

Hazardous Alcohol Consumption Moderates the Relationship Between Safer Sex Maintenance Strategies and Condomless Sex With Clients Among Female Sex Workers in Mexico

Shirley J. Semple, PhD¹ , Eileen V. Pitpitan, PhD¹,
Heather A. Pines, PhD¹, Alicia Harvey-Vera, PhD¹,
Gustavo Martinez, MD², M. Gudelia Rangel, PhD³,
Steffanie A. Strathdee, PhD¹, and Thomas L. Patterson, PhD¹

Abstract

Understanding the relationship between cognitive and behavioral processes and long-term behavior change is critical to developing behavior change maintenance interventions. We examined the relationship between cognitive and behavioral safer sex maintenance strategies and condomless vaginal/anal sex with clients among female sex workers (FSWs) in Mexico. We hypothesized a moderating effect of hazardous alcohol use, such that the relationship between the use of safer sex maintenance strategies and condomless sex would be weaker among FSWs who meet criteria for hazardous alcohol consumption. Data were gathered from 602 FSWs enrolled in a sexual risk reduction intervention with a text messaging maintenance component. Seven cognitive and behavioral strategies purported to be critical in sustaining long-term behavior change were measured (e.g., maintenance self-efficacy). The relationship between FSWs' use of safer sex maintenance strategies and condomless vaginal/anal sex with clients was moderated by hazardous alcohol consumption. The association was weaker among FSWs who met criteria for hazardous alcohol consumption. Among FSWs who met criteria for hazardous alcohol consumption, maintenance self-efficacy was associated with fewer condomless sex acts with clients ($b = -0.35, p < .001$). Among FSWs who did not meet criteria for hazardous alcohol consumption, recovery self-efficacy ($b = -0.21, p < .05$) and self-monitoring ($b = -0.34, p < .001$) were associated with fewer acts of condomless sex. Results indicate the importance of examining the multidimensional nature of safer sex maintenance strategies and of exploring subgroup differences in their associations with behavioral outcomes. Interventions that address safer sex maintenance strategies in the context of alcohol treatment should be developed for this subgroup of FSWs.

Keywords

alcohol and substance abuse, behavioral theories, global health, sex work, sexual behavior

It is widely recognized that treatment effects of behavior change interventions diminish over time (Rothman, 2000; Voils et al., 2014), and adherence to new health behaviors is often poor. In health-related studies, lapses in positive behavior change occur more than 50% of the time within 6 to 12 months (Voils et al., 2014; Vrijens, Vincze, Kristanto, Urquhart, & Burnier, 2008). Our research on sexual risk behavior change among female sex workers (FSWs) is consistent with these findings.

In response to the concentrated and escalating HIV epidemics among key populations along the U.S.–Mexico border (Strathdee, Magis-Rodriguez, Mays, Jimenez, & Patterson,

2012), we developed and evaluated a brief, sexual risk reduction intervention for FSWs called *Mujer Segura*. The intervention was efficacious in reducing HIV/STI incidence among

¹University of California San Diego, La Jolla, CA, USA

²Federación Mexicana de Asociaciones Privadas (FEMAP), Ciudad Juarez, Chihuahua, Mexico

³U.S.–Mexico Border Health Commission, Tijuana, Baja California, Mexico

Corresponding Author:

Shirley J. Semple, Department of Psychiatry, University of California San Diego, 9500 Gilman Drive, La Jolla, CA 92037-0608, USA.
Email: ssemple@ucsd.edu

FSWs by 40% over 6 months (Patterson et al., 2008) and among FSWs who inject drugs (FSW-WIDs) by 60% over 1 year (Strathdee et al., 2013); however, in the latter study, 31% of FSW-WIDs reported an increase in condomless sex after 6 months. Understanding the cognitive and behavioral strategies that can maintain behavior change over time is essential to support long-term healthy behavior.

Voils et al. (2014) theorized that seven cognitive and behavioral strategies are critical to sustaining long-term behavior change to improve cardiovascular health, and each can be applied to other health domains (Rothman, 2000). *Self-regulatory focus* refers to attention and efforts directed toward avoiding reversion to undesirable behaviors (e.g., condomless sex). *Maintenance self-efficacy* describes the individual's trust in her ability to persist in desirable behaviors and to overcome barriers. *Recovery self-efficacy* captures the individual's confidence in her ability to "get back on track" following a setback. Maintenance also involves *planning for high-risk situations* and developing strategies to deal with them. *Self-monitoring* involves tracking health behaviors and establishing guidelines for defining a lapse or relapse. *Satisfaction with outcomes* is achieved when positive expectations for behavior change are realized, and the benefits of the new behavior are viewed as outweighing those of the old. Last, maintenance involves *enlisting social support* from friends and family who can help the individual sustain behavior changes.

For FSWs in Mexico, sexual risk behavior change and behavioral maintenance may also depend on other behavioral factors, such as alcohol use. The relationship between alcohol use and condomless sex with clients has been documented among FSWs in lower- and middle-income countries (LMIC; Chersich, Bosire, King'ola, Temmerman, & Luchters, 2014; Verma, Saggurti, Singh, & Swain, 2010). Experimental studies in the general population of women have demonstrated that alcohol intoxication can lead to disinhibition, lower self-control, increased passivity, and impaired judgment regarding safer sex behaviors (Maisto, Carey, Carey, Gordon, & Schum, 2004; Stoner et al., 2008). Regardless of the precise mechanisms, hazardous alcohol consumption may undermine the use of cognitive and behavioral maintenance strategies, increasing the likelihood of engaging in condomless sex with clients, even if FSWs employ safer sex maintenance strategies.

