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Substance use, anxiety, and self-management efficacy in HIV-positive individuals: A mediation analysis

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ABSTRACT

Context: In China, the social stigma of both substance use and HIV remains major barrier. HIV-positive individuals have been demonstrated to have higher psychosocial distress in the literature. To ensure quality of life among HIV-positive Chinese individuals, self-efficacy in HIV-related management including substance use and anxiety is the key to suppress viral load and maintain healthy lives. **Objectives:** We examine the mediation relationship among substance use, anxiety, and self-management efficacy. **Method:** A cross-sectional study design was used. In total, 137 HIV-positive individuals were recruited from two premier Chinese hospitals: Beijing's Ditan Hospital and Shanghai's Public Health Clinic Center (SPHCC). **Results:** HIV-positive substance users had significantly lower HIV-management efficacy and higher anxiety scores. About a third of the relations between substance use and anxiety were mediated by HIV-management self-efficacy. Those who used substances in the previous week had higher anxiety levels suggesting the presence of a recency effect. Their higher levels of anxiety could be largely explained by their lower HIV-management efficacy. **Conclusion:** It is useful for healthcare providers to assess substance use behaviors in HIV-positive individuals as well as provide support in managing anxiety in this population. Meanwhile, enhancing self-management efficacy to ensure healthy lifestyles may support achieving optimal lives with HIV.

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Substance use; China; HIV; anxiety; self-management

Introduction

China is declaring a war on drugs. In 2014, President Xi Jinping and Premier Li Keqiang both denounced drug use and called for stronger efforts to fight drugs (Tiezzi, 2015). In total, 2.76 million people in 2015 were documented as “drug addicts” reported from police precincts, hospitals and rehabilitation agencies (Chinese Association of Drug Abuse Prevention and Treatment, 2017). Within this population, three-quarters were under 35 years old (Levin, 2015), and 6.4% were HIV-positive (Chu et al., 2015). As 0.03% of the general population is HIV-positive (Ministry of Health People's Republic of China Joint United Nations Programme on HIV/AIDS World Health Organization, 2015), this indicates that HIV-positive individuals are overrepresented in the substance-use population. Indeed, in 2015, injection drug users (IDUs) accounted for 20% of all new HIV infections (Ministry of Health People's Republic of China Joint United Nations Programme on HIV/AIDS World Health Organization, 2015).

In recent years, synthetic drugs such as crystal methamphetamine and ketamine have become more popular than heroin in China, the reigning dominant drug (Zhang & Chin, 2015). According to China's National Narcotics Control Commission 2014 Annual Report on Drug Control

in China, heroin is the most abused drug in China followed by synthetic drugs such as ketamine, methamphetamine, and other amphetamine-type stimulants (Bureau of international narcotics and law enforcement affairs, 2015).

In China, people who injected drugs historically have low rates of linkage to HIV care and may face some of the largest barriers to accessing potential lifesaving medications (Bao, Liu, & Lu, 2010). One possible explanation is due to China having some of the world's harshest drug laws: those caught trafficking large amounts of drugs can face the death penalty, and the police have the authority to mandate casual drug users to compulsory drug rehabilitation centers, which have been described by human rights groups as little more than labor camps (Levin, 2015). In addition, providers seem reluctant to diagnose alcohol and drug use problems, as they may either see it either as a sign of character defect or a bad habit (Sugarman, Rose, & Metzger, 2014). The social stigma of substance abuse remains a major barrier to recognition of the disease (Liao et al., 2014). In addition, physicians receive little or no training in the treatment of substance-use disorders (Powell & Zhang, 2007). Furthermore, substance abuse is culturally conceptualized as “a bad habit” that can be overcome simply by increasing self-control (Sun, Bao, et al., 2014).

The link between drug use and HIV risk has been described among populations of men who have sex with men (MSM) worldwide (Bao et al., 2015; Ding, He, Zhu, & Detels, 2013; Pappas & Halkitis, 2011; Semple, Strathdee, Zians, & Patterson, 2010; Shacham & Cottler, 2010), and drug use has also been linked to increased risk behaviors in MSM (Cheung, Lim, Guadamuz, Koe, & Wei, 2015; Liao et al., 2014; Xu et al., 2014). Recent studies have shown a strong role of substance use and multiple partnerships for predicting HIV risk (Xu et al., 2014). One study conducted in China shows that alcohol influence and using substances (e.g., alkyl nitrite) with casual partners and those newly diagnosed with HIV (within 6 months) were associated with risky sexual behaviors (He et al., 2012). Another study found that more than a quarter (28.5%) of MSM had reported their use of recreational drugs in the past 6 months, while only 0.42% of study participants stated that they had injected drugs in the last six months (Xu et al., 2014). In words, many MSM were likely using methamphetamine and/or ketamine, rather than heroin. In addition, those who used substances had higher monthly income compared to their non-substance using counterparts, suggesting a potential emphasis on use for recreational purposes (Zhang et al., 2016).

