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MACHINE LEARNING MODEL PROPOSAL THAT ASSOCIATES THE MAIN EPIDEMIOLOGICAL AND SOCIODEMOGRAPHIC CHARACTERISTICS OF HIGH-RISK PREGNANT WOMEN TO PREDICT THE LEVEL OF ANXIETY

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ABSTRACT:
The mental health of pregnant women includes preexisting and current factors that can increase their anxiety, especially in high-risk pregnancies. The stratification of intervening variables aims to understand the multidimensionalities in which pregnant women are inserted and can contribute to a favorable outcome for the mother and baby binomial. The objective was to describe the clinical-epidemiological profile and sociodemographic characteristics of high-risk pregnant women and to analyze the association of these variables with the level of anxiety through a descriptive, quantitative and documentary study, with 339 pregnant women. For data collection, the Aaron Beck Anxiety Questionnaire and two instruments authored by the author were used. In the analysis of sociodemographic and epidemiological variables with the level of anxiety, it was observed that there is statistical evidence of a significant association between the level of anxiety and the variables presented, suggesting a new model to predict anxiety in public health..
Keywords: Mental health; Clinical-epidemiological profile; Social characteristics; Public health.

PROPOSTA DE MODELO DE APRENDIZAGEM DE MÁQUINA QUE ASSOCIA AS PRINCIPAIS CARACTERÍSTICAS EPIDEMIOLÓGICAS E SOCIODEMOGRÁFICAS DE GESTANTES DE ALTO RISCO PARA PREDIZER O NÍVEL DE ANSIEDADE

RESUMO:
A saúde mental da gestante inclui fatores preexistentes e atuais, que podem aumentar a sua ansiedade, principalmente em gestações de alto risco. A estratificação de variáveis intervvenientes visa conhecer as multidimensionalidades em que a gestante está inserida e pode contribuir para um desfecho favorável ao binômio mãe e bebê. O objetivo foi descrever o perfil clínico-epidemiológico e as características sociodemográficas de gestantes de alto risco e analisar a associação dessas variáveis com o nível de ansiedade por meio de um estudo descritivo, quantitativo e documental, com 339 gestantes. Para coleta de dados, foram utilizados o Questionário de Ansiedade Aaron Beck e dois instrumentos de autoria do autor. Na análise das variáveis sociodemográficas e epidemiológicas com o nível de ansiedade, observou-se que há evidências estatísticas de associação significativa entre o nível de ansiedade e as variáveis apresentadas, sugerindo um novo modelo para prever a ansiedade em saúde pública.
Palavras-chave: Saúde mental; Perfil clínico-epidemiológico; Características sociais; Saúde pública.

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1. INTRODUCTION

For Leahy (2011), today's society is living in an age of anxiety. According to the author, it is estimated that approximately 18% of the American population will be affected by some anxiety disorder in a few years. Although this number is twice as high as the rate of depression, and given the worrying prognosis regarding the number of people who will suffer from anxiety throughout their lives, reaching an average of 30%, anxiety disorders do not receive adequate attention (Leahy, 2011) from health authorities.

Another point highlighted by Leahy (2011) is that just as clinical depression is much more serious than "feeling down," clinical anxiety is also more serious than everyday concerns and has a significant impact on an individual's life, interfering with work life, social life, and more stable personal relationships.

Leahy (2011) adds that this clinical condition is even more worrying due to the predisposition to other pathologies. People with anxiety disorders are more likely to become clinically depressed, suffering from two debilitating conditions at the same time. This tendency is also seen in the relationship between anxiety disorders and substance use, such as alcohol (Leahy, 2011).

Da Silva *et al*. (2023) present two distinct concepts regarding anxiety. For the authors, state anxiety is related to a temporary emotional situation associated with feelings of tension, which can vary in intensity over time. Trait anxiety, on the other hand, is related to a more stable personal characteristic, that is, individuals who tend to react with anxiety to stressful situations and perceive several situations as stressful.