The purpose of this study was to investigate whether hazardous alcohol use moderates the relationship between FSWs' existing safer sex maintenance strategies and condomless vaginal/anal sex with clients. We hypothesized that the relationship would be weaker for FSWs who meet criteria for hazardous alcohol consumption. To evaluate this hypothesis, we used baseline (precounseling) data from an efficacy trial of an intervention designed to sustain behavior changes following sexual risk reduction counseling (Patterson et al., 2019). Our rationale for using baseline data is twofold. First, characterizing FSWs' existing safer sex

maintenance strategies and their relationship with condom use can help identify critical intervention targets and inform the content and delivery of maintenance messages to enhance participant engagement and intervention effectiveness. Second, HIV knowledge among FSWs in the study sites (2004-2006) was considerable. The majority of FSWs (>90%), precounseling, were aware of important modes of sexual HIV transmission (anal sex, multiple partners; Robertson et al., 2012). As such, it is likely that at enrollment (i.e., precounseling), FSWs have engaged in condom use with clients and have some experience with trying to maintain safer sex practices.

Method

Sample Selection

The sample consisted of 602 FSWs in Tijuana and Ciudad (Cd.) Juárez enrolled in a 24-month text messaging behavioral maintenance intervention (*Mujer Saludable Siempre* [MSS]; Healthy Woman Forever) following brief sexual risk reduction counseling (Patterson et al., 2019). To be eligible for MSS, participants had to be cisgender female; at least 18 years of age; self-identify as a FSW; report having traded sex for drugs, money, shelter, or other material benefit in the previous month; report condomless vaginal or anal sex with a client in the previous month; report no previous HIV-positive test result; own a cell phone; and agree to be tested for HIV/STIs at baseline and follow-up assessments.

Persons were ineligible if they reported trying to get pregnant or had a psychiatric diagnosis with current psychotic symptoms or suicidal ideation.

Recruitment and Procedures

Participants were recruited between January 2016 and December 2017, primarily through time-location sampling (Patterson et al., 2019). Outreach workers canvassed sex work venues/locations frequented by FSWs (e.g., bars, streets). Women who appeared eligible were asked a few screening questions (e.g., age ≥ 18 years), and if interested were referred for a screening interview to our office in the red-light district of Tijuana or SADEC-FEMAP (Salud y Desarrollo Comunitario de Ciudad Juárez, A.C. and Federación Mexicana de Asociaciones Privadas, A.C.) in downtown Cd. Juárez. Eligible women were scheduled for a 2-hour baseline visit, which included a 60 minute face-to-face, computer-assisted personal interview (Nova Software), followed by the *Mujer Segura* counseling session (30-45 minutes; Patterson et al., 2019). Participants were reimbursed the equivalent of \$30 USD for the session. The research protocol was reviewed and approved by institutional review boards at the University of California, San Diego, Xochicalco University in Tijuana, and Salud y Desarrollo Comunitario and Federación Mexicana de

Asociaciones Privadas (SADEC-FEMAP) in Cd. Juarez. All participants provided written informed consent. All procedures were conducted in accordance with the 1964 Helsinki Declaration and its later amendments

Measures

Exposure of Interest: Safer Sex Maintenance Scales. Seven theoretically derived scales (Voils et al., 2014) were used to assess participants' use of cognitive and behavioral maintenance strategies. All but two scales were developed by our research team. Planning for high-risk situations and recovery self-efficacy were developed by Schwarzer et al. (2007) and modified for use in this study. Sample items, number of items in each scale and Cronbach's alphas appear in parentheses as follows: *Self-regulatory focus* (8 items; $\alpha = .94$; "When I have protected sex with a client, I think about how using condoms is helping to save my life"); *Maintenance self-efficacy* (8 items; $\alpha = .94$; "I am confident that I can continue to use condoms, even if a new partner resists"); *Recovery self-efficacy* (8 items; $\alpha = .97$; "I am confident that I am able to resume using condoms, even if I slip up and have unprotected sex once or twice"); *Planning for high-risk situations* (8 items; $\alpha = .93$; "I have made a plan for avoiding unprotected sex when I am going to be drinking"); *Self-monitoring* (8 items; $\alpha = .94$; "I think about all the advantages of using condoms before I go to work"); *Satisfaction with outcomes* (8 items; $\alpha = .78$; "I have peace of mind every time that I use a condom with a client"); and *Enlisting social support* (8 items; $\alpha = .95$; "I practice with a friend or fellow sex worker how to say no to a client who insists on having unprotected sex"). Items were measured on a 4-point scale ranging from 1 = *strongly disagree* to 4 = *strongly agree*. Mean scores were calculated for each scale, with higher scores indicating greater use of the maintenance strategy. The possible range of scores for each of the seven safer sex maintenance strategies scales was 1 to 4. An overall score was also created by summing the means for the seven behavioral maintenance scales. The possible range of scores for the overall use of maintenance strategies scale was 7 to 28 (Cronbach's $\alpha = .98$).

Outcome of Interest: Condomless Vaginal/Anal Sex Acts With Clients. Participants were asked about the frequency of vaginal and anal sex acts with clients in the past month and the frequency of condom use during those acts. To calculate the total number of condomless vaginal/anal sex acts with clients, we subtracted the total number of times a condom was used during vaginal and anal sex from the total number of vaginal and anal sex acts.

Moderator of Interest: Hazardous Alcohol Consumption. Severity of alcohol use in the past year was measured by the 10-item Alcohol Use Disorders Identification Test (AUDIT; Saunders, Aasland, Babor, De la Fuente, & Grant, 1993). A

binary variable was created to measure hazardous alcohol consumption defined as an AUDIT score ≥ 8 (hazardous alcohol consumption = 1, nonhazardous alcohol consumption = 0), which is consistent with the definition used in previous research with FSWs in LMIC (Bazzi et al., 2015; Chersich et al., 2014).

Covariates

Background Characteristics. Age of participant and number of clients in the past 6 months were treated as continuous variables. Average monthly income in the past six months ($\geq 3,500$ Mexican pesos = 1; $\leq 3,499$ Mexican pesos = 0) was coded as a binary variable.

