Objective: to describe characteristics of pregnant women at risk and analyze the relationship with type of delivery and complications during pregnancy and puerperium. Methods: a retrospective study with secondary data of 1,574 at-risk pregnant women followed up in an educational intervention by telemedicine. Results: pregnant women with an average age of 35 years and high educational level participated. Preference for normal delivery was 43.1%, but only 17.3% had normal delivery. During pregnancy, 43.5% sought emergency care. In the postpartum period, 2.0% needed an ICU. Emergency room search was associated with age and contacts with the intervention. Cesarean delivery was associated with age, physical inactivity and overweight/obesity. ICU admission was associated with age and BMI. Conclusion: pregnant women were of high age and education, the younger and who had more contacts with the intervention sought more the emergency room. Older age, physical inactivity and overweight/obesity were factors associated with cesarean delivery.

Descriptors: Prenatal Care; Pregnancy, High-Risk; Nursing; Health Promotion; Telemedicine.
INTRODUCTION

Prenatal care is essential for a positive experience in pregnancy and the puerperium by promoting respectful, individualized, and woman-centered maternal care at every contact, with the implementation of effective practices and relevant information in a timely manner as well as by through emotional and psychosocial support⁹.

Despite the great advances achieved in reducing maternal mortality in recent decades, mainly with the initiatives of the Millennium Development Goals, promoted by the United Nations (UN) between 2000 and 2015, as well as with the establishment of the objectives of sustainable development until 2030, maternal mortality is still high, with around 295,000 deaths per year worldwide in 2017⁴⁻⁶. Problems such as unequal access to health services, delay in identifying and treating complications associated with pregnancy and lack of guidance are still obstacles to overcome⁴⁻⁸. If, on the one hand, coverage for assisted births in health institutions is almost universal in Brazil, on the other hand, there is an excessive use of medicalization and surgical interventions, with high rates of births by cesarean sections⁹.

A study that analyzed the quality of prenatal care in Brazil showed that only 15% of pregnant women received qualified prenatal care, considering all the actions recommended for this type of care. Better rates were observed among older pregnant women, with higher income, from the southeast region and from municipalities with more than 300 thousand inhabitants and a higher human development index (HDI), showing the impact of social inequalities in prenatal care⁶.

A recent survey conducted in southern Brazil analyzed prenatal care for pregnant women at risk attended by the public service. The results showed adequacy of prenatal care in 74% of visits, with high coverage and early onset, but with flaws in relation to information about gestational diseases and test results⁵.

The World Health Organization (WHO) recommendations emphasize nutritional interventions, maternal and fetal assessment, preventive measures, interventions for symptoms and health interventions to improve prenatal care⁰.

Maintaining healthy lifestyle habits includes a conscious and balanced diet and the practice of physical activities in the pregnant woman's routine to avoid excessive weight gain during pregnancy. In relation to maternal assessment, the main recommendations refer to the monitoring of gestational diabetes, reduction or cessation of tobacco and other substances, HIV and syphilis, whereas in relation to the fetus, the main recommendation is to perform at least one ultrasound before the 24th week of gestation⁵.

Preventive measures provide antibiotic therapy for women with asymptomatic bacteriuria and tetanus vaccination. Measures to relieve symptoms and discomfort in relation to nausea and vomiting, heartburn, cramps, low back and pelvic pain, constipation, edema and varicose veins should also be offered⁹.

Prenatal book use, healthy behavior promotion, nutritional supplement distribution and at least eight contacts with the health service or eight prenatal consultations are elements of qualification of prenatal care⁹.

Educational interventions for pregnant women have increased in recent years and have shown positive results through the use of educational booklets, face-to-face or telephone interventions, contributing to improving maternal-fetal mortality indicators⁷.