For Da Paz *et al*. (2022), mental disorders (MD) are defined as changes in the individual's behavior, emotion, and cognition; symptoms such as irritability, somatic complaints, and feelings of uselessness are also identified. The authors also highlight that the occurrence of MD is higher in women, and one of the predisposing factors is the pregnancy period. During pregnancy, a high prevalence of anxiety and depression can be observed due to the physical changes that occur during the pregnancy cycle, for example, the hormonal action that acts on mood modulation (da Paz *et al*., 2022).

According to Araujo *et al*. (2008), the gestational period can be defined as a highly significant transitional moment in a woman's life, which generates the need for numerous adaptations. During pregnancy, women may be more vulnerable to developing an anxiety disorder. Anxiety disorders during pregnancy can result in harm to both the pregnant woman and the fetus. Therefore, knowledge regarding the factors associated with anxiety during pregnancy is of great importance (Araujo *et al*.,

2008), as they can serve as diagnostics for the implementation of actions aimed at maternal and child health.

Da Paz *et al*. (2022) add that the stratification of women as high-risk pregnant women is in itself a factor for the manifestation of an anxious state. The concept of high-risk pregnancy has been discussed in the literature, and its definition has undergone revisions and modifications over the years following the biological, psychological, and sociocultural changes that women are subject to. Júnior and Almeida (1972) defined "pregnancy risk" as the opportunity for physical, psychological, and social harm to which the pregnant woman and the fetus are exposed. According to these authors, this is not a pregnancy within a state of physiological normality, but it cannot be seen as a pathological state either.

Cesar (1998) highlights that pregnancy risk arises to identify the degrees of vulnerability in the periods of pregnancy, childbirth, puerperium, and the child's life in its first year. In the most recent literature, the definition of high-risk pregnancy has been expanded and discussed within the scope of public policies aimed at maternal and child health, with special attention given to high-risk pregnant women. In the contemporary scenario, according to Da Paz *et al*. (2022), high-risk pregnancy involves all situations that may interfere with the expected evolution of the pregnancy cycle, in which the psychological profile of these women may be altered. This condition becomes even more complicated in situations in which the woman needs to go through the hospitalization process. Nagai *et al*. (2022) emphasize that some factors such as maternal age, harmful sociodemographic conditions, previous reproductive history, obstetric disease in the current pregnancy, and previous or acquired health problems during the gestational evolution, such as hypertension, diabetes, obesity, among others, may contribute to an unfavorable gestational prognosis.

Brasil (2022) adds that defining gestational risk is complex. The lists and criteria for definitions are highly divergent in the specialized literature. Although prenatal care in itself implies a continuous risk assessment, it is possible to identify the conditions that classify the pregnant woman as being at high risk at the first prenatal consultation. Some individual characteristics, sociodemographic conditions, previous reproductive history, and clinical conditions prior to pregnancy may bring an increased risk of pathologies and incidents or be aggravated by pregnancy. However, these characteristics do not make up a static and immutable list and must be evaluated according to the epidemiological profile of pregnant women in a given context (Brasil, 2022).

Shiavo, Rodrigues, and Perosa (2018) also add that anxiety during pregnancy is one of the most common psychological changes and that the level of intensity varies in different societies and cultures. Silva *et al*. (2017) cite

some characteristics of pregnant women that make up the risk stratification (clinical, obstetric, and sociodemographic conditions) and that increase the likelihood of suffering from anxiety. These characteristics include psychiatric comorbidities prior to or during pregnancy, stressful events, social disadvantage, history of spontaneous abortion, fetal death, premature birth, or early neonatal death.

