

Original Research

The characteristics of the vulnerable Chinese gay men with depression and anxiety: a cross-sectional study

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Abstract

Background and objective: Depression and anxiety are the most common mental disorders for human health, especially for gay men. This study aimed to assess the status and characteristics of Chinese gay men who were vulnerable to depression, anxiety, or the comorbidity of the two disorders. **Material and methods:** A total of 367 samples from a cross-sectional survey conducted between November and December 2017 were included. The Chinese version of SCL-90-R was used to measure the levels of anxiety and depression. The unadjusted associations of demographic characteristics with anxiety, depression, and comorbidity were evaluated by chi-square test. The most predictive factors of the respondents' depression, anxiety and the comorbidity were identified using multivariable logistic regression models. **Results:** The prevalence rates of depression, anxiety, and comorbidity were 36.51%, 27.79%, and 26.16%, respectively among gay men. Age, being the only child at home, personal monthly income, sexual orientation disclosure status, and source of participants were related to the prevalence of depression, anxiety, and comorbidity (all $p < 0.05$). **Conclusions:** Depression and/or anxiety are highly prevalent among Chinese gay men. Prevention strategies should be developed to target the related factors in the gay men population to thwart or slow down the situation. It is also crucial for social and family members to increase the acceptance of Chinese gay men.

Keywords: Chinese gay men; Depression; Anxiety; Comorbidity; Characteristics

1. Introduction

Mental disorders, a worldwide public health issue, are an increasingly significant barrier to human health. Depression and anxiety as types of mental disorders are currently the most common in the world [1,2]. According to the World Health Organization (WHO), almost 322 million people suffered from depression globally, and its proportion was estimated to be 4.4% in 2015. Meanwhile, about 264 million people suffered from anxiety disorders, accounting for 3.6% of the global population. In China, the prevalence rates of depression and anxiety were 4.2% and 3.1%, respectively [2]. Depression and anxiety are the two major causes of other diseases and disability worldwide.

Furthermore, depression and anxiety share many common symptoms and often occur as comorbid illnesses, which indicates that people might experience both conditions simultaneously [1–3]. Previous studies have proven that depression, anxiety, and their comorbidity could lead to physical diseases, such as cancer, diabetes mellitus, and cardiovascular disease [4,5]. Besides, the comorbidity was associated with poorer course trajectories of diseases and was more harmful than the single symptom of depression or anxiety. For instance, comorbid anxiety and depression could increase the risk of other diseases, and patients with the comorbidity had a higher risk of suicidal ideations and/or behaviors [6,7]

Notably, more recent studies on mental health have mainly focused on vulnerable groups, such as unpaid people [8,9] and victims of violence [10]. Yet, few scholars have paid close attention to the mental health status of sexual minorities. Sexual minorities have long been susceptible to be misunderstood, excluded, discriminated and antagonized as compared to heterosexual individuals [11–17]. In recent years, some European countries and the United States have gradually changed their attitudes towards homosexuals, and some of them completed the legalization of same-sex marriage. However, in many countries, such as developing countries in Asia and Africa, which are deeply affected by religion and traditional ideology, homosexuals are still hard to get public support and favorability [13,14,18,19]. Therefore, though current research on homosexuals in most developed countries represented by European countries and America has shifted their focus from physical health to mental health, relevant studies are still underrepresented in Asia and Africa. China has lots of deep-rooted conventional concepts against homosexuals since ancient times, such as “no descendants are the greatest unfilial crime”, “a wife must submit to her husband” [13,14]. This will undoubtedly negatively impact the mental health status of homosexuals in China, especially gay men. There is scant literature towards homosexuals and most of them mainly focused on men who have sex with men (MSM) and virus carriers of



sexually transmitted diseases (STDs) in China [20,21]. In recent years, although some researchers have studied the psychological health of homosexuals, such as the influence of stigmatization, homophobia, and other social negative attitudes towards homosexuals [22], there have been few research on gay men with specific psychological disorders like depression or anxiety, especially their comorbidity.

