Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company’s public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
The impact of COVID-19 pandemic on mental health in gay, bisexual, and other men who have sex with men in China: Difference by HIV status

Chenglin Hong a,*, Fei Yu b, Hui Xue b, Dapeng Zhang c, Guodong Mi b

a Department of Social Welfare, UCLA Luskin of Public Affairs, Los Angeles, United States
b Danlan Beijing Media Limited, Beijing, China
c National Center for AIDS/STD Control and Prevention, Chinese Center for Disease Control and Prevention, China

ARTICLE INFO
Keywords:
Men who have sex with men
Mental health
HIV
COVID-19
Depression
China

ABSTRACT
Population-based measures and public health response to stem the spread of the coronavirus may have caused unintended isolation and increased the risk of psychiatric illnesses. The objective of this study is to assess psychological distress among gay, bisexual, and other men who have sex with men (MSM) in China during the COVID-19 pandemic and examine whether these mental health outcomes differ by HIV status. Data were derived from a cross-sectional survey on the impact of COVID-19 on users of Blued, the largest gay social networking app in July 2020. All active users on Blued were invited to complete a survey regarding sexual behaviors, HIV prevention and treatment service utilization, and various health and mental health outcomes. Among all participants (n = 1205), over half (53.2%) of the participants screened mild to severe psychological distress: 34.9% screened mild, 11.6% screened moderate, and 6.6% screened severe psychological distress. Of all participants, 20.9% met the criteria for anxiety and 19.6% for depression. Psychological distress was associated with younger age having a degree below college, being unemployed, and having lower income. MSM with HIV were more likely to report depression or anxiety compared to HIV negative/unknown status MSM after adjusting for study covariates (AOR = 1.80, 95%CI 1.01–3.26; AOR = 2.04, 95%CI 1.11–3.67, respectively). MSM in China experience a high burden of psychological distress during the COVID-19 pandemic. Integrated HIV treatment and mental health services are needed to provide adequate and timely mental health support to MSM living with HIV.

1. Introduction
Population-based measures and public health response to stem the spread of the coronavirus may have caused unintended isolation and increased the risk of psychiatric illnesses. A recent systematic review revealed the high rates of depression, anxiety, stress, and other psychological distress in the general population (Xiong et al., 2020). Fear, social isolation, and loneliness during this unprecedented time also contribute to worsening mental health outcomes among more vulnerable populations, such as sexual and gender minorities, including gay, bisexual, and other men who have sex with men (MSM), a population that is already disproportionately impacted by adverse mental health conditions due to experiences of discrimination, homophobia, sexism, and other minority stressors (Meyer, 2003). Emerging evidence has documented the unique concerns and challenges in accessing health-care, HIV prevention and care services, and mental health well-being experienced by MSM since the pandemic began (Hong et al., 2021; Kamal et al., 2021; Santos et al., 2022).

Indeed, MSM already had higher psychological burdens such as anxiety, depression, and post-traumatic stress disorder (PTSD) than their heterosexual counterparts before the pandemic (Meyer, 2003; Ross et al., 2018). This is particularly true in China, where MSM experience additional stressors and rejections from their families due to the traditional culture that overemphasizes the value of marriage and fertility (Liu et al., 2018). These vulnerabilities highlight the importance of assessing the impact of physical distancing and lockdown measures on their mental health during the pandemic when social distancing policies dictate leaving home only for essential activities. However, to our knowledge,
no investigation has measured the psychological distress among this vulnerable population in mainland China since the pandemic began, and little is known about the factors associated with poor mental health outcomes during the COVID-19 crisis.

