DATA MINING ON NURSING CONSULTATION FOR THE POSTPARTUM PERIOD

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Abstract: Nursing consultation for the postpartum period is aimed to identify risks and complications of postpartum women. During the consultation, the nurse is expected to support and provide information and education on breastfeeding, encouraging mothers to breastfeed their infants, thereby reducing the rates of weaning. The literature presents some factors that may contribute to early weaning. This project aims to assess whether Data Mining can help complement the already known risks and complications in the postpartum period. For this purpose, a database was generated from the extension project "Consulta Puerperal de Enfermagem"(Nursing Consultation for the Postpartum Period), in the city of Ponta Grossa. Based on the results obtained, it has been possible to identify the sociodemographic and obstetric profile of nursing mothers, breast problems such as sore nipples and milk retention, among other factors, that influence the practice of weaning. In conclusion, Mining Data provided an opportunity for the identification of relevant and potentially useful factors that may encourage the prevalence of breastfeeding, reducing early weaning, through health education in the postpartum period.

Keywords: Data mining, postpartum, breastfeeding, weaning

1. INTRODUCTION

The postpartum period is characterized by the physiological and gradual decline of the maternal body. Thus, it requires special care, as well as information on some important aspects of this period, such as: involutive phenomena, establishment of breastfeeding and care of the neonate [1].

The nursing consultation for the postpartum period project aims at the wellbeing of the mother and the newborn, the detection and evaluation of physiological postpartum factors and especially at providing direction and guidance to breastfeeding. [2].

The Brazilian Ministry of Health and the World Health Organization recommend exclusive breastfeeding until six months of life, justifying the benefits of this practice in maternal and infant health, but this is far from actual reality [3].

Research on breastfeeding in Brazil [4] shows that the average duration of exclusive breastfeeding is around 1 month of age, although 96% of women begin breastfeeding within the first hour of life of the newborn. Of these women, only 11% feed their babies only breast milk during 4-6 months, 41% keep breastfeeding until the

end of the 1ˢᵗ year of life and 14% until the child is 2 years of age.

Despite the recognized importance of the benefits of breastfeeding for both mother and child, the incidence of early weaning is still high, reaching in average (34%) of newborn [4]. Early weaning is understood as the cessation of breastfeeding before the infant has completed six months of life, regardless of the reason [5].

For a better understanding of this issue it is necessary to identify the factors that lead nursing mothers to wean their children early in the city of Ponta Grossa. Among the multiple causes for this practice, the literature highlights the lack of information on the biopsychological function of breastfeeding and scarce training of the nursing team [6].

Since early weaning is considered a public health problem, the Ministry of Health implemented programs and campaigns that promote breastfeeding. The Program *Iniciativa Hospital Amigo da Criança* established in 1990 is aimed to promote, protect and support breastfeeding in hospitals based on the "*Dez Passos para o Incentivo do Aleitamento Materno*"(Ten Steps to Encourage Breastfeeding), which propose changes in routines and procedures [7]-[8].

Also, the Program *Iniciativa Unidade Básica Amiga da Amamentação* has been recently implemented, which is focused on supporting and promoting breastfeeding, specifically at the primary care basic health units. This program creates opportunities for services aimed to promote health and prevent and solve problems that may lead to early weaning [7].

Based on these strategies, a survey was conducted by the Ministry of Health in all Brazilian capitals and other 239 cities, indicating that in the southern region the average period of breastfeeding increased from 225.2 days to 302.8 days. The study also concluded that there was an increase in the rate of exclusive breastfeeding of children under four months of age, from 35 % in 1999 to 52% in 2008 [4].

In order to understand the factors associated to weaning in the city of Ponta Grossa, the extension project "Consulta Puerperal de Enfermagem" (Nursing Consultation for the Postpartum Period) was developed in 2006. Since the establishment of the project, the nurses at Universidade Estadual de Ponta Grossa (UEPG) have been providing care to nursing mothers, clarifying questions about postpartum, care, to the newborn, breastfeeding, etc. [9]. The question posed here is: "through nursing consultation for the postpartum period is it possible to identify the factors that lead to early weaning in the city of Ponta Grossa?"

To answer this question the database of the extension project "Consulta Puerperal de Enfermagem", containing data collected between February and November 2010. Data Mining algorithms were applied to this set of data.

Data Mining is one of the steps of the KDD (*Knowledge Discovery in Databases*) process aimed to extract patterns from databases. Besides Data Mining, it is important to mention the Preprocessing steps (aimed to preparing the set(s) of data for extraction) and the Post processing steps, which facilitate the analysis of these patterns by experts in order to construct new knowledge [10].