China is home to the largest group of homosexuals, because of its largest population in the world. The largest gay social network in China reported that there were about 70 million Chinese homosexuals in 2015 [23]. However, influenced by homosexual stigma and traditional conception that overemphasizes heterosexual marriage, fertility, and filial piety, there is a great prejudice against homosexuals from their families, especially for Chinese gay men, because men are usually considered responsible for carrying on the family line. Since gay men cannot meet this expectation, most of them fail to attain their parents' approval or understanding of their sexual orientation [11,13,16,24,25]. Considering the consequences brought by mainstream ideology, many Chinese gay men conceal their sexual orientation, and some even choose to be in a lavender marriage to avoid harm, stigma, discrimination, and condemnation from society and family [11,12,14–16]. Therefore, Chinese gay men were vulnerable to anxiety or depression, even the symptoms of both anxiety and depression. To fill the current research gap, we conducted this cross-sectional survey to assess the anxiety and/or depression status of Chinese gay men and summarize the characteristics of those who are susceptible to anxiety and/or depression.

2. Methods

2.1 Research design and setting

This study is a cross-sectional survey that collected data in both online and offline ways. The online survey was launched in November and terminated in December 2017. Participants were recruited by sending questionnaire links to specialized online dating apps (including Blueed, Gaypark, Tantan, etc.). We also shared the links to some related internet gay groups, such as QQ and WeChat groups. The offline survey was conducted in several pilot sites in Yunnan Province with the help of the Chinese Center for Disease Control and Prevention (China CDC). On the front page of the questionnaire, we informed that participation in this study was totally voluntary and anonymous, with no incentives provided to the respondents. Only those who self-identified as gay could be included. Meanwhile, those who self-identified as bisexual, had sex with other men for other purposes (curiosity, commercially), or had been diagnosed with psychiatric disorders were excluded.

Considering the difficulty of finding the Chinese gay men group, we adopted convenience sampling and snowball sampling. All questionnaires were finished by volunteers themselves. Finally, we received 298 online questionnaires and 78 offline questionnaires, respectively. In order

to ensure data accuracy, a logic error-check inference to the online questionnaires was conducted to screen whether consistent answers and blank content exist. There were nine online questionnaires excluded, and the effective rate of the responses was 96.98%. Offline questionnaires collected by China CDC met the inclusion and exclusion criteria and were all valid. We used double-entry and validation by the EpiData 3.1 software (EpiData Association, Copenhagen, Denmark) to create the offline dataset and to ensure data accuracy.

2.2 Measures

The online survey was conducted in an anonymous chat style, while the offline survey used a face-to-face interview in China CDC's pilot sites. The interview took about 10–15 minutes. The questionnaire used in this study consists of the following parts:

2.2.1 Social demographics

Eight questions in Part one inquired about general information such as age, household registration, education level, whether they were the only child at home, monthly income, years of identifying sexual orientation, numbers of current sexual partners, sexual orientation disclosure status and source of participants. Age was classified into five categories: less than 20 years old, between 20 and 24 years old, between 25 and 29 years old, between 30 and 34 years old, at and over 35 years old. Household registration was classified as countryside and city. Education level was divided into junior high school, high school, college, over post-graduate. Being the only child at home and sexual orientation disclosure status was classified into yes and no, respectively. Personal monthly income (Chinese Yuan, CNY) was divided into four groups: <3000 CNY, 3001–5000 CNY, 5001–7000 CNY, >7000 CNY. Years of sexual orientation's identification were classified as 0, 1, 2, ≥ 3 . The source of participants was classified into offline and online.

2.2.2 The Chinese version SCL-90-R

We selected two dimensions (depression and anxiety) from the Chinese version of the Symptom Checklist-90-R (SCL-90-R), which has been proven good reliability and validity by many Chinese researchers [22,26,27]. The two dimensions are used to reflect whether the tester has experienced symptoms related to clinical depression and anxiety [28]. There were thirteen questions in SCL-90-R inquiring about depression, such as loss of sexual interest or pleasure, feeling low in energy, etc. Ten questions in SCL-90-R inquired about anxiety, including nervousness or shakiness inside, trembling, etc. All questions utilized a 5-point Likert scale (1 = not at all, 2 = a little bit, 3 = moderately, 4 = quite a bit, 5 = extremely). We classified questions scored less than three into a negative level, and those scored three or greater into a positive level.

Table 1. Sample demographics (n = 367).

