Preliminary Concept Rules of Determining Pregnancy Condition: Simbumil Data Analysis Result

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ABSTRACT
The purpose of this study was to establish pregnancy condition rules using pregnancy medical records called SIMBUMIL database- electronic pregnancy medical records (consists of a group of patient data, history data, pregnancy examination data, and physical examination information such as palpation, abdominal, auscultation and percussion examination). In this study SIMBUMIL database was analyzed by means of conducting a set of data analyses. The analyses were carried out by administering several stages, the first stage was identifying the function of each element in the medical record; second stage was understanding the contents of each element; the third was determining the interrelationship between data elements; and the last stage was determining conclusions. The results of the analyses process were the formation of rules that become the initial concept of making decisions about the condition of a pregnancy.

Keywords : *electronic medical record, SIMBUMIL, patient history, pregnancy examination, complication of pregnancy, pregnancy conditions, decision making.*

I. INTRODUCTION

According to [1] Medical records are files that contain identity, history, physical, laboratory, diagnosis and medical treatment of a patient recorded both in writing and electronically. Furthermore, it is elaborated that electronic medical records contains all health information such as medical history, diagnosis, treatment, date of immunization, and allergies as found in conventional medical records (Source: Practice Fusion). NHS Foundation Trust added that it is a collection of patient or population health information that is electronically stored systematically in a digital format. This recording can be used together by some different health services.

In addition to the above description, Smith (2013) mentioned that electronic medical records contain information about a person's health and treatment conditions that are used to make important decisions in the treatment process [2]. According to the Medical Practice Law in the explanation of article 46 paragraph, (1) what is meant by medical records is a file that contains records and documents about the patient's identity, examination, treatment, actions and other services that have been given to the patient. The definition of medical records is strengthened through the Regulation of the Minister of Health (Permenkes) No. 269/2008, stated that the type of medical record data can be in the form of texts (both structure and arrative), digital images (if it has applied digital radiology), sounds (such as heart sounds), videos and bio signal ones such as ECG recordings.

It is found that there are a number of advantages of implementing electronic medical records. One of which is that doctors can use electronic medical records whenever and wherever they are, without waiting for the medical records to be found or delivered to the doctors as conventional medical records.

However, the availability of electronic medical record databases in Indonesia currently less considers the relationship between health data elements that have been collected to predict the possibility of complications of pregnancy. Fitri in her research [3] stated that there was a relationship between the incidence of postpartum hemorrhage with the risk factor for prolonged labour and birth weight. This event gives an idea if only there are rules that look for links between data elements in the database that might provide a warning to doctors.

Therefore, researchers think to establish rules to help determine the possibility of complications for pregnancy. A patient undergoes a health check to determine the treatment of various health problems. Clinical examinations combined with the patient history, sometimes enough for doctors to determine the care needed and the treatment that should be given to the

patient. The availability of medical records that record the patient history data and clinical examinations for the pregnant patient can be used to determine the pregnancy condition and it can become a warning for any complications in a pregnancy [4].

The pregnancy condition that is used as a warning for a pregnancy complication can be prepared by forming rules of determining the pregnancy condition. The rules to determine the pregnancy condition are formed based on the current clinical condition of a prenatal care, such as the palpation examination results, abdomen, physical, auscultation, and the pregnant women history data. The formation of rules that can be used in making decisions about pregnancy conditions is the discussion topic of this paper. The applied rules use interrelated data elements and are indicators of the complication conditions in a pregnancy.

II. METHODS

In this study, the determination of data elements used in making the rules for pregnancy conditions is carried out through a data analyses process. The process consists of several stages, which are: the identification of each element functions in the medical record; the stage of understanding the content of each element; the determination of the relationship between data elements; and the stage of determining the pregnancy conditions, as shown in Figure 1.

Data analyses using SIMBUMIL database has a group of patient data, history data, and physical data consisting of *palpation*, *abdominal*, *auscultation*, and *percussion* data [4].

