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Authors

Yang, Joyce P
Shiu, Chengshi
Zhang, Lin
et al.

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Health disparities affecting persons living with HIV and using substances in China

Joyce P. Yang, PhD [a], Chengshi Shiu, MSW, PhD, GStat [b,c], Lin Zhang, RN, MPH [d], Kerong Wang, RN, BSN [d], Hongzhou Lu, MD, PhD [e], Hongxin Zhao, MD [f], Wei-Ti Chen, RN, CNM, PhD, FAAN [c,*]

[a] Department of Psychology, University of San Francisco, San Francisco, CA, USA
[b] Department of Social Work, National Taiwan University, Taipei, Taiwan
[c] School of Nursing, University of California Los Angeles, Los Angeles, CA, USA
[d] Shanghai Public Health Clinical Center, Fudan University, Shanghai 201508, China
[e] Beijing Ditan Hospital, Capital Medical University, Beijing 100015, China
[f] The Third People's Hospital of Shenzhen, Shenzhen 518114, China

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ABSTRACT

Health disparities affecting persons living with HIV (PLWH) as well as those affecting individuals who use substances have been documented in China. However, health status and outcomes within the intersectional population of those who both live with HIV and use substances is not well understood. One hundred and sixty-nine PLWH receiving care in China completed surveys assessing HIV-clinical factors, substance use, and HIV-related physical health symptoms. We tested associations between substance use and health symptoms using multivariate logistic and ordinal regressions. Using one substance over the past week was associated with greater maximal severity of physical symptoms ($p < .01$); using two or more substances in the past week was associated with both increased total physical symptom severity ($p < .05$) and a dosage response in increased maximal severity ($p < .01$). Findings highlight the need for providers to address substance use for comprehensive care of PLWH to improve overall wellbeing.

1. Introduction

The U.S. Health Resources and Services Administration defines health disparities as differences affecting populations in terms of the presence of disease, health outcomes, or access to care (U.S. Department of Health and Human Services, 2020). Others (Carter-Pokras & Baquet, 2002) argue for consideration of an entire "chain of events" that may include differences in environment, health status, health outcomes, as well as healthcare quality, access, and utilization. These differences, referred to collectively as social determinants of health, include examination of health by race or ethnicity, sex, gender, sexual identity and orientation, age, disability status or special health care needs, socio-economic status, and geographic location (Brennan Ramirez et al., 2008). Individuals living with HIV as well as those living with substance use disorders may be considered to have a disability when barriers of social, economic, or political nature hinder their "full and effective participation in society on an equal basis with others" (United Nations General Assembly, 2006).

Carter-Pokras and Baquet's (Carter-Pokras & Baquet, 2002) definition of health disparities allows for a broad understanding of a particular population's health experience through examining the disparate conditions in their environment. It encompasses consideration of factors such as a) stigma or societal perceptions of the population; b) access to, utilization of, and quality of healthcare received by the population, which may be moderated by experiences with discrimination in healthcare settings; c) the population's overall health status and well-being; as well as d) individual health outcomes affecting the population. Examining the health experience of persons living with HIV and also use substances in China in this manner facilitates understanding the health disparities they experience along the healthcare continuum from environment to outcome.

Individuals living with HIV in China experience a significant amount of stigma (Rao et al., 2012; Zhang et al., 2018). This stigma arises from misconceptions about the illness and its transmission routes, government sanctioned public health messaging such as "Stay away from AIDS", and associations of HIV with other stigmatized populations such

* Corresponding author at: School of Nursing, University of California Los Angeles, Los Angeles, CA 90095, USA.
E-mail address: wchen@sonnet.ucla.edu (W.-T. Chen).

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as the poor or intravenous drug using communities (Yang et al., 2016; Zhang & Ma, 2002). HIV stigma has long been documented to result in decreased access to care, for example due to discriminatory government policies and laws, or societal apathy and denial of the epidemic (Malcolm et al., 1998). Internalized stigma as well as previous negative experiences with discrimination in healthcare settings affects utilization of care, as individuals living with HIV may self-exclude from treatment (Lieber et al., 2006). Discriminatory attitudes on the part of providers may also contribute to poorer quality of care (Li et al., 2007; Li et al., 2013). Finally, significant evidence suggests poorer health status, health outcomes, and health quality of life are observed among persons who are HIV seropositive compared to their seronegative counterparts (e.g., (Petoumenos et al., 2017; Thomas et al., 2017)).

