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Complete List of Authors:	Carvalho, Aline; Brazilian National Cancer Institute, Division of Tobacco Control Bertoni, Neilane; Brazilian National Cancer Institute, Division of Population Research Coutinho, Carolina; Fundação Getulio Vargas's Sao Paulo School of Business Administration Bastos, Francisco ; Oswaldo Cruz Foundation Fonseca, Vania; Fernandes Figueira Institute, Oswaldo Cruz Foundation
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TOBACCO USE BY LGBT INDIVIDUALS: FINDINGS FROM A BRAZILIAN NATIONAL SURVEY

Authors:

Aline de Mesquita Carvalho[1], Neilane Bertoni[2], Carolina Fausto de Souza Coutinho[3], Francisco Inácio P. M. Bastos[4], Vania de Matos Fonseca[5]

1 Division of Tobacco Control, Brazilian National Cancer Institute, Rio de Janeiro, Brazil

2 Division of Population Research, Brazilian National Cancer Institute, Rio de Janeiro, Brazil

3 Fundação Getulio Vargas's Sao Paulo School of Business Administration, São Paulo, Brazil

4 Oswaldo Cruz Foundation, Rio de Janeiro, Brazil

5 Fernandes Figueira Institute, Oswaldo Cruz Foundation, Rio de Janeiro, Brazil

Corresponding author

Aline de Mesquita Carvalho

Adress: Rua Marques de Pombal, 125, 5º andar, Centro, CEP: 20230-240, Rio de Janeiro, RJ, Brasil

e-mail: alimesq@uol.com.br

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ABSTRACT

Objective: The study aims to identify the prevalence of use of tobacco products by the LGBT population (lesbians, gays, bisexuals, transvestites, transsexuals, transgenders) in Brazil, the users´ profile and associations between tobacco use and social and behavioral variables.

Methodology: The study used data from a representative nationwide household survey of the Brazilian population aged 12-65 years – the first one to address the issue of sexual orientation/gender identity. The study sample consisted of 15,801 individuals. Social and behavioral characteristics and the use of tobacco products were compared according to sexual orientation/gender identity. Multivariate logistic model was constructed to assess the association between tobacco use and sexual orientation/gender identity, as well as models stratified by heterosexuals and LGBT.

Results: Prevalence of any tobacco product use was 44.68% among LGBT and 17.02% among heterosexual population. Waterpipe use was ~8 times higher for LGBT than for heterosexuals (13.50% vs. 1.55%). LGBT tobacco users were younger and more schooling than heterosexual tobacco users. After adjusting for social and behavioral variables, multivariate model showed that LGBT individuals were 150% more likely to use tobacco products than heterosexuals (AOR: 2.52; 95%CI:1.61-3.95). In the model for the LGBT population, schooling, alcohol consumption, illicit drug consumption, violence, and anxiety/depression were significantly associated with tobacco use.

Conclusion: Prevalence of tobacco use among LGBT was higher than among heterosexual, and the profile of tobacco users differed between them. It is urgent to monitor health issues in the LGBTQIA+ population in Brazil and to adopt tobacco control strategies for this group.

Keywords: LGBT; sexual minorities; gender minorities; tobacco use

Strenghts and limitations of this study

- The study yielded unprecedented data on tobacco use in the Brazilian LGBT population, contributing to the elaboration of tobacco control measures, strategies, and policies in this population.

- The study used data from the first representative nationwide survey in Brazil to address the issue of sexual orientation/gender identity.

- The LGBT (or its variations) group encompasses subgroups with highly distinct characteristics, experiences and particular issues related to their orientation or identity. Thus, treating all these subgroups as a single category reduces the fact that these differences may impact smoking differently.

INTRODUCTION

Smoking is considered a pandemic and thus a serious global public health problem, confronted in Brazil through coordinated and structured actions since the 1980s. This work was strengthened later by ratification of the World Health Organization´s Framework Convention on Tobacco Control, the first international public health treaty, which contains comprehensive measures in different areas focused on the reduction of tobacco supply and demand.[1]

However, there are still numerous challenges for tobacco control in Brazil and the world [2,3]. Despite the significant reduction in the prevalence of Brazilian smokers in recent years in the general population, from 34.8% in 1989 to 12.8% in 2019[4,5], smoking affects population groups unequally. According to the National Health Survey of 2019, the prevalence of tobacco use varied according to sex (men: 16.2% [95%CI 15.6-16.9] vs. women: 9.8% [95%CI 9.4-10.3]) and schooling (none or incomplete primary 17.6% [95%CI 16.9-18.4] vs. university 7.1% [95%CI 6.4-7.8]).[5]

Especially in the case of specific populations such as sexual and gender minorities (e.g., lesbians, gays, bisexuals, transsexuals, transvestites, transgenders, queers, intersex, asexuals, and others, combined in the LGBTQIA+ and other variations), the issue appears to be more serious, since published studies with data from other countries [6-8] and rare Brazilian studies point to higher consumption of tobacco products in this group. [9-11]

This scenario is aggravated by other variables associated with the LGBTQIA+ population, such as higher prevalence of health problems when compared to the general population. [12-14;11] This population also encounters greater difficulty in accessing health services, due to a series of factors, including prejudice, discrimination, and disinformation. [15-17]

Another key point is the tobacco industry´s approach to this group through supposed corporate social responsibility actions and other forms of promoting tobacco products.[18-22] There is little material (especially peer-reviewed articles) on the topic in Brazil, which ends up appearing through news in the mass media, intermittently, as in the case of the tobacco industry´s sponsorship of the LGBT Parade in São Paulo in 2019, and participation in human resources forums that address the issue of diversity.[23-25]

It is thus essential to shed light on smoking prevalence in the LGBTQIA+ population in Brazil, including both epidemiological indicators and an in-depth understanding of the phenomenon. Data such as prevalence, factors associated with different consumption patterns, and the profile of users in this specific group compared to the general population are necessary for orienting prevention and control measures as well as for backing the creation of public policies targeted specifically to this group.

Brazil lacks data and information on this population from comprehensive and representative national surveys. In addition, most of official health and social data collection instruments in Brazil do not have fields for identifying the LGBTQIA+ population.

The current study aims to know the prevalence of use of various tobacco products in the Brazilian LGBT population, using a comprehensive and nationally representative survey, as well as the profile of these users and possible associations between tobacco use and other variables.

METHODOLOGY

The data analyzed in this study are from the 3rd Brazilian Household Survey on Substance Use (BHSU-3), a representative nationwide survey of the Brazilian population

aged 12 to 65 years. A multistage stratified cluster sampling plan was used, including all 27 state capitals, in addition to small, medium, and large cities from Brazil´s five geographic regions, considering both the urban and rural areas. Data were collected from May to December 2015, obtaining a total of 16,273 complete interviews in 351 municipalities. Further details on the survey can be found in a specific publication.[26]

This was the first time in Brazil that a representative nationwide survey obtained data about the LGBTQIA+ population. The variable that allowed identification of this population was obtained with the question: "Do you consider yourself…", with the following options: "heterosexual", "homosexual (gay or lesbian)", "bisexual", "transsexual, transvestite, transgender", "other", "don´t know", or "prefer not to answer". This question ended up encompassing two distinct conceptual groups: sexual orientation (which would include options such as heterosexual, homosexual, or bisexual, among others not included) and gender identity (which would include options such as transsexual, transvestite, and transgender), and other definitions not included as options (e.g., cisgender woman or man, nonbinary, among others). Nevertheless, given the low prevalence of some categories in the sample, we opted to create a dichotomous variable called sexual orientation/gender identity, where one of the categories was "heterosexual" (n=15,641) and the other was "LGBT", which included homosexuals, bisexuals, transsexuals, transvestites, and transgenders (n=160). Individuals that reported "other" (n=1), "don´t know" (n=428), or "prefer not to answer" (n=43) were excluded from the analysis. The analyses presented here thus refer to a sample of 15,801 individuals.

Prevalence rates were estimated for use of tobacco products in the 12 months prior to the interview, with the respective 95% confidence intervals, for each of the following products: industrialized cigarettes, cigars, cigarillos, pipes, clove or kretek cigarettes, straw or hand-rolled cigarettes, waterpipes, smokeless tobacco (chewing tobacco, snuff),

and electronic cigarettes. A variable was also constructed on the use of any tobacco product among those described above, as well as on smoked tobacco products alone (excluding chewing tobacco and snuff from the analysis). These prevalence rates were calculated for the general population and stratified between heterosexuals and LGBT, and the groups´ comparison was based on overlapping versus no overlapping of the confidence intervals.

The principal outcome was defined in the subsequent analyses as the use of any tobacco product in the 12 months prior to the interview. The sociodemographic and behavioral characteristics of heterosexual and LGBT individuals were compared according to use or nonuse of tobacco products, namely: age group (12 to 24, 25 to 34, 35 to 65 years), sex (male or female), having a steady/stable partner, schooling (primary or less, secondary, university [incomplete or complete]), religion, alcohol consumption (at least one dose in the 12 months prior to the interview), illicit drug consumption (use of at least one illicit drug in the 12 months prior to the interview), having been the victim of violence in the 12 months prior to the interview, and depression or anxiety (self-report of diagnosis by a health professional).

A multivariate logistic model was constructed to assess the association between tobacco use in the 12 months prior to the survey and sexual orientation/gender identity, adjusting for the above-mentioned social and behavioral variables. We also calculated multivariate logistic models stratified between heterosexuals and LGBT to assess how the use of tobacco products was associated with such social and behavioral variables for each of these subgroups. For all the models, we present the adjusted odds ratios and their respective 95% confidence intervals.

All the analyses were performed in the R software version 4.0.3 using the “survey” and “srvy” packages to take the complex sampling design into account. [27]

The survey was conducted by the Oswaldo Cruz Foundation (FIOCRUZ) and financed by the Brazilian National Secretariat for Drug Policies (SENAD). The study protocol was approved by the Institutional Review Board of the Joaquim Venâncio Polytechnic Health School/FIOCRUZ (CAAE #35283814.4.0000.5241).

Patient and Public Involvement: Patients or the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

RESULTS

Social and behavioral characteristics of the general population according to sexual orientation/gender identity

Considering the population, independently of tobacco use, differences were observed between heterosexuals and LGBT in relation to all the target social and behavioral characteristics except for depression/anxiety **(Table 1)**. In the LGBT population, compared to heterosexuals, there were higher proportions of males (61.90% [95%CI: 52.89-70.90] vs. 48.45% [95%CI: 48.26-48.64]), individuals without a steady/stable partner (62.33% [95%CI: 53.43-71.23] vs. 38.75% [95%CI: 37.53-39.96]), with university schooling (41.95% [95%CI: 32.98-50.91] vs. 16.62% [95%CI: 15.41-17.82]), that consumed alcohol (73.22% [95%CI: 64.39-82.05] vs. 42.94% [95%CI: 41.61-44.27]), that consumed illicit drugs (22.97% [95%CI: 15.50-30.45] vs. 3.06% [95%CI: 2.63-3.49]), and that had been victims of violence in the 12 months prior to the interview (18.20% [95%CI: 10.21-26.19] vs. 6.39% [95%CI: 5.80-6.96]). Meanwhile, there was a lower proportion of persons aged 35 to 65 years among LGBT (28.73% [95%CI: 21.58-35.88]) than among heterosexuals (51.76% [95%CI: 51.56-51.95]), and this difference was statistically significant. (**Table 1**).

Table 1: Profile of the population according to sexual orientation/gender identity and consumption of tobacco products in the 12 months prior to the survey. Brazil, 2015

	LGBT									Heterosexual									Total		
	Use tobacco products			Don´t use tobacco products			Total			Use tobacco products			Don´t use tobacco products			Total					
	%	95%CI		%	95%CI		%	95%CI		%	95%CI		%	95%CI		%	95%CI		%	95%CI	
		LL	UL		LL	UL		LL	UL		LL	UL		LL	UL		LL	UL		LL	UL
Sex																					
Male	68.41	55.83	81.00	56.64	44.26	69.01	61.90	52.89	70.90	58.59	56.39	60.79	46.37	45.83	48.90	48.45	48.26	48.64	48.58	48.42	48.74
Female	31.59	19.00	44.17	43.36	30.99	55.74	38.10	29.10	47.11	41.41	39.21	43.61	53.63	53.10	54.16	51.55	51.36	51.74	51.42	51.26	51.58
Age																					
12 to 24 years	24.13	11.98	36.28	30.79	17.61	43.97	27.81	18.59	37.03	20.22	17.88	22.56	29.50	29.01	29.99	27.92	27.71	28.13	27.92	27.73	28.11
25 to 34 years	52.41	38.49	66.32	36.22	23.73	48.72	43.45	34.26	52.64	19.87	18.16	21.58	20.41	20.05	20.77	20.32	20.17	20.47	20.55	20.42	20.67
35 to 65 years	23.46	14.21	32.72	32.99	22.11	43.87	28.73	21.58	35.88	59.91	57.60	62.21	50.09	49.62	50.56	51.76	51.56	51.95	51.53	51.35	51.71
Steady/stable partner																					
Yes	33.31	19.93	46.68	41.19	29.03	53.36	37.67	28.77	46.57	60.97	58.39	63.55	61.31	60.03	62.59	61.25	60.04	62.47	61.02	59.80	62.24
No	66.69	53.32	80.07	58.81	46.64	70.97	62.33	53.43	71.23	39.03	36.45	41.61	38.69	37.41	39.97	38.75	37.53	39.96	38.98	37.76	40.20
Schooling																					
Primary or less	19.70	8.20	31.20	13.05	4.07	22.03	16.02	8.79	23.26	55.54	52.83	58.26	42.64	41.03	44.25	44.84	43.31	46.37	44.56	43.03	46.09
Secondary	34.77	22.06	47.48	47.90	35.57	60.23	42.03	32.99	51.07	31.85	29.40	34.30	39.92	38.55	41.29	38.54	37.29	39.80	38.58	37.33	39.83
University	45.53	32.03	59.03	39.05	26.97	51.13	41.95	32.98	50.91	12.61	10.89	14.33	17.44	16.13	18.75	16.62	15.41	17.82	16.86	15.66	18.07
Religion																					
No	22.27	10.52	34.03	20.76	9.96	31.56	21.44	13.22	29.65	13.63	11.85	15.41	7.48	6.66	8.30	8.52	7.72	9.32	8.65	7.86	9.44
Yes	77.73	65.97	89.48	79.24	68.44	90.04	78.56	70.35	86.78	86.37	84.59	88.15	92.52	91.70	93.34	91.48	90.68	92.28	91.35	90.56	92.14
Alcohol consumption*																					
Yes	85.76	75.35	96.16	63.10	50.06	76.14	73.22	64.39	82.05	67.14	64.71	69.57	37.97	36.57	39.37	42.94	41.61	44.27	43.23	41.91	44.56
No	14.24	3.84	24.65	36.90	23.86	49.94	26.78	17.95	35.61	32.86	30.43	35.29	62.03	60.63	63.42	57.06	55.73	58.39	56.77	55.44	58.09
Consumption of any drug*																					
Yes	35.26	22.51	48.01	13.05	5.18	20.93	22.97	15.50	30.45	11.50	9.77	13.23	1.33	0.99	1.67	3.06	2.63	3.49	3.25	2.82	3.69
No	64.74	51.99	77.49	86.95	79.07	94.82	77.03	69.55	84.50	88.50	86.77	90.23	98.67	98.33	99.02	96.94	96.51	97.37	96.75	96.31	97.18
Victim of violence*																					
Yes	28.30	14.41	42.19	10.05	1.94	18.16	18.20	10.21	26.19	10.90	9.12	12.68	5.47	4.89	6.05	6.39	5.80	6.98	6.50	5.90	7.11
No	71.70	57.81	85.59	89.95	81.84	98.06	81.80	73.81	89.79	89.10	87.32	90.88	94.53	93.95	95.12	93.61	93.02	94.20	93.50	92.89	94.10
Depression/Anxiety																					
Yes	27.56	15.66	39.45	12.71	3.31	22.11	19.34	11.78	26.90	22.29	20.16	24.42	14.65	13.53	15.77	15.95	14.87	17.04	15.99	14.91	17.06
No	72.44	60.55	84.34	87.29	77.89	96.69	80.66	73.10	88.22	77.71	75.58	79.84	85.35	84.23	86.47	84.05	82.96	85.13	84.01	82.94	85.09

