

RESILIENCE, SYNDEMIC FACTORS, AND SEROSORTING BEHAVIORS AMONG HIV-POSITIVE AND HIV-NEGATIVE SUBSTANCE-USING MSM

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Serosorting is commonly employed by MSM to reduce HIV risk. We hypothesize that MSM perceive serosorting to be effective, and that serosorting is predicted by resilience and inversely related to syndemic characteristics. Surveys included 504 substance-using MSM. Logistic regression models examined syndemic and resilience predictors of serosorting, separately by serostatus. For HIV-positive men, positive coping behaviors ($P = .015$) and coping self-efficacy ($P = .014$) predicted higher odds, and cognitive escape behaviors ($P = .003$) lower odds, of serosorting. For HIV-negative men, social engagement ($P = .03$) and coping self-efficacy ($P = .01$) predicted higher odds, and severe mental distress ($P = .001$), victimization history ($P = .007$) and cognitive escape behaviors ($P = .006$) lower odds, of serosorting. HIV-negative serosorters reported lower perceptions of risk for infection than non-serosorters ($P < .000$). Although high risk HIV-negative men may perceive serosorting to be effective, their high rates of UAI and partner change render this an ineffective risk reduction approach. Relevant public health messages are urgently needed.

The disproportionate impact of HIV infection among men who have sex with men (MSM) has been well documented over the past three decades (Wolitski, Valiserry, & Stall 2008). Current research among urban MSM emphasizes syndemic theory as a framework for understanding the production of health disparities (Bruce, Harper, & Adolescent Medicine Trials Network for HIV/AIDS, 2011; Stall, Friedman, & Catania, 2008). Syndemic theory views adverse health conditions as fundamentally interconnected; that is, “two or more afflictions, interacting synergistically, contrib-

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uting to an excess burden of disease” (Centers for Disease Control and Prevention, 2011). In particular, research has employed a syndemic approach to understand the conditions driving the HIV epidemic among MSM (Stall et al., 2003; Mustanski, Garofalo, Herrick, & Donenberg, 2007).

As compared to men in the general population, health disparities among MSM are evidenced in higher rates of depression and other mental health problems, victimization, and substance dependence (Cochran & Mays 2008) and sexual compulsivity (Parsons, Grov, & Golub, 2011). Links between mental distress, substance use and sexual risk behaviors are further evidenced by the frequent use of sex and drugs for cognitive escape purposes (Alvy et al., 2011). Inadequate or negative coping skills are also prevalent in this population (Martin & Alessi, 2010).

RESILIENCE

Enhancing resilience among MSM may be a productive approach for alleviating these health disparities (Stall et al., 2008). In connection with MSM, resilience has been defined as a process of adaptation and readjustment that occurs despite multiple personal and social losses (Rabkin, Remien, Katoff, & Williams, 1993), and may involve adaptations in psychological, social and/or behavioral characteristics. In the lesbian, gay, bisexual and transgendered (LGBT) literature, resilience has been largely operationalized by measures of coping skills or strategies (Siegel & Meyer, 1999), stress-related growth (Bonet, Wells, & Parsons, 2007) and social support (Gwadz et al., 2006).

The resilience literature on MSM is scant (De Santis, 2008), but suggests that, despite syndemic health disparities, most MSM exhibit resilience (Herrick et al., 2011). This is evidenced in the areas of smoking cessation and recovery (Greenwood et al., 2005), avoiding recreational drug use or addiction despite its prevalence in the urban MSM community (Mills et al., 2004; Stall et al., 2001), and participation in the gay rights movement over the past 40 years (Herrick, 2011). These studies evidence health promotion, altruism, and social justice, which are all characteristics of resilience (Kent & Davis, 2010), and taken together, this research would appear to indicate an inclination for behavioral resilience among MSM.

SEROADAPTATION

Seroadaptation can be viewed as a functional response to the HIV/AIDS epidemic (McConnell, Bragg, Shiboski, & Grant, 2010) due to widespread knowledge of HIV transmission risk in MSM communities (Van de Ven et al., 2002). Seroadaptation includes a range of non-condom-based HIV sexual risk reduction strategies, such as strategic positioning (choosing sex role in anal intercourse based on partners' serostatus) and serosorting (selecting partners with concordant serostatus; Philip, Yu, Donnell, Vittinghoff, & Buchbinder, 2010). It has been suggested that seroadaptation is the prevailing form of sexual risk management among some MSM (Snowden, Raymond, & McFarland, 2009). Extensive seroadaptation, when combined with other safer sex practices such as abstinence and condom use, has been estimated to reduce HIV transmission by as much as 98% (McConnell et al., 2010). Such adaptive behavioral responses may constitute evidence of resilience by MSM.

