BRIEF COMMUNICATION

A potential syndemic effect associated with symptoms of depression among men who have sex with men

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Introduction: Globally, depression rates are high among men who have sex with men (MSM). Multiple factors may interact synergistically to increase this risk. This analysis assessed the prevalence of symptoms of depression among MSM in Brazil and synergistic effects of several factors.

Methods: Cross-sectional study conducted in 12 cities using respondent-driven sampling. Sociodemographic and behavioral characteristics were collected. The PHQ-9 was used to screen for depression. Having moderate-severe depressive symptoms was compared to none-mild using logistic regression. The syndemic factor was a composite of hazardous alcohol use, sexual violence, and discrimination due to sexual orientation. Those with one to three of these factors were compared to those with none.

Results: The weighted prevalence of moderate-severe depressive symptoms was 24.9% (95%CI = 21.8-28.8) and 16.2%, 22.9%, 46.0% and 51.0% when none, one, two, or three syndemic factors were present, respectively, indicating a dose-response effect. Perception of HIV risk, high level of HIV knowledge, known HIV infection, and health self-rated as poor or very poor were also associated with depressive symptoms.

Conclusion: The prevalence of moderate-severe depressive symptoms among MSM in Brazil is high, and selected factors act synergistically in increasing their prevalence. Public health policies should consider holistic depression prevention and treatment interventions for this population.

Keywords: Depression; syndemic; MSM; RDS

Introduction

Depression is a chronic disorder affecting large populations worldwide. The prevalence of major depression among adults varies across regions, countries, age, gender, and socioeconomic status (SES), and it is increasing in the general population. In 2019, the overall prevalence of depression was estimated at 5.0% globally, 5.3% in Brazil, and 5.2% in the United States.1

Men who have sex with men (MSM) are disproportionately affected by depression, which may be explained by several factors, including stigma and discrimination due to sexual orientation, sexual and physical violence, risky sexual behavior, and substance use.2-5

Many of these factors may be independently associated with depression, and they are contextually intertwined, signaling that the potential accumulation of one or more factors may increase the likelihood of developing depression symptoms. The syndemics model focuses on the biosocial complex, consisting of interacting, co-present, or sequential diseases and the social and environmental factors that promote and enhance the negative effects of disease interaction.6 Understanding contextual factors through a syndemic approach may contribute to more effective public health interventions. Moreover, published data on depression among MSM in Brazil are scarce, and this study is the first to assess potential synergistic effects of contextual factors on depression. We examined the potential of a syndemic effect of selected factors on symptoms of depression in a large, nationwide, respondent-driven sampling (RDS) multicenter study among MSM in Brazil.

Methods

This cross-sectional analysis of 4,176 MSM recruited in 12 Brazilian cities in 2016 used RDS methodology, and 4,116 respondents were available for analysis. Eligibility criteria were age 18+ years, self-reported sex with another man in the previous 12 months, and living, working, or studying in a host city: Belo Horizonte

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Participants were interviewed for sociodemographic, social network, sexual behavior, substance use, HIV/sexually transmitted infection (STI) knowledge and risk perception, symptoms of depression, and health service indicators. Participants were also tested for HIV, syphilis, and hepatitis B and C. Symptoms of depression were assessed using the Patient Health Questionnaire (PHQ-9), which includes nine items (depressed mood, anhedonia, sleeping problems, lack of energy, changes in appetite or weight, feelings of guilt or worthlessness, concentration problems, feelings sluggish or restless, and having suicidal thoughts) and refers to the past 2 weeks. Each item has four possible responses, ranging from 0 (not at all) to 3 (nearly every day), and the sum of each score was classified as absence of depression (0-4), mild (5-9), moderate (10-14), moderately severe (15-19), or severe depression (20-27). For purposes of analysis, we compared those respondents with a score of ≥ 10 to those with < 10 points.

