



Research paper

Suicidal thought in southern Brazil: Who are the most susceptible?

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ARTICLE INFO

Keywords:

Suicidality
Brazil
Suicide
Epidemiology
Mental health

ABSTRACT

Background: Suicide is one of the leading causes of death among adolescents and young adults worldwide. However, risk factors for suicidal thoughts might change across cultures and contexts. We aimed to assess the prevalence and associated factors of suicidal thought among adults in a southern Brazilian city.

Methods: This population-based cross-sectional study used a multistage sampling procedure to evaluate individuals with 18 years or more, living in a southern city in Brazil. We collected suicidal thought using a question from the Patient Health Questionnaire-9. In addition, we collected information on sociodemographic, behavioral, and health variables, through a questionnaire using standardized and validated instruments. We calculated prevalence ratios (PR) using Poisson Regression models with robust adjustment of the variance.

Results: We collected information from 1295 individuals, 6.6% were positive for suicidal thought. In multivariate analysis, factors independently associated with suicidal thoughts included: being a woman, poor, reporting current tobacco use, having household food insecurity, having three or more morbidities, being in the upper tertile of the stress scores, having had a depression diagnostic in the last year and sadness.

Limitations: We cannot say that the associations found are causal. Suicidal thoughts were assessed from a single question.

Conclusion: Suicidal thought is a prevalent condition, most likely associated with being a woman, having worst socioeconomic conditions, a poorer health, a higher stress, using tobacco and having depression and/or sadness.

1. Introduction

Worldwide, it is estimated that over 800,000 people from all ages die by suicide every year. Suicide is the second-leading cause of death among people aged 15–29 years (World Health Organization, 2014b). In the Americas, 65,000 people commit suicide per year. Suicide is the third-leading cause of death among people aged 20–24 years and the fourth-leading cause of death in the groups aged 10–19 and 25–44 years (Organización Panamericana de la Salud, 2014).

Self-injurious thoughts and behaviors are considered one of the strongest predictors of suicide attempts and suicide death (Castellvi et al., 2017). Suicidal thoughts include recurring thoughts about death, ranging from a desire to not wake up in the morning, or a belief that others would be better off if the individual were dead, to even transient thoughts about committing suicide or specific plans for suicide (Turecki and Brent, 2016). Suicidal thoughts may be considered one of the first steps in suicidal behavior and can be screened for to

prevent these deaths (American Psychiatric Association, 2013; Franklin et al., 2017).

A systematic review conducted with Chinese studies found that suicidal thoughts in the elderly population in both urban and rural areas varied between 2.2–17.8%, reaching 41.2% in inpatients in mental health centers (Simon et al., 2013). Another systematic review presented variations in the prevalence of suicidal thoughts, with 5.5% in the age group of 11–18 years in France, 10.2% in the group of 11–16 years in the USA and 61.0% in a sample of university students in Australia (Michelmore and Hindley, 2012).

In Brazil, a study using data from a nationwide representative sample of the entire country found a total prevalence of suicidal thought of 3.8%. However, estimates varied across different states, and for the southern region it was 4.4%. (Carpena et al., 2019a). Studies from other regions of Brazil have also found divergent estimates and show that 8.4% of men and 10.3% of women aged 18 years or older had suicide thought in the last 2 weeks (Coelho et al., 2010).

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<https://doi.org/10.1016/j.jad.2019.09.046>

Received 23 January 2019; Received in revised form 8 July 2019; Accepted 8 September 2019

Available online 10 September 2019

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The occurrence of suicidal thoughts is higher among women, single people, and those with lower socioeconomic status and poor support networks (Tran Thi Thanh et al., 2006; da Silva et al., 2012; Gisle and Van Oyen, 2013; Brunoni et al., 2015; Choi et al., 2015; Wahlin et al., 2015). Suicidal thoughts are also associated with psychiatric disorders, functional ability impairments and avoidance of social interaction, especially among elderly adults (Almeida et al., 2012; Chiu et al., 2012; Li et al., 2016; Chang et al., 2017).

We aimed to investigate suicidal thoughts and associated factors among adults and the elderly population in a municipality in the southern region of Brazil, and to examine if the factors associated with suicidal thoughts are influenced by age.