Serosorting is one of the most common seroadaptation practices employed by MSM to decrease HIV risk (Truong et al., 2006; Parsons et al., 2005). This strategy is used by HIV-positive MSM to avoid stigma, rejection, or confrontation related to serostatus disclosure (Rosser et al., 2010); to avoid spreading the virus to others (O'Dell, Rosser, Miner, & Jacoby, 2008); and because of the criminalization of HIV transmission (O'Dell et al., 2008). HIV-negative MSM also utilize serosorting as a means of decreasing HIV infection risk (McFarland et al., 2012).

Serosorting has demonstrated protective effects in comparison to discordant unprotected anal intercourse (UAI; Golden, Stekler, Hughes, & Wood, 2008), and appears to have reduced HIV transmission among MSM in San Francisco (McConnell et al., 2010). Recent studies have indicated high levels of acceptability and adherence to serosorting in comparison to other safer sex practices among HIV-negative MSM (McFarland et al., 2012), leading some community organizations to embrace serosorting as a protective measure to be encouraged (Eaton et al., 2007). Nevertheless, proponents acknowledge that the effectiveness of serosorting for reducing HIV transmission requires repeated and frequent HIV testing (McConnell et al., 2010; Philip, 2010), a low proportion of undiagnosed infection (McFarland et al., 2012), substantial knowledge of HIV transmission risk factors (McConnell et al., 2010), and increased disclosure and honesty among sexual partners (McFarland et al., 2012; Parsons et al., 2006).

If serosorting is perceived by MSM to be effective in reducing HIV risks, then both syndemic and resilience theories would appear to provide cogent avenues for identifying those men most likely to incorporate the behavior. In this paper, we describe differences in substance use, sexual risk behaviors, syndemic symptoms, and resilience measures between high risk substance-using HIV-positive and HIV-negative MSM. We then examine serosorting as an expression of behavioral resilience amidst an array of syndemic health disparities, and describe the implications of our findings for serosorting as a risk reduction strategy.

METHODS

Data are drawn from baseline assessments of 504 MSM participating in an ongoing risk reduction intervention trial being conducted in South Florida. South Florida (Miami/Ft. Lauderdale) is a well-known migration destination for MSM, with the second highest proportion of same-sex households among large cities in the nation (Smith & Gates, 2001). Miami reports the highest AIDS and HIV incidence rates in the U.S. (Centers for Disease Control and Prevention, 2009), and almost half (45%) of HIV-positive MSM in a recent Miami study were unaware of their infection (Center for Disease Control and Prevention, 2005).

The study is a randomized clinical trial testing the efficacy of a four-session small group discussion intervention compared to a single-session individual counseling condition, both of which were based on theories of resilience and psychological empowerment (Fergus & Zimmerman, 2005; Zimmerman, 1995). Participants were recruited between November 2008 and October 2010 through multiple methods, including direct outreach, participant referral, and internet and print media. Eligible men were between the ages of 18 and 55; reported recent (past 90 days) UAI with a nonmonogamous partner(s); and met one or more of three substance use inclusion criteria: binge drinking (5 or more drinks) or drug use, excluding marijuana, at least three times, or marijuana use at least 20 days, in the past month. All interviews were

conducted in private offices using computer-assisted face-to-face interviews. Clients received HIV and drug education literature, condoms, and a \$50 stipend upon completion of the baseline interview, which lasted about two hours. Research protocols were approved by the University of Delaware's (predecessor institution) and Nova Southeastern University's Institutional Review Boards. This report excludes 11 study participants whose HIV status was indeterminate (i.e., reported never testing or receiving inconclusive results).

MEASURES

Substance use measures included past 90 day frequency of use of each substance, including the non-medical use of prescription medications. Sexual behavior measures included counts of past 90 day receptive and insertive anal intercourse events, with or without substance use, with or without a condom, with a casual or primary partner, and with a seroconcordant, serodiscordant, or unknown serostatus partner. Participant HIV status was assessed by self report, and seropositivity was verified with a notice of diagnosis or antiretroviral prescription. Sexual partner serostatus was assessed by the questions, "in the past 3 months, how many times did you have receptive/insertive anal sex without a condom when you knew your partner was HIV-positive /HIV- negative/unknown status?." We defined serosorting as zero occasions of UAI with serodiscordant or unknown serostatus partners in the past 90 days.