The application of Data Mining in database makes possible the extraction of knowledge for the identification of factors and strategies in healthcare. [11]. The new variables in a given scenario provide an important step toward the discovery of new information on the weaning process in the city of Ponta Grossa.
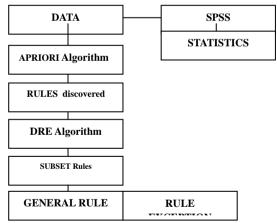
The present article brings two contributions: one of a scientific nature and the other of a social nature. 1) Allows us to evaluate and disseminate the opportunity of appropriation of Data Mining in healthcare. 2) Provides additional information to assist the formulation of local policies, in order to increase the prevalence of breastfeeding, encourage and promote education in prenatal care and postpartum period.

2. METHODS

This is a descriptive-exploratory study based on a quantitative approach that used the database of the extension project "*Consulta puerperal de Enfermagem: educação em saúde no ciclo gravídico-puerperal*" (nursing consultation for the postpartum period: health education in the pregnancy-postpartum period) of Universidade Estadual de Ponta Grossa, approved under number165/2011 and protocol 17345/11, by the Ethics Committee in Research of UEPG.

The study population was composed by women whose immediate postpartum period (1st to 10th day) occurred in 2010 at Hospital Evangélico of Ponta Grossa and who agreed to participate in the nursing consultation by signing the Informed Consent. (TCLE). A convenience sample[1] of 119 postpartum women (total number of participants) was used, characterizing a study case.

A semi-structured questionnaire was used for data collection and contained 30 1questions (Annex) concerning: identification; gynecological. Obstetric and family history; nutritional state and current pregnancy. Data collection took place from February to November 2010 and the data were organized in an Excel spreadsheet.

Steps adopted in the study shown in figure 1:

Figure 1- Steps made

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[1] Women assisted at the healthcare service during the year of 2010 and who agreed to participate in the research by signing the informed consent.

From the database, descriptive analysis of the variables was performed using the *software Statistical Package for Social Science for Windows* (SPSS, version 13.0).

For pattern extraction an algorithm based on *apriori* for mining association rules was used [12], in order to associate facts related or not to weaning, and find out combinatorial scenarios for the several variables available [13]. For parameterization of the *apriori* algorithm [12] support values of 1% and 70% for confidence were adopted. These parameter values are justified because the strategy used was that of discovery of rules of exception for the post-processing of patterns, i.e., based on this originally discovered set of rules, pairs of rules were identified: general rules and their respective rules of exception. This parameterization (s1%, c70%) made it possible to discover rules of exception, which tend to have a lower support value and will probably be of greater interest to the expert, since they contradict the general rule [14].

An example of interpretation of a pair of rules (general and exception) is given [13] [14]:

- "If A, then B" corresponds to the general rule, with exception being the rule "if (A and B), then (no) C".

Noting that the general rule has high coverage (support) and the rule of exception has low coverage.

Of the total discovered rules those representing associations involving weaning were selected, since the purpose of this study is to identify risk factors for weaning.

3. RESULTS AND DISCUSSIONS

Regarding the age of the nursing mothers women who participated in the nursing consultation for the postpartum period project, the study showed that 32 (26.9%) were aged 16-19 years, being considered lactating teens. 59 (53.8%) of the mothers were 20-30 years old and 26 (19.3%) of them were over 30 years. Of these, 53 (44.6%) breastfed for less than six months and 38 (31.9%) breastfed for 6 months, as recommended by the World Health Organization [8].

According to Gigante [5], nursing mothers in the 10-19 age range are more likely to wean their infants early, because motherhood in adolescence [16] has its peculiarities, due to social, psychological and biological factors.

Regarding marital status, 71 nursing mothers reported being single (59.7%) and regarding schooling only 9 (7.6%) said they did not complete elementary school. The fact that most women reported being single is consistent with the sociodemographic profile of Brazilian women [15] and reflects social issues, since they support their families alone. In the postpartum period, these women find it hard to play "the role of mother" alone, especially when breastfeeding, this variable being considered a risk factor for early weaning.

The education level may also influence breastfeeding success by facilitating a more informed decision on breastfeeding. Mothers with low education level may find it difficult to understand actions aimed to promote breastfeeding. [17].