One potential factor that could exacerbate MSM’s underlying mental health issues is HIV infection (Geesa and Roberts, 2001). In many settings, MSM live in communities and societies where gay sexual orientation and HIV infection are strongly stigmatized (Starks et al., 2013). Numerous studies have demonstrated the elevated rates of depression, anxiety, and PTSD among MSM living with HIV around the globe, due to reasons such as lack of social support (Collins et al., 2006; Jones et al., 2021; Tabler et al., 2021). There is also emerging evidence demonstrating the disproportionately high levels of depression and anxiety symptoms experienced by people living with HIV (PLWH) since the pandemic began (Jones et al., 2021; Marbaniang et al., 2020; Sieve Fodjo et al., 2020). In China, Sun et al. found that PLWH reported high depressive and anxiety symptoms during the COVID-19 (Sun et al., 2020). However, the study was not specifically among MSM living with HIV and how these psychological distresses were measured is unknown. These considerations suggested the need and value assess the mental health issues among Chinese MSM during the pandemic. Therefore, this study aimed to examine the prevalence of depression and anxiety among MSM during the COVID-19 pandemic and their associated factors. We also sought to understand whether mental health outcomes differ by HIV status among Chinese MSM recruited online.

2. Material and methods

2.1. Study design and recruitment

We conducted a cross-sectional survey in July 2020 on Blued, a geosocial networking (GSN) app for MSM in China. Recruitment occurred through the built-in advertising function within the app, including advertising banners, pop-up messages, clickable links, etc. The survey was primarily advertised to Blued users in Beijing and Chengdu, but it was open to all Blued users. Potential participants were asked if they would like to participate in a short survey. Those who indicated interest and clicked the link were directed to a survey platform designed by Sojump within the Blued app for further study information and eligibility screening. Eligible criteria for the study include male gender at birth, current Blued user, and aged 18 and above. All eligible participants provided informed consent electronically before completing the online survey. To be eligible for this current analysis, we limited the sample to those who reported being gay or bisexual and completed the questionnaire on mental health. The study protocol and procedures were approved by the Institution Review Board of the Beijing Center for Disease Prevention and Control.

2.2. Measures

Psychological distress. A 4-item Patient Health Questionnaire (PHQ-4) was used to measure anxiety and depression symptoms among the participants, which was previously validated in other Chinese populations (Xiong et al., 2015). The questionnaire asked about the frequency of being bothered by nervousness, worry, depression, and loss of interest in the past two weeks. Response options include (0) not at all; (1) several days; (2) more than half of the day; (3) nearly every day. A total score is determined by the sum of the 4 items and ranges from 0 – 12. Psychological distress was categorized as normal (0–2), mild (3–5), moderate (6–8), and severe (9–12). A score of 3 or higher for the first 2 items suggests anxiety symptoms, and a score of 3 or higher for the last 2 items indicates depression symptoms. Cronbach’s alpha in the sample was 0.92, indicating very good internal consistency of the items in our sample.

Self-reported HIV status. Participants were asked, “What was the result of your last HIV test?” (negative, positive, I don’t know, I am not sure). The variable was then dichotomized into I = HIV positive and 0 = HIV negative/unknown.

Sociodemographic characteristics. Participants were asked to report their age, residing city, sexual orientation, gender identification, highest education level, employment status, and income level. Participants were also asked about their relationship status and substance use history over the past 6 months.

2.3. Data analysis

Descriptive statistics were reported using frequency measures. We used bivariate analyses to examine associations between sociodemographic characteristics, substance use, and self-reported HIV status. In addition, we used a multivariable logistic regression model to examine the association between anxiety and depression with self-reported HIV status, adjusting for significant variables at p < 0.05 in bivariate analyses. Data were analyzed using R software.

3. Results

3.1. Participant characteristics

A total of 1308 MSM completed the survey, of whom 1205 participants were eligible for this analysis. Among those, 4.7% (n = 59) self-reported being HIV positive. The average age of participants was 31.40 (SD = 8.73, range:18–70). Nearly eighty percent (79.7%) were identified as gay, and 96.8% were cis-gender males. Most participants had some college degree (69.1%) and were employed (79.9%). About half (52.0%) had a monthly income of 7000 RMB or higher (~$1000 USD). Over thirty (30.6%) were in a primary relationship, and 32.2% reported having used substances in the past six months (see Table 1).