Syndemic Symptoms

The General Mental Distress Scale (GMDS) is comprised of past year DSM-IVR symptom counts for depression (9 items), anxiety (12 items), and somatic disorders (4 items). This scale is reducible to classifications indicating clinical significance (sub-clinical, moderate and severe; Dennis, 2002) and was further dichotomized in the analyses presented here into severe and not severe. Alpha reliability coefficients for the depression, anxiety, and somaticism subscales in this study were 0.822, 0.829, and 0.706, respectively.

Substance dependence was assessed by the endorsement of three or more of seven DSM-IVR criteria in the past year (e.g., needing more drug to get the same effect, experiencing withdrawal symptoms, being unable to quit or cut down).

The Cognitive Escape Scale (Alvy et al., 2011) is a seven-item (e.g., when I am drunk or high, I will do anything with almost any guy) Likert-type scale with four response choices (strongly agree to strongly disagree) that assesses the use of alcohol and/or drugs together with sex to escape cognitive awareness of behavioral norms related to HIV transmission risk (McKirnan, Venable, Ostrow, & Hope, 2001). The measure was included here because it directly assesses the link between substance use and sexual risk, and has also been shown to mediate the relationship between the co-occurring psychosocial health problems of depression and sexual risk among MSM (Alvy et al., 2011). The alpha reliability coefficient in this study was 0.701. For analysis, we dichotomized the scale at the 75th percentile, which was a score of 22 with a range of 7 to 28 (mean = 18.45; *SD* = 4.80). This transformation did not change the significance of the measure in regression analyses, but was undertaken to facilitate interpretability of the results.

Victimization was assessed by affirmative responses to the following events: being attacked with a weapon or being beaten so as to cause bruises, cuts, or broken bones (physical abuse); being forced to participate in sexual acts against one's will

(sexual abuse); or being made to feel very bad about oneself or one's life (emotional abuse). For analysis, we used a summary measure: any lifetime abuse vs. no abuse.

Resilience

The Brief COPE Scale (Carver, 1997) assesses respondents' recent coping behaviors when under stress, rated on a four-point scale from "I've been doing this a lot" to "I haven't been doing this at all." We first dichotomized the responses such that 1 = a lot/moderately and 0 = a little/not at all. We then reduced the 11-item instrument to ten items, combining five measures of positive coping behaviors (e.g., taking action, getting help and advice) and five measures of negative coping behaviors (e.g., denial, substance use) into separate subscales with values ranging from 0 to 5. Alpha reliability coefficients for the positive and negative coping subscales were 0.718 and 0.722, respectively.

The Coping Self-Efficacy Scale (CSES, reduced form; Chesney, Neilands, Chambers, Taylor, & Folkman, 2006) consists of 13 items that measure the level of confidence someone has in performing coping behaviors under stress, rated on a ten-point scale from certain can do to cannot do at all. Three distinct factors are included: self-efficacy for problem-focused coping, stopping unpleasant thoughts, and getting social support. Psychometric tests have shown high levels of internal consistency and test-retest reliability among HIV-positive MSM (Chesney et al., 2006). The alpha reliability coefficient in this study was 0.908. For analysis, we dichotomized the scale at the 75th percentile, which was a score of 104 with a range of 25 to 130 (mean = 88.91; SD = 22.54). This transformation did not change the significance of the measure in regression analyses, but was undertaken to facilitate the interpretability of the results.

Given the importance of diverse and supportive social networks to the concept of resilience (Dolan, 2011), the *Social Engagement Scale* assessed, by past 90 day event counts, respondents' participation in a variety of social settings (e.g., classes, volunteering, public and/or organizational meetings, getting together with friends and relatives, sports. For analysis, we dichotomized the sum of these counts at the 75th percentile, with those above that level defined as having high social engagement. This value was 51 total social engagement events in the past 90 days, with a range of 0 to 160 (mean = 36.5; SD = 27.82).