2. Methods

2.1. Study design and population

This was a population-based cross-sectional study carried out in Rio Grande, a southern Brazilian city. It is an industrial city with one of the largest ports in Brazil and comprises approximately 210,000 inhabitants, 96% of whom are urban residents. This research was approved by the Health Research Ethics Committee of the Federal University of Rio Grande under process #20/2016.

The target population consisted of individuals of both genders aged 18 years old or older living in the urban area of the city. Individuals who were institutionalized in nursing homes, hospitals and prisons and those with physical or mental impairments that prevented them from responding to the questionnaire were not considered eligible. Data were collected between April and July 2016 by trained interviewers who were recruited for this study.

Participants information was obtained through a standardized questionnaire, which was previously tested in a pilot study. This questionnaire was composed mostly of closed questions on socioeconomic, demographic and behavioral characteristics, as well as mental health. Fieldwork quality control was performed concomitantly with the data collection. On a weekly basis, a fieldwork supervisor randomly drew 10% of the questionnaires applied in the previous week and called the residents to ask standard questions. The data were entered into Epi-Data 3.1 program and then transferred to the statistical package Stata 11.2, where the database was cleaned, and new variables were created.

2.2. Sampling and sample size

The sample size calculation was performed considering a 95% confidence level, a 5% prevalence of the outcome, a margin of error of 1.3 percentage points, and a design sampling effect of 20%, resulting in a total sample of 1287 individuals. We added 10% to this value for possible losses and refusals. Thus, 1416 individuals would be required for the sample.

The sampling process was carried out in two stages based on data from the 2010 Demographic Census. First, the census tracts were selected, and then the households were selected. To sample 1416 individuals, it was necessary to include 710 households, since each household had, on average, two residents aged 18 or over. To minimize the effect of sample design (i.e., the primary sample unit considered was the census tract, not the individual), we estimated the selection of an average of ten households by census tract. Therefore, a systematic selection of 72 census tracts was carried out, and then the households were selected proportionally to the size of the sector.

Prior to the official interviews, a study supervisor went to each selected household. The purpose of this was to determine the number of residents aged 18 or older, as well as to inform the residents about the study and arrange a schedule for the interview. In case the house was uninhabited or did not exist, the house immediately next to the right (looking at it from the front), was selected. More details on sampling and fieldwork are published elsewhere (Dumith et al., 2018).

2.3. Outcome

Suicidal thoughts were screened using the last question of the Patient Health Questionnaire-9 (PHQ-9), validated for the Brazilian population (Santos et al., 2013), namely, “Over the last 2 weeks, how often have you thought about hurting yourself in any way or that you would be better off dead?” Possible answers were “none”, “less than one week”, “one week or more” or “almost every day”. Those who responded with anything other than “none” were considered to be a positive case for suicidal thoughts.

2.4. Exposure variables

Several covariables were measured, including demographic, socioeconomic, behavioral, and health-related variables. The socioeconomic and demographic factors were sex (male or female), age (18–39, 40–59 or ≥ 60 years), skin color (white, brown, black or yellow), marital status (single, married, divorced or widowed), living situation (not alone or alone), education (0–8, 9–11 or ≥ 12 years), wealth index (based on reported assets and then categorized into tertiles) and household food insecurity (defined as any point different from zero in the Brazilian Scale of Food Insecurity and Hunger in Brazil (EBIA)) (Perez-Escamilla et al., 2004; Segall-Corrêa and Marin-Leon, 2009).

Behavioral variables were current smoking status (smoking or not smoking), alcohol abuse in the last month (defined as having drunk, on a single occasion, five or more doses of alcohol for men or four or more doses for women) (World Health Organization, 2014a), physical activity at leisure time (measured through International Physical Activity Questionnaire (IPAQ) (Matsudo et al., 2001), with participants being considered physically active when any amount of activity was reported) and obesity (body mass index ≥ 30 kg/m²).

Health variables included the following: the number of morbidities (considering hypertension, diabetes, dyslipidemia, heart disease, stroke, arthritis or rheumatism, cancer, renal failure or chronic respiratory disease), which were further categorized as having none, 1, 2 or ≥ 3 morbidities; self-reported sleep quality (very good or good, regular and poor or very poor); consultation with a physician in the last month (no or yes); perceived health status (excellent/very good, good or regular/poor); quality of life (measured through short version of the World Health Organization Quality of Life (WHOQOL-BREF) questionnaire) (Fleck et al., 2000; Kluthcovsky and Kluthcovsky, 2009), which was categorized into tertiles; perceived stress (assessed with the Perceived Stress Scale (PSS-14) (Siqueira Reis et al., 2010), which was categorized into tertiles; reported diagnosis of depression in the last year (no or yes); and self-reported sadness (measured through Andrews and Whitney (2012) faces scale9).

