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Direct and Indirect Effects between Internalized Homonegativity and High-risk Sex

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Abstract

The bivariate association between internalized homonegativity and high-risk sex among men who have sex with men has been indistinguishable from zero. This indicates a lack of predictive utility of the construct, but does not elucidate how it contributes to processes that include intermediate variables that can increase or decrease risk behavior. We used both structural equation modeling and mediation process analyses to assess indirect effects on unprotected anal intercourse as a function of compulsive sexual behavior and the number of male sexual partners in a sample of men who have sex with men. Internalized homonegativity predicted an increase in unprotected anal intercourse through compulsive sexual behavior, and a decrease through the number of male sexual partners. These results suggest differential pathways that combine to form no association when they are not considered in analysis. The absence of a bivariate association indicates that a variable is not a predictor, but do not preclude a variable from functioning as part of a larger process.

Keywords

internalized homonegativity; statistical mediation analysis; suppression; men who have sex with men

INTRODUCTION

Basic epidemiologic analyses emphasize the exploration of univariable associations between each exposure and the defined outcome. Should an exposure show no association in the univariable analysis, it would call for no further consideration. If, however, there were an observed association between the exposure and the outcome variables, then further analyses would involve adjustment, either through stratification or by multivariable regression (Kleinbaum, Kupper, & Morgenstern, 1982). While useful for identifying the total association between an exposure and an outcome, this approach ignores the potential mechanisms that link the two variables (Susser & Susser, 1996).

Recently, Newcomb and Mustanski (2009) synthesized the research on internalized homonegativity (referred to in their manuscript as internalized homophobia) and high-risk

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sex. Internalized homonegativity relates to the extent to which individuals accept negative societal attitudes about same-sex relationships and behavior (Shidlo, 1994). Individuals with internalized homonegativity tend to be isolated from other gay, bisexual, or lesbian individuals (Meyer, 2003; Meyer & Dean, 1998; Williamson, 2000) and suffer psychological distress (Meyer, 1995). Based on these factors, the studies included in the meta-analysis attempted to identify an empirical association with risky sexual behavior. The authors concluded that the univariable association was indistinguishable from unity, and that internalized homophobia should be eclipsed by other, more-compelling risk factors. If the research question of interest is an explanation of the variance of high-risk sex, then their conclusion is quite reasonable. If, however, there is interest in understanding how internalized homonegativity could impact risk behavior, both directly and indirectly, then its exclusion from further studies will preclude any such analysis.

Traditional mediation approaches presuppose a statistically-significant univariable association between exposure and outcome (Baron & Kenny, 1986). There are, however, alternative explanations to a small or unobservable association that merit consideration. First, there is measurement error, which tends to restrict the magnitude of any effect estimate (Cheung & Lau, 2008). Second, there may be multiple pathways between exposure and outcome, and these different pathways can have conflicting directions of effect (Cerin & MacKinnon, 2008; Koeske, 1998; MacKinnon, Krull, & Lockwood, 2000; Mallinckrodt, Abraham, Wei, & Russell, 2006). In this case, estimating a total effect would be akin to summing up the pathways, which could result in a net effect of zero.

In line with the consideration of multiple pathways, there can be heterogeneity in response to stigma (Miller & Kaiser, 2001), including internalized homonegativity. For example, lower self esteem in tandem with internalized homonegativity can precede avoidant coping styles (Nicholson & Long, 1990). The avoidant coping, while potentially harmful in terms of mental health, can confer a protective benefit in terms of HIV risk. Should men have fewer sexual partners, then their frequency of exposure to high-risk events can potentially be reduced. Other studies, however, allude to the development of outcomes to mitigate stigma and psychological distress (Meyer, 1995), which can ultimately facilitate risk behavior. Examples of these outcomes include substance use expectancies (Kashubeck-West & Szymanski, 2008) and sexual sensation seeking (Preston, D'Augelli, Kassab, & Starks, 2007) and compulsive sexual behavior (Dew & Chaney, 2005).