Nursing educational activities with pregnant women and women who have recently given birth were assessed in northeastern Brazil. An educational intervention with the use of a booklet to promote healthy eating practices has proven effective in improving the knowledge, attitudes and practices of pregnant women regarding healthy eating based on the use of regional foods⁸. Another telephone nursing intervention with pregnant women to promote self-efficacy and exclusive breastfeeding included three telephone contacts over the course of a month. The intervention was applied by a nurse experienced in lactation to improve self-efficacy and duration of breastfeeding. There was a significant difference at two months of a baby's life in relation to the duration of breastfeeding, and at four months, with greater self-efficacy for breastfeeding⁹.

In relation to high-risk pregnant women, educational actions have shown to be limited, as assessed by an integrative review that described educational strategies for preventing pregnancy complications that did not identify studies with educational actions for high-risk pregnant women⁷.

The present study sought to explore the characteristics of pregnant women at risk participating in an educational intervention by telemonitoring and the relationship of these characteristics with the outcomes and complications related to childbirth and the puerperium.

OBJECTIVE

To describe characteristics of pregnant women at risk and analyze the relationship with type of delivery and complications during pregnancy and the puerperium.

METHODS

Ethical aspects

This study analyzed secondary data from a private health company and followed the recommendations of Resolution 510/2016 of the Brazilian National Health Council (Conselho Nacional de Saúde), which states that there is no need for submission and assessment by a Research Ethics Committee in studies with a database of aggregated information, with no possibility of individual identification of the study subjects.

Design

This is an observational, retrospective case series study with analysis of secondary data from a telemedicine program aimed at pregnant women at risk in a private health company, which followed the STROBE recommendation.

The data analyzed in this study were generated during the telephone calls of the telemedicine program, following a specific script for each session. The consultations were carried out over a year (April 2018 to April 2019). The data generated during the sessions were stored in software developed by the health company itself and subsequently extracted in the form of an Excel Program Spreadsheet.
by the information technology team, with the support of the telemedicine program's nurse manager, from August to October 2019.

The telemedicine program called “Futura Mamãe” was a program with monthly monitoring, carried out by nurses and aimed at pregnant women at risk. The Futura Mamãe Program was applied by telemonitoring and included educational strategies (applied by phone, chat, SMS, and WhatsApp), educational videos and one to three face-to-face visits with nurses or other health professionals (nutritionist or physical educator), in addition to monitoring the newborns up to 4 months of life.

The content of educational strategies included: care for a healthy pregnancy; importance of prenatal care; awareness for choosing the type of delivery; adequate nutrition; gastric discomfort and edema; preparation of the breasts; preparing for childbirth and accompanying guidance; importance of rest, general review of guidelines; preparing for childbirth and baby care (pediatrics at home).

The pregnant women were counted by telephone by the program team and those who agreed to participate received an average of 9 contacts from the “Futura Mamãe” Program. Participants could also contact the program for 24 hours (free contact via 0800) to answer questions about pregnancy or complications, whenever necessary.

The program aimed to increase the rate of normal childbirth/reduce the rate of cesarean sections and reduce emergency room visits and reduce hospitalizations in Intensive Care Units (ICUs).

Pregnant women were considered at risk based on the following indicators: age> 35 years, history of abortions, obesity, multiple pregnancies, previous diseases and/or diseases acquired during pregnancy (such as diabetes, pre-eclampsia and eclampsia), emotional factors and presence of bad health habits (tobacco or alcohol consumption) [10-11].

The dependent variables or outcomes of this study were normal delivery rate/cesarean delivery rate, emergency room visits during pregnancy and rate of ICU admissions after delivery.

The independent variables were sociodemographic (age and education) and clinical (health perception, emotional data, obstetric follow-up, pregnancy complications, Body Mass Index (BMI), planned pregnancy, type of delivery you want, chronic diseases, smoking, alcoholic beverages, food, physical activity and adherence to the consultation plan.

Data analysis included descriptive and inferential statistics. Qualitative descriptive data were presented by means of frequency and percentage, quantitative data were presented as means, standard deviations, and medians. The association between qualitative variables was tested using Pearson's chi-square and Fisher's exact test. The association between quantitative variables was tested using the Brunner-Munzel, Wilcoxon-Mann-Whitney and Kruskal-Wallis tests. For all analyzes, a significance level of 5% was adopted.