According to Da Luz *et al*. (2014), the demographic and epidemiological transition in Brazil has been occurring rapidly and brings important challenges for health system managers and researchers, with repercussions for society in general. In this scenario, the authors highlight social inequality, poverty, and the fragility of institutions (da Luz *et al*., 2014)

Xavier *et al*. (2013) also highlight that indicators related to maternal health are considered very sensitive to social inequalities. Differentiated living conditions found in different population groups, unequal access to social resources (health, education, income, work, security, participation), and how social class, gender, and race/ethnicity intertwine, composing some conditions that operate and reflect as social determinants of health. In this context, issues of gender, race/ethnicity, and social class are extremely important, and adequate management of these variables is necessary to deal with situations of vulnerability related to the health-disease process, whether individual, social, or even programmatic (Xavier *et al*., 2013).

From this perspective, the Ministry of Health proposed an operational classification to identify and classify reproductive risk factors. To this end, the factors were divided into four categories: individual characteristics and unfavorable sociodemographic conditions, previous reproductive history, preexisting clinical conditions and clinical complications, and obstetric disease in the current pregnancy. Some conditions found in the first group indicate situations of individual and/or social vulnerability, such as level of education, family or marital conflicts, unfavorable working conditions, exposure to unhealthy environments, and drug abuse. Such conditions often result in inequalities and discrimination, whether due to social class, gender, skin color, age, or others (Xavier *et al*., 2013).

Obstetric risk stratification aims to ensure that each pregnant woman receives the care necessary for her needs by teams with the appropriate specialization and qualifications (Brazil, 2022). The multidimensional context in which the pregnant woman is inserted must receive individualized and differentiated attention; identifying the possible biopsychosocial vulnerabilities that can contribute to greater psychological suffering in high-risk pregnant women is a strategy that favors a more optimistic outcome for the mother and baby binomial.

Therefore, the present research aimed to

describe the clinical-epidemiological profile of high-risk pregnant women and survey their sociodemographic characteristics. Based on the characterization of the sample, we sought to analyze the association of demographic and epidemiological variables with the level of anxiety of high-risk pregnant women admitted to the maternity ward of HB in Rondônia, Brazil.

2. MATERIAL AND METHODS

The study is classified as descriptive, quantitative, and documentary. The field research was conducted at the Dr. Ary Tupinambá Pena Pinheiro Base Hospital, Hospital de Base or HB. Opened in 1983, this hospital unit, located in the municipality of Porto Velho, serves as a state reference for tertiary care in the most diverse medical and surgical specialties, acting as a teaching hospital and serving a large number of the population coming from the 52 municipalities of Rondônia; from the states of Acre, lower Amazonas and Mato Grosso, in addition to the neighboring country - Bolivia (Carvalho, 2015).

This research was approved by the Research Ethics Committee of the Fundação Universidade Federal de Rondônia, Brazil (Approval number: CAEE n 5.825.169), following the ethical criteria established in resolution 466/12 of the National Research Ethics Committee (CONEP).

The research population comprises women stratified as high-risk pregnant women admitted to the HB Maternity Hospital with the following prevalent diseases: high blood pressure and/or diabetes. Pregnant women were selected non-probabilistic through convenience sampling, following the following inclusion criteria: age over 18 years, diagnosis of high blood pressure and/or diabetes, and being hospitalized in the HB maternity ward during the collection period. The sample comprised 339 women. The invitation to participate in the research occurred during the approach of patients hospitalized in the maternity ward, and the confidentiality and autonomy of the participants were ensured by signing the Free and Informed Consent Form (FICF).

Data was collected using Three instruments: a sociodemographic questionnaire, the Aaron Beck Anxiety Inventory (BAI) (used with the translation already validated in Portuguese), and the form.

The sociodemographic questionnaire and the form, written by the authors, aimed to identify some sociodemographic characteristics of the study population and the current and previous clinical/obstetric conditions before pregnancy. The BAI was used to assess the anxiety status of the pregnant women. The sociodemographic questionnaire and the Anxiety Inventory were applied directly to each pregnant woman. The last instrument used, the form, was completed using information obtained from each patient's electronic medical records.