Notes: *In the 12 months prior to the survey; 95%CI: 95% confidence interval; LL: lower limit of 95%CI; UL: upper limit of 95%CI
LGBT includes homosexuals, bisexuals, transvestites, and transsexuals

Social and behavioral characteristics of tobacco users according to sexual orientation/gender identity

Independently of sexual orientation/gender identity, most individuals that used tobacco products were males. In the population that had used tobacco products in the 12 months prior to the survey, most LGBT individuals were from the younger age groups (i.e., 12 to 34 years), while heterosexuals were mostly over 35 years. There was also a statistically significant difference in schooling: among LGBT persons that consumed tobacco products, 34.77% (95%CI: 22.06-47.48) had studied up to secondary school and 45.53% (95%CI: 19.32-36.29) had complete/incomplete university degree, while most heterosexual users had less schooling, with 55.54% (95%CI: 52.83-58.26) having studied complete primary school or less and only 12.61% (95%CI:10.89-14.33) had complete/incomplete university degree. Meanwhile, among tobacco users there was a lower proportion of LGBT with a steady/stable partner (33.31%, 95%CI: 19.93-46.68), compared to heterosexuals (60.97%, 95%CI: 58.39-63.55) **(Table 1)**.

The prevalence rates of LGBT smokers that consumed alcohol and illicit drugs (85.76% [95%CI:75.35-96.16] and 35.26% [95%CI: 22.51-48.01], respectively) were higher than the prevalence rates among heterosexual smokers (67.14% [95%CI: 64.71-69.57] and 11.50% [95%CI: 9.77-13.23], respectively). The proportion of LGBT tobacco users that reported having been victims of violence was also significantly higher than among heterosexual users (28.30% [95%CI: 14.41-42.19] vs. 10.90% [95%CI: 9.12-12.68]) **(Table 1).**

Use of tobacco products in the 12 months prior to the survey according to sexual orientation/gender identity

The prevalence of use of any tobacco product in the LGBT population was 44.68% (95%CI: 35.13-54.23), significantly higher than in the heterosexual population (17.02%; 95%CI: 16.19-17.85). The prevalence of use of industrialized cigarettes in the LGBT population was 39.53% (95%CI: 29.85-49.20), significantly higher than the prevalence among heterosexuals (15.10%; 95%CI: 14.32-15.88). (**Table 2**).

Table 2: Prevalence of use of tobacco products in the 12 months prior to the survey according to sexual orientation/gender identity. Brazil, 2015

	LGBT			Heterosexuals			Total		
	%	95%CI		%	95%CI		%	95%CI	
		LL	UL		LL	UL		LL	UL
Any tobacco product	44.68	35.13	54.23	17.02	16.19	17.85	17.29	16.46	18.11
Smoked tobacco products	44.68	35.13	54.23	16.84	16.01	17.66	17.11	16.29	17.92
Industrialized cigarettes	39.53	29.85	49.20	15.10	14.32	15.88	15.34	14.56	16.11
Straw cigarettes	6.04	1.29	10.78	3.84	3.32	4.37	3.86	3.34	4.39
Waterpipe	13.50	7.21	19.78	1.55	1.19	1.90	1.66	1.31	2.02
Kretek cigarettes	8.33	3.58	13.08	0.85	0.65	1.04	0.92	0.72	1.12
Smokeless tobacco (chewing tobacco, snuff)	0.52	0.00	1.54	0.64	0.45	0.82	0.63	0.45	0.82
Cigars	3.46	0.00	7.41	0.58	0.43	0.73	0.61	0.46	0.76
Electronic cigarettes	2.88	0.27	5.49	0.40	0.24	0.55	0.42	0.27	0.57
Cigarillos	1.57	0.00	3.16	0.33	0.23	0.43	0.34	0.24	0.45
Pipe	1.67	0.00	3.81	0.28	0.19	0.36	0.29	0.20	0.38

Notes: 95%CI: 95% confidence interval; LL: lower limit of 95%CI; UL: upper limit of 95%CI
LGBT includes homosexuals, bisexuals, transvestites, and transsexuals

In the LGBT population, the prevalence of waterpipe smoking was 8 times higher than the estimated prevalence among heterosexuals (13.50% [95%CI: 7.21-19.78] vs. 1.55% [95%CI: 1.19-1.90]). There was also a statistically significant difference in the

prevalence of kretek cigarette smoking between LGBT persons (8.33%; 95%CI: 3.58-13.08) and heterosexuals (0.85%; 95%CI: 0.65-1.04). Cigars, electronic cigarettes, and pipes showed prevalence less than 1% in the general population, but in all these cases, the point prevalence rates among LGBT persons were higher than among heterosexuals, but without statistical significance. (**Table 2**).

Prevalence of use of tobacco products in the 12 months prior to the survey according to social and behavioral characteristics and sexual orientation/gender identity

Prevalence of smoking among LGBT persons was statistically higher than among heterosexuals in both sexes and in all age groups and schooling levels, and was also higher among individuals that consumed alcohol, that reported having been victims of violence, and with a reported diagnosis of depression/anxiety (Table 3). Prevalence of smoking increased proportionally with age among heterosexuals, with 12.32% (95%CI: 10.68-13.96) in the 12 to 24 year group, 16.64% (95%CI: 15.00-18.28) in the 25 to 34 year group, and 19.70% (95%CI: 18.61-20.78) in the group 35 to 65 year group, but the same was not observed among LGBT persons: (20.24% [95%CI: 11.41-29.06], 27.36% [95%CI: 19.74-34.98], and 24.55% [95%CI: 19.77-29.34], respectively) (**Table 3**).

Table 3: Prevalence of use of tobacco products in the 12 months prior to the survey according to sexual orientation/gender identity and other characteristics. Brazil, 2015

	LGBT			Heterosexuals			Total		
	%	95%CI		%	95%CI		%	95%CI	
		LL	UL		LL	UL		LL	UL
Total	44.68	35.13	54.23	17.02	16.19	17.85	17.29	16.46	18.11
Sex									
Male	49.38	36.93	61.83	20.58	19.23	21.92	20.94	19.59	22.28
Female	37.04	23.18	50.89	13.67	12.75	14.59	13.84	12.93	14.75
Age									
12 to 24 years	38.76	18.93	58.59	12.32	10.68	13.96	12.58	10.95	14.20
25 to 34 years	53.88	39.09	68.67	16.64	15.00	18.28	17.41	15.78	19.03
35 to 65 years	36.48	23.85	49.12	19.70	18.61	20.78	19.79	18.71	20.87
Steady/stable partner									
Yes	39.50	25.06	53.94	16.94	15.86	18.01	17.07	16.00	18.14
No	47.80	35.13	60.48	17.14	15.90	18.38	17.62	16.36	18.87
Schooling									
Primary or less	54.94	30.48	79.41	21.08	19.75	22.41	21.20	19.87	22.53
Secondary	36.95	23.07	50.84	14.06	12.85	15.27	14.30	13.08	15.52
University	48.49	34.45	62.54	12.91	11.27	14.55	13.77	12.12	15.42
Religion									
No	46.42	25.72	67.12	27.21	24.02	30.40	27.67	24.53	30.81
Yes	44.20	33.75	54.65	16.07	15.21	16.92	16.30	15.45	17.15
Alcohol consumption*									
Yes	52.32	41.44	63.20	26.61	25.15	28.06	27.03	25.59	28.47
No	23.77	6.83	40.71	9.80	8.97	10.63	9.86	9.03	10.70
Consumption of any illicit drug*									
Yes	68.56	51.98	85.15	63.97	56.89	71.04	64.28	57.53	71.04
No	37.55	26.78	48.32	15.53	14.75	16.32	15.70	14.92	16.49
Victim of violence*									
Yes	69.46	48.04	90.88	29.02	24.84	33.20	30.12	26.00	34.24
No	39.16	28.73	49.59	16.20	15.38	17.01	16.39	15.58	17.21
Depression/Anxiety									
Yes	63.65	41.47	85.83	23.77	21.56	25.98	24.24	22.01	26.47
No	40.13	29.94	50.31	15.73	14.88	16.58	15.96	15.12	16.80

Notes: *In the 12 months prior to the survey; 95%CI: 95% confidence interval; LL: lower limit of 95%CI; UL: upper limit of 95%CI
LGBT includes homosexuais, bisexuals, transvestites, and transsexuals

Neither LGBT persons nor heterosexuals showed a statistically significant difference in prevalence of smoking according to presence of a steady/stable partner, but prevalence of smoking among LGBT persons was significantly higher than among heterosexuals for both types of partner status (**Table 3**).

Among heterosexuals, the prevalence of smoking decreased as schooling increased and was higher among individuals with primary schooling or less (21.08% [IC 95%: 19.75-22.41]) and lower among those that had finished university (12.91% [95%CI: 11.27-14.55]). The same pattern was not seen in the LGBT population **(Table 3).**

Higher prevalence rates of smoking were seen in persons that had consumed alcohol in the previous 12 months, compared to non-consumers, both in the LGBT population (52.32% [95%CI: 41.44-63.20] vs. 23.77% [95%CI: 6.83-40.71]) and among heterosexuals (26.61% [95%CI: 25.15-28.06] vs. 9.80% [95%CI: 8.97-10.63])); the same was true for those who had used illicit drugs in the previous 12 months compared to those who had not, both in the LGBT population (68.56% [95%CI: 51.98-85.15]) vs. 37.55% [IC95%: 26.78-48.32]) and among heterosexuals (63.97% [95%CI: 56.89-71.04] vs. 15.53% [95%CI: 14.75-16.32]).

As observed among heterosexuals, prevalence of smoking in the LGBT population was higher in those who had suffered violence in the 12 months prior to the interview (69.46%; 95%CI: 41.47-85.83), compared to those who had not (39.16%; 95%CI: 28.73-49.59), and among those with diagnosis of depression and/or anxiety (36.65%; 95%CI: 41.47-85.83) compared to those without such a diagnosis (40.13%; 95%CI: 29.94-50.31). However, although these differences exceeded 30 and 20 percentage points, respectively, they were not statistically significant.

Among LGBT persons, no statistically significant difference was seen in prevalence of smoking between those without and without a religion, contrary to heterosexuals, in whom prevalence of smoking was higher among those without a religion (27.21% [95%CI: 24.02-30.40]) compared to those with a religion (16.07% [95%CI: 15.21-16.92]).

Models

The multivariate model for the general population showed that, after adjusting for other sociodemographic and behavioral variables, LGBT persons were 150% more likely to use tobacco products when compared to heterosexuals (AOR: 2.52; 95%CI: 1.61-3.95) **(Table 4)**.