Persons living with substance use disorders in China similarly face significant stigma (Mak et al., 2015). In a global study ranking degree of stigma experienced among often stigmatized health conditions (Room et al., 2001), drug addiction was ranked the highest in 14 countries, including China. Negative attitudes towards those who use substances have also been linked to decreased access to, utilization of, and quality of health care (van Boekel et al., 2013). The poorer health status and health outcomes present among many individuals with substance use disorders have also been reflected in existing literature (e.g., (Ahern et al., 2007; Galea & Vlahov, 2002)).

Taken together, persons living with HIV and using substances face an intersection of stigmatized health conditions, and experience health disparities along the healthcare continuum, ranging from upstream environmental factors affecting their daily life down to final health outcomes. Research on this intersectional population in other parts of the world suggests that HIV and substance use disorders co-occur at high rates with health outcomes that are dynamically related resulting in recommendations for regular dual screening and integrated interventions (Hitch et al., 2019; Pinto et al., 2019; Wijesinghe et al., 2023). However, although research has been conducted in China on health disparities separately affecting PLWH (e.g., (Luo et al., 2020; Yan et al., 2014) as well as those affecting persons with substance use disorders (Zhao et al., 2004), the intersectional impact here remains to be understood.

Indeed, health outcomes among persons living with both HIV and substance use disorders in China have not been well documented. Furthermore, research is needed that examines whether substance use functions to affect Chinese PLWH health in a dosage response manner (i.e., more substances use leading to a greater negative impact on health). To begin addressing this gap, this study utilizes secondary data to assess the relationship between substance use and health symptoms among individuals living with HIV and using substances in China.

2. Methods

2.1. Participants and procedures

Data for this study were collected at two leading infectious disease hospitals in Shanghai and Beijing, China. Participants were enrolled into the study in two waves, one in each city. The first wave was from November 2009 to March 2010, and the second wave was from July 2014 to March 2016. Power analyses were conducted in Stata15 and indicate that for a power of 0.80 with alpha set at 0.05, we will be able to detect a small effect with a sample larger than 110. One hundred and seven participants were enrolled in the first wave of data collection and 62 participants were enrolled in the second wave, resulting in a total sample size of 169, thus our study was adequately powered for our research questions.

Study inclusion criteria were a) 18 years of age or older, b) HIV seropositive, and c) currently receiving HIV care at one of the two hospitals. The exclusion criteria were a) not being able to read and write in Chinese, and b) being too ill to complete the survey. Healthcare providers at the outpatient clinics of the hospitals discuss ongoing research participation opportunities as part of routine care visits. Interested patients were referred to research staff who then gave information about study procedures and obtained written consent for participation in the 60-min Audio Computer Assisted Self-Interview (ACASI) survey. The ethics review boards of the University of Washington (Protocol #36129C) and Yale University (Protocol #1207010522) approved all study procedures.

2.2. Patient and public involvement

None. Patients and members of the public were not involved in the design, or conduct, or reporting, or dissemination plans of the research.

2.3. Measures

The self-reported ACASI survey assessed for participants' demographics, HIV clinical factors, substance use, and physical health symptoms.

2.4. Demographic social determinants of health and HIV clinical factors

Demographics assessed were sex assigned at birth (0 = male; 1 = female) and age (ranging from 19 to 70 years of age). Social health determinants of income (1 = not enough to live; 2 = just enough to live; 3 = more than enough to live) and education (0 = without college degree; 1 = college degree or higher) were also assessed. HIV clinical factors assessed were the number of years that participants had been living with HIV (ranging from 3 to 23 years), whether they had ever received a diagnosis of AIDS (0 = never diagnosed; 1 = diagnosed); most recent CD4 count (ranging from 9 to 1100 cells/mm^3; which was divided by 100 for a percentage unit);s and whether participants were currently on anti-retroviral treatment (0 = no; 1 = yes).