3.2. Psychological distress and associated factors

PHQ-4 scores indicated that over half (53.2%) of the participants screened mild to severe psychological distress: 34.9% screened mild, 11.6% screened moderate, and 6.6% screened severe psychological distress. Of all participants, 20.9% met the criteria for anxiety and 19.6% for depression. The correlation between anxiety and depression was 0.84. Complete descriptive characteristics of PHQ-4 items and GAD2 & PHQ2 subscales were in Table 3.

In bivariate analyses, being screened for anxiety was associated with younger age, being gay (vs. bisexual), being transgender, having a degree below college, being unemployed (vs. employed), and having lower income (<3000 RMB vs. >10,000 RMB), and self-reported being HIV positive (p < 0.05 for all). All these factors were significantly associated with depression as well (p < 0.05 for all). Mental health outcomes did not differ by relationship status and recent substance use.

3.3. Depression and anxiety by HIV status

MSM living with HIV reported significantly higher rates of psychological distress (63.7% vs. 52.7%, p < 0.05). Specifically, the prevalence of anxiety and depression among MSM self-reported positive was significantly higher than those who were HIV negative or unknown status (35.6% vs. 20.2%, 35.6 vs. 18.8%, p < 0.05 for both). In multivariable analyses, self-reported HIV positive was significantly associated with being screened for anxiety and depression (AOR = 1.80, 95%CI 1.01–3.26; AOR = 2.04, 95%CI 1.11–3.67, respectively), adjusting for age, sexual orientation, gender identity, education level, employment status, and income level (see Table 2).

4. Discussion

This study is among the first to examine the mental health status among MSM in China during the COVID-19 pandemic. Overall, the
prevalence of psychological distress was high, with more than half of the respondents reporting mild to severe psychological distress, which was higher than findings before the pandemic in this population (Fu et al., 2020; Su et al., 2018). These findings were consistent with studies on the impact of COVID-19 on mental health in sexual and gender minorities in Hong Kong, the U.S., and the U.K. (Gonzales et al., 2020; Kneale and Bécares, 2020; Suen et al., 2020). Our finding highlighted the ways that the COVID-19 pandemic may exacerbate underlying mental health issues experienced by Chinese MSM. China was among the first countries to implement strict social distancing orders to control the COVID-19 transmission. These measures required MSM to stay at home, resulting in further social isolation and a lack of social connections and community support compared to pre-pandemic (Suen et al., 2020). This is particularly concerning given that MSM living in China already had limited access to mental health support and resources due to various barriers before the pandemic (Liu et al., 2018). Further research on how to provide appropriate mental health services and care among Chinese MSM is warranted.

Similar to pre-pandemic, socioeconomic status (SES) was significantly associated with mental health outcomes among sexual and gender minorities (Liu et al., 2018; Shangani et al., 2020). In our analyses, MSM reported having lower SES, such as lower education level, lower-income level, and unemployment were more likely to experience psychological distress during the pandemic. This is especially important given the severe economic impact and consequences experienced by MSM due to the COVID-19, such as loss of employment, reductions in income, and food insecurity (Santos et al., 2022). The fear of losing jobs, financial insecurity, and inability to cover basic needs may be additional stressors during this unprecedented time. Our study adds to the literature substantially by indicating the critical role of SES on psychological health among sexual and gender minorities. Interventions to promote mental health well-being should consider addressing the socioeconomic and structural inequalities to maximize the effort and the long-term effect (Rojas-García et al., 2015).

