

## **Alcohol use and problems related to the Maxakali indigenous peoples' worldview: a cross-sectional census study**

Uso de álcool e problemas relacionados à visão de mundo dos povos indígenas Maxakali: um estudo censitário transversal

Uso del alcohol y problemas relacionados con la cosmovisión de los pueblos indígenas Maxakali: un estudio de censo transversal

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### **Abstract**

The objectives were to estimate the prevalence of Alcohol Use and Alcohol-Related Problems and relate it to sociodemographic characteristics. A population-based cross-sectional study was carried out with 1,036 Maxakali aged nine years and older. A questionnaire was applied to 66 indigenous leaders about alcohol consumption in 2016 and its negative consequences. The association between the study objects was examined by applying the chi-square test, Fisher's exact test, and cluster analysis. Kappa values were calculated to assess questionnaire reproducibility. The 12-month prevalence was 39.1%. The use rate of women (17.3%) was 3.6 times lower than the rate of men. Male alcohol use rates increase from 8.1% to 64% in the 9-14 to 15-19 age group. The highest proportions of alcohol use between mothers and fathers were found in extended families and associated with the negative consequences of those who use cachaça. Female use begins between 20 and 24 years of age, and the rates of problems related to this use exceed those of men aged 25 to 45 years. It is expected that the ease of application and the predictive power of this tool will allow the detection and monitoring of alcohol use and its consequences in the Maxakali people.

**Keywords:** Indians, South American; Alcoholic beverages; Quantitative research.

### **Resumo**

Os objetivos foram estimar a prevalência do Uso de Álcool e Problemas Relacionados ao Álcool e relacioná-la às características sociodemográficas. Estudo transversal de base populacional com 1.036 *Maxakali* a partir de nove anos. Foi aplicado um questionário a 66 lideranças indígenas sobre o consumo de álcool em 2016 e suas consequências negativas. A associação entre os objetos de estudo foi examinada por meio da aplicação dos testes qui-quadrado, exato de Fisher e análise de cluster. Os valores de Kappa foram calculados para avaliar a reprodutibilidade do questionário. A prevalência foi de 39,1%. A taxa das mulheres (17,3%) foi 3,6 vezes inferior à taxa dos homens. As taxas de uso masculino de álcool aumentam de 8,1% para 64% nas idades de 09 a 14 para 15 a 19 anos. As maiores proporções de uso de álcool entre mães e pais foram em famílias extensas e associadas às consequências negativas de quem usa cachaça. O uso feminino inicia-se dos 20 aos 24 anos, as taxas de problemas relacionados a esse uso ultrapassaram as

dos homens na faixa dos 25 aos 45 anos. Espera-se que a facilidade de aplicação e o poder preditivo desta ferramenta permitam a detecção e monitoramento do uso de álcool e suas consequências no povo Maxakali.

**Palavras-chave:** Índios sul-americanos; Bebidas alcoólicas; Pesquisa quantitativa.

### Resumen

Los objetivos eran estimar la prevalencia del consumo de alcohol y los problemas relacionados con el alcohol y relacionarlo con las características sociodemográficas. Estudio cruzado de la base de la población con 1.036 maxakali de nueve años. Se aplicó un cuestionario a 66 líderes indígenas sobre el consumo de alcohol en 2016 y sus consecuencias negativas. La asociación entre los objetos de estudio se examinó aplicando las pruebas de chi-cuadrado, el análisis exacto de Fisher y Cluster. Los valores de Kappa se calcularon para evaluar la reproducibilidad del cuestionario. La prevalencia fue del 39,1%. La tasa de mujeres (17,3%) fue 3.6 veces menor que la tasa de hombres. Las tasas de alcohol masculino aumentan de 8,1% a 64% a las edades de 09 a 14 por 15 a 19 años. Las mayores proporciones de consumo de alcohol entre madres y padres fueron en familias numerosas y se asociaron con las consecuencias negativas de aquellos que usan cachaça. El uso femenino comienza de 20 a 24 años, los problemas de los problemas relacionados con este uso han superado a los de los hombres de 25 a 45 años. Se espera que la facilidad de aplicación y el poder preditivo de esta herramienta permitan la detección y monitoreo del consumo de alcohol y sus consecuencias en la gente Maxakali.

**Palabras clave:** Indios sudamericanos; Bebidas alcohólicas; Investigación cuantitativa.

## 1. Introduction

Mortality statistics and epidemiology detail the disparity in the consumption of alcohol, its damage to health, and its social and economic burden (WHO, 2014). More than 200 codes of diseases and health hazards included in the tenth revision of the International Classification of Diseases (ICD-10) list harmful alcohol consumption as a component cause. These diseases and conditions would not exist in the absence of harmful alcohol consumption. Of these, more than 30 included alcohol consumption in the definition of the disease, the necessary cause being, for example, alcoholic liver disease.

