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HIV prevention interventions to reduce sexual risk for African Americans: The influence of community-level stigma and psychological processes



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ABSTRACT

Interventions to improve public health may benefit from consideration of how environmental contexts can facilitate or hinder their success. We examined the extent to which efficacy of interventions to improve African Americans' condom use practices was moderated by two indicators of structural stigma—Whites' attitudes toward African Americans and residential segregation in the communities where interventions occurred. A previously published meta-analytic database was re-analyzed to examine the interplay of community-level stigma with the psychological processes implied by intervention content in influencing intervention efficacy. All studies were conducted in the United States and included samples that were at least 50% African American. Whites' attitudes were drawn from the American National Election Studies, which collects data from nationally representative samples. Residential segregation was drawn from published reports. Results showed independent effects of Whites' attitudes and residential segregation on condom use effect sizes. Interventions were most successful when Whites' attitudes were more positive or when residential segregation was low. These two structural factors interacted: Interventions improved condom use only when communities had both relatively positive attitudes toward African Americans and lower levels of segregation. The effect of Whites' attitudes was more pronounced at longer follow-up intervals and for younger samples and those samples with more African Americans. Tailoring content to participants' values and needs, which may reduce African Americans' mistrust of intervention providers, buffered against the negative influence of Whites' attitudes on condom use. The structural factors uniquely accounted for variance in condom use effect sizes over and above intervention-level features and community-level education and poverty. Results highlight the interplay of social identity and environment in perpetuating intergroup disparities. Potential mechanisms for these effects are discussed along with public health implications.

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Introduction

People who perceive greater bias against them because of their group membership – including being an ethnic minority, sexual minority, or mentally ill – experience poorer mental and physical health, utilize healthcare less, and suffer higher rates of mortality than those who perceive less bias (Bird & Bogart, 2001; Pascoe & Smart Richman, 2009; Williams & Mohammed, 2009). While perceptions of discrimination are not synonymous with actual discrimination because people may either underestimate or

overestimate discrimination (Dumont, Seron, Yzerbyt, & Postmes, 2006; Vorauer, 2006), converging evidence of the health effects of discrimination is provided by indications of stigma at the structural level. For example, greater residential segregation is associated with poorer physical health among African Americans, not only because it differentially exposes African Americans to environmental toxins and limits access to healthy foods and quality health care (Smedley, Stith, & Nelson, 2003; Williams & Collins, 2001) but also because of the impact of segregation on psychological factors, including stress and social exclusion (Kramer & Hogue, 2009; MacDonald & Leary, 2005).

The present research is novel in its focus on bridging work on structural influences on health with psychological influences in the context of HIV prevention interventions. Although previous research suggests the importance of considering how structural

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factors may operate through and interact with individual-level factors, little empirical research has examined these influences jointly (Kramer & Hogue, 2009; White & Borrell, 2011). Moreover, previous work in this area has focused primarily on African Americans' perceptions of discrimination rather than directly on Whites' biases toward African Americans. We investigated how the efficacy of interventions designed to limit transmission of HIV by increasing condom use may be influenced by structural stigma – specifically, Whites' attitudes toward African Americans and residential segregation in the communities where intervention trials occurred – and explored the moderating role of psychological factors.

Despite recent medical advances in its treatment, HIV remains a major health issue in the United States and worldwide. There are approximately 48,000 new HIV infections annually in the U.S., with 44% of new infections occurring among African Americans (Centers for Disease Control, 2011). As the White House Office of National AIDS Policy (2010) noted, “HIV disproportionately affects the most vulnerable in our society—those Americans who have less access to prevention and treatment services” (p. ix). Transmission of HIV can be prevented through safer sex practices, including consistent and correct condom use (Weller & Davis-Beaty, 2002). Numerous trials have investigated behavioral interventions that deliver content interpersonally and address deficits as a strategy for increasing protective behaviors among African Americans.

The current research reports a secondary analysis of a meta-analysis of HIV prevention interventions targeted toward African Americans (Johnson et al., 2009). Meta-analysis, which provides an estimate of the magnitude of behavior change following interventions, is ideal for considering how geographic differences in stigma might shape intervention efficacy. Because intervention trials have been conducted throughout the U.S., meta-analysis allows for examination of whether Whites' attitudes and level of residential segregation in these different locations relate to intervention efficacy. Previous meta-analyses support that interventions targeting African Americans have generally increased condom use (Darbes et al., 2008). Johnson et al. found that interventions were efficacious up to three years later and were most successful when they included particular features, such as multiple intensive sessions and interpersonal skills training. Although previous meta-analyses have examined overall efficacy of interventions and have identified intervention features that are linked to greater success, they have not considered whether structural features of intervention communities may play a role in intervention efficacy. Indeed, Johnson et al. observed that, even after accounting for significant intervention-level moderators, condom use effect sizes lacked homogeneity, suggesting that other moderators may explain some of the heterogeneity in effect sizes. Thus, the present analysis considered not only whether structural factors influenced intervention efficacy, but also whether inclusion of structural factors altered Johnson et al.'s conclusions regarding which intervention-level features were associated with greater efficacy.