Table 1
Characteristics and associations with depression and anxiety among Chinese gay, bisexual, and other men who have sex with men (n = 1251).

| Characteristic                  | N (%)          |
|--------------------------------|----------------|
| Age (years)                    | 31.40 (8.73)   |
| City                           |                |
| Beijing                        | 682 (54.5%)    |
| Chengdu                        | 280 (22.4%)    |
| Others                         | 289 (23.1%)    |
| Sexual orientation             |                |
| Gay                            | 997 (79.7%)    |
| Bisexual                       | 254 (20.3%)    |
| Gender identification          |                |
| Gay                            | 1211 (96.8%)   |
| Transgender                    | 40 (3.2%)      |
| Education level                |                |
| College and higher             | 865 (69.1%)    |
| Below college                  | 386 (30.9%)    |
| Employment status              |                |
| Employed                       | 999 (79.9%)    |
| Student                        | 160 (12.8%)    |
| Unemployed                     | 59 (4.7%)      |
| Others                         | 33 (2.6%)      |
| Income level                   |                |
| <3000 RMB                      | 222 (17.7%)    |
| 3000–6999 RMB                  | 378 (30.2%)    |
| 7000–10000 RMB                 | 267 (21.3%)    |
| >10000 RMB                     | 384 (30.7%)    |
| Being in a primary relationship| 383 (30.6%)    |
| Substance use in the past 6 months* | 403 (32.2%) |
| Self-reported HIV positive     | 59 (4.7%)      |
| Psychological distress         |                |
| Normal (0–2)                   | 586 (46.8%)    |
| Mild (3–5)                     | 437 (34.9%)    |
| Moderate (6–8)                 | 145 (11.6%)    |
| Severe (9–12)                  | 83 (6.6%)      |
| Anxiety (GAD2 ≥ 3)             | 262 (20.9%)    |
| Depression (PHQ2 ≥ 3)          | 245 (19.6%)    |

*Substances include includes any of the following: rush popper, meth, 0 capsules, G-spot liquid, K powder, Ecstasy, and “others.”

Table 2
Psychological distress by HIV status among Chinese gay, bisexual, and other men who have sex with men (n = 1251).

| HIV status     | Anxiety | Depression |
|----------------|---------|------------|
|                | OR [95%] CI | AOR [95%] CI | OR [95%] CI | AOR [95%] CI |
| Self-reported HIV positive |        |            |            |            |
| Positive       | 2.18 [1.24, 3.75] | 1.80 [1.01, 3.26] | 2.38 [1.35, 4.11] | 2.04 [1.11, 3.67] |
| Age            | 0.96 [0.95, 0.98] | 0.96 [0.95, 0.98] | 0.96 [0.95, 0.98] | 0.96 [0.95, 0.98] |
| City           |                |            |            |            |
| Beijing        | ref          | ref        | ref        | ref        |
| Chengdu        | 0.95 [0.67, 1.41] | 1.16 [0.81, 1.65] | 1.34 [1.02, 1.79] | 1.65 [1.09, 2.47] |
| Others         | 1.30 [0.93, 1.79] | 1.43 [1.02, 1.99] | 1.34 [1.02, 1.79] | 1.65 [1.09, 2.47] |
| Gender identification |        |            |            |            |
| Gay            | ref          | ref        | ref        | ref        |
| Bisexual       | 0.65 [0.45, 0.93] | 0.60 [0.40, 0.98] | 0.62 [0.42, 0.97] | 0.62 [0.42, 0.97] |
| Ethnicity      |                |            |            |            |
| Han            | ref          | ref        | ref        | ref        |
| Ethnic minorities | 1.40 [0.78, 2.23] | 1.28 [0.73, 2.14] | 1.28 [0.73, 2.14] | 1.19 [0.67, 2.04] |
| Education level |                |            |            |            |
| College and higher | 1.83 [1.38, 2.43] | 1.66 [1.24, 2.14] | 1.33 [0.96, 1.85] | 1.22 [0.85, 1.72] |
| Below college  | 1.50 [1.04, 2.02] | 1.59 [1.13, 2.04] | 1.67 [1.15, 2.97] | 1.74 [1.21, 2.50] |
| Employment status |        |            |            |            |
| Employed       | ref          | ref        | ref        | ref        |
| Student        | 1.18 [0.78, 1.74] | 1.11 [0.73, 1.67] | 0.62 [0.33, 1.15] | 0.62 [0.33, 1.15] |
| Unemployed     | 1.86 [1.04, 3.24] | 1.77 [1.13, 3.12] | 1.07 [0.70, 1.77] | 1.07 [0.70, 1.77] |
| Others         | 0.39 [0.09, 1.11] | 0.38 [0.09, 1.12] | 0.59 [0.17, 1.52] | 0.57 [0.16, 1.53] |
| Income level   |                |            |            |            |
| <3000 RMB      | 2.31 [1.50, 3.55] | 2.20 [1.44, 3.34] | 1.80 [0.96, 3.34] | 1.80 [0.96, 3.34] |
| 3000–6999 RMB  | 2.52 [1.73, 3.70] | 2.66 [1.29, 2.98] | 2.02 [1.07, 2.50] | 2.02 [1.07, 2.50] |
| 7000–10000 RMB | 1.99 [1.37, 3.03] | 1.61 [1.08, 2.47] | 2.18 [1.07, 3.70] | 2.18 [1.07, 3.70] |
| >10000 RMB     | ref          | ref        | ref        | ref        |
| Being in a primary relationship | 1.21 [1.00, 1.45] | 1.16 [0.85, 1.55] | 1.40 [0.90, 2.17] | 1.40 [0.90, 2.17] |
| Substance use in last 6 months* | 0.97 [0.72, 1.30] | 1.04 [0.78, 1.41] | 1.04 [0.78, 1.41] | 1.04 [0.78, 1.41] |