2.5. Data analysis

Descriptive analysis was used to estimate the prevalence of suicidal thoughts and to describe the sample. Bivariate analysis was performed to assess global associations between the outcome and the independent variables. To identify explanatory variables that were independently associated with suicidal thoughts, a multivariable analysis was conducted through Poisson regression, with robust adjustment of variance (Barros and Hirakata, 2003). Prevalence ratios (PRs) and 95% confidence intervals (95% CIs) were reported. Analyses were conducted in Stata 11.2 software, with consideration given to the sampling design effect. The significance level was set to 5% for two-tailed tests.

To control for possible confounders, we used a four-level hierarchical model of analysis (Victora et al., 1997). Variables were selected using the backward method, and a *p*-value of < 0.20 was adopted as a threshold to keep the variables in the final model. Interactions were also tested for sex and age with all other variables. The significance level for interaction tests was a *p*-value < 0.10 .

Table 1
Sample description according to social, economic and behavioral characteristics. Rio Grande, Brazil, 2016 (N = 1295).

Variables	n	%
Sex		
Male	562	43.4
Female	733	56.6
Age (years)		
18–39	508	39.3
40–59	477	36.8
≥60	310	23.9
Skin color		
White	1072	82.9
Brown, black or yellow	221	17.1
Marital status		
Married	600	46.3
Single, widowed or divorced	695	53.7
Living situation		
Not alone	1170	90.4
Alone	124	9.6
Education (years)		
0–8	541	41.8
9–11	397	30.7
≥12	355	27.5
Wealth index (tertiles)		
1st (lower)	444	34.3
2nd	417	32.2
3rd (higher)	433	33.5
Household food insecurity		
No	841	64.9
Yes	454	35.1
Current smoking status		
Not smoking	1063	82.1
Smoking	232	17.9
Alcohol abuse (last month)		
No	1140	88.2
Yes	152	11.8
Physically active at leisure time		
No	862	66.6
Yes	432	33.4
Obesity (BMI ≥ 30 kg/m ²)		
No	945	76.3
Yes	294	23.7
Morbidities (quantity)		
0	561	44.0
1	325	25.6
2	211	16.6
≥3	175	13.8
Self-reported sleep quality		
Very good/good	811	62.6
Regular	346	26.7
Poor/very poor	138	10.7
Consultation with a physician (last month)		
No	879	67.9
Yes	416	32.1
Perceived health status		
Excellent/very good	278	21.5
Good	581	44.8
Regular/poor	436	33.7
Quality of life (tertile)		
1st (lower scores)	431	33.3
2nd	432	33.4
3rd (higher scores)	431	33.3
Perceived stress (tertile)		
1st (less stressed)	438	33.8
2nd	475	36.7
3rd (more stressed)	382	29.5
Depression (last year)		
No	1184	91.4
Yes	111	8.6
Sadness		
No	1178	91.0
Yes	117	9.0

Notes: n = absolute frequency; % = prevalence.

3. Results

3.1. Sample description

The response rate was 90.6% (N = 1295, from 1429 eligible individuals). Overall, 56.6% were females, 39.3% were aged between 18 and 39 years, 46.3% were married, 82.9% had white skin color and 41.8% had 8 years or less of education. In addition, 17.9% were currently using tobacco, 11.8% had abused alcohol in the last month, 33.4% were physically active during leisure time, 35.1% showed food insecurity, 23.7% were obese, 13.8% reported three or more morbidities, 10.7% reported poor or very poor sleep quality, 32.1% had a consultation with a physician in the last month, 33.7% perceived their health as poor or regular, 8.6% reported being diagnosed with depression in the last year and 9.0% perceived themselves as sad (see Table 1).

