Analysis of Expert System for Early Diagnosis of Disorders During Pregnancy Using the Forward Chaining Method

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ABSTRACT

Now a days technological developments are increasingly having a positive influence on the development of human life, including in the health sector. One of them is an expert system that can transfer an expert's knowledge into a computer application to simplify and speed up the diagnosis of a disorder or disease in humans. The purpose of this final project is to design an application to diagnose diseases that occur during pregnancy which is caused by the existence of these pregnancies to simplify and speed up the diagnosis of diseases experienced by pregnant women. This study uses the forward chaining method. By involving experts in this expert system analysis according to current needs. Users are given easy access to information on several types of pregnancy disorders and their symptoms, as well as consultation through several questions that the user must answer to find out the results of the diagnosis. While experts are facilitated in system management, both the process of adding, updating and, deleting data.

I. Introduction

Pregnancy is happy for the family, but also requires sacrifice[1] that is not easy for a mother. Sometimes pregnancy [2]brings problems to the health of pregnant women. Knowledge of the disorders that occur during pregnancy[1], [3] is needed, especiallyor pregnant women[4], [5], because they are the ones who feel the disturbances [6], [7]directly. The many disorders caused by pregnancy make it difficult to diagnose, especially since some pregnancy disorders have similar symptoms. This causes the time needed to diagnose disorders[8] that occur in pregnant women to be longer, while pregnant women need fast results [9]to find out what disorders they are experiencing. Therefore we need a computer-based [10]tool that can help them to diagnose disorders in pregnancy to be more accurate[11]. With the rapid advancement of computer technology, technology helps people in various fields of life, one of which is the health sector. Currently, computer technology[12] help solves problems that occur, such as performing operations, medical check-ups[13], and others. One of the computer technologies used is Artificial Intelligence (artificial intelligence). One part of an artificial intelligence system [14]is an expert system which is a computer program that mimics expert thinking and knowledge to solve a specific problem[15] The implementation of an expert system is seen as a way of storing expert knowledge in a particular field into a computer program in such a way that it can make decisions[16] and make intelligent reasoning. During its development, expert systems help people in various fields, including in the health sector[17]. Thus, an expert system can be used to assist in diagnosing early pregnancy disorders. [3], [18][19]

II. Research Method

A. Collecting Data

Andhika Adhitama Gama (2015) [20]Expert system for early detection of website-based Herniated Nucleus Purposes (HNP) uses the Naïve Bayes method[21], in his research he says the system is more accurate, it's just that the drawback is that it is not integrated with a clinic or hospital.

B. Maintaining the Integrity of the Specifications

Pregnancy

The following are some definitions of pregnancy:

Pregnancy is the union of sperm from a man and an ovum from a woman. Pregnancy is a period starting from contraception until the fetus is born, the normal length of pregnancy is 280 days, or 9 months and 7 days, which is calculated from the first day of the last menstrual period. Pregnancy is a woman containing a fertilized egg or pregnancy by sperm.

1. Etiology of Pregnancy

will occur if there are the following 5 aspects, namely:

Ovum

The ovum is a cell with a diameter of approximately 0.1 mm consisting of a nucleus floating in the vitellus surrounded by the zona pellucid by Radiata chromosomes.

Spermatozoa

Shaped like a tadpole, consisting of a slightly flattened oval head containing a core, a neck that connects the head to the middle, and a tail that can move so that sperm can move quickly.

Conception a fusion event between sperm and ovum in the fallopian tube.

Nidation

Nidation is the entry or implantation of the product of conception into the endometrium.

Placentation

Placentation is a very important tool for the fetus which is useful for the exchange of substances between mother and child and vice versa.

2. Signs of pregnancy

Pregnancy has signs of whether a mother is pregnant or not, here are the signs of pregnancy:

a. Amenorrhea

If a woman is pregnant when she is already married complains of having late menstruation, then the mind that she is pregnant, despite the stress, drugs, chronic diseases can also result in delayed menstruation.

b. Nausea and Vomiting

Nausea and vomiting are common symptoms, ranging from bad taste to prolonged vomiting. In medicine, it is often called morning sickness because it occurs often in the morning.

c. Matodynia

Is a feeling of tightness and pain in the breasts caused by enlarged breasts?

d. Complaints of urinating

Increased urinary frequency and frequent nighttime urination, caused by the pressure of the enlarged uterus and the cranial pull by the uterus.

e. Change in weight

In 2-3 months of pregnancy, there is often weight loss, due to decreased appetite and vomiting.

f. Changes in basal temperature

g.A rise in basal temperature for more than 3 weeks is usually a sign of pregnancy.