*Substances include includes any of the following: rush popper, meth, 0 capsules, G-spot liquid, K powder, Ecstasy, and “others.”

AOR: adjusted odds ratio. Multivariable model adjusted for age, sexual orientation, gender identification, education level, income, employment status. Bold values are statistically significant p values of less than or equal to 0.05. CI: confidence interval.
Correlations between GAD2, PHQ2, and PHQ-4 (n = 1251).

| Anxiety items (GAD2) | Mean | SD | Cronbach’s alpha |
|----------------------|------|----|------------------|
| Feeling nervous, anxious or on edge | 0.84 | 0.85 |
| Not being able to stop or control worrying | 0.77 | 0.87 |

| Depression items (PHQ2) | Mean | SD | Cronbach’s alpha |
|-------------------------|------|----|------------------|
| Little interest or pleasure in doing things | 0.88 | 0.86 |
| Feeling down, depressed, or hopeless | 0.71 | 0.88 |

| PHQ sum score | Mean | SD | Cronbach’s alpha |
|--------------|------|----|------------------|
| 1.60 | 1.64 | 0.88 |

| Total scale score (PHQ4) | Mean | SD | Cronbach’s alpha |
|--------------------------|------|----|------------------|
| 3.21 | 3.10 | 0.92 |

Acknowledgements

The authors would like to thank all study participants, who generously gave their time and efforts for this study.

References

Ballivian, J., Alcaide, M.L., Cecchini, D., Jones, D.L., Abbamonte, J.M., Cassetti, L., 2020. Impact of COVID-19-related stress and lockdown on mental health among people living with HIV in Argentina. J. Acquir. Immune Defic. Syndr. 85 (4), 475–482. https://doi.org/10.1097/QAI.0000000000002495.

Beltran, R.M., Hallows, A.W., Hong, C., et al., 2022. Social determinants of disease: HIV and COVID-19 experiences. Curr. HIV/AIDS Rep. https://doi.org/10.1007/s11904-021-00595-6.

Cesla, J.A., Roberts, J.E., 2001. Meta-analysis of the relationship between HIV infection and risk for depressive disorders. Am. J. Psychiatry. 158 (5), 725–730.

Collins, P.Y., Holman, A.R., Freeman, M.C., Patel, V., 2006. What is the relevance of mental health to HIV/AIDS care and treatment programs in developing countries? A systematic review. AIDS 20 (12), 1571–1582. https://doi.org/10.1097/01.aids.0000238402.70579.d4.