Type of Sex Work Venue. Participants were presented with a list of nine types of sex worker (barmaid, dance hostess, taxi girl, brothel worker, street worker [i.e., FSWs who solicit clients in street-based venues, such as street corner], lover, call girl or escort, companion, other) and asked to select the one that best described their work situation. Responses were recoded into a binary variable (street worker = 1, indoor/establishment-based = 0).

Depressive Symptoms. The 21-item Beck Depression Inventory (BDI-II) was used to measure depressive symptoms experienced over the previous 2 weeks (Beck, 1967, 1976). Each item has graded statements that are scored from 0 to 3 to show increasing depressive symptoms. A summary variable was calculated.

Use of Illicit Drugs. Participants reported their use of 12 illicit drugs during the past month (e.g., methamphetamine). Frequency of use was rated on a scale from 0 = *never* to 6 = *every day* and recoded into binary variables (*does use* = 1, *does not use* = 0). A summary variable was computed and recoded into a binary variable (used illicit drugs in past month, *yes* = 1, *no* = 0).

Statistical Analyses

We first calculated descriptive statistics to characterize the sample by hazardous alcohol consumption in the past year using *t* tests for binary variables and chi-square tests for continuous variables. Intercorrelations among the seven maintenance strategies scales and correlations between each maintenance scale and the outcome of interest (condomless vaginal/anal sex) were also computed. We then conducted hierarchical linear regressions with number of condomless vaginal/anal sex acts with clients in the past month as the dependent variable (DV). Because of skewness in the distribution, the DV was transformed using a log 10 transformation.

Three sets of hierarchical linear regressions were performed. In the first analysis, we tested the hypothesis that hazardous alcohol consumption moderates the relationship between safer sex maintenance strategies and condomless

vaginal/anal sex acts with clients. We used analytic procedures for testing moderation delineated by Aiken and West (1991). The number of condomless vaginal/anal sex acts was regressed on three sets of variables. In Step 1, the model included background characteristics (i.e., age, income, number of clients in past 6 months), type of sex work venue (street-based vs. indoor/establishment-based), depressive symptoms (BDI-II score), hazardous alcohol consumption in the past year, and illicit drug use in the past month. In Step 2, overall use of safer sex maintenance strategies (summary score) was added to the model. In Step 3, an interaction term between the overall use of safer sex maintenance strategies and hazardous alcohol consumption was added to the model specified in Step 2.

In the second analysis, we stratified the sample by hazardous alcohol consumption and examined each maintenance strategy as a separate exposure of interest to achieve greater specificity in understanding the effect of each maintenance strategy on the practice of condomless vaginal/anal sex acts with clients. Bivariate associations between maintenance strategies and the outcome were examined by specifying seven separate models stratified by hazardous alcohol consumption. Covariates (excluding hazardous alcohol consumption) were included in each model (Step 1) to adjust for potential confounding.

In the third analysis, we examined independent associations of safer sex maintenance strategies in relation to condomless vaginal/anal sex with clients stratified by hazardous alcohol consumption. In Step 1, the model included the same variables as were included in Step 1 of the first analysis (excluding hazardous alcohol consumption). In Step 2, the seven individual safer sex maintenance strategies were entered simultaneously as a set of variables.

Results

Sample Characteristics

The average age of participants was 37.6 years ($SD = 10.3$, median = 37.0 years, range = 18-70 years), 85.2% reported secondary school education or less, 58.1% were never married, and the majority self-identified as a street-based FSW (64.8%). Forty-three percent met criteria for hazardous alcohol consumption in the past year and 54% reported using illicit drugs in the past month. The average number of clients in the past 6 months was 363 ($SD = 280$, median = 300, range = 1-1,000), and the average number of condomless vaginal/anal sex acts in the past month was 36.8 ($SD = 44.9$, median = 21.0, range = 1-408). The average BDI-II score was 15.8 ($SD = 11.2$, median = 15.0, range = 0-60). Using a cut-point of 20 or more on the BDI-II (Beck, Steer, & Brown, 1996), 34.2% of participants met criteria for moderate to severe depression. FSWs who met criteria for hazardous alcohol consumption were significantly younger, used more illicit drugs in the past month, and were more likely to

work in an establishment-based/indoor venue compared with their counterparts who did not meet criteria for hazardous alcohol consumption (Table 1).

FSWs' Use of Safer Sex Maintenance Strategies (Precounseling) and Group Differences Based on Hazardous Alcohol Consumption

Mean scores for safer sex maintenance strategies at baseline were highest for satisfaction with outcomes ($M = 3.0$, $SD = 0.40$, range = 1.4-4.0) and recovery self-efficacy ($M = 3.0$, $SD = 0.56$, range = 1.0-4.0), followed by self-regulatory focus ($M = 2.9$, $SD = 0.55$, range = 1.0-4.0) and maintenance self-efficacy ($M = 2.9$, $SD = 0.57$, range = 1.0-4.0), self-monitoring ($M = 2.8$, $SD = 0.57$, range = 1.0-4.0) and planning for high-risk situations ($M = 2.8$, $SD = 0.58$, range = 1.0-4.0), and enlisting social support ($M = 2.4$, $SD = 0.60$, range = 1.0-4.0). Mean score for overall use of safer sex maintenance strategies scale was 19.8 ($SD = 3.2$, range = 7.4-27.6). Intercorrelations among the seven maintenance strategies ranged from 0.39 to 0.82. All seven safer sex maintenance strategies were inversely correlated with condomless vaginal/anal sex (range = -0.22 to -0.37). FSWs who met criteria for hazardous alcohol consumption had significantly lower mean scores for all safer sex maintenance strategies compared with FSWs who did not meet criteria.