3.2. The occurrence and distribution of suicidal thoughts

The prevalence of suicidal thoughts was 6.6% (95% CI 5.1; 8.0). It was higher among those who reported having had a diagnosis of depression in the last year (26.1%), considered themselves as sad (23.1%), were in the upper tertile of perceived stress scores (14.7%), had lower scores for quality of life (14.4%) and had three or more morbidities (13.1%). On the other hand, a lower prevalence of suicidal thoughts occurred among those who were at the lower tertile of perceived stress (1.1%), perceived their health as excellent or very good (1.4%) and were at the upper tertile of quality of life scores (1.9%) (see Table 2).

3.3. Variables associated with suicidal thoughts

In crude analysis, we found that women, individuals with 8 years of education or less, living alone, poorer, with current tobacco use, physically inactive, with food insecurity, obese and with poor sleep quality presented higher probability of having suicidal thoughts (Table 2). However, after adjustment, only female sex (PR = 1.55; 95% CI 1.01; 2.37) being poor (PR = 3.72; 95% CI 1.97; 7.02), reporting current tobacco use (PR = 1.70; 95% CI 1.10; 2.62), having household food insecurity (PR = 1.75; 95% CI 1.13; 2.72), having three or more morbidities (RP = 2.58; 95% CI 1.40; 3.75), poor self-reported quality of sleep (PR = 2.21; 95% CI 1.13; 4.30), being in the upper tertile of stress scores (PR = 4.97; 95% CI 1.75; 14.1), having had a depression diagnostic in the last year (PR = 2.26; 95% CI 1.26; 3.77) and sadness in the most of last year (PR = 1.63; 95% CI 1.05; 2.52), remained independently associated to suicidal thoughts.

3.4. Interaction analysis

In interaction analysis, although age did not present and association, it was observed that middle-aged women (40–59 years old) were more likely to have suicidal thoughts than their younger counterparts (18–39 years old) (RP = 2.40; p = 0.03). In addition, brown and black skin color men were more likely to have these thoughts when compared to white skin color ones (RP = 2.39; p = 0.03). We have also observed that household food insecurity presented a significant association only for the elderly (60 years or more).

4. Discussion

The prevalence of suicidal thoughts among adults and the elderly population was 6.6%, which represents one in every 15 individuals of the target population. This was an intermediary frequency when compared to data from other national and international surveys. In Brazil, population-based studies assessing suicidality are scarce, and prevalence values could range from 0.67% to almost 10% (Brunoni et al.,

Table 2

Crude and adjusted prevalence ratio for associations between suicidal thoughts and independent variables. Multivariate analysis conducted with four hierarchical levels through Poisson regression with robust adjustment of variance. Population-based sample of adults and elderly of Rio Grande, Brazil, 2016.

