

RESEARCH ARTICLE

Open Access



The association between involuntary subordination and common mental disorders among men who have sex with men (MSM) in Shanghai, China

Shuxian Zhang^{1†}, Suping Wang^{1†}, Zezhou Wang¹, Ying Wang¹, Xueqin Jiang¹, Gang Xu^{1*} and Yong Cai^{1,2*} 

Abstract

Background: Involuntary subordination is a mechanism that switches off fighting behaviors when a losing organism is unable to continue in a struggle. The study aim was to investigate the association between involuntary subordination and the common mental disorders of anxiety and depression among men who have sex with men (MSM) in Shanghai, China.

Methods: A cross-sectional study was conducted of 547 MSM in four Shanghai districts. Sociodemographic and psychosocial participant data were collected. Logistic regression was used to assess the association between anxiety, depression, and involuntary subordination.

Results: 12.2 and 30.9% Of the MSM demonstrated high levels of anxiety and depression respectively. Univariate analysis showed that involuntary subordination and the involuntary subordination constructs of defeat, social comparison, submissive behavior, and entrapment were associated with anxiety and depression. Multivariate analysis indicated that defeat ($OR_m = 1.091$, 95% $CI = 1.004-1.185$) and entrapment ($OR_m = 1.174$, 95% $CI = 1.079-1.278$) were significantly associated with anxiety. Defeat ($OR_m = 1.265$, 95% $CI = 1.166-1.372$), social comparison ($OR_m = 1.119$, 95% $CI = 1.061-1.181$), entrapment ($OR_m = 1.132$, 95% $CI = 1.047-1.224$), and submissive behavior ($OR_m = 0.897$, 95% $CI = 0.825-0.975$) were significantly associated with depression.

Conclusions: The findings confirmed an association between anxiety, depression, and involuntary subordination among MSM. These findings could form the basis of a new, integrated, and holistic approach to the identification of high-risk groups and the development of interventions for anxiety and depression among MSM.

Keywords: China, Men who have sex with men, Depression, Anxiety, Involuntary subordination

Background

There are much higher rates of depression, anxiety, panic disorders, and substance use disorders in men who have sex with men (MSM) than in heterosexual men [5–7, 26, 35, 36]. Research shows that 60% of MSM in China exhibit symptoms consistent with negative mood, such as extreme tension, depression, anxiety, panic, and loneliness, and 20% of these individuals

report previous suicidal attempts. MSM are a sexual minority group and therefore may not easily be accepted into mainstream society. MSM are subject to institutionalized prejudice, social stress, social exclusion, physical violence, physical harassment, rape, incest, and destruction of personal property, which can negatively affect their psychosocial condition [20, 32]. According to minority stress theory, MSM experience disproportionately burdensome degrees of stigma, prejudice, and discrimination. As a result, they are at risk for increased levels of depression, substance use [27, 28]. Studies have shown that mental disorders like depression and anxiety

* Correspondence: xugang567@sina.com; caiyong202028@hotmail.com

[†]Shuxian Zhang and Suping Wang contributed equally to this work.

¹School of Public Health, Shanghai Jiao Tong University, School of Medicine, No.227, South Chongqing Road, Shanghai 200025, People's Republic of China

Full list of author information is available at the end of the article



contribute to human immunodeficiency virus (HIV) vulnerability and suicidal ideation [18, 23, 24].

According to social rank theory, involuntary subordination is a mechanism that switches off fighting behaviors when a losing organism is unable to continue in a struggle (thus saving the organism from injury). A subordinate individual may feel helpless, hopeless, inferior, and inadequate and exhibit inhibition of thought. Involuntary subordination leads to a redirection of behavior toward the pursuit of more realistic goals and a new position in the social hierarchy ([38, 17]). However, if individuals are incapable of escaping from a defeating situation or cannot accept defeat, involuntary subordination becomes prolonged and maladaptive, and then manifests as major depression and anxiety disorders ([38, 39, 42]). Social rank theory views depression as a natural consequence of prolonged involuntary subordination. Sturman and Mongrain found that involuntary subordination predicts the recurrence of major depression [45]. Involuntary subordination has also been linked to anxiety disorders. Anxious people may have a defense system dominated by frequent social comparisons and a readiness to submit [11, 12, 48, 49].

Early conceptualizations of involuntary subordination defined it as a latent variable derived from entrapment (feeling stuck or trapped and wanting to escape) and poor social comparisons (i.e., feelings of perceived inferiority) [45]. This definition was later considered too narrow and subsequent research has expanded the concept of involuntary subordination to include other constructs. For example, submissive behavior may be associated with involuntary subordination. Taylor has suggested, on theoretical grounds, that defeat should be considered another indicator of involuntary subordination [47]. Therefore, involuntary subordination can be regarded as a range of interconnected feelings and perceptions, including the perception that one is of lower status than others (unfavorable social comparison), the feeling that one has been defeated by a dominant other (social defeat), the feeling that one has no chance to escape an uncontrollable set of circumstances (entrapment), and the perception that one wishes to avoid conflict (submissive behavior) [1, 2, 11, 13]. A confirmatory factor analysis supported this four-variable model of involuntary subordination [44]. This model provides the basis for a new empirical involuntary subordination measure, which draws on items from questionnaire measures of the four variables (unfavorable social comparison, social defeat, entrapment, and submissive behavior) to evaluate involuntary subordination in a more comprehensive way.