Table 4: Factors associated with the use of tobacco product in the 12 months prior to the survey. Brazil, 2015

	Total				Heterosexuals				LGBT			
	AOR	95%CI		p value	AOR	95%CI		p value	AOR	95%CI		p value
		LL	UL			LL	UL			LL	UL	
Sexual orientation/ gender identity												
Heterosexual	1.00	-	-	-	-	-	-	-	-	-	-	-
LGBT	2.52	1.61	3.95	<0.001	-	-	-	-	-	-	-	-
Sex												
Male	1.36	1.22	1.53	<0.001	1.36	1.21	1.52	<0.001	1.64	0.59	4.57	0.352
Female	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-
Age												
12 to 24 years	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-
25 to 34 years	1.61	1.30	2.01	<0.001	1.59	1.27	1.99	<0.001	2.39	0.83	6.92	0.114
35 to 65 years	2.12	1.76	2.55	<0.001	2.13	1.76	2.57	<0.001	1.03	0.33	3.25	0.956
Steady/stable partner												
Yes	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-
No	1.29	1.14	1.47	<0.001	1.29	1.14	1.47	<0.001	1.13	0.43	2.94	0.810
Schooling												
Primary or less	2.70	2.26	3.23	<0.001	2.69	2.24	3.22	<0.001	4.53	1.14	18.04	0.037
Secondary	1.50	1.24	1.81	<0.001	1.49	1.23	1.81	<0.001	1.13	0.38	3.37	0.828
University	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-
Religion												
No	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-
Yes	0.64	0.52	0.78	<0.001	0.63	0.51	0.77	<0.001	1.47	0.46	4.71	0.519
Alcohol consumption*												
Yes	3.26	2.87	3.70	<0.001	3.25	2.86	3.70	<0.001	2.94	1.04	8.29	0.046
No	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-
Consumption of any illicit drug*												
Yes	7.26	5.16	10.20	<0.001	7.48	5.25	10.65	<0.001	4.35	1.20	15.80	0.030
No	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-
Victim of violence*												
Yes	1.65	1.33	2.04	<0.001	1.62	1.30	2.02	<0.001	3.55	1.05	11.99	0.046
No	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-
Depression/Anxiety												
Yes	1.73	1.49	2.00	<0.001	1.72	1.48	1.99	<0.001	3.20	1.10	9.36	0.038
No	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-

Notes: *In the 12 months prior to the survey;
AOR: adjusted odds ratio; 95%CI: 95% confidence interval; LL: lower limit of 95%CI; UL: upper limit of 95%CI
LGBT includes homosexuals, bisexuals, transvestites, and transsexuals

In the multivariate model exclusively for heterosexuals, all the variables analyzed were associated significantly with the outcome. For the LGBT group model, the odds ratio only showed statistically significance for the variables schooling, alcohol consumption, illicit drug consumption, violence, and anxiety/depression, and the direction of these associations remained the same for the two population groups.

DISCUSSION

This study presents nationally representative data on the Brazilian LGBT population and points to higher prevalence of smoking in this population, when compared to heterosexuals, corroborating findings from studies with similar characteristics in other countries. [9-11]

According to the current study´s findings, LGBT tobacco users are mostly younger, more schooling, and with a lower proportion of persons with steady/stable partners, which distinguishes them from heterosexual tobacco users or smokers in general in Brazil, but similar to the profile of users of electronic smoking devices and waterpipe with regard to age and schooling.[28] Their profile was also similar to the general population of smokers, the majority of whom were males, but they showed higher prevalence rates of alcohol and illicit drug consumption. This information is relevant for proposing tobacco control measures targeted to LGBTQIA+ groups, both for prevention of smoking initiation and for smoking cessation.

Analyzing the prevalence of use of single tobacco products (i.e., separately for various products), we found higher prevalence of the use of nearly all types of products in the LGBT population when compared to the total population and heterosexuals.

Various recent studies have reported the use by LGBTQIA+ groups of so-called alternative tobacco products, or other tobacco products, generally meaning products other than industrialized cigarettes. [29-31] Such use can occur concurrently (use more than one tobacco product), or as already reported, the concurrent use of other products such as alcohol and illicit drugs in this population, [31-36] which was also seen in the current study.

The prevalence of use of electronic cigarettes, waterpipe, and straw cigarettes in the Brazilian population over 15 years of age remains low according to comprehensive population surveys. [28,37] However, an increase has been observed in these prevalence rates in recent years. It is also worthy of note that use of electronic cigarettes and waterpipe is higher among younger individuals with more schooling and who reside in the states of the Midwest, South, and Southeast regions of the country.[28] In the case of straw cigarettes, although consumption is higher in persons 25 years or older living in rural areas, there was a decrease in this group and an increase in younger individuals and residents of urban areas.[37.38]

The increase in the use of these products in the Brazilian population, especially young people, is an important challenge to be faced by the country´s tobacco control efforts. However, there are still no published data that allow assessing a possible increase of smoking in the LGBTQIA+ population, since information on sexual orientation and gender identity is not normally collected or published especially in surveys with representative samples of the population, as mentioned above.

Electronic Nicotine Delivery Systems (ENDS), which included electronic cigarettes and heated tobacco products, have their commercialization, importation, and advertising banned in Brazil by the National Health Regulatory Agency (ANVISA).[39]

However, the news story on the tobacco industry´s sponsorship of the LGBTQIA+ Parade in 2019, cited above, mentions heated tobacco products, even quoting the brand name and referring readers to the company´s website for more information.[40] In other words, the story featured both news and advertising, mixing a purported corporate social responsibility measure with publicity for a new product in this population group.

The tobacco industry uses a series of promotional strategies for its products, meanwhile garnering support from strategic groups and persons such as legislators and opinion-makers.[41,42] Corporate social responsibility, [43] which includes an approach to minority groups, has been documented in other studies, not only in relation to sexual minorities, but also blacks and indigenous peoples.[20,44,45] There are also numerous reports and extensive evidence that the tobacco industry promotes its products in the LGBTQIA+ population, for example through the inclusion of videos and advertising in various media.[19,21,22] There is thus a need for more research and studies to assess the hypothesis that such approaches partly explain the higher tobacco use observed in this population.

The study indicated that having a religion was a protective factor against tobacco use in heterosexuals and the general population, but not in the LGBT population. Published paper with data from a longitudinal study in the United States reported that young members of sexual minorities suffer intolerance and oppression by some religious denominations, which may help explain the fact that having a religion does not have the same beneficial effect in this population.[46]

Alcohol and illicit drug consumption, history of victimization from violence, and a diagnosis of depression or anxiety by a health professional were associated with higher prevalence of smoking in the LGBT population. Blosnich et al.[47], in a systematic

review of the etiology of the disparity in tobacco use among sexual minorities, discuss the existence of two groups in which factors related to higher smoking prevalence in the LGBTQIA+ population could be classified: those exclusive to this population, such as homophobia, reaction to the disclosure of their sexual orientation, and identification with subgroups belonging to sexual minorities; and others that are common to the general population but with higher rates in the LGBTQIA+ population, including alcohol and illicit drug use, violence, and mental disorders. In the current study, despite similarities in factors common to the general population, it was not possible to find a significant difference in magnitude.

The article by Blosnich et al. [47] is still the most extensive review of factors that may explain smoking prevalence in the LGBTQIA+ population. Recent reviews were performed in specific sub-identities within this population, which may help elucidate the topic, since the subgroups have distinct characteristics, as in the case of transgenders and bisexuals. [8,48] However, such reviews have not addressed etiological factors in depth.

Notwithstanding the topic´s importance, we highlight a limitation to the study, namely a factor that was not explored (indeed, that was impossible to explore) but that is highly relevant, the understanding that the acronym LGBTQIA+ (or its variations) encompasses different groups related to sexual orientation and gender identity. In fact, the acronym combines subgroups with highly distinct characteristics and experiences and particular issues inherent to their orientation or identity. Thus, treating all these subgroups as a single category reduces the fact that these differences may impact smoking differently, including the way it is manifested. An example involves studies that address specific groups within the LGBTQIA+ population, such as studies on transgenders or lesbians, or even those that manage to stratify their analyses within some subcategory of this larger acronym. [6-8,10,49,50]

Another limitation is a possible classification error in the sexual orientation/gender identity variable (e.g., a transgender person self-identified as heterosexual). Since the issue is sensitive, there will always be the possibility of classification error, especially in surveys using face-a-face questionnaires or interviews.[51] However, the fact that this is an unprecedented nationwide survey on this topic - that has received relatively little attention in Brazil - overrides these possible limitations.

There is still a gap in the determinant factors underlying this association or that can help understand it better. There is also a need for studies that better explore a possible explanatory or causal model for such higher prevalence rates in the consumption of tobacco by the LGBTQIA+ population.

Based on the above, it is urgent to obtain data that characterize the LGBTQIA+ population with all its diversity through large population-based studies, as well as to intensify health studies in this group. Meanwhile, in addition to future studies, the data presented here provide potential backing for immediate policies and actions to protect this population from smoking and its associated harms and risks. In addition to the characteristics of this group as a whole, policies and measures should take those who smoke into account in order to communicate and act more effectively to reverse this situation.

Contributor Statements:

Aline de Mesquita Carvalho - Substantial contributions to: the conception and design of the work; analysis and interpretation of data for the work; Drafting the work, revising

it critically for important intellectual content; final approval of the version to be published; agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Neilane Bertoni - Substantial contributions to: the conception and design of the work; the acquisition, analysis, interpretation of data for the work; drafting the work, revising it critically for important intellectual content; final approval of the version to be published; agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Carolina Fausto de Souza Coutinho - Substantial contributions to: the acquisition, analysis, and interpretation of data for the work; revising the work critically for important intellectual content; final approval of the version to be published; agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Francisco Inácio P. M. Bastos - Substantial contributions to: the acquisition, analysis, and interpretation of data for the work; revising the work critically for important intellectual content; final approval of the version to be published; agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Vania de Matos Fonseca - Substantial contributions to: the conception and design of the work; analysis and interpretation of data for the work; revising the work critically for important intellectual content; final approval of the version to be published; agreement to

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This study does not involve human participants

REFERENCES

1. Portes LH, Machado CV, Turci SRB, Figueiredo, VC, Cavalcante TM, Costa e Silva, VL. A Política de Controle do Tabaco no Brasil: um balanço de 30 anos. Ciência & Saúde Coletiva. 2018, 23(6): 1837-1848

2. Peruga A, López MJ, Martinez C, Fernández E. Tobacco control policies in the 21st century: achievements and open challenges. Mol Oncol. 2021 Mar;15(3):744-752. doi: 10.1002/1878-0261.12918. Epub 2021 Feb 15

3. Bialous S, Da Costa e Silva VL Where next for the WHO Framework Convention on Tobacco Control? Tobacco Control 2022;31:183-186.

4. Monteiro, C. A., Cavalcante, T. M., Moura, E. C., Claro, R. M., & Szwarcwald, C. L. (2007). Population-based evidence of a strong decline in the prevalence of smokers in Brazil (1989-2003). *Bulletin of the World Health Organization*, *85*(7), 527–534. https://doi.org/10.2471/BLT.06.039073

5. Instituto Brasileiro de Geografia e Estatística. (2020). *Pesquisa nacional de saúde 2019: percepção do estado de saúde, estilos de vida, doenças crônicas e saúde bucal: Brasil e regiões*

6. Lee JG, Griffin GK, Melvin CL. Tobacco use among sexual minorities in the USA, 1987 to May 2007: a systematic review. *Tob Control.* 2009; 18: 275-282

7. Li J, Berg CJ, Weber AA, Vu M, Nguyen J, Haardörfer R, Windle M, Goodman M, Escoffery C. Tobacco Use at the Intersection of Sex and Sexual Identity in the U.S., 2007-2020: A Meta-Analysis. Am J Prev Med. 2021 Mar;60(3):415-424.

8. Shokoohi M, Salway T, Ahn B, Ross LE. Disparities in the prevalence of cigarette smoking among bisexual people: a systematic review, meta-analysis and meta-regression. Tob Control. 2020 Sep 15:
9. Bertoni, N et al. Electronic cigarettes and narghile users in Brazil: Do they differ from cigarettes smokers? Addictive Behaviors, vol 98, November 2019
10. Fontanari, A.M.V, Churchill, S, Schneider, M.A, Soll, B, Costa, A. B., Lobato. M.I.R. Tobacco use among transgender and gender non-binary youth in Brazil. Cien Saude Colet [internet periodical] (2020/Jan). [Cited 30 June 2021]. http://cienciaesaudecoletiva.com.br/artigos/tobacco-use-among-transgender-and-gender-nonbinary-youth-in-brazil/17490?id=17490
11. Torres, JL, Gonçalves, GP, Pinho, AA, Souza, MHN. O Inquérito Nacional de Saúde LGBT+: metodologia e resultados descritivos. Cadernos de Saúde Pública, 2021; 37(9).
12. Simoni JM, Smith L, Oost KM, Lehavot K, Fredriksen-Goldsen K. Disparities in physical health conditions among lesbian and bisexual women: a systematic review of population-based studies. J Homosex. 2017 Jan;64(1):32-44.
13. Caceres BA, Jacjman KB, Ferrer L, Cato KD, Hughes TL. A scoping review of sexual minority women´s health in Latin America and the Caribbean. Int J Nurs Studi. 2019;94(2019):85-97.
14. Meads C, Carmona C, Kelly, M. Lesbian, gay and bisexual people´s health in the UK: a theoretic critic and systematic review. Diversity and Quality in Health and Care. 2012; 9: 19-32
15. Ferreira BO, Bonan C. Abrindo os armários do acesso e da qualidade: uma revisão integrativa sobre assistência à saúde das populações LGBTT. Ciênc. saúde coletiva. 2020;25(5):1765-78

16. Wilson EC, Jalil EM, Moreira RI, Velasque L, Castro CV, Monteiro L, Veloso VG, Grinsztejn B. High risk and low HIV prevention behaviours in a new generation of young trans women in Brazil. AIDS Care. 2021 Aug;33(8):997-1001.

17. Teixeira SL, Jalil CM, Jalil EM, Nazer SC, Silva SDCC, Veloso VG, Luz PM, Grinsztejn B. Evidence of an untamed HIV epidemic among MSM and TGW in Rio de Janeiro, Brazil: a 2018 to 2020 cross-sectional study using recent infection testing. J Int AIDS Soc. 2021 Jun;24(6):e25743. doi: 10.1002/jia2.25743. PMID: 34132470; PMCID: PMC8207443.

18. Smith, EA, Offen N, Malone RE. Pitures worth a thousand words: noncommercial tobacco content in the lesbian, gay and bisexual press. J health commun. 2006 Oct-Nov; 11(7):635-49.

19. Smith, EA, Offen N, Malone RE. What makes an ad a cigarette ad? Commercial tobacco imagery in the lesbian, gay, and bisexual press. J Epidemiol Community Health. 2005 Dec;59(12):1086-91.