Other variables were age, schooling, self-defined skin color, SES, HIV/AIDS knowledge, self-rated chances of acquiring HIV, known HIV positivity, and self-rated health status. Age was categorized as < 25 or ≥ 25 years old, schooling as < 12 or ≥ 12 years of formal education, skin color as white or non-white. Socioeconomic condition was classified according to the Brazilian census bureau criteria as upper (A/B) or lower (C/D/E). Alcohol use was assessed by the Alcohol Use Disorders Identification Test (AUDIT), with a score of 8 or higher classified as hazardous use. Sexual identity and experiences of discrimination or physical and sexual violence due to sexual orientation were also included. Self-perceived discrimination was based on a previous latent class analysis (LCA) and was classified as none/mild, moderate, or severe, as described elsewhere. Sexual violence was assessed as having occurred during childhood, adolescence, or adulthood, hierarchically classified in this order. We also analyzed condom use during first sexual encounter and during the last anal receptive sexual encounter, exchange of sex for money, stable partnership, family disapproval of sexual orientation, living alone, use of the same health care provider when needed, any illicit drug use, and previous syphilis testing; these indicators were assessed for the previous 6 months. HIV knowledge was previously described using item response theory (IRT) and categorized as low, moderate, or high, according to the score percentile distribution (< 25, 25-75, and > 75%, respectively).

Statistical analysis

In each site, Gile’s successive sampling estimator was used to generate weighted estimates using RDS Analyst Software (version 0.57) before merging into a single dataset. Overall proportions were estimated using complex sample analysis to take into account the sampling design, and each city was treated as a stratum. Those with moderate/moderately severe or severe depressive symptoms (10+ points) were compared to those with none or mild depressive symptoms (0-9 points). The magnitude of the associations with depressive symptoms was estimated by the weighted odds ratio (ORw) with 95%CI using multiple logistic regression. Initially, variables with p-values < 0.20 in the univariate analysis were used to begin modeling, and only those with p-values < 0.05 remained in the final model. Because of power considerations, we were limited to three variables when constructing the syndemic indicator: discrimination due to sexual orientation, sexual violence, and hazardous alcohol use. We also recoded discrimination and sexual violence as dichotomous variables (yes/no). These variables were chosen based on the final model and are consistently found to be associated with depression in the literature. We then reassessed the association of the syndemic indicator with depressive symptoms comparing the presence of at least one, two, or all three variables to those with none of the three as follows: univariate analysis was followed by multivariate analysis adjusting for the remaining variables of the final model (i.e., HIV knowledge, self-rated chances of acquiring HIV, and self-rated health status), and, finally, we added sociodemographic conditions (i.e., age, skin color, schooling, and SES), due to potential heterogeneity among the cities. Complex sample analysis was also used, and ORw with 95%CI were estimated. All analyses were conducted using the SAS statistical package complex survey procedure.

Ethics statement

The study was approved by the research ethics committee of Universidade Federal do Ceará (CONEP #1.024.053).

Results

Moderate to severe depressive symptoms were present in 24.9% (95%CI = 21.8-28.8) of the total sample, while such symptoms were present in 16.2, 22.9, 46, and 51% when none, one, two, or three syndemic factors were present, respectively. Table 1 indicates overall proportions, number and proportion of depressive symptoms in each category, and univariate and multivariate results. Most participants were younger than 25 years old, with ≥ 12 years of schooling, non-white, and of lower SES. Univariate associations (p < 0.05) with moderate-severe depressive symptoms were: illicit drug use and hazardous alcohol use, history of physical and sexual violence during childhood or adolescence, moderate or high/very high discrimination due to sexual orientation, family disapproval of sexual identity, moderate/high HIV knowledge, moderate/high perception of risk of acquiring HIV, known to be HIV positive prior to the study, regular/poor/very poor self-rated health status, previous syphilis testing, and seeking the same health care provider when needed. In addition, exchanging sex for money, having a steady partner, and not using a condom during first sex or last anal sex were also associated with moderate-severe depressive symptoms in the univariate analysis.
Table 1 Univariate and multivariate analysis of factors associated with symptoms of depression (n=4,176)