Defeat, entrapment, submissiveness, and perceived low status (unfavorable social comparison) are associated with different types of psychopathology through maladaptive functioning of involuntary subordination [13,

15]. However, there is little research on these associations. It also remains unclear whether involuntary subordination, as it reflects social adaptive functions, is associated with psychological problems in sexual minority groups. Therefore, a new focus is needed on the psychological correlates of MSM. The purpose of this study was to investigate symptoms of depression and anxiety among MSM in metropolitan Shanghai, China, and to explore the role of involuntary subordination in depression and anxiety. The primary study hypotheses were (1) involuntary subordination is related to depression and anxiety status and (2) involuntary subordination constructs (defeat, entrapment, submissiveness, and low perceived status) are associated with depression/anxiety. Guided by previous research findings, we used a combined theoretical and empirical approach to examine these hypotheses and generate recommendations for diagnosis and intervention strategies for anxiety and depression among MSM.

Methods

Study population and eligibility criteria

The cross-sectional study was conducted from March to May in 2014 in four districts of Shanghai. With the help of the local Center for Disease Control and Prevention (CDC) and non-governmental organizations (NGOs), we could get easy access to the MSM participants. All participants must be at least 18 years old, biologically male and a and responded “Yes” when asked “Have you ever had anal sex with men in the previous 6 months”. A total of 567 MSM agreed to participate, and 547 participants (response rate of 96%) completed the whole questionnaire.

Recruitment and procedure

As MSM were usually “hidden” populations, the unique “snowball” sampling technique was adopted to obtain participants [8]. The local CDC and NGOs helped us target 5 to 10 so-called “seeds” that met our inclusion criteria. The “seeds” were asked to recruit MSM from the same sociocultural background with them until an adequate sample was obtained. It has been reported that the prevalence of anxiety or depression is about 20 to 60% among MSM. With an expected rate of 40%, the sample size of 512 MSM is allowed for the calculation of a 95% confidence interval with a precision of $\pm 6\%$ and a design effect of 2.

The anonymous face-to-face interviews are divided into two parts. First, our outreach interviewers were requested to introduce the goal and procedure of the study as well as the potential risks before the participants signed the informed consent. Then, every participant was asked to complete a self-administered questionnaire in 30 min independently in a private room. Commute

expense compensation was given to the participant to increase compliance.

Sociodemographic variables

Sociodemographic data included age, income, marital status (refers to only heterosexual marriage), employment status, place of residence, education level, self-reported sexual orientation, whether one had voluntary HIV counseling and testing in the past 6 months, and the HIV test results.

Psychological variables

Depression

The Center for Epidemiologic Studies Depression scale (CES-D) was used to measure clinically significant depression symptoms [4, 33]. It is a 20-item Likert-type scale. Participants were asked how often they had experienced depressive symptoms within the past week, rated from 0 (less than a day or never) to 3 (5 to 7 days); higher total scores indicate severer depression (Cronbach's alpha coefficient = 0.891; range 0–57). A cut-off point of score 22 was adopted based on recent validation research [41].

Anxiety

The Generalized Anxiety Disorder 7-item scale (GAD-7) was used to measure generalized anxiety disorder [19, 40]. It is a 7-item likert-type scale. Participants were asked how often they had experienced anxiety symptoms in the past 2 weeks, rated from 0 (not at all) to 3 (nearly every day); higher total scores indicate severer generalized anxiety disorder (Cronbach's alpha coefficient = 0.922; range 0–21). A cut-off point of score 10 was adopted based on previous research [40].

Involuntary subordination

Involuntary subordination was measured using the 32-item Involuntary Subordination Questionnaire (ISQ) [44]. The ISQ comprises four subscales representing the dimensions of defeat, entrapment, perceived social comparison, and submissiveness. Sturman selected the eight items with the highest item–total correlations from the Defeat Scale (DS) [13], the Entrapment Scale (ES) [13], the Social Comparison Rating Scale (SCRS) [1], and the Submissive Behavior Scale (SBS) [14] to develop the ISQ. The following are example items from each scale: DS, “I feel that I have not made it in life” and “I feel that I have lost my standing in the world”; ES, “I am in a situation I feel trapped in”; SCRS, “I feel that I am more confident than other people”; and SBS, “I let others criticize me or put me down without defending myself.” The four scales are rated on response scales that vary from 5 points to 10 points. To create a cohesive scale, the response options for all the

items selected for the ISQ were changed to a Likert format, as follows: 1 = strongly disagree, 2 = disagree, 3 = neutral (neither agree nor disagree), 4 = agree, and 5 = strongly agree; higher total scores indicate higher levels of involuntary subordination (Cronbach's alpha coefficient = 0.915; range 35–136). Higher scores on each subscale indicate higher levels of perceived defeat (Cronbach's alpha = 0.879; range 8–40), entrapment (Cronbach's alpha = 0.869; range 8–40), and submissiveness (Cronbach's alpha = 0.632; range 8–40), and lower levels of perceived social comparison (Cronbach's alpha = 0.780; range 1–29).