20. Washington, HA. Burning Love: Big Tobacco Takes Aim at LGBT Youths. Am J Public Health. 2002 July; 92(7): 1086–1095.

21. Stevens P, Carlson LM, Hinman JM. An analysis of tobacco industry marketing to lesbian, gay, bisexual, and transgender (LGBT) populations: strategies for mainstream tobacco control and prevention. Health Promot Pract. 2004;5(3Suppl):129S-34S.

22. Lee JGL, Agnew-Brune CB, Clapp JA, Blosnich JR. Out smoking on the big screen: tobacco use in LGBT movies 2000–2011. Tob Control. 2014 Nov;23(e2):e156-8.

23. Athosgls. Philip Morris Brasil apoia a programação da 23ª Parada do orgulho LGBT de São Paulo. [Internet] https://athosgls.com.br/philip-morris-brasil-apoia-programacao-da-23a-parada-do-orgulho-lgbt-de-sao-paulo/#prettyPhoto

24. Folha do Mate [Internet]. Venâcio Aires, RS: Folha do Mate, 2020 [acesso em 14 fev 2021]. Philip Morris Brasil recebe selo de direitos humanos e diversidade. https://folhadomate.com/noticias/geral/philip-morris-brasil-recebe-selo-de-direitos-humanos-e-diversidade/

25. Azevedo A. Diversidade e inclusão LGBTI+ são temas de seminários em Curitiba. ViaG [Internet]. 2019 [accessed 17 Feb. 2021]. https://revistaviag.com.br/14647-2/

26. Fundação Oswaldo Cruz, Bastos FI, Bertoni N, et al, organizadores. III Levantamento Nacional sobre o uso de drogas pela população brasileira [Internet]. Rio de Janeiro: ICICT/FIOCRUZ; 2017

27. Lumley, Thomas. Complex Surveys: A Guide to Analysis Using R. Hoboken: John Wiley & Sons, 2010. 276 p..

28. Bertoni, Neilane et al. Prevalence of electronic nicotine delivery systems and waterpipe use in Brazil: where are we going? Revista Brasileira de Epidemiologia [online]. 2021, v. 24, suppl 2 [Accessed 29 March 2022], e210007. https://doi.org/10.1590/1980-549720210007.supl.2 Epub 10 Dec 2021. ISSN 1980-5497. https://doi.org/10.1590/1980-549720210007.supl.2

29. Ortiz K, Mamkherzi J, Salloum R, Matthews AK, Maziak W. Waterpipe tobacco smoking among sexual minorities in the United States: Evidence from the National Adult Tobacco Survey (2012-2014). Addict Behav. 2017 Nov;74:98-105. doi: 10.1016/j.addbeh.2017.06.001. Epub 2017 Jun 9. PMID: 28601749; PMCID: PMC5553049.

30. Nayak P, Salazar LF, Kota KK, Pechacek TF. Prevalence of use and perceptions of risk of novel and other alternative tobacco products among sexual minority adults: Results from an online national survey, 2014-2015. *Prev Med*. 2017;104:71-78. doi:10.1016/j.ypmed.2017.05.024

31. Fallin-Bennett et al / Other Tobacco Product Use Among Sexual Minority Young Adult Bar Patrons Am J Prev Med 2017;53(3):327–334

32. Paul A Gilbert, PhD, Christine M Kava, PhD, Rima Afifi, PhD, High-School Students Rarely Use E-Cigarettes Alone: A Sociodemographic Analysis of Polysubstance Use Among Adolescents in the United States, *Nicotine & Tobacco Research*, Volume 23, Issue 3, March 2021, Pages 505–510,

33. Arterberry BJ, Davis AK, Walton MA, Bonar EE, Cunningham RM, Blow FC. Predictors of empirically derived substance use patterns among sexual minority groups presenting at an emergency department. Addict Behav. 2019 Sep;96:76-81. doi: 10.1016/j.addbeh.2019.04.021. Epub 2019 Apr 22. PMID: 31048112; PMCID: PMC6736643.

34. Adzrago D, Tami-Maury I, Schick V, Wilkerson JM. Co-occurring substance use and psychological distress among exclusive e-cigarette use and other tobacco use among sexual and gender minorities in Texas. Drug Alcohol Depend. 2021 Dec 1;229(Pt A):109135.

35. Delahanty J, Ganz O, Hoffman L, Guillory J, Crankshaw E, Farrelly M. Tobacco use among lesbian, gay, bisexual and transgender young adults varies by sexual and gender identity. Drug Alcohol Depend. 2019 Aug 1;201:161-170.

36. Goodwin SR, Moskal D, Marks RM, Clark AE, Squeglia LM, Roche DJO. A Scoping Review of Gender, Sex and Sexuality Differences in Polysubstance Use

in Adolescents and Adults. Alcohol Alcohol. 2022 Mar 12:agac006. doi: 10.1093/alcalc/agac006. Epub ahead of print. PMID: 35284931.

37. Grilo G, Welding K, Szklo AS, *et al.* Straw cigarette branding: misleading descriptors and a new Marlboro man. *Tobacco Control* Published Online First: 17 November 2021. doi: 10.1136/tobaccocontrol-2021-056983
38. Szklo AS. Monitoramento da epidemia de tabagismo no Brasil a partir dos resultados da Pesquisa Nacional de Saúde (PNS) 2019. [Presentation]. Divisão de Pesquisa Populacional. Instituto Nacional de Câncer José Alencar Gomes da Silva.https://www.inca.gov.br/sites/ufu.sti.inca.local/files//media/document//resultados_pesquisa_nacional_saude_2019.pdf *[Accessed* 17 Jun 2021*]*
39. Agência Nacional de Vigilância Sanitária (Brasil). Resolução da Diretoria Colegiada RDC nº 46, de 28 de agosto de 2009. Proíbe a comercialização, a importação e propaganda de quaisquer dispositivos eletrônicos para fumar, conhecidos como cigarro eletrônico [Internet]. Diário Oficial da União. 31 ago 2009. [accessed 14 Feb. 2021]. http://antigo.anvisa.gov.br/documents/10181/2718376/RDC_46_2009_COMP.pdf/2148a322-03ad-42c3-b5ba-718243bd1919
40. https://gay.blog.br/gay/philip-morris-reforca-politica-de-inclusao-e-patrocina-parada-lgbt-de-sp/
41. Lee S, Ling PM, Glantz, SA. The vector of the tobacco epidemic: tobacco industry practices in low and middle-income countries. Cancer Causes Control, 23 (suppl 1) (2012), pp. 117-129.

42. Gilmore, A. Understanding the vector in order to plan effective tobacco control policies: an analysis of contemporary tobacco industry materials. Tobacco Control, 2012; 21: 119-126.

43. Fooks, G., Gilmore, A., Collin, J., Holden, C., & Lee, K. (2013). The Limits of Corporate Social Responsibility: Techniques of Neutralization, Stakeholder Management and Political CSR. *Journal of Business Ethics*, *112*(2), 283–299. https://doi.org/10.1007/s10551-012-1250-5

44. Thompson, S., Smith, J., Lee, K., & Thompson, S. (2020). Industry sponsored harm reduction conference courts Indigenous peoples in Canada. *Tobacco Control*. https://doi.org/10.1136/tobaccocontrol-2020-055669

45. Yerger, V. B., & Malone, R. E. (2002). African American leadership groups: Smoking with the enemy. *Tobacco Control*, *11*(4), 336–345.

46. Rostosky SS, Danner F, Riggle ED. Is religiosity a protective factor against substance use in young adulthood? Only if you're straight! J Adolesc Health. 2007 May;40(5):440-7. doi: 10.1016/j.jadohealth.2006.11.144. Epub 2007 Feb 15. PMID: 17448402.

47. Blosnich J, Lee JGL, Horn K. A systematic review of the aetiology of tobacco disparities for sexual minorities. Tobacco Control 2013;22:66-73.

48. Wolford-Clevenger C, Hill SV, Cropsey K. Correlates of Tobacco and Nicotine Use Among Transgender and Gender Diverse People: A Systematic Review Guided by the Minority Stress Model. Nicotine Tob Res. 2022 Mar 1;24(4):444-452.

49. Delahanty J, Ganz O, Hoffman L, Guillory J, Crankshaw E, Farrelly M. Tobacco use among lesbian, gay, bisexual and transgender young adults varies by sexual and gender identity. Drug Alcohol Depend. 2019 Aug 1;201:161-170.

50. Emory K, Kim Y, Buchting F, Vera L, Huang J, Emery SL. Intragroup Variance in Lesbian, Gay, and Bisexual Tobacco Use Behaviors: Evidence That Subgroups Matter, Notably Bisexual Women. Nicotine Tob Res. 2016 Jun;18(6):1494-501.

51. McNeel, S. Sensitive Issues in Surveys: Reducing Refusals While Increasing Reliability and Quality of Responses to Sensitive Survey Items. In: Gideon, L. Handbook of Survey Methodology for the Social Sciences. Springer Science+Business Media. 2012: 377-396.

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TOBACCO USE BY SEXUAL AND GENDER MINORITIES: FINDINGS FROM A BRAZILIAN NATIONAL SURVEY

Authors:

Aline de Mesquita Carvalho[1], Neilane Bertoni[2], Carolina Fausto de Souza Coutinho[3], Francisco Inácio Bastos[4], Vania de Matos Fonseca[5]

1 Instituto Nacional de Câncer, Division of Tobacco Control, Rio de Janeiro, Brazil

2 Instituto Nacional de Câncer, Division of Population Research, Rio de Janeiro, Brazil

3 Getulio Vargas Foundation School of Business Administration of São Paulo, São Paulo, Brazil

4 Oswaldo Cruz Foundation, Rio de Janeiro, Brazil

5 Instituto Fernandes Figueira, Fiocruz, Rio de Janeiro, Brazil

Corresponding author

Aline de Mesquita Carvalho

Address: Rua Marques de Pombal, 125, 5º andar, Centro, CEP: 20230-240, Rio de Janeiro, RJ, Brasil

e-mail: alimesq@uol.com.br

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ABSTRACT

Objective: The study aims to identify the prevalence of use of tobacco products by Sexual and Gender Minorities (SGM) in Brazil, the users´ profile, and associations between tobacco use and social and behavioral variables.

Methodology: The study used data from a representative nationwide household survey of the Brazilian population aged 12-65 years – the first one to address the issue of sexual orientation/gender identity. The study sample consisted of 15,801 individuals. Social and behavioral characteristics and the use of tobacco products were compared according to sexual orientation/gender identity. A multivariate logistic model was constructed to assess the association between tobacco use and sexual orientation/gender identity, as well as models stratified by SGM and non-SGM.

Results: Prevalence of any tobacco product use was 44.7% among SGM and 17.0% among non-SGM. Waterpipe use was ~8 times higher for SGM than for non-SGM (13.5% vs. 1.6%). SGM tobacco users were younger and had more schooling than non-SGM tobacco users. After adjusting for social and behavioral variables, the multivariate model showed that SGM were 150% more likely to use tobacco products than non-SGM (AOR: 2.52; 95%CI:1.61-3.95). In the model for SGM, schooling, alcohol consumption, illicit drug consumption, violence, and anxiety/depression were significantly associated with tobacco use.

Conclusion: Prevalence of tobacco use among SGM was higher than among non-SGM, and the profile of tobacco users differed between them. It is urgent to monitor health issues in SGM in Brazil and to adopt tobacco control strategies for this group.

Keywords: LGBT; sexual minorities; gender minorities; tobacco use

Strengths and limitations of this study

- The study yielded unprecedented data on tobacco use by Brazilian SGM, contributing to the elaboration of tobacco control measures, strategies, and policies in this population.

- The study used data from the first representative nationwide survey in Brazil to address the issue of sexual orientation/gender identity.

- The term SGM encompasses subgroups with highly distinct characteristics, experiences, and particular issues related to their orientation or identity. Thus, treating all these subgroups as a single category overlooks the fact that these differences may impact smoking differently.

INTRODUCTION

Smoking is considered a pandemic and thus a serious global public health problem, confronted in Brazil through coordinated and structured actions since the 1980s. This work was strengthened later by ratification of the World Health Organization´s Framework Convention on Tobacco Control, the first international public health treaty, which contains comprehensive measures in different areas focused on the reduction of tobacco supply and demand [1]

However, there are still numerous challenges for tobacco control in Brazil and the world [2,3]. Despite a significant reduction in smoking prevalence in recent years in the general population of Brazil, from 34.8% in 1989 to 12.8% in 2019 [4,5], smoking affects population groups unequally. According to the National Health Survey of 2019, prevalence of tobacco use varied according to sex (men: 16.2% [95%CI 15.6-16.9] vs. women: 9.8% [95%CI 9.4-10.3]) and schooling (none or incomplete primary 17.6% [95%CI 16.9-18.4] vs. university 7.1% [95%CI 6.4-7.8]).[5]

Especially in the case of specific populations such as Sexual and Gender Minorities − SGM (e.g., lesbians, gays, bisexuals, transsexuals, transvestites, transgenders, queers, intersex, asexuals, and others, frequently known by the acronym LGBTQIA+), the issue appears to be more serious, since published studies with data from other countries [6-8] and the rare existing Brazilian studies point to higher consumption of tobacco products in this group. [9-11]

This scenario is aggravated by other variables associated with SGM, such as higher prevalence of health problems when compared to the general population. [12-14;11] The population of SGM also encounters greater difficulty in accessing health

services, due to a series of factors, including prejudice, discrimination, and disinformation. [15-17]

Another key point is the tobacco industry´s approach to this group through supposed corporate social responsibility actions and other forms of promoting tobacco products.[18-22] There is little material (especially peer-reviewed articles) on the topic in Brazil, which ends up appearing through news in the mass media, intermittently, as in the case of the tobacco industry´s sponsorship of the LGBT Parade in São Paulo in 2019, and participation in human resources forums that address the issue of diversity.[23-25]

It is thus essential to shed light on smoking prevalence among SGM in Brazil, including both epidemiological indicators and an in-depth understanding of the phenomenon. Data such as prevalence, factors associated with different consumption patterns, and the profile of users in this specific group compared to the general population are necessary for orienting prevention and control measures as well as for backing the creation of public policies targeted specifically to this group.