Contemporary analytic approaches to mediation do not presuppose a statistically-significant, total effect for the aforementioned reasons. The first approach focuses on the covariance structure of the specified variables, and assumes a homogeneous process for the entire study sample (MacKinnon, 2008). Structural equation models are used to simultaneously estimate an indirect and a direct effect (MacKinnon, 2008; MacKinnon, Fairchild, & Fritz, 2007; MacKinnon, et al., 2000). The total effect, τ , can be estimated using a model that specifies the exposure variable as the only predictor of the outcome. After including the intermediate variable, it is possible to estimate the indirect effect, which is the product of the coefficients of two paths: (a) the path from the exposure to the mediator, α , and (b) the path from the mediator to the outcome, β . The direct effect, τ' , can be summed with the indirect effect, and should approximate τ . For a traditional mediation model, both $\alpha\beta$ and τ are of the same sign, and $|\tau'| < |\tau|$. If there are conflicting pathways, however, the direct and indirect effects will have different signs, and $|\tau'|$ may be greater than $|\tau|$. This would be a situation of inconsistent mediation, also referred to as suppression (MacKinnon, et al., 2000).

A second analytic approach to mediation, proposed by Collins, Graham, and Flaherty (1998), focuses on processes within individuals, and estimates probabilities of having or not having a designated mediation process. Ideally, mediation occurs when individuals with a

designated exposure have a greater probability of developing an intermediate variable, and having this intermediate variable yields a greater probability of developing the outcome of interest. These probabilities are similar to the estimation of the paths contributing to the indirect effect estimated in the structural equation modeling approach. The final criterion, however, is unique in that it requires evidence of individuals with the designated exposure having a greater probability of presenting the mediation process, which is the joint presence of both the intermediate variable and the outcome.

The aim of the present study was to estimate direct and indirect effects between internalized homonegativity and unprotected anal intercourse with male partners (UAIMP) in a sample of men who have sex with men (MSM). Intermediate variables considered in a structural equation modeling approach were compulsive sexual behavior and the number of male sexual partners in the 90 days preceding the study. We hypothesized that compulsive sexual behavior would contribute to a positive, indirect effect on UAIMP, given the evidence of a positive associations between internalized homonegativity and high-risk sex (Dew & Chaney, 2005) and between compulsive sexual behavior and high-risk sex (Benotsch, Kalichman, & Kelly, 1999; Benotsch, Kalichman, & Pinkerton, 2001; Chaney & Dew, 2003). We also hypothesized that the number of male sexual partners would contribute to a negative, indirect association between internalized homonegativity and high-risk sex as a function of avoidance (Nicholson & Long, 1990). In addition to structural equation modeling, we classified participants based on the intermediate variables and the outcome to assess the probability of classification as a function of internalized homonegativity.

METHOD

Study Design

The Men's INternet Study—II (MINTS—II) was a cross-sectional study conducted in 2005 among MSM. Potential participants were recruited via banner advertisements for a study on sexual health that were placed on social networking websites specific to MSM. The data collection methods have been detailed elsewhere (Rosser, et al., 2009), and are briefly summarized here. To be eligible, participants had to be at least 18 years of age and indicate at least one male sexual partner in the year prior to the survey. To obtain a multi-ethnic sample with large enough groups for comparison, participants were over-sampled based on their primary racial/ethnic identification. Once deemed eligible, participants were asked to complete a series of items related to sexual health, psychosocial factors, and content acceptability for future interventions related to sexual health and HIV transmission. At completion, 2,716 men took the survey.

Measures

Internalized Homonegativity—Participants also completed the 26 items of the Reactions to Homosexuality scale (Ross & Rosser, 1996). Responses were indicated using seven-point Likert-type scales (1=strongly disagree, 7=strongly agree). For this analysis, we used a short form of the scale (Smolenski, Diamond, Ross, & Rosser, In press) that included seven of the original items loading on three factors: personal comfort with a gay identity, social comfort with gay men, and public identification as gay. All items were coded at analysis so that a higher score indicated higher internalized homonegativity. Coefficient alpha of the short version in this sample was 0.73.