Independent variables	Frequency	Percentage (%)
Age		
<20	73	19.89
20–24	75	20.43
25–29	87	23.71
30–34	54	14.72
≥35	78	21.25
Household registration		
Countryside	173	47.14
City	194	52.86
Education level		
≤Junior high school	36	9.81
High school	102	27.79
College	189	51.50
≥Post-graduate	40	10.90
Being the only child in the family		
No	206	56.13
Yes	161	43.97
Personal monthly income (CNY)		
<3000	140	38.15
3001–5000	92	25.07
5001–7000	62	16.89
>7000	73	19.89
Years of sexual orientation's identification		
≤3	101	27.52
4–6	74	20.16
7–9	65	17.72
≥10	127	34.60
Number of current sexual partners		
0	144	30.24
1	111	30.25
2	55	14.99
≥3	57	15.52
Sexual orientation disclosure status		
No	209	56.95
Yes	158	43.05
Source of participants		
Offline	78	21.25
Online	289	78.75
Dependent variables		
Depression		
Negative	233	63.49
Positive	134	36.51
Anxiety		
Negative	265	72.21
Positive	102	27.79
Comorbidity		
Negative	271	73.84
Positive	96	26.16

2.2.3 Statistical analysis

We used the Statistical Package for Social Sciences (SPSS) version 22.0 (SPSS Inc., Chicago, IL, USA) to analyze study data. The alpha level was set at 0.05 Unadjusted associations between demographic characteristics and depression and/or anxiety detection rates were statistically analyzed using chi-square tests. A non-conditional forward stepwise multiple logistic regression was employed to confirm possible factors associated with depression and/or anxiety. The results were presented as an odds ratio (OR) value with a 95% confidence interval (95% CI).

2.2.4 Ethical review

This study was conducted in accordance with the Declaration of Helsinki. Wuhan University's School of Health Science approved this study (MS2017024). China CDC reviewed this study and offered us great help in the offline data collection process.

3. Results

Table 1 shows the demographics of the 367 Chinese gay men. There were 68.86% of the respondents (n = 216) aged 20 to 34 years. The majority (n = 194) were from urban areas. A total of 229 respondents (62.40%) had a college or higher level of education. Over half of the participants (56.13%) were the only child in their families. The majority (63.22%) earned 5000 CNY or less per month, while 73 respondents (19.89%) had more than 7000 CNY per month. One hundred and twenty seven respondents (34.60%) self-identified their sexual orientation for 10 years or more, and 57 respondents (15.52%) had more than two sexual partners. Most Chinese gay men (56.95%) were not willing to disclose their sexual orientation publicly. The prevalence rates of depression and anxiety were 36.51% and 27.79%, respectively, and 26.16% of the participants had the two disorders at the same time.

Table 2 illustrates an unadjusted relationship between the two mental disorders and the demographics of the participants. The Chi-square test proved that the respondents' depressive disorder was significantly associated with age ($\chi^2 = 56.518, p < 0.001$), educational level ($\chi^2 = 30.987, p < 0.001$), being the only-child ($\chi^2 = 93.323, p < 0.001$), personal monthly income ($\chi^2 = 60.662, p < 0.001$), number of current sexual partners ($\chi^2 = 52.929, p < 0.001$), sexual orientation disclosure ($\chi^2 = 91.514, p < 0.001$) and source of participants ($\chi^2 = 42.087, p < 0.001$). Age ($\chi^2 = 46.067, p < 0.001$), educational level ($\chi^2 = 19.006, p < 0.001$), being the only-child ($\chi^2 = 76.523, p < 0.001$), personal monthly income ($\chi^2 = 31.502, p < 0.001$), number of current sexual partners ($\chi^2 = 35.271, p < 0.001$), sexual orientation disclosure ($\chi^2 = 59.990, p < 0.001$) and source of participants ($\chi^2 = 25.354, p < 0.001$) were common factors affecting participants' anxiety (all p -values < 0.001). Table 2 also shows that the comorbidity of anxiety and depression was significantly affected by age ($\chi^2 = 42.073, p <$

Table 2. Demographics vs. participants who suffered from depression, anxiety and the comorbidity of the two disorders.