DATA ANALYSES

Analyses were conducted using IBM SPSS Statistics v. 19. Given that serosorting behaviors have different motivations and meanings for HIV-positive and HIV-negative men (van Kesteren, Hospers, & Gerjo, 2007), separate regression models were constructed by serostatus. Bivariate logistic regression models were constructed to predict 100% serosorting behavior in the past 90 days by syndemic and resilience factors. Those measures showing significant associations in the bivariate models were included in multivariate logistic regression models. Hosmer and Lemeshow tests confirmed that the predictors were a good fit for each model (Tabachnick & Fidell, 2007).

TABLE 1. Baseline Characteristics of Substance-Using MSM by Serostatus *N* = (504)

	Positive (<i>N</i> = 239)		Negative (<i>N</i> = 265)		Chi-square or F-statistic	<i>P</i>
	<i>N</i>	47.40%	<i>N</i>	52.60%		
Demographics						
Age ^a	42.07	-7.95	36.44	-10.14	47.261	< 0.001
Ethnicity:						
Hispanic	49	20.50%	79	29.80%	5.748	0.017
African American/Caribbean	65	27.20%	39	14.70%	11.951	0.001
White	115	48.10%	134	50.60%	0.301	0.583
Other	10	4.20%	13	4.90%	0.488	0.485
Education - 16 years	69	28.90%	95	35.80%	2.788	0.083
Substance use (past 90 days)						
Alcohol (binge drinking)	172	72.00%	239	90.20%	27.73	< 0.001
Marijuana	161	67.40%	168	63.40%	0.350	0.35
Poppers	138	57.70%	133	50.20%	2.883	0.09
Cocaine (powder)	115	48.10%	107	40.40%	3.054	0.081
Methamphetamine	88	36.80%	43	16.20%	27.705	< 0.001
Crack cocaine	72	30.10%	30	11.30%	27.529	< 0.001
Rx sedatives	88	36.80%	84	31.70%	1.466	0.226
Rx opioids	55	23.00%	71	26.80%	0.958	0.328
Sexual behaviors (past 90 days)						
Anal intercourse partners ^a	16.41	-21.49	10.09	-13.79	15.707	< 0.001
Anal intercourse times ^a	34.06	-36.63	31.39	-45.92	0.513	0.474
UAI times ^a	26.08	-34.00	18.82	-33.94	5.740	0.017
Serosorter 100% of the time	71	29.70%	127	47.90%	17.485	< 0.001
Syndemic factors						
Severe mental distress (past year)	155	64.90%	138	52.10%	8.431	0.004
DSM-IVR substance dependence	159	66.50%	153	57.70%	4.118	0.042
Cognitive escape ^b	92	38.50%	50	18.90%	23.918	< 0.001
Victimization history (lifetime)	195	81.60%	209	78.90%	0.585	0.444
First abuse before age 18	138	57.70%	140	52.80%	1.225	0.268
Resilience measures						
Positive coping behaviors ^a	2.74	-1.57	3.02	-1.50	4.336	0.042
Negative coping behaviors ^a	2.16	-1.49	1.77	-1.45	8.825	0.003
Coping self-efficacy ^b	50	20.90%	82	30.90%	6.530	0.011
Social engagement ^b	47	19.70%	79	29.80%	6.899	0.009

Note. ^aMean (*SD*). ^b75th percentile.

RESULTS

Demographic, substance use, sexual behavior, and syndemic and resilience characteristics are shown in Table 1 by serostatus. The mean age of the sample was 39.1 (*SD* = 9.6; range = 18-55), with HIV-positive men about 6 years older, on average, than HIV-negative men (42.07 vs. 36.44, $F = 47.261$, $P < .001$). The ethnic diversity of South Florida was represented, including 25.4% Hispanic, 20.6% African American/Caribbean, and 49.4% white non-Hispanic men. Hispanic men were less likely ($X^2 = 5.748$, $P = .017$), and Black men more likely ($X = 11.951$, $P = .001$), to report HIV-positive serostatus. About one-third of the sample (32.5%) had the equivalent of a bachelor's degree or higher education.