From 2000 to 2017, 288 deaths were reported among the Maxakali indigenous people, and 25.3% of these deaths occurred among people aged 20 years and over. The two main causes of death in this age group are represented by the groups of external causes (21 individuals: 28.8%) and by injuries, poisoning, and some other consequences, with 11 deaths (15.1%), according to Brasil (2017). In the age group from 20 to 49 years, 23 deaths (72%) and 28% over 49 years were registered. Regarding gender, 25 (78%) occurred among men. The underlying causes reported were 26 (81.3%) due to aggressions, injuries, and trauma and 3 (9.4%) due to alcohol intoxication.

In addition to these 32 deaths where harmful alcohol consumption can be linked as a component cause, in the group of necessary causes, there are four deaths. Two (02) deaths from liver cirrhosis; one (01) due to alcoholic liver disease and one (01) death due to addiction syndrome (Brasil, 2017). These 36 deaths represent 49.3% of deaths in Maxakali aged 20 years and over.

Results of the National Survey on Patterns of Alcohol Consumption among Brazilian Indigenous Peoples showed that 38.4% (559) used alcohol and 25.6% (372) drank but stopped. Among the 931, the dependency rate was 22.9%, higher than that found in the Brazilian population (12.3%) for 2007. Dependence among women (11.8%) is twice as much as the population of Brazilian women (6.9%), while for men (28.7%), compared to 19.5% of the general population. Also, with dependency, the age group with the highest rate was for the 18 to 24 age group with 29.3%, while in the general population it was 19.2% for the same age group (Brasil, 2009). Regarding the pattern of alcohol use, 44.1% had a diagnosis of harmful use, which was higher among indigenous women (44.9%), compared to 41.1% of men (Brasil, 2007).

For the Maxakali, with the replacement of the traditional fermented beverage by distilled (*cachaça*), some cultural practices were shaped by interethnic contact and are related to negative issues for drinkers and people in their social environments: families, villages, and communities (Oliveira et al., 2019). This gap asks us: what is the prevalence of alcohol

use and harmful consequences related to harmful use in the Maxakali population from nine years of age onwards? How do alcohol use and its consequences related to the sociodemographic characteristics of this population?

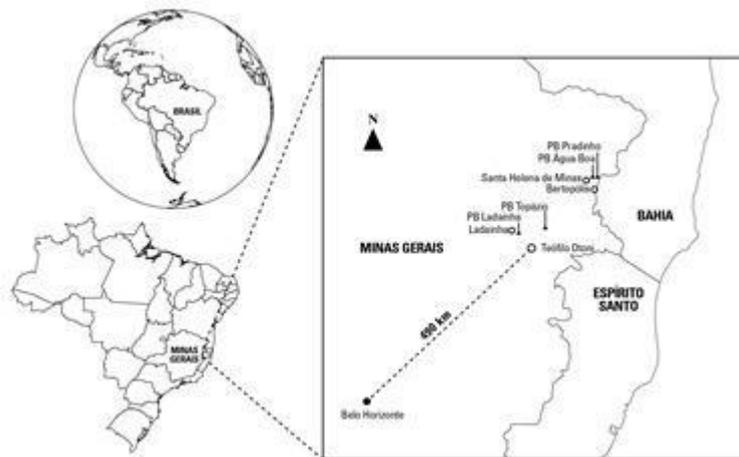
The objectives of the present study were: (i) to estimate the proportion of AU & ARP and to examine how the prevalence varies according to sociodemographic characteristics; (ii) to examine AU associations and their consequences to these characteristics. The aim is to reflect on the associations of AU & ARP measures with the Maxakali worldview, considering gender, age group, family structure, parental alcohol use, and household income.

## 2. Methodology

### Study design and sample

This was an analytical cross-sectional study with census sampling (Pereira et al., 2018). The sample was designed according to qualitative research findings on AU initiation among the Maxakali including all the 1,036 Maxakali older than eight years of age residing in the Água Boa and Pradinho communities, located in the municipalities of Santa Helena de Minas and Bertópolis, state of Minas Gerais, Brazil (Figure 1).

**Figure 1** - Map of the Brazilian territory highlighting the study site.



Source: Authors (2022).

### Procedures

During the quantitative data collection, the collectivist characteristic of the Maxakali culture was explored. According to ethnographic studies, their societies are governed by the notion of person, in which there is no individual / collective dichotomy (Ribeiro, 2008; Spillane & Smith, 2007; Popovich, 1980; Álvares, 1992). Rather than developing a questionnaire to be applied individually and exploring the individual's spontaneous representation of symptoms linked to AU & ARP (Barbor et al., 1989; DSM-V, 2013), we explored the collectivist culture of 66 intentionally selected Maxakali leadership. These could respond to the AU and ARP experiences of their  $\geq 9$ -year-old relatives from their 19 villages in the last year.

