Factors associated with increased cigarette consumption in the Brazilian population during the COVID-19 pandemic

Fatores associados ao aumento do consumo de cigarros durante a pandemia da COVID-19 na população brasileira

Factores asociados al aumento del consumo de tabaco durante la pandemia de COVID-19 en la población brasileña

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Abstract

Social distancing measures adopted in various countries to mitigate the impact of the COVID-19 pandemic can lead to unwanted effects on their populations' health and behaviors. This study aimed to investigate smoking behavior in the Brazilian adult population during the COVID-19 pandemic and analyze factors associated with the increase in cigarette consumption. An online survey was performed, and the final sample included 45,160 individuals. The study used post-stratification weights and calculated crude prevalence ratios (PR) and adjusted by sex, age, and schooling, and respective 95% confidence intervals (95%CI). Poisson regression models with robust variance were applied to analyze associations between increased cigarette consumption and sociodemographic variables and adherence to social distancing, quality of sleep, state of mind, and changes in work and earnings. Prevalence of smokers was 12% (95%CI: 11.1-12.9), 34% of whom reported an increase in cigarette consumption. The increase was greater among women (PR = 1.27; 95%CI: 1.01-1.59) and individuals with incomplete secondary schooling (PR = 1.35; 95%CI: 1.02-1.79). The increase in cigarette consumption was associated with worse quality of sleep, feeling isolated from family members or sad, depressed, or anxious, loss of earnings, and worse self-rated health. Health promotion strategies, smoking prevention, and encouragement for smoking cessation, as well as mental health interventions, should be continued and reinforced in the context of social distancing during the COVID-19 pandemic.

COVID-19; Quarentine; Health Risk Behaviors; Tobacco Use Disorders; Risk Factores

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Introduction

The COVID-19 pandemic, caused by the novel coronavirus (SARS-CoV-2) and declared by the World Health Organization (WHO) on March 11, 2020 [1], altered various aspects of society, interfering in social contact, the economy, employment, increasing inequalities, and health services' routines and dynamics [2]. The WHO recommended social distancing measures [1] to mitigate spread of the virus, save lives, and improve health services' response. However, such recommendations may also result in negative effects on health and living conditions in society [3,4], and behavioral changes, such as the an increase in cigarette consumption [5,6,7,8,9].

During periods of epidemics and social distancing, the separation of loved ones and friends, loss of freedom, fear of acquiring the disease, changes in routine activities, and financial losses can cause situations of distress, anxiety, depression, stress, insomnia, and irritability [10,11,12], which in turn can increase the urge to smoke [7,13,14,15]. A study in Australia during the COVID-19 pandemic identified an association between increased cigarette consumption and depression (odds ratio – adjusted OR = 1.09; 95% confidence interval – 95%CI: 1.04-1.13), anxiety (adjusted OR = 1.12; 95%CI: 1.06-1.18), and stress (adjusted OR = 1.10; 95%CI: 1.05-1.15) [7].

Although the results are not adjusted for other factors that may affect COVID-19 progression, systematic reviews indicate that smoking is likely to be associated with worse prognosis of the disease, greater need for admission to the intensive care unit (ICU), and adverse COVID-19 outcomes [16,17,18,19]. Factors involved in the relationship between smoking and SARS-CoV-2 infection include the increase in type 2 angiotensin-converting enzyme (ACE2) in the population of smokers [20,21], repetitive "hand-mouth" movements, the increase in viral contamination [16,22], and worse cardiorespiratory performance [23]. Smoking is also one of the most important risk factors for cardiovascular and metabolic diseases [24,25] and comorbidities which in turn magnify the risk of exacerbation of COVID-19. A study found that smokers with COVID-19 present 3.25 times higher odds of developing more severe forms of the disease when compared to non-smokers [26].

Considering the harmful effects of smoking on health, initiated or aggravated during epidemic processes and the additional risks of such behaviors in the COVID-19 pandemic, it is necessary to monitor the occurrence of smoking and changes in smoking behavior in order to promote and target interventions and public policies to encourage healthy behaviors during social distancing. We thus aimed to investigate smoking behavior in the Brazilian adult population during the COVID-19 pandemic and analyze factors associated with the increase in cigarette consumption.

