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Prevalence and factors associated with tobacco use in women deprived of liberty in a prison in the Brazilian Midwest

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Abstract *Tobacco use is a Public Health issue, and the release of its use in the prison system is controversial. Its prevalence in this population is high, including in women's prisons. The objective of this article is to estimate tobacco use prevalence in women deprived of liberty and its associated factors. Cross-sectional study with 259 participants who answered a questionnaire in a prison in the Brazilian Midwest. The dependent variable was tobacco use, and the independent variables were sociodemographic, life history, legal status, and use of other drugs. Descriptive and bivariate analyses were performed, using prevalence ratios through the Chi-square test and Poisson regression in the multivariate analysis. Tobacco use prevalence was 86.87%. In the final model, the variables: age group, from 18-39 years (PR 1.33; 95%CI 1.10-1.61), alcohol use (PR 1.26; 95%CI 1.00-1.59), marijuana use (PR 1.16; 95%CI 1.03-1.30), and interaction between prison time and cocaine use (PR 1.05; 95%CI 1.00-1.11) remained associated with tobacco use. Tobacco use prevalence was high. The age group 18-39 years, alcohol and marijuana use and interaction between imprisonment length of 36 months or more and cocaine use were associated with tobacco use.*
Key words *Tobacco use, Prison, Women, Risk Factors*

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Introduction

There are eleven million people in prison worldwide, with prisons operating above capacity in 119 countries where measures to reduce the prison population have been inadequate. Brazil is the third country with the largest prison population (811,707), in absolute numbers, after the United States (2,068,800) and China (1,690,000). In our country, the prison population rate was 381 people deprived of liberty per 100,000 inhabitants, of which 5.1% were women. Brazil stands out in the growth of these rates when comparing the historical series between countries. Women showed an increase of 455% in the incarceration rate between 2000 and 2016, while, for example, a 2% reduction was observed in Russia[1]. The Penitentiary System of the State of Mato Grosso considered around 17,000 inmates in its custody, 12,460 of which were in physical cells, and the rest in home arrest with electronic monitoring[2].

Notably, tobacco use and the use of illicit drugs or other health issues in the general population are different from the epidemiological profile among individuals in the prison system, significantly how they are distributed, potentiated by overcrowded conditions, an unhealthy structure of cells with humidity, dirt, poor lighting, and ventilation, intense physical contact between prisoners, violence, abuse that directly impact health demands, thus hindering the care and treatment of these individuals in comprehensively and effectively[3].

Tobacco use is a public health issue, a neurobehavioral disease caused by nicotine dependence, and a risk factor for chronic noncommunicable diseases[4]. The World Health Organization (WHO) points out that tobacco kills more than 8 million people yearly, and about 7 million of these deaths result from the direct use of this product, of which about 1.2 million are non-smokers exposed to secondhand smoke[5]. The WHO also states that about 80% of the world's 1.3 billion smokers live in low- and middle-income countries, where the burden of tobacco-related disease and death is highest[6].

Health care in the prison system should be available and provided under conditions similar to health care for the general population. In this regard, several organizations have developed guidelines and standards for providing health care in correctional facilities. In Brazil, the Ministry of Health developed the National Comprehensive Health Care Policy for People Deprived of Liberty in the Prison System (PNAISP), established through Interministerial Ordinance No. 1 of January 2, 2014, whose main objective is assuring the right to health for all persons deprived of their liberty in the Prison System. Moreover, this policy aims to guarantee this population's access to the Unified Health System (SUS), respecting the precepts of human rights and citizenship[7], and the National Health Care Policy for Incarcerated and Released Women (PNAMPE)[8].

We should highlight that Brazil has consolidated the National Tobacco Control Program (PNCT) within the SUS, including the Clinical Protocol and Therapeutic Guidelines for Nicotine Dependence[9]. As a result, the smoker's cognitive-behavioral approach and drug treatment, with Nicotine and Bupropion Replacement Therapy, started to be provided free of charge to the Brazilian population.