During qualitative phase 1 of the Mixed Methods Research [Oliveira, 2018), researching and drawing with Maxakali allowed the researchers to describe and illustrate the experience of the interviewees in their life stories regarding AU and ARP in their villages (Oliveira et al., 2016; 2019; Oliveira, 2018).

The research findings were organized in three dimensions: (1) alcohol use pattern (initiation, frequency, quantity); (2) contexts (access, where, how, when, and who), and (3) the ARP (family and village) (Oliveira et al., 2016; 2019). Dimensions

were pooled and interrelated to the drawings in a PowerPoint presentation to be shared publicly with each community. It was planned, before the interview, to contextualize and describe in Portuguese and Maxakali languages, the meanings of these dimensions about two issues. The first question is about the AU among relatives, a question that opens a less invasive dialogue on a delicate topic: alcohol consumption (Johnston et al., 2010). It has to be noted that, everyone regarding from the primary socialization sources (Oetting & Donnermeyer, 1998), as family, village, and house of chants in this study, is a relative or a friend from the allied family in Maxakali world view.

The other is about ARP on the consumption of relatives (Oliveira, 2018; Oliveira et al., 2019). These questions are considered to be effective predictors of both current and future adverse alcohol outcomes (Johnston et al., 2010). A nominal census of 1,036 Maxakali  $\geq 9$  years of age from the two communities was obtained in spreadsheets in the .xls file format using the local system (Brasil, 2017). Each individual is identified by the system with nine variables. We worked on these worksheets adding the AU and ARP variables, which were printed and used as questionnaires.

### **Dependent variables – Alcohol Use (AU) & Alcohol-Related Problems (ARP)**

For AU and ARP, the 66 leaders were asked whether, if a relative from family “A”, “B”, and “C” from the village AB01, for example, had drunk *cachaça* in the past year. Each relative  $\geq 9$  years of age was coded (1) did not drink (2) drank. Among those who drank *cachaça*, they also identified what kind of behavior they experienced, the options for responses were:

(a) Violent behavior: "drink and become a jaguar": when a relative drinks, he or she may experience a kind of trance. he or she feels transmuted into a jaguar and can fight or kill people or animals. Then he or she returns to normal and does not remember exactly what happened (Oliveira et al., 2016; 2019): (1) when the relative drinks, does not have violent behavior; (2) when the relative drinks, he or she becomes a jaguar.

(b) Family neglect: “lack of parental care due to excessive spending on alcohol or negotiation of the fair and household items by *cachaça*” (Oliveira et al., 2016; 2019): (1) when the relative leaves for the city, drinks, but keeps part of the money for family expenses; (2) a relative goes out to the city, drinks and does not buy the fair or negotiates the fair and the domestic utensils for *cachaça*.

(c) Child neglect: "mother who, when she drinks, forgets to care for her children" (Oliveira et al., 2016; 2019): (1) a relative who is mother and drinks but cares for her children; (2) a relative who is mother and drinks, but does not care for her children when she is drunk.

To obtain a score of relatives who consume *cachaça* and need more care regarding their behaviors, the sum of ARP for each relative was taken into account. A coding was created from the leaders' perspective with three levels: For social drinkers, relatives who drank and did not cause social problems, Score 1. Relatives with one consequence received Score 2. Score 3 was given to relatives who presented two or three consequences.

### **Independent variables: sociodemographic characteristics**

Subjects were coded from 1 to 1036; the gender (1) for women and (2) for men. Age in years and grouped in age groups: 9-14, 15-19, 20-44; 25-45 and 46 years and over.

The relation of kinship was obtained from the forms of the family: (1) married mother; (2) married father; (3) widowed mother, separated or single; (4) widowed father, separated or single parent; (5) grandfather or grandmother; or (6) child; stepchild, nephew/niece, grandson/granddaughter (Brasil, 2017).

In these forms, the family structure is classified according to the main characteristic of the composition of the residence: (1) Mother-Father family: presence of father and mother with biological child, being able to still have stepdaughters, nephews, etc. (2) Single-Parent family: presence of only one parent, widowed, divorced or single with children, cousins,

relatives without grandparents; (3) Extended family: presence of more than one mother-father family or Single-Parent family with or without grandparents; being able to have stepdaughters, nephews, etc (Brasil, 2017).

The consumption of alcohol by the mother and/or the father was identified in the SPSS program by crossing the relation of the variables of kinship with "Use of Alcohol". For the identification of alcohol consumption by parents in an extended family, the mothers and/or the older parents of these residences were chosen to represent this condition, which was extrapolated to all members of that household.