Methods

This study used data from the research project *ConVid – Behavior Survey*. This is an online health survey conducted during the COVID-19 pandemic to assess changes in the lives of Brazilian adults, related to social distancing measures. The present study is a partnership between researchers from the Federal University of Minas Gerais (UFMG), Oswaldo Cruz Foundation (Fiocruz), and State University of Campinas (Unicamp). Participants provided formal consent, and all the answers were anonymized and with no type of participant's identification. The study was approved by the Brazilian National Commission on Research Ethics (approval number 3.980.277).

Data collection took place from April 24 to May 24, 2020. Subjects were invited to participate in the study through a snowball-type sampling process. In the first stage, the 15 researchers involved in the design or development of the study chose a total of 200 other researchers from different states of Brazil and invited them to perticipate as respondents. In addition, each of 15 above-mentioned researchers chose another 20 persons from their social network, totaling 500 selected persons. These persons, called "seeds", were then asked to send the study link to at least 12 persons from their social networks, with stratification by sex, age bracket (18-39 years; 40-59; 60 or more) and schooling (incomplete secondary or less; complete secondary or more). The persons invited by the "seeds" comprised the second wave of the recruiting chain. Each person in the second wave was asked to invite at least three other persons from their social networks, through a message at the end of the questionnaire: "Be part of the ConVid Network and share this survey with three or more contacts from your

social network. You can do this by clicking here or copying and sending our link, https://convid.fio-cruz.br". Information on the study was publicized through press releases, social communiqués from the participating research institutions, state health departments, and social media. The survey's link was also available on the websites of the research institutions' with which the researchers were affiliated. This process led to a rapid increase in contacts, and the final sample of respondents was 45,160 adult individuals (18 years or older) [27].

The *ConVid – Behavior Survey* addressed such topics as adherence to social distancing, economic losses, noncommunicable diseases, lifestyle changes, and state of mind, among others. Futher details about the study procedures are available elsewhere [27].

The target outcome variable in this study, "increase in cigarette consumption during the pandemic", was analyzed with the following questions: "Are you a smoker?"; "Before the pandemic, on average how many cigarettes did you smoke per day?"; and "During the pandemic, on average, how many cigarettes do you smoke per day?" The choices for the latter two questions were: "I didn't (don´t) smoke cigarettes, only other products"; "Fewer than 1 a day"; "1 to 9 cigarettes"; "10 to 19 cigarettes"; "20 to 29 cigarettes"; "30 to 39 cigarettes"; "40 or more cigarettes". To assess the number of cigarettes before (time 1 or t1) and during the pandemic (time 2 or t2), we used the midpoint in the response category and calculate the difference between the two moments (t2 - t1). Increase in cigarette consumption was defined as a positive difference between t2 and t1.

Explanatory variables included the following factors: adherence to social distancing measures, quality of sleep, state of mind (feeling isolated from family, feeling sad or depressed, feeling anxious or nervous), changes in work or employment, in earnings, and in self-assessed health status, besides sociodemographic variables (Box 1).

The following sociodemographic variables were analyzed: sex (male and female), age bracket (18-39; 40-59; and 60 years or older), and schooling (complete Primary or less; complete Secondary; and complete University or more).

Considering that the sample was non-probabilistic, post-stratification weights were used, based on data from the *Brazilian National Household Sample Survey* (PNAD 2019) of the Brazilian Institute of Geography and Statistics (IBGE), for the sample to have the same distribution as the Brazilian population according to state, sex, age bracket, race/color, and schooling. To assess the factors associated with the increase in cigarette consumption, we calculated crude prevalence ratios (PR) and adjusted by sex, age, and schooling and respective 95%CI, using Poisson regression models with robust variance.

Data processing used Stata, version 14 (https://www.stata.com), employing the survey module, which considers the post-stratification weights.

Results

Most of the study participants were women (53.6%; 95%CI: 52.0-55.0), 18 to 39 years of age (45.7%; 95%CI: 44.3-47.1), and with complete secondary schooling (72.4%; 95%CI: 71.3-73.5).

Prevalence of smokers in the study population was 12% (95%CI: 11.1-12.9), and 34% of the smokers reported having increased their cigarette consumption (Figure 1). Of all the persons who increased their cigarette consumption, 6.4% (95%CI: 4.3-9.4) increased by up to 5 cigarettes per day, 22.5% (95%CI: 19.6-25.7) by around 10 cigarettes per day, and 5.1% (95%CI: 3.4-7.7) by 20 or more cigarettes per day.