Brazil lacks data and information on this population from comprehensive and representative national surveys. In addition, most official health and social data collection instruments in Brazil do not have fields for identifying SGM.

The current study aims to estimate the prevalence of use of various tobacco products in Brazilian SGM, using a comprehensive and nationally representative survey, as well as the profile of these users and possible associations between tobacco use and other variables.

METHODOLOGY

The data analyzed in this study are from the 3rd National Survey on Drug Use by the Brazilian Population, a representative nationwide survey of the Brazilian population aged 12 to 65 years. A multistage stratified cluster sampling plan was used, including all 27 state capitals, in addition to small, medium, and large cities from Brazil´s five geographic regions, considering both the urban and rural areas. Data were collected from May to December 2015, obtaining a total of 16,273 complete interviews out of the 16,400 planned interviews (i.e., 99.2% of the number of interviews defined a priori), in 351 municipalities. In order to address non-response, both hot deck imputation and post-stratification adjustments in the weights were used. The variables used for this purpose were as follows: sex, age strata, major geographic regions, and household characteristics. Further details on the survey can be found in a specific publication, summarizing its methods and broad findings [26]

This was the first time in Brazil that a representative nationwide survey obtained data on SGM. The variable that allowed identification of this population was obtained with the question: “Do you consider yourself…”, with the following options: “heterosexual”, “homosexual (gay or lesbian)”, “bisexual”, “transsexual, transvestite, transgender”, “other”, “don´t know”, or “prefer not to answer”. This question ended up encompassing two distinct conceptual groups: sexual orientation (which would include options such as heterosexual, homosexual, or bisexual, among others not included) and gender identity (which would include options such as transsexual, transvestite, and transgender), and other definitions not included as options (e.g., cisgender woman or man, nonbinary, among others). Nevertheless, given the low prevalence of some categories in the sample, we opted to create a dichotomous variable called sexual orientation/gender identity, where one of the categories was “non-SGM” (n=15,641) and the other was

"SGM", which included homosexuals, bisexuals, transsexuals, transvestites, and transgenders (n=160). Individuals that reported "other" (n=1), "don´t know" (n=428), or "prefer not to answer" (n=43) were excluded from the analysis. The analyses presented here thus refer to a sample of 15,801 individuals.

Prevalence rates were estimated for use of tobacco products in the 12 months prior to the interview, with the respective 95% confidence intervals, for each of the following products: industrialized cigarettes, cigars, cigarillos, pipes, clove or kretek cigarettes, straw or hand-rolled cigarettes, waterpipes, smokeless tobacco (chewing tobacco, snuff), and electronic cigarettes. A variable was also constructed on the use of any tobacco product among those described above, as well as on smoked tobacco products alone (excluding chewing tobacco and snuff from the analysis). These prevalence rates were calculated for the general population and stratified between SGM and non-SGM, and the groups´ comparison was based on overlapping versus no overlapping of the confidence intervals.

Proportion of sociodemographic and behavioral characteristics of SGM and non-SGM (N and %), with the respective 95% confidence intervals, were compared according to use or nonuse of tobacco products, namely: age group (12 to 24, 25 to 34, 35 to 65 years), sex (male or female), having a steady/stable partner, schooling (primary or less, secondary, university [incomplete or complete]), religion, alcohol consumption (at least one dose in the 12 months prior to the interview), illicit drug consumption (use of at least one illicit drug in the 12 months prior to the interview), having been the victim of violence in the 12 months prior to the interview, and depression or anxiety (self-report of diagnosis by a health professional).

The principal outcome was defined in the subsequent analyses as the use of any tobacco product in the 12 months prior to the interview. Prevalence rates, with the

respective 95% confidence intervals, were calculated for SGM and non-SGM according to the same sociodemographic and behavioral characteristics described above. Comparison of the groups was based on overlapping versus non-overlapping of the confidence intervals.

A bivariate logistic model was fitted to assess the association between tobacco use in the 12 months prior to the survey and all the above-mentioned social and behavioral variables, including sexual orientation/gender identity. Bivariate logistic analysis was calculated for both SGM and non-SGM, in tandem, assessing the association of the same social and behavioral variables with tobacco use.

A multivariate logistic model was fitted to assess the putative association between tobacco use in the 12 months prior to the survey and sexual orientation/gender identity, adjusting for the above-mentioned social and behavioral variables. We also calculated multivariate logistic models stratified between SGM and non-SGM to assess how the use of tobacco products was associated with such social and behavioral variables for each of these subgroups. For all the models, we present the adjusted odds ratios and their respective 95% confidence intervals.

All the analyses were performed in R version 4.0.3 using the "survey" and "srvy" packages to take the complex sampling design into account. [27]

The original survey was conducted by the Oswaldo Cruz Foundation (FIOCRUZ), funded by the Brazilian National Secretariat for Drug Policies (SENAD).

The study protocol was approved by the Institutional Review Board of the Joaquim Venâncio Polytechnic Health School/FIOCRUZ (CAAE #35283814.4.0000.5241).

Patient and Public Involvement: Neither patients nor the public were involved in the study's design, performance, reporting, or publication of research plans.

RESULTS

Social and behavioral characteristics of the general population according to sexual orientation/gender identity

Considering the population, independently of tobacco use, differences were observed between SGM and non-SGM in relation to all the target social and behavioral characteristics except for depression/anxiety **(Supplementary Table 1)**. Among SGM, compared to non-SGM, there were higher proportions of males (61.9% [95%CI: 52.9-70.9] vs. 48.5% [95%CI: 48.3-48.6]), individuals without a steady/stable partner (62.3% [95%CI: 53.4-71.2] vs. 38.8% [95%CI: 37.5-40.0]), with university schooling (42.0% [95%CI: 33.0-50.9] vs. 16.6% [95%CI: 15.4-17.8]), that consumed alcohol (73.2% [95%CI: 64.4-82.1] vs. 42.9% [95%CI: 41.6-44.3]), that consumed illicit drugs (23.0% [95%CI: 15.5-30.5] vs. 3.1% [95%CI: 2.6-3.5]), and that had been victims of violence in the 12 months prior to the interview (18.2% [95%CI: 10.2-26.2] vs. 6.4% [95%CI: 5.8-7.0]). Meanwhile, there was a lower proportion of persons aged 35 to 65 years among SGM (28.7% [95%CI: 21.6-35.9]) than among non-SGM (51.8% [95%CI: 51.6-52.0]), and this difference was statistically significant. (**Supplementary Table 1**).

Social and behavioral characteristics of tobacco users according to sexual orientation/gender identity

Independently of sexual orientation/gender identity, most individuals that used tobacco products were males. In the population that had used tobacco products in the 12 months prior to the survey, most SGM were from the younger age groups (i.e., 12 to 34 years), while non-SGM were mostly over 35 years. There was also a statistically significant difference in schooling: among SGM that consumed tobacco products, 34.8% (95%CI: 22.1-47.5) had studied up to secondary school and 45.5% (95%CI: 19.3-36.3) had complete/incomplete university degree, while most non-SGM–users had less schooling, with 55.5% (95%CI: 52.8-58.3) having completed primary school or less, while only 12.6% (95%CI:10.9-14.3) had complete/incomplete university education. Meanwhile, among tobacco users there was a lower proportion of SGM with steady/stable partners (33.3%, 95%CI: 19.9-46.7), compared to non-SGM (61.0%, 95%CI: 58.4-63.6) **(Supplementary Table 1)**.

The prevalence rates of SGM tobacco users that consumed alcohol and illicit drugs (85.8% [95%CI:75.4-96.2] and 35.3% [95%CI: 22.5-48.0], respectively) were higher than the prevalence rates among non-SGM tobacco users (67.1% [95%CI: 64.7-69.6] and 11.5% [95%CI: 9.8-13.2], respectively). The proportion of SGM tobacco users that reported having been victims of violence was also significantly higher than among non-SGM users (28.3% [95%CI: 14.4-42.2] vs. 10.9% [95%CI: 9.1- 12.7]) **(Supplementary Table 1).**

Use of tobacco products in the 12 months prior to the survey according to sexual orientation/gender identity

The prevalence of use of any tobacco product by SGM was 44.7% (95%CI: 35.1-54.2), significantly higher than by non-SGM (17.0%; 95%CI: 16.2-17.9). The prevalence of use of industrialized cigarettes by SGM was 39.5% (95%CI: 29.9-49.2), significantly higher than the prevalence among non-SGM (15.1%; 95%CI: 14.3-15.9). (**Supplementary Table 2**).

We performed additional analyses on the prevalence of use of any tobacco product, for all interviewees who answered "don´t know" for the variable sexual orientation/self-identified gender (n=428). The prevalence was 18.1% (95%IC:13.9-22.3) (data not included in the Table).

Among SGM, the prevalence of waterpipe smoking was 8 times higher than the estimated prevalence among non-SGM (13.5% [95%CI: 7.2-19.8] vs. 1.6% [95%CI: 1.2-1.9]). There was also a statistically significant difference in the prevalence of kretek cigarette smoking between SGM (8.3%; 95%CI: 3.6-13.1) and non-SGM (0.9%; 95%CI: 0.7-1.0). Cigars, electronic cigarettes, and pipes showed prevalence less than 1% in the general population, but in all these cases, the point prevalence rates among SGM were higher than among non-SGM (however, without statistical significance) (**Supplementary Table 2**).

Prevalence of use of tobacco products in the 12 months prior to the survey according to social and behavioral characteristics and sexual orientation/gender identity

Prevalence of smoking among SGM was statistically higher than among non-SGM in both sexes and in all age groups and schooling levels, and was also higher among

individuals that consumed alcohol, that reported having been victims of violence, and that reported a diagnosis of depression/anxiety (**Supplementary Table 3**). Prevalence of smoking increased proportionally with age among non-SGM, with 12.3% (95%CI: 10.7-14.0) in the 12 to 24 year group, 16.6% (95%CI: 15.0-18.3) in the 25 to 34 year group, and 19.7% (95%CI: 18.6-20.8) in the group 35 to 65 year group, but the same was not observed among SGM: (20.2% [95%CI: 11.4-29.1], 27.4% [95%CI: 19.7-35.0], and 24.6% [95%CI: 19.8-29.3], respectively) (**Supplementary Table 3**).

Neither SGM nor non-SGM showed statistically significant difference in prevalence of smoking according to presence of a steady/stable partner, but prevalence of smoking among SGM was significantly higher than among non-SGM for both types of partner status (**Supplementary Table 3**).

Among non-SGM, the prevalence of smoking decreased as schooling increased and was higher among individuals with primary schooling or less (21.1% [IC 95%: 19.8-22.4]) and lower among those that had finished university (12.9% [95%CI: 11.3-14.6]). The same pattern was not seen among SGM **(Supplementary Table 3).**

Higher prevalence rates of smoking were seen in persons that had consumed alcohol in the previous 12 months, compared to non-consumers, among both SGM (52.3% [95%CI:41.4-63.2] vs. 23.8% [95%CI: 6.8-40.7]) and non-SGM (26.6% [95%CI:25.2-28.1] vs. 9.8% [95%CI: 9.0-10.6])). The same was true for those who had used illicit drugs in the previous 12 months compared to those who had not, both in SGM (68.6% [95%CI:52.0-85.2]) vs. 37.6% [IC95%:26.8-48.3]) and non-SGM (64.0% [95%CI:56.9-71.0] vs. 15.5% [95%CI:14.8-16.3]).

As observed among non-SGM, prevalence of smoking among SGM was higher in those who had suffered violence in the 12 months prior to the interview (69.5%; 95%CI:

41.5-85.8), compared to those who had not (39.2%; 95%CI: 28.7-49.6), and among those with diagnosis of depression and/or anxiety (36.7%; 95%CI: 41.5-85.8) compared to those without such a diagnosis (40.1%; 95%CI: 29.9-50.3). However, although these differences exceeded 30 and 20 percentage points, respectively, they were not statistically significant.

Among SGM, no statistically significant difference was seen in prevalence of smoking between those without versus with a religion, contrary to non-SGM, in whom prevalence of smoking was higher among those without a religion (27.2% [95%CI: 24.0-30.4]) compared to those with a religion (16.1% [95%CI: 15.2-16.9]).

Additional information on statistical modeling

Bivariate analysis showed that SGM had an odds ratio of 3.94 (95%CI:2.66;5.84) for having used tobacco products in the previous 12 months compared to non-SGM. Other intermediate analyses revealed that for non-SGM, all variables (with the sole exception of having a steady partner) were associated with tobacco use. Among SGM, the use of alcohol and illicit drugs, having been a victim of violence, and previous diagnosis of anxiety and depression were associated with tobacco use (**Supplementary Table 4**).

The multivariate model for the general population showed that, after adjusting for other sociodemographic and behavioral variables, SGM were 150% more likely to use tobacco products when compared to non-SGM (AOR:2.52; 95%CI:1.61-3.95) **(Supplementary Table 5)**.

In the multivariate model fitting data on non-SGM, all the variables analyzed were associated significantly with the outcome. As for the model on SGM, the odds ratios were only statistically significant for schooling, alcohol consumption, illicit drug consumption,

violence, and anxiety/depression. The direction of these associations remained the same for the two groups.

DISCUSSION

This study presents nationally representative data on Brazilian SGM and points to higher prevalence of smoking in this population, when compared to non-SGM, corroborating findings from studies with similar characteristics in other countries. [9-11]

According to the current study´s findings, SGM tobacco users are mostly younger, more educated, and with a lower proportion of persons with steady/stable partners, which distinguishes them from non-SGM tobacco users or tobacco users in general in Brazil, but similar to the profile of users of electronic smoking devices and waterpipes with regard to age and schooling.[28] Their profile was also similar to the general population of tobacco users, the majority of whom were males, but they showed higher prevalence rates of alcohol and illicit drug consumption. This information is relevant for proposing tobacco control measures targeted to SGM, both for prevention of smoking initiation and for smoking cessation.