RESULTS

This study analyzed data from 1,574 pregnant women who participated in the “Futura Mamãe” Program from April 2018 to April 2019. The data were extracted from the company’s database from August to October 2019. The pregnant women were 20 states of the country, with a predominance in São Paulo (69.0%), Rio de Janeiro (13.3%), and Minas Gerais (4.2%).

The average age of pregnant women was 34.9 years and the average Body Mass Index (BMI) in the first trimester of pregnancy was 27.2. Participants had a good level of education; 22.4% have had an abortion; 43.5% went to the emergency room (ER) during pregnancy; 42.1% had some complications during pregnancy; 20% of puerperal women needed ICU admission in the postpartum period (Table 1).

| Variable                  | n  | %    |
|---------------------------|----|------|
| Age (years)               |    |      |
| <30                       | 218| 13.8 |
| 30-34                     | 380| 24.1 |
| 35 – 39                   | 731| 46.4 |
| 40 – 44                   | 230| 14.6 |
| 45 and older              | 15 | 0.9  |
| Education                 |    |      |
| Elementary school         | 6  | 0.38 |
| High school*              | 179| 11.4 |
| Higher education*         | 1001| 63.8 |
| Graduate degree*          | 382| 24.4 |
| No information            | 6  | 0.4  |
| Origin                    |    |      |
| São Paulo                 | 1086| 69.0 |
| Rio de Janeiro            | 209 | 13.3 |
| Minas Gerais              | 66  | 4.2  |
| Pernambuco                | 52  | 3.3  |
| Bahia                     | 47  | 3.0  |
| Federal District          | 39  | 2.5  |
| Others***                 | 42  | 4.8  |
| Previous abortions        |    |      |
| No                        | 1222| 77.6 |
| Yes                       | 352 | 22.4 |
| Intercurrence during pregnancy | | |
| No                        | 911 | 57.9 |
| Yes                       | 663 | 42.1 |

Health-related data showed that pregnant women rated their health as good (96.9%), planned pregnancy (73.6%), were sedentary (66.2%) and never gave birth (57.6%). The analysis of habits showed that 92.3% of pregnant women had never smoked and 6.8% were former smokers. Only 0.9% reported being smokers during pregnancy and 10.8% reported having the habit of consuming alcoholic beverages.

Analysis of emotional aspects in relation to the current pregnancy showed that pregnant women reported mainly joy (92.9%) and anxiety (5.7%). Moreover, 97.8% reported feeling excited, 40.7% more emotional (crying more than before) and 33.9% more irritated.

Regarding the diet, 92.0% reported eating normally and 7.7% reported reduced appetite. Most pregnant women reported working normally during pregnancy (86.7%), many reported sleep disorders (37.4%) fatigue (45.0%).

At the beginning of the program, there was a predominance of preference for normal delivery (43.1%) and cesarean section (35.7%). Part of pregnant women, however, did not know how to inform the preference for type of delivery (21.2%) at the beginning of the program. At the end of the program, 71.5% of pregnant women said they planned to have a cesarean delivery and 28.5% had a normal delivery, but 82.5% had a cesarean delivery and 17.5% had a normal delivery. Among the
participants, 98.2% reported that the program was an important support during pregnancy.

We analyzed the relationship between the number of contacts of the pregnant woman with the program and the type of delivery, the complications, the search for the ER during pregnancy and ICU admission in the postpartum period. Pregnant women who went to the ER during pregnancy had significantly more contacts with the program, but there was no association between the number of contacts and the other variables analyzed (Table 2).