Binge drinking (more than five drinks at one sitting) was prevalent (81.5%), with majorities also endorsing marijuana (65.3%) and poppers (amyl nitrites; 53.8%). Powder cocaine use was reported by 44%, methamphetamine 26%, and crack cocaine 20.2% of the sample. More than one-third (34.1%) endorsed the misuse of prescription sedatives, and one-quarter prescription opioids. A larger proportion of HIV-negative men (90.2%) than HIV-positive men (72%) reported binge drinking ($X^2 = 27.730$, $P < .001$). HIV-positive men were more likely than HIV-negative men

TABLE 2. Bivariate and Multivariate Logistic Regression Models of Predictors of Serosorting Among Positive MSM ($N = 239$)

Predictor of serosorting	<i>P</i>	<i>OR</i>	<i>95% CI</i>
BIVARIATE			
Syndemic factors			
DSM-IVR substance dependence	0.503	0.820	0.458, 1.466
Severe mental distress (past year)	0.544	0.837	0.471, 1.488
Victimization history (lifetime)	0.450	1.333	0.623, 2.814
Cognitive escape ^a	0.003	0.390	0.209, 0.729
Resilience measures			
Coping self-efficacy ^a	0.014	2.245	1.176, 4.284
Social engagement ^a	0.712	1.138	0.572, 2.265
Negative coping behaviors	0.232	0.891	0.737, 1.077
Positive coping behaviors	0.015	1.256	1.046, 1.509
MULTIVARIATE			
Cognitive escape ^a	0.007	0.418	0.222, 0.786
Coping self-efficacy ^a	0.019	2.034	1.044, 3.904
Positive coping behaviors	0.097	1.175	0.971, 1.421

Note. ^a75th percentile.

to be current users of methamphetamine (36.8% vs. 16.2%, $X^2 = 27.705$, $P < .001$) and crack cocaine (30.1% vs. 11.3%, $X^2 = 27.529$, $P < .001$).

HIV-positive men reported higher mean levels of UAI occasions (26.08 vs. 18.82, $F = 5.74$, $P = .017$), as well as more anal intercourse partners (16.41 vs. 10.09, $F = 15.707$, $P < .001$), than HIV-negative men. A greater proportion of HIV-negative men (47.9%) than HIV-positive men (29.7%) reported 100% serosorting in the past 90 days ($X^2 = 17.485$, $P < .001$).

Syndemic factors were prevalent, including severe mental distress (58.1%), substance dependence (61.9%), and victimization history (80.2%). HIV-positive men were generally more likely to report syndemic factors than HIV-negative men, including severe mental distress (64.9% vs. 52.1%; $X^2 = 8.431$, $P = .004$), substance dependence (66.5% vs. 57.7%; $X^2 = 4.118$, $P = .042$), and high levels of cognitive escape (38.5% vs. 18.9%; $X^2 = 23.918$, $P < .001$), but both groups were about equally likely to have been victimized. HIV-negative men scored higher than HIV-positive men on all measures of resilience, including positive coping behaviors (3.02 vs. 2.74; $F = 4.336$, $P = .042$), fewer negative coping behaviors (1.77 vs. 2.16; $F = 8.825$, $P = .003$), and higher coping self-efficacy (30.9% vs. 20.9%; $X^2 = 6.530$, $P = .011$), and social engagement (29.8% vs. 19.7%; $X^2 = 6.899$, $P = .009$).

Results of the bivariate logistic regression models predicting serosorting among HIV-positive MSM are shown in Table 2. Men scoring above the 75th percentile on the cognitive escape measure had just .39 times the odds of serosorting compared to HIV-positive men who scored lower on cognitive escape (95% CI = 0.209, 0.729; $P = .003$). No other syndemic characteristics were significant. In terms of resilience measures, men with high coping self-efficacy scores had more than two times the odds of serosorting compared to men with lower self-efficacy (OR = 2.245; 95% CI = 1.176, 4.284; $P = .014$). In addition, each additional positive coping behavior endorsed increased the odds of serosorting among HIV-positive men by a factor of 1.256 (95% CI = 1.046, 1.509; $P = .015$).

TABLE 3. Bivariate and Multivariate Logistic Regression Models of Predictors of Serosorting Among Negative MSM (N = 265)

Predictor of Serosorting	P	OR	95% CI
BIVARIATE			
Syndemic factors			
DSM-IVR substance dependence	0.069	0.634	0.388, 1.036
Severe mental distress (past year)	0.001	0.419	0.256, 0.687
Victimization history (lifetime)	0.007	0.428	0.233, 0.789
Cognitive escape ^a	0.006	0.394	0.203, 0.764
Resilience measures			
Coping self-efficacy ^a	0.010	1.999	1.177, 3.395
Social engagement ^a	0.030	1.807	1.061, 3.079
Negative coping behaviors	0.017	0.813	0.685, 0.964
Positive coping behaviors	0.586	1.046	0.890, 1.228
MULTIVARIATE			
Severe mental distress	0.008	0.493	0.293, 0.829
Victimization history (lifetime)	0.047	0.524	0.277, 0.993
Cognitive escape ^a	0.011	0.397	0.195, 0.809
Coping self-efficacy ^a	0.204	1.485	0.807, 2.732
Social engagement ^a	0.007	2.202	1.241, 3.907
Negative coping behaviors	0.579	1.064	0.854, 1.326

Note. ^a75th percentile.

