Brazilian Journal of Psychiatry
bjp
Revista Brasileira de Psiquiatria

Braz J Psychiatry. 2022 Sep-Oct;44(5):517-521
doi:10.47626/1516-4446-2022-2454
Brazilian Psychiatric Association

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. Socio-demographic 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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Submitted Jan 05 2022, accepted Mar 28 2022, Epub Aug 29 2022.

How to cite this article: Guimarães MDC, McKinnon K, Dourado I, Veras MA, Magno L, Almeida M, et al. A potential syndemic effect associated with symptoms of depression among men who have sex with men. Braz J Psychiatry. 2022;44:517-521. http://doi.org/10.47626/1516-4446-2022-2454

(n=348), Rio de Janeiro (n=317), São Paulo (n=339), Brasília (n=335), Campo Grande (n=350), Manaus (n=337), Belém (n=349), Recife (n=345), Salvador (n=343), Fortaleza (n=353), Curitiba (n=347), or Porto Alegre (n=333). Detailed procedures have been described elsewhere.[7]

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, feeling 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).[8] For purposes of analysis, we compared those respondents with a score of $\geqslant$ 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 $\geqslant$ 25 years old, schooling as $<$ 12 or $\geqslant$ 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).[9] Alcohol use was assessed by the Alcohol Use Disorders Identification Test (AUDIT), with a score of 8 or higher classified as hazardous use.[10] 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.[11] 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).[12]

Statistical analysis

In each site, Gile's successive sampling estimator was used to generate weighted estimates using RDS Analyst Software (version 0.57)[13] 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 (OR_w) 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 OR_w 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 $\geqslant$ 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)

			Moderate/moderately severe/severe depressive symptoms[†]				
				Univariate		Multivariate	
Characteristics	Total n	%[‡]	%[§]	OR_w (95%CI)	p-value	OR_w (95%CI)	p-value
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	1.0			
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		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	1.0		-	-
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		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)							
Low/none	1,995	53.8	18.4	1.0		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)[†]							
Low	969	27.4	19.1	1.0		1.0	
Moderate/high	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		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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Table 1 (*continued*)

			Moderate/moderately severe/severe depressive symptoms[†]				
				Univariate		Multivariate	
Characteristics	Total n	%[‡]	%[§]	OR_w (95%CI)	p-value	OR_w (95%CI)	p-value
Used same healthcare service when needed							
Yes	2,685	73.3	22.6	1.0		-	-
No	1,209	26.7	32.6	1.66 (1.14-2.41)	0.008*		
Received money for sex ever							
No	2,726	66.7	21.7	1.0		-	-
Yes	1,281	33.3	30.4	1.58 (1.10-2.28)	0.014*		
Steady partnership (last 6 months)							
No	1,139	30.6	19.1	1.0		-	-
Yes	2,919	69.4	27.1	1.59 (1.12-2.26)	0.010*		
Last anal intercourse was condomless							
No	2,587	64.2	21.6	1.0		-	-
Yes	1,304	35.8	29.8	1.54 (1.07-2.23)	0.021*		
First sexual intercourse was condomless							
No	1,763	45.0	20.5	1.0		-	-
Yes	2,264	55.0	28.0	1.51 (1.07-2.13)	0.018*		

AUDIT = Alcohol Use Disorders Identification Test; IRT = item response theory; LCA = latent class analysis; OR_w = weighted odds ratio.
* Statistically significant.
[†] Compared to none/mild depressive symptoms.
[‡] Weighted proportion (according to the social network size) of each category of the characteristic in the sample.
[§] Weighted proportion (according to the social network size) of moderate/moderately severe/severe depressive symptoms for each category.