### **Test-retest and ethical aspects**

At another time, a test-retest was performed to evaluate the reproducibility of the questionnaire (Siegel & Castellan, 2006). The same methodology of data collection was replicated with the same key informants. The reapplication interval of the questionnaire was 11 to 14 days (Terwee et al., 2007). The same ethical aspects were adopted using specific Informed Consent Terms in each approach. This research was approved by the National Research Ethics Committee and, Federal University of Minas Gerais in Brazil (CAAE-1.438.160).

### **Data analysis**

Bivariate associations were examined using Pearson's  $\chi^2$ . We expected that some of the group differences revealed in consumption and behavior experienced, at least in part, would reflect different levels of the other independent variables. The association/relationship between two categorical variables were performed using the chi-square test. Fisher's exact test is similar to the chi-square test and was applied when the number of expected cases below 5 occurred. All the results were presented in percentage values in order to describe the results of the studied variables (Johnson & Bhattacharyya, 1986; Johnson, 1988). These were considered significant for a probability of significance of less than 5% ( $p < 0.05$ ), with at least 95% confidence in the conclusions presented. The reproducibility of the questionnaire was calculated using the Kappa concordance index (Siegel & Castellan, 1981; 2006).

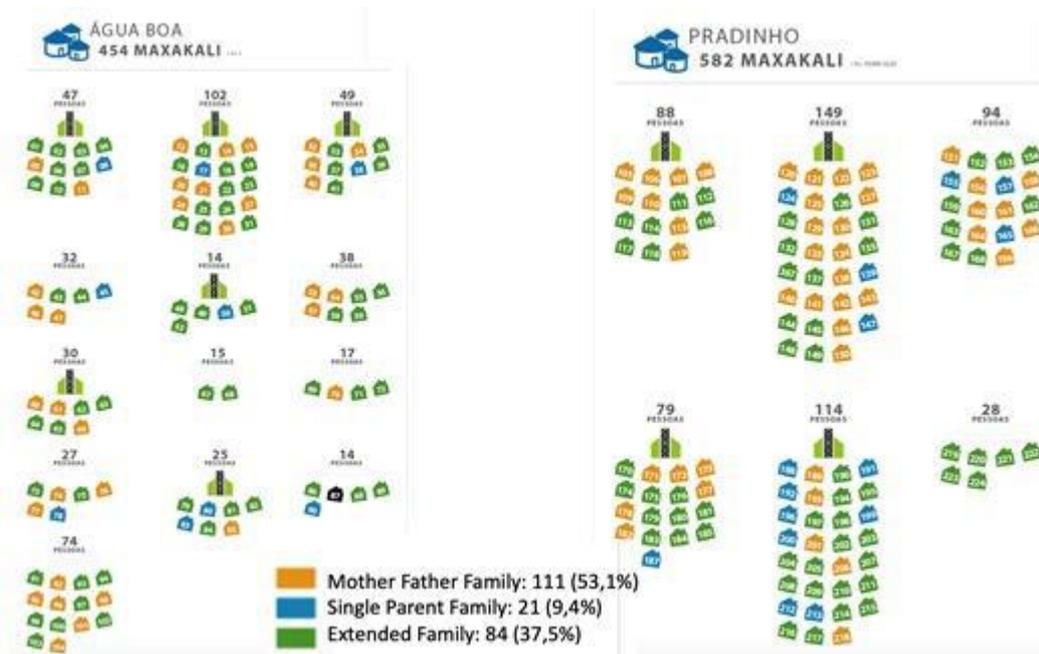
## **3. Results**

### **Population and sample**

The communities of Água Boa and Pradinho are made up of 224 households, 326 families with a population of 1,636 people; together they represented 78.2% of the Maxakali indigenous population.

The sample consisted of 1,036 people, whose ages ranged from 9 to 97 years old, with a mean of 25.4 years and a standard deviation of 15.3. Differences between gender and age were not significant (510 men and 526 women), with 636 (61%) between nine and 25 years old and 400 (39%) over 26 years old; living with 250 mothers, 209 fathers, and 91 grandparents in 119 (53.1%) nuclear families, 21 (9.4%) single-parent families and 84 (37.5%) extended families (Figure 2).

**Figure 2** - Scheme of the type of family constitution and number of individuals living in the studied villages.



Source: Authors (2022).

### Alcohol use (AU)

The prevalence of alcohol use is frequent. In Maxakali, the 12-month prevalence of alcohol use was 39.1%. The usage rate for women (17.3%) was 3.6 times lower than the usage rate for men (61.6%).

The 12-month prevalence of alcohol use was 56% in the 20–24-year age group, increasing to 77.9% in those over 45 years of age. The rates of use among young adults (20 to 24 years old) are higher among men (95.6%) than among women (8.8%).