The increase in consumption was greater among women (PR = 1.3; 95%CI: 1.1-1.6) and among individuals with incomplete secondary schooling (PR = 1.3; 95%CI: 1.1-1.8), compared to those with a bachelor's degree or higher. There were no significant differences in relation to age bracket (Table 1).

Table 2 shows factors associated with the increase in cigarette consumption during the COVID-19 pandemic. In relation to quality of sleep, compared to persons that continued to sleep well during the pandemic, there was an increase in cigarette consumption in individuals who began to suffer sleep problems during the pandemic (adjusted PR = 2.1; 95%CI: 1.4-3.0) or those whose preexisting sleep problems became worse (adjusted PR = 2.2; 95%CI: 1.5-3.2). Meanwhile, persons who reported that their sleep problems had improved reduced their cigarette consumption (adjusted PR = 0.5; 95%CI: 0.2-0.9). As for state of mind, there was a higher prevalence of increasing cigarette consumption

Box 1

Description of the explanatory variables.

VARIABLES	QUESTIONS	CATEGORIES
Adherence to social distancing measures	During the novel coronavirus pandemic, to what degree have you restricted contact with others?	1) No restriction: Nothing different, leading a normal life 2) Little restriction: I've attempted to take precautions, keep a distance from others, reduce contact somewhat, and not visit older people, but I've continued to work and go out 3) Intense restriction: I've stayed at home and only go out for groceries and medicines 4) Total restriction: I've stayed strictly at home, only going out for necessities and healthcare
Quality of sleep	Has the pandemic affected the quality of your sleep?	1) No, I continue to sleep well 2) With the pandemic, I began to have sleep problems 3) I already had sleep problems and they have continued the same 4) I already had sleep problems and they became much worse 5) My sleep problems decreased during the pandemic
Feeling isolated from family members	During the pandemic, how often have you felt isolated from your family or close friends?	1) Never 2) Occasionally 3) Often 4) Always
Feeling sad or depressed	During the pandemic, how often have you felt sad or depressed?	1) Never 2) Occasionally 3) Often 4) Always
Feeling anxious or nervous	During the pandemic, how often have you felt anxious or nervous?	1) Never 2) Occasionally 3) Often 4) Always
Change in work	How has the pandemic affected your occupation or work?	1) Remained the same 2) Began working 3) Stopped working
Change in family earnings	How has the pandemic affected your family income?	1) Remained the same 2) Increased 3) Decreased 4) Family now has no income
Change in self-rated health	Do you think the pandemic caused any change in your health?	1) Remained the same 2) Improved 3) Worsened

Figure 1

Prevalence of smokers and changes in smoking habit during the COVID-19 pandemic. *ConVid – Behavior Survey*, Brazil, 2020.
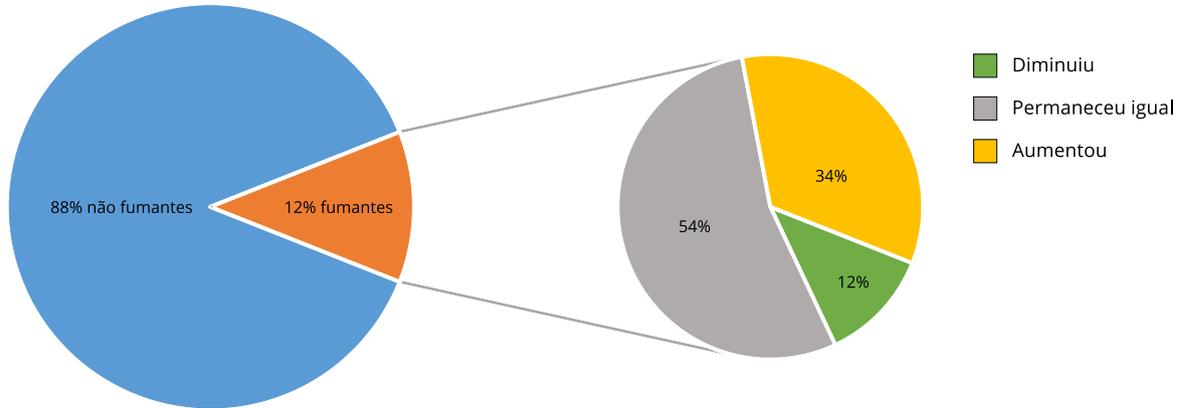
Table 1

Prevalence and prevalence ratio for the increase in cigarette consumption during the COVID-19 pandemic, according to sociodemographic characteristics. *ConVid – Behavior Survey*, Brazil, 2020.