2.5. Substance use

A 10-item scale adapted from the WHO ASSIST screener (WHO, 2010), assesses use of alcohol, tobacco, crack cocaine, powder cocaine, heroin, inhalants, marijuana, methamphetamine/speed, and other substances. Participants rated frequency of use of the 10 types of substances over the previous week, ranging from 0 (never) to 7 (once a day) or 8 (more than once a day). For data analysis in this study, we then trichotomized participants into 0 – no substance use, 1 – use of 1 substance over the past week, 2 – use of 2 or more substances over the past week.

2.6. Health symptoms

The Revised Sign and Symptoms Checklist for HIV (SSC-HIVrev; (Holzemer et al., 2001) was used to assess health symptoms. Of the original 72-item scale, 64 items were retained that were not sex-specific so could apply to our entire sample. Participants rated the intensity of symptoms they experienced from 0 (no/not at all) to 3 (severe). Cronbach's alpha for the total scale score was 0.97. A variable of the total number of symptoms (possible range 0–64) was derived by summing all symptoms endorsed at any severity, and a maximum symptom severity variable (possible range 0 [lowest severity] to 192 [highest severity]) was created by aggregating the maximum severity score across all the symptoms.

2.7. Data analysis

Descriptive statistics were computed for demographic variables and to better understand clinical factors and physical symptoms. Bivariate analyses were conducted to examine the association between demographic characteristics and trichotomized use of substances (0 substances used, 1 substance used, 2 or more substances used). F-tests were used for continuous factors, chi-square tests were conducted for

categorical factors, and Fisher's exact tests were conducted for variables with cell sizes below 10. To examine the impact of substance use on physical symptoms (total number and maximum severity of symptoms), we conducted multivariable regression models using a stepped approach, controlling only for study wave/site as fixed effects in the first model, and a range of additional clinical and demographic social determinant factors in the second full control model. Negative binomial models were used for count outcomes and ordered logit models were used for ordinal outcomes. We fitted two models for each outcome. In model 1, we only included substance use to evaluate its crude relationships with the outcomes; and in model 2, we further included controlling variables to better evaluate the adjusted associations between substance use and the outcomes. To ensure that model assumptions were not violated by current model specifications, we conducted the likelihood-ratio test for negative binomial models to determine necessity over the Poisson model, and the Brant test for ordered logit models for the assumption of parallel regression. All statistical assumptions were met. Statistical significance was determined at the alpha = 0.05 level; however, when results were significant at a more stringent alpha level of 0.01, those figures are noted as well. To handle the data structure, the cluster robust estimator was used for statistical inference. Analytic procedures were conducted in Stata15.

In summary, our specific aims were to test for the dosage response impact of substance use on HIV-related physical health symptoms controlling for study site, demographic social determinants of health, and clinical factors.

3. Results

One participant was excluded from analyses due to missing data, yielding a sample of $N = 168$. Sixty-five percent of the participants were male, with a mean age of 39.48 years ($SD = 10.31$). Socioeconomically, 34.5 % completed college or more, 60.7 % were not currently working; 39.9 % reported having not enough income, about 15 % reporting just enough income, and 15 % reporting more than enough income. In terms of clinical characteristics, on average, participants had lived with HIV for 5.31 years ($SD = 3.97$), and 15.5 % had received an AIDS diagnosis. The majority (82.7 %) are currently on antiretroviral medication, with a mean CD4 count of 3.70 ($SD = 7.82$). Demographic details are summarized in Table 1.

Table 2 summarizes the results from the two multivariable regression models examining total number of physical symptoms reported by participants as well as the maximal severity of physical symptoms as outcomes. In each multivariable regression model, we entered substance use (with two levels: 1 substance use and 2+ substance use) in Model 1 with study site as the only control variable, and demographic and clinical factors in Model 2 for a full control model. Our results suggest that multiple substance use is associated with a greater total number of physical symptoms (a.IRR = 1.921, 95 % CI: 1.130–3.264, $p < .05$; see Fig. 1) as well as higher maximal severity of physical symptoms (a.OR = 1.596, 95 % CI: 1.776–2.052, $p < .01$; see Fig. 2), an association that remained significant even after controlling for demographic and clinical factors (total symptoms: a.IRR = 1.822, 95 % CI: 1.011–3.283, $p < .05$ and maximal severity: a.OR = 1.901, 95 % CI: 1.511–2.391, $p < .01$).