Statistical analysis

Statistical analysis was performed using SPSS Statistics (version 23.0 for Windows, IBM, Armonk, NY, USA). Baseline descriptive statistics were calculated to summarize sociodemographic characteristics and psychosocial variables. Then, univariate analysis was performed using binary logistic regression to detect the association between sociodemographic variables and depression/anxiety, as well as between each involuntary subordination variables and depression/anxiety. Then, the univariate logistic regression analysis was used to examine the association between depression, anxiety, and involuntary subordination among MSM after adjusting for significant sociodemographic variables. Following that, a forward stepwise multivariate logistic regression was used to evaluate the multiple risk factors associated with depression/anxiety after adjusting for significant sociodemographic variables. We chose logistic regression other than multiple linear regression because it was more likely to have practical significance. The odd ratio represented the extents that variables influenced the risk of depression or anxiety while the regression coefficient reflected the degrees that variables influenced the score of CES-D or GAD-7. Multicollinearity was assessed using the post-hoc variance inflation factor method. We planned to conduct a ridge regression if multicollinearity was found in the diagnostics.

Results

Table 1 summarizes the associations between sociodemographic characteristics and depression/anxiety among MSM. The 547 MSM who completed the survey had a mean age of 30.5 years (range 17.3–65.3); 79.3% of the participants reported never having been married and 5.7% were divorced or widowed. Most (71.3%) reported being homosexual. HIV test outcomes were 5.9, 80.2, and 13.9% for positive, negative, and unknown, respectively. Binary logistic regression showed a significant relationship between the sociodemographic variable of education level and depression. Individuals with a college level or higher level of education had a lower level

Table 1 Sociodemographic characteristics and their associations with psychosocial variables for MSM participants in Shanghai (N = 547)

Socio-demographics	Number of the participants N (col%)	Depression		Anxiety	
		N (row%)	ORu (95%CI)	N (row%)	ORu (95%CI)
<i>Age group (years)</i>					
< 25	148 (27.1)	41(27.7)	0.748(0.396–1.415)	20(13.5)	1.228(0.491–3.071)
25–40	337 (61.6)	107(31.8)	0.908(0.512–1.612)	40(11.9)	1.058(0.451–2.483)
> 40	62 (11.3)	21(33.9)	1	7(11.3)	1
<i>Employment status</i>					
Employed	447 (81.7)	137(30.6)	1	54(12.1)	1
Unemployed	100 (18.3)	32(32.0)	1.065(0.668–1.697)	13(13.0)	1.087(0.569–2.080)
<i>Highest education level</i>					
Senior high school or less	157 (28.7)	62(39.5)	1	21(13.4)	1
College degree or above	390 (71.3)	107(27.4)	0.579(0.392–0.855)**	46(11.8)	0.866(0.498–1.506)
<i>Current marital status</i>					
Married	82 (15.0)	24(29.3)	1	12(14.6)	1
Single	434 (79.3)	132(30.4)	1.056(0.629–1.773)	50(11.5)	0.760(0.385–1.499)
Divorced or widowed	31 (5.7)	13(41.9)	1.745(0.740–4.114)	5(16.1)	1.122(0.360–3.494)
<i>Income</i>					
< 3000	133 (24.3)	48(36.1)	1	23(17.3)	1
3000–6000	211 (38.6)	66(31.3)	0.806(0.510–1.274)	23(11.8)	0.643(0.348–1.187)
> 6000	203 (37.1)	55(27.1)	0.658(0.411–1.053)	19(9.4)	0.494(0.257–0.948)*
<i>Residence status</i>					
Local	147 (26.9)	38(25.9)	1	14(9.5)	1
Non-local	400 (73.1)	131(32.8)	1.397(0.914–2.135)	53(13.3)	1.451(0.779–2.703)
<i>Self-reported sexual orientation</i>					
Non-homosexual	157 (28.7)	44(28.0)	1	17(10.8)	1
Gay/ homosexual	390 (71.3)	125(32.1)	1.211(0.805–1.822)	50(12.8)	1.211(0.675–2.173)
<i>Have had a VCT</i>					
No	250 (45.8)	79(31.6)	1	30(12.0)	1
Yes	296 (54.2)	90(30.4)	0.946(0.657–1.361)	37(12.5)	1.048(0.627–1.752)
<i>HIV test outcome</i>					
Positive	24 (5.9)	5(20.8)	1	3(12.5)	1
Negative	330 (80.2)	96(29.1)	1.559(0.566–4.295)	35(10.6)	0.831(0.236–2.926)
Unknown	54 (13.9)	68(35.2)	2.067(0.739–5.781)	29(15.0)	1.238(0.347–4.419)

ORu Univariate odds ratio; 95% CI 95% confidence interval; VCT Voluntary HIV counseling and testing. * $p < 0.05$, ** $p < 0.01$

of depression ($ORu = 0.579$, 95% $CI = 0.392–0.855$). Binary logistic regression showed a significant relationship between the sociodemographic variable of income and anxiety. Individuals earning more than 6000 yuan per month had a lower level of anxiety ($ORu = 0.494$, 95% $CI = 0.257–0.948$).