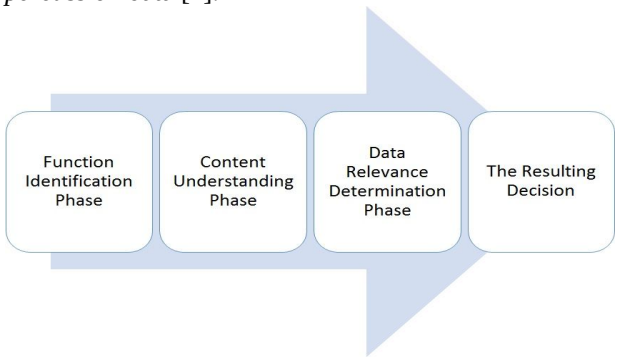

Figure 1 Data Analyses

The function identification phase is performed to determine the function of each attribute found in each relation (*file*) on the SIMBUMIL database. The content understanding phase of the attributes is done to know and understand the contents of the attributes. The data relevance determination phase is taken to obtain interrelated attributes in determining the pregnancy complication conditions in pregnant women. The conclusion stage of the pregnancy condition is completed to determine which complicating pregnancy conditions can be identified based on the content of the attributes.

The rules produced are in the form of the attributes that become the parameters for some pregnancy complications. The resulting decision is based on the contents of each attribute. The most important thing to produce this rule is the knowledge or information about the clinical condition relevance of the pregnant women.

The SIMBUMIL database has several entities identified as subjective and objective data as shown in Table 1. Subjective data consists of entities relating to the patient data and medical history data relevant to the pregnancy care. Objective data consists of entities that relate to examinations during a patient's care for pregnancy. This division of data groups provides an understanding that subjective data consists of master data and historical data, while objective data is transaction data.

Tabel 1. *SIMBUMIL database schema entity*

Types of Data	Entity Names
Subjective Data (patient's data)	Patient, Patient's_Husband, Patient's_Marriage, Patient's_Knowledge
Subjective Data (history data)	Disease_Record, FamilyDisease_Record, Menstruation_Record, Pregnancy_Record, Childbirth_Record
Objective Data	Examination_Record, Abdomen_Examination, Palpation_Examination, Percussion_Examination, Auscultation_Examination

The entity *Examination_Record* is an entity that functions to record the results of the current pregnancy examination, while the entity *Childbirth_Record* is an entity that records data on the previous pregnancies. Both entities, Examination Record and Childbirth Record are related since the Examination Record will be a historical data and placed in the Childbirth Record. A relationship is also showed between the entity Patient and *Disease_Record*. There is also a relation between the entity *FamilyDisease_Record* and *Disease_Record*. *FamilyDisease_Record* is an entity that stores data on hereditary family diseases and infectious diseases, while the entity *Disease_Record* is an entity that stores data on the disease suffered by the patients in their previous pregnancy and current pregnancy. The entity relation between patient relationships with several other relations in the History (*Anamnesis)* data group is shown in Figure 2.

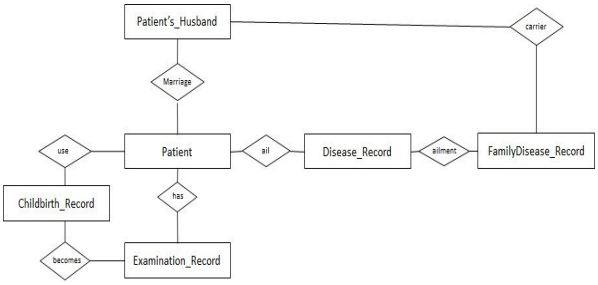

Figure 2 Entity relationships on conceptual schemes

III. DISCUSSION

The potential pregnancy complications can be detected early through medical record data. One way to get information about the pregnancy complication is through the provision of rules that can support the decision on whether or not the complicating conditions of pregnancy are present. The rules created for pregnancy complication which becomes the main causes of maternal deaths during pregnancy and childbirth are bleeding, hypertension, prolonged labour, and infection [5][6]. The rules of the labour complication condition are formulated from this condition: the abnormal baby's location or breech that might be the cause of the prolonged labour.

The forming of this rule is proceeded by performing the attribute functions identification process contained in the SIMBUMIL database. The identification is done to find out the attributes that become the factors to increase the pregnancy complication. The identification is carried out based on the pregnancy health literature. The function identification phase produces several attributes that complicate pregnancy, as shown in Table 2 which displays the pregnancy complication attributes in the form of a breech or transverse baby position.