h. Breast changes

i.Due to the stimulation of prolactin and HPL, the breasts secrete colostrum, usually after a gestation of more than 16 weeks.

j. Uterine changes

The uterus changes in size, shape, and consistency. The uterus turns soft and globular in shape.

k. There is a fetal pulse (FHR from 18-20 weeks)

l. Feel the movement of the child (started at 18-20 weeks UK)

III. Result

In advanced reasoning, the rules are tested one by one in a particular order. When every rule is tested, an expert system will evaluate whether the conditions are true or false. If the conditions are correct, then the rule is saved and then the next rule is tested. This process will be repeated until the entire rule base is tested under various conditions. According to Giarattano and Reley (1994), the advanced inference method is very suitable for handling control (controlling) and forecasting (diagnosis). Knowledge in production rules is presented in the form(1):

IF [antecedent] THEN [konsekuen]

IF [kondisi] THEN [aksi]

IF [premis] THEN [konklusi]

The rules in the production rule are classified into the first-degree rule and the meta-rule. Rule (2) the first degree is a rule whose concluding part is not the premise of another rule. on the other hand, the meta-rule is a rule whose conclusions are the premise for other rules. The following shows how, how the advanced continuous inference method works.

A=1   IF A=1 AND B= 2

B=2   THEN C=3 AND D= 4

    IF C = 3 THEN D= 4

A. Knowledge Acquisition

Table1. Symptom/disease coding matrix

No	SymptomCodes	01	02	03	04	05	06	07	08	09	10	11	12	13	14
1	G001	1	1											1	1
2	G002	1	1												1
3	G003	1													
4	G004	1	1												1
5	G005	1	1											1	1
6	G006	1	1												1
7	G007		1		1	1									1
8	G008		1								1	1			1
9	G009		1	1	1	1								1	1
10	G010		1											1	1
11	G011		1												1
12	G012														1
13	G013		1												1
14	G014														1
15	G015				1	1	1								
16	G016				1	1	1								
17	G017					1	1								
18	G018						1								

19	G019	1							
20	G020		1	1	1				
21	G021					1	1	1	1
22	G022		1		1				
23	G023	1	1	1					
24	G024			1	1				
25	G025			1	1				
26	G026				1				
27	G027				1				
28	G028					1	1	1	1
29	G029		1	1	1				
30	G030						1	1	1
31	G031						1	1	1

explanation :

1. Codes beginning with the letter G are codes for symptoms.
The following is a description of each code:

Symptom Codes	Table Symptom
	Table column subhead
G001	Excess headaches
G002	Gaining excess weight
G003	Blood pressure between 140/90 or 160/110
G004	Proteinuria
G005	Swelling of the face and hands
G006	There is swelling in other parts
G007	Yellow eyes
G008	Pain in the stomach
G008	Nausea and vomiting
G009	Vaginal bleeding
G010	Vaginal bleeding
G011	Blurred vision
G012	Proteinuria +3
G013	Blood pressure greater than or equal to 160/110
G014	Convulsions
G015	The tongue is dry and dirty
G016	Vomiting continuously until the mother feels weak
G017	Difficulty defecating
G018	Loss of consciousness
G019	Double vision

Symptom Codes	Table Symptom
	Table column subhead
G020	Vaginal bleeding occurs before 20 weeks of gestation
G021	Vaginal bleeding occurs after 20 weeks of gestation
G022	Lower abdominal pain
G023	Upper abdominal pain
G024	Pain that radiates throughout the lower abdomen
G025	Shoulder pain
G026	Pain during bowel movements
G027	There is a lump on the back of the hip
G028	Fresh red blood
G029	colic
G030	Blackish blood
G031	Uterus tense like a plank

Codes beginning with the letter P are codes for disturbances.
The following is a description of each code:

Disease Code	Keterangan
	Disease Data
P001	Mild Pre Eclampsia
P002	Severe Pre-Eclampsia
P003	Hyperemesis Gravidarum level 1
P004	Hyperemesis Gravidarum level 2
P005	Hyperemesis Gravidarum level 3
P006	Abortus
P007	Disturbed ectopic pregnancy
P008	Retrouterine hematocele
P009	Placenta Previa
P010	Mild Placenta Solution
P011	Medium Placental Solution
P012	Heavy Placental Solution
P013	Mola Hidatidosa
P014	Eclampsia

B. Rule Production

Production rules are usually written in the form if-then (IF-THEN) which can be said to be a two-part implication relationship, namely the premise (if) and the concluding part (then). Premise and conclusion rules can relate to "OR" or "AND". The following are production principles in identifying disease:

Rule 1 Rule 1

IF Excessive headache '20'

AND Excessive weight gain '20 '

AND Blood pressure between 140/90 or 160/110 '15'

AND Proteinuria '45'

THEN Mild Pre-EclampsiaAturan 2 Rule 2

IF Vomiting continuously until the mother feels weak

AND Vaginal bleeding occurs before 20 weeks of gestation

THEN Impaired ectopic pregnancy

In the case of tracing the decision tree above, there is a problem, that is, not all symptoms can be detected according to the facts in the field, therefore as an expert, give a weight of 50% if a disease is detected that has a weight of more than 50% then the disease is detected and if it is less than 50% doubtful disease.