Variables	Depression			Anxiety			Comorbidity		
	Negative (233)	Positive (134)	χ^2 (<i>p</i>)	Negative (265)	Positive (102)	χ^2 (<i>p</i>)	Negative (271)	Positive (96)	χ^2 (<i>p</i>)
Age									
<20	55	18		59	14		59	14	
20–24	54	21		65	10		65	10	
25–29	30	57	56.518 (<0.001)	41	46	46.067 (<0.001)	44	43	42.073 (<0.001)
30–34	28	26		34	20		35	19	
≥35	66	12		66	12		68	10	
Household registration									
Countryside	104	69	1.605 (0.205)	120	53	1.318 (0.251)	120	52	2.577 (0.108)
City	129	65		145	49		150	44	
Educational level									
≤Junior high school	13	23		20	16		22	14	
High school	52	50	30.987 (<0.001)	62	40	19.006 (<0.001)	63	39	18.170 (<0.001)
College	134	55		149	40		151	38	
≥Post-graduate	34	6		34	6		35	5	
Being the only child in the family									
No	175	31	93.323 (<0.001)	186	20	76.523 (<0.001)	188	18	73.774 (<0.001)
Yes	58	103		79	82		83	78	
Personal monthly income (CNY)									
≤3000	100	40		106	34		110	30	
3001–5000	32	60	60.662 (<0.001)	49	43	31.502 (<0.001)	50	42	34.458 (<0.001)
5001–7000	35	27		43	19		43	19	
>7000	66	7		67	6		68	5	
Years of sexual orientation’s identification									
≤3	57	44		68	33		68	33	
4–6	45	29	4.440 (0.218)	57	17	2.122 (0.548)	57	17	3.129 (0.372)
7–9	43	22		47	18		50	15	
≥10	88	39		93	34		96	31	
Number of current sexual partners									
0	61	83		81	63		82	62	
1	84	27	52.929 (<0.001)	93	18	35.271 (<0.001)	94	17	42.486 (<0.001)
2	50	5		50	5		53	2	
≥3	38	19		41	16		42	15	
Sexual orientation disclosure status									
No	89	120	91.514 (<0.001)	118	91	59.990 (<0.001)	122	87	60.139 (<0.001)
Yes	144	14		147	11		149	9	
Source of participants									
Offline	74	4	42.087 (<0.001)	74	4	25.354 (<0.001)	77	1	31.733 (<0.001)
Online	159	130		191	98		194	95	

0.001), educational level ($\chi^2 = 18.170, p < 0.001$), being the only-child generation ($\chi^2 = 73.774, p < 0.001$), personal monthly income ($\chi^2 = 34.458, p < 0.001$), number of current sexual partners ($\chi^2 = 42.486, p < 0.001$), sexual

orientation disclosure ($\chi^2 = 60.139, p < 0.001$) and source of participants ($\chi^2 = 31.733, p < 0.001$).

The odds ratios (ORs) obtained from the multivariable logistic regression models with the 95% confidence inter-

Table 3. Associations between demographic characteristics and depression, anxiety and the comorbidity of the two disorders.