Variables	Total % (95%CI)	IIncrease in cigarette smoking		PR (95%CI)
		No % (95%CI)	Yes % (95%CI)	
Total		66.0 (62.1-69.6)	34.0 (30.4-37.9)	
Sex				
Male	46.4 (45.0-47.9)	69.8 (63.8-75.2)	30.2 (24.8-36.1)	Reference
Female	53.6 (52.0-55.0)	61.6 (56.7-66.3)	38.4 (33.7-43.3)	1.3 (1.1-1.6)
Age bracket (years)				
18-39	45.7 (44.3-47.1)	62.8 (56.1-69.0)	37.2 (31.0-43.9)	1.1 (0.8-1.5)
40-59	34.0 (32.7-35.4)	68.8 (63.4-73.7)	31.2 (26.3-36.6)	0.4 (0.7-1.3)
60 or more	20.3 (19.1-21.6)	67.0 (58.1-74.9)	33.0 (25.1-41.9)	Reference
Schooling				
Complete Primary or less	11.1 (10.1-12.3)	55.6 (43.3-67.3)	44.4 (32.7-56.7)	1.3 (1.1-1.8)
Complete Secondary	72.4 (71.3-73.5)	67.8 (63.2-72.1)	32.2 (27.9-36.8)	0.9 (0.8-1.1)
Complete University or more	16.5 (16.0-17.0)	67.1 (64.8-69.4)	32.9 (30.6-35.2)	Reference

95%CI: 95% confidence interval; PR: prevalence ratio.

Table 2

Factors associated with increased cigarette consumption during the COVID-19 pandemic. *ConVid – Behavior Survey*, Brazil, 2020.