Hierarchical Linear Regressions

Analysis 1: Moderating Effect. In Step 1, covariates accounted for a significant proportion (24%) of the variance in the DV ($\Delta R^2 = .242$, $F = 27.0$, $p < .001$). In Step 2, safer sex maintenance strategies (summary score) accounted for a significant 12% of the variance in the DV ($\Delta R^2 = .124$, $F = 42.7$, $p < .001$). In Step 3, the significant interaction term (summary score $\times$ hazardous alcohol consumption), accounted for 0.5% of variance in the DV ($\Delta R^2 = .005$, $F = 38.7$, $p < .001$; Table 2). Analyses to determine the direction and magnitude of the moderating effect revealed that the association between use of safer sex maintenance strategies (summary score) and number of condomless vaginal/anal sex acts was weaker among FSWs who met criteria for hazardous alcohol consumption ($b = -0.37$, $t = -8.0$, $p < .05$) compared with FSWs who did not meet criteria ($b = -0.51$, $t = -8.3$, $p < .001$; Figure 1).

Analysis 2: Bivariate Associations Between Safer Sex Maintenance Strategies and Condomless Vaginal/Anal Sex With Clients Stratified by Hazardous Alcohol Consumption. Each safer sex maintenance strategy when examined individually was significantly and inversely associated with condomless vaginal/anal sex for both FSWs who met criteria for hazardous alcohol consumption and for those who did not meet criteria (Table 3).

Table 1. Characteristics of Female Sex Workers in Tijuana and Ciudad Juarez, Mexico by Hazardous Alcohol Consumption.

Variable	Total (N = 602), % (n)	No hazardous alcohol consumption (n = 344), % (n)	Hazardous alcohol consumption (n = 258), % (n)	Test statistic	p
Marital status				$\chi^2 = 5.6$	.13
Never married	58.1 (350)	54.4 (187)	63.2 (163)		
Married or common-law	26.9 (162)	29.4 (101)	23.6 (61)		
Divorced or separated	12.0 (72)	12.5 (43)	11.2 (29)		
Widowed	3.0 (18)	3.8 (13)	1.9 (5)		
Education				$\chi^2 = 8.0$	.33
Some grade school	16.6 (100)	16.9 (58)	16.3 (42)		
Grade school	28.1 (169)	26.2 (90)	30.6 (79)		
Some secondary school	12.8 (77)	12.8 (44)	12.8 (33)		
Secondary school	27.7 (167)	27.0 (93)	28.7 (74)		
Some high school	8.6 (52)	10.2 (35)	6.6 (17)		
High school	4.5 (27)	4.4 (15)	4.7 (12)		
Some university	1.2 (7)	1.7 (6)	0.4 (1)		
Read/write, no education	0.5 (3)	0.9 (3)	0 (0)		
Average monthly income ^a				$\chi^2 = 1.19$	.28
≤3,499 Mexican pesos	23.1 (139)	24.7 (85)	20.9 (54)		
≥3,500 Mexican pesos	76.9 (463)	75.3 (259)	79.1 (204)		
Have children	95.3 (574)	95.6 (329)	95.0 (245)	$\chi^2 = 0.15$	.70
Household composition				$\chi^2 = 5.0$	.17
Lives with child(ren) and spouse/steady partner	12.1 (73)	12.8 (44)	11.2 (29)		
Lives with child(ren) only	42.9 (258)	39.0 (134)	48.1 (124)		
Lives with spouse/steady partner only	12.1 (73)	13.1 (45)	10.9 (28)		
Does not live with spouse/steady nor child(ren)	32.9 (198)	35.2 (121)	29.8 (77)		
Lives with spouse or steady	24.3 (146)	25.9 (89)	22.1 (57)	$\chi^2 = 1.15$	.29
Depressive symptoms, M (SD)	15.8 (11.2)	15.0 (11.3)	16.7 (11.1)	t = 1.9	.06
Meets criteria for moderate to severe clinical depression	34.2 (200)	30.6 (101)	39.0 (99)	$\chi^2 = 4.47$	.04
AUDIT-10, M (SD)	8.8 (9.6)	2.0 (2.4)	17.9 (7.9)	t = 31.5	<.001
Number of drugs used, ^b M (SD)	1.2 (1.5)	1.0 (1.4)	1.4 (1.6)	t = 3.3	<.001
Amount earned in Mexican pesos for anal sex without a condom, M (SD)	151 (247)	131 (238)	176 (255)	t = 2.1	.03
Amount earned in Mexican pesos for vaginal sex without a condom, M (SD)	350 (304)	339 (281)	365 (332)	t = 0.99	.32
Sex work venue type					
Street based	64.8 (390)	73.0 (251)	53.9 (139)	$\chi^2 = 23.5$	<.001
Indoor/establishment based	35.2 (212)	27.0 (93)	46.1 (119)		
Number of clients, ^a M (SD)	363 (280)	351 (283)	378 (276)	t = 1.19	.23
Age, years, M (SD)	37.6 (10.3)	38.5 (10.9)	36.5 (9.5)	t = 2.3	.02

Note. AUDIT = Alcohol Use Disorders Identification Test.

^aIn past 6 months. ^bIn past month.