Concurrently, HIV-positive individuals have been widely reported to exhibit higher psychosocial distress (e.g., depression and anxiety) in China than those who do not have HIV (Mo, Lau, Yu, & Gu, 2015; Niu, Luo, Liu, Silenzio, & Xiao, 2016; Yu et al., 2015). A recent study also reported that initiation of antiretroviral treatment (ART) in the MSM population was associated with depression and anxiety (Tao et al., 2017). In particular, individuals who were diagnosed with HIV within the last 12 months experienced HIV-related stigma (Yang et al., *In Press*) presented depressive and anxiety symptomology, and were associated with higher suicidal ideation in HIV-positive MSM population (Wu et al., 2015).

Recent WHO guidelines suggest that HIV-positive individuals should initiate ART as soon as they are ready to (World Health Organization, 2016). Self-efficacy in HIV-related self-management is critical in the effort to suppress viral load and allow individuals to maintain their quality of life (QOL) (Huang et al., 2013; Villegas et al., 2013). Indeed, HIV-positive individuals with good HIV self-management efficacy demonstrate higher rates of ART adherence (Yunyong et al., 2016). Other potential factors associated with self-management efficacy included patient-provider relationships (Chen et al., 2013), mental status (Nokes et al., 2012), age (Langebeek et al., 2014), and perceived stigma (Tyer-Viola et al., 2014). In addition, social support can also enhance HIV self-management efficacy (Zhu et al., 2017). Research supports the utility of providers not only offering ART, but at the same time, providing support for these individuals' mental health to improved HIV self-management efficacy (Zhu et al., 2017).

Many Chinese MSM experienced emotional distress, and therefore, may exhibit more risky sexual behaviors and seek more support from their family (Yunyong et al., 2016). One study showed that close to half (49%) of HIV-positive Chinese MSM in their sample presented with anxiety and almost three quarters (73%) of demonstrated depressive symptomology (Sun, Wu, et al., 2014). However, with better self-management

efficacy, ART adherence can be improved, along with decreased substance use and improved QOL (Huang et al., 2013).

Given the limited empirical evidence in substance use, anxiety, and self-management efficacy in the HIV-positive Chinese population, the present study seeks to examine the mediation relationship among these three variables. We hypothesize that Chinese HIV-positive substance users have higher anxiety and their anxiety levels will be mediated by their lower HIV-management efficacy.

Methods

This project was developed and conducted through an ongoing collaboration between US and Chinese investigators at Yale University, Beijing Ditan Hospital, and Shanghai Public Health Clinic Center (SPHCC).

Design

A cross-sectional study design was used for the study.

Participants

One hundred and thirty-seven HIV-positive individuals were recruited from two premier Chinese hospitals: Beijing's Ditan Hospital and Shanghai's Public Health Clinic Center (SPHCC) in China. We recruited these HIV-positive individuals (74% men) who were referred by their infectious disease primary care physicians. These individuals were 18 years and older, without significant cognitive problems, and were receiving care at one the two hospitals above, either inpatient or outpatient.

Data collection

Potential participants were approached directly by clinic staff and their primary care providers, who informed them about the study; those who were interested were referred to study personnel. After study staff explained the nature, risks, and benefits of the study, those who agreed to participate provided written informed consent. All participants received 150 RMB (~US\$20) as compensation for their participation in the survey. The questionnaire was delivered via audio computer-assisted self-interview (ACASI). All study procedures were reviewed and approved by the institutional review boards of the three institutions involved.

For the first wave of the study, we conducted a survey in 2011 at SPHCC to assess a sample of recently HIV-diagnosed individuals for descriptive information on HIV-related mental health and their symptom management. Participants ($N = 107$) completed an hour-long ACASI survey of demographics, substance use, self-efficacy, and psychometrically validated measures of anxiety. In the second wave of the study, we recruited 30 HIV-positive individuals at Beijing Ditan Hospital and SPHCC to understand their mental health, substance use, self-efficacy and their symptom management strategies.

Measures

Both waves study participants completed a one-time 60-minute ACASI survey that consisted of standardized measures to assess demographics, HIV-related anxiety, HIV-management efficacy, and their experiences of substance use. The measures used have been previously tested in Chinese populations and have shown strong reliability and validity.