Compulsive Sexual Behavior Inventory—The Compulsive Sexual Behavior Inventory includes 28 items that capture three domains: control, abuse, and violence (Coleman, Miner, Ohlerking, & Raymond, 2001). We used the 13-item control subscale for this analysis in line with other researchers since this subscale most closely relates to the theoretical construct and

its associated lack of control over sexual feelings or urges (Raymond, Lloyd, Miner, & Kim, 2007). All items were measured using 5-point Likert-type scales (1=never, 5=very frequently). Coefficient alpha in this sample was 0.91.

Sexual Behavior—Participants were asked to provide data on the number of male sexual partners during the 90 days prior to the survey. In addition, they were asked to provide the number of men with whom they had unprotected anal intercourse (UAIMP).

Statistical Methods—Prior to estimating the direct and indirect effects of internalized homonegativity on high-risk sex, we estimated measurement models of both latent variables. We used a latent variable framework for the measurement models and subsequent structural models to separate measurement error from the estimated score on the latent variables. This reduced nondifferential misclassification, which often attenuates any observed effect estimates (Cheung & Lau, 2008). For internalized homonegativity, we estimated a second-order latent variable model with the three first-order latent constructs (i.e., personal comfort, social comfort, public identification) serving as indicators of overall internalized homonegativity. Models were estimated using the mean and covariance matrix, and the scale for each latent variable was set by assigning unit variance to each latent variable. Fit was assessed with the χ^2 value, the comparative fit index (CFI; Bentler, 1990), the Tucker-Lewis index (TLI; Tucker & Lewis, 1973), and the root mean squared error of approximation (RMSEA; Steiger, 1990). A value of 0.95 or above on the CFI and TLI, and a value of 0.05 or below on the RMSEA were considered indicators of good model fit (Hu & Bentler, 1999). All measurement and structural equation mediation models were estimated using the maximum likelihood estimator in *Mplus*, Version 5.1 (Muthén & Muthén, 2007).

Building on the measurement models, we tested structural models that included hypothesized unidirectional pathways. For single mediation models, we estimated three paths: (1) α , the effect of the internalized homonegativity on each mediator, (2) β , the effect of each mediator on the frequency of unprotected anal intercourse, and (3), τ' , the direct effect of internalized homonegativity on UAIMP after partitioning the variance associated with the indirect pathways. Each potential mediator was considered in separate models. Effect estimates for the indirect pathways were computed as $\alpha\beta$, the product of the pathways that included the intermediate variable. We estimated bias-corrected bootstrap confidence intervals using 10,000 draws with replacement (MacKinnon, Lockwood, & Williams, 2004). These confidence intervals are considered the most robust for mediation analysis, and take into account multivariate non-normality in the model. The scale for endogenous latent variables in these and the multiple mediation models was set by constraining the path between the latent and its first indicator variable to 1 (Kline, 2005).

We estimated two multiple-mediator models. The first included the direct effect of internalized homonegativity on UAIMP in addition to the indirect effects through the potential intermediate variables. The second model included the same pathways as the first multiple-mediator model, and included a direct effect of compulsive sexual behavior on the total number of male sexual partners. We assessed a model that included the demographic covariates of age, education, HIV-status, and residential area to the models, and the parameter estimates were not changed greater than 10%. As such, we only report here the results from the models without covariates to retain the largest sample size.

The mediation process model was designed for categorical variables; however, there are techniques to adapt continuous variables to such an analysis (Collins, et al., 1998). To illustrate this approach, we dichotomized compulsive sexual behavior and the number of male sexual partners in the past 90 days at the median. For UAIMP, we dichotomized to reflect any UAIMP versus none. For the analysis, we created groupings of the intermediate

variable(s) and outcome in accordance with the specified models, and used a multinomial regression model to compare those with a mediation process to those without.

RESULTS

The participants in the MINTS 2 study were predominantly young, had low to middle income levels, lived in medium- to large-sized cities, and were well educated (Table I). Over 80% of the sample reported exclusive same-sex behavior in the three years prior to the survey. Comparison between those included ($n=1,677$) and those excluded ($n=1,030$) revealed that there were more Latino men included (23.0% versus 16.9%, $p<.001$) and fewer men whose sexual behavior was exclusively with men over the three years prior to the survey (85.3% versus 82.1%, $p=.03$).