Table 2 Pregnancy complication detection attributes feta malposition breech fetus

Attributes	Functions
Fundus Fetal Organ	This attribute stores organ data that is in the uterine fundus. Fetal organs that can be on the uterine fundus are the head, buttocks, back, legs or arms.
Uterus Right Side Border	
Uterus Left Side Border	
Fetus Back Location	This attribute is used to store the location of the fetus's back.
Fetus Small Section Location 1	Attributes for storing the fetus foot location data
Fetus Small Section Location 2	Contains location data of the Fetus's hand
The Lowest Fetus Part	Contains data of the fetus body part under the uterus
Baby's Heartbeat Location	The baby's heartbeat position is clear. If it is located in the center, the baby's position might be breech
Patient's Symptoms	Attributes storing patient symptoms related to the conditions that occur during the examination

Attributes as seen in the table 2 are obtained through the *Palpation* examination. The fetus organ position in the breech fetus indicates the fetus's head at the top with the foot approaching the cervix. The position of breech babies will be prone to pregnant women if they happen to an over 36 weeks old pregnancy. *Fundus Fetal Organ* Attributes is an attribute used to find out what organs are present in the uterine fundus. If the head is palpated, the fetus is breech. If it is empty, the baby's position is transverse. The occurrence of malposition of the fetus or breech fetus can lead to prolonged labour.

Prolonged labour or obstructed labour is the cause of maternal death during a delivery [7]. Several things that cause the occurrence of a prolonged or obstructed labour can be identified based on the data of several attributes that have been provided on SIMBUMIL as stated in Table 3.

Table 3 Difficulty for prolonged/obstructed labour.

Conditions	Attributes
Fetus Malposition	1. Fundus Fetal Organs 2. The lowest fetal part 3. Punctum Maximum 4. Position of the Fetus Back
Big Fetus	1. The increased fundal height is above normal 2. Recorded Disease 3. Family illness
Labour Opening - Time	1. No_Pregnancy 2. Time1_Duration 3. Time2_Duration 4. Time2_Water Break 5. Time2_Meneran 6. Time2_Vulva 7. Time2_Baby's Weight
Tumor	Recorded Disease

Conditions that can cause the prolonged labour can be identified by several attributes that have been available at SIMBUMIL, such as data stored on the examination of labour (times). The fetal malposition location can also be an indicator of the prolonged labour that can be detected through *palpation* examination attribute containing fetal position data. In addition, the results of auscultation associated with the data location *punctum maximum* provides data on the location of the fetal heartbeat. *The Punctum Maximum* is used to determine the clear position of the fetal heartbeat (FHR).

Understanding the content of the attribute must also be done to determine the presence or absence of pregnancy complications. The attribute content of understanding phase is done to find out the meaning of the data filled. The data filled in the SIMBUMIL database attribute is the conclusion of the results of the examination conducted by the Midwife or Doctor, for instance, the examination conclusion used is the examination of the pregnant women pulse. The results of the pulse examination will be concluded according to the criteria used, called the normal pulse, *tachycardia* (heart rate too fast than normal), and *bradycardia* (heart rate slower than normal).

This phase is carried out to determine the health condition of the pregnancy based on the attribute contents. The potential pregnancy complications, fetus malposition or breech can be known when the normal pregnancy condition is not fulfilled, as stated on Table 4.

Tabel 2 Normal Position Condition on a fetus palpation examination

Attribute	Data (normal condition)
Fundus Fetus Organ	Buttock palpated
Uterus Right Side Border	Back or fetus small part
Uterus Left Side Border	Back or fetus small part
Fetus Back Location	Uterus Right Side Border or Uterus Left Side Border
Fetus Small Section Location 1	Uterus Right Side Border
Fetus Small Section Location 2	Uterus Left Side Border
The Lowest Fetus Part	Head
Baby's Heartbeat Location	Left or Right symphysis

The data entered on the attribute is based on the examination results of the palpation examination. Fetal organs that are recognized in the palpation examination among others are: head, buttocks, back, legs, and hands. If the fundus uteri palpation examination results in the palpation of a head or no palpable organ found (empty), the position of the baby is abnormal or malposition. *The Punctum Maximum* which indicates the potential fetus malposition is at the left position of the *prosesus xifoideus* (bottom part of the *sternum*), right *prosesus xifoideus*, left center, and right center. The *maximum punctum* position in the left or right center indicates the transverse fetus position.