| Characteristics                              | Total n | % | Univariate | Multivariate |
|-----------------------------------------------|---------|---|------------|--------------|
|                                              |         |   | OR<sub>u</sub> (95%CI) | p-value | OR<sub>m</sub> (95%CI) | p-value |
| **Moderate/moderately severe/severe depressive symptoms** |          |   |               |           |              |         |
| Age (years)                                  |         |   |               |           |              |         |
| ≥ 25                                         | 1,608   | 39.6 | 23.9         | 1.00     | -          | -       |
| < 25                                         | 2,469   | 53.2 | 25.8         | 1.10 (0.78-1.56) | 0.577 | -         | -       |
| Schooling (years)                            |         |   |               |           |              |         |
| < 12                                         | 1,004   | 31.2 | 28.4         | 1.00     | -          | -       |
| ≥ 12                                         | 3,076   | 68.8 | 23.6         | 0.78 (0.54-1.14) | 0.195 | -         | -       |
| Skin color                                    |         |   |               |           |              |         |
| White                                        | 1,282   | 32.0 | 24.3         | 1.00     | -          | -       |
| Non-white                                    | 2,824   | 68.0 | 25.1         | 1.04 (0.74-1.48) | 0.809 | -         | -       |
| Socioeconomic class                          |         |   |               |           |              |         |
| A/B (upper)                                  | 1,880   | 40.3 | 24.0         | 1.00     | -          | -       |
| C/D/E (lower)                                | 2,236   | 59.7 | 25.6         | 1.09 (0.79-1.52) | 0.597 | -         | -       |
| Illicit drug use (weekly, past 6 months)     |         |   |               |           |              |         |
| No                                           | 2,914   | 68.8 | 21.9         | 1.00     | -          | -       |
| Yes                                          | 1,144   | 31.2 | 31.4         | 1.63 (1.14-2.34) | 0.008* | -         | -       |
| Hazardous alcohol use                        |         |   |               |           |              |         |
| No (AUDIT < 8 points)                        | 2,043   | 54.0 | 20.8         | 1.0      | -          | -       |
| Yes (AUDIT ≥ 8 points)                       | 1,917   | 46.0 | 30.0         | 1.63 (1.15-2.31) | 0.006* | 1.62 (1.13-2.31) | 0.008* |
| History of physical violence due to sexual orientation |         |   |               |           |              |         |
| No                                           | 3,144   | 75.9 | 22.3         | 1.00     | -          | -       |
| Yes                                          | 924     | 24.1 | 32.9         | 1.71 (1.17-2.50) | 0.006* | -         | -       |
| History of sexual violence                   |         |   |               |           |              |         |
| None                                         | 3,200   | 79.7 | 20.7         | 1.0      | -          | -       |
| Childhood                                    | 479     | 10.1 | 36.3         | 2.18 (1.33-3.58) | <0.001* | 1.60 (0.90-2.84) | 0.112 |
| Adolescence                                  | 261     | 7.5  | 52.0         | 4.15 (2.29-7.51) | <0.001* | 3.41 (1.67-6.96) | 0.001* |
| Adulthood                                    | 118     | 2.6  | 17.5         | 0.81 (0.36-1.82) | 0.608 | 0.72 (0.32-1.60) | 0.418 |
| History of discrimination due to sexual orientation (LCA) |         |   |               |           |              |         |
| None                                         | 1,995   | 53.8 | 18.4         | 1.0      | -          | -       |
| Moderate                                     | 1,363   | 31.5 | 26.2         | 1.57 (1.05-2.34) | 0.028* | 1.33 (0.87-2.03) | 0.184 |
| High/very high                               | 725     | 15.3 | 44.6         | 3.57 (2.26-5.62) | <0.001* | 2.59 (1.58-4.26) | <0.001* |
| Family approval of sexual identity           |         |   |               |           |              |         |
| Approves/indifferent                         | 3,559   | 87.2 | 23.7         | 1.0      | -          | -       |
| Disapproves                                  | 557     | 12.8 | 33.2         | 1.60 (1.05-2.43) | 0.029* | -         | -       |
| HIV Knowledge (IRT score)<sup>+</sup>        |         |   |               |           |              |         |
| Low                                          | 969     | 27.4 | 19.1         | 1.0      | -          | -       |
| Moderate                                     | 3,147   | 72.6 | 27.1         | 1.58 (1.04-2.40) | 0.034* | 2.04 (1.28-3.24) | 0.003* |
| Self-rated chance of acquiring HIV infection |         |   |               |           |              |         |
| None/low                                     | 2,082   | 50.0 | 17.6         | 1.0      | -          | -       |
| Moderate/High                                | 1,654   | 39.3 | 32.7         | 2.28 (1.60-3.25) | <0.001* | 1.98 (1.34-2.93) | 0.001* |
| Known to be HIV positive                     | 300     | 10.6 | 31.0         | 2.10 (1.17-3.78) | 0.013* | 1.69 (0.95-3.01) | 0.075 |
| Self-rated health status                     |         |   |               |           |              |         |
| Very good/good                               | 3,194   | 77.1 | 20.8         | 1.0      | -          | -       |
| Regular/poor/very poor                       | 881     | 22.9 | 39.0         | 2.43 (1.64-3.60) | <0.001* | 2.33 (1.48-3.66) | 0.001* |
| Lives alone                                  |         |   |               |           |              |         |
| No                                           | 3,379   | 78.9 | 23.5         | 1.0      | -          | -       |
| Yes                                          | 715     | 21.1 | 30.4         | 1.42 (0.95-2.14) | 0.089 | -         | -       |
| Previous syphilis testing (< 12 months)      |         |   |               |           |              |         |
| Yes                                          | 2,449   | 58.8 | 22.2         | 1.0      | -          | -       |
| No                                           | 1,640   | 41.2 | 28.8         | 1.39 (0.98-1.95) | 0.063 | -         | -       |