The measurement model that included the hypothesized measurement structures of both internalized homonegativity and compulsive sexual behavior failed to produce adequate fit ($\chi^2=2027.68$, $df=186$, $p<.001$; CFI=0.84; TLI=0.81; RMSEA=0.08, 90% CI=0.08, 0.09, SABIC=105290.09). The modification indices identified two items in the compulsive sexual behavior scale that cross-loaded on internalized homonegativity (“How often have you felt guilty or shameful about aspects of your sexual behavior,” and “How often have you concealed or hidden your sexual behavior from others”), and three items that had highly correlated residuals, suggesting redundancy (“How often have you had trouble controlling your sexual (1) urges, (2) behavior, and (3) feelings”). We removed the two cross-loaded items, and retained the item with the highest factor loading (urges) from the redundant items. The final measurement model, which included two additional residual covariances, produced adequate fit to the data ($\chi^2=401.95$, $df=98$, $p<.001$; CFI=0.96; TLI=0.95; RMSEA=0.043, 90% CI=0.039, 0.047, SABIC=87677.07). While exploratory given the scale revision of compulsive sexual behavior, the Pearson correlation between scores from this reduced, 9-item measure with the original 13-item measure was 0.98 (95% CI=0.97, 0.98).

Estimation of the total effect between each model variable showed that internalized homonegativity was associated with an increase in compulsive sexual behavior, a decrease in the number of male sexual partners, and a non-significant decrease in the number UAIMP (Table II). Higher compulsive sexual behavior was associated with higher numbers of sexual partners and UAIMP. Finally, participants reporting a higher frequency of sexual partners were more likely to report more UAIMP.

Incorporation of compulsive sexual behavior into a structural equation model of direct and indirect effects retained the associations between internalized homonegativity and compulsive sexual behavior, and between compulsive sexual behavior and UAIMP observed in the univariable analyses (Figure 1, Model A). The indirect effect, $\alpha\beta$, was 0.27 (95% CI=0.18, 0.40), suggesting positive association between internalized homonegativity and UAIMP as a function of compulsive sexual behavior. The direct effect, however, remained negative and strengthened in magnitude, which provided evidence of suppression. This suggested an alternative pathway through which internalized homonegativity is also associated with a decrease in UAIMP.

The other single mediation model showed a reduction in the number of sexual partners as internalized homonegativity increased (Figure 2, Model B). When combined with the increase in UAIMP that accompanied an increase in the number of sexual partners, the indirect effect as -0.31 (-0.42 , -0.23). Inspection of the direct effect again indicated suppression, with internalized homonegativity now being associated with a modest increase in the frequency of UAIMP independent of the number of male sexual partners.

Simultaneous modeling of both compulsive sexual behavior and the number of male sexual partners as intermediate variables yielded a direct effect that was indistinguishable from zero. In Figure 2 (Model 1), participants with higher internalized homonegativity had an increase in UAIMP as a function of compulsive sexual behavior ($\alpha\beta=0.14$, 95% CI=0.06, 0.23), and a decrease in UAIMP as a function of the number of male sexual partners ($\alpha\beta=-0.25$, 95% CI=-0.36, -0.18).

Inclusion of a direct effect of compulsive sexual behavior on the number of male sexual partners did not affect the direct effect estimate between internalized homonegativity and UAIMP. It did, however, show an indirect effect of internalized homonegativity on the number of male sexual partners ($\alpha\beta=0.52$, 95% CI=0.31, 0.82) as a function of compulsive sexual behavior. Extending this indirect effect to UAIMP yielded a third pathway linking internalized homonegativity and UAIMP ($\alpha\beta=0.13$, 95% CI=0.06, 0.23). The other indirect effect through compulsive sexual behavior ($\alpha\beta=0.14$, 95% CI=0.04, 0.26) was independent of the number of male sexual partners. The two pathways that included compulsive sexual behavior had a total effect of 0.27, which when combined with the indirect effect through the number of male sexual partners independent of compulsive sexual behavior ($\alpha\beta=-0.43$, 95% CI=-0.62, -0.29) and the direct effect, gives an estimate of the total effect of internalized homonegativity on UAIMP of -0.12, which closely mirrored the results of the univariable regression of UAIMP on internalized homonegativity.