Tabel 3 Palpation Condition and Time Examination which has the potential of prolonged/ obstructed labour

Attribute	Data (normal condition)
Fundus Fetus Organ	Palpation of head or empty
The Lowest Fetus Part	Buttocks, back, legs, or hands
Punctum Maximum	Left prosesus xifoideus, right prosesus xifoideus, Left Center, Right Center
Fetus Back Location	Uterus
No_Pregnancy	1 (primigravida), 2 (multigravida)
Time1_Duration	24 or 18
Time2_Duration	2 hours
Time2_Water Break	Abnormal (early break)
Time2_Meneran	Normal, abnormal
Time2_Vulva	Abnormality
Time2_Baby's Weight	Fetus too large

This malposition condition can be used to determine the potential prolonged/obstructed labour. The prolonged labour is a difficult labour and is characterized by too slow progress. The prolonged labour can occur due to several abnormalities, one of which is a disorder involving the fetus.

Another indication of the prolonged labour is the extension of the latent phase or active phase, or both. The prolonged labour is a primigravida labour lasting more than 24 hours and multigravida lasts more than 18 hours [3], and the Time_2 is > than 2 hours [8]. This indication can be known at the time of labour (Time), especially at the Time_1 and Time_2 checks. The attribute contents that show the potential for prolonged / obstructed labour are shown in Table 5.

The attributes needed in determining the potential emergence of complications in breech / transverse fetuses are taken from the *Auscultation_examination*, *Palpation_Examination*, and *Examination_Record*. Attributes taken from the*Examination_Record* are

attributes of complaints. A view to get the required data can be created by using the following query:

```
SELECT Name, Patient's Symptoms,
       FundusFetalOrgan,
       UterusRightSideBorder,
FROM   Patient, Examination_Record,
       Palpation_Examination,
       Auskultasi_Examination
WHERE  Name=v_patient'sname AND
       convert(nvarchar(11),Date_Chec
       kup,103) =
       convert(nvarchar(11),
       GETDATE(),103)
```

Attributes needed to determine the potential pregnancy complications of prolonged/obstructed labour, and the view formation of the required data can be created by using the following query:

```
SELECT Name, FundalHeight, Fundus Fetus
       Organ, Fetus Back Location, The
       Lowest Fetus Part,
       PunctumMaximum, Disease,
       FamilyDisease,
       Number_Pregnancy,
       Time1_Duration,
       Time2_Duration,  Time2_Water
       Break,  Time2_Meneran,
       Time2_Vulva,  Time2_Baby's
       Weight
FROM   Patient, Disease_Record,
       FamilyDisease_Record,
       Examination_Record,
       Palpation_Examination,
       Auscultation_Examination
WHERE  Name=v_patientName
AND    Disease ='Tumor' AND
       Convert(nvarchar(11),Date_Chec
       kup,103) =
       convert(nvarchar(11),
       GETDATE(),103)
```

The rules used to determine the potential for pregnancy complications have the following structure:

```
IF condition (view_tabel) = condition
(normal_tabel) then finding = "Normal"
```

This rule uses two tables with the same data structure. The first table (view_tabel) is a table formed using queries from the SIMBUMIL database. The second table (normal table) is a table prepared with the content attribute for the normal conditions of each pregnancy complication. The contents of the two tables will be compared. If each attribute has the same content, the pregnant woman health will be in a good condition.

```
       UterusLeftSideBorder,
       FetusBackLocation,
       FetusSmallSectionLocation1,
       FetusSmallSectionLocation2,
       TheLowesFetusPart,
       PunctumMaximum
```

The difference in the content attribute will be a concern for the potential pregnancy complication

IV. CONCLUSION

A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

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