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Only hazardous alcohol use, history of sexual violence during adolescence, high/very high discrimination due to sexual orientation, moderate/high HIV knowledge, moderate/high perception of risk of acquiring HIV, and regular/poor/very poor self-rated health status were independently associated with depression \( (p < 0.05) \).

Table 2 indicates statistically significant associations between the syndemic variables, i.e., a combination of sexual violence (yes/no), alcohol use more than four times a month (yes/no), discrimination due to sexual orientation (yes/no), and depressive symptoms in all analyses. A dose-response relationship with moderate-severe depressive symptoms \( (p < 0.01) \) was observed when one, two, or
three of these factors were present, as compared to none, in the univariate analyses, multivariate analyses adjusting for the other covariates, or multivariate analyses with the addition of the sociodemographic indicators.

Discussion
In this first study to describe the prevalence of moderate-severe depressive symptoms among MSM in multiple cities in Brazil, we found higher estimates than for the overall Brazilian adult population (24.9 and 10.9%, respectively). Independent factors associated with depression in this study corroborate the literature and include sexual violence, poor self-rated health, discrimination due to sexual orientation, and hazardous alcohol use. Furthermore, the potential for a syndemic effect of three variables was demonstrated with a synergistic dose-response relationship and an elevated OR when three factors were present, highlighting possible avenues for public health policies towards prevention and treatment of depression among MSM in Brazil.