**Table 2** - Relationship between the number of contacts with the program, type of delivery, complications, going to the emergency room and hospitalization in Intensive Care Units, São Paulo, São Paulo, Brazil, 2019

| Variable                                      | Number of contacts | p value* |
|-----------------------------------------------|--------------------|----------|
| Type of delivery                              |                    |          |
| Caesarean section                             | 9.19               | 0.194    |
| Forceps                                       | 9.00               |          |
| Normal                                        | 9.68               |          |
| Intercurrence                                 |                    |          |
| Yes                                           | 9.08               | 0.057    |
| No                                            | 9.41               |          |
| Emergency room during pregnancy               |                    |          |
| Yes                                           | 9.68               | <0.001*  |
| No                                            | 8.95               |          |
| Calls to the emergency room during pregnancy  |                    | <0.001** |
| None of the time                              | 8.95               |          |
| Once                                          | 9.55               |          |
| Twice                                         | 9.87               |          |
| Three times                                   | 9.01               |          |
| 4 times or more                               | 10.02              |          |
| Went to the Postpartum Intensive Care Unit    |                    | 0.933    |
| Yes                                           | 9.65               |          |
| No                                            | 9.26               |          |

Note: *Wilcoxon-Mann-Whitney (p<0.001); **Kruskal-Wallis (p<0.001).

The possible relationship between the type of delivery, age and BMI was also analyzed. Cesarean delivery was found to be associated with higher age and BMI (Table 3).

**Table 3** - Association between type of delivery, age, and Body Mass Index, São Paulo, São Paulo, Brazil, 2019

| Variable      | Type of delivery | p value* |
|---------------|------------------|----------|
| Age (years)   |                  |          |
| 35.1          | Caesarean section| <0.001*  |
| 34.3          | Normal           |          |
| Body Mass Index|                  | <0.001** |
| 27.4          | Caesarean section|          |
| 25.9          | Normal           |          |

Note: *Wilcoxon-Mann-Whitney (p<0.001); *Brunner-Munzel (p<0.001).

The type of delivery was significantly associated with the practice of physical exercises during pregnancy. Normal delivery was more frequent among women who practiced exercise during pregnancy (p<0.001).

ICU admission was associated with older age and higher BMI (Table 4). The other variables analyzed were not associated with ICU admission. Analysis of the search for the ER during pregnancy showed that the women who went to the ER were significantly younger (p<0.001). BMI, however, was not associated with the search for the ER during pregnancy (Table 4).

**Table 4** - Relationship between age, Body Mass Index admission and going to the emergency room during pregnancy, São Paulo, São Paulo, Brazil, 2019

| Variable | Age (years) | Body Mass Index | p value |
|----------|-------------|-----------------|---------|
| Yes      | 38.2        | <0.001**        | 34.5    |
| No       | 34.3        |                 | 33.4    |
| Yes      | 28.6        | <0.001*         | 27.4    |
| No       | 27.1        |                 | 26.9    |

Note: *Wilcoxon-Mann-Whitney (p<0.001); **Brunner-Munzel (p<0.001).

We also sought to identify possible association between emotional variables, life habits and the search for the ER during pregnancy. Pregnant women who reported insecurity and fear, who cried more frequently, who reported more tiredness/fatigue and who had difficulty working were significantly more to the ER during pregnancy (Table 5).

**Table 5** - Relationship between going to the emergency room during pregnancy and emotional variables and lifestyle habits, São Paulo, São Paulo, Brazil, 2019