Table 2. Number of Condomless Vaginal/Anal Sex Acts With Clients Regressed on Covariates (Step 1), Overall Use of Safer Sex Maintenance Strategies (Summary Score) (Step 2), and the Interaction Between the Overall Use of Safer Sex Maintenance Strategies and Hazardous Alcohol Consumption (Step 3) Among Female Sex Workers in Tijuana and Ciudad Juarez, Mexico ($N = 601$).^a

Variable	Step 1		Step 2		Step 3	
	β	t	β	t	β	t
Age of FSW	0.030	0.79	0.027	0.77	0.024	0.70
Beck depression score	0.000	-0.01	-0.023	-0.66	-0.021	-0.60
Sex work venue (street-based vs. indoor/establishment based)	-0.010	-0.26	-0.021	-0.57	-0.012	-0.32
Number of clients in past 6 months	0.385	9.99***	0.359	10.17***	0.356	10.09***
Hazardous alcohol consumption	0.070	1.85	0.023	0.67	-0.081	-1.35
Drug use in the past month	0.218	5.62***	0.149	4.11***	0.136	3.72***
Average monthly income in past 6 months (Mexican pesos)	0.014	0.36	0.059	1.65	0.062	1.72
Overall use of safer sex maintenance strategies	—	—	-0.370	-10.77***	-0.376	-10.94***
Overall use of safer sex maintenance strategies $\times$ hazardous alcohol consumption	—	—	—	—	0.128	2.12*
R^2	.242		.366		.371	
R^2 change	.242***		.124***		.005*	
Multiple R	.492		.605		.609	
Adjusted R^2	.233		.358		.361	
F (df)	27.0*** (7,593)		42.7*** (8,592)		38.7*** (9,591)	

Note. FSW = female sex worker; β = standardized regression coefficient.

^aOne case missing data on number of condomless sex acts.

* $p < .05$. ** $p < .01$. *** $p < .001$ (two-tailed tests).

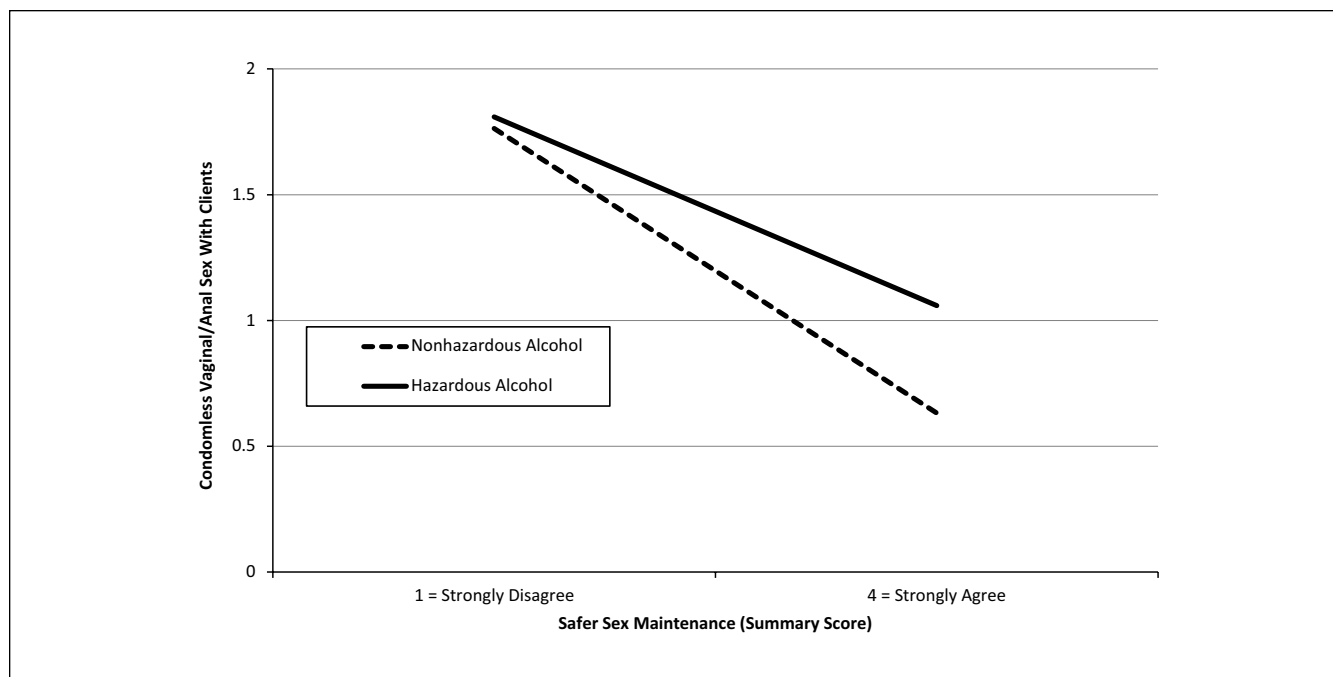


Figure 1. Interaction between hazardous alcohol consumption and safer sex maintenance strategies among female sex workers in Mexico. Note. Figure depicts predicted values based on regression results and the actual response scale for individual safer sex maintenance strategy items.

Table 3. Bivariate Associations Between Individual Safer Sex Maintenance Strategies and the Number of Condomless Vaginal/Anal Sex Acts With Clients Among Female Sex Workers in Tijuana and Ciudad Juarez, Mexico, Adjusting for Covariates and Stratified by Hazardous Alcohol Consumption ($N = 601$).^a

Variable	Nonhazardous alcohol consumption ($n = 343$)		Hazardous alcohol consumption ($n = 258$)	
	β	t	β	t
Recovery self-efficacy	-0.33	-6.97***	-0.33	-6.66***
Planning for high-risk situations	-0.29	-6.15***	-0.40	-8.15***
Maintenance self-efficacy	-0.32	-6.65***	-0.44	-9.14***
Satisfaction with outcomes	-0.24	-4.87***	-0.24	-4.61***
Self-monitoring	-0.37	-7.84***	-0.38	-7.33***
Enlist social support	-0.21	-4.33***	-0.18	-3.22***
Self-regulatory focus	-0.25	-5.29***	-0.33	-6.45***

Note. β = standardized regression coefficient. Models adjust for age, Beck depression, sex work venue, number of male clients in past 6 months, drug use in past month, and average monthly income in past 6 months.

^aOne case missing data on number of condomless sex acts.