Whites' community-level attitudes and residential segregation are structural environmental pressures that intervention participants face before they enter and when they leave interventions. These structural factors are likely to influence intervention efficacy because they affect both the targeted behavior—condom use—and the extent to which participants are engaged in the interventions. Consistent with a growing body of research, Whites' attitudes and residential segregation are likely to be associated with both increased engagement in sexual risk behavior and increased risk for acquiring a sexually transmitted disease, implying lack of condom use (Biello et al., 2012; Roberts et al., 2012; Rosenthal et al., 2013; Stock, Gibbons, Peterson, & Gerrard, 2013). To the extent that coping with discrimination is stressful and depleting (Inzlicht,

McKay, & Aronson, 2006), structural stigma is also likely to affect condom use via its influence on decreased levels of self-control and self-regulatory resources (Gibbons et al., 2012). Discrimination and stigma are also associated with mistrust of majority group members (Bergsieker, Shelton, & Richeson, 2010; Dovidio et al., 2008); this mistrust is likely to translate into decreased engagement in and acceptance of intervention messages (Wyatt, 2009). When interventions fail to address these influences of structural stigma on condom use and on the intervention itself, efficacy for improving condom use would be expected to suffer (Johnson et al., 2010; Wyatt, 2009).

Whites' community-level attitudes toward African Americans and residential segregation may both affect intervention efficacy. Because African Americans are vigilant for cues of bias (Dovidio et al., 2008; Vorauer, 2006), either negative community attitudes or high levels of residential segregation may be sufficient to undermine intervention effectiveness. Research on intergroup contact demonstrates that intergroup orientations (e.g., intergroup anxiety and empathy) are the consequence of both the frequency of contact and the quality of contact, that is, whether contact is experienced positively or negatively (see Tausch & Hewstone, 2010, for a review). In general, the valence of contact is more influential for intergroup orientations than frequency of contact. However, intergroup orientations are most favorable when contact is *both* positive and frequent (Towles-Schwen & Fazio, 2001), suggesting that community attitudes and segregation may interact such that positive community attitudes and low levels of residential segregation may combine to produce an environment highly conducive to intervention efficacy. Given the importance of the valence of intergroup contact and the paucity of research on Whites' community-level attitudes, our examination of additional moderators of structural stigma focused on Whites' attitudes.

In addition to our central focus on the influences of residential segregation and Whites' attitudes toward African Americans on intervention efficacy, we examined factors that may exacerbate or buffer against the impact of structural stigma. Our inclusion criteria, described in detail in the Method section, permitted analysis of studies in which at least 50% of the sample identified as African American ($M = 81\%$). As Whites' attitudes toward African Americans would be expected to influence African Americans specifically, we expected a stronger effect of Whites' attitudes for samples with higher proportions of African Americans. Late childhood to early adolescence has been suggested as a critical period during which experiences with discrimination may be especially detrimental, because identity is still developing and external evaluations of the self are being integrated into the self-concept (Gibbons et al., 2007). To this point, the impact of stigma tends to lead to riskier behavior, and increased sexual risk in particular, among younger African Americans (Roberts et al., 2012; Stevens-Watkins, Brown-Wright, & Tyler, 2011). Accordingly, more negative attitudes among Whites were expected to adversely influence intervention efficacy when samples were, on average, younger.

Conversely, due to the effects of stigma on self-regulation and mistrust (Bergsieker et al., 2010; Dovidio et al., 2008; Gibbons et al., 2012; Inzlicht et al., 2006), an effect of Whites' attitudes may be weakened by intervention features that potentially improved participants' self-regulation or communicated racial sensitivity and respect. Interventions that seek to improve self-control, potentially by teaching interpersonal skills for negotiating condom use with sexual partners, may buffer against an effect of Whites' attitudes. Similarly, tailoring content to participants' values and needs, which may communicate respect for participants' cultural values, may limit the effect of Whites' attitudes.