| Variable | Current pregnancy feeling | p value |
|----------|---------------------------|---------|
| Yes      | 822                       | 56.9    |
| No       | 622                       | 43.1    |
| Yes      | 49                        | 55.1    |
| No       | 40                        | 44.9    |
| Yes      | 05                        | 45.5    |
| No       | 6                        | 54.5    |
| Yes      | 01                        | 11.1    |
| No       | 8                        | 88.9    |
| Yes      | -                         | 100.0   |
| No       | 19                       | 54.3    |
| Yes      | 868                      | 56.6    |
| No       | 667                      | 43.4    |
| Yes      | 545                      | 59.1    |
| No       | 377                      | 40.9    |
| Yes      | 337                      | 52.7    |
| No       | 302                      | 47.3    |
| Yes      | 02                       | 33.3    |
| No       | 04                       | 66.7    |
| Yes      | 03                       | 100.0   |
| No       | -                        | -       |
| Yes      | 957                      | 58.0    |
| No       | 432                      | 42.0    |
| Yes      | 287                      | 53.9    |
| No       | 245                      | 46.1    |
| Yes      | 02                       | 50.0    |
| No       | 01                       | 50.0    |
| Yes      | 02                       | 28.6    |
| No       | 05                       | 71.4    |
| Yes      | 509                      | 59.1    |
| No       | 352                      | 40.9    |
| Yes      | 358                      | 54.4    |
| No       | 300                      | 45.6    |
| Yes      | 19                       | 41.3    |
| No       | 27                       | 58.7    |
| Yes      | 01                       | 33.3    |
| No       | 02                       | 66.7    |
| Yes      | 826                      | 57.2    |
| No       | 619                      | 42.8    |
| Yes      | 548                      | 48.6    |
| No       | 579                      | 51.4    |
| Yes      | 06                       | 54.6    |
| No       | 05                       | 45.4    |
| Yes      | 01                       | 33.3    |
| No       | 02                       | 66.7    |
| Yes      | 817                      | 56.2    |
| No       | 636                      | 43.8    |
| Yes      | 63                       | 58.9    |
| No       | 44                       | 41.1    |
| Yes      | 09                       | 64.3    |
| No       | 05                       | 35.7    |

Note: *Wilcoxon-Mann-Whitney (p<0.001); **Brunner-Munzel (p<0.001).
In 2018, WHO recommended using non-clinical interventions to reduce the number of cesarean sections worldwide through health education, with an emphasis on topics about fear and anxiety related to childbirth, the natural process and individual reactions, stages, hospital routines and forms of pain relief(16).

In this educational process, the need to pay greater attention to the gaps identified by women themselves as related to women's choices such as home birth and vaginal delivery after cesarean section is highlighted. The importance of recognizing childbirth as an important and valuable life experience for the people involved is stressed(16).

Analysis of the "Futura Mamãe" Program database also showed a significant impact of the average BMI profile of overweight (27.2) in the first trimester of pregnancy and a higher risk of cesarean delivery, with more than 60% of overweight women/obesity. High BMI at the beginning of pregnancy and excessive gestational weight gain have been associated with negative obstetric outcomes and increased risk of complications(16,17-19).

A study that described the obstetric outcome of overweight/obese women concluded that pre-gestational overweight/obesity women had an increased risk of developing pre-eclampsia (OR 3.2; 95% CI 1.1–9.9; p=0.03) and there was a trend towards an association between type of surgical delivery or forceps and over/obesity (OR 1.8; 95% CI 0.9–3.5; p=0.04)(17).

Obesity was also associated with an increased risk of developing thrombosis, gestational diabetes, increased blood pressure and pre-eclampsia, mental health problems during pregnancy and after childbirth. Fetal risks associated with maternal obesity include miscarriage, neural tube defects, fetal macrosomia, fetal deaths and increased need for ultrasound exams(18).

A study conducted in southern Brazil that analyzed the impact of BMI at the beginning of pregnancy and gestational weight gain on pregnancy outcome concluded that the higher the BMI in the first trimester and the weight gain during pregnancy, the greater the risk of surgical delivery. However, there was no relationship between BMI and gestational weight gain with increased risk of hypertension and diabetes(19).

In the present study, physical activity during pregnancy was associated with a significantly higher proportion of normal deliveries (49.6%) than cesarean deliveries (34.7%), similarly to other studies(20-21). Sedentary pregnant women during pregnancy had an increased risk of having an emergency cesarean delivery and need for a vacuum extractor for vaginal deliveries(21).

Exercise during pregnancy was associated with reduced risk of cesarean sections, particularly emergency(20). The greatest risk reduction was related to exercise more than 5 times during 17 weeks (~2.2%) and 30 weeks of gestation (~3.6%) compared with sedentary pregnant women (p <0.001). High impact exercises between 17 and 30 weeks of gestation were associated with reduced risk of cesarean section (~3.0% and ~3.4%, respectively)(20).