Brazil has stood out worldwide due to the implantation and implementation of tobacco control policies that are progressively more effective, which reduced tobacco use prevalence from 34.8% in 1989 in the adult population[10] to 12.6% in 2019[11], although reducing tobacco use among women was lower than among men.

Prison tobacco use has been seen as a stress coping mechanism[12], combined with the lack of smoking cessation treatments, which may contribute to high smoking rates. Women experience separation from family and friends, deprivation of liberty, long periods of boredom in cells, and stress around the personal situation they must address when returning to the community[13]. Furthermore, we observe difficulties interacting with prisoners, correctional officers, and the health team.

Considering tobacco use as a public health problem, besides its higher prevalence in the population deprived of liberty, because this chemical dependence is a risk factor for NCDs, this study aims to estimate tobacco use prevalence and the associated factors in women deprived of liberty in Cuiabá, Mato Grosso, Brazil.

Methods

This cross-sectional epidemiological study was conducted with all 259 adult women deprived of their liberty at the Ana Maria do Couto May Female Penitentiary in Cuiabá, Central West Brazil.

The interviews were held in the prison unit's ward from October 2020 to March 2021 by the medical researcher who works in public health and tobacco use by order of arrival of the partic-

ipants. An interview was conducted, and a questionnaire containing questions with the following fields (independent variables) was applied: general information with identification, sociodemographic data, arrest date, life history, criminal history, use of tobacco, alcohol, and other drugs, and questions related to comorbidities.

The dependent variable was tobacco use, defined when the respondent answered that she was smoking and had smoked more than 100 cigarettes in her lifetime.

All women deprived of their liberty who voluntarily accepted to participate were included, and women who had cognitive or behavioral impairments that hindered their answers to the questionnaire were excluded.

Regarding data analysis, a descriptive analysis was initially performed, followed by bivariate analysis, to associate the dependent variable (tobacco use) and other independent variables, using the Mantel-Haenszel chi-square test and the measure of association with the Prevalence Ratio, with their respective 95% confidence intervals. Possible confounding and interactions were also tested through stratified analysis per the biological plausibility criteria endorsed by the scientific literature. Variables with association test with $p<0.20$ were tested in Poisson's multivariate model with robust variance estimation, gradually removing by the backward method, and maintaining the variables with a p-value less than 5% ($p<0.05$) in the final multivariable model.

Analyses were performed using Epi-Info® 7.2.4 software (Center for Disease Control and Prevention, Atlanta, Georgia, USA), with subsequent use of SPSS® software version 20.0 (SPSS Inc., Chicago, IL, USA) for analysis of the multivariate model. The Research Ethics Committee of the Federal University of Mato Grosso approved the research project under Opinion No. 4.038.796. All participants were informed about the characteristics of the study and signed the Informed Consent Form.

Results

The mean age of the inmates was 32.63 (SD±9.12) years. Table 1 shows the descriptive sociodemographic data, where the most prevalent age group was 18-29 years (46.33%), and being single was the most common marital status, with 51.74%. Regarding schooling, the largest group was incomplete elementary school, with 43.24%. Most were brown (62.93%).

On average, women deprived of their liberty were incarcerated for at least 51.73 months (SD±58.56) or 4.31 years. Table 1 also contains life history, criminal justice status, and substance use data. Notably, most of them were raised without parents (55.21%), had good family relationships (55.60%), and had children younger than 12 years old (45.46%). As for their legal status, most of them were in a temporary situation (57.53%). Concerning substance use, tobacco use prevalence was 86.87%, and the use of other drugs up to imprisonment: alcohol use was 67.18%, and use of illicit drugs (marijuana or cocaine) was 57.92%.

The mean initiation age of smoking was 13.41±1.91 years, alcohol 15.60±3.67 years, marijuana 15.50±2.92 years, and cocaine 16.33±3.30 years (Table not shown).

