersonal skills, play a role in sexual activity status. Managing one's emotions and substance use and avoiding risky situations are important skills for individuals who have engaged in risky sexual encounters in the past, but would now like to avoid these situations.

Evaluation of the influence of condom-related intervention features on the 3 frequency-related outcomes of interest indicated that none of these features moderated the impact of interventions on number of sexual occasions, number of partners, or sexual activity status. This finding should provide reassurance that increased numbers of sexual occasions, larger numbers of partners, and more likely sexual activity are not iatrogenic effects of providing condoms or training in condom use skills and interpersonal negotiation skills.

### Sexual Frequency Reduction as a Prevention Alternative

Overall, interventions that included informational, motivational, and behavioral skills components, consistent with the IMB model,<sup>18,19</sup> were more likely to influence frequency outcomes than were interventions that did not include all 3 IMB components. The number of sexual occasions was significantly reduced after exposure to an hour (or more) of motivational training. Similarly, studies that included 6 hours of interpersonal skills training or 3 hours of intrapersonal skills training were the most successful at reducing the number of sexual partners. Studies were most successful at influencing sexual activity status when they included 6 hours of HIV information and at least 1 hour of intrapersonal skills training. The need for different doses of diverse types of training may be due, in part, to the level of skill participants already have upon entering into the intervention. Research should investigate the dynamic interplay among various types of HIV risk reduction intervention content and participants' initial IMB skills levels, ensuring that no critical component is omitted.<sup>150</sup>

Overall, after more than 20 years of studying HIV and designing related interventions, it is clear that progress toward risk prevention is being made. The results of this synthesis suggest that targeting frequency-related outcomes is another avenue by which HIV transmission risk can be reduced. Although condom use has been touted as the primary and most beneficial sexual risk reduction outcome, interventions that integrate key elements of behavioral theory are also successful at reducing frequency-related outcomes for some population subgroups.

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