*** $p < .001$.

Analysis 3a: FSWs Who Met Criteria for Hazardous Alcohol Consumption ($n = 258$). In Step 1, covariates accounted for 31% of the variance in the DV ($\Delta R^2 = .31$, $F = 19.2$, $p < .001$). In Step 2, safer sex maintenance strategies as a set of variables accounted for a significant 18% of the variance in the DV ($\Delta R^2 = .18$, $F = 18.7$, $p < .001$). One strategy—*maintenance self-efficacy*—was associated with fewer condomless vaginal/anal sex acts with clients. Number of clients and use of illicit drugs yielded positive and significant associations with the outcome (Table 4).

Analysis 3b: FSWs Who Did Not Meet Criteria for Hazardous Alcohol Consumption ($n = 343$). In Step 1, covariates accounted for 19% of the variance in the DV ($\Delta R^2 = .19$, $F = 13.0$, $p < .001$). In Step 2, safer sex maintenance strategies as a set of variables accounted for 15% of the variance in the DV ($\Delta R^2 = .15$, $F = 13.1$, $p < .001$). Two strategies—*recovery self-efficacy* and *self-monitoring*—were inversely and significantly associated with the number of condomless vaginal/anal sex acts. Number of clients and income were positively and significantly associated with the DV (Table 4).

Discussion

This study examined the association between FSWs' existing use of safer sex maintenance strategies and condomless vaginal/anal sex with clients. Hazardous alcohol consumption moderated the relationship between safer sex maintenance strategies and condomless sex with clients. The association was attenuated for FSWs who met criteria for hazardous alcohol consumption compared with their counterparts who did not meet those criteria. On exploring the individual safer sex maintenance strategies stratified by alcohol consumption, we found that among FSWs who met criteria for hazardous alcohol consumption, increased use of maintenance

self-efficacy was associated with fewer condomless vaginal/anal sex acts with clients. Among FSWs who did not meet criteria for hazardous alcohol consumption, increased use of self-monitoring and recovery self-efficacy were associated with fewer condomless vaginal/anal sex acts. These findings support the multidimensional nature of safer sex maintenance strategies and may help guide the development of safer sex maintenance interventions for FSWs.

Our findings suggest that maintenance self-efficacy (person's perceived ability or confidence to maintain a new behavior and deal with unexpected problems) is important to the maintenance of safer sex behaviors among FSWs, particularly those who engage in hazardous alcohol consumption. The latter has been associated with internalized self-criticism, low self-worth, and impulsive control difficulties (Blank, Connor, Gray, & Tustin, 2016; Skinner & Veilleux, 2016; Watkins, Franz, DiLillo, Gratz, & Messman-Moore, 2015), suggesting that in addition to alcohol treatment, enhancement of self-efficacy, particularly condom use self-efficacy, may be important for both achieving and maintaining behavior change in this subgroup of FSWs.

The association between recovery self-efficacy for safer sex maintenance and sexual risk behavior among FSWs who did not meet criteria for hazardous alcohol consumption is supported in the literature on weight loss and smoking cessation (Elfeddali, Bolman, Candel, Wiers, & De Vries, 2011; Pedersen et al., 2018). In these domains, recovery self-efficacy (beliefs about one's ability to recommence a behavior following a lapse or relapse) has been identified as a significant predictor of maintenance behavior. This finding suggests that maintenance interventions should promote cognitive and behavioral strategies to enhance self-efficacy in relation to relapse (e.g., get back on track immediately, mobilize social supports) (DiClemente et al., 2014; Larimer, Palmer, & Marlatt, 1999). The absence of a relationship

Table 4. Condomless Vaginal/Anal Sex With Clients Regressed on Covariates (Step 1), and Safer Sex Maintenance Strategies, Stratified by Hazardous Alcohol Consumption (Step 2) (*N* = 601).^a

Step	Variable	Nonhazardous alcohol consumption (<i>n</i> = 343)		Hazardous alcohol consumption (<i>n</i> = 258)	
		β	<i>t</i>	β	<i>t</i>
1	Age of FSW	0.03	0.58	0.04	0.63
	Beck depression score	-0.01	-0.16	0.01	0.10
	Sex work venue (street-based vs. indoor/establishment-based)	-0.01	-0.13	-0.03	-0.56
	Number of clients in past 6 months	0.35	6.74***	0.44	7.66***
	Drug use past month	0.17	3.12**	0.29	5.23***
	Average monthly income in past 6 months (Mexican pesos)	0.07	1.37	-0.07	-1.26
2	Age of FSW	0.03	0.60	-0.00	-0.07
	Beck depression score	0.00	0.03	-0.05	-1.03
	Sex work venue (street-based vs. indoor/establishment-based)	-0.03	-0.58	-0.03	-0.52
	Number of clients in past 6 months	0.33	6.91***	0.37	7.42***
	Drug use past month	0.08	1.62	0.21	4.15***
	Average monthly income in past 6 months (Mexican pesos)	0.12	2.45*	-0.02	-0.44
	Recovery self-efficacy	-0.21	-2.42*	0.08	0.89
	Planning for high-risk situations	-0.01	-0.15	-0.11	-1.12
	Maintenance self-efficacy	-0.01	-0.07	-0.35	-3.60***
	Satisfaction with outcomes	0.14	1.68	0.10	1.40
	Self-monitoring	-0.34	-4.08***	-0.11	-1.19
	Enlist social support	-0.07	-1.31	0.02	0.39
	Self-regulatory focus	0.09	1.08	-0.07	-0.76
	<i>R</i> ²	.189	.341	.314	.499
	<i>R</i> ² change	.189	.152	.314	.184
	Multiple <i>R</i>	.434	.584	.561	.706
	Adjusted <i>R</i> ²	.174	.315	.298	.472
	<i>F</i> (<i>df</i>)	13.0*** (6,336)	13.1*** (13,329)	19.2*** (6,251)	18.7*** (13,244)

Note. FSW = female sex worker; β = standardized regression coefficient.