Demographics

Study participants' age, gender, sex, income, current residency (Beijing, Shanghai or others), marital/partner status, years of education, sexual preferences, potential transmission route, and employment status were collected.

Substance-use assessment

This is a 10-item survey modified from Lightfoot and Colleagues (2005) substance assessment scale, that assesses lifetime and recent (past 3 months) use of licit and illicit substances, including tobacco, alcohol, cocaine, crack, heroin, inhalants, marijuana, opiates, methamphetamine, and speed. Participants are asked how often they have used each drug in the past week, on a 9-point scale (0 = never to 8 = more than once a day). Although in the original survey we included 10 different response categories, for these analyses we excluded tobacco and alcohol use as the prevalence rates of these two common substances were high. If included, over half of the sample would be considered substance users. Therefore, in this analysis, we only included people who had been use cocaine, crack, heroin, inhalants, marijuana, opiates, methamphetamine, and speed. We calculated study participants who had used a least one substance in last week compared to those who did not use any (Lightfoot et al., 2005).

Anxiety

The 10-item instrument derived from the Symptom Checklist-90-R (SCL-90-R) is a brief distress assessment designed to evaluate a broad range of psychological problems and symptoms include somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism. The SCL-90-R is normed on individuals 13 years and older and scored on a five-point scale (0–4) assessing “how much” the respondent was bothered by each symptom in the past week (Jin et al., 2012).

HIV-management efficacy

The revised Sign and Symptom Checklist is a 72-item instrument that asks respondents to evaluate symptoms they are experiencing on that day by rating the intensity (mild, moderate, or severe) of the symptom including fatigue, diarrhea, palpitation, and more clinical symptoms. Cronbach's reliability estimate in our sample was 0.97 (Holzemer et al., 1999).

Data analysis

First univariate statistics were computed to obtain an overall understanding of the sample regarding demographic backgrounds and distributions of selected variables. Second

bivariate analysis was conducted to compare participants with and without recent substance use. Third, a series of multivariable linear regression was computed with HIV-management efficacy and anxiety scores as the main outcomes. As the goal was to test whether HIV-management efficacy can mediate the relation between substance use and anxiety, following Baron and Kenny's approach (Baron & Kenny, 1986), the series of regression included the following three steps. In Model 1, we regressed HIV-management efficacy on the substance use and other covariates; in Model 2, we regressed anxiety scores on substance use and other covariates; and in Model 3, we regressed anxiety scores on both substance use and HIV-management efficacy. We then applied seemingly unrelated regression and Wald tests to investigate the magnitude of reduction in the relation between substance use and anxiety across Model 2 and Model 3. Finally, using these estimated coefficients we calculated the direct, indirect, and total effects. We used bootstrap techniques with an additional 1,500 datasets to calculate the standard errors, including beta coefficients in multivariable regression and mediation analysis (Hayes, 2009). All the statistical analysis was conducted in a commercial statistical software package, Stata 13.

Results

Table 1 summarizes the overall demographic information as well as distributions of selected variables in the sample. The mean age of the study participants was 39 years old. In the total sample, 27% of the study participants had used substances in last week. A majority of the participants (62%) had a high school degree or lower. More than one third (38%) of the study participants stated that they do not have adequate income when we ask whether their income is not enough, barely enough or more than enough. 17% ($N = 23$) of the participants had been given a diagnosis of AIDS. 82% ($N = 113$) were currently using ART; CD4 counts were averaged at 283 cells/mm³. Limited differences in demographic backgrounds and clinical conditions were found between substance users and non-users. However, the two psychological factors, HIV-management efficacy, and anxiety scores were significantly different between substance users and non-users. HIV-positive substance users had significantly lower HIV-management efficacy as well as higher anxiety scores as compared with non-user peers.

Table 2 summarizes the results of multivariable regressions. In Model 1, where HIV-management efficacy was the outcome, substance users on average had significantly lower HIV-management efficacy by 7.86 units ($SE = 3.23$, $p < 0.05$) compared with non-users even after controlling for all the other demographic variables, clinical factors, and waves of data. In Model 2 where anxiety scores were the outcome, substance users on average had significantly higher anxiety scores by 4.7 units ($SE = 1.64$, $p < 0.01$) compared with non-users even after controlling for all the other demographic variables, clinical factors, and waves of data. In Model 3 where anxiety scores were the outcome and HIV-management efficacy was entered into the model, substance users on average no longer had significantly higher anxiety scores at the 0.05 alpha level and the difference in anxiety scores was

Table 1. Sample characteristics and bivariate analysis.