The data were analyzed using the R programming language integrated with R Studio, the SigmaPlot 14.5 software (Academic Perpetual License—Single User—ESD Systat® USA), and the Past 4.03 software (Windows version).

Data analysis followed a model proposed by different authors (Altman, 1991; Fruchterman & Reingold, 1991; Cohen, 1992; Silberzahn & Uhlmann, 2015; Yang *et al*., 2020; Wu *et al*., 2021; Zhu *et al*., 2022; Cuperlovic-Culf *et al*., 2023) as described below:

• Step 1. Data wrangling was performed, i.e., the organization and checking of the database, organizing the variables into columns and observations into rows;

• Step 2. Calculation of descriptive statistics for the quantitative variable age, presenting the measures of position (mean), dispersion (standard deviation, standard error, and amplitude), and shape (skewness and kurtosis) of the data;

• Step 3. Calculate frequency distribution (absolute and relative) using the frequency diagram for nominal, ordinal, and binary categorical variables. In this case, the objective was to characterize the sample.

• Step 4. Using different machine learning tools (algorithms) with the Python language, propose models to predict the development of anxiety for the population in question (libraries: pandas, numpy, seaborn, matplotlib, plotly.express, scipy.stats, sklearn.model_selection, sklearn.svm, sklearn.metrics, sklearn.linear_model, sklearn.neighbors, xgboost).

The age normality test was applied to explain the sample based on age and gestational period variables. This method was chosen because it deals with qualitative data.

3. RESULTS AND DISCUSSION

The study included 339 pregnant women aged 29.6 years (Standard Deviation ± 6.61; Standard Error ± 0.36; a range of 27 {between 18 and 45}; asymmetry of 0.08; kurtosis of -0.91 and non-normal distribution with $P < 0.05$ for the Shapiro-Wilk, Anderson-Darling, Lilliefors, and Jarque-Bera tests. Of these, eight (2.3%) were in the 1st trimester, 44 (13%) in the 2nd trimester and 287 (84.7%) in the 3rd trimester of pregnancy.

Of the gestational risk markers defined for this study, it was observed that 19.5% of the sample had hypertensive disorders, 57.8% were stratified as diabetic, and 22.7% had diabetes and hypertension simultaneously.

Regarding the sociodemographic characteristics of the women, according to the results presented in Table 1, the predominant level of education was complete high school (39.8%). The second highest relative frequency was incomplete elementary school (16.8%), and the lowest was complete elementary school (5.9%). The brown race prevailed among the women, with 77.9% of the sample. Regarding

age, the classification proposed by Papalia and Martorell (2022) was adopted. It was observed that the most significant percentage of women (84.3%) were in the age group of 20 to 40 years old, called emerging Adulthood. Adolescents between 11 and 20 years old had a higher percentage (9.2%) compared to those included in the classification identified as intermediate (40 to 65 years old), with 6.5%. In the family context, the definition of Costa and Dias (2012) was used for the nuclear family model and reconstituted family.

The nuclear or traditional family comprises the parental couple and children (father, mother, children/siblings). In the second configuration, a reinvestment characterizes the new conjugal union, and the relationships that derive from this appear in the names of the new family units after remarriage. For example, blended families, families with stepfather/stepmother, reconstructed families, remarried, and reconstituted families, among others (Costa; Dias, 2012). In the present study, 42.5% of the sample comprised reconstituted families, followed by the nuclear family model, with 35.3%. Regarding the number of minor children, 36.6% of the women had only one child, 25.1% had two children, 9.4% had three or more children, and no children, 28.9%. The percentage of up to 3 people living in the residence predominated (57.5%).

Among the pregnant women, 54.8% did not have a paid job. The predominant family income was between R$1,302 and R$2,300 for 26.5% of the sample; 9.8% had no income, and 21.8% had an income below the minimum wage. Regarding their participation in federal government programs, 57.2% reported not being included in these social benefits. Regarding their place of origin, most women (72.6%) were from the municipality of Porto Velho; 26.5% were from other municipalities in Rondônia, and 0.9% were from other states (Table 1).