The 12-month prevalence showed great variation between genders in adolescence. In boys, the use began in the age group of 9 to 14 years (6.7%), increasing to 62.9% in the age group 15 to 19. At 16 years of age, 50% of adolescents drink, reaching 68.8% at 17.

Among women, the onset was later at 20 to 24 years of age (8.8%), increasing to 25.3% at 25 to 45 years of age, reaching 74.2% above 45 years of age.

Regarding communities, the prevalence of 12 months of alcohol use in Pradinho was higher (41.7%) than in Água Boa (36.2%). The use rate for women was lower in Água Boa (14.3%) while in Pradinho it was 20.1%. Regarding the rates for men, in Água Boa this was four times higher than among women and three times higher in Pradinho.

Considering the lowest and highest rates in the villages, the prevalence of 12 months of alcohol use in Água Boa, the village with the lowest rate was in AB13 (25.9%) for the highest (58.8%). In Pradinho, this variation was 30.7% to 47.7% .

### **Social problems related to alcohol use**

Among the 405 (39.1%) who use cachaça, 246 (60.7%) identified harmful use of consumption that causes damage to health and social problems for the drinker and the people around him and the community, generally. In women and men, the ARP rates were 61.8% and 63.4%, respectively.

The initiation of AU among women occurred between the ages of 20 to 24 years, however, the rates of ARP in the last 12 months reach 40% of women of these ages. From age 25 to 45, rates for women exceed the ARP rates for men of this age (82.5% vs. 66.4%).

Pradinho was the community that presented the highest rates of ARP 63% when compared to Água Boa (57.7%). In Água Boa, the prevalence rates of ARP in women (66.7%) were higher than among men (55.4%).

For the ARP rates in the villages, in 12 villages women had higher rates than men, 10 of the 13 villages in Água Boa, and 2 in Pradinho. It is noteworthy that in six villages in Água Boa, all women who use alcohol have ARP. In Pradinho, only one village had 100% of the women have ARP.

Concerning violent behavior and the loss of family bond of the individual who drinks cachaça, the rates showed similar behavior between genders. Gender differences were identified between communities; while in Pradinho the highest rates were found for 61.1% men, in Água Boa women had the highest rates (61%).

For the negligence linked to parents who go to the city to sell their agricultural surpluses or receive their payments to buy the food market for their families, 31 relatives were identified, 30 men and one woman. Regarding mothers who do not take care of their children when they drink, they recognized that 15 female relatives showed this behavior when using cachaça. 14 friends who drink cause problems for him, 86% of them male

### **Participation of AU & ARP determining variables and sociodemographic variables**

There were a total of 896 individuals who participated in this study. The distribution forms in the clusters for AU and ARP are shown in Tables 1 and 2, respectively.

The variables AU and ARP were the two Determining Variables (DV) in the construction of the clusters, and there were significant differences among their respective clusters. The results of the comparative analysis among the clusters about the variables of interest regarding the AU & ARP are presented in Tables 3 and 4.

**Table 1** - Distribution of individuals in the groups formed in the cluster analysis for the determinant variable Alcohol Use (AU)

Cluster	Determining variable	Characteristics	n	%
C-AU1	89.7% drink	Gender: Male (67.9%); Age: 25 to 45 years (100%); Family structure: Extended Family (57.1%); Nuclear Family (41.7%); Mother alcohol use (60.9%); Father alcohol use (99.4%);	156	17.4
C-AU2	48.1% drink	Gender: Male (52.95); Age: 9 to 14 years (41.6%); 20 to 24 (29.2%); 60 and + (29.2%); Family structure: Extended Family (79%); Mother alcohol use (80.4%); Father alcohol use (95.2%);	291	32.5
C-AU3	100% don't drink	Gender: Female (65.5%); Age: 9 to 14 years (60.5%); Family structure: Nuclear family (63%); Mother alcohol use (2.1%); Father alcohol use (78.6%);	281	31.4
C-AU4	29.2% drink	Gender: Male (48.2%); Female (51.8%); Age: 15 to 19 years (100%); Family structure: Extended Family (61.3%); Use of Alcohol by the Mother (41.7%); Use of Alcohol by the Father (89.9%).	168	18.7
<b>Total</b>			<b>896</b>	<b>100.0</b>

Source: Authors (2022).

**Table 2** - Distribution of individuals in the groups formed in the cluster analysis for the determinant variable Alcohol Related Problem (ARP).