Variables	Increase in cigarette smoking		Crude PR (95%CI)	Adjusted PR (95%CI) *
	No **% (95%CI)**	**Yes** **% (95%CI)**		
Intensity of social restriction				
No restriction	77.9 (39.3-95.0)	22.1 (5.0-60.7)	Reference	Reference
Little restriction	65.7 (57.2-73.3)	34.3 (26.7-42.8)	1.5 (0.4-5.9)	1.4 (0.4-5.4)
Intense restriction	64.8 (59.9-69.5)	35.2 (30.5-40.1)	1.6 (0.4-6,0)	1.4 (0.4-5.4)
Total restriction	69.9 (60.5-77.9)	30.1 (22.1-39.5)	1.4 (0.3-5.2)	1.2 (0.3-4.8)
Quality of sleep				
Not affected, I continue to sleep well	79.4 (72.1-85.2)	20.6 (14.8-27.9)	Reference	Reference
I began to have sleep problems	56.2 (48.5-63.5)	43.8 (36.5-51.5)	2.1 (1.5-3.1)	2.1 (1.4-3.0)
I continue to have sleep problems	74.6 (67.0-80.9)	25.4 (19.1-33.0)	1.2 (0.8-1.9)	1.2 (0.8-1.8)
My sleep problems became much worse	52.7 (44.7-60.5)	47.3 (39.4-55.3)	2.3 (1.6-3.3)	2.2 (1.5-3.2)
My sleep problems decreased	90.0 (81.4-94.9)	10.0 (5.1-18.6)	0.5 (0.2-1.0)	0.5 (0.2-0.9)
Feeling isolated from family members				
Never	83.1 (72.5-90.2)	16.9 (9.8-27.5)	Reference	Reference
Occasionally	71.6 (63.5-78.5)	28.4 (21.5-36.5)	1.7 (0.9-3.0)	1.6 (0.2-0.9)
Often	63.3 (57.4-68.8)	36.7 (31.2-42.6)	2.2 (1.3-3.7)	2.0 (1.2-3.4)
Always	54.5 (45.8-62.8)	45.5 (37.2-54.2)	2.8 (1.5-4.7)	2.4 (1.4-4.2)
Feeling sad or depressed				
Never	86.9 (72.9-94.2)	13.1 (5.8-27.1)	Reference	Reference
Occasionally	78.6 (73.0-83.2)	21.4 (16.8-26.9)	1.2 (0.7-2.0)	1.2 (0.7-2.0)
Often	58.9 (52.9-64.6)	41.1 (35.4-47.1)	2.3 (1.4-3.8)	2.2 (1.4-3.7)
Always	50.3 (40.5-60.0)	49.7 (40.0-59.5)	2.6 (1.5-4.5)	2.4 (1.4-4.0)
Feeling anxious or nervous				
Never	86.9 (72.9-94.2)	13.1 (5.8-27.1)	Reference	Reference
Occasionally	78.6 (73.0-83.2)	21.4 (16.8-26.9)	1.6 (0.7-3.7)	1.7 (0.7-3.7)
Often	58.9 (52.9-64.6)	41.1 (35.4-47.1)	3.1 (1.4-6.9)	3.1 (1.4-6.7)
Always	50.3 (40.5-60.0)	49.7 (40.0-59.5)	3.8 (1.4-6.9)	3.5 (1.6-7.8)
Change in work				
Remained the same	68.2 (63.7-72.5)	31.8 (36.3-37.5)	Reference	Reference
Started working	75.3 (44.1-92.2)	24.7 (7.8-55.9)	0.8 (0.3-2.2)	0.8 (0.3-2.3)
Stopped working	60.3 (61.8-69.4)	39.7 (32.6-47.2)	1.2 (0.9-1.6)	1.2 (0.9-1.5)
Change in income				
Remained the same	70.7 (63.9-76.7)	29.3 (23.3-36.0)	Reference	Reference
Increased	67.9 (35.3-89.2)	32.1 (10.8-64.7)	1.1 (0.4-2.8)	1.1 (0.5-2.5)
Decreased	65.8 (60.4-70.7)	34.2 (29.3-39.6)	1.2 (0.9-1.5)	1.1 (0.9-1.5)
Now have no income at all	53.8 (42.6-64.5)	46.2 (35.5-57.4)	1.6 (1.1-2.2)	1.5 (1.1-2.0)
Change in self-rated health				
Remained the same	70.5 (65.6-74.9)	29.5 (25.1-34.4)	Reference	Reference
Improved	75.5 (52.1-89.8)	24.5 (25.1-34.4)	0.8 (0.4-1.8)	0.9 (0.4-1.9)
Worsened	54.5 (48.1-60.9)	45.5 (30.1-51.9)	1.5 (1.2-1.9)	1.5 (1.2-1.8)

I95%CI: 95% confidence interval; PR: prevalence ratio.

Note: no restriction: did nothing, life as usual; little restriction: attempted to take precautions, keep a distance from others, reduce contact somewhat, not visit older people, but still go out; intense restriction: stayed home, only going out for groceries or medicines; total restriction: stayed strictly at home, only go out for necessities and healthcare.

* Adjusted PR by sex, age, schooling.

among persons who reported the following: feeling isolated from family members often (adjusted PR = 2.0; 95%CI: 1.2-3.4) or always (adjusted PR = 2.4; 95%CI: 1.4-4.2); feeling sad or depressed often (adjusted PR = 2.2; 95%CI: 1.4-3.7) or always (adjusted PR = 2.4; 95%CI: 1.4-4.0); and feeling anxious or nervous often (adjusted PR = 3.1; 95%CI: 1.4-6.7) or always (adjusted PR = 3.5; 95%CI: 1.6-7.8). A partial reduction in earnings did not alter cigarette consumption, while losing all of one's earnings (zero income) increased consumption (adjusted PR = 1.5; 95%CI: 1.1-2.0). Worse self-assessed health status was also associated with increased cigarette consumption (adjusted PR = 1.5; 95%CI: 1.2-1.8). The variables adherence to social distancing and change in work/employment were not associated with increased cigarette consumption.