Table 1
Sample Characteristics and Bivariate Analysis between Substance Use and Selected Variables ($N = 168$).

	Total Sample		0 Substance Use		1 Substance Use		2+ Substance Uses		p-value[a]
	Mean or N	SD or %	Mean or N	SD or %	Mean or N	SD or %	Mean or N	SD or %	
Substance use (n, %)									
0 substance	94	55.95							
1 substance	47	27.98							
2+ substances	27	16.07							
# of total symptoms (mean, SD)	15.99	15.40	11.68	12.56	16.34	14.87	30.96	16.35	< 0.001
Maximal symptom severity (n, %)									0.240
No/Not at all	26	15.48	21	22.34	3	6.38	2	7.41	
Mild	30	17.86	18	19.15	9	19.15	3	11.11	
Moderate	72	42.86	36	38.30	24	51.06	12	44.44	
Severe	40	23.81	19	20.21	11	23.40	10	37.04	
Demographic factors									
Birth sex (n, %)									< 0.001
Male	110	65.48	50	53.19	36	76.60	24	88.89	
Female	58	34.52	44	46.81	11	23.40	3	11.11	
Age (mean, SD)	39.48	10.31	39.55	10.71	38.7	10.39	40.04	8.74	0.845
Education (n, %)									0.054
<College	110	65.48	68	72.34	29	61.70	13	48.15	
≥College	58	34.52	26	27.66	18	38.30	14	51.85	
Work status									0.858
Not working	102	60.71	58	61.70	27	57.45	17	62.96	
Currently working	66	39.29	36	38.30	20	42.55	10	37.04	
Income (n, %)									0.832
Not enough	67	39.88	39	41.49	18	38.30	10	37.04	
Just enough	75	15.48	41	43.62	23	48.94	11	40.74	
More than enough	26	15.38	14	14.89	6	12.77	6	22.22	
Clinical factors									
Year with HIV (mean, SD)	5.31	3.97	5.69	4.22	4.83	3.40	4.93	4.02	0.409
AIDS diagnosis (n, %)									0.609
Ever	26	15.48	16	17.02	5	10.64	5	18.52	
Never	142	84.52	78	82.98	42	89.36	22	81.48	
CD4 level (mean, SD)	3.70	7.82	4.34	10.33	2.99	2.17	2.86	2.33	0.522
On HIV medication (n, %)									0.723
Not currently on	29	17.26	15	15.96	10	21.28	4	14.81	
Currently on	139	82.74	79	84.04	37	78.72	23	85.19	
Study sites									< 0.001
2012 Study	106	63.10	48	51.06	33	70.21	25	92.59	
2015 Study	62	36.90	46	48.94	14	29.79	2	7.41	

a. F-test for continuous factors; Chi-square or Fisher's Exact tests for categorical factors depending on the cell sizes. For any cell size below 10, Fisher's exact tests were used.

Table 2
Results of Multivariable Regression Models with Total Number of Physical Symptoms and Maximal Severity of Physical Symptoms as the Outcome (N = 168).

	Total Number of Physical Symptoms (Negative Binomial Regression)				Maximal Severity of Physical Symptoms (Ordinal Logistic Regression)			
	Model 1[a]		Model 2[b]		Model 1[a]		Model 2[b]	
	a.IRR	95 % CI	a.IRR	95 % CI	a.OR	95 % CI	a.OR	95 % CI
Substance use								
1 Substance use (vs. 0 use)	1.240	(0.805–1.909)	1.166	(0.773–1.758)	1.596**	(1.313–1.94)	1.460**	(1.239–1.721)
2+ Substance uses (vs. 0 use)	1.921*	(1.130–3.264)	1.822*	(1.011–3.283)	1.909**	(1.776–2.052)	1.901**	(1.511–2.391)
Demographic factors								
Female (vs. Male)			0.961	(0.842–1.097)			0.868	(0.569–1.324)
Age			1.006†	(0.999–1.013)			1.001	(0.996–1.007)
≥ College (vs. < College)			1.473†	(0.942–2.304)			1.591	(0.852–2.973)
Work status								
Currently working (vs. Not working)			1.199	(0.835–1.721)			1.529	(0.918–2.548)
Income								
Just enough (vs. not enough)			0.578**	(0.470–0.711)			0.279**	(0.225–0.345)
More than enough (vs. not enough)			0.534**	(0.360–0.793)			0.329**	(0.175–0.618)
Clinical factors								
Year with HIV			1.003**	(1.002–1.005)			1.040†	(0.998–1.085)
AIDS Diagnosis			0.968	(0.853–1.099)			0.775**	(0.719–0.836)
CD4 Level			0.948**	(0.939–0.957)			0.956**	(0.931–0.981)
On HIV Medication (vs. not on med)			0.787	(0.418–1.481)			0.558	(0.235–1.321)
Study sites	5.149**	(4.732–5.604)	4.837**	(4.734–4.941)	3.371**	(2.253–5.043)	3.315**	(2.122–5.181)