When asked about their occupation, only 10 (8.4%) reported they did not work, and were then considered "stay at home" mothers. Of the postpartum working women (91.6%), more than half reported not having formal contract (72.3%), and therefore were not entitled to maternity leave. It can be observed that formal work interfered with breastfeeding of mothers after three months, because some women resume work after the end of maternity leave, and thus lose contact with their babies for some hours [8], which impairs the breastfeeding process because the children will such less than usual. It is up to the nurse professional to guide the mothers regarding the emptying of the breasts in order to prevent engorgement, which is one of the factors for weaning.

In order to increase the promotion of breastfeeding, the National Congress passed, in August 2010, through the Program Empresa Cidadã (Citizen Company) a law that extended maternity leave from 120 days to 180 days, ensuring physical and mental rest for postpartum women, and more time for breastfeeding [7].

It has been noted that most postpartum women (98.3%) had attended prenatal appointments, and 50 (42.0%) had six consultations. Concerning guidance on breastfeeding, 35 (29.4%) postpartum women reported not having had any guidance during prenatal care and 70 (5.,8%) did not prepare their breasts for breastfeeding as recommended in the pregnancy cycle. Regarding the guidance given to nursing mothers in 33.6% of the cases it was provided by a professional nurse. Based on the information obtained in the prenatal care, we obtained a high rate (108; 90.8%) of nursing mothers who were able to breastfeed during the postpartum period.

Prenatal care is aimed at early detection of changes in the pregnant woman and her fetus, and it is also the right moment for nurses in the identification of knowledge by the pregnant women related to breastfeeding, ensuring its beginning and maintenance [6]. Right now it is important that the pregnant women is informed on how to prepare the breasts for breastfeeding, in order to prevent cracks and more serious complications such as mastitis, breast abscesses and accumulation (retention) of milk [3].

Regarding the minimum number of consultations in the prenatal care, (42.0%) had at least six consultations, as recommended by the Ministry of Health [7]. The guidance on breastfeeding in prenatal care is characterized in the study according to the standards of the World Health Organization [4], since most nursing mothers (90.8%) were able to breastfeed in the postpartum period and (31.9%) breastfed their infants until six months.

Besides the statistics, the set of association rules discovered was also analyzed. Based on Apriori algorithm [12] 107162 rules were obtained, with 810 pairs of rules (general rule and respective exceptions) being identified [14].

Since the research is focused on discovering risk factors for early weaning, from the 810 pairs of rules, those pairs that referenced the variable breastfeeding in postpartum were extracted, such as:

General Rule 1:

If guidance on breastfeeding yes, then breastfeeding in the postpartum period yes (70.6%, 88.1%). Which reads: 70.6% of nursing mothers received guidance on breastfeeding, and 88.1% of these were able to breastfeed during the postpartum period.

Rule of Exception 1:

If guidance on breastfeeding was received yes and **milk retention**, then **breastfeeding in the postpartum period no** (1.7%, 100.0%).

This indicates that even though guidance on breastfeeding is provided, if milk is accumulated (retained) in the breasts, the mother will not be able to breastfeed in the postpartum period..

General Rule 2:

If breasts were prepared for breastfeeding yes, then breastfeeding in the postpartum period yes (40.3%, 87.5%). Which reads: 40.3% of the nursing mothers prepared their breasts for breastfeeding during pregnancy, and 87.5% of these were able to breastfeed in the postpartum period.

Rule of Exception 2:

If breasts were prepared yes and **milk retention,** then **breastfeeding in the postpartum period no** (1.7%, 100.0%).

This indicates that even though the nursing mothers prepared their breasts for breastfeeding during pregnancy, if milk is retained in their breasts, then these mothers will not be able to breastfeed in the postpartum period.

General Rule 3:

If the nursing mother participated in programs targeted for pregnant women, then breastfeeding in the postpartum period yes (23.5%, 78.6%). Which reads: 23.5% of the nursing mothers participated in pregnancy groups, and 78.6% of them were able to breastfeed in the postpartum period.

Rule of Exception 3:

If the nursing mother participated in programs targeted for pregnant women and **maternal complication**, then **breastfeeding in the postpartum period no** (1.7%, 100.0%).

This means that even those nursing mothers who participated in these programs targeted for pregnant women were not able to breastfeed in the postpartum period if they had any complication.

It becomes evident that one risk factor for weaning characterized in these rules, milk retention, albeit less common in the postpartum period, is an important complication. Breast problems [5] are considered the main factors that lead to early weaning, among them, nipple injuries and engorgements are the most common. Milk retention [3] is seen in the literature as a complication because of the inadequate emptying of breasts. This causes milk to accumulate in the alveoli blocking milk ducts.