Psychosocial health conditions among men who have sex with men

Table 2 summarizes scores on the psychosocial health measures; 12.2% of participants showed high-level

generalized anxiety disorder and 30.9% had experienced clinically significant depression symptoms.

Table 3 shows that participants in the high-level group of anxiety or depression demonstrated more involuntary subordination and more perceived defeat, entrapment, submissive behavior, and unfavorable social comparisons.

Table 4 shows the correlations between involuntary subordination and psychosocial variables. Scores on the ISQ and all four ISQ subscales were significantly correlated with depression and anxiety scores.

Table 2 Frequency distributions of psychosocial variables for MSM participants (N = 547)

Psychosocial variables	Number	Percent%
<i>GAD-7-anxiety</i>		
Low level (score < 10)	480	87.8
High level (score > =10)	67	12.2
<i>CES-D-depression</i>		
Low level (score < 22)	378	69.1
High level (score > =22)	169	30.9

GAD-7 Generalized Anxiety Disorder 7-item scale, *CES-D* Center for Epidemiologic Studies Depression scale

Association between involuntary subordination and depression

Table 5 summarizes the results of the binary regressions. After adjusting for education level, all four scales (DS, ES, SCRS, and SBS) and the ISQ showed a significant association with depression. Participants who reported a sense of defeat (*AOR* = 1.352, 95% *CI* = 1.280–1.428), entrapment (*AOR* = 1.272, 95% *CI* = 1.216–1.333), social comparison (*AOR* = 1.170, 95% *CI* = 1.123–1.220), submissiveness (*AOR* = 1.164, 95% *CI* = 1.108–1.223), and involuntary subordination were at increased risk of depression. The multivariate logistic regression showed that all the variables remained significantly associated with depression: defeat (*ORm* = 1.265, 95% *CI* = 1.166–1.372), social comparison (*ORm* = 1.119, 95% *CI* = 1.061–1.181), and entrapment (*ORm* = 1.132, 95% *CI* = 1.047–1.224). However, submissive behavior showed a reverse association with depression in the multivariate logistic regression (*ORm* = 0.897, 95% *CI* = 0.825–0.975). The multicollinearity diagnostics showed a variance inflation factor no greater than 10, so we concluded that the four involuntary subordination variables made independent contributions to the involuntary subordination score.

Association between involuntary subordination and anxiety

Table 6 summarizes the results of the binary regressions. After adjusting for income level, all four scales (DS, ES,

SCRS, and SBS) and the ISQ showed a significant association with anxiety. Participants who reported a sense of defeat (*AOR* = 1.236, 95% *CI* = 1.171–1.304), social comparison (*AOR* = 1.089, 95% *CI* = 1.039–1.145), submissiveness (*AOR* = 1.225, 95% *CI* = 1.142–1.314), entrapment (*AOR* = 1.256, 95% *CI* = 1.188–1.329), and involuntary subordination (*AOR* = 1.086, 95% *CI* = 1.064–1.110) were at increased risk of depression. The multivariate logistic regression showed that only two variables remained significantly associated with anxiety: defeat (*ORm* = 1.091, 95% *CI* = 1.004–1.185) and entrapment (*ORm* = 1.174, 95% *CI* = 1.079–1.278).

Discussion

Our findings indicated a high prevalence of psychosocial problems among MSM in Shanghai, China. Almost one third of the participants (30.9%) suffered from depression; the prevalence of depression in the general adult population in China is 2.06%. The findings also showed that anxiety was more prevalent in our sample (12.2%) than in the general population in China (1.32%) [31]. The results of the current study indicate that the MSM population experiences poor mental health. As expected, all ISQ components were related to depression and anxiety among MSM.

The significant associations found here between socio-demographic variables and depression and anxiety support previous findings. MSM who have a higher education level are less likely to have depression symptoms. Education improves well-being in men, because it increases work creativity and a sense of control and provides payoffs, such as feelings of dominance and earning capacity [34]. We found that income was associated with anxiety disorders; a pattern consistent with previous study findings [10]. Previous research indicates that low income is linked to distress, because it functions as an indirect proxy for social rank [9, 52].