Table 1. Sociodemographic characteristics of the subjects.

Sociodemographic characteristics	**AF**	**RF**
Education level		
Incomplete elementary school	57	16.8
Complete elementary school	20	5.9
Incomplete high school	48	14.2
Complete high school	135	39.8
Incomplete undergraduate	38	11.2
Complete undergraduate	41	12.1
	339	**100**
Race		
Black	31	9.1
Brown	264	77.9
White	44	13.0

	339	**100**
Age rating		
Adolescence (11 to <20 years)	31	9.2
Emerging Adulthood (20 to <40 years)	285	84.3
Middle Adulthood (40 to 65 years)	22	6.5
	338	**100**
Family context		
Nuclear family	120	35.3
Reconstituted family	144	42.5
Single-parent family	28	8.3
Other family models	47	13.9
	339	**100**
Number of minor children		
None	98	28.9
One	124	36.6
Two	85	25.1
Three or more	32	9.4
	339	**100**
Number of people in the household		
Up to three people	195	57.5
Four to six people	125	36.9
Above six people	19	5.6
	339	**100**
Engages in paid work		
No	186	54.8
Yes	153	45.1
	339	**100**
Family income (Approximate values in US dollars)		
No income	33	9.8
Up to R$1,301.00 (Approximately $210)	74	21.8
De R$ 1.302,00 a R$ 2.300,00 ($210 to $370)	90	26.5
De R$ 2.301,00 a R$ 3.300,00 ($370 to $530)	55	16.2
De R$ 3.301,00 a R $ 4.301,00 ($530 to $690)	40	11.8
Acima de R$ 4.301,00 (Approximately $690)	47	13.9
	339	**100**
Insertion into Federal Government program		
No	194	57.2
Yes	145	42.8
	339	**100**
Municipality of origin		
Porto Velho	246	72.6
Other Municipalities of RO	90	26.5
Municipalities of other states	3	0.9
	339	**100**

AF – Absolute frequency; AR – Relative frequency. Source: own authorship.

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Table 2 illustrates the data regarding the support network, family planning, and prenatal care for pregnant women. The vast majority of women (86.1%) rely on this social support, with a predominance of family support networks (67%). Regarding family planning, 64.9% of pregnant women reported not having planned their pregnancy, with 82.9% having attended prenatal care and 16.8% having attended incompletely; 0.3% of them did not attend prenatal care.

Table 2. Support network, family planning, and pregnancy monitoring.

Maternal-fetal support, planning, and care network	**AF**	**RF**
Has a support network		
No	47	13.9
Yes	292	86.1
	339	**100**
Type of support network		
Family support network	227	67.0
A support network of friends	6	1.8
Community support network	2	0.6
Has more than one support network	56	16.5
Does not have a support network	48	14.1
	339	**100**
Planned pregnancy		
No	220	64.9
Yes	119	35.1
	339	**100**
Pregnancy monitoring		
No prenatal care	1	0.3
Incomplete prenatal care	57	16.8
Complete prenatal care	281	82.9
	339	**100**

AF – Absolute frequency; AR – Relative frequency. Source: own authorship.

In Table 3, the results presented demonstrate the characteristics of the study population about the consumption of legal and illegal drugs. Regarding tobacco, 81.4% are non-smokers; 11.2% identified themselves as former smokers, 5.6% stated that they stopped consuming this substance during pregnancy, and 1.8% declared themselves to be smokers. Regarding alcoholism, 59.6% do not consume alcohol, 2.9% identified themselves as former alcoholics, 36% stopped consuming it during pregnancy, and 1.5% declared themselves to be alcoholics. Regarding illegal substances, 97.9% declared not to use drugs not permitted by law;

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1.1% had contact with these substances, with 0.9% being former users and 1.2% users. Regarding the mental health of the women investigated, 4.4% are undergoing psychiatric treatment, 0.3% are undergoing neurological treatment, and 5.0% in psychological support.