a. Model 1: with study sites as the only control variable; b. full control model; † $p < .10$; * $p < .05$; ** $p < .01$.

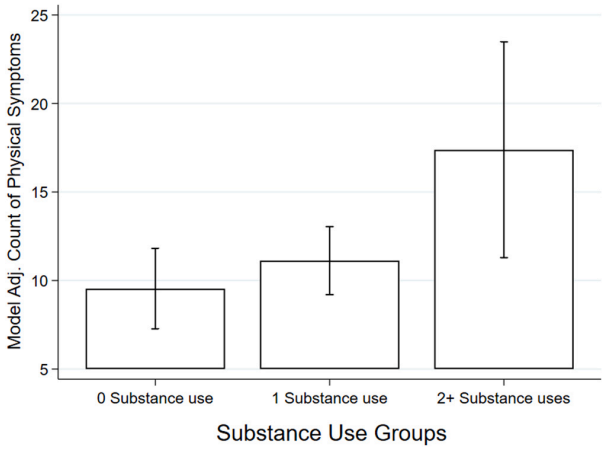

Fig. 1. Model adjusted total number of physical symptoms by substance use groups based on model 2 with total number of physical symptoms as the outcome.

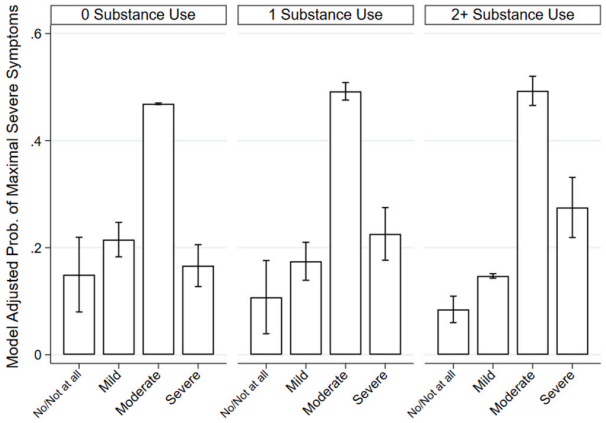

Fig. 2. Model adjusted maximal severity of physical symptoms by substance use groups based on model 2 with maximal severity of physical symptoms as the outcome.

Using only one substance was not significantly associated total number of symptoms in either model, however was associated with maximal severity of physical symptoms in both models (Model 1: a.OR = 1.596, 95 % CI: 1.313–1.940, $p < .01$ and Model 2: a.OR = 1.460, 95 % CI: 1.239–1.721, $p < .01$).

In terms of demographic variables within the full control model, compared to having not enough income, having either just enough or more than enough income was associated with lower total number of physical symptoms (a.IRR = 0.578, 95 % CI: 0.470–0.711, $p < .01$ and a.IRR = 0.534, 95 % CI: 0.360–0.793, $p < .01$ respectively) as well as lower maximal severity of symptoms (a.OR = 0.279, 95 % CI: 0.225–0.345, $p < .01$ and a.OR = 0.329, 95 % CI: 0.175–0.618, $p < .01$ respectively). In terms of clinical factors, years living with HIV was significantly associated with total number of physical symptoms and marginally associated with maximal severity of symptoms.