To summarize, we sought to investigate the interplay of structural and psychological factors related to stigma in influencing the

efficacy of HIV prevention interventions for increasing condom use (or reducing unprotected intercourse) among African Americans. Based on previous research, we predicted that the efficacy of HIV prevention interventions for increasing condom use would be lower in communities where Whites' attitudes toward African Americans were less favorable or residential segregation was greater. We further predicted that interventions would be particularly successful in communities where Whites' attitudes were relatively positive and segregation was simultaneously low. Whites' attitudes were expected to be more strongly related to intervention efficacy when interventions had higher proportions of African Americans or younger participants but more weakly related to efficacy when interventions included techniques to improve interpersonal skills or tailored content for the targeted population. We also explored whether the effects of structural stigma remained over and above important intervention features and community-level poverty, education, and population density for Whites and African Americans.

Method

Because methodological details for this meta-analytic database appear elsewhere (Johnson et al., 2009), only a brief summary appears here. Published studies and dissertations were retrieved from (1) electronic databases (e.g., PubMed, PsycINFO), (2) the Syntheses of HIV/AIDS Risk Reduction Project's HIV intervention database, and (3) recent issues of relevant journals and reference sections of included articles. Studies available as of June 1, 2006 that met selection criteria were included, which required that an intervention (1) incorporated HIV risk reduction content, (2) was conducted in the United States and included a sample of at least 50% African Americans, (3) used a randomized controlled trial design, (4) delivered the intervention face to face, and (5) provided sufficient information for calculating effect sizes on a behavioral outcome. Studies available after 2006 were not included for two reasons. First, the indicator of Whites' attitudes (described below) was only available through 2008. Given large shifts in Whites' attitudes following President Obama's election to office in 2008 (Goldman, 2012), we were hesitant to extrapolate beyond the existing data. Second, inclusion of studies beyond 2006 would limit ability to examine to what extent inclusion of structural factors altered the conclusions drawn by Johnson et al. The present analysis further required that a study provided, at minimum, the location in which the intervention was conducted; the re-analysis also focused on condom use, the primary risk-related outcome in the original database. In all, 70 independent studies that included 99 separate interventions (k) met selection criteria. Citations for included studies appear in [Supplemental Content 1](#).

Two independent raters coded study information (e.g., location), characteristics of the sample (e.g., % African American), and content of the treatment and control conditions (e.g., interpersonal skills training). Inclusion of interpersonal skills training and tailored content were coded as present or absent. Interpersonal skills training was present if a study targeted negotiating condom use with a sexual partner. Tailored intervention content was present if steps were undertaken to enhance applicability and acceptability of the intervention for the targeted sample, ranging from conducting focus groups prior to intervention development to pilot testing the intervention. Although samples were predominantly African American, tailoring sometimes targeted other demographic characteristics (e.g., gender, age group). Inter-rater reliability was good (mean Cohen's kappa = 0.66 for categorical variables; mean Spearman–Brown correlation = 0.90 for continuous variables); disagreements were resolved by discussion.

Following standard practice, we disaggregated comparisons (a) for the 12 trials with more than one intervention conditions; (b) for

8 trials that reported outcomes separately for sample characteristics (e.g., gender); and (c) for 3 trials that did both. Effect sizes were calculated for each intervention condition or characteristic and analyzed as separate studies (Lipsey & Wilson, 2001). Condom use effect sizes (the standardized mean difference, d) were calculated as the difference between the treatment and control groups, divided by the pooled standard deviation; in the absence of this information, standard procedures were used to transform statistical information to d . Positive effect sizes indicate that condom use increased in the treatment group, relative to the control group. Effect sizes were corrected for sample size bias. Because timing of follow-up assessments varied, we analyzed the final follow-up assessment from each study.

Data on Whites' attitudes toward African Americans were drawn from the American National Election Studies (ANES). The ANES collects political and public opinion data in most even-numbered years from nationally representative samples. Since 1964, the ANES has asked White respondents to rate their warmth or coolness toward African Americans using a feeling thermometer (i.e., ANES item VCF0206). Ratings between 0 and 50 were described as unfavorable and ratings between 50 and 100 as favorable. Because responses of 98, 99, and 100 were rounded down to 97 in the original data, this value represents the maximum value; missing and "don't know" values were omitted from analyses.

We obtained privileged access to ANES data, providing the geographic locations of individual respondents. The counties and states in which the intervention trials were conducted were extracted from studies, supplemented with information provided by study authors. Our general approach was to match the year in which the trial was conducted to Whites' attitudes collected in the same year. Trials conducted in odd-numbered years were matched with Whites' attitudes from the previous year (e.g., 1995 trial matched with Whites' attitudes in 1994).