Discussion

The current study's findings pointed to 12% prevalence of smokers, a third of whom reported having increased their cigarette consumption during the pandemic. Meanwhile, 12% reported smoking less, while 54% were smoking the same amount. Increased cigarette smoking was greater among women and individuals with incomplete secondary schooling. After adjusting for sex, age, and schooling, factors associated with the increase in cigarette consumption were the following: feeling isolated from family members, sad or depressed, anxious, worse quality of sleep, complete loss of earnings, and worse self-assessed health status.

A study in Australia during the COVID-19 pandemic found a similar prevalence of smokers (11%) to that in our study (12%), but the majority (89%) of the Australian smokers interviewed had not changed their smoking behavior, and the prevalence of increased cigarette smoking among smokers was only 6.9% [7]. The same study found other negative behavior changes besides smoking more, such as a decline in physical activity (48.9%), worse sleep (40.7%), and increased alcohol intake (26.6%) [7]. Studies in Italy and the United States indicated an increase in prevalence of smoking during the economic recessions in those countries, attributed to the assumed effect of the increase in stress caused by financial problems and unemployment [28,29]. However, another study in Italy in 2016 and 2017 on the effect of the economic crisis on lifestyle found a reduction in smoking due to budget restrictions and lower buying power [30]. In this sense, paradoxically, a crisis period can either predispose to increased smoking, hinder initiation, or contribute to smoking cessation [30].

State of mind (or mood) is an important factor in increased tobacco consumption. Various studies have described the relationship between tobacco use and negative affect, anguish, or sensitivity to anxiety among individuals in situations of stress [7,31,32,33,34,35,36,37]. Alexander et al. [32] reported that feelings related to social isolation were associated with tobacco use; individuals doubled their consumption during the crisis caused by Hurricane Katrina in New Orleans, United States, which left thousands of persons stranded. By analyzing a sample of 279 smokers, the same authors found that Blacks increased their tobacco consumption twofold, and that the stressors with the greatest impact were: mental distress, lower social support, and increased social and economic vulnerability. A systematic review that examined comorbidity of posttraumatic stress disorder and tobacco use found that prevalence of tobacco use in individuals with posttraumatic stress disorder was 24%, with high levels of nicotine dependence and heavy use of tobacco products [31]. The increase in chain smoking among individuals with this disorder emphasizes the importance of negative emotional states such as anxiety, depression, and stress as contributing factors to tobacco use [31]. Neurophysiology provides evidence of nicotine's action on the central nervous system, altering mood by producing a feeling of relief from stress, anguish, and sadness [38,39]. This effect of positive feedback is mediated by the meso-limbic dopaminergic system [39].

Worse sleep is a stressful and anxiogenic situation, also observed in a study in Hubei Province, China, with 939 individuals in social isolation due to the COVID-19 pandemic [40]. As in the current study, Altena et al. [41] identified the relevance of worse sleep for increased tobacco consumption. Sleep plays an important role in emotional regulation, and sleep disorders involve changes in emotional behavior [41] that can result in an increase in tobacco consumption.

The association between the loss of earnings and increased cigarette smoking was also identified, possibly because the pandemic amplifies families' social vulnerability and consequently the presence

of negative emotional states. The influence of loss of work and earnings on psychosocial disorders has also been well documented in the international literature [42,43]. Losing one's employment is considered one of the most stressful experiences in adulthood, leading to decreased purchasing power, family breakdown, and low self-esteem [44], in addition to being associated with changes in health status, such as depression and anxiety [45]. Prior socioeconomic status modulates the pandemic's negative effects, and the impact of COVID-19 tends to be more severe in populations that are more vulnerable to adverse social determinants [46,47].

Given the above, it is important to promote health promotion strategies oriented to the adoption or maintenance of positive health behaviors that should be used to cope with the increase in psychological distress during the pandemic. A comprehensive, multisector, and governmental tobacco control approach is necessary, considering all the tenets and commitments of the WHO Framework Convention on Tobacco Control (WHO-FCTC) to detain the tobacco epidemic and save lives [48]. Smoking cessation by any means should be a priority [16].

Smoking cessation can also be difficult, especially in an adverse context like the COVID-19 pandemic, given that access to health services may be compromised. In addition, during the social distancing imposed by the pandemic, face-a-face support for smokers from public healthcare workers has been hampered, with difficulty in initiating and continuing cessation treatment in the units of Brazil's Unified National Health System (SUS) [49]. Contributing factors include both the recommendation to only leave home in situations of extreme necessity and the interruption in the supply of face-to-face activities (individual and in group) in primary care, whether to avoid crowding or due to work overload.