Cluster	Determining variable	Characteristics	n	%
C-ARP1	Does not drink: 61,6%	Gender: Female (50,8%); Age: 25 to 45 years (100%); Family structure: Extended family (50,4%); Mother-father family (48,4%); Mother alcohol use (38,8%); Father alcohol use (89,2%);	250	27,9
C- ARP2	Does not drink: 94,5%	Gender: Female (53,4%); Age: 9 to 14 years (50,5%); 15 to 19 (36,2%) Family structure: Mother-father family (72,2%) Mother alcohol use (21,7 %); Father alcohol use (80,3%);	309	34.5
C- ARP3	Does not drink: 76,3%	Gender: Male (50,7%); Age: 9 to 14 years (40%); 15 to 19 (16,6%); 20 to 24 (21,1%); 46 and more (22,3%). Family structure: Extended family (97,9%); Mother alcohol use (71,5%); Father alcohol use (98,8%);	337	37.6
<b>Total</b>			<b>896</b>	<b>100.0</b>

Source: Authors (2022).

**Table 3 - Comparative analysis among clusters in relation to the variables of interest AU.**

Variables	Clusters				p
	1	2	3	4	
<b>Gender</b>					
Male	106 (67.9%)	154 (52.9%)	97 (34.5%)	81 (48.2%)	< 0.001*
Female	50 (32.1%)	137 (47.1%)	184 (65.5%)	87 (51.8%)	
<b>Age group</b>					
9 to 14 years old	0 (0.0%)	121 (41.6%)	170 (60.5%)	0 (0.0%)	< 0.001*
15 to 19 years old	0 (0.0%)	0 (0.0%)	0 (0.0%)	168 (100.0%)	
20 to 24 years old	0 (0.0%)	85 (29.2%)	1 (0.4%)	0 (0.0%)	
25 to 45 years old	156 (100.0%)	0 (0.0%)	96 (34.2%)	0 (0.0%)	
46 years or more	0 (0.0%)	85 (29.2%)	14 (5.0%)	0 (0.0%)	
<b>Family Structure</b>					
Nuclear family	65 (41.7%)	52 (17.9%)	177 (63.0%)	57 (33.9%)	< 0.001*
Single parent family	2 (1.3%)	9 (3.1%)	13 (4.6%)	8 (4.8%)	
Extended family	89 (57.1%)	230 (79.0%)	91 (32.4%)	103 (61.3%)	
<b>Use of alcohol by the mother</b>					
Yes	95 (60.9%)	234 (80.4%)	6 (2.1%)	70 (41.7%)	< 0.001*
No	61 (39.1%)	57 (19.6%)	275 (97.9%)	98 (58.3%)	
<b>Use of alcohol by the father</b>					
Yes	155 (99.4%)	277 (95.2%)	221 (78.6%)	151 (89.9%)	< 0.001*
No	1 (0.6%)	14 (4.8%)	60 (21.4%)	17 (10.1%)	
<b>Monthly per capita household income (median)</b>					
> R\$ 65,20	76 (48.7%)	151 (51.9%)	137 (48.8%)	81 (48.2%)	0.833
≤ R\$ 65,20	80 (51.3%)	140 (48.1%)	144 (51.2%)	87 (51.8%)	

Note: the probability of significance refers to the Chi-square test. Source: Authors (2022).

**Table 4 - Comparative analysis among clusters in relation to the variables of interest ARP.**

Variables	Clusters			p
	1	2	3	
<b>Gender</b>				
Male	123 (49,2%)	144 (46,6%)	171 (50,7%)	0,571
Female	127 (50,8%)	165 (53,4%)	166 (49,3%)	
<b>Age group</b>				
9 to 14 years	0 (0,0%)	156 (50,5%)	135 (40,0%)	< 0,001
15 to 19 years	0 (0,0%)	112 (36,2%)	56 (16,6%)	
20 to 24 years	0 (0,0%)	15 (4,9%)	71 (21,1%)	
25 to 45 years	250 (100,0%)	2 (0,6%)	0 (0,0%)	
46 years and more	0 (0,0%)	24 (7,8%)	75 (22,3%)	
<b>Family structure</b>				
Mother-father family	121 (48,4%)	223 (72,2%)	7 (2,1%)	< 0,001
Single-parent family	3 (1,2%)	29 (9,4%)	0 (0,0%)	
Extended family	126 (50,4%)	57 (18,4%)	330 (97,9%)	
<b>Mother alcohol use</b>				
Yes	97 (38,8%)	67 (21,7%)	241 (71,5%)	< 0,001
No	153 (61,2%)	242 (78,3%)	96 (28,5%)	
<b>Father alcohol use</b>				
Yes	223 (89,2%)	248 (80,3%)	333 (98,8%)	< 0,001
No	27 (10,8%)	61 (19,7%)	4 (1,2%)	
<b>Monthly per capita household income (median)</b>				
> R\$ 65,20	122 (48,8%)	146 (47,2%)	177 (52,5%)	0,387
≤ R\$ 65,20	128 (51,2%)	163 (52,8%)	160 (47,5%)	

Note: the probability of significance refers to the Chi-square test. Source: Authors (2022).