The measures of association between tobacco use and sociodemographic data are shown in Table 2. Variables associated with tobacco use were the age group 18-39 years (PR 1.44; 95%CI 1.17-1.78) and schooling up to high school (PR 1.17; 95%CI 0.93-1.49).

In Table 3, the bivariate analysis shows the association between tobacco use and having suffered childhood violence (PR 1.12; 95%CI 1.03-1.23), drug-related crime (PR 1.11; 95%CI 1.01-1.23), alcohol use (PR 1.50; 95%CI 1.18-1.90), marijuana use (PR 1.32; 95%CI 1.17-1.28) and cocaine use (PR 1.17; 95%CI 1.07-1.28).

Seeking some associations between cocaine and tobacco use, at first, this use was stratified between the age group from 18-39 years and 40 years and over, where an association of 1.12 times more between cocaine and tobacco use was observed only with a statistically significant association in the age group 18-39 years. Moreover, when stratifying cocaine and tobacco use by prison time, an association was identified only among those who had been in prison for 36 months or longer, with 1.26 times more cocaine use among the latter (Table 4).

In the final multivariable model, Table 5, we observed that the following variables remained associated with tobacco use: age group 18-39 years (PR 1.33; 95%CI 1.10-1.61), alcohol use (PR 1.26; 95%CI 1.00-1.59), marijuana use (PR 1.16; 95%CI 1.03-1.30) and interaction between prison time 36 months and over and marijuana use (PR 1.16; 95%CI 1.03-1.30) and interaction between prison time 36 months and over.

Discussion

The tobacco use prevalence found was relatively high in this study (86.9%). This data is similar to that of the international and national literature, which has found high tobacco use rates in people deprived of liberty[14,15]. A study in the Brazilian Northeast showed that 60.3% of the inmates were

Table 1. Distribution of sociodemographic characteristics related to life history, criminal justice, and substance use of women deprived of their liberty (N=259). Cuiabá-MT, Brazil, 2021.

Variables	Categories	Frequency (n)	Percentage (%)
Age group	18-29 years	120	46.33
	30-39 years	89	34.36
	40-49 years	38	14.67
	50 years and over	12	4.63
Schooling	Illiterate	2	0.77
	Elementary School incomplete	112	43.24
	Elementary School	16	6.18
	High School incomplete	60	23.17
	High School	45	17.37
	Higher Education incomplete	18	6.95
	Higher Education	6	2.32
Skin color	White	96	37.07
	Brown	107	41.31
	Black	56	21.62
Sexual orientation	Heterosexual	180	69.50
	Homosexual	24	9.27
	Bisexual	55	21.24
Marital status	Separated/widower	16	6.18
	Single	134	51.74
	Married/common-law marriage	109	42.08
Religion	Yes	181	69.88
	No	78	30.12
Raised by	Parents	116	44.79
	Others	143	55.21
Family relationship	Good/reasonable	144	55.60
	Poor	115	44.40
Children under 18	No	110	42.47
	Yes <12 years	118	45.46
	Yes 12-17 years	31	11.97
Legal status	Convicted	110	42.47
	Provisional	149	57.53
Prison time	Up to 35 months	133	51.35
	36 months and over	126	48.65
Suffered childhood violence	Yes	110	42.47
	No	149	57.53
Tobacco use status	Smoker	225	86.87
	Former smoker	16	6.18
	Never smoked	18	6.95
Alcohol use	Until prison	174	67.18
	Stopped before prison	42	16.22
	Never drank	43	16.60
Illicit drug use (marijuana or cocaine)	Until prison	150	57.92
	Stopped before prison	19	7.34
	Never used	90	34.75

Source: Authors.

Table 2. Bivariate analysis. Association between smoking and sociodemographic variables in women deprived of liberty (N=259). Cuiabá-MT, Brazil, 2021.