Level	Variables	%	Crude PR (95% CI)	Adjusted PR (95% CI)
1st	Sex		$p = 0.04$	$p = 0.05$
	Male	5.0	1.00	1.00
	Female	7.8	1.56 (1.02;2.40)	1.55 (1.01;2.37)
	Age (years)		$p = 0.28$	$p = 0.39$
	18–39	5.3	1.00	1.00
	40–59	7.6	1.42 (0.93;2.18)	1.34 (0.80;2.22)
	≥60	7.1	1.34 (0.78;2.29)	1.06 (0.59;1.90)
	Skin color		$p = 0.91$	$p = 0.96$
	White	6.5	1.00	1.00
	Brown, black or yellow	6.8	1.04 (0.54;2.01)	0.99 (0.54;1.82)
	Marital status		$p = 0.08$	$p = 0.20$
	Married	5.9	1.00	1.00
	Single	5.8	0.99 (0.58;1.69)	0.83 (0.50; 1.37)
	Widowed or divorced	10.0	1.70 (0.97;2.97)	1.31 (0.76;2.24)
	Living situation		$p = 0.02$	$p = 0.53$
	Not alone	6.1	1.00	1.00
	Alone	11.3	1.86 (1.09;3.17)	1.23 (0.64;2.35)
	Education (years)		$p = 0.01$	$p = 0.62$
	0–8	8.9	2.10 (1.26;3.50)	1.37 (0.62;3.03)
	9–11	5.5	1.31 (0.70;2.45)	1.06 (0.53;2.11)
	≥12	4.2	1.00	1.00
Wealth index (tertiles)		$P < 0.01$	$P < 0.01$	
1st (lower)	10.4	3.74 (1.97;7.08)	3.72 (1.97;7.02)	
2nd	6.5	2.34 (1.13;4.82)	2.34 (1.13;4.81)	
3rd (higher)	2.8	1.00	1.00	
2nd	Household food insecurity		$p < 0.01$	$p = 0.01$
	No	4.4	1.00	1.00
	Yes	10.6	2.40 (1.58;3.66)	1.75 (1.13;2.72)
	Current smoking status		$p < 0.01$	$p = 0.02$
	Not smoking	5.6	1.00	1.00
	Smoking	11.2	2.02 (1.36;3.00)	1.70 (1.10;2.62)
	Alcohol abuse (last month)		$p = 0.47$	$p = 0.68$
	No	6.8	1.00	1.00
	Yes	5.3	0.78 (0.39;1.55)	0.86 (0.42;1.78)
	Physically active at leisure time		$p = 0.04$	$p = 0.45$
	No	7.5	1.63 (1.03;2.57)	1.20 (0.75;1.91)
Yes	4.6	1.00	1.00	
3rd	Obesity (BMI ≥ 30 kg/m ²)		$p = 0.02$	$p = 0.11$
	No	5.4	1.00	1.00
	Yes	9.9	1.83 (1.13;2.97)	1.50 (0.90;2.50)
	Morbidities (quantity)		$p < 0.01$	$p < 0.01$
	0	4.5	1.00	1.00
	1	5.5	1.24 (0.61;2.54)	1.19 (0.57;2.49)
	2	7.6	1.70 (0.89;3.25)	1.57 (0.82;3.01)
	≥3	13.1	2.95 (1.51;5.78)	2.58 (1.40;3.75)
	Self-reported sleep quality		$p = 0.01$	$p = 0.05$
	Very good/good	4.7	1.00	1.00
	Regular	9.0	1.91 (1.17;3.14)	1.76 (1.08;2.89)
	Poor/very poor	11.6	2.48 (1.34;4.56)	2.21 (1.13;4.30)
	Consultation with a physician (last month)		$p = 0.23$	$p = 0.05$
No	7.2	1.36 (0.82;2.25)	1.62 (1.00;2.61)	
Yes	5.3	1.00	1.00	
4th	Perceived health status		$p < 0.01$	$p = 0.48$
	Excellent/very good	1.4	1.00	1.00
	Good	5.2	3.59 (1.24;10.4)	1.85 (0.68;5.05)
	Regular/poor	11.7	8.13 (3.01;21.9)	1.76 (0.64;4.87)
	Quality of life (tertile)		$p < 0.01$	$p = 0.06$
	1st (lower scores)	14.4	7.75 (3.59;16.7)	2.35 (0.94;5.86)
	2nd	3.2	1.75 (0.70;4.36)	1.11 (0.45;2.76)
	3rd (higher scores)	1.9	1.00	1.00
	Perceived stress (tertile)		$p < 0.01$	$p = 0.01$
	1st (less stressed)	1.1	1.00	1.00
	2nd	5.1	4.43 (1.56;12.6)	3.12 (1.06;9.20)
	3rd (more stressed)	14.7	12.1 (5.36;30.8)	4.97 (1.75;14.1)
	Depression (last year)		$p < 0.01$	$p < 0.01$
	No	4.7	1.00	1.00
Yes	26.1	5.52 (3.82;8.00)	2.26 (1.26;3.77)	
Sadness		$p < 0.01$	$p = 0.03$	
No	4.9	1.00	1.00	
Yes	23.1	4.69 (3.21;6.84)	1.63 (1.05;2.52)	

Notes: % = prevalence of suicidal thoughts by categories; PR = prevalence ratio; 95% CI = 95% confidence interval.

2015). However, these findings are not restricted to the region; in fact, studies from high-income settings also show different point prevalence estimates (Crosby et al., 2011; Almeida et al., 2012; Batterham and Christensen, 2012; Choi et al., 2015). This finding is probably a consequence of a lack of standardization in the way in which suicidality is measured as well as in the investigations of the population, which makes point prevalence comparisons between studies a difficult task.

Nonetheless, a population-based study of the entire Brazilian population, using the exact same question from the PHQ-9 to assess suicidal thoughts, found a prevalence of 3.6% (almost half the prevalence found in our study) (Carpena et al., 2019a). In this same study, when the authors analyzed the prevalence in the state in which the city of Rio Grande is located, the prevalence was 4.4%, showing that our results are higher than expected for our region.