Table 2 Weighted OR[†] of the syndemic variable[‡] on symptoms of depression[§] among men who have sex with men, Brazil, 2016

Characteristics	OR[‖] (95%CI)	OR_{adj}[¶] (95%CI)	OR_{adj}[††] (95%CI)
Syndemic variable[‡]			
Only one factor	1.54 (1.00-2.36)	1.63 (1.07-2.46)	1.70 (1.12-2.57)
At least two factors	4.39 (2.60-7.40)	4.33 (2.56-7.30)	4.45 (2.62-7.54)
All three factors	5.38 (1.95-14.84)	5.96 (1.87-19.01)	5.89 (1.90-18.23)
Other covariates			
High HIV/AIDS knowledge		1.98 (1.23-3.19)	2.25 (1.39-3.66)
Self-rated chance of acquiring HIV			
High chance of acquiring HIV		1.99 (1.35-2.92)	2.18 (1.48-3.19)
Known HIV positive		1.75 (0.99-3.07)	2.12 (1.20-3.76)
Regular/poor/very poor self-rated health		2.20 (1.40-3.45)	2.13 (1.35-3.35)
Sociodemographic variables			
Age ($<$ 25 years old)			1.23 (0.85-1.78)
Skin color (non-white)			1.15 (0.79-1.68)
Socioeconomic status (C-D-E)			0.91 (0.63-1.32)
Schooling ($\geqslant$ 12 years)			0.78 (0.51-1.20)

OR_{adj} = adjusted odds ratio.
[†] According to social network size.
[‡] Sexual violence, hazardous alcohol use, discrimination due to sexual orientation.
[§] Moderate/moderately severe/severe depressive symptoms.
[‖] Unadjusted weighted OR.
[¶] Adjusted weighted OR for the other covariates.
[††] Adjusted weighted OR for the other covariates and for age, schooling, race, and socioeconomic status.

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).[14] 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.[2-5] Furthermore, the potential for a syndemic effect of three variables was demonstrated with a synergistic dose-response relationship and an elevated OR_W 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,[15] suggesting an even more urgent need for a holistic approach to health disparities among MSM.

Acknowledgements

Financial support for this study was provided by the Brazilian Ministry of Health through its Secretaria de Vigilância Sanitária and its Departamento de Prevenção, Vigilância e Controle de Infecções Sexualmente Transmissíveis, HIV/AIDS e Hepatites Virais. We would like to thank to all participants for their time and the support from nongovernmental organizations (NGOs) and health services for this study.

The Brazilian HIV/MSM Surveillance Group is composed of the following collaborators: Alexandre Kerr Pontes, Universidade Federal do Rio de Janeiro, Rio de Janeiro; Ana Cláudia Camillo, Fundação Alfredo da Mata, Manaus; Ana Maria de Brito, Ageu Magalhães, Fundação Oswaldo Cruz (FIOCRUZ), Recife; Ana Rita Coimbra Motta-Castro, FIOCRUZ/Universidade Federal do Mato Grosso do Sul, Campo Grande; Daniela Riva Knauth and Andréa Fachel Leal, Universidade Federal do Rio Grande do Sul, Porto Alegre; Edgar Merchan-Hermann and Ximena Pamela Diaz, Universidade de Brasília, Brasília; Luana N. C. Lima, Instituto Evandro Chagas, Belém; Maria Amélia Veras, Faculdade de Ciências Médicas da Santa Casa de São Paulo, São Paulo; Maria Inês Dourado, Universidade Federal da Bahia, Salvador; Lígia Regina Franco Sansigolo Kerr, Universidade Federal do Ceará, Fortaleza; Lisangela Cristina de Oliveira, Centro Universitário Autônomo do Brasil, Curitiba; Mark Drew Crosland Guimarães, Universidade Federal de Minas Gerais, Belo Horizonte; Raimunda Hermelinda Maia Macena, Universidade Federal do Ceará, Fortaleza; Rosa Salani Mota, Universidade Federal do Ceará, Fortaleza; Maria do Socorro Cavalcante, Secretaria de Saúde do Ceará, Fortaleza; Carl Kendall, Tulane University, New Orleans.

Disclosure

The authors report no conflicts of interest.

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