Delle Donne, V., Ciccarelli, N., Masararoni, V., Lombardi, F., Lamonica, S., Borghetti, A., Fabiani, M., Cauda, R., Di Giambenedetto, S., 2021. Psychological distress during the initial stage of the COVID-19 pandemic in an Italian population living with HIV: results of a survey. Infection. Med. Le. 29 (3), 54–64.

Fu, H., Feng, T., Wang, T., Wu, X., Cai, Y., Yang, T., 2020. Reported prevalence of depression or depressive symptoms among men who have sex with men in China, 2004–2018: a systematic review and meta-analysis. J. Affect. Disord. 277, 192–203. https://doi.org/10.1016/j.jad.2020.08.011.

Gonzales, G., Loret de Mola, E., Gavulic, K.A., McKay, T., Purcell, C., 2020. Mental health needs among lesbian, gay, bisexual, and transgender college students during the COVID-19 pandemic. J. Adolesc. Health 67 (5), 645–648. https://doi.org/10.1016/j.jadohealth.2020.08.006.

Hong, C., Horvath, K.J., Stephenson, R., Nelson, K.M., Pottel, A.E., Walsh, J.L., John, S. A., 2021. PrEP use and persistence among young sexual minority men 17–24 years old during the COVID-19 pandemic. AIDS Behav. https://doi.org/10.1007/s10461-021-10425-5.

Jones, D.L., Ballivian, J., Rodriguez, V.J., Uribe, C., Cecchini, D., Salazar, A.S., Cassetti, I., Alcaide, M.L., 2021. Mental health, coping, and social support among people living with HIV in the americas: a comparative study between Argentina and the USA during the SARS-CoV-2 pandemic. AIDS Behav. 25 (8), 2391–2399. https://doi.org/10.1007/s10461-021-03013-1.

Kamal, K., Li, J.J., Hahn, H.C., Liu, C.H., 2021. Psychiatric impacts of the COVID-19 global pandemic on U.S. sexual and gender minority young adults. Psychiatr. Res. 299, 113855. https://doi.org/10.1016/j.psychres.2021.113855.

Kneale, D., Bécares, L., 2020. The mental health and experiences of discrimination of LGBTQ people during the COVID-19 pandemic: initial findings from the Queerantine Study. medRxiv. https://doi.org/10.1101/2020.06.06.20111643. 2020, 08.03.20167403.

Liu, X., Jiang, D., Chen, X., Tan, A., Hou, Y., He, M., Lu, Y., Mao, Z., 2018. Mental health status and associated contributing factors among gay men in China. Int. J. Environ. Res. Publ. Health 15 (6), 1065. https://doi.org/10.3390/ijerph15061065.

Marbaniang, I., Sangle, S., Nimkar, S., Salvi, K., Chavan, A., Gupta, A., Suryavanshi, N., Mave, V., 2020. The burden of anxiety among people living with HIV during the COVID-19 pandemic in Pune, India. BMC Publ. Health 20 (1), 1598. https://doi.org/10.1186/s12889-020-08565-8.

Meyer, L.H., 2003. Prejudice, social stress, and mental health in lesbian, gay, and bisexual populations: conceptual issues and research evidence. Psychol. Bull. 129 (5), 674–697. https://doi.org/10.1037/0033-2909.129.5.674.

Pizarroso, M., Carrion-Park, C., Clark, U.S., Gonzalez, J., Byrd, D., Morgello, S., 2021. Physical and mental health screening in a New York City HIV cohort during the COVID-19 pandemic: a preliminary report. JAIDS J. Acquire. Immun. Defici. Syndrome. 86 (3), e54. https://doi.org/10.1097/QAI.0000000000002564.

Ridgway, J.P., Schmitt, J., Friedman, E., Taylor, M., Devlin, S., McNulty, M., Pitkä, D., 2020. HIV care continuum and COVID-19 outcomes among people living with HIV during the COVID-19 pandemic, Chicago, IL. AIDS Behav. 24 (10), 2770–2772. https://doi.org/10.1007/s10461-020-02895-2.