The frequency of suicidal thoughts was higher among females and was more than two times higher in middle-aged women (40–59 years old) than in younger women (18–39 years). This association has been described in several studies (Tran Thi Thanh et al., 2006; Crosby et al., 2011; Chiu et al., 2012; Gisle and Van Oyen, 2013; Wahlin et al., 2015; Carpena et al., 2019a). According to the Brazilian Ministry of Health, women were responsible for 69% of suicidal attempts during the 2011–2016 period (Ministério da Saúde, 2017), which is in line with our result that women had more suicidal thoughts than men. It is possible that this phenomenon is observed due to socially established gender roles, according to which women would be more prone to talking about feelings and seeking help (Wahlin et al., 2015).

Similarly, socioeconomic characteristics had an important effect on the prevalence of suicidal thoughts. Less affluent individuals were 2–7 times more likely to have suicidal thoughts than were their well-off counterparts, and household food insecurity was independently responsible for a 75% increase in the probability of having these thoughts, even after adjustments were made for possible confounding factors. The effect of food insecurity was greater among those aged 60 years or older. A plausible explanation for these results is social determination, in which inequality, poverty and food insecurity can lead to psychological stress, feelings of powerlessness and, hence, depressed mood and suicidal thoughts (Compton and Shim, 2015).

Behavioral characteristics such as tobacco use (70% increased likelihood) but not alcohol was associated with a higher probability of suicidal thought. Other studies have already shown the association between tobacco and suicide (Hughes, 2008; Almeida et al., 2012) and have even proposed plausible explanations for this association, such as preexisting conditions that increase the risk of suicide, and debilitated health, which can lead to suicide and decrease levels of serotonin and monoamine oxidase (Hughes, 2008).

Regarding health variables, we found that the higher the number of morbidities the individual reported by medical diagnosis, the higher the probability of having had suicidal thoughts. The number of morbidities may result in a wide range of impairments, resulting in difficulties performing daily tasks, whether personal or work-related, thus increasing the probability of suicidal behavior (Meltzer et al., 2012; Cooper et al., 2015).

We should emphasize that more stressed individuals, compared to their less stressed counterparts, presented a 14-fold higher probability of having suicidal thoughts. Stress is related to the friction between individuals and their daily life obstacles, which can be ordinary ones (such as paying bills or having an argument) or extreme and adverse ones (natural disasters, violent experiences), which may become toxic if prolonged or permanent (Franke, 2014). Biological mechanisms in the relationships among adverse situations, physiological stress markers and suicidal behavior have been described in the literature.

Psychiatric patients with suicidal behavior who reported sexual abuse during childhood had significantly higher levels of 3-methoxy-4-hydroxyphenylglycol (MHPG) in the cerebrospinal fluid and of cortisol and adrenaline/noradrenaline in urine samples than did those who did not have this experience. Reduced levels of cortisol in urine were also

associated with feelings of neglect during childhood and adolescence among these same patients (Sunnqvist et al., 2008). It is possible that the higher the perceived stress, the higher (quantitatively and/or qualitatively) the difficulties faced and the longer the duration of toxic physiological responses, thus increasing hopelessness and a desire to stop suffering and, hence, suicidal thoughts.

In addition, those with poorer sleep quality, which could be a consequence of stress, had a higher probability of having had suicidal thoughts. A longitudinal study conducted in the United States identified that poor quality sleep measured at baseline independently increased suicide risk by 39% after 10 years of follow-up (Bernert et al., 2014). This association may be explained by deficits in emotional and neuro-cognitive processing resulting from poor-quality sleep. The fragmentation of sleep can result in emotional reactivity, intensifying negative emotional responses and reducing positive effects. Sleep deprivation increases amygdala activation, thus also increasing reactivity to negative emotions (Walker, 2009; Bernert et al., 2014).

Depression and sadness are highly correlated with suicidal thoughts, which is an association that has been identified in several surveys from different countries and in different populations (Asad et al., 2010; Almeida et al., 2012; Chiu et al., 2012; da Silva et al., 2012; Choi et al., 2015; Li et al., 2016; Santos et al., 2017). In fact, sadness and suicidal thoughts are symptoms of criterion A of the major depressive episode diagnostic, according to the Diagnostic and Statistical Manual of Mental Disorders—5th Edition (DSM-5) (American Psychiatric Association, 2013).