Analyzing the prevalence of use of single tobacco products (i.e., separately for various products), we found higher prevalence rates for the use of nearly all types of products in SGM when compared to the total population and non-SGM.

Various recent studies have reported the use, by SGM, of so-called alternative tobacco products, or other tobacco products, generally meaning products other than industrialized cigarettes. [29-31] Such use can be concurrent (use of more than one tobacco product), or as already reported, the concurrent use of other products such as

alcohol and illicit drugs in this population, [31-36] which was also seen in the current study.

The prevalence of use of electronic cigarettes, waterpipes, and straw cigarettes in the Brazilian population over 15 years of age remains low according to comprehensive population surveys. [28,37] However, an increase has been observed in these prevalence rates in recent years. It is also worthy of note that use of electronic cigarettes and waterpipes is higher among younger individuals with more schooling and who reside in the states of the Midwest, South, and Southeast regions of the country.[28] In the case of straw cigarettes, although consumption is higher in persons 25 years or older living in rural areas, there was a decrease in this group and an increase in younger individuals and residents of urban areas.[37.38]

The increase in the use of these products in the Brazilian population, especially young people, poses an important challenge for the country´s tobacco control efforts. However, there are still no published data that allow assessing a possible increase in smoking among SGM, since information on sexual orientation and gender identity is not normally collected or published, especially in surveys with representative samples of the population, as mentioned above.

Electronic Nicotine Delivery Systems (ENDS), which included electronic cigarettes and heated tobacco products, have their commercialization, importation, and advertising banned in Brazil by the National Health Regulatory Agency (ANVISA).[39] However, the news story on the tobacco industry´s sponsorship of the LGBTQIA+ Parade in 2019, cited above, mentions heated tobacco products, even quoting the brand name and referring readers to the company´s website for more information.[40] In other words, the

story featured both news and advertising, mixing a purported corporate social responsibility measure with publicity for a new product in this population group.

The tobacco industry uses a series of promotional strategies for its products, meanwhile garnering support from strategic groups and persons such as legislators and opinion-makers.[41,42] Corporate social responsibility, [43] which includes an approach to minority groups, has been documented in other studies, not only in relation to sexual minorities, but also blacks and indigenous peoples.[20,44,45] There are also numerous reports and extensive evidence that the tobacco industry promotes its products among SGM, for example through the inclusion of videos and advertising in various media.[19,21,22] There is thus a need for more research to assess the hypothesis that such approaches partly explain the higher tobacco use observed in this population.

The study indicated that having a religion was a protective factor against tobacco use in non-SGM and the general population, but not in SGM. A published paper with data from a longitudinal study in the United States reported that young members of sexual minorities suffer intolerance and oppression by some religious denominations, which may help explain the fact that having a religion does not have the same beneficial effect in this population.[46]

Alcohol and illicit drug consumption, history of victimization from violence, and a diagnosis of depression or anxiety by a health professional were associated with higher prevalence of smoking in SGM. Blosnich et al.[47], in a systematic review of the etiology of the disparity in tobacco use among sexual minorities, discuss the existence of two groups in which factors related to higher smoking prevalence in SGM could be classified: those exclusive to this population, such as internalized homophobia, reaction to the disclosure of their sexual orientation, and identification with subgroups belonging to

sexual minorities; and others that are common to the general population but with higher rates in SGM, including alcohol and illicit drug use, violence, and mental disorders. In the current study, despite similarities in factors common to the general population, it was not possible to find a significant difference in magnitude.

The article by Blosnich et al. [47] is still the most extensive review of factors that may explain smoking prevalence among SGM. Recent reviews were performed in specific sub-identities within this population, which may help elucidate the topic, since the subgroups have distinct characteristics, as in the case of transgenders and bisexuals. [8,48] However, such reviews have not addressed etiological factors in depth.

Notwithstanding the topic´s importance, we highlight a limitation to the study, namely a factor that was impossible to explore due to the relatively low figures for SGM (despite the large sample size), but that is highly relevant: the understanding that the term SGM (or the acronym LGBTQIA+ and its variations) encompasses different groups related to sexual orientation and gender identity. In fact, the acronym combines subgroups with highly distinct characteristics and experiences and particular issues inherent to their orientation or identity. Thus, treating all these subgroups as a single category reduces the fact that these differences may impact smoking differently, including the way it is manifested. An example involves studies that address specific groups within SGM, such as studies on transgenders or lesbians, or even those that manage to stratify their analyses within some subcategory of this broad category. [6-8,10,49,50]

Another limitation is a possible classification error in the sexual orientation/gender identity variable (e.g., a transgender person self-identified as heterosexual). Since the issue is sensitive, there will always be the possibility of classification error, especially in surveys using face-a-face questionnaires or

interviews.[51] However, the fact that this is an unprecedented nationwide survey on this topic - which has received relatively little attention in Brazil - overrides these possible limitations.

The field work was carried out in 2015. Nevertheless, our study analyzes data from the last nationwide study carried out before the discontinuation of different national surveys. Due to a combination of decisions by the federal government and the pandemic, nationwide surveys have been discontinued and even the 2020 Census has yet to be finalized (as of March 2023).

Meanwhile, the results are fully generalizable for the Brazilian population in the respective period, due to strict compliance with probability-sampling rules in every step and procedure, according to both the national guidelines issued by IBGE and international guidelines. [52,53]

There is still a gap in knowledge of underlying determinants of this association or that can help understand it better. There is also a need for studies that better explore a possible explanatory or causal model for such higher prevalence rates in the consumption of tobacco by SGM.

Based on the above, it is urgent to obtain data that characterize SGM with all their diversity through large population-based studies, as well as to intensify health studies in this group. Meanwhile, in addition to future studies, the data presented here provide potential backing for immediate policies and actions to protect this population from smoking and its associated harms and risks.

We believe it is important to address the interface between tobacco control policies and other related policies such as LGBT health, mental health, and human rights.

We also highlight the importance of pursuing specific strategies for the profile of tobacco users that was identified in this population (young, more educated, and single), such as intensifying communication and monitoring of internet/social networks, bars, and parties. Finally, we emphasize the importance of greater attention to this population in terms of the supply of treatment for nicotine addiction and the inclusion of this topic in clinical protocols.

In addition to the characteristics of this group as a whole, policies and measures should take those who use tobacco products into account in order to communicate and act more effectively to reverse this situation.

Contributor Statements:

Aline de Mesquita Carvalho - Substantial contributions to: the conception and design of the work; analysis and interpretation of data for the work; Drafting the work, revising it critically for important intellectual content; final approval of the version to be published; agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Neilane Bertoni - Substantial contributions to: the conception and design of the work; the acquisition, analysis, interpretation of data for the work; drafting the work, revising it critically for important intellectual content; final approval of the version to be published; agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Carolina Fausto de Souza Coutinho - Substantial contributions to: the acquisition, analysis, and interpretation of data for the work; revising the work critically for important intellectual content; final approval of the version to be published; agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Francisco Inácio P. M. Bastos - Substantial contributions to: the acquisition, analysis, and interpretation of data for the work; revising the work critically for important intellectual content; final approval of the version to be published; agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Vania de Matos Fonseca - Substantial contributions to: the conception and design of the work; analysis and interpretation of data for the work; revising the work critically for important intellectual content; final approval of the version to be published; agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Disclaimer: The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policies or positions of any Brazilian government agency.

Data sharing statement:

Data are available upon reasonable request

Ethics Approval:

This article used data from the 3rd National Survey on Drug Use by the Brazilian Population, which was submitted and approved by an Institutional Review Board for Research with Human Subjects of FIOCRUZ (No. 902.763m CEP/EPSJY - CAAE: 35283814.4.0000.5241). All participants read and signed the informed consent form before participating in the study. In the case of minors, the term was also signed by the parents or guardians. All participants had their anonymity guaranteed.

REFERENCES

1. Portes LH, Machado CV, Turci SRB, Figueiredo, VC, Cavalcante TM, Costa e Silva, VL. A Política de Controle do Tabaco no Brasil: um balanço de 30 anos. Ciência & Saúde Coletiva. 2018, 23(6): 1837-1848

2. Peruga A, López MJ, Martinez C, Fernández E. Tobacco control policies in the 21st century: achievements and open challenges. Mol Oncol. 2021 Mar;15(3):744-752. doi: 10.1002/1878-0261.12918. Epub 2021 Feb 15

3. Bialous S, Da Costa e Silva VL Where next for the WHO Framework Convention on Tobacco Control? Tobacco Control 2022;31:183-186.

4. Monteiro, C. A., Cavalcante, T. M., Moura, E. C., Claro, R. M., & Szwarcwald, C. L. (2007). Population-based evidence of a strong decline in the prevalence of smokers in Brazil (1989-2003). *Bulletin of the World Health Organization*, *85*(7), 527–534. https://doi.org/10.2471/BLT.06.039073

5. Instituto Brasileiro de Geografia e Estatística. (2020). *Pesquisa nacional de saúde 2019: percepção do estado de saúde, estilos de vida, doenças crônicas e saúde bucal: Brasil e regiões*

6. Lee JG, Griffin GK, Melvin CL. Tobacco use among sexual minorities in the USA, 1987 to May 2007: a systematic review. *Tob Control.* 2009; 18: 275-282

7. Li J, Berg CJ, Weber AA, Vu M, Nguyen J, Haardörfer R, Windle M, Goodman M, Escoffery C. Tobacco Use at the Intersection of Sex and Sexual Identity in the U.S., 2007-2020: A Meta-Analysis. Am J Prev Med. 2021 Mar;60(3):415-424.

8. Shokoohi M, Salway T, Ahn B, Ross LE. Disparities in the prevalence of cigarette smoking among bisexual people: a systematic review, meta-analysis and meta-regression. Tob Control. 2020 Sep 15:

9. Bertoni, N et al. Electronic cigarettes and narghile users in Brazil: Do they differ from cigarettes smokers? Addictive Behaviors, vol 98, November 2019

10. Fontanari, A.M.V, Churchill, S, Schneider, M.A, Soll, B, Costa, A. B., Lobato. M.I.R. Tobacco use among transgender and gender non-binary youth in Brazil. Cien Saude Colet [internet periodical] (2020/Jan). [Cited 30 June 2021]. http://cienciaesaudecoletiva.com.br/artigos/tobacco-use-among-transgender-and-gender-nonbinary-youth-in-brazil/17490?id=17490

11. Torres, JL, Gonçalves, GP, Pinho, AA, Souza, MHN. O Inquérito Nacional de Saúde LGBT+: metodologia e resultados descritivos. Cadernos de Saúde Pública, 2021; 37(9).

12. Simoni JM, Smith L, Oost KM, Lehavot K, Fredriksen-Goldsen K. Disparities in physical health conditions among lesbian and bisexual women: a systematic review of population-based studies. J Homosex. 2017 Jan;64(1):32-44.

13. Caceres BA, Jacjman KB, Ferrer L, Cato KD, Hughes TL. A scoping review of sexual minority women´s health in Latin America and the Caribbean. Int J Nurs Studi. 2019;94(2019):85-97.

14. Meads C, Carmona C, Kelly, M. Lesbian, gay and bisexual people´s health in the UK: a theoretic critic and systematic review. Diversity and Quality in Health and Care. 2012; 9: 19-32

15. Ferreira BO, Bonan C. Abrindo os armários do acesso e da qualidade: uma revisão integrativa sobre assistência à saúde das populações LGBTT. Ciênc. saúde coletiva. 2020;25(5):1765-78

16. Wilson EC, Jalil EM, Moreira RI, Velasque L, Castro CV, Monteiro L, Veloso VG, Grinsztejn B. High risk and low HIV prevention behaviours in a new generation of young trans women in Brazil. AIDS Care. 2021 Aug;33(8):997-1001.

17. Teixeira SL, Jalil CM, Jalil EM, Nazer SC, Silva SDCC, Veloso VG, Luz PM, Grinsztejn B. Evidence of an untamed HIV epidemic among MSM and TGW in Rio de Janeiro, Brazil: a 2018 to 2020 cross-sectional study using recent infection testing. J Int AIDS Soc. 2021 Jun;24(6):e25743. doi: 10.1002/jia2.25743. PMID: 34132470; PMCID: PMC8207443.

18. Smith, EA, Offen N, Malone RE. Pitures worth a thousand words: noncommercial tobacco content in the lesbian, gay and bisexual press. J health commun. 2006 Oct-Nov; 11(7):635-49.

19. Smith, EA, Offen N, Malone RE. What makes an ad a cigarette ad? Commercial tobacco imagery in the lesbian, gay, and bisexual press. J Epidemiol Community Health. 2005 Dec;59(12):1086-91.

20. Washington, HA. Burning Love: Big Tobacco Takes Aim at LGBT Youths. Am J Public Health. 2002 July; 92(7): 1086–1095.

21. Stevens P, Carlson LM, Hinman JM. An analysis of tobacco industry marketing to lesbian, gay, bisexual, and transgender (LGBT) populations: strategies for mainstream tobacco control and prevention. Health Promot Pract. 2004;5(3Suppl):129S-34S.

22. Lee JGL, Agnew-Brune CB, Clapp JA, Blosnich JR. Out smoking on the big screen: tobacco use in LGBT movies 2000–2011. Tob Control. 2014 Nov;23(e2):e156-8.