Further studies are needed to explore the pathways through which these and other syndemic factors interact and multiply overall disease burden; the ways in which social environments, especially conditions of social inequality and injustice, contribute to disease clustering, interaction, and vulnerability; and the underlying mechanisms of the syndemic effect to inform optimal interventions. Limitations include the cross-sectional design, potential dependency of data due to RDS recruitment, lack of national representativeness of MSM, and lack of data on access to depression treatment. Data are pre-COVID-19, and the pandemic has seen a staggering increase in mental health disorders, including depression, suggesting an even more urgent need for a holistic approach to health disparities among MSM.

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Disclosure
The authors report no conflicts of interest.

References
1 GBD 2019 Disease and Injuries Collaborators. Global burden of 369 diseases and injuries in 204 countries and territories, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet. 2020;396:1204-22.
2 Kunze-Drechsler CP, Bailey RC, Okali DO, Graham SM, Mehta S D, Otieng FO. Depressive symptoms, alcohol and drug use, and physical and sexual abuse among men who have sex with men in Kisumu, Kenya: the Anza Mapema Study. AIDS Behav. 2018;22:1517-29.
3 Wei D, Wang X, You X, Luo X, Hao C, Gu J, et al. Prevalence of depression, anxiety and suicide among men who have sex with men in China: a systematic review and meta-analysis. Epidemiol Psychiatr Sci. 2020;29:e136.
4 Milz AR, Rodger AJ, Leplin AG, Sowell J, Nwokolo NC, Allan S, et al. Investigating conceptual models for the relationship between depression and condomless sex among gay, bisexual, and other men who have sex with men: using structural equation modelling to assess mediation. AIDS Behav. 2020;24:1793-806.
5 Batchelder AW, Safren S, Mitchell AD, Ivancic I, O’ Cleirigh C. Mental health in 2020 for men who have sex with men in the United States. Sex Health. 2017;14:59-71.
6 Singer M, Bulled N, Ostrach B, Mendenhall E. Syndemics and the biosocial conception of health. Lancet. 2017;389:941-50.
7 Kendall C, Kerr L, Mota RS, Guimarães MDC, Leal AF, Merchán-Harnann E, et al. The 12 city HIV Surveillance Survey among MSM in Brazil 2016 using respondent-driven sampling: a description of methods and RDS diagnostics. Rev Bras Epidemiol. 2019;22:e190004.
8 Santos IS, Tavares BF, Munhoz TN, de Ameida LSP, da Silva NB, Tamis BD, et al. Sensitivity and specificity of the Patient Health Questionnaire-9 (PHQ-9) among adults from the general population. Cad Saude Publica. 2013;29:1533-43.
9 Associação Brasileira de Empresas e Pesquisa (ABEP). Critério Brasil 2015 e atualização da distribuição de classes para 2016 [Internet]. [cited 2021 Dec 21]. www.abep.org/criterio-brasil.
10 Babor TF, Higgins-Biddle J, Saunders JB, Monteiro MG. AUDIT: the alcohol use disorders identification test: guidelines for use in primary care. 2nd ed. Genbra: World Health Organization; 2001.
11 Magnó L, da Silva LAV, Guimaraes MDC, Versas MASM, de Deus LFA, Leal AF, et al. Discrimination based on sexual orientation and the sexual and reproductive health of men who have sex with men in Brazil. Cad Saude Publica. 2017;33:e00125515.
12 Gomes RRFM, Ceccato MGB, Kerr LRFS, Guimaraes MDC. Factors associated with low knowledge on HIV/AIDS among men who have sex with men in Brazil. Cad Saude Publica. 2017;33:e00125515.
13 Gile KJ, Handcock MS. Respondent-driven sampling: an assessment of current methodology. Sociol Methodol. 2010;40:285-327.
14 Barros MBA, Medina LBP, Lima MG, de Azevedo RCS, Sousa NFS, Malta DC. Association between health behaviors and depression: findings from the 2019 Brazilian National Health Survey. Rev Bras Epidemiol. 2021;24:e210010.
15 COVID-19 Mental Disorders Collaborators. Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic. Lancet. 2021;398:1700-12.