Results of the multivariate logistic regression model predicting serosorting among HIV-positive men are also shown in Table 2. High cognitive escape remained a syndemic predictor of (non)serosorting behavior (OR = .418, 95% CI = 0.222, 0.786; $P = .007$). For resilience measures, high coping self-efficacy remained a significant predictor of serosorting (OR = 2.034, 95% CI = 1.044, 3.904; $P = .019$).

Results of the bivariate logistic regression models predicting serosorting among HIV-negative MSM are shown in Table 3. Three syndemic factors, including severe mental distress (OR = .419, 95% CI = 0.256, 0.687; $P = .001$), lifetime victimization (OR = .428, 95% CI = 0.233, 0.789; $P = .007$), and a high cognitive escape (OR = .394, 95% CI = 0.203, 0.764; $P = .006$) were associated with lower odds of serosorting. Three resilience measures, including high coping self-efficacy (OR = 1.999, 95% CI = 1.177, 3.395; $P = .010$), social engagement scores (OR = 1.807, 95% CI = 1.061, 3.079; $P = .030$), and fewer negative coping behaviors (OR = .813, 95% CI = 0.685, 0.964; $P = .017$) were associated with higher odds of serosorting.

Results of the multivariate logistic regression model predicting serosorting among HIV-negative MSM are also shown in Table 3. All three syndemic factors that were significant in the bivariate models remained in the multivariate model, with severe mental distress (OR = .493, 95% CI = 0.293, 0.829; $P = .008$), high cognitive escape (OR = .397, 95% CI = 0.195, 0.809; $P = .011$), and lifetime victimization (OR = 0.524, 95% CI = 0.277, 0.993; $P = .047$) each associated with lower odds of serosorting. For resilience measures, high social engagement increased the odds of serosorting by a factor of 2.202 (95% CI = 1.241, 3.907; $P = .007$).

Finally, we examined the relationship between HIV-negative men's perception of their risk of becoming infected and serosorting behavior: 83.5% of HIV-negative 100% serosorters believed that their chance of becoming infected in the future

was less than 50%, whereas just 56.5% of nonserosorters did so ($X^2 = 27.476$; $P < .001$).

DISCUSSION

We examined the relationships between 100% serosorting behaviors and several measures of syndemic factors and resilience that are commonly used in the respective literatures. We believe this to be the first report using a resilience framework to understand serosorting as an adaptive risk reduction strategy. These analyses show that high risk MSM who reported 100% serosorting in the past 90 days, regardless of serostatus, were less likely to report at least some syndemic symptoms, and more likely to exhibit resilience characteristics, than men who did not.

Serosorting among HIV-positive men was predicted by lower levels of cognitive escape and higher levels of coping self-efficacy and positive coping skills. Although the HIV-positive men in the study exhibited very high levels of syndemic symptoms, including severe mental distress and substance dependence, the data suggest that significant numbers of these men manage to enact HIV risk reduction in spite of these problems. More specifically, these resilient strategies appear to be evidenced in coping skills that include seeking emotional support, taking action, asking for help and advice, and finding something good in life's challenges. This suggests that intervention approaches that emphasize resilience-building may be effective vehicles for reducing sero-discordant/unknown UAI among HIV-positive men, despite their histories of syndemic problems.

Although serosorting, relative to condom use, may result in increased transmission of other sexually transmitted infections, as well as potential risks such as HIV superinfection and drug resistance (World Health Organization; WHO, 2011), prior research provides clear evidence that 100% condom use among HIV-positive men is unlikely to be achieved (McFarland et al., 2012). Recent World Health Organization (2011) guidance on serosorting states: "Serosorting may be a potential harm reduction strategy for individuals who choose not to use condoms, but it should not be promoted as an alternative strategy for HIV prevention." The men in our sample reported heavy substance use, low rates of condom use, high frequencies of UAI, and rapid partner change. Given this, it would appear that a carefully considered and targeted harm reduction approach—including encouraging high risk HIV-positive men to select other HIV-positive men as their partners—would be within the spirit of the WHO guidelines and also contribute to reducing the number of new HIV infections among MSM.