Using the derived categorical distributions of compulsive sexual behavior, the number of male sexual partners, and UAIMP, we identified four groups of participants. Three groups reflected the mediation processes shown in Figure 2, Model B: (a) compulsive sexual behavior above the median and any UAIMP, (b) both compulsive sexual behavior and number of male sexual partners above the median and any UAIMP, and (c) number of male sexual partners above the median and any UAIMP (Table III). The fourth group served as the referent, and included all other participants who did not evidence any of the three mediation processes. From the multinomial regression, participants with higher internalized homonegativity had a greater likelihood of having a mediation process through compulsive sexual behavior. We also observed a reduced likelihood of manifesting the mediation process that only includes the number of male sexual partners.

DISCUSSION

We did not identify a total effect of internalized homonegativity on UAIMP that was distinguishable from zero. This supported Newcomb and Mustanski's (2009) assertion that internalized homonegativity has little utility in regression models with a primary goal of predicting high-risk behavior. We identified indirect effects, however, and these effects were in opposing directions. In our univariable analysis, the combination of these pathways yielded a small effect indistinguishable from zero. Without considering the indirect effects, we would have concluded that there was no meaningful association, which would have prevented the identification of subgroups of participants for whom internalized homonegativity was part of a risk or a protective process.

The findings of this study supported earlier accounts of differential effects of internalized homonegativity (Nicholson & Long, 1990). From the theoretical and empirical literature on internalized homonegativity, negative mood is considered a proximal outcome. Similar to the meta-analysis of internalized homonegativity, a meta-analysis of the effect of negative mood found no overall association with high-risk sex (Crepaz & Marks, 2001). Interestingly, other work with negative mood found differential responses similar to those observed in this study (Bancroft, Janssen, Strong, Carnes, Vukadinovic, & Long, 2003). In that study, some participants with negative mood reported higher sexual frequency while others reported a

reduction. Negative mood has been identified as an intermediate variable between internalized homonegativity and substance use, which in turn preceded high-risk sex (Johnson, Chesney, & Morin, 2008). If negative mood is indeed an intermediate variable between internalized homonegativity and the intermediate variables described here, then it could explain, at least partially, why there are conflicting pathways stemming from internalized homonegativity.

Both the structural equation modeling technique and the mediation process technique provided evidence in favor of mediation, albeit in different forms. From the structural equation models, we were able to estimate an effect size for the magnitude of each indirect effect. Given the conflicting directionality of the pathways, the mediation process approach was useful both as an alternative analytic framework and as a visualization of how the indirect effects contributed to estimable heterogeneity in the study sample. The mediation process analysis did not provide information relevant to the magnitude of any indirect effect, but it allowed us to visualize the frequency with which the identified pathways (or, processes) occurred in the study population. Approximately 37% of the sample was classified into one of three mediation patterns which would lead to risk; however, this proportion is limited by the reliance on distributional characteristics to categorize the intermediate variables. From the structural equation model, we expected internalized homonegativity to be positively associated with the two groups for whom compulsive sexual behavior was part of the process. Conversely, we anticipated fewer individuals with internalized homonegativity to be classified in the third process which excluded compulsive sexual behavior given the observed protective association in the structural equation models. The regression coefficients were consistent with these expectations.

Models of direct and indirect effects not only improve an understanding of variable relationships in research, they can also inform intervention design. From the models presented here, it appeared that compulsive sexual behavior and the number of male sexual partners were both determinants of UAIMP, making them the best candidates for a direct intervention. Assuming that internalized homonegativity plays a part in the causal mechanisms underlying compulsive sexual behavior and sexual partnering, then it would be necessary to address this construct in order to effectively intervene on the target variables. Research on and elaboration of other intermediate variable models can provide additional insight into which variables to target, and which factors are necessary to be effective in intervening.