Involuntary subordination manifests as clinical depression and anxiety disorders when individuals cannot accept their new social position following failure in competition [38, 39]. Involuntary subordination, as a

Table 3 Involuntary subordination in different psychosocial groups

Variable	<i>GAD-7-anxiety</i>				<i>p</i>	<i>CESD-depression</i>				<i>p</i>
	Low level		High level			Low level		High level		
	(N ₁ = 480)		(n ₁ = 67)			(N ₂ = 378)		(n ₂ = 169)		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Defeat	16.74	5.588	23.955	5.695	< .001	15.286	4.808	22.852	5.32	< .001
Social Comparison	20.59	5.526	23.119	4.673	< .001	19.603	5.383	23.799	4.54	< .001
Submissive Behavior	21.552	4.366	25.105	3.993	< .001	21.143	4.257	23.876	4.377	< .001
Entrapment	19.063	5.949	26.746	5.218	< .001	17.759	5.406	25.024	5.477	< .001
Involuntary Subordination	77.944	16.965	98.925	14.715	< .001	73.791	15.296	95.55	14.335	< .001

GAD-7 Generalized Anxiety Disorder 7-item scale, *CES-D* Center for Epidemiologic Studies Depression scale, *M* mean, *SD* Standard deviation

Table 4 Correlations between involuntary subordination and psychosocial variables

Variable	M	SD	1	2	3	4	5	6	7
1. Defeat	17.623	6.076	–						
2. Social Comparison	20.899	5.488	.415**	–					
3. Submissive Behavior	21.987	4.473	.616**	.122**	–				
4. Entrapment	20.004	6.380	.860**	.384**	.661**	–			
5. Involuntary subordination	80.514	18.057	.919**	.609**	.725**	.923**	–		
6. Anxiety	4.673	4.460	.507**	.261**	.331**	.536**	.521**	–	
7. Depression	17.159	10.712	.666**	.440**	.367**	.620**	.668**	.650**	–

M mean, SD Standard deviation. **Significant Pearson correlation ($p < 0.01$, two-tailed)

reflection of social strata at the community level, affects psychological and emotional factors at an individual level. Recent research has clarified the role of social adaptive functions in psychological problems. Depression has been viewed as a mechanism that reduces social risk [3] and social loss [22], and solves social problems through rumination, agitation, and the seeking of social support [51].

All the involuntary subordination variables were associated with both depression and anxiety after adjusting for sociodemographic factors. This could be explained by the relatively high comorbidity of depression and anxiety and the overlap between the symptomatology and neurology of these disorders [30]. Allan and Gilbert have demonstrated that poor social comparison is associated with higher levels of interpersonal sensitivity and depression in both nonclinical student and psychiatric inpatient groups [16]. Sturman and Mongrain [43], have shown that internal and external entrapment account for about 50% of the variance in self-reported levels of depression. Depressed individuals have a strong desire to escape from aversive thoughts or external circumstances and perceive their situation as uncontrollable. One study found that submissive behavior (labeled as “subassertive”) was associated with various psychological problems (e.g., depression and social anxiety) [21]. One systematic review [46] has confirmed that defeat and entrapment both play a central role in depressive symptoms, anxiety, and suicidality.

The present findings showed that defeat, entrapment, low perceived status, and submissiveness were still significantly associated with depression after adjusting for sociodemographic factors. However, only defeat and entrapment were significantly associated with anxiety in both the univariate and multivariate regression models. Although anxiety and depression may share common evolutionary origins [29], some research indicates that anxiety and depression have different functions in the involuntary subordination process. Whereas depression helps to avoid future defeat, anxiety promotes reconciliation, increases sensitivity to possible threats, and focuses on future attacks that would result in loss of status [37]. The perception of defeat begins with an initial evaluation of the current situation followed by a perception of entrapment (and a decision whether to escape or not). Submissiveness and low perceived status suggest that positive self-appraisals such as self-worth and adequacy are absent, whereas defeat and entrapment indicate that negative cognitions are overactivated. Research suggests that depression is a complex combination of high negative affectivity and low positive affectivity, but that anxiety is only correlated with high negative affectivity [50]. Moreover, we found that submissive behavior was a protective factor for depression in the multivariate regression models. It may be that submissive behavior plays a vital role in group cohesion and the control of agonistic behavior [25],

Table 5 The association between involuntary subordination and depression for MSM participants (N = 547)

Variable	ORu (95%CI)	AOR (95%CI)	ORm (95%CI)
Defeat	1.347(1.277–1.422)**	1.352(1.280–1.428)**	1.265(1.166–1.372)**
Social Comparison	1.175(1.128–1.224)**	1.170(1.123–1.220)**	1.119(1.061–1.181)**
Submissive Behavior	1.170(1.114–1.229)**	1.164(1.108–1.223)**	0.897(0.825–0.975)*
Entrapment	1.275(1.218–1.334)**	1.272(1.216–1.333)**	1.132(1.047–1.224)**
Involuntary subordination	1.113(1.092–1.136)**	1.115(1.093–1.138)**	

CI Confidence interval; ORu Univariate odds ratio, AOR Adjusted OR, odds ratios adjusted for highest education level; ORm Odds ratio obtained from forward stepwise multivariate logistic regression using significant variables from the univariate analysis as input. * $p < 0.05$, ** $p < 0.01$

Table 6 The association between involuntary subordination and anxiety for MSM participants ($N = 547$)