Variables	Tobacco use				PRc	95%CI	p-value
	Yes		No				
	N	%	N	%			
Faixa etária							
18 a 39 anos	193	92.34	16	7.66	1.44	(1.17-1.78)	<0.001
40 e mais	32	64.00	18	36.00	1.00	-	-
Orientação sexual							
Heterossexual	154	85.56	26	14.44	1.05	(0.96-1.16)	0.344
Homossexual/bissexual	71	89.87	8	10.13	1.00	-	-
Estado civil							
Solteira/separada/viúva	132	88.00	18	12.00	1.03	(0.93-1.14)	0.529
Casada/união estável	93	85.32	16	14.68	1.00	-	-
Cor							
Parda/preta	144	88.34	19	11.66	1.05	(0.95-1.16)	0.361
Branca	81	84.38	15	15.62	1.00	-	-
Escolaridade							
Até médio completo	207	88.09	28	11.91	1.17	(0.93-1.49)	0.049
Superior e mais	18	75.00	6	25.00	1.00	-	-
Religião							
Não	66	84.62	12	15.38	0.96	(0.86-1.07)	0.481
Sim	159	87.85	22	12.15	1.00	-	

PRc: Crude prevalence ratio. 95% CI: 95% confidence interval. p-value: p-value for the chi-square test.

Source: Authors.

smokers[16]. Another study carried out with women deprived of liberty in the U.S. showed that most inmates (73.9%) were smokers, and 60.6% of them had already attempted to quit smoking at least once in their lifetime. Overall, 64.2% reported interest in participating in the smoking cessation program, but only 24.5% felt very confident[17].

Notably, most female smokers in the Penitentiary responded positively that they would like to participate in a cessation program. Possibly, these women felt the importance of the almost daily presence of the principal researcher of this study, who, besides tobacco use, voluntarily performed care for other diseases, with health guidelines, referrals, and more straightforward interventions demanded by the study population.

However, the numbers were much higher when comparing the tobacco use prevalence in this study with the general population. The VIGITEL 2020 (Telephone Survey on Surveillance of Risk and Protection Factors for Chronic Diseases) carried out only in Brazilian capitals identified that the tobacco use prevalence in adults was 9.5% and was higher in males (11.7%) than in females (7.6%). In Cuiabá-MT, this prevalence of female smokers was 8.1%[18].

Some possible explanations can be suggested to understand better this high prevalence rate in women deprived of liberty. First, prison is a hostile environment, leading to worse chronic stress conditions, restrictive norms in these communities, and difficult access to health services[19]. Other situations, also not evaluated in this study, may be related to imbalances, inequalities, and social violence expressed in the incarceration situation, besides unhealthy conditions such as poorly ventilated cells, the very social marginalization of these women deprived of liberty, and the limited access to health care[3].

In our study, a higher tobacco use prevalence was observed among younger women, and this association was statistically significant in the final model. Similar to other studies that show in young adults the highest tobacco use prevalence among all age groups in most industrialized countries and significant variability in smoking behavior[20,21].

Another variable associated with tobacco use in the final model was previous alcohol use, as

Table 3. Bivariate analysis. Association between tobacco use, life history, criminal justice history, drug use in women deprived of liberty. Cuiabá-MT, Brazil, 2021.