This study had several strengths, including the use of structural equation modeling to account for measurement error and two different approaches to analyze mediation. In spite of these strengths, we were limited in terms of the variables available to consider for mediation analysis and the data were cross-sectional. We were able to use the literature to inform our specified models, but we are unable to test the temporal sequence assumed by both mediation analysis techniques. Finally, internalized homonegativity is associated with additional outcomes that have been identified as intermediate variables (Johnson, et al., 2008; Kashubeck-West & Szymanski, 2008; Preston, et al., 2007; Ross, Rosser, & Neumaier, 2008). While we did not have data specific to the reported intermediate variables, the incorporation of these variables into a structural equation model could elaborate the pathways identified here or elucidate additional pathways that we were unable to observe.

Overall, internalized homonegativity can contribute to an understanding of risk behavior among MSM, but this contribution is most likely in the form of indirect pathways. Since internalized homonegativity, in this and in other studies, lacks an observable total effect, some have called for its exclusion from future research (Newcomb & Mustanski, 2009). If the goal of a study is to identify a predictive model of risk behavior, then parsimony and

statistical considerations would lead to the exclusion of internalized homonegativity from the model. If, however, the goal of a study is to gain insight into mechanisms or processes that contribute to risk behavior, then excluding internalized homonegativity can result in an incomplete understanding. For future work with internalized homonegativity and other determinants that have substantive interest, but non-compelling total effects, it is prudent to consider and analyze the underlying mechanisms prior to ending a line of research.

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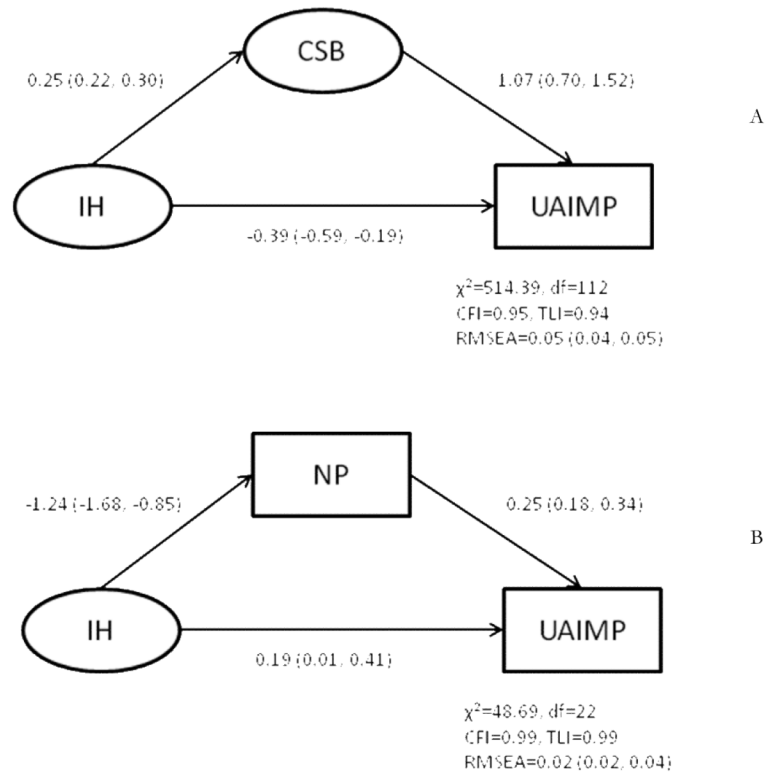


Figure 1. Single mediation models internalized homonegativity (IH) and unprotected anal intercourse with male partners (UAIMP) that include compulsive sexual behavior (CSB; Model A) and the number of male sex partners (NP; Model 2). Abbreviations for the model fit indexes are: df=degrees of freedom; CFI=comparative fit index; TLI=Tucker-Lewis index; RMSEA=root mean squared error of approximation. 90% confidence intervals are presented for the RMSEA estimate.