Variable	ORu (95%CI)	AOR (95%CI)	ORm (95%CI)
Defeat	1.232(1.170–1.298)**	1.236(1.171–1.304)**	1.091(1.004–1.185)*
Social Comparison	1.091(1.039–1.146)**	1.089(1.039–1.145)**	
Submissive Behavior	1.226(1.143–1.314)**	1.225(1.142–1.314)**	
Entrapment	1.253(1.186–1.324)**	1.256(1.188–1.329)**	1.174(1.079–1.278)**
Involuntary subordination	1.084(1.063–1.107)**	1.086(1.064–1.110)**	

ORu Univariate odds ratio, AOR Adjusted OR, odds ratios adjusted for income; ORm Odds ratio obtained from forward stepwise multivariate logistic regression using significant variables from the univariate analysis as input. * $p < 0.05$, ** $p < 0.01$

maintains the individual's social position, and redirects behavior toward more productive pursuits.

These findings could form the basis of a new, integrated, and holistic approach to the identification of high-risk groups and the development of interventions for anxiety and depression among MSM. MSM may improve their social status and increase their self-efficacy and resilience through targeted interventions. Further research like a prospective cohort study can be designed to validate the exact causal relationship between involuntary subordination, anxiety and depression. Randomized controlled trials can be designed to explore intervention strategies for these common mental disorders among MSM. In addition, an open and tolerant social environment is required for MSM and other sexual minority groups.

Limitations

Several study limitations should be acknowledged in drawing conclusions from the results. First, because this was a cross-sectional study, causality cannot be inferred from these results. That is, we cannot determine whether involuntary subordination causes depression and anxiety. It remains for future longitudinal research to determine whether and how involuntary subordination is involved in the onset, maintenance, and recovery from depression and anxiety. Second, the snowball sampling technique we used may have caused selection bias. However, this method is commonly used in targeting hard-to-reach populations. More studies are needed with larger sample sizes to validate our conclusions. Finally, all data were self-reported and participants' responses may not have been completely honest; biases in self-reported data are inevitable.

Conclusions

Our findings provide evidence of the prevalence of specific psychosocial problems among MSM in Shanghai, China. MSM are more likely to be depressed or anxious. This may have implications for mental healthcare services and social support for MSM. This study used an evolutionary framework to understand the relationship

between mental disorders and involuntary subordination. As such, it offers a new, innovative perspective on the association between individual psychological problems and social rank problems.

Abbreviations

CDC: Center for Disease Control and Prevention; CES-D: Center for Epidemiologic Studies Depression scale; CI: Confidence interval; DS: Defeat Scale; ES: Entrapment Scale; GAD-7: Generalized Anxiety Disorder 7-item scale; HIV: Human immunodeficiency virus; ISQ: Involuntary Subordination Questionnaire; M: Mean; MSM: Men who have sex with men; N: Number; NGO: Non-governmental organization; OR: Odds ratio; SBS: Submissive Behavior Scale; SCRS: Social Comparison Rating Scale; SD: Standard deviation; VCT: Voluntary human immunodeficiency virus counseling and testing

Acknowledgments

We are grateful to the individuals who volunteered their time to participate the study. We thank Diane Williams, PhD, from Liwen Bianji, Edanz Group China (www.liwenbianji.cn/ac), for editing the English text of a draft of this manuscript.

Authors' contributions

All authors contributed the design of this research. SZ and GX drafted the manuscript. SW was involved in the interpretation of the data and performed statistical analyses. ZW, XJ, YW played a major role in the field survey. YC made a substantial contribution to the interpretation of the data and were involved in revision of the manuscript through all stages. All authors read and approved the final manuscript.

Funding

This work was sponsored by the National Natural Science Funds (71673187, 71603166), Shanghai Pujiang Program (14PJJC076), Social Cognitive and Behavioral Sciences program of Shanghai Jiao Tong University(14JCRY03), Cross-study Research Foundation about Medicine and Engineering of Shanghai Jiao Tong University (YG2014QN23). The funding body played no role in the design of the study and collection, analysis, and interpretation of data and in writing the manuscript.

Availability of data and materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

The whole research process strictly complied with American Psychological Association ethical standards and with the Code of Ethics of the World Medical Association (Declaration of Helsinki). Written informed consent was obtained from all participants before the study began. This study was approved by the Ethics Committee of the School of Public Health at Shanghai Jiao Tong University.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Author details

¹School of Public Health, Shanghai Jiao Tong University, School of Medicine, No.227, South Chongqing Road, Shanghai 200025, People's Republic of China. ²Shanghai Jiao Tong University Institute of Social Cognitive and Behavioral Sciences, No. 800, Dongchuan Road, Shanghai 200240, People's Republic of China.