Variables	Depression			Anxiety			Comorbidity		
	OR	95% CI	<i>p</i>	OR	95% CI	<i>p</i>	OR	95% CI	<i>p</i>
Age									
<20	0.724	(0.12, 4.30)	0.723	0.199	(0.04, 1.02)	0.053	0.284	(0.05, 1.76)	0.176
20–24	1.115	(0.20, 6.15)	0.901	0.143	(0.03, 0.75)	0.021	0.161	(0.03, 0.94)	0.043
25–29	9.013	(1.81, 44.88)	0.007	1.927	(0.54, 6.83)	0.310	1.341	(0.34, 5.25)	0.674
30–34	6.313	(1.57, 25.31)	0.009	1.775	(0.56, 5.62)	0.329	1.413	(0.69, 3.20)	0.306
≥35	-	-	-	-	-	-	-	-	-
Household registration									
Countryside	0.875	(0.39, 1.93)	0.741	1.222	(0.58, 2.57)	0.597	1.491	(0.69, 3.20)	0.306
City	-	-	-	-	-	-	-	-	-
Educational level									
≤Junior high school	4.221	(0.59, 29.86)	0.149	0.540	(0.10, 3.05)	0.485	0.433	(0.07, 2.78)	0.378
High school	2.532	(0.49, 12.86)	0.263	1.060	(0.23, 4.97)	0.941	1.027	(0.19, 5.49)	0.976
College	1.795	(0.42, 7.56)	0.426	0.999	(0.25, 4.06)	0.999	0.873	(0.18, 4.06)	0.862
≥Post-graduate	-	-	-	-	-	-	-	-	-
Being the only child in the family									
No	0.376	(0.18, 0.79)	0.010	0.343	(0.16, 0.73)	0.005	0.371	(0.17, 0.83)	0.015
Yes	-	-	-	-	-	-	-	-	-
Personal monthly income (CNY)									
≤3000	4.859	(1.15, 20.50)	0.031	15.183	(3.40, 67.76)	<0.001	9.409	(1.97, 44.85)	0.005
3001–5000	7.666	(1.87, 31.42)	0.005	5.495	(1.39, 21.62)	0.015	5.751	(1.31, 25.12)	0.020
5001–7000	3.786	(1.01, 14.16)	0.048	2.862	(0.78, 10.49)	0.112	3.874	(0.95, 15.80)	0.059
>7000	-	-	-	-	-	-	-	-	-
Years of sexual orientation's identification									
≤3	3.405	(0.78, 14.71)	0.101	1.877	(0.54, 6.51)	0.321	2.441	(0.63, 9.51)	0.198
4–6	1.224	(0.33, 4.52)	0.761	0.587	(0.19, 1.73)	0.335	0.733	(0.23, 2.33)	0.598
7–9	0.683	(0.17, 2.75)	0.592	0.814	(0.25, 2.68)	0.734	0.601	(0.17, 2.13)	0.430
≥10	-	-	-	-	-	-	-	-	-
Number of current sexual partners									
0	2.300	(0.78, 6.78)	0.131	1.099	(0.42, 2.87)	0.847	1.150	(0.43, 3.03)	0.777
1	1.430	(0.45, 4.58)	0.548	0.660	(0.21, 2.07)	0.476	0.594	(0.18, 1.93)	0.387
2	0.530	(0.16, 2.75)	0.592	0.730	(0.19, 2.68)	0.637	0.210	(0.04, 1.23)	0.083
≥3	-	-	-	-	-	-	-	-	-
Sexual orientation disclosure status									
No	3.464	(1.51, 7.96)	0.003	3.858	(1.59, 9.33)	0.003	4.021	(1.54, 10.51)	0.005
Yes	-	-	-	-	-	-	-	-	-
Source of participants									
Offline	0.042	(0.01, 0.16)	<0.001	0.061	(0.02, 0.24)	<0.001	0.017	(0.01, 0.14)	<0.001
Online	-	-	-	-	-	-	-	-	-

vals (CIs) and *p*-values were listed in Table 3. From the multivariable logistic regression, we found that age, being the only child, personal monthly income, sexual orientation disclosure and source of participants were the most significant predictors to the prevalence of anxiety and depression. Compared with gay men aged ≥35, those aged 25–29 (OR = 9.013, 95% CI = 1.81–44.88) and those aged 30–34 (OR = 6.313, 95% CI = 1.57–25.31) were more likely to suffer from depression. While those who aged 20–24 were less

prone to anxiety (OR = 0.143, 95% CI = 0.03–0.75) when compared with participants age over 35 years old. Those who were not the only child in their family felt less depressive (OR = 0.376, 95% CI = 0.18–0.79) and anxious (OR = 0.343, 95% CI = 0.16–0.73). Besides, compared with persons who had personal monthly income >7000 CNY, those who earned ≤7000 CNY per month felt more depressive (≤3000: OR = 4.859, 95% CI = 1.15–20.50; 3001–5000: OR = 7.666, 95% CI = 1.87–31.42; 5001–7000: OR

= 3.786, 95% CI = 1.01–14.16), and those with personal monthly income ≤ 5000 CNY were more likely to experience anxiety (≤ 3000 : OR = 15.183, 95% CI = 3.40–67.76; OR = 5.495, 95% CI = 1.39–21.62). Chinese gay men who kept their sex orientation confidential and who were the online participants felt more depressive and anxious than those who disclosed their sexual orientation (all $p < 0.05$).