Health education and guidance to women on breastfeeding during the pregnancy and postpartum cycle contribute to successful breastfeeding. During nursing consultations, women should be informed on the benefits of breastfeeding, the disadvantages of using artificial milk, and guided and trained on breastfeeding techniques, minimizing the risks for early weaning. [8].

Other groups of rules selected are:

General Rule 4:

If age range is 21-30 years, then breastfeeding in the postpartum period yes (45.4%; 88.9%). Which reads: 45.4% of the nursing mothers are aged 21-30 years, and 88.9% of these were able to breastfeed in the postpartum period.

Rule of Exception 4:

If age range 21-30 years and **milk retention**, then **breastfeeding in the postpartum period no** (1.7%; 100.0%).

This indicates that, if nursing mother aged 21-30 years is associated and milk retention factor is present, then the mother will not breastfeed in the postpartum period.

General Rule 5:

If primiparous, then breasts prepared for breastfeeding No (12.6%, 73.3%). Which reads: 12.6% of postpartum women are primiparous, and 73.3% of them did not prepare their breasts for breastfeeding.

Rule of Exception 5:

If primiparous and **age range 21-30 years**, then **breasts prepared for breastfeeding yes** (3.4%, 75.0%).

This set reflects a greater association between first pregnancy and age range 21-30 years with breasts prepared for breastfeeding.

General Rule 6:

If age range above 30 years, then breastfeeding yes (23.5%, 78.6%). Which reads: 23.5% of the postpartum women are over 30 years, and 78.6% of them were able to breastfeed in the postpartum period.

Rule of Exception 6:

If age range above 30 years and **underwent three cesarean sections**, then **breastfeeding no** (1.7%, 100.0%).

It is clear that if the nursing mother is above 30 years and underwent three caesarean sections, then she will not breastfeed in the postpartum period.

Therefore, being older and multiparous does not indicate that the nursing mother is prepared for breastfeeding. In care practice [6] we observed that most women who had more than one pregnancy and breastfed successfully, will find it easier to breastfeed again and will be less susceptible to early weaning.

4. CONCLUSIONS AND FUTURE PERSPECTIVES

The present study aimed to try Data Mining in order to better understand the risk factors that can lead to early weaning, an undesirable situation for both the mother and the newborn baby.

Based on the data survey in nursing consultations in the postpartum period performed in the city of Ponta Grossa, it has been possible to observe factors associated to the practice of early weaning. Nipple injuries and even more serious complications such as milk retention were identified as a common factor for early weaning. The sociodemographic and obstetric profile of nursing women were also characterized, which has made it possible to better understand the population treated by the nurse professionals and potentialize the actions targeted to the referred population.

From the results obtained and the readjustment of the procedures, it is believed that it is possible to increase the prevalence of breastfeeding, as well as to reduce early weaning through proper guidance of nursing mothers in the pregnancy and postpartum cycle.

It is worth mentioning that it is possible to broaden the fight against infant mortality through programs targeted for pregnant women focused on the idea that "breastfeeding" should be the first choice of the mother.

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ANNEX

I- IDENTIFICATION

Name:
Age:
Marital Status: ☐ Single ☐ Married ☐ Cohabitant ☐ Divorced
Education: ☐ basic ☐ secondary ☐ higher
                    ☐ complete   ☐ incomplete
Works: ☐ Yes   ☐ No   **Occupation:**
Formal Contract: ☐ Yes ☐ No
Maternity Leave:

II- OBSTETRIC HISTORY (previous pregnancy)

Number of pregnancies:
Mode of delivery ☐ Cesarean section   ☐ Normal labor delivery   (☐ episiotomy: ☐ no episiotomy) ☐ Home birth ☐ Hospital birth
Had any complications during the pregnancies? ☐ No ☐ Yes Which?
Any miscarriage? ☐ No ☐ Yes How many?
Breastfed the children? ☐ No ☐ Yes
Breastfeeding time ☐ <6 months   ☐ = 6 months ☐ > 6 months

III- NUTRITIONAL STATUS

Weight before pregnancy:　　　**Current weight:**　　　**Height:**　　　**BMI:**
Nutritional diagnosis: ☐ Low weight ☐ Normal weight ☐ Overweight
☐ Obesity I ☐ Obesity II
How many meals per day? Breakfast ☐　Lunch ☐　Afternoon snack　Dinner ☐

IV- ELIMINATIONS

Stool frequency? Once a day ☐　twice a day☐　+ than three times a day ☐ Does not empty the bowels every day
Is your bladder emptying normal? Yes ☐　No☐