Variables	Tobacco use				PRc	95%CI	p-value
	Yes		No				
	N	%	N	%			
Raised by							
Parents	97	83.62	19	16.38	0.93	(0.85-1.03)	0.164
Others	128	89.51	15	10.49	1.00	-	-
Family relationship							
Good/reasonable	125	86.81	19	13.19	0.99	(0.91-1.10)	0.971
Poor	100	86.96	15	13.04	1.00	-	-
Children under 18							
Yes	127	85.23	22	14.77	0.96	(0.87-1.05)	0.364
No	98	89.09	12	10.91	1.00	-	-
Legal status							
Convicted	94	85.45	16	14.55	1.23	(0.97-1.07)	0.562
Provisional	131	87.92	18	12.08	1.00	-	-
Prison time							
Up to 35 months	115	86.47	18	13.53	0.99	(0.90-1.09)	0.843
36 months and over	110	87.30	16	12.60	1.00	-	-
Suffered childhood violence							
Yes	102	92.73	8	7.27	1.12	(1.03-1.23)	<0.001
No	123	82.55	26	17.45	1.00	-	-
Drug-related crime							
Yes	42	87.50	6	12.50	1.01	(0.89-1.14)	0.887
No	183	86.73	28	13.27	1.00	-	-
Alcohol use before prison							
Yes	198	92.09	17	7.91	1.50	(1.18-1.90)	<0.001
No	27	61.35	17	38.63	-	-	-
Marijuana use before prison							
Yes	145	96.67	5	3.33	1.32	(1.17-1.28)	<0.001
No	80	73.39	29	26.61	1.00	-	-
Cocaine use before prison							
Yes	107	80.82	6	19.18	1.17	(1.07-1.28)	<0.001
No	118	22.94	28	77.06	1.00	-	-

PRc: Crude prevalence ratio. 95%CI: 95% confidence interval. p-value: p-value for the chi-square test.

Source: Authors.

found in another study[22]. Alcohol and nicotine have interactive pharmacological effects that motivate their combined use, besides a reinforcing and cross-tolerance role in developing consumption, maintenance, and dependence on both substances[23].

Similar to previous alcohol use, in our study, previous marijuana use was also associated with smoking, as found in another study[22]. The pre-incarceration biopsychosocial conditions and the health situation of the prison population show that disorders related to other drugs commonly precede imprisonment among people deprived of their liberty. Another study shows that using tobacco and marijuana, two of the most used substances worldwide, are strongly linked in several aspects[24].

Possibly, the use of other drugs may influence tobacco use, both in initiating and maintaining dependence, qualifying these users as polyaddicts[25,26]. A study shows that most (64%) individuals sentenced to prison reported drug use in the month preceding their arrest. Furthermore, nearly half of the subjects met the criteria for the disorder related to substance use before incarceration, with 40% having a drug use-related

Table 4. Stratified analysis by age group and prison time regarding cocaine and tobacco use among women deprived of liberty. Cuiabá-MT, Brazil, 2021.

Variables	Tobacco use				PRc	95%CI	p-value
	Yes		No				
	N	%	N	%			
Age group							
18-39 years							
Cocaine use	93	97.89	2	2.11	1.12	(1.03-1.20)	0.006
Not using	100	87.72	14	12.28	1.00		
40 years and over							
Cocaine use	14	77.78	4	22.22	1.38	(0.93-2.05)	0.132
Not using	18	56.25	14	43.75	1.00		
Prison time							
Up to 35 months							
Cocaine use	55	90.16	6	9.84	1.08	(0.95-1.24)	0.253
Not using	60	83.33	12	16.67	1.00		
36 months and over							
Cocaine use	51	98.08	1	1.92	1.26	(1.11-1.43)	0.001
Not using	57	78.08	17	21.92	1.00		

PRc: Crude prevalence ratio. 95% CI: 95% confidence interval. p-value: p-value for the chi-square test.

Source: Authors.

Table 5. Final multivariate model for tobacco use among women deprived of liberty. Cuiabá-MT, Brazil, 2021.