	Total sample	Non substance users	Substance users	<i>p</i>
N	137	100 (73%)	37 (27%)	
Wave				0.065
2011	107	74	33	
2015	30	26	4	
Demographic backgrounds				
Gender (<i>n</i> , %)				0.518
Men	101 (73.72)	72 (72.00)	29 (78.38)	
Women	36 (26.28)	28 (28.00)	8 (21.62)	
Age (mean, SD)	38.54 (10.13)	38.08 (10.40)	39.78 (9.39)	0.384
Education (<i>n</i> , %)				0.073
HS or below	85 (62.04)	67 (67.00)	18 (48.65)	
College or above	52 (37.96)	33 (33.00)	19 (51.35)	
Income (<i>n</i> , %)				0.462
Inadequate	52 (37.96)	39 (39.00)	13 (35.14)	
Barely adequate	61 (44.53)	46 (46.00)	15 (40.54)	
Enough	24 (17.52)	15 (15.00)	9 (24.32)	
Clinical factors				
Year with HIV (mean, SD)	5.03 (3.69)	5.09 (3.56)	4.86 (4.08)	0.753
Ever had AIDS (<i>n</i> , %)				0.797
Yes	23 (16.79)	16 (16.00)	7 (18.92)	
No	114 (83.21)	84 (84.00)	30 (81.08)	
HIV medication (<i>n</i> , %)				0.455
Currently on medication	113 (82.48)	84 (84.00)	29 (78.38)	
Not on medication	24 (17.52)	16 (16.00)	8 (21.62)	
CD4 (mean, SD) cells/mm ³	283.94 (214.65)	278.45 (218.33)	298.49 (206.76)	0.63
Psychological factors (mean, SD)				
HIV-management efficacy	68.28 (17.48)	70.61 (17.88)	62.05 (14.85)	0.011*
Anxiety	16.93 (7.58)	15.71 (7.09)	20.22 (7.99)	0.001 [†]

HS = high school; SD = standard deviation; [†] $p < 0.001$; * $p < 0.05$.

Table 2. Multivariable regressions with HIV-management efficacy and anxiety scores as the outcomes.

	Model 1		Model 2		Model 3	
	B	(SE)	B	(SE)	B	(SE)
Outcome	HIV-Management efficacy		Anxiety		Anxiety	
Substance use						
Yes (vs. No)	-7.86*	(3.23)	4.7**	(1.64)	3.12 [†]	(1.61)
HIV-management efficacy	-	-	-	-	-0.20**	(0.04)
Demographic backgrounds						
Gender						
Women (vs. Men)	-3.32	(3.59)	1.27	(1.71)	0.60	(1.54)
Age	-0.18	(0.16)	-0.02	(0.07)	-0.05	(0.06)
Education						
College and above (vs. Below)	-6.24**	(3.58)	2.23 [†]	(1.32)	0.97	(1.26)
Income						
Barely adequate (vs. Inadequate)	10.23**	(3.39)	-3.67**	(1.38)	-1.6	(1.28)
Enough (vs. Inadequate)	7.6	(4.90)	-2.88	(2.00)	-1.35	(1.69)
Clinical factors						
Year with HIV	0.45	(0.58)	-0.17	(0.30)	-0.08	(0.29)
Ever had AIDS						
No (vs. Yes)	1.07	(4.34)	-0.19	(1.74)	0.03	(1.50)
HIV medication						
Not on medication (vs. Yes)	5.59	(4.20)	-0.54	(1.87)	0.59	(1.56)
CD4	0.01*	(0.01)	0.00	(0.00)	0.00	(0.00)
Wave						
2015 (vs. 2011)	4.14	(5.09)	-2.73	(2.17)	-1.89	(1.87)
R²	0.17		0.14		0.32	

[†] $p < 0.10$; * $p < 0.05$; ** $p < 0.01$.

reduced to 3.12 (SE = 1.61, $p > 0.05$). When the differences between substance users and non-users from Models 2 and 3 were compared, the seemingly unrelated regression and Wald test showed that the reduction was 1.51 units (SE = 0.03, $p < 0.01$).

Finally, the mediation analysis showed that as demonstrated in Figure 1, while the direct effect was not significant at the 0.05 alpha level, the indirect effect was significant at 1.58 (SE = 0.72, $p < 0.05$), and the total effect was 4.70 (SE = 1.61, $p < 0.01$). This suggested that about a third of

the relations between substance use and anxiety were mediated by HIV-management efficacy.