V- FAMILY HISTORY

☐ Hypertension　Degree of relationship:　　　　　　　　　☐ DM　Degree of relationship:
☐ Heart disease　Degree of relationship:
☐ Cervical carcinoma　　Degree of relationship:
☐ Breast cancer　Degree of relationship:　　　　　　　☐ Others:

VI- PHYSICAL EXAMINATION: GENERAL

AP:　　　　　**Pulse:**　**T:**　　　**Mucosae:** ☐ Normally colored ☐ Pale
Oral cavity:
Mucosae: ☐ intact ☐ presence of injuries ☐
Dentition: ☐ full ☐ incomplete　☐ presence of dental caries
Prostheses: ☐ present ☐ absent　　**Hygiene:** ☐ adequate ☐ regular ☐ poor
Heart auscultation: ☐ unchanged　☐ with changes
Chest auscultation: ☐ unchanged　☐ with changes
Remarks:

VII- CURRENT PREGNANCY

Planned pregnancy? ☐ Yes　☐No
Prenatal care: ☐ Yes☐ No
Consultations:　　　☐ < 6 consultations　　☐ =6 consultations　　☐ > 6 consultations
Maternal complications:　☐ Bleedings ☐ ITU　　　☐　　Thrombosis ☐ Infection　☐ No　　　☐ Others:
Mode of delivery:
Breasts prepared for breastfeeding:　　☐ Yes ☐　Padding　☐　Ointment ☐ Sunbath ☐ Light
　　　　　　　☐ No
Guidance on breastfeeding:　　☐ No　　☐ Yes
Health professional who provided guidance:　☐ Doctor　☐　Nurse ☐ Others
Did you breastfeed your child?

Breastfeeding time   ☐ <6 months   ☐ = 6 months ☐ > 6 months

PHYSICAL EXAMINATION OF THE BREASTS

Breasts: ☐ Symmetrical   ☐ Asymmetrical
Nipples: ☐ Protruded ☐ Semi-protruded   ☐ Pseudo-inverted
☐ Inverted   ☐ Flat
Engorgement: ☐ No ☐   ☐ Yes   ☐ Right   ☐ Left ☐
Bilateral
Crack: ☐ No ☐ Yes   ☐ Right   ☐ Left
Aspect of breasts: ☐ full   ☐ flabby   ☐ milk retention
Signs of inflammation: ☐ No   ☐ Yes
Lactation: ☐ Poor   ☐ Abundant   ☐ Normal
Suction: ☐ No   ☐ Yes

PHYSICAL EXAMINATION OF THE ABDOMEN

Abdomen: ☐ Flat ☐ Globular   ☐ Distended   ☐Flabby
☐ Painful   Stretch marks
Auscultation (RHA): ☐ Present   ☐ Absent☐ Reduced   ☐ Enlarged
Pain on palpation: ☐ No   ☐ Yes
Bowel evacuations: ☐ Present ☐ Absent
Bleeding: ☐ No ☐   ☐ Yes
Urinary tract: ☐ Infection   ☐ Bleeding   ☐ Pain   ☐ Normal
Urination: ☐ Dysuria ☐ Oliguria ☐ Anuria ☐ Pyuria ☐ Hematuria ☐ Proteinuria
☐ Normal
Uterine height: ☐ < 1-2cm at umbilical scar ☐< 3-4 cm at umbilical scar
umbilical   **Incision:** ☐ No ☐ Yes   Type: ☐ Episiorrhaphy
☐ Cesarean section
Lochia: ☐ Red   ☐ Serous   ☐ Albo
Amount: ☐ Reduced   ☐ Moderate   ☐ Large

LOWER LIMBS

Skin color: ☐ Normally colored ☐ Cyanotic ☐ Pale ☐ Jaundiced
☐ Flushed ☐ Spotted
Skin characteristics: ☐ Turgid ☐ Dry ☐ Thickened ☐ Scaly
☐ Hydrated
Wounds/ Ulcers: ☐ Absent   ☐ Present
Edema :   ☐ No ☐ Yes   ☐ +/4+   ☐ ++/4+   ☐ +++/4+ ☐ 4+/4+
Varicose veins: ☐ No ☐ Yes ☐ Bilateral   ☐ MID ☐ MIE
Peripheral perfusion: ☐ Normal (up to 2 seconds) ☐ Changed
Homan Sign: ☐ Negative   ☐ Positive ☐ ☐ Right   ☐ Left
Flag Sign: ☐ Negative   ☐ Positive ☐ ☐ Right   ☐ Left