We first matched Whites' attitudes aggregated at the county level to the counties in which intervention trials were conducted ($k = 62$; 63% of cases). In the absence of a match, estimates were calculated by averaging observations from adjacent counties in the same year or by using the temporal trend across available years within the same county. For prison samples or when only the state was known ($k = 5$), Whites' attitudes were calculated for the entire state. For multisite trials or studies that recruited participants from multiple counties ($k = 15$), an average attitudinal score was calculated across sites for which data were available, weighted by the number of participants drawn from each site. Sensitivity analyses examined the extent to which imputed attitude scores affected results.

Residential segregation was approximated using dissimilarity scores, which reflect the proportion of African American residents who would need to move across census tracts in order to obtain an even distribution of African Americans across an entire metropolitan area. A score of 100 reflects complete segregation and, 0, complete integration (Glaeser & Vigdor, 2001). Predicted dissimilarity scores, corresponding to the metropolitan area and year in which an intervention trial was conducted, were calculated primarily using Frey's (2012a) dissimilarity scores based on the 1990, 2000, and 2010 censuses. For six metropolitan areas not available in Frey (2012a), dissimilarity scores for 1980, 1990, and 2000 were drawn from the Lewis Mumford Center's database. State-level dissimilarity scores, used for prison samples or when only the state was known, were drawn from Frey's (2012b) calculations using data from the 2000 census and 2005–2009 American Community Survey, which was assumed to reflect dissimilarity in 2007. For multisite trials or studies that recruited participants from multiple counties, the predicted dissimilarity score was calculated for each study site and then averaged across all sites, weighted by the number of participants drawn from each site.

Stigmatized communities may be marked by both lower socioeconomic status and educational attainment, and the effect of Whites' attitudes may vary depending on whether an area is predominantly composed of African Americans or Whites. Thus, we examined whether the effect of Whites' attitudes persisted over and above community-level poverty, educational attainment, and population density for African Americans and Whites; all variables were drawn from the U.S. census at the county level. Two characterizations of poverty, percent of residents living below the poverty line and median household income, were examined. Percent who completed high school and population densities for African Americans and Whites were selected to characterize educational attainment and population density. The indicators of poverty and population densities were linked directly to the year in which the intervention was conducted. If interventions were conducted in a year for which estimates were not available predicted scores were calculated. Because educational attainment data were only available in decennial census years, the linear trend was used.

All moderators of condom use effect sizes were examined using modified least squares regression analyses with each effect size weighted by the inverse of its variance, incorporating both fixed- and random-effects components (Harbord & Higgins, 2008), a strategy known to be relatively conservative, statistically. Interventions were conducted in 50 different sites. Although multiple interventions were conducted in some sites, they were also conducted over time. Moreover, alternative analyses (Cheung, 2013; Konstantopoulos, 2011) that explicitly controlled for clustering of intervention effects by site or time yielded the same pattern of results. For simplicity of interpretation and because the clustered analyses do not permit simultaneously controlling for site and time, we report the modified least squares analyses. To reduce multicollinearity, continuous moderators were mean centered before constructing interaction terms or examining multiple moderators simultaneously. Predicted estimates of effect size means and confidence intervals at different levels of moderators of interest were probed using the moving-constant technique (Johnson & Huedo-Medina, 2011). Analyses were conducted in Stata 11.2 (StataCorp, 2009).

Results

Trials were conducted in locations throughout the U.S, but primarily in medium to large cities in the Northeast and Southeast. The number of trials conducted in a particular site ranged from 1 to 11. Eleven trials were conducted in both Los Angeles County and Fulton County, Georgia, which encompasses Atlanta. In total, trials included over 40,000 participants who were predominantly African American (81%) and female (65%). Follow-up assessments of condom use occurred between 1 and 156 weeks following the interventions. In all, 70% of trials included interpersonal skills training and 41% tailored content. Observed values of Whites' attitudes toward African Americans ranged from 46.82 to 97, with a median of 63.75. Observed values of residential segregation ranged from 32.57 to 83.85, with a median of 69.76. Whites' attitudes and residential segregation were correlated: greater segregation was associated with Whites' more negative attitudes toward African Americans ($r = -0.37, p < .001$).

Independent and interactive effects of Whites' attitudes and residential segregation

We observed a significant weighted mean effect size, d_+ , of 0.18 for post-intervention changes in condom use (95% CI: 0.11, 0.24). Table 1 presents individual moderators of intervention efficacy, probed at the minimum, median, and maximum values observed in the data. Consistent with hypotheses, effect sizes for changes in

Table 1

Condom use effect sizes as a function of Whites' attitudes toward African Americans, residential segregation, and variability in Whites' attitudes.