In the study of the association between the DV-AU clusters and the variables related to the community, it was observed that the Pradinho community has a higher percentage of individuals belonging to the 2nd cluster and the Água Boa community has a higher percentage of individuals belonging to the 3rd cluster. For DV-ARP, it was observed that the two communities showed a similar behavior.

### **Reproducibility**

In assessing the reproducibility of the questionnaire (Siegel and Castellan, 2006), the Kappa values for consumption was 0.90, considered almost perfect. For problem drinking the coefficient was 0.74 considering a substantial agreement (Cicchetti and Sparrow, 1981).

## **4. Discussion**

In indigenous communities, including the Maxakali peoples, where alcohol was traditionally consumed, the production of their alcoholic and non-alcoholic fermented beverages generally took place on a small scale, as a domestic or collective activity, generally, the responsibility of the female gender (Fernandes, 2004) who used their fermentation techniques. This is when and where surpluses from their hunting, gathering, and small plantations were seasonally available (Souza & Garnelo, 2007). Therefore, alcohol consumption was often an occasional and community activity, associated with the ceremonial use of rituals or community festivals (Fernandes, 2004; Souza, Oliveira and Kohatsu, 2003; Souza & Garnelo, 2007).

In the Maxakali indigenous people  $\geq 9$  years of age, the prevalence of 12 months of alcohol use was 39.1%. Although surveyed among different age groups, the prevalence of alcohol consumption Maxakali was higher than that found by the Kaingang of Paraná (29.9%) and very close to the rate found in the first survey of alcohol use among Brazilian indigenous peoples of 38.4% (Brasil, 2009). In contrast, 60.9% of Maxakali are abstainers, practically double the rate of 30.7% for the Brazilian population (WHO, 2014).

The usage rate for women (17.3%) was 3.6 times lower than the usage rate for men (61.6%) and lower than the 24.4% rate found for the indigenous female population in Brazil  $\geq 18$  years old (Brasil, 2009). In addition to gender, age is also an important factor in the initiation of alcohol consumption, which has implications for the establishment of interventions for prevention and control (Prussing & Gone, 2011; Whitesell, et al, 2012; Souza, Oliveira, and Kohatsu, 2003).

In Maxakali men, use began in the age group 9 to 14 years (5.7%), increasing to 62.9% in adolescence. On the other hand, among women, the onset occurred later at 20 to 24 years of age (8.8%), increasing to 25.3% at 25 to 45 years of age, reaching 74.2% above 45 years of age. In some indigenous groups, such as the Teréna, Gavião, Xavante, Karajá, Tikuna, Kayapó, Kaiwá, Xakriabá, Makuxi, the consumption of distilled beverages begins between 10 and 12 years of age, and sometimes even at 7 years of age. This pattern is also observed among the Maxakali. According to studies, the fact that they start drinking at this age seems to mark male initiation ceremonies (Souza & Garnelo, 2007; Souza, Oliveira, and Kahatsu, 2003).

Considering the definition of abusive consumption of 5 doses (225 mL or 70g of pure alcohol) of alcoholic beverage on one occasion for men and 4 (180mL or 56g) doses for women (DSM-V, 2013), it is observed that the consumption of 21/2 glasses of cachaça (450ml or 144g of pure alcohol) among teenagers Maxakali (Oliveira et al., 2016) is double the five doses defined for heavy consumption for men. When you drink three glasses, you consume seven doses more than the five, considered as the cutoff point for abusive consumption.

Compared to adults, children and adolescents tend to have higher blood alcohol concentrations after drinking similar amounts of alcohol (JOHNSTON et al., 2010). Extrapolating from what is known about alcohol metabolism in adults,

excessive alcohol consumption for young people should be defined as follows: 3 doses for ages 9-13; 4 doses (14 to 15 years) and 5 for  $\geq 16$  years of age (Donovan, 2009; Johnston et al., 2010). This implies that when Maxakali teenagers drink 2 and a half glasses of cachaça (Oliveira et al., 2016), they are taking 7, 6, 5 doses in addition to the doses defined for abusive consumption for their respective age groups.

These studies indicate that the younger the age of onset of consumption, the greater the chance of developing harmful use symptoms and alcohol use disorders in adulthood in these adolescents (Cheadle & Whitbeck, 2011; Swaim et al., 2011; Whitesell et al., 2012; 2014; Martinez et al., 2015).

When a Maxakali consumes cachaça and crosses the boundaries (of thinking, acting, imagining, and judging) of his people's culture, both the person who drinks and the others in his sociocultural environment can be affected by harmful consequences of this use (Oliveira et al., 2018; 2019; Pena, 2005; Rubinger, 1980; Ribeiro, 2008). In the Maxakali world of life, the consequences related to the harmful use of cachaça were presented in the form of accidents, marital disharmonies, neglect, in addition to violent behavior, illnesses, and deaths, regarding to the individual who drinks, families and villages are also affected by these consequences (Oliveira, 2018; Oliveira et al., 2019; 2018).