Received: 25 December 2018 Accepted: 17 October 2019

Published online: 27 November 2019

References

- Allan S, Gilbert P. A social comparison scale: psychometric properties and relationship to psychopathology. *Pers Individ Dif*. 1995;19(3):293–9.
- Allan S, Gilbert P. Submissive behaviour and psychopathology. *Br J Clin Psychol*. 1997;36(4):467–88.
- Allen NB, Badcock PB. The social risk hypothesis of depressed mood: evolutionary, psychosocial, and neurobiological perspectives. *Psychol Bull*. 2003;129(6):887–913.
- Cheung CK, Bagley C. Validating an American scale in Hong Kong: the Center for Epidemiological Studies Depression Scale (CES-D). *J Psychol*. 1998;132:169–86. <https://doi.org/10.1080/00223989809599157>.
- Cochran SD, Mays VM. Lifetime prevalence of suicide symptoms and affective disorders among men reporting same-sex sexual partners: results from NHANES III. *Am J Public Health*. 2000a;90(4):573–8.
- Cochran SD, Mays VM. Relation between psychiatric syndromes and behaviorally defined sexual orientation in a sample of the US population. *Am J Epidemiol*. 2000b;151(5):516–23.
- Cochran SD, Mays VM, Sullivan JG. Prevalence of mental disorders, psychological distress, and mental health services use among lesbian, gay, and bisexual adults in the United States. *J Consult Clin Psychol*. 2003;71(1):53–61.
- Deuba K, Ekström AM, Shrestha R, Ionita G, Bhatta L, Karki DK. Psychosocial health problems associated with increased HIV risk behavior among men who have sex with men in Nepal: a cross-sectional survey. *PLoS One*. 2013; 8(3):e58099.
- Diaz RM, Ayala G, Bein E, Henne J, Marin BV. The impact of homophobia, poverty, and racism on the mental health of gay and bisexual Latino men: findings from 3 US cities. *Am J Public Health*. 2001;91(6):927–32.
- Dijkstrakersten SM, Biesheuvelleliefeld KE, Jc VDW, Penninx BW, van Marwijk HW. Associations of financial strain and income with depressive and anxiety disorders. *J Epidemiol Community Health*. 2015;69(7):660.
- Gilbert P. *Depression: the evolution of powerlessness*. New York: Guilford Press; 1992a.
- Gilbert P. *Human nature and suffering*: Guilford Press; 1992b.
- Gilbert P, Allan S. The role of defeat and entrapment (arrested flight) in depression: an exploration of an evolutionary view. *Psychol Med*. 1998;28(3):585–98.
- Gilbert P, Allan S. Assertiveness, submissive behaviour and social comparison. *Br J Clin Psychol*. 2011;33(3):295–306.
- Gilbert P, Allan S, Brough S, Melley S, Miles JNV. Relationship of anhedonia and anxiety to social rank, defeat, and entrapment. *J Affect Disord*. 2002; 71(1):141–51.
- Gilbert P, Allan S, Trent DR. Involuntary subordination or dependency as key dimensions of depressive vulnerability? *J Clin Psychol*. 1995;51(6):740–52.
- Gilbert P. The evolution of social attractiveness and its role in shame, humiliation, guilt and therapy. *Br J Med Psychol*. 1997;70(2): 113–147.
- Guadamuz TE, Mccarthy K, Wimonasate W, Thienkrua W, Varangrat A, Chaikummao S, et al. Psychosocial health conditions and HIV prevalence and incidence in a cohort of men who have sex with men in Bangkok, Thailand: evidence of a syndemic effect. *Aids Behav*. 2014;18(11):2089.
- He X, Li C, Qian J, Cui H, Wu W. Reliability and validity of a generalized anxiety disorder scale in general hospital outpatient. *Shanghai Arch Psychiatry*. 2010;22:200–3.
- Hershberger SL, D'Augelli AR. The impact of victimization on the mental health and suicidality of lesbian, gay, and bisexual youths. *Dev Psychol*. 1995;31(1):65–74.
- Horowitz LM, Rosenberg SE, Baer BA, Ureno G, Villasenor VS. Inventory of interpersonal problems: psychometric properties and clinical applications. *J Consult Clin Psychol*. 1988;56(6):885–92.
- Keller MC, Nesse RM. The evolutionary significance of depressive symptoms: different adverse situations lead to different depressive symptom patterns. *J Pers Soc Psychol*. 2006;91(2):316–30.
- Kelly B, Raphael B, Judd F, Perdices M, Kernutt G, Burnett P, et al. Suicidal ideation, suicide attempts, and HIV infection. *Psychosomatics*. 1998;39(5):405.
- Li R, Cai Y, Wang Y, Sun Z, Zhu C, Tian Y, et al. Psychosocial syndemic associated with increased suicidal ideation among men who have sex with men in Shanghai, China. *Health Psychol*. 2016;35(2):148–56. <https://doi.org/10.1037/hea0000265>.
- Maclean PD. *The triune brain in evolution*: Springer; 1990.
- Mays VM, Cochran SD. Mental health correlates of perceived discrimination among lesbian, gay, and bisexual adults in the United States. *Am J Public Health*. 2001;91(11):1869–76.
- Meyer IH. Minority stress and mental health in gay men. *J Health Soc Behav*. 1995;36(1):38–56.