In this scenario, strengthening health education actions via Internet and telephone counseling [50] become timely and complementary strategies for the established regulatory measures at the global and national levels. A guideline based on systematic reviews and meta-analyses concluded that pharmaceutical treatment combined with counseling by trained professionals, whether individual or in group or by telephone, are highly effective methods in smoking cessation [51]. The guideline also indicated that the efficacy of counseling increases with the increase in the duration and number of sessions performed. Interventions are also recommended through self-help materials (pamphlets, booklets, manuals, e-mail messages, videos, audios, computer programs, and websites), which are less effective than the previous options, but which have great potential for reaching the target public and at lower cost [51].

Regulatory measures feature the initiative taken by South Africa, banning the sale of tobacco and nicotine products during the COVID-19 pandemic, designating them as nonessential goods [52]. In the sphere of health education interventions, both the WHO and the Brazilian Ministry of Health, via the National Cancer Institute (INCA), have used online resources with the aim of alerting smokers and persons exposed to passive smoking to the risks associated with COVID-19, and encouraging cessation of the habit during the pandemic.

The WHO recently launched a tobacco control project [53]. This new Access Initiative for Quitting Tobacco (AIQT) aims to provide free access and support for adherence to nicotine replacement therapy and access to Florence, a virtual assistant that helps the interface user in the individual development of the quit-smoking plan and answers any doubts related to smoking and COVID-19 [53]. Another key initiative is the *World No Tobacco Day*, promoted annually by the WHO in the month of May, in which the objective in 2020 was to raise young people's awareness concerning the tobacco industry's manipulation tactics [54].

In Brazil, the global campaign was addressed with the theme *Smoking and Coronavirus (COVID-19*, given the given the role of smoking as a potential risk factor for COVID-19 and aggravation of cases. At the national level, Brazil holds the campaign *National No Smoking Day*, celebrated since 1986 in the month of August. In 2020, the Brazilian campaign was aligned thematically with the global campaign and established a second action phase called *Coronavirus: Another Reason for you to Quit Smoking* [55]. Illustrated and text pieces were produced to support communications via websites and social media, underlining the importance of not smoking and the adoption of healthy habits, besides incentivizing cessation and discouraging smoking initiation during the pandemic. In addition, given the difficulties for initiating and continuing treatment for smokers in the units of the SUS, due to social distancing measures, the Brazilian National Cancer Institute (INCA) prepared a web-series with eight short

videos featuring content addressing the harms from smoking [49]. The institution also published an alert to the population on the risks of smoking for aggravating the health crisis, in which it provided a list of recommendations that can be followed individually to quit smoking [56]. A note by the National Network of Coordinators of the National Tobacco Control Program, published on the institution's site, reinforced the importance of guaranteeing that smokers already in individual or group treatment should receive the medication for the period, besides continuing with the group or individual treatment guidelines, via telephone messages or other communication tools [57].

This is the first study to investigate smoking behavior in the Brazilian adult population during the COVID-19 pandemic and to analyze factors associated with the increase in cigarette consumption. The study's strengths featured the inclusion of various health behaviors in a large study sample and the timing of the data collection in sync with social distancing in Brazil, with rapid responses and low cost. However, there were also some limitations that merit consideration. First, all the data are self-reported, which means that answers are subject to recall bias. Second, the data are cross-sectional, and thus causality cannot be inferred. Third, the sampling design was non-probabilistic, and the study's participants had more schooling and better Internet access on average than the general population, which required applying post-stratification weights to the data analysis. Consequently, any generalization to other populations needs to be confirmed by other studies. Longitudinal studies are also recommended to assess the impact of social distancing measures on smoking behavior changes over time.

Final remarks

The data suggest that the the worsening of mental health, quality of sleep, self-assessement of health status and the lack of earnings are factors associated with the increase in cigarette consumption by Brazilian adults during the COVID-19 pandemic. Health promotion measures targeted to the adoption or maintenance of health behaviors, such as messages via social media and orientation from healthcare workers, especially in primary healthcare, should thus be used to mitigate the pandemic's psychological suffering and unhealthy behaviors like smoking. In addition, strategies for tobacco prevention and the promotion of smoking cessation should thus be continued and reinforced while the social distancing measures are in force, for the impacts of tobacco consumption not to further aggravate the population's health conditions during the COVID-19 pandemic.