Discussion

In this study, we aimed to test the hypothesis that HIV-positive substance users had higher anxiety levels as compared with their non-user HIV-positive peers, and their high levels of anxiety could be mediated by their lower HIV-management

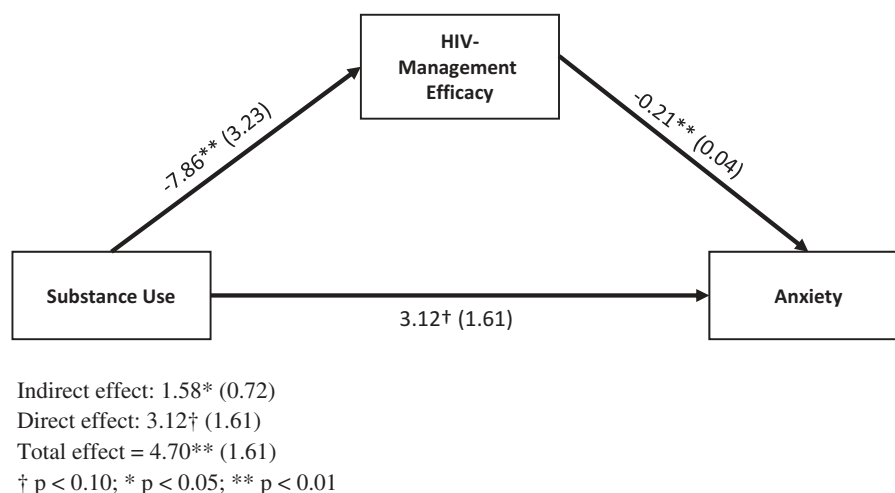


Figure 1. Mediation analysis among substance use, HIV-management efficacy, and anxiety.

efficacy. In our harmonized data, we found evidence showing that among these Chinese HIV-positive patients, those who had used substances in the last week had higher anxiety levels as compared with those who did not use the substance. Moreover, their higher levels of anxiety could be largely explained by their lower HIV-management efficacy. Indeed, 33% of the difference in the anxiety levels could be attributed to their lower HIV-management efficacy.

Studies have shown that HIV-positive substance users tend to have more unprotected sex compared to HIV-positive peers who were not influenced by drugs (He et al., 2012). Our study also presented similar results that HIV-positive individuals who were using substance has more issues with self-management. These difficulties might include not being able to taking ART on-time, not using safe sex practices, and being unable to resources to problem solve life stressors (Eller et al., 2014). Meanwhile, these HIV-positive substance users were also impaired with higher anxiety compared to HIV-positive peers who were not influenced by drugs. In the mediation analysis, HIV-positive substance users presented with less optimal HIV-management efficacy, which led to worse anxiety.

Literature indicates that anxiety is one of the major risk factors for non-adherence to ART, especially in newly initiated HIV-infected individuals (Tao, et al., 2017). Healthcare providers can also influence HIV-positive individuals' self-efficacy in order to reduce the medication adherence difficulty when initiating ART (Lee, Rand, Ellen, & Agwu, 2014). This study suggests there may be utility for HIV primary care providers in China to obtain history of and current substance use, as well as evaluate mental status. As these two factors significantly influence HIV-management efficacy, they can affect future negative outcomes, such as sub-optimal ART adherence and increased sexual behavior. Therefore, intervening for anxiety symptoms might enhance self-management efficacy and contribute to better treatment outcomes in the future (Tao et al., 2017).

In China, HIV-positive men (and especially MSM in this study) present with more psychosocial issues than women (Li et al., 2016). With the influence of substances, MSM might

exhibit more risky sexual behaviors (Wang et al., 2017). Research on implementing effective interventions to reduce anxiety as well as enhance self-management efficacy in HIV-positive individuals in China is warranted, as these factors are highly associated with QOL (Li et al., 2016). In addition, enhancing self-management efficacy such as increasing positive coping strategies and ART adherence can support the maintenance of positive health outcomes and therefore, lead to a better QOL (Chen et al., 2013).

It may be warranted for HIV primary care providers to not only assess substance-use behaviors in HIV-positive individuals but also assist in managing anxiety in this population. These efforts can contribute to enhanced self-management efficacy, which supports QOL among those living with HIV. In the collective Chinese culture, family support to encourage HIV-related self-management can decrease anxiety and self-stigma; therefore, intervention including family members should be encouraged in the future study.

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Disclosure of potential conflicts of interest

No conflict of interest has been declared by the authors.

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