In the present study, a significant association was found between emotional variables, some lifestyle habits and the search for ER during pregnancy. Pregnant women who reported insecurity and fear, who cried more frequently, who reported more tiredness/fatigue and who had difficulty working were significantly more at the ER during pregnancy.

**DISCUSSION**

The characterization of the sample showed that most of pregnant women included in the program were aged 35 and over had a high level of education and were overweight, which reflects the female behavioral change over the past decades. Women in Brazil and in the world have opted for greater dedication to studies and professional life, are inserted in positions of professional leadership and live with competitiveness and need for a vacuum extractor for vaginal deliveries(21).

Older mothers are more prepared for pregnancy, whether physical, psychological, emotional, relational, social or financial. They are women who can have healthier children with better developmental capacities(13). On the other hand, women may feel inadequate in relation to age and pregnancy, attitudes that can trigger other factors in addition to those already commonly associated with the risk label, such as insecurity and anxiety, impairing the normal evolution of this period(13).

Advanced maternal age showed an association with cesarean delivery, as observed in other studies14-15. However, the initial preference of pregnant women for normal delivery in the present study occurred in 43.1% of pregnant women and only 17.3% had a normal delivery.

The highest proportion of pregnant women in the study was between 35 and 39 years old and the average age associated with cesarean delivery was 35.1 years. Studies suggest that mothers aged ≥40 years may have higher risks of gestational diabetes, elective cesarean section and placenta previa, compared to younger mothers. A recent study showed that women ≥45 years old were at increased risk for obstetric complications such as pre-eclampsia, prolonged hospitalization and premature rupture of membranes(13).

### Table 5 (concluded)

| Variable                                      | Went to the emergency room during pregnancy | p value |
|-----------------------------------------------|--------------------------------------------|---------|
| Drink alcoholic beverages                     |                                            |         |
| Never                                         | 791                                        | 56.3    |
| Up to 3 doses                                  | 91                                         | 58.3    |
| From 4 to 7 doses                              | 05                                         | 41.7    |
| More than 7 doses                              | 02                                         | 100.0   |
| Drink alcoholic beverages                     |                                            | 0.510   |
| Never                                         | 791                                        | 56.3    |
| Up to 3 doses                                  | 91                                         | 58.3    |
| From 4 to 7 doses                              | 05                                         | 41.7    |
| More than 7 doses                              | 02                                         | 100.0   |
| Physical activity during pregnancy            |                                            |         |
| No                                            | 553                                        | 56.1    |
| Yes                                           | 336                                        | 57.1    |
| Sleep pattern                                  |                                            |         |
| Normal                                        | 571                                        | 58.1    |
| Do not sleep like they used to                 | 240                                        | 53.7    |
| Difficulty returning to sleep                  | 29                                         | 56.9    |
| Unable to go back to sleep                     | 47                                         | 53.4    |

**Notas:** *Teste Exato de Fisher; **Qui-Quadrado de Pearson (p<0.005).**
Study limitations

Secondary data from a company that offered the intervention were used and the sample included pregnant women with a high level of education and access to private health services, which does not represent the average profile of Brazilian women and makes generalizations difficult. Another limitation is the design of the study, of the retrospective case series type, with secondary data, which does not allow establishing causal relationships between variables, only associations.

Contributions to health

Among the study’s contributions, the potential of telemedicine interventions for pregnant women at risk stands out, which can contribute to stimulate healthy lifestyle habits, such as the practice of physical activity during pregnancy, in addition to emotional support for pregnant women. These measures can impact on normal birth rates and more rational use of health services.

CONCLUSION

The high-risk pregnant women were highly educated and aged, with a predominance of overweight. The youngest, who had more contacts with the intervention, who reported fear, insecurity, greater emotionality, fatigue and greater difficulty for work, sought more often the ER during pregnancy. Older age, physical inactivity and overweight/obesity were factors associated with cesarean delivery. Normal delivery was more frequent among women who exercised during pregnancy. ICU admission in the postpartum period was associated with higher age and BMI.

These data allow planning interventions to improve the health conditions of pregnant women at risk, with a view to increasing the rate of normal births and reducing complications.

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