- Meyer IH. Prejudice, social stress, and mental health in lesbian, gay, and bisexual populations: conceptual issues and research evidence. *Psychol Bull*. 2003;129(5):674–97.
- Nesse R. Emotional disorders in evolutionary perspective. *Br J Med Psychol*. 1998;71(4):397–415.
- Nesse RM. Is Depression an Adaptation? *Arch Gen Psychiatry*. 2000;57(1):14–20.
- Phillips MR, Zhang J, Shi Q, Song Z, Ding Z, Pang S, et al. Prevalence, treatment, and associated disability of mental disorders in four provinces in China during 2001–05: an epidemiological survey. *Lancet*. 2009;373(9680):2041.
- Puckett JA, Newcomb ME, Garofalo R, Mustanski B. The impact of victimization and neuroticism on mental health in young men who have sex with men: internalized homophobia as an underlying mechanism. *Sex Res Social Policy*. 2016;13(3):193–201. <https://doi.org/10.1007/s13178-016-0239-8>.
- Radloff LS. The CES-D scale a self-report depression scale for research in the general population. *Appl Psychol Meas*. 1977;1(3):385–401.
- Ross CE, Mirowsky J. Sex differences in the effect of education on depression: resource multiplication or resource substitution? *Soc Sci Med*. 2006;63(5):1400–13. <https://doi.org/10.1016/j.socscimed.2006.03.013>.
- Safren SA, Reisner SL, Herrick A, Mimiaga MJ, Stall RD. Mental health and HIV risk in men who have sex with men. *J Acquir Immune Defic Syndr*. 2010;55(Suppl 2):S74–7. <https://doi.org/10.1097/QAI.0b013e3181fbc939>.
- Sandfort TG, de Graaf R, Bijl RV, Schnabel P. Same-sex sexual behavior and psychiatric disorders: findings from the Netherlands mental health survey and incidence study (NEMESIS). *Arch Gen Psychiatry*. 2001;58(1):85–91.
- Sloman L. A new comprehensive evolutionary model of depression and anxiety. *J Affect Disord*. 2008;106(3):219–28.
- Sloman L, Price JS. Losing behavior (yielding subroutine) and human depression: proximate and selective mechanisms. *Ethol Sociobiol*. 1987; 8(87):99–109.
- Sloman L, Price J, Gilbert P, Gardner R. Adaptive function of depression: psychotherapeutic implications. *Am J Psychother*. 1994;48(3):401–16.
- Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med*. 2006;166(10):1092.
- Stall R, Mills TC, Williamson J, Hart T, Greenwood G, Paul J, et al. Association of co-occurring psychosocial health problems and increased vulnerability to HIV/AIDS among urban men who have sex with men. *Am J Public Health*. 2003;93(6):939–42.
- Stevens A, Price J. *Evolutionary Psychiatry*. In: *Medical Microbiology*. 2nd ed; 2000.
- Sturman E, Mongrain M. Self-criticism and major depression: an evolutionary perspective. *Br J Clin Psychol*. 2005;44(Pt 4):505.
- Sturman ED. Involuntary subordination and its relation to personality, mood, and submissive behavior. *Psychol Assess*. 2011;23(1):262–76. <https://doi.org/10.1037/a0021499>.
- Sturman ED, Mongrain M. The role of personality in defeat: a revised social rank model. *Eur J Pers*. 2008;22(1):55–79.
- Taylor PJ, Gooding P, Wood AM, Tarrrier N. The role of defeat and entrapment in depression, anxiety, and suicide. *Psychol Bull*. 2011;137(3):391–420.
- Taylor PJ, Wood AM, Gooding P, Johnson J, Tarrrier N. Are defeat and entrapment best defined as a single construct? *Pers Individ Dif*. 2009;47(7):795–7.
- Trower P, Gilbert P. New theoretical conceptions of social anxiety and social phobia. *Clin Psychol Rev*. 1989;9(1):19–35.

49. Trower, P., Gilbert, P., & Sherling, G. Social anxiety, evolution, and self-presentation. In *Handbook of social and evaluation anxiety*. Boston: Springer; 1990. 11–45.
50. Watson D, Clark LA, Carey G. Positive and negative affectivity and their relation to anxiety and depressive disorders. *J Abnorm Psycho*. 1988;97(3):346.
51. Watson PJ, Andrews PW. Toward a revised evolutionary adaptationist analysis of depression: the social navigation hypothesis. *J Affect Disord*. 2002;72(1):1–14.
52. Wolff BC, Santiago CD, Wadsworth ME. Poverty and involuntary engagement stress responses: examining the link to anxiety and aggression within low-income families. *Anxiety Stress Coping*. 2009;22(3):309.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Ready to submit your research? Choose BMC and benefit from:

- fast, convenient online submission
- thorough peer review by experienced researchers in your field
- rapid publication on acceptance
- support for research data, including large and complex data types
- gold Open Access which fosters wider collaboration and increased citations
- maximum visibility for your research: over 100M website views per year

At BMC, research is always in progress.

Learn more biomedcentral.com/submissions