^aOne case missing data on number of sex acts with clients.

p* < .05. *p* < .01. ****p* < .001 (two-tailed tests).

between recovery self-efficacy and condomless vaginal/anal sex among FSWs who met criteria for hazardous alcohol consumption warrants further research. However, behavior change self-efficacy is likely to be weaker among this subgroup of FSWs and may need to be enhanced in the behavior acquisition phase of an intervention before teaching these maintenance skills.

Self-monitoring was also identified as a significant predictor of fewer condomless vaginal/anal sex acts with clients among FSWs who did not meet criteria for hazardous alcohol consumption. This construct has been identified as key to weight loss and maintenance (Laitner, Minski, & Perri, 2016). In terms of safer sex maintenance, self-monitoring involves tracking behavioral adjustments and monitoring one's progress in maintaining goals, such as consistently using condoms with clients (Febbraro & Clum, 1998). In MSS, self-monitoring involved daily tracking of the use of

cognitive and behavioral strategies (e.g., thinking about or writing down the advantages of using condoms daily). At least one study has shown that self-monitoring is associated with greater use of condoms during the behavior acquisition phase (Lightfoot, Rotheram-Borus, Comulada, Gundersen, & Reddy, 2007). The present study may be one of the first to suggest a link between self-monitoring of safer sex practices and long-term reductions in sexual risk behaviors.

Treating hazardous alcohol consumption in the context of a safer sex maintenance intervention is likely to entail challenges. Although alcohol treatment programs are available in Tijuana and Cd. Juarez, few FSWs reported seeking treatment, thereby suggesting barriers to utilization. Thus, interventions for FSWs will need to deliver safer sex cognitive and behavioral maintenance messages in the context of active alcohol consumption, which is consistent with the concept of harm reduction.

Limitations

Because participants were research volunteers, they may not be representative of FSWs in the study sites or elsewhere in Mexico. It is also possible that FSWs provided socially appropriate responses, and thus overreported their use of safer sex maintenance strategies. This study also used baseline data. Though appropriate for our overall research aims, the causal impact of safer sex maintenance strategies on maintenance behaviors can only be determined through analyses of prospective, longitudinal data.

Conclusions

This study presents newly developed measures to assess FSWs' use of cognitive and behavioral safer sex strategies to support behavior change maintenance. Our findings demonstrate the utility of these measures by examining precounseling levels of FSWs' use of safer sex maintenance strategies and their associations with condomless vaginal/anal sex with clients, as well as subgroup differences based on hazardous alcohol consumption. The findings from this study and future analyses that identify theoretical predictors of FSWs' safer sex maintenance behaviors are likely to have important policy implications for Mexico and other LMIC.

Authors' Note

The research protocol was reviewed and approved by institutional review boards at the University of California, San Diego, Xochicalco University in Tijuana, and Salud y Desarrollo Comunitario and Federación Mexicana de Asociaciones Privadas (SADEC-FEMAP) in Cd. Juárez. All participants provided written informed consent. All procedures were conducted in accordance with the 1964 Helsinki Declaration and its later amendments.

Acknowledgments

The authors gratefully acknowledge study staff, participants, and the Municipal and State Health Departments of Tijuana, Baja California, Mexico and Ciudad Juárez, Chihuahua, Salud y Desarrollo Comunitario de Ciudad Juárez and Federación Mexicana de Asociaciones Privadas (SADEC-FEMAP), and Universidad Xochicalco de Tijuana.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by the National Institutes of Health, grants NIH R01 DA039071 (TLP), R37 DA019829 (SAS), R01 DA039071-03S1 (AHV), and R01 DA042666 (EVP).

ORCID iD

Shirley J. Semple  <https://orcid.org/0000-0002-9060-9113>

References

- Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. Thousand Oaks, CA: Sage.
- Bazzi, A. R., Rangel, G., Martinez, G., Ulibarri, M. D., Syvertsen, J. L., Bazzi, S. A., . . . Strathdee, S. A. (2015). Incidence and predictors of HIV and sexually transmitted infections among female sex workers and their intimate male partners in northern Mexico: A longitudinal, multilevel study. *American Journal of Epidemiology*, 181, 723-731.
- Beck, A. T. (1967). *Depression: Clinical, experimental and theoretical aspects*. New York, NY: Harper & Row.
- Beck, A. T. (1976). *Cognitive therapy and emotional disorder*. New York, NY: Hoeber.
- Beck, A. T., Steer, R. A., & Brown, G. K. (1996). *Manual for the Beck Depression Inventory-II (BDI-II)*. San Antonio, TX: Psychological Corporation.
- Blank, M. L., Connor, J., Gray, A., & Tustin, K. (2016). Alcohol use, mental well-being, self-esteem and general self-efficacy among final-year university students. *Social Psychiatry and Psychiatric Epidemiology*, 51, 431-441.
- Chersich, M. F., Bosire, W., King'ola, N., Temmerman, M., & Luchters, S. (2014). Effects of hazardous and harmful alcohol use on HIV incidence and sexual behavior: A cohort study of Kenyan female sex workers. *Global Health*, 10, 22. doi:10.1186/1744-8603-10-22
- DiClemente, R. J., Wingood, G. M., Sales, J. M., Brown, J. L., Rose, E. S., Davis, T. L., . . . Hardin, J. W. (2014). Efficacy of a telephone-delivered sexually transmitted infection/human immunodeficiency virus prevention maintenance intervention for adolescents: A randomized clinical trial. *JAMA Pediatrics*, 168, 938-946.
- Elfeddali, I., Bolman, C., Candel, M. J., Wiers, R. W., & De Vries, H. (2011). The role of self-efficacy, recovery self-efficacy, and preparatory planning in predicting short-term smoking relapse. *British Journal of Health Psychology*, 17, 185-201.
- Febbraro, G. A., & Clum, G. A. (1998). Meta-analytic investigation of the effectiveness of self-regulatory components in the treatment of adult problem behaviors. *Clinical Psychology Review*, 18, 143-161.
- Laitner, M. H., Minski, S. A., & Perri, M. G. (2016). The role of self-monitoring in the maintenance of weight loss success. *Eating Behaviors*, 21, 193-197.
- Larimer, M. E., Palmer, R. S., & Marlatt, G. A. (1999). Relapse prevention: An overview of Marlatt's cognitive-behavioral model. *Alcohol Research & Health*, 23, 151-160.
- Lightfoot, M., Rotheram-Borus, M. J., Comulada, S., Gundersen, G., & Reddy, V. (2007). Self-monitoring of behavior as a risk reduction strategy for persons living with HIV. *AIDS Care*, 19, 757-763.
- Maisto, S. A., Carey, M. P., Carey, K. B., Gordon, C. M., & Schum, J. L. (2004). Effects of alcohol and expectancies on HIV-related risk perception and behavioral skills in heterosexual women. *Experimental and Clinical Psychopharmacology*, 12, 288-297.
- Patterson, T. L., Mausbach, B., Lozada, R., Staines-Orozco, H., Semple, S. J., Fraga-Vallejo, M., . . . Strathdee, S. A. (2008). Efficacy of a brief behavioral intervention to promote condom use among female sex workers in Tijuana and Ciudad Juárez, Mexico. *American Journal of Public Health*, 98, 2051-2057.
- Patterson, T. L., Semple, S. J., Abramovitz, D., Harvey-Vera, A., Pines, H. A., Verdugo, S., . . . Strathdee, S. A. (2019). Impact