23. Athosgls. Philip Morris Brasil apoia a programação da 23ª Parada do orgulho LGBT de São Paulo. [Internet] https://athosgls.com.br/philip-morris-brasil-apoia-programacao-da-23a-parada-do-orgulho-lgbt-de-sao-paulo/#prettyPhoto

24. Folha do Mate [Internet]. Venâcio Aires, RS: Folha do Mate, 2020 [acesso em 14 fev 2021]. Philip Morris Brasil recebe selo de direitos humanos e diversidade. https://folhadomate.com/noticias/geral/philip-morris-brasil-recebe-selo-de-direitos-humanos-e-diversidade/

25. Azevedo A. Diversidade e inclusão LGBTI+ são temas de seminários em Curitiba. ViaG [Internet]. 2019 [accessed 17 Feb. 2021]. https://revistaviag.com.br/14647-2/

26. Fundação Oswaldo Cruz, Bastos FI, Bertoni N, et al, organizadores. III Levantamento Nacional sobre o uso de drogas pela população brasileira [Internet]. Rio de Janeiro: ICICT/FIOCRUZ; 2017

27. Lumley, Thomas. Complex Surveys: A Guide to Analysis Using R. Hoboken: John Wiley & Sons, 2010. 276 p..

28. Bertoni, Neilane et al. Prevalence of electronic nicotine delivery systems and waterpipe use in Brazil: where are we going? Revista Brasileira de Epidemiologia [online]. 2021, v. 24, suppl 2 [Accessed 29 March 2022], e210007. https://doi.org/10.1590/1980-549720210007.supl.2 Epub 10 Dec 2021. ISSN 1980-5497. https://doi.org/10.1590/1980-549720210007.supl.2

29. Ortiz K, Mamkherzi J, Salloum R, Matthews AK, Maziak W. Waterpipe tobacco smoking among sexual minorities in the United States: Evidence from the National Adult Tobacco Survey (2012-2014). Addict Behav. 2017 Nov;74:98-105. doi: 10.1016/j.addbeh.2017.06.001. Epub 2017 Jun 9. PMID: 28601749; PMCID: PMC5553049.

30. Nayak P, Salazar LF, Kota KK, Pechacek TF. Prevalence of use and perceptions of risk of novel and other alternative tobacco products among sexual minority adults: Results from an online national survey, 2014-2015. *Prev Med*. 2017;104:71-78. doi:10.1016/j.ypmed.2017.05.024

31. Fallin-Bennett et al / Other Tobacco Product Use Among Sexual Minority Young Adult Bar Patrons Am J Prev Med 2017;53(3):327–334

32. Paul A Gilbert, PhD, Christine M Kava, PhD, Rima Afifi, PhD, High-School Students Rarely Use E-Cigarettes Alone: A Sociodemographic Analysis of Polysubstance Use Among Adolescents in the United States, *Nicotine & Tobacco Research*, Volume 23, Issue 3, March 2021, Pages 505–510,

33. Arterberry BJ, Davis AK, Walton MA, Bonar EE, Cunningham RM, Blow FC. Predictors of empirically derived substance use patterns among sexual minority groups presenting at an emergency department. Addict Behav. 2019 Sep;96:76-81. doi: 10.1016/j.addbeh.2019.04.021. Epub 2019 Apr 22. PMID: 31048112; PMCID: PMC6736643.

34. Adzrago D, Tami-Maury I, Schick V, Wilkerson JM. Co-occurring substance use and psychological distress among exclusive e-cigarette use and other tobacco use among sexual and gender minorities in Texas. Drug Alcohol Depend. 2021 Dec 1;229(Pt A):109135.

35. Delahanty J, Ganz O, Hoffman L, Guillory J, Crankshaw E, Farrelly M. Tobacco use among lesbian, gay, bisexual and transgender young adults varies by sexual and gender identity. Drug Alcohol Depend. 2019 Aug 1;201:161-170.

36. Goodwin SR, Moskal D, Marks RM, Clark AE, Squeglia LM, Roche DJO. A Scoping Review of Gender, Sex and Sexuality Differences in Polysubstance Use

in Adolescents and Adults. Alcohol Alcohol. 2022 Mar 12:agac006. doi: 10.1093/alcalc/agac006. Epub ahead of print. PMID: 35284931.

37. Grilo G, Welding K, Szklo AS, *et al.* Straw cigarette branding: misleading descriptors and a new Marlboro man. *Tobacco Control* Published Online First: 17 November 2021. doi: 10.1136/tobaccocontrol-2021-056983

38. Szklo AS. Monitoramento da epidemia de tabagismo no Brasil a partir dos resultados da Pesquisa Nacional de Saúde (PNS) 2019. [Presentation]. Divisão de Pesquisa Populacional. Instituto Nacional de Câncer José Alencar Gomes da Silva.https://www.inca.gov.br/sites/ufu.sti.inca.local/files//media/document//resultados_pesquisa_nacional_saude_2019.pdf *[Accessed* 17 Jun 2021*]*

39. Agência Nacional de Vigilância Sanitária (Brasil). Resolução da Diretoria Colegiada RDC nº 46, de 28 de agosto de 2009. Proíbe a comercialização, a importação e propaganda de quaisquer dispositivos eletrônicos para fumar, conhecidos como cigarro eletrônico [Internet]. Diário Oficial da União. 31 ago 2009. [accessed 14 Feb. 2021]. http://antigo.anvisa.gov.br/documents/10181/2718376/RDC_46_2009_COMP.pdf/2148a322-03ad-42c3-b5ba-718243bd1919

40. https://gay.blog.br/gay/philip-morris-reforca-politica-de-inclusao-e-patrocina-parada-lgbt-de-sp/

41. Lee S, Ling PM, Glantz, SA. The vector of the tobacco epidemic: tobacco industry practices in low and middle-income countries. Cancer Causes Control, 23 (suppl 1) (2012), pp. 117-129.

42. Gilmore, A. Understanding the vector in order to plan effective tobacco control policies: an analysis of contemporary tobacco industry materials. Tobacco Control, 2012; 21: 119-126.

43. Fooks, G., Gilmore, A., Collin, J., Holden, C., & Lee, K. (2013). The Limits of Corporate Social Responsibility: Techniques of Neutralization, Stakeholder Management and Political CSR. *Journal of Business Ethics*, *112*(2), 283–299. https://doi.org/10.1007/s10551-012-1250-5

44. Thompson, S., Smith, J., Lee, K., & Thompson, S. (2020). Industry sponsored harm reduction conference courts Indigenous peoples in Canada. *Tobacco Control*. https://doi.org/10.1136/tobaccocontrol-2020-055669

45. Yerger, V. B., & Malone, R. E. (2002). African American leadership groups: Smoking with the enemy. *Tobacco Control*, *11*(4), 336–345.

46. Rostosky SS, Danner F, Riggle ED. Is religiosity a protective factor against substance use in young adulthood? Only if you're straight! J Adolesc Health. 2007 May;40(5):440-7. doi: 10.1016/j.jadohealth.2006.11.144. Epub 2007 Feb 15. PMID: 17448402.

47. Blosnich J, Lee JGL, Horn K. A systematic review of the aetiology of tobacco disparities for sexual minorities. Tobacco Control 2013;22:66-73.

48. Wolford-Clevenger C, Hill SV, Cropsey K. Correlates of Tobacco and Nicotine Use Among Transgender and Gender Diverse People: A Systematic Review Guided by the Minority Stress Model. Nicotine Tob Res. 2022 Mar 1;24(4):444-452.

49. Delahanty J, Ganz O, Hoffman L, Guillory J, Crankshaw E, Farrelly M. Tobacco use among lesbian, gay, bisexual and transgender young adults varies by sexual and gender identity. Drug Alcohol Depend. 2019 Aug 1;201:161-170.

50. Emory K, Kim Y, Buchting F, Vera L, Huang J, Emery SL. Intragroup Variance in Lesbian, Gay, and Bisexual Tobacco Use Behaviors: Evidence That Subgroups Matter, Notably Bisexual Women. Nicotine Tob Res. 2016 Jun;18(6):1494-501.

51. McNeel, S. Sensitive Issues in Surveys: Reducing Refusals While Increasing Reliability and Quality of Responses to Sensitive Survey Items. In: Gideon, L. Handbook of Survey Methodology for the Social Sciences. Springer Science+Business Media. 2012: 377-396.

52. Statistics Canada. 3.2.2 Probability sampling. In: Statistics: Power from Data! 2021. Available in: https://www150.statcan.gc.ca/n1/edu/power-pouvoir/ch13/prob/5214899-eng.htm#shr-pg0.

53. Instituto Brasileiro de Geografia e Estatística. Amostra mestra para o sistema integrado de pesquisas domiciliares. Rio de Janeiro, 2007.

Supplementary Table 1: Profile of the population according to sexual orientation/gender identity and consumption of tobacco products in the 12 months prior to the survey. Brazil, 2015

	SGM									Non-SGM									Total		
	Use tobacco products			Don´t use tobacco products			Total			Use tobacco products			Don´t use tobacco products			Total					
	%	95%CI		%	95%CI		%	95%CI		%	95%CI		%	95%CI		%	95%CI		%	95%CI	
		LL	UL		LL	UL		LL	UL		LL	UL		LL	UL		LL	UL		LL	UL
Sex																					
Male	68.4	55.8	81.0	56.6	44.3	69.0	61.9	52.9	70.9	58.6	56.4	60.8	46.4	45.8	46.9	48.5	48.3	48.6	48.6	48.4	48.7
Female	31.6	19.0	44.2	43.4	31.0	55.7	38.1	29.1	47.1	41.4	39.2	43.6	53.6	53.1	54.2	51.6	51.4	51.7	51.4	51.3	51.6
Age																					
12 to 24 years	24.1	12.0	36.3	30.8	17.6	44.0	27.8	18.6	37.0	20.2	17.9	22.6	29.5	29.0	30.0	27.9	27.7	28.1	27.9	27.7	28.1
25 to 34 years	52.4	38.5	66.3	36.2	23.7	48.7	43.5	34.3	52.6	19.9	18.2	21.6	20.4	20.1	20.8	20.3	20.2	20.5	20.6	20.4	20.7
35 to 65 years	23.5	14.2	32.7	33.0	22.1	43.9	28.7	21.6	35.9	59.9	57.6	62.2	50.1	49.6	50.6	51.8	51.6	52.0	51.5	51.4	51.7
Steady/stable partner																					
Yes	33.3	19.9	46.7	41.2	29.0	53.4	37.7	28.8	46.6	61.0	58.4	63.6	61.3	60.0	62.6	61.3	60.0	62.5	61.0	59.8	62.2
No	66.7	53.3	80.1	58.8	46.6	71.0	62.3	53.4	71.2	39.0	36.5	41.6	38.7	37.4	40.0	38.8	37.5	40.0	39.0	37.8	40.2
Schooling																					
Primary or less	19.7	8.2	31.2	13.1	4.1	22.0	16.0	8.8	23.3	55.5	52.8	58.3	42.6	41.0	44.3	44.8	43.3	46.4	44.6	43.0	46.1
Secondary	34.8	22.1	47.5	47.9	35.6	60.2	42.0	33.0	51.1	31.9	29.4	34.3	39.9	38.5	41.3	38.5	37.3	39.8	38.6	37.3	39.8
University	45.5	32.0	59.0	39.1	27.0	51.1	42.0	33.0	50.9	12.6	10.9	14.3	17.4	16.1	18.8	16.6	15.4	17.8	16.9	15.7	18.1
Religion																					
No	22.3	10.5	34.0	20.8	10.0	31.6	21.4	13.2	29.7	13.6	11.9	15.4	7.5	6.7	8.3	8.5	7.7	9.3	8.7	7.9	9.4
Yes	77.7	66.0	89.5	79.2	68.4	90.0	78.6	70.4	86.8	86.4	84.6	88.2	92.5	91.7	93.3	91.5	90.7	92.3	91.4	90.6	92.1
Alcohol consumption*																					
Yes	85.8	75.4	96.2	63.1	50.1	76.1	73.2	64.4	82.1	67.1	64.7	69.6	38.0	36.6	39.4	42.9	41.6	44.3	43.2	41.9	44.6
No	14.2	3.8	24.7	36.9	23.9	49.9	26.8	18.0	35.6	32.9	30.4	35.3	62.0	60.6	63.4	57.1	55.7	58.4	56.8	55.4	58.1
Consumption of any drug*																					
Yes	35.3	22.5	48.0	13.1	5.2	20.9	23.0	15.5	30.5	11.5	9.8	13.2	1.3	1.0	1.7	3.1	2.6	3.5	3.3	2.8	3.7
No	64.7	52.0	77.5	87.0	79.1	94.8	77.0	69.6	84.5	88.5	86.8	90.2	98.7	98.3	99.0	96.9	96.5	97.4	96.8	96.3	97.2
Victim of violence*																					
Yes	28.3	14.4	42.2	10.1	1.9	18.2	18.2	10.2	26.2	10.9	9.1	12.7	5.5	4.9	6.1	6.4	5.8	7.0	6.5	5.9	7.1
No	71.7	57.8	85.6	90.0	81.8	98.1	81.8	73.8	89.8	89.1	87.3	90.9	94.5	94.0	95.1	93.6	93.0	94.2	93.5	92.9	94.1
Depression/Anxiety																					
Yes	27.6	15.7	39.5	12.7	3.3	22.1	19.3	11.8	26.9	22.3	20.2	24.4	14.7	13.5	15.8	16.0	14.9	17.0	16.0	14.9	17.1
No	72.4	60.6	84.3	87.3	77.9	96.7	80.7	73.1	88.2	77.7	75.6	79.8	85.4	84.2	86.5	84.1	83.0	85.1	84.0	82.9	85.1

Notes: *In the 12 months prior to the survey; 95%CI: 95% confidence interval; LL: lower limit of 95%CI; UL: upper limit of 95%CI
SGM comprise (for the purposes of this analysis) homosexuals, bisexuals, transvestites, and transsexuals
Non-SGM can be roughly defined as those who define themselves as heterosexuals

Supplementary Table 2: Prevalence of use of tobacco products in the 12 months prior to the survey according to sexual orientation/gender identity. Brazil, 2015