Moderator dimension/ Level (value)	\hat{d}_+ (95% CI)	t-test for moderator	β	I^2_{residual}
Whites' attitudes toward African Americans ($k = 99$)		2.56*	0.20	74.66%
Minimum (46.82)	0.04 (-0.08, 0.16)			
Median (63.75)	0.16 (0.10, 0.23)			
Maximum (97.00)	0.41 (0.22, 0.59)			
Residential segregation ($k = 99$)		-3.27**	-0.36	73.72%
Minimum (32.57)	0.68 (0.37, 1.00)			
Median (69.76)	0.19 (0.12, 0.25)			
Maximum (83.85)	-0.00 (-0.13, 0.12)			

Note. Effect sizes (d) are modeled using fixed slopes and a random-effects constant; each moderator dimension is entered individually. Predicted estimates (and 95% CI) of the standardized mean difference (d) between the intervention and control groups are listed; positive values imply that intervention groups were more likely to use condoms than the control group. Predicted effect sizes are given at the minimum, median, and maximum values observed in the data. k = Number of effect sizes in the analysis. I^2_{residual} = Variance remaining unexplained by the moderator. * $p \leq .05$. ** $p \leq .01$.

condom use were significantly smaller in communities where Whites held less favorable attitudes toward African Americans ($\beta = 0.20$). In communities where Whites had relatively negative attitudes toward African Americans, HIV prevention interventions on average failed ($d_+ = 0.04$), as the confidence interval including zero indicates. In contrast, interventions succeeded when Whites had moderately to highly positive attitudes toward African Americans (d_+ s = 0.16 and 0.41, respectively). Providing converging evidence on the influence of structural stigma, effect sizes were also smaller in more segregated communities ($\beta = -0.36$). As the confidence intervals indicate, interventions failed to improve condom use when conducted in highly segregated communities (e.g., $d_+ = 0.05$ with 80% segregation), but succeeded in less segregated communities (e.g., $d_+ = 0.49$ with 47% segregation).

Furthermore, Whites' attitudes and residential segregation interacted. As Table 2 illustrates, interactions of Whites' attitudes with other continuous factors were probed at the 10th and 90th percentiles of the observed data. The only condition in which trials significantly improved condom use among participants in the intervention conditions relative to controls was when residential segregation was relatively low and Whites' attitudes toward African Americans were relatively positive ($d_+ = 0.53$). Alternatively, Whites' attitudes significantly related to condom use effect sizes when segregation was low but not when segregation was high. The significant influence of Whites' attitudes in conditions of low segregation is indicated by the predicted effect size for positive attitudes ($d_+ = 0.53$) falling beyond the confidence interval for negative attitudes (-0.03, 0.28), implying that these estimates differ significantly from one another. Yet, because the confidence intervals for the mean effect sizes in conditions of high segregation include the other mean, these estimates do not differ from one another ($p > .05$).

Sensitivity analysis for Whites' attitudes

The relationship of Whites' attitudes to condom use effect sizes was only marginally worse when Whites' attitudes were imputed rather than exactly matched in time and location (interaction: $t = -1.69, p = .10$). The influence of Whites' attitudes also did not depend on the year in which the study was conducted, suggesting these patterns are temporally stable (interaction: $t = 1.66, p = .10$).

Table 2
Interactions of Whites' attitudes with other factors predicting condom use effect sizes.

Moderator dimension/Level (value) ^a	\hat{d}_+ (95% CI)	t-test for interaction	Multiple R	I^2_{residual}
Whites' attitudes × Residential segregation (<i>k</i> = 98)		-2.99**	0.48	72.80%
Negative attitudes, Low segregation	0.13 (-0.03, 0.28)			
Positive attitudes, Low segregation	0.53 (0.37, 0.69)			
Negative attitudes, High segregation	0.12 (-0.04, 0.29)			
Positive attitudes, High segregation	-0.26 (-0.56, 0.03)			
Whites' attitudes × Time since intervention (in weeks; <i>k</i> = 98)		2.22*	0.28	74.88%
Negative attitudes, 1 week	0.16 (-0.01, 0.34)			
Positive attitudes, 1 week	0.16 (-0.01, 0.33)			
Negative attitudes, 26 weeks	0.08 (-0.03, 0.18)			
Positive attitudes, 26 weeks	0.26 (0.15, 0.38)			
Negative attitudes, 52 weeks	-0.02 (-0.19, 0.15)			
Positive attitudes, 52 weeks	0.37 (0.24, 0.50)			
Whites' attitudes × Proportion of sample African American (<i>k</i> = 99)		2.51*	0.35	73.04%
Negative attitudes, 100% African American	0.00 (-0.16, 0.16)			
Positive attitudes, 100% African American	0.40 (0.26, 0.53)			
Negative attitudes, 50% African American	0.22 (0.01, 0.43)			
Positive attitudes, 50% African American	-0.03 (-0.29, 0.23)			
Whites' attitudes × Sample age (in years; <i>k</i> = 98)		-4.28***	0.67	62.06%
Negative attitudes, adolescents	-0.09 (-0.25, 0.07)			
Positive attitudes, adolescents	0.69 (0.52, 0.86)			
Negative attitudes, adults	0.11 (-0.04, 0.27)			
Positive attitudes, adults	0.05 (-0.08, 0.19)			
Whites' attitudes × Content tailoring (<i>k</i> = 98)		-3.20**	0.43	70.71%
Negative attitudes, Not tailored	-0.09 (-0.22, 0.05)			
Positive attitudes, Not tailored	0.37 (0.23, 0.51)			
Negative attitudes, Tailored	0.25 (0.11, 0.41)			
Positive attitudes, Tailored	0.18 (0.03, 0.34)			