The higher overall levels of 100% serosorting observed among HIV-negative men compared to HIV-positive men in our study, which differs from others' research findings (Parsons et al., 2005; McFarland et al., 2012) may well be grounded in HIV-negative men's generally lower levels of syndemic symptoms and higher levels of resilience, as well as the more difficult disclosure issues faced by HIV-positive men. Among HIV-negative men, lower levels of three syndemic factors—cognitive escape, victimization history, and severe mental distress—predicted serosorting. Three resilience measures—higher coping self efficacy and social engagement, and lower levels of negative coping skills were also associated with 100% serosorting behavior.

Moreover, the data provide evidence that serosorting is perceived by HIV-negative MSM to be an effective risk reduction strategy, as fully 83.5% of HIV-negative serosorters believed that their chance of becoming infected in the future was

less than 50%, compared to just 56.5% of nonserosorters. Despite this perception among study participants, our findings indicate that promoting serosorting as a risk reduction strategy among high risk, substance-using HIV-negative MSM is likely to be unsuccessful, and would perhaps increase the level of new infections (Eaton et al., 2007; Golden et al., 2008). HIV-negative men in the study averaged 10 partners ($SD = 13.79$) and almost 19 UAI encounters (18.82 ; $SD = 33.94$) in the past 90 days. Given these rates of partner change and unprotected sex, no amount of increase in the frequency of HIV testing could eliminate the risk associated with undiagnosed infections. Recently infected sex partners often have very high viral loads, increasing both the transmissibility of the virus and the risk of serosorting (Pinkerton, 2008). Moreover, almost half (45%) of HIV-positive MSM in a recent Miami study were unaware of their infection (Centers for Disease Control and Prevention, 2005). And going further, in another report from this same study, we found that over 31% of HIV-negative men seroconverted within 5 years of moving to South Florida (Egan et al., 2011).

LIMITATIONS

Although the recruitment procedures resulted in a sample of a wide age range and broadly inclusive of the racial/ethnic makeup of South Florida, our ability to generalize the findings to other MSM is limited by the study eligibility requirements, including regular substance use and recent UAI. Syndemic characteristics are likely much more prevalent among high risk substance users than among MSM in general, and the relationship of syndemic and resilience factors to serosorting behaviors may well be different across MSM subgroups as well. We also note that all data are based on self-report, potentially leading to underreporting of socially undesirable behaviors. Given the high levels of substance use and sexual risk behaviors we found, however, underreporting of these and other stigmatized behaviors would appear to be uncommon. Further, our measure of serosorting covered the past 90-day period, excluded participants who reported anything less than 100% serosorting during that time, and was based upon reported counts of sexual behaviors; no data on whether the observed serosorting behaviors were intended were collected. Finally, it must be cautioned that the cross-sectional data presented do not permit attributions of causality to the observed relationships of the syndemic and resilience measures to serosorting behaviors.

CONCLUSIONS

We examined syndemic and resilience factors among high risk MSM and their relationship to serosorting behaviors. We found that 100% serosorting was associated with fewer syndemic symptoms and higher levels of resilience factors. Resilience would appear to be a potentially important target for intervention approaches to reduce sexual risk behaviors among high risk MSM. Given the high rates of sexual partner change and UAI we found among substance using HIV-positive men, a harm reduction policy that includes the encouragement of serosorting among high risk HIV-positive MSM would seem to be a reasonable approach to reducing new infections.

For HIV-negative men, serosorting was predicted by measures of resilience and was also associated with a lower perceived likelihood of becoming infected in the future. Taken together, these findings suggest that serosorting is enacted by HIV-

negative men as an adaptive and effective risk reduction strategy. Because high risk HIV-negative men like those in this study have very high rates of unprotected sex and partner change, however, frequent testing cannot be effective in enabling them to be aware of their real status. Public health messages that clearly identify these risks for HIV-negative MSM (e.g., that many men are unaware of their infection) could make a critically important contribution to prevention efforts. Our findings further suggest the potential promise of resilience-based intervention approaches for HIV-negative men that target other aspects of sexual risk reduction, such as the development of positive coping skills in place of using sex and drugs to cope, reducing the number of partners, and increasing condom use.

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