Variables	PRc	95%CI		p-value	PRa	95%CI		p-value
		Lower limit	Upper limit			Lower limit	Upper limit	
Age group 18-39 years	1.44	1.17	1.78	0.001	1.33	1.10	1.61	0.003
Schooling up to High School	1.17	0.93	1.49	0.049	-	-	-	-
Raised by parents	0.93	0.85	1.03	0.164	-	-	-	-
Suffered childhood violence	1.12	1.03	1.23	<0.001	-	-	-	-
Drug-related crime	1.11	1.01	1.23	0.003	-	-	-	-
Alcohol use before prison	1.50	1.18	1.90	<0.001	1.26	1.00	1.59	0.049
Marijuana use before prison	1.32	1.17	1.48	<0.001	1.16	1.03	1.30	0.011
Interaction between prison time 36 months or more of cocaine use	1.26	1.11	1.43	0.001	1.05	1.00	1.11	0.034

PRc: Crude prevalence ratio. PRa: Prevalence ratio adjusted by Poisson Robust regression model with variable selection by a backward method. 95%CI: 95% confidence interval.

Source: Authors.

disorder and 21% alcohol use-related disorder[27]. In another study with 102 adults incarcerated in an urban prison in the U.S., more than 70% of the participants were smokers, despite solid knowledge (95%) of the link between smoking and severe diseases[28].

Epidemiological studies have shown that nicotine use is a gateway to marijuana and cocaine use in human populations. The licit drug problem usually starts in adolescence and continues with illicit drugs[29]. Aligned with this, our research found that the mean age of tobacco use initiation was lower than alcohol, marijuana, and cocaine.

A study conducted with a sample of 287 women in a female penitentiary in Porto Alegre-RS,

Brazil, found that 54.4% had used psychoactive substances (throughout their lives), 15.7% had alcohol dependence, and 38.3 % were addicted to other substances, such as marijuana, cocaine, and crack[30]. Another study with a sample of 134 women in a penitentiary in Rio de Janeiro-RJ, Brazil, identified that 45.5% of the women used illicit drugs when released, and marijuana was the most commonly used, followed by cocaine and crack[31].

In this study, the model of interaction between prison time and cocaine consumption ended up remaining in the multivariate model, indicating an association between cocaine and tobacco use among those deprived of liberty with extended imprisonment. Possibly, the prevalence of cocaine use was higher among the latter, consistent with another study that shows the use of illicit substances associated with an adjusted 2.47 higher likelihood of tobacco use (95%CI 1.29-5.39). The bivariate analysis showed that each additional five years of incarceration history was associated with a 1.32-fold more significant likelihood of tobacco use (95%CI 1.02-1.71)[15].

Some limitations of the study must be considered. Cross-sectional studies do not necessarily establish a relationship between cause and effect and the use of subjective or self-report information, which can lead to memory bias. Another limitation is that the information collected was self-reported, which could have contributed to underestimating the proportions of the explanatory variables. However, using the prevalence ratio as a measure of effect in the bivariate and the multivariate Poisson model analyses allowed a good adjustment of the measures of effect and prevented the overestimation of the measures of association.

Knowledge about the factors associated with tobacco use in the population studied becomes relevant when planning to implement a cessation program. This work is one of the first studies to evaluate the factors associated with tobacco use in the entire female population deprived of liberty in a Brazilian penitentiary. The diversity of factors involved should be considered, such as obstacles to cessation, highlighting aspects related to this woman's social space condition and that she is polyaddicted. The public authorities should allow these smokers to become tobacco-free, which will reduce harm to this population's health.

Conclusion

The prevalence of tobacco use among women deprived of liberty in this study was high. The main variables associated with tobacco use were age group 18-39 years, alcohol and marijuana use, and interaction between 36 months and over prison time and cocaine use. Women's incarceration offers an excellent opportunity to address smoking cessation treatment. Among so many adverse circumstances related to prison life, we should highlight that it is possible to develop actions such as approaching smoking cessation, improving health education, and establishing health support networks for this vulnerable and neglected population if it is in the interest of the prison public service and the SUS.

Collaborations

SM Montanha has worked on the conception, design, analysis, data interpretation, article writing, critical review, and approval of the version to be published. C Botelho has worked on the design, analysis, and critical review. AMC Silva has worked on the design, analysis, data interpretation, article writing, and critical review.

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