Note. Effect sizes (*d*) are modeled using fixed-effects slopes and a random-effects constant; each moderator dimension is entered individually. Predicted estimates (and 95% CI) of the standardized mean difference (*d*) between the intervention and control groups are listed; positive values imply that intervention groups were more likely to use condoms than the control group. *k* = Number of effect sizes in the analysis. I^2_{residual} = Variance remaining unexplained by the moderator. **p* ≤ .05. ***p* ≤ .01. ****p* ≤ .001.

^a Predicted effect sizes are given at the 10th and 90th percentiles for attitudes (negative attitudes = 50.00; positive attitudes = 80.84), residential segregation (low segregation = 60.57; high segregation = 82.54), and age (adolescents = 13.19 years; adults = 39 years).

In contrast, the effect of Whites' attitudes did vary as a function of time elapsed since the interventions (see Table 2). In communities with positive attitudes, intervention participants, relative to controls, improved their condom use over time ($d_+ = 0.16$ at 1 week, 0.26 at 26 weeks, and 0.37 at 52 weeks). In communities with negative attitudes toward African Americans, condom use effect sizes were consistently non-significant over time ($d_+ = 0.16$ vs. 0.08 vs. -0.02).

Factors that may increase the effect of Whites' attitudes

As Table 2 shows, the expected relationship of Whites' attitudes to condom use effect sizes emerged for trials that sampled greater proportions of African Americans and for trials with more adolescents. When samples were 100% African American, trials had no effect on intervention participants relative to controls in communities with relatively negative attitudes ($d_+ = 0.00$) but significantly positively influenced condom use in communities with relatively positive attitudes ($d_+ = 0.40$). Whites' attitudes did not significantly relate to condom use effect sizes for trials with fewer African Americans, as indicated by the overlapping confidence intervals. Similarly, when adolescents were targeted, interventions succeeded in communities with positive attitudes ($d_+ = 0.69$) but failed in those with negative attitudes ($d_+ = -0.09$); Whites' attitudes were not related to intervention efficacy among adults.

Factors that may buffer against Whites' attitudes

Inclusion of content targeting interpersonal skills did not moderate the effect of Whites' attitudes (*p* > .10), but tailoring intervention content for the targeted sample buffered against the

effect of Whites' negative attitudes (see Table 2). When trials did not tailor content, the effect of Whites' attitudes was robust—these interventions failed in communities with relatively negative attitudes ($d_+ = -0.09$) but succeeded in communities with relatively positive attitudes ($d_+ = 0.37$). However, interventions that tailored their content significantly improved condom use not only when Whites' attitudes in the community were positive toward African Americans ($d_+ = 0.18$) but also when they were relatively negative ($d_+ = 0.25$).

No moderator identified in Johnson et al.'s (2009) analysis correlated more than |0.19| with Whites' attitudes, suggesting Whites' attitudes may have effects independent of the sample characteristics and intervention features previously found to be related to intervention success. Indeed, when entered simultaneously, Whites' attitudes remained a significant predictor of intervention efficacy over and above the sample characteristics (e.g., percent of samples that were HIV positive, men who have sex with men, and retained at the end of the study) and intervention features (e.g., dosage and interpersonal skills training) that related to efficacy. However, the effect of intervention dosage observed in Johnson et al. became non-significant after accounting for Whites' attitudes. Inclusion of the structural factors, significant interactions, and intervention features reduced heterogeneity markedly (from $I^2 = 74.72$ to 52.80%). This final model explained 53% of the variability in effect sizes; in the previous analysis, intervention-level features explained 41% of the variance.