Although there are conditions other than depressive disorders in which suicidal thoughts may occur, it is more frequent among individuals with depressed mood. From a behavioral-cognitive perspective, depressive conditions are characterized by individuals' negative beliefs about themselves, others and the future. Thus, cognitive distortions can lead to negative thoughts, thus fostering negative feelings and resulting in a downward spiral of hopelessness, which can nourish suicidal thoughts (Beck et al., 1979).

In a previous publication, we found that depression was associated with most of the aforementioned variables in this same population. In that sense, we could hypothesize that the associations we have found here for suicidal thoughts could be mediated by depression (Carpena et al., 2019b). However, this should be assessed in future research. We must highlight that perceived stress was the variable most associated with depressive symptoms in that same study (Carpena et al., 2019b).

This study has some limitations that should be acknowledged. The cross-sectional design of this study and the way in which the variables were assessed do not allow for the establishment of causality. Therefore, associations between the outcome and independent behavioral variables, such as current tobacco use, are susceptible to reverse causality and should be interpreted with caution. In addition, suicidal thoughts were assessed from a single question, thus preventing the measure of the intensity and frequency of these thoughts, and we were not able to explore other important domains of suicidality, such as planning and attempts, which have been shown to have different predictors. The prevalence of suicidal thoughts may have been underestimated because individuals might have been reluctant to express this kind of feeling in an interview. However, we should acknowledge that our prevalence is already higher than the expected prevalence for the region and that even when individuals might have underreported their symptoms, we do not think that this would have biased our association results, since misclassification was most likely nondifferential. In addition, since the sample size calculation, for the original research, was based on a point prevalence and not measures of association, we cannot rule out that the lack of association between some variables and suicidal thought could be due to lack of power. However, a sample of almost 1300 individuals would still give us a good power level for most of the associations evaluated.

Our study also has some strengths. It was a population-based sample with a high response rate, which enabled us to extrapolate our results to the whole municipality of the urban community. This extrapolation

facilitates dialog with politicians to transform our data into policy, which is the main goal of public health research. Multivariable techniques were used to control for confounders and test for interactions, thus preventing misleading results. Associations in that range, from important social determinants of health to individual behaviors, were found and described. Thus, this manuscript presents a comprehensive diagnosis of the situation studied.

We conclude that the prevalence of suicidal thoughts in the sample was almost seven for every hundred individuals. It was identified that being female, being poorer, having household food insecurity, being a current smoker, presenting multiple morbidities, reporting poor sleep quality, being more stressed, reporting a diagnosis of depression in the last year and reporting sadness for most of the previous year were independent risk factors for suicidal thoughts. We recommend intersectoral actions aiming for social development (e.g., sustainable economic development) and the prevention and promotion of mental health targeted to the risk groups described. Longitudinal studies would be useful in investigations of the causality chain of determinants of suicidal thoughts.

Role of the funding source

This study received financial support from the Foundation for Research Support of the State of Rio Grande do Sul (FAPERGS) – Support to New Doctors / First Projects Program – ARD/PPP 2014, under file no. 16/2551-0000359-9. In addition, this study was made possible by funding from the Post-Graduation Program in Public Health (PPGSP/FURG) and Federal University of Rio Grande (FURG). MXC received a scholarship for a PhD's degree from the Coordination of Improvement of Higher-Level Personnel (CAPES).

CRedit authorship contribution statement

Samuel C. Dumith: Writing - original draft, Formal analysis, Supervision, Writing - review & editing. **Lauro Miranda Demenech:** Writing - original draft. **Marina Xavier Carpena:** Writing - original draft, Formal analysis. **Seiko Nomiyama:** Writing - original draft. **Lucas Neiva-Silva:** Writing - original draft. **Christian Loret de Mola:** Supervision, Writing - review & editing.

Data for reference

Data would be available after a formal request to a data management committee.

Declaration of Competing Interest

None.

Acknowledgments

SC Dumith is a research productivity fellow at National Council for Scientific and Technological Development (CNPQ.)

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.jad.2019.09.046](https://doi.org/10.1016/j.jad.2019.09.046).

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