Rojas-García, A., Ruiz-Pérez, I., Rodríguez-Barranco, M., Gonzáles-Bradley, D.C., Pastor-Moreno, G., Ricci-Cellabell, L., 2015. Healthcare interventions for depression in low socioeconomic status populations: a systematic review and meta-analysis. Clin. Psychol. Psychopathol. Res. 55 (4–5), 435–456. https://doi.org/10.1080/13691058.2015.1018775.

Santos, G.M., Hong, C., Wilson, N., Nutor, J.J., Harris, O., Garner, A., Holloway, I., Ayala, G., Howell, S., 2022. Persistent disparities in COVID-19-associated impacts on HIV prevention and care among a global sample of sexual and gender minority individuals. Global Publ. Health. 1–16. https://doi.org/10.1080/17441670.2022.206362. 060.

Shangani, S., Gamael, K.E., Ogunbajo, A., Cai, J., Operario, D., 2020. Intersectional minority stress disparities among sexual minority adults in the USA: the role of race/ethnicity and socioeconomic status. Cult. Health Sex. 22 (4), 398–412. https://doi.org/10.1080/13691058.2019.1604994.
Siewe Fodjo, J.N., Villela, E.F. de M., Van Hees, S., dos Santos, T.T., Vanholder, P., Reyntiens, P., Van den Bergh, R., Colebunders, R., 2020. Impact of the COVID-19 pandemic on the medical follow-up and psychosocial well-being of people living with HIV: a cross-sectional survey. JAIDS J. Acquire. Immun. Deficiency Syndrome. 85 (3), 257–262. https://doi.org/10.1097/QAI.0000000000002468.

Starks, T.J., Rendina, H.J., Breslow, A.S., Parsons, J.T., Golub, S.A., 2013. The psychological cost of anticipating HIV stigma for HIV-negative gay and bisexual men. AIDS Behav. 17 (8), 2732–2741. https://doi.org/10.1007/s10461-013-0425-0.

Su, X., Zhou, A.N., Li, J., Shi, L., Huan, X., Yan, H., Wei, C., 2018. Depression, loneliness, and sexual risk-taking among HIV-Negative/Unknown men who have sex with men in China. Arch. Sex. Behav. 47 (7), 1959–1968. https://doi.org/10.1007/s10508-017-1061-y.

Suen, Y.T., Chan, R.C.H., Wong, E.M.Y., 2020. Effects of general and sexual minority-specific COVID-19-related stressors on the mental health of lesbian, gay, and bisexual people in Hong Kong. Psychiatr. Res. 292, 113365 https://doi.org/10.1016/j.psychres.2020.113365.

Sun, S., Hou, J., Chen, Y., Lu, Y., Brown, L., Operario, D., 2020. Challenges to HIV care and psychological health during the COVID-19 pandemic among people living with HIV in China. AIDS Behav. 24 (10), 2764–2765.

Tabler, J., Mykyta, L., Schmitz, R.M., Kamimura, A., Martinez, D.A., Martinez, R.D., Flores, P., Gonzalez, K., Marquez, A., Marroquin, G., 2021. Getting by with a little help from our friends: the role of social support in addressing HIV-related mental health disparities among sexual minorities in the lower rio grande valley. J. Homosex. 68 (2), 269–289.

Xiong, J., Lipsitz, O., Nafr, F., Lui, L.M.W., Gill, H., Phan, L., Chen-Li, D., Iacobucci, M., Ho, R., Majeeed, A., McIntyre, R.S., 2020. Impact of COVID-19 pandemic on mental health in the general population: a systematic review. J. Affect. Disord. 277, 55–64. https://doi.org/10.1016/j.jad.2020.08.001.

Xiong, N., Fritzche, K., Wei, J., Hong, X., Leonhart, R., Zhao, X., Zhang, L., Zhu, L., Tian, G., Noite, S., 2015. Validation of patient health questionnaire (PHQ) for major depression in Chinese outpatients with multiple somatic symptoms: a multicenter cross-sectional study. J. Affect. Disord. 174, 636–643.