Finally, variables in the final model remained statistically significant after controlling for county-level (a) percentage of high school graduates, (b) median household income, (c) percentage below the poverty line, and (d) population density of African Americans and of Whites. The first two of these variables related on

a bivariate basis to intervention success but became non-significant when the factors in the final model were controlled.

Discussion

The present research sought to conceptually integrate previous research on structural factors in stigma, commonly emphasized by public health researchers (e.g., Hatzenbuehler, Keyes, & Hasin, 2009; Williams & Collins, 2001) and psychological factors, emphasized by health and social psychologists (e.g., Pascoe & Smart Richman, 2009) in the context of the efficacy of HIV prevention intervention trials predominantly involving African American participants. The use of meta-analysis allowed us to examine how Whites' attitudes toward African Americans and residential segregation distinctly and jointly influenced outcomes in 70 studies conducted between 1988 and 2005 in 50 unique sites, encompassing over 40,000 individual participants. It has been theorized that stigma can hamper attempts to promote healthier behaviors (Johnson et al., 2010; Wyatt, 2009), but no previous research to our knowledge, primary or meta-analytic, has empirically demonstrated associations of stigma to intervention efficacy. In addition, whereas previous research amply demonstrates the adverse effects of perceived racial bias on the health and health-related behaviors of African Americans (Pascoe & Smart Richman, 2009; Williams & Mohammed, 2009), the present research reveals the direct negative effects of Whites' attitudes on African Americans' health.

Both Whites' attitudes toward African Americans and residential segregation, two distinct indicators of structural stigma, were related to effect sizes for changes in condom use. Supporting psychological research on the quantity and quality of intergroup contact (Towles-Schwen & Fazio, 2001), interventions were uniquely effective when residential segregation was relatively low and Whites' attitudes were relatively favorable. Previous research has suggested that perceived discrimination may moderate the influence of residential segregation. Potentially, areas marked by high segregation and low perceived discrimination may be protective because they confer less likelihood of encountering discrimination (Bell, Zimmerman, Almgren, Mayer, & Huebner, 2006; White & Borrell, 2011). To the extent that community-level attitudes are a proxy for the likelihood that individuals perceive discrimination in their day to day lives, the present results suggest otherwise. Rather than a protective effect, we observed essentially a main effect of residential segregation—when segregation was high, improvements in condom use were not evident, no matter how supportive Whites' attitudes toward African Americans.

Interventions did not improve condom use either immediately or up to a year later in communities with less positive racial attitudes. By contrast, in communities where Whites' attitudes toward African Americans were more positive, the efficacy of interventions relative to control conditions increased over time. Research suggests that continuous engagement in behaviors requiring self-regulation facilitates improvement in self-regulatory resources (Baumeister, Gailliot, DeWall, & Oaten, 2006). Accordingly, with repeated behavioral practice and success, interventions conducted in favorable environments may allow intervention participants to build their self-regulatory resources, while control participants remain stagnant or potentially decline over time. As negative attitudes appeared to erode any intervention gains over time, stigma may contribute to the common observation that health promotion interventions tend to initially produce small to moderate changes in behavior, that then erode over time. Nonetheless, the present results more strongly suggest that changes can be better maintained in communities with more supportive intergroup climates.

Understanding how structural stigma may activate processes that undermine the effectiveness of health-related interventions

can also be informative for designing interventions for stigmatized populations. Inclusion of content targeting interpersonal skills, which we theorized may lead to improved self-control, did not reduce the effect of Whites' attitudes. However, inclusion of a self-affirmation task, in which participants affirm their self-worth in a valued domain, may aid participants in improving self-control despite chronic depletion of their self-regulatory resources, allowing them to begin to enact the desired behavior change (see Cook et al., 2013; Schmeichel & Vohs, 2009). Indeed, some of the most efficacious HIV prevention interventions for African Americans include activities to improve a sense of ethnic and/or gender pride (e.g., Jemmott, Jemmott, & Fong, 1998), which may engage processes similar to those that are activated when individuals affirm their self-worth. Such activities may be particularly important to incorporate in interventions targeting younger, entirely African American samples, who are especially strongly affected by stigma.