Factors affecting the comorbidity also included age, being the only child, personal monthly income, sexual orientation disclosure, and source of participants. Specifically, compared with gay men aged ≥ 35 , those aged from 20 to 24 were less likely to have the comorbidity (OR = 0.161, 95% CI = 0.03–0.94). Gay men who were not the only child at home (OR = 0.371, 95% CI = 0.17–0.83) were less likely to experience the comorbidity, while gay men who earned monthly income ≤ 5000 had more chance to suffer from the comorbidity (≤ 3000 : OR = 9.409, 95% CI = 1.97–44.85; OR = 5.751, 95% CI = 1.31–25.12). Chinese gay men who did not disclose their sexual orientation (OR = 4.021, 95% CI = 1.54–10.51) had a higher risk of comorbidity than those who disclose their sexual orientation. We also found that the offline participants were less likely to have the comorbidity (OR = 0.017, 95% CI = 0.01–0.14) than online participants.

4. Discussion

This study is the first report revealing the current status of, and demographic factors associated with depression and/or anxiety among gay men in China. This study showed a markedly high level of depression, anxiety, and the comorbidity among Chinese gay men, which indicated worrisome circumstances of their psychological issues.

A substantial amount of research in Europe and America has compared the LGBTQ (Lesbians, Gays, Bisexuals, Transgender, Queer) with heterosexuality about the two disorders' prevalence [29,30]. In the present study, the prevalence rates of depression and anxiety among gay men were 36.51% and 27.79%, respectively, which were higher than heterosexuality. A relevant study conducted in Sweden [31] showed a much lower prevalence of depression (19.1%) and anxiety (6.4%) among Swedish gay men. The reason may be linked to the full support and recognition towards gay marriage from over 75% of Swedish [19]. In fact, the detection rates of the current study were still much higher than most studies in Europe and America, as a meta-analysis of European and North American sexual minority reported [30]. We speculate that it may be due to the deep-rooted traditional ideology overemphasizing marriage and fertility, in which many Chinese, especially the older generation, usually marginalize non-heterosexual individuals [13,16,22]. A Chinese traditional proverb has represented the importance of continuing bloodlines, stating that no child is the most unfilial act, suggesting Chinese men's responsibility to pass on their family names. Therefore, this sexual orientation is contrary to social-cultural and family expectations,

which may cause bad consequences, such as family breakdown and friends' alienation [13,32].

Family pressure is regarded as the biggest concern of Chinese gay men [33,34], which may create a significant psychological burden for Chinese gay men. A previous study has also reported that parental rejection may cause a lasting impact on sexual minority adults' mental health [35]. Therefore, Chinese gay men are more likely to conceal their sexual orientation, which is consistent with our results that 56.95% of the respondents kept their sexual orientation confidential. Previous literature have also provided evidence to the assumption above that most Chinese gay men are not willing to disclose their sexuality to others, including family members, friends, colleagues and employers, because they are afraid of the stigma and social discrimination from people in their lives [11,13–15,36].

In this study, Chinese gay men with hidden sexual orientation were three times more likely to suffer from anxiety and/or depression than those who disclosed their sexuality. It may be attributed to the fact that Chinese gay men may worry about the consequences of disclosing their sexual orientation, such as family rejection [37] and discrimination at the workplace [38,39]. Our research revealed that Chinese gay men aged 25–34 years were most vulnerable to depression, which was inconsistent with previous studies in other countries that LGBT (Lesbians, Gays, Bisexuals, Transgender) at older age experienced more prejudice [12,40], but gay men in China aged 20–24 years reported a lower level of anxiety and the comorbidity. We assumed that gay men aged 25–34 years may face the pressure of both marriage and workload (or study load). It is common in China that once children reach marriageable age (between the ages of 25–34 in China), their parents would possibly force them to get married. The age of 25–34 is a time when students start to look for a job after graduation and show their ambitions at work, while most of Chinese gay men aged 20–24 years were still at school and may have less pressure than people who worked, hence less risk of anxiety and the comorbidity. It is necessary for the society, especially family members, to be more acceptable and treat Chinese gay men equally. The local mental health professionals may also cooperate with CDC and help Chinese gay men develop their own identity with individualized strategies [41] to relieve their anxiety and/or depression caused by sexual orientation.