Table 3. Health-related characteristics of high-risk pregnant women.

Health-related characteristics	**AF**	**RF**
Smoking		
No	276	81.4
Ex-smoker	38	11.2
Interrupted during pregnancy	19	5.6
Yes	6	1.8
	339	**100**
Pregnant smoker		
No	314	92.6
Yes	25	7.4
	339	**100**
Alcohol consumption (Ethylism)		
No	202	59.6
Ex-alcoholic	10	2.9
Interrupted during pregnancy	122	36.0
Yes	5	1.5
	339	**100**
Illicit drugs		
No	332	97.9
Former user	3	0.9
Yes	4	1.2
	339	**100**
Psychiatric treatment		
No	324	95.6
Yes	15	4.4
	339	**100**
Neurological treatment		
No	338	99.7
Yes	1	0.3
	339	**100**
Psychological support		
No	322	95.0
Yes	17	5.0
	339	**100**

AF – Absolute frequency; AR – Relative frequency. Source: own authorship.

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When pregnant women were classified in gestational risk markers by clinical history, 58.4% of the sample did not present previous diseases. When gestational risk factors were classified by obstetric history, 52.5% of pregnant women had a history of previous obstetric complications (Table 4).

Table 4. Classification of clinical and obstetric gestational risk.

Classification of high-risk pregnancy	**AF**	**RF**
By clinical history		
No	198	58.4
Yes	141	41.6
	339	**100**
By obstetric history		
No	161	47.5
Yes	178	52.5
	339	**100**

AF – Absolute frequency; AR – Relative frequency. Source: own authorship.

The results described in Table 5 were obtained from the anxiety inventory analysis. Of the total sample, 31.6% of pregnant women presented mild anxiety, 29.6% were classified as having moderate anxiety, 24.5% presented severe anxiety, and 14.3% represented women with minimal anxiety.

Table 5. Sample stratification on the anxiety scale.

Anxiety level classification	**AF**	**RF**
Minimal anxiety	57	14.3
Mild anxiety	107	31.6
Moderate anxiety	92	29.6
Severe anxiety	83	24.5
	339	**100**

AF – Absolute frequency; AR – Relative frequency. Source: own authorship.

Table 6. Model accuracy in different Machine Learning tools.

Algorithms	**Accuracy**
XGBoost classifier (eXtreme Gradient Boosting)	76.5%
KNN classifier (k-nearest neighbors)	73.5%
Logistic Regression	76.5%
SVC classifier (Support Vector Machine)	80.4%

Algorithm comparing anxiety levels (Table 5) versus explanatory variables (Tables 1-4). Source: own authorship.

The sample's age characteristics are similar to those of other investigations, such as the research by Gadelha *et al*. (2020) carried out in a tertiary maternity hospital in Fortaleza with high-risk pregnant women. In this reference, the median age observed by the authors was 30 years; here, we identified the average age of 29.6 years (Standard Deviation ± 6.61).

Regarding the level of education of pregnant women, the present study found results similar to the research carried out by Da Paz *et al*. (2022). The average level of complete education among the participants in this study was 76.7%, and in the studies by Da Paz *et al*. (2022), it was 55.9%; in both studies, the percentages represent the majority of the population. Other studies also report a prevalence of complete high school education in high-risk pregnant women, such as the findings by Pereira *et al*. (2023) and Jacob *et al*. (2020).

The predominant race among women was represented by brown skin color (77.9%), similar results found by Gadelha *et al*. (2020), in which the brown skin color had a higher prevalence (80.8%). In the data found by Nagai *et al*. (2022), the white race represented the majority, making up 47.7% of the sample, a result different from that presented here.