Interventions that tailored content for the targeted participants, which we believe reduced mistrust among participants, mitigated the effect of Whites' attitudes on the success of interventions. Tailoring encompasses a broad set of research strategies and reflects tailoring content to a sample's needs on the basis of ethnicity, but also among other factors, gender, age, and HIV serostatus. It is unclear whether certain aspects, types, or quantity of tailoring specifically accounted for this buffering effect. Even so, it is possible that tailoring on any of these dimensions may signal that one's minority status is respected, creating a sense of social inclusiveness that facilitates both trust in and commitment to the intervention (Bergsieker et al., 2010; Walton & Cohen, 2007). Although the advantage of meta-analysis is that, by aggregating across studies, patterns such as the effect of tailoring on intervention efficacy can be better discerned, additional primary-level research can further illuminate the specific processes that represent the primary underlying psychological and social-structural mechanisms.

Some limitations to the present analyses should be noted. The observed values of our structural indicators appear to have limited range. With respect to Whites' attitudes toward African Americans, the most negative community attitude fell barely below the midpoint of the scale, for which a score of 50 reflects neutrality toward African Americans. Thus, it may initially appear that our results are based on communities that are not representative of the attitudes of Whites toward African Americans. We note, however, that the mean of Whites' attitudes toward African Americans across our samples (65.80) is similar to that of representative White samples in the ANES in the years of our intervention trials, 1988 to 2005 ($M = 63.31$; $SD = 19.33$). In terms of the residential segregation index, the 10th percentile for residential segregation across our samples, at 60.57, reflected that the communities we studied were generally fairly segregated. Nevertheless, our findings are likely to generalize broadly because the U.S. is still a largely racially segregated society ($M = 64.0$ across all metropolitan areas in the U.S. 2000 Census; Iceland, Weinberg, & Steinmetz, 2002).

We were also limited in the variables we considered because of the nature of the factors and the measures included directly in the studies in our meta-analytic database or that could be reliably coded across the studies. Thus, there may be numerous other structural- or individual-level factors that we did not include in our analyses that contribute to our results. We lacked direct measures of the psychological processes through which we believe stigma affected behavior change. One particularly important direction for future research involving primary or secondary data is to examine the effects of structural stigma on psychological mechanisms such as self-regulation, trust, belonging, and feelings of being accepted and respected (see Pachankis and Hatzenbuehler, 2013; Smart Richman, 2013, for discussions of these mechanisms). In addition,

changes in participants' condom use reflect self-report rather than objective measures. Also, although our findings implicate that some mechanisms (e.g., trust) may be more influential than others (e.g., self-regulation), experimental research that includes direct measures of these constructs could provide valuable independent evidence. Inclusion of new interventions that have appeared since the Johnson et al. (2009) analysis may also increase power to examine such trends.

Despite these limitations, our analytic approach reflected a number of strengths. We sought to validate our findings by demonstrating that the effect of Whites' attitudes was not due to our imputation of data and that the effect was specific to African American samples. Furthermore, because the effect of stigmatizing environments may be due to increased mistrust and reduced self-regulation (Dovidio et al., 2008; Gibbons et al., 2012), we believe that the observed effects are likely to generalize to other health promotion attempts among African Americans, including for example, diabetes management and weight loss. Environments also differ in the extent to which they stigmatize other minority groups, including gay, lesbian, bisexual, and transgender (GLBT) individuals (Hatzenbuehler et al., 2009). Because stigma is also stressful for GLBT individuals, leading to impaired self-regulation (Hatzenbuehler, 2009) and mistrust toward majority individuals and societal institutions (Meyer, 1995), HIV prevention efforts directed toward gay men may be similarly influenced by environmental stigma.

Conclusions

The present research provides support for an influence of structural stigma on the efficacy of interventions for bringing about behavior change, highlighting the role of stigma in the environment in perpetuating health disparities. We acknowledge, however, that our findings provide a clearer demonstration that residential segregation and Whites' attitudes influence the efficacy of HIV prevention interventions than of the potential mechanisms that underlie these effects. Our meta-analysis was limited by the data within or generally available across all of the studies for identifying the specific mechanisms involved. Our findings, though, also reinforce the value of meta-analysis to discern systematic influences that may not be evident in primary-level data. Indeed, because most of the studies included in our analysis examined the efficacy of interventions in a single location, they could not detect the kinds of effects that we found in our research (i.e., variation as a function of residential segregation and community racial attitudes).

Moreover, an added value of the current work is that, even though mediation could not be directly tested, the convergence of findings in the literature (e.g., the importance of trust in adherence) and factors (e.g., content tailoring) we found that moderated the influence of structural stigma can strongly implicate likely underlying processes that can be pursued more directly in future primary-level research. Thus, while we are unable to fully answer the question of how residential segregation and community racial attitudes influence the efficacy of HIV prevention interventions, the findings of the present research illustrate the potential value of meta-analysis for advancing theory and research, for identifying specific productive areas for future work, and for guiding new interventions and applications.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.socscimed.2013.06.028>.

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