Contributors

All the authors contributed to the study's conception and project, data analysis and interpretation, and writing and critical revision of the article, and approved the final version for publication, taking responsibility for all aspects of the work, guaranteeing the accuracy and integrity of all its parts.

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Resumo

Medidas de distanciamento social adotadas em diversos países para mitigar o impacto da pandemia de COVID-19 podem acarretar efeitos indesejáveis sobre a saúde e o comportamento das populações. Este estudo objetivou investigar o comportamento de fumar na população adulta brasileira durante a pandemia de COVID-19 e analisar os fatores associados ao aumento do consumo de cigarro. Foi realizado um inquérito virtual e a amostra final correspondeu a 45.160 indivíduos. Foram utilizados pesos de pós-estratificação e calculadas as razões de prevalência (RP) brutas e ajustadas por sexo, idade e escolaridade, e os respectivos intervalos de 95% de confiança (IC95%). Modelos de regressão de Poisson com variância robusta foram aplicados para a análise de associação entre o aumento do consumo de cigarros e as variáveis sociodemográficas e as relativas à adesão ao distanciamento social, qualidade do sono, estado de ânimo, alteração no trabalho e nos rendimentos. A prevalência de fumantes foi de 12% (IC95%: 11,1-12,9), dos quais 34% relataram aumento no consumo de cigarros. Esse aumento foi maior entre as mulheres (RP = 1,27; IC95%: 1,01-1,59) e entre indivíduos com o Ensino Médio incompleto (RP = 1,35; IC95%: 1,02-1,79). O aumento do consumo de cigarros esteve associado à piora da qualidade do sono, sentir-se isolado dos familiares, triste ou deprimido, ansioso, ficar sem rendimentos e pior avaliação do estado de saúde. Estratégias de promoção da saúde, de prevenção do uso e de incentivo à cessação do consumo de cigarros, bem como intervenções em saúde mental, devem ser continuadas e reforçadas no contexto de distanciamento social durante a pandemia de COVID-19.

COVID-19; Quarentena; Comportamento de Risco; Tabagismo; Fatores de Risco

Resumen

Las medidas de distanciamiento social adoptadas en diversos países para mitigar el impacto de la pandemia de COVID-19 pueden acarrear efectos indeseables sobre la salud y el comportamiento de las poblaciones. Este estudio tuvo como objetivo investigar el comportamiento de fumar en la población adulta brasileña, durante la pandemia de COVID-19, y analizar los factores asociados al aumento del consumo de tabaco. Se realizó una encuesta virtual y la muestra final correspondió a 45.160 individuos. Se utilizaron pesos de pos-estratificación y se calcularon las razones de prevalencia (RP) brutas y ajustadas por sexo, edad y escolaridad, así como los respectivos intervalos de 95% de confianza (IC95%). Se aplicaron modelos de regresión de Poisson con variancia robusta para el análisis de asociación entre el aumento del consumo de tabaco y las variables sociodemográficas, así como las relativas a la adhesión al distanciamiento social, calidad del sueño, estado de ánimo, cambios en el trabajo e ingresos. La prevalencia de fumadores fue de un 12% (IC95%: 11,1-12,9), de los cuales un 34% relataron un aumento en el consumo de cigarrillos. Este aumento fue mayor entre las mujeres (RP = 1,27; IC95%: 1,01-1,59) y entre individuos con la enseñanza media incompleta (RP = 1,35; IC95%: 1,02-1,79). El aumento del consumo de tabaco estuvo asociado con un empeoramiento de la calidad del sueño, sentirse aislado de los familiares, triste o deprimido, ansioso, quedarse sin ingresos, al igual que con una peor evaluación del estado de salud. Las estrategias de promoción de salud, prevención del consumo y de alicientes para dejar el hábito de fumar, así como intervenciones en salud mental, deben ser continuas y estar reforzadas en el contexto de distanciamiento social durante la pandemia de COVID-19.

COVID-19; Cuarentena; Conductas de Riesgo para la Salud; Tabaquismo; Factores de Riesgo