Regarding family income, 26.5% of pregnant women reported having an income above one minimum wage, representing most of them. A different result was identified in the research by Gadelha *et al*. (2020), in which the prevalent family income was 1 to 3 minimum wages (53.6%). In the data obtained by Nagai *et al*. (2022), there was a predominance of per capita income below one minimum wage, corresponding to 66.1% of the sample. In the current study, per capita income below a minimum wage corresponded to 21.8% of the sample, representing the second highest income among pregnant women.

In the work scenario, 54.8% of pregnant women had no paid job. This result was also observed in the research by Nagai *et al*. (2022) and Gadelha *et al*. (2020), in which 54.7% and 53.6% (respectively) of women were not included in the job market.

Regarding the municipality of origin, 72.6% of high-risk pregnant women lived in Porto Velho, data also mentioned by Gadelha *et al*. (2020). According to the authors, 80.4% of pregnant women lived in the capital.

Regarding the support network of the group investigated, the family support network stood out. This support model was also observed in the study by Maffei *et al*. (2022) with pregnant women followed up at a reference outpatient clinic for high-risk prenatal care, in which the family category corresponded to 51% of the total members of the network maps. According to the authors, family members are the most significant and frequently cited factor for pregnant women. In the pregnancy planning category, this study found that 64.9% of women did not plan their current pregnancy. Data

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similar to these are also presented in the studies by Da Paz *et al*. (2022) and Nagai *et al*. (2022), in which the absence of family planning was predominant in the total sample evaluated, corresponding to 58% and 61.9%, respectively. According to Shiavo, Rodrigues, and Perosa (2018), although the right to family planning is included in the law as a responsibility of the state, which guarantees men and women access to information about contraceptive methods, this guarantee may not be occurring effectively. This weakness may be related to limitations and deficiencies in the care infrastructure, little information for women about contraception, or the spouse's resistance to seeking services (Shiavo; Rodrigues; Perosa, 2018).

Regarding gestational monitoring, there was a prevalence of adherence to adequate and regular prenatal care (82.9%). These data converge with that observed by Rezende and Souza (2012), in which 84.4% of high-risk pregnant women started prenatal care in the 1st trimester. Similar findings were also found in the study by Fernandes, Campos, and Francisco (2019), in which most women (85.6%) started prenatal care in the 1st trimester of pregnancy. For Mario *et al*. (2019), the early initiation of prenatal care and its adequate conduct are important to ensure the health and reduce morbidity and mortality of the mother and fetus. According to the Humanization Program in Prenatal and Birth (PHPN), established by the Ministry of Health in 2000, adequate prenatal care should begin up to the fourth month of pregnancy, consist of at least six follow-up consultations and include blood and urine tests (Mario *et al*., 2019).

Brasil (2010) also highlights the importance of continuous and safe gestational monitoring since a pregnancy that is progressing well can become high risk at any time during the development of the pregnancy or labor. Therefore, it is necessary to reclassify the risk at each prenatal consultation and during labor. In the category of characteristics of pregnant women focused on health, alcohol use during pregnancy was observed in 1.5% of the sample; 36% of them reported stopping use due to pregnancy, and 59.6%, representing the majority, mentioned not having contact with this psychoactive substance. No studies with high-risk pregnant women were found with an emphasis on the "drugs" variable. However, investigations with pregnant women who use a variety of legal and illegal substances indicate results similar to those presented here. Drug use by pregnant women is a serious social and public health problem. Those with chemical dependency have a higher risk of obstetric and fetal complications. Given these factors, Kassada *et al*. (2013) classify this population as a high-risk pregnancy, not only due to drug use during the fetal development period but also due to the social and emotional risk conditions of these women.

In a study by Fiorentin and Vargas

(2006) conducted with pregnant women without risk stratification regarding alcohol consumption, it was observed that the majority of women (65%) reported not using this substance. Regarding tobacco and alcohol use, Kassada *et al*. (2013) observed that the most commonly used drug of abuse among participants during pregnancy was cigarettes (9.14%), followed by alcohol (6.09%). A national study conducted with 450 pregnant women treated by the SUS found a prevalence of 6% of harmful use and 3.1% of alcohol dependence (Brazil, 2022).