4. Discussion

In this study, we focused on an intersectional population of persons who are both living with HIV and also concurrently using substances in China, examining the relationship between multiple substance use and physical health symptom frequency and severity. Our findings suggest that using substances is associated with greater total number of physical symptoms as well as increased maximal severity of physical symptoms. In addition, this association appears to have a dosage response effect, as the adjusted odds ratio of experiencing maximal severity of symptoms increases from 1.596 if participants used one substance over the past week to 1.909 if using multiple substances.

We examined these associations controlling for demographic social determinants and clinical factors. In terms of demographic factors, having just enough or more than enough income compared to having not enough income, was associated with lower total number of physical symptoms as well as lower maximal severity. This is not surprising, as those with lower SES have been documented to have poorer health due to less preventative care access among other reasons (Liu et al., 1999). In terms of clinical factors, years of living with HIV was positively associated with total number of physical symptoms as well as marginally associated with maximal severity of physical symptoms, an association above and beyond age (which is generally associated with poorer

health).

There are various factors that may contribute to the association between multiple substance use and poorer physical health visible in our sample of participants living with HIV. First, individuals living with HIV experience significant stigma in China (Rao et al., 2012). Stigma is a well-known barrier to receiving appropriate healthcare, both preventative and curative (Malcolm et al., 1998). Furthermore, persons living with substance use disorder in China also experience stigma (Mak et al., 2015), which affects their health care seeking behaviors as well. Taken together, persons living with HIV and using substances experience double stigma as an intersectional population, which may underlie the relationship observed between substance use and increased physical symptom frequency and severity.

4.1. Limitations

There are several limitations present in this study. First, our substance use variable that was trichotomized to "never using", "using one", or "using two or more" substances in the past week may be highly heterogeneous as the WHO ASSIST scale assesses nine distinct categories of substances, including alcohol and tobacco, in addition to other drugs. Future research with larger sample sizes may be powered to detect unique patterns of association between particular substances and the experience of physical health symptoms. Second, as our study samples represent individuals living with HIV who are located in two major cities of China receiving care at leading infectious disease hospitals, results may not be generalizable to PLWH living in other parts of the country. Future research with broader reach of urban and rural study sites may provide more robust epidemiological data to analyze similar questions. Third, as this is a cross sectional survey study, associations among variables do not imply causality. Indeed, existing literature has posited that experiencing physical health symptoms can contribute to the use of substances to cope. This pattern of behavior is negatively reinforced due to temporary relief experienced from substance use, which may in turn exacerbate poor health and additional physical symptoms (Ostafin & Brooks, 2011). Therefore, while the temporal directionality assumed of substance use leading to physical health symptoms may hold, the alternative of physical symptoms being present first leading to substance use may also be possible.

5. Conclusion

Our findings of a dosage response of multiple substance use and increased total number of physical symptoms as well as maximal severity of physical symptoms compared to those who use a single substance and those who do not use substances point to the importance of assessing for and treating substance use when providing care for individuals living with HIV. Our examination of an intersectional sample contributes to the literature on health disparities affecting this population with co-existing disabilities.

Indeed, addressing substance use issues may greatly improve quality of life for persons living with HIV. Future directions of research may include specifically examining the impact of substance use treatment on physical symptoms experienced by PLWH, and whether reducing substance use can improve health and overall wellbeing.

Ethics approval statement

This study involves human participants and was approved by the institutional boards of University of Washington (Protocol #36129C) and Yale University (Protocol #1207010522).

Author contributions statement

All authors made substantial contributions to this scholarly product. Specifically, JPY led the manuscript conceptualization, wrote the original draft, reviewed and edited subsequent drafts of the article. CSS led and conducted the data analysis as well as contributed to methodological design and manuscript review. WTC led the study design, obtained funding, and reviewed manuscript. LZ, KW, HL, and HZ contributed to methodological design, data collection, and manuscript review. All authors reviewed and approved final article.

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Declaration of competing interest

The authors have no competing interests to disclose.

Data availability

Data are available upon reasonable request. Deidentified participant data as well as a statistical analyses plans are stored in a secure server by the corresponding author. Please email Dr. Wei-ti Chen with inquiries: wchen@sonnet.ucla.edu

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