- of time perspectives on texting intervention to reduce HIV/STI transmission among female sex workers in Tijuana and Ciudad Juarez, Mexico. *Journal of Behavioral Medicine*, 42, 111-127. doi:10.1007/s10865-018-9948-1
- Pedersen, S., Snichotta, F. F., Sainsbury, K., Evans, E. H., Marques, M. M., Stubbs, R. J., . . . Lähteenmäki, L. (2018). The complexity of self-regulating food intake in weight loss maintenance. A qualitative study among short- and long-term weight loss maintainers. *Social Science & Medicine*, 208, 18-24.
- Robertson, A. M., Ojeda, V. D., Nguyen, L., Lozada, R., Martinez, G. A., Strathdee, S. A., & Patterson, T. L. (2012). Reducing harm from HIV/AIDS misconceptions among female sex workers in Tijuana and Ciudad Juarez, Mexico: A cross-sectional analysis. *Harm Reduction Journal*, 9, 35. doi:10.1186/1477-7517-9-35
- Rothman, A. J. (2000). Toward a theory-based analysis of behavioral maintenance. *Health Psychology*, 19(1 Suppl.), 64-69.
- Saunders, J. B., Aasland, O. G., Babor, T. F., De la Fuente, J. R., & Grant, M. (1993). Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption—II. *Addiction*, 88, 791-804.
- Schwarzer, R., Schuz, B., Ziegelmann, J. P., Lippke, S., Luszczynska, A., & Scholz, U. (2007). Adoption and maintenance of four health behaviors: Theory-guided longitudinal studies on dental flossing, seat belt use, dietary behavior, and physical activity. *Annals of Behavioral Medicine*, 33, 156-166.
- Skinner, K. D., & Veilleux, J. C. (2016). The interactive effects of drinking motives, age, and self-criticism in predicting hazardous drinking. *Substance Use & Misuse*, 51, 1342-1352.
- Stoner, S. A., Norris, J., George, W. H., Morrison, D. M., Zawacki, T., Davis, K. C., & Hessler, D. M. (2008). Women's condom use assertiveness and sexual risk-taking: Effects of alcohol intoxication and adult victimization. *Addictive Behaviors*, 33, 1167-1176.
- Strathdee, S. A., Magis-Rodriguez, C., Mays, V. M., Jimenez, R., & Patterson, T. L. (2012). The emerging HIV epidemic on the Mexico-U.S. border: An international case study characterizing the role of epidemiology in surveillance and response. *Annals of Epidemiology*, 22, 426-438.
- Strathdee, S. A., Abramovitz, D., Lozada, R., Martinez, G., Rangel, M. G., Vera, A., . . . Patterson, T. L. (2013). Reductions in HIV/STI incidence and sharing of injection equipment among female sex workers who inject drugs: Results from a randomized controlled trial. *PLoS One*, 8, e65812. doi:10.1371/journal.pone.0065812
- Verma, R. K., Saggurti, N., Singh, A. K., & Swain, S. N. (2010). Alcohol and sexual risk behavior among migrant female sex workers and male workers in districts with high in-migration from four high HIV prevalence states in India. *AIDS and Behavior*, 14(Suppl.1), S31-S39.
- Voils, C. I., Gierisch, J. M., Yancy, W. S., Sandelowski, M., Smith, R., Bolton, J., & Strauss, J. L. (2014). Differentiating behavior initiation and maintenance: Theoretical framework and proof of concept. *Health Education & Behavior*, 41, 325-336.
- Vrijens, B., Vincze, G., Kristanto, P., Urquhart, J., & Burnier, M. (2008). Adherence to prescribed antihypertensive drug treatments: Longitudinal study of electronically compiled dosing histories. *BMJ*, 336, 1114-1117. doi:10.1136/bmj.39553.670231.25
- Watkins, L. E., Franz, M. R., DiLillo, D., Gratz, K. L., & Messman-Moore, T. L. (2015). Does drinking to cope explain links between emotion-drive impulse control difficulties and hazardous drinking? A longitudinal test. *Psychology of Addictive Behaviors*, 29, 875-884.