To date, a safe dose of alcohol consumption during pregnancy has not been identified. Teratogenic effects can vary depending on the amount of alcohol consumed, the frequency of consumption, and the moment of gestational age at which the alcohol was consumed. In addition to other factors such as maternal and fetal genetics, age, and maternal nutrition (Brazil, 2022).

In general, it is found that complications from drug use are not restricted to pregnant women but also extend significantly to the fetus. Yamaguchi *et al*. (2008) point out that most of these substances have active ingredients that cross the placental and blood-brain barriers without prior metabolism, acting mainly on the fetal central nervous system, causing cognitive deficits in the newborn, malformations, withdrawal syndromes, among others.

Regarding maternal mental health, in the present study, only 1 pregnant woman, corresponding to 0.3% of the sample, stated that she was undergoing neurological monitoring. This result is similar to the research by Luz *et al*. (2015) conducted with 52 pregnant women attended at the High-Risk Prenatal Care Unit of the Divinópolis Polyclinic, in which 2 participants, representing (3.8%) of the population, reported treatment with a neurologist. Regarding psychiatric and psychological monitoring, the data obtained here were close to those found by Luz *et al*. (2015). According to the authors, 5 women reported receiving psychiatric and psychological care, representing 9.6% of the sample. In the present study, 15 (4.4%) pregnant women in the group investigated reported psychiatric treatment and 17 (5.0%) psychiatric treatment.

In classifying gestational risk by clinical and obstetric history, the data revealed showed very different results from the study by Da Paz *et al*. (2022) and Da Silva *et al*. (2018). In the present study, 41.6% of the sample presented risk due to clinical history and 52.5% due to obstetric history. In the findings of Da Paz *et al*. (2022), the research revealed that 29% of pregnant women presented risk due to clinical history and 26% due to obstetric history. In the findings of da Silva *et al*. (2018), the presence of 24.3% for preexisting clinical conditions and 12.1% for reproductive complications in previous pregnancies was observed. In both studies, the results were lower than those

presented here.

O nível de ansiedade na amostra estudada foi influenciado pela variável planejamento familiar. Nas gestações não planejadas o grau de ansiedade das participantes foi maior em relação as grávidas que optaram pelo planejamento familiar. Neste grupo, composto por mulheres que planejaram a gravidez atual, o grau de ansiedade foi mais controlado. Tais resultados, são diferentes dos achados de Da Paz *et al*. (2022) em que a ansiedade foi predominante, independentemente da presença ou não do planejamento familiar. Por isso, a necessidade de um modelo que avalie um problema como sendo multifatorial e anão apenas em função de alguma característica.

4. CONCLUSIONS

This study aims to fill a gap in the production of knowledge focused on high-risk pregnant women, using as a sample those hospitalized at the HB in Rondônia. However, it is important to highlight the need for more research focused on the health-disease process of high-risk pregnant women, particularly at the tertiary level of health care. Identifying the biopsychosocial factors that predispose to unfavorable outcomes is a strategy that involves several government sectors and civil society to qualify maternal and child health care, contributing to a more optimistic scenario for the mother and baby binomial.

The proposed model indicates the most appropriate variables for predicting the development of anxiety in pregnant women. Even though it is a non-probabilistic and convenience sample, when used as a classifier, the algorithm (Support Vector Machine) showed an accuracy greater than 80%, which makes these Machine Learning tools based on the questionnaires applied an important strategy for application in primary, prenatal and hospital care in public health.

Authors' contributions

MFS, LCOG, IAF, MVAV and RNC planned and designed the study; MFS collected the data; AMMN, TPLM, and LCOG processed and analyzed the data; All authors participated in writing, discussing, and approving the final version of the study.

Conflict of interest

The authors declare that there is no conflict of interest in this study.

Data availability

The study made all data available. The corresponding author can provide any other information by email.

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