This study also found that those who were the only child in their families were especially vulnerable to suffer from depression, anxiety, and even both of these two disorders. We infer that the only child in their families may face greater pressure of getting married and having children to pass on their family names, as compared to those having siblings [22]. With the implementation of the one-child policy in China since 1978, there are many families with the only child. Therefore, it is necessary for the government to take effective actions, such as legislating to protect

gay men's rights. Not surprisingly, the current study also revealed that lower personal income was associated with a poorer mental health condition. We also found participants who accepted our survey online had a higher possibility to develop depression, anxiety, and the comorbidity. Sexual minorities are more active in social media than heterosexuals [42], and previous studies have also proven that the LGBT who were dependent on online social media had more psychiatric symptoms and lower self-esteem than those who liked offline social activities [43,44]. Thus it is understandable that gay men who agreed to participate in the online survey had a higher level of anxiety and/or depression. In addition, gay men who disclose their sexual orientation may confront with more social stigmas and conflict [14,45], thus aggravating their stress and psychological problems. These may also be the reasons that gay men were more depressive and/or anxious because the proportion of online samples (44.29%) who disclosed sexual orientation was higher than offline samples (38.46%) in our study. Therefore, we suggest that the society should carry out offline activities to raise awareness of gay men and increase their social acceptance.

In view of the scant exploration of Chinese gay men's mental health, the literature available for reference is limited. The current study, as one of the few studies in this field, had the following limitations: firstly, for the reason that it is difficult to find enough samples of Chinese gay and for the purpose of protecting their privacy, we adopted non-random sampling to distribute questionnaires both online and offline, which may lead to a certain bias. For instance, participants should have the ability to use the web or gay dating apps, which resulted in the young age of our sample that 64.03% of participants were under 30 years old. We cannot guarantee that the results are completely uniform among older gay males. Secondly, the cross-sectional investigation only considered the current mental health status of Chinese homosexual men, whereas neglecting dynamically changing social, familial, or ecological factors. We also overlooked the causality between the mental disorders and the independent variables. Thirdly, we did not assess the non-response rate because many online questionnaires did not get replies. Additionally, the results may be underestimated, since volunteers who participated in this investigation were more likely to be outgoing and cheerful, and squint towards better mental health status than those who refused our surveys. Thus, the application of our findings needs to be done with caution. The limitations above-mentioned should be considered in future studies.

5. Conclusions

The present study indicated that Chinese gay men had a high prevalence of depression, anxiety, and comorbid anxiety and depression. Age, being the only child, personal monthly income, sexual orientation disclosure status, and source of participants are significantly related to the

prevalence of depression and/or anxiety. To better address the mental health issues of Chinese gay men, joint efforts from the public, social organizations and the government are needed. We, therefore, call for more social acceptance and understanding from the society and family members, and more prevention strategies, such as building more psychological counseling institutions and more offline infrastructure for Chinese gay men. In addition, more in-depth research in depression and/or anxiety for Chinese gay men is needed.

Abbreviations

WHO, World Health Organization; MSM, men who have sex with men; STDs, sexually transmitted diseases; China CDC, Chinese Center for Disease Control and Prevention; SCL-90-R, Symptom Checklist-90-R; SPSS, Statistical Package for the Social Sciences; OR, odds ratio; 95% CI, 95% confidence interval; CNY, Chinese Yuan; LGBTQ, Lesbians, Gays, Bisexuals, Transgender, Queer; LGBT, Lesbians, Gays, Bisexuals, Transgender, Queer.

Author contributions

Both authors XL, DJ designed the study and wrote the protocol, and revised the paper. Author DJ collected information from Chinese gay men and conducted the statistical analysis. Author XL conducted literature searches and wrote the first draft of the manuscript. Author XL and DJ reviewed and edited the manuscript. All authors contributed to and have approved the final manuscript.

Ethics approval and consent to participate

Ethical approval was granted by the Ethics Committee in Wuhan University, China (MS2017024).

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Conflict of interest

The authors declare no conflict of interest.

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