	SGM			Non-SGM			Total		
	%	95%CI		%	95%CI		%	95%CI	
		LL	UL		LL	UL		LL	UL
Any tobacco product	44.7	35.1	54.2	17.0	16.2	17.9	17.3	16.5	18.1
Smoked tobacco products	44.7	35.1	54.2	16.8	16.0	17.7	17.1	16.3	17.9
Industrialized cigarettes	39.5	29.9	49.2	15.1	14.3	15.9	15.3	14.6	16.1
Straw cigarettes	6.0	1.3	10.8	3.8	3.3	4.4	3.9	3.3	4.4
Waterpipe	13.5	7.2	19.8	1.6	1.2	1.9	1.7	1.3	2.0
Kretek cigarettes	8.3	3.6	13.1	0.9	0.7	1.0	0.9	0.7	1.1
Smokeless tobacco (chewing tobacco, snuff)	0.5	0.0	1.5	0.6	0.5	0.8	0.6	0.5	0.8
Cigars	3.5	0.0	7.4	0.6	0.4	0.7	0.6	0.5	0.8
Electronic cigarettes	2.9	0.3	5.5	0.4	0.2	0.6	0.4	0.3	0.6
Cigarillos	1.6	0.0	3.2	0.3	0.2	0.4	0.3	0.2	0.5
Pipes	1.7	0.0	3.8	0.3	0.2	0.4	0.3	0.2	0.4

Notes: 95%CI: 95% confidence interval; LL: lower limit of 95%CI; UL: upper limit of 95%CI
SGM comprise (for the purposes of this analysis) homosexuals, bisexuals, transvestites, and transsexuals
Non-SGM can be roughly defined as those who define themselves as heterosexuals

Supplementary Table 3: Prevalence of use of tobacco products in the 12 months prior to the survey according to sexual orientation/gender identity and other characteristics. Brazil, 2015

	SGM			Non-SGM			Total		
	%	95%CI		%	95%CI		%	95%CI	
		LL	UL		LL	UL		LL	UL
Total	44.7	35.1	54.2	17.0	16.2	17.9	17.3	16.5	18.1
Sex									
Male	49.4	36.9	61.8	20.6	19.2	21.9	20.9	19.6	22.3
Female	37.0	23.2	50.9	13.7	12.8	14.6	13.8	12.9	14.8
Age									
12 to 24 years	38.8	18.9	58.6	12.3	10.7	14.0	12.6	11.0	14.2
25 to 34 years	53.9	39.1	68.7	16.6	15.0	18.2	17.4	15.8	19.0
35 to 65 years	36.5	23.9	49.1	19.7	18.6	20.8	19.8	18.7	20.9
Steady/stable partner									
Yes	39.5	25.1	53.9	16.9	15.9	18.0	17.1	16.0	18.1
No	47.8	35.1	60.5	17.1	15.9	18.4	17.6	16.4	18.9
Schooling									
Primary or less	54.9	30.5	79.4	21.1	19.8	22.4	21.2	19.9	22.5
Secondary	37.0	23.1	50.8	14.1	12.9	15.3	14.3	13.1	15.5
University	48.5	34.5	62.5	12.9	11.3	14.6	13.8	12.1	15.4
Religion									
No	46.4	25.7	67.1	27.2	24.0	30.4	27.7	24.5	30.8
Yes	44.2	33.8	54.7	16.1	15.2	16.9	16.3	15.5	17.2
Alcohol consumption*									
Yes	52.3	41.4	63.2	26.6	25.2	28.1	27.0	25.6	28.5
No	23.8	6.8	40.7	9.8	9.0	10.6	9.9	9.0	10.7
Consumption of any illicit drug*									
Yes	68.6	52.0	85.2	64.0	56.9	71.0	64.3	57.5	71.0
No	37.6	26.8	48.3	15.5	14.8	16.3	15.7	14.9	16.5
Victim of violence*									
Yes	69.5	48.0	90.9	29.0	24.8	33.2	30.1	26.0	34.2
No	39.2	28.7	49.6	16.2	15.4	17.0	16.4	15.6	17.2
Depression/Anxiety									
Yes	63.7	41.5	85.8	23.8	21.6	26.0	24.2	22.0	26.5
No	40.1	29.9	50.3	15.7	14.9	16.6	16.0	15.1	16.8

Notes: *In the 12 months prior to the survey; 95%CI: 95% confidence interval; LL: lower limit of 95%CI; UL: upper limit of 95%CI
SGM comprise (for the purposes of this analysis) homosexuals, bisexuals, transvestites, and transsexuals
Non-SGM can be roughly defined as those who define themselves as heterosexuals

Supplementary Table 4: Additional information on statistical modeling, including findings from bivariate analyses. Brazil, 2025

	Total (n=15,801)				Non-SGM (n=15,641)				SGM (n=160)			
	UOR	95%CI		p value	UOR	95%CI		p value	UOR	95%CI		p value
		LL	UL			LL	UL			LL	UL	
Sexual orientation/ gender identity												
Non-SGM	1.00	-	-	-	-	-	-	-	-	-	-	-
SGM	3.94	2.66	5.84	<0.001	-	-	-	-	-	-	-	-
Sex												
Male	1.65	1.48	1.84	<0.001	1.64	1.47	1.83	<0.001	1.66	0.77	3.59	0.204
Female	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-
Age												
12 to 24 years	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-
25 to 34 years	1.46	1.22	1.76	<0.001	1.42	1.17	1.72	<0.001	1.85	0.67	5.10	0.242
35 to 65 years	1.71	1.46	2.02	<0.001	1.75	1.48	2.06	<0.001	0.91	0.35	2.33	0.841
Steady/stable partner												
Yes	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-
No	1.04	0.93	1.16	0,51	1.01	0.91	1.14	0.80	1.40	0.64	3.09	0.404
Schooling												
Primary or less	1.68	1.44	1.97	<0.001	1.80	1.53	2.13	<0.001	1.30	0.41	4.07	0.66
Secondary	1.04	0.88	1.24	0.62	1.10	0.92	1.32	0.28	0.62	0.28	1.39	0.252
University	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-
Religion												
No	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-
Yes	0.51	0.43	0.60	<0.001	0.51	0.43	0.61	<0.001	0.91	0.37	2.27	0.848
Alcohol consumption*												
Yes	3.39	3.01	3.80	<0.001	3.34	2.97	3.75	<0.001	2.94	1.04	8.29	0.046
No	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-
Consumption of any illicit drug*												
Yes	9.66	7.15	13.04	<0.001	9.65	7.06	13.19	<0.001	3.63	1.47	8.96	0.007
No	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-
Victim of violence*												
Yes	2.20	1.79	2.69	<0.001	2.12	1.72	2.61	<0.001	3.53	1.18	10.56	0.027
No	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-
Depression/Anxiety												
Yes	1.68	1.48	1.92	<0.001	1.67	1.46	1.90	<0.001	2.61	0.94	7.30	0.071
No	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-

Notes: *In the 12 months prior to the survey;
UOR: unadjusted odds ratio; 95%CI: 95% confidence interval; LL: lower limit of 95%CI; UL: upper limit of 95%CI
SGM comprise (for the purposes of this analysis) homosexuals, bisexuals, transvestites, and transsexuals
Non-SGM can be roughly defined as those who define themselves as heterosexuals

Supplementary Table 5: Factors associated with the use of tobacco products in the 12 months prior to the survey. Brazil, 2015

		Total (n=15,801)				Non-SGM (n=15,641)				SGM (n=160)			
		AOR	95%CI		p value	AOR	95%CI		p value	AOR	95%CI		p value
			LL	UL			LL	UL			LL	UL	
Sexual orientation/ gender identity													
	SGM	1.00	-	-	-	-	-	-	-	-	-	-	-
	Non-SGM	2.52	1.61	3 .95	<0.001	-	-	-	-	-	-	-	-
Sex													
	Male	1.36	1.22	1.53	<0.001	1.36	1.21	1.52	<0.001	1.64	0.59	4.57	0.352
	Female	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-
Age													
	12 to 24 years	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-
	25 to 34 years	1.61	1.30	2.01	<0.001	1.59	1.27	1.99	<0.001	2.39	0.83	6.92	0.114
	35 to 65 years	2.12	1.76	2.55	<0.001	2.13	1.76	2.57	<0.001	1.03	0.33	3.25	0.956
Steady/stable partner													
	Yes	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-
	No	1.29	1.14	1.47	<0.001	1.29	1.14	1.47	<0.001	1.13	0.43	2.94	0.810
Schooling													
	Primary or less	2.70	2.26	3.23	<0.001	2.69	2.24	3.22	<0.001	4.53	1.14	18.04	0.037
	Secondary	1.50	1.24	1.81	<0.001	1.49	1.23	1.81	<0.001	1.13	0.38	3.37	0.828
	University	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-
Religion													
	No	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-
	Yes	0.64	0.52	0.78	<0.001	0.63	0.51	0.77	<0.001	1.47	0.46	4.71	0.519
Alcohol consumption*													
	Yes	3.26	2.87	3.70	<0.001	3.25	2.86	3.70	<0.001	2.94	1.04	8.29	0.046
	No	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-
Consumption of any illicit drug*													
	Yes	7.26	5.16	10.20	<0.001	7.48	5.25	10.65	<0.001	4.35	1.20	15.80	0.030
	No	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-
Victim of violence*													
	Yes	1.65	1.33	2.04	<0.001	1.62	1.30	2.02	<0.001	3.55	1.05	11.99	0.046
	No	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-
Depression/Anxiety													
	Yes	1.73	1.49	2.00	<0.001	1.72	1.48	1.99	<0.001	3.20	1.10	9.36	0.038
	No	1.00	-	-	-	1.00	-	-	-	1.00	-	-	-

Notes: *In the 12 months prior to the survey;
AOR: adjusted odds ratio; 95%CI: 95% confidence interval; LL: lower limit of 95%CI; UL: upper limit of 95%CI
SGM comprise (for the purposes of this analysis) homosexuals, bisexuals, transvestites, and transsexuals
Non-SGM can be roughly defined as those who define themselves as heterosexuals

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract TOBACCO USE BY SEXUAL AND GENDER MINORITIES INDIVIDUALS: FINDINGS FROM A BRAZILIAN NATIONAL SURVEY
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found Fully available IN THE ABSTRACT
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported Pages 4 and 5
Objectives	3	State specific objectives, including any prespecified hypotheses Pages 5: lines 98-101
Methods		
Study design	4	Present key elements of study design early in the paper Methodology: page 6, lines 105-107. Full details about Methods are available at the FIOCRUZ ARCA open repository at: https://www.arca.fiocruz.br/handle/icict/34614. (Please see the English version). The links are available at the revised Methods section (page 6) and should be browsed by the readers who may want to know additional details.
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection Methodology, page 6, lines 107-110
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants Methodology: page 6, Lines 107-132
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable Methodology: pages 6 and 7, lines 118-169
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group Methodology: pages 6 and 7, lines 119-151 Full details about Methods are available at the FIOCRUZ ARCA open repository at: https://www.arca.fiocruz.br/handle/icict/34614. (Please see the English version). The links are available at the revised Methods section (page 6).
Bias	9	Describe any efforts to address potential sources of bias Full details about Methods are available at the FIOCRUZ ARCA open repository at: https://www.arca.fiocruz.br/handle/icict/34614. (Please see the English version). The links are available at the revised Methods section (page 6).
Study size	10	Explain how the study size was arrived at Full details about Methods are available at the FIOCRUZ ARCA open repository at: https://www.arca.fiocruz.br/handle/icict/34614. (Please see the English version). The links are available at the revised Methods section (page 6).
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable,

		describe which groupings were chosen and why Page 7, line 145
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding Pages 7 and 8 respecting the analyses for this specific paper. Full information about several aspects of the use of different statistical methods are available in the Methods section (chapter 2) of the original report.
		(*b*) Describe any methods used to examine subgroups and interactions Pages 7 and 8
		(*c*) Explain how missing data were addressed The database used for the present analysis did not require treatment for missing data, since imputation had already been used. Full details about Methods are available at the FIOCRUZ ARCA open repository at: https://www.arca.fiocruz.br/handle/icict/34614. (Please see the English version). The links are available at the revised Methods section (page 6).
		(*d*) If applicable, describe analytical methods taking account of sampling strategy Full details about Methods are available at the FIOCRUZ ARCA open repository at: https://www.arca.fiocruz.br/handle/icict/34614. (Please see the English version). The links are available at the revised Methods section (page 6).
		(*e*) Describe any sensitivity analyses It was not carried out for this specific paper.
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed Page 6 Data about follow-up do not exist due to the cross-sectional design of the survey Full details about Methods are available at the FIOCRUZ ARCA open repository at: https://www.arca.fiocruz.br/handle/icict/34614. (Please see the English version). The links are available at the revised Methods section (page 6).
		(b) Give reasons for non-participation at each stage The study follows the procedures of a classic multi-step survey. Meta-data were collected about non-participation in each one of the steps, but as happens in population-based surveys on sensitive issues, worldwide, there were no additional questions about reasons about non-participation beyond what had been strictly approved by the FIOCRUZ IRB and local IRBs. The survey was non-judgmental and non-intrusive, allowing people to feel as be free as possible to answer about their putative use of licit and illicit substances. One must remember that interviews took place in the interviewees' households. Full details about Methods are available at the FIOCRUZ ARCA open repository at: https://www.arca.fiocruz.br/handle/icict/34614. (Please see the English version). The links are available at the revised Methods section (page 6).
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders

		Pages 9 -10 and supplemental table 1
		(b) Indicate number of participants with missing data for each variable of interest Please, see item 12c of this checklist
Outcome data	15*	Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included Pages 16-20
		(*b*) Report category boundaries when continuous variables were categorized Page 7, line 145
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period This should not be attempted for large population-based surveys. The underlying demography and social geography are very dynamic. Any inference considering a stationary framework would generate statistical artefacts instead of accurate estimates.
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Summarise key results with reference to study objectives Page 20, 1st and 2nd paragraphs
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias Pages 23 - 24
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence Pages 20-25
Generalisability	21	Discuss the generalisability (external validity) of the study results Page 24, lines 412-415 The results are fully generalizable for the Brazilian population at the period in consequence of the strict use of probability-sampling rules in every step and procedures in full compliance with both the national guidelines issued by IBGE and international guidelines (e.g. https://www150.statcan.gc.ca/n1/edu/power-pouvoir/ch13/prob/5214899-eng.htm)
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based Funding Statement available at page 26

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.