About families, there are cultural differences in their definition and, therefore, in the role of the family in primary socialization (Oetting et al., 1998). For example, in the Gê tribes, the elders have specific roles and are generally highly regarded. The grandparents and fathers of extended families exert great influence through their opinions, as do the Maxakali (Popovich, 1980). Therefore, the main source of socialization responsible for the task of raising children is more likely to involve a relative other than the biological parents (Oetting & Donnermeyer, 1998).

The results of the present study show that in Maxakali extended families, 95.2% of the fathers's drink and it was in these families that the highest proportion (80.4%) of use of Kaxmuk by mothers was observed. Thus, while it is possible that grandparents can serve as vital and supportive cultural role models, it is also possible that their previous life experiences similarly encourage substance use among younger generations (Oetting & Donnermeyer, 1998; Eitle et al., 2013).

The results of this study corroborate the findings of qualitative research with the Maxakali, where the role of alcohol consumption is linked with the roles of parents and grandparents in the transmission of cultural norms: "My wife and I were on postpartum. My father came to visit us and gave me cachaça to teach me singing (rituals)" (Oliveira et al., 2018). That is, while the father or grandfather or both drink to sing religious songs, they can, in addition to transmitting social norms through learning the songs of religion and stories of ancestors, also determine patterns of AU behavior, while culture is transmitted through each generation (Oetting & Donnermeyer, 1998).

It is noteworthy that, while the proportion of teenagers who drink have harmful consequences related to the consumption of cachaça is 4.5% in the ARP2 Conglomerate, where Nuclear Families are predominant, in the ARP3 Conglomerate, where there is 97.9 % of Extended Families this proportion increases more than five times for adolescents, young adults and elderly in these families. It is also observed that this conglomerate was the one with the highest proportions of alcohol use by the mother (71.5%) and by the fathers (98.8%) of these extended families.

Results of research that analyzed the relationships of family structure with alcohol use highlight that living in families with separated parents is a risk factor for the development of early use in adolescence and disorders related to alcohol use in adulthood (Cheadle and Whitebeck, 2011; Barret & Turner, 2006; Eitle et al., 2013; Martinez et al., 2015). In the present study, no relationship was observed between single-parent families and other types of families regarding the use of cachaça and its related consequences.

One of the strengths of this study is that the dataset is pioneering and the only one to include the entire Maxakali population over eight years of age. However, there are several limitations. The results of this study with the Maxakali cannot be extrapolated to other Brazilian indigenous peoples. The cross-sectional design of the study also prevents causal

interpretations of the observed associations. We do not know if cachaça consumption is influenced by the availability of the alcohol source or if the alcohol source influences the drinking behavior. For example, since the Maxakali does not produce cachaça, it is not clear whether young people who obtain alcohol from a certain source drink more alcohol or whether consumption behaviors are related to the specific sources where alcohol is traded.

Although these results are not new, they establish that in males, Maxakali boys and young people constitute a unique group concerning perceived parental norms and alcohol-related problems (Prussing & Gone, 2011). From a prevention standpoint, programs that have been found effective in reducing alcohol consumption in other populations in this age group may not be effective for the Maxakali.

## 5. Final Considerations

The critical period from late childhood to early adolescence for intervention efforts in these communities is evident. Of course, interventions must be early and gender-sensitive (Prussing & Gone, 2011). These should start with boys before age 9 and women before age 20 to delay the onset of use and the harmful consequences associated with the harmful use of alcohol (Whitesell et al., 2012). It should also be noted that more intensive prevention efforts are indicated for young people who have had their father and mother's alcohol use diagnosed (Eitle et al., 2013; Martinez et al., 2015).

The usual practice is to transfer responsibility for education and prevention of alcohol use to schools as the children grow. Including Maxakali families in prevention aimed at late-onset alcohol use and reducing consumption levels among boys and women can reduce morbidity and mortality among Maxakali  $\geq$  20 years of age. This family approach must bring together strong cultural values of care and sociability for at-risk youth and women.

Finally, effective and sustainable interventions must be grounded in the two Maxakali communities, embodying their worldviews on effective prevention program. Community based participatory research must be implemented, bringing together the scientific experience of researchers and the cultural experience of community members.

With the almost perfect and substantial concordance of reproducibility in the application of the questionnaire for AU & ARP, we hope that the brevity, ease of use, and predictive power of this new tool, built from the local System (Brasil, 2017), will allow detection and monitoring of the AU & ARP and avoid harm as early as possible to children under the age of nine and young Maxakali women. We believe that with these results, you have what you need to get started.

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