C. Matrix Value

Symptom / Disease matrix table

Symptoms (G) / Disease (P)	Value Table													
	P001	P002	P003	P004	*P005*	P006	P07	P008	P009	P010	P011	*P012*	P013	P014
G001	20					30		30	20	20	20			
G002	20										20			
G003	15										15			
G004	45										45			
G005		40										40		
G006		30										30		
G007			45										45	
G008				40										40
G009				40										40
G010			40		40								40	
G011						50								
G012						40								
G013							40							
G014							30							
G015								45	30					

Sympt oms (G) / Disease (P)	Value Table													
	P0 01	P0 02	P0 03	P0 04	*P0 05*	P0 06	P 07	P 00 8	P0 09	P0 10	P0 11	*P0 12*	P0 13	P0 14
G016								30						
G017									30					
G018									20					
G019				40					30					
G020	100	70	85	80	80	50	70	70	75	80	100	100	70	85	80

Sample case

Table 5. Sample case

Code	Contoh			
	Answer	*Weight*	*Direction*	*Description*
G001	Ya	right	45	G002
G002	Ya	right	20	G003
G003	Ya	right	15	G004
G004	Ya	right	15	G001

In the case example above the symptoms are met with a weight of 90%, the disease detected is P001 disease.
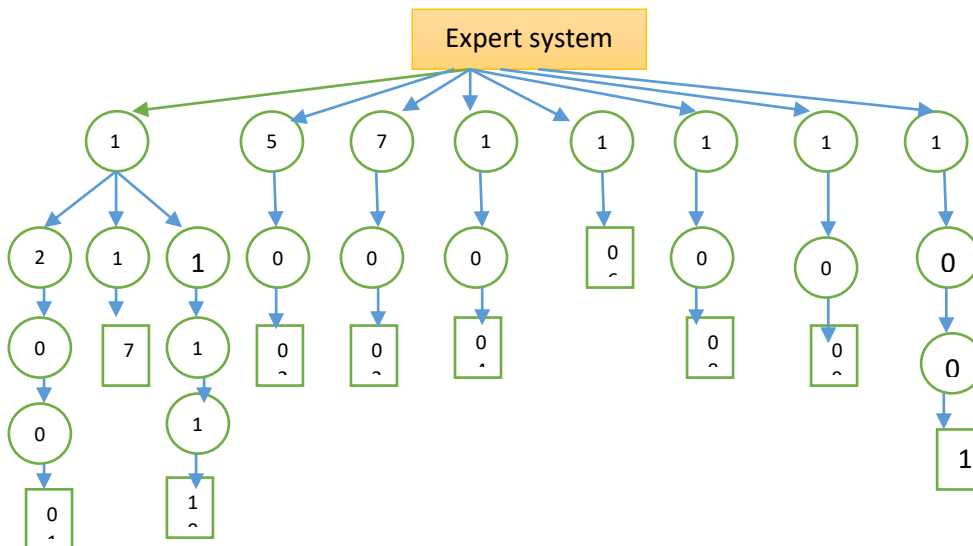

Figure 1. Diagnosis tracking tree for pregnancy symptoms

In Figure 1 above are the symptoms used in the initial question in an expert system for the early diagnosis of pregnancy disorders. If G001 is answered "YES" then it will go to G002 until P001 is found and so on, After the symptoms are grouped according to each disease and an examination is carried out on the knowledge base, the system can provide analysis results in the form of diseases attacked, symptoms that arise and diseases and suggestions for handling them.

IV. Conclusion

Expert System for Early Diagnosis of Disorders During Pregnancy Using the forward-chaining approach can help the process of diagnosing pregnancy disorders so that the diagnosis process is faster and this expert system has an output in the form of solutions about disorders that occur during pregnancy and provides explanations, levels of risk, anticipation and methods. treatment that must be done for the disorder that is being experienced. A Suggestion in developing Early Diagnosis of Disorders during Pregnancy with an Expert System Approach is that the making of the matrix should be done automatically by the system to make it easier for experts to analyze the system. The knowledge base of the system, namely data on pregnancy disorders, will be even better if it is added with data from the latest findings or research therefore the results of the diagnosis will be more accurate and the information obtained will be more complete.

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