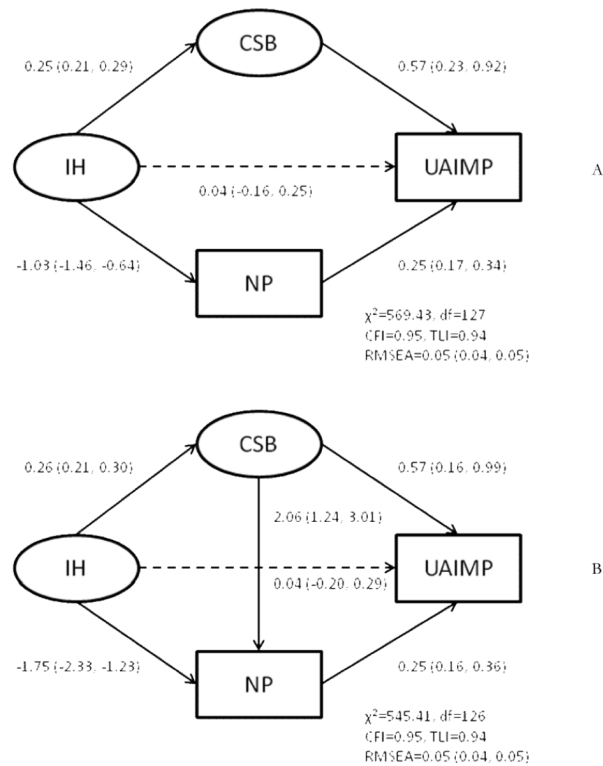


Figure 2. Multiple mediation models of internalized homonegativity (IH) and unprotected anal intercourse with male partners (UAIMP) that include compulsive sexual behavior (CSB) and the number of male sex partners (NP). Model A includes both intermediate variables as they were specified in the single mediation models. Model B includes an additional direct effect of CSB on NP. Abbreviations for the model fit indexes are: df=degrees of freedom; CFI=comparative fit index; TLI=Tucker-Lewis index; RMSEA=root mean squared error of approximation. 90% confidence intervals are presented for the RMSEA estimate.

Table I
Characteristics of the included participants (N=1,677)

Variable	<i>n</i>	%
Age, years		
18 – 24	578	34.5
25 – 34	693	41.3
35 – 44	282	16.8
45 and above	79	4.7
Missing	45	2.7
Race/ethnicity		
Asian	299	17.8
Black	277	16.5
Latino	358	21.4
White	410	24.5
Other	216	12.9
Missing	117	7.0
Residential area		
Rural	81	4.8
Small town	219	13.1
Medium – sized city	437	26.1
Suburb	395	23.6
Large city	531	31.7
Missing	14	0.8
Education		
Through high school	221	13.2
Some college	508	30.3
College	517	30.8
Post graduate	430	25.6
Missing	1	0.1
Gender of sexual partners, last three years		
Only men	1,374	81.9
Both women and men	300	17.9
Missing	3	0.2

Table II
Unstandardized (b) and standardized (B) coefficients from bivariate regression analyses of each predictor and outcome variable

Predictor	Criterion						
	CSB		No. Partners		UAIMP		
	<i>M (SD)</i>	<i>b (95% CI)</i>	<i>B</i>	<i>b (95% CI)</i>	<i>B</i>	<i>b (95% CI)</i>	
IH	2.88 (1.22)	0.22 (0.17, 0.26)	0.43	-1.19 (-1.71, -0.68)	-0.15	-0.11 (-0.34, 0.12)	-0.03
CSB	2.62 (0.80)	-	-	0.80 (0.03, 1.57)	0.06	0.79 (0.32, 1.26)	0.11
NPART	5.32 (8.22)	-	-	-	-	0.25 (0.15, 0.35)	0.50
UAIMP	1.68 (4.10)	-	-	-	-	-	-

Note: IH=internalized homonegativity, CSB=compulsive sexual behavior, UAIMP=number of unprotected anal intercourse male sexual partners, last 90 days.

Table III
Classification of participants into mediation patterns

Mediation pattern	<i>n</i>	%	<i>M</i>_{IH} (95% CI)	<i>POR</i> (95% CI)
CSB	202	12.05	0.41 (0.30, 0.52)	1.94 (1.63, 2.31)
CSB and No. Partners	163	9.72	0.29 (0.18, 0.40)	1.67 (1.42, 1.97)
No. Partners	245	14.61	-0.49 (-0.59, -0.39)	0.41 (0.31, 0.54)
No mediation pattern	1,067	63.63	-0.07 (-0.12, -0.02)	1 (Referent)

Note: CSB=compulsive sexual behavior, POR=prevalence odds ratio, *M*_{IH}=mean of internalized homonegativity score