



Expert System for Diagnosis of Uterine Myomas Using the Certainty Factor Method

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Abstract

An expert system which is part of artificial intelligence is a computer system that is able to imitate the reasoning of an expert with certain expertise. An expert system in the form of software can replace the role of an expert (human) in the decision-making process based on the symptoms given to a certain level of certainty. This study raises the problem that many women experience, namely not understanding that they have uterine myomas. Many women do not understand and are not aware that there are already symptoms that are felt and these symptoms are symptoms of the presence of uterine myomas in their bodies. Therefore, it is necessary for women to be able to diagnose independently so that they can take treatment as quickly as possible. In this study, the expert will first provide the expert CF values. Then the user / respondent gives an assessment of his condition with the CF User values. In the end, the values obtained from these two factors will be processed using the certainty factor formula. Users must provide answers to all questions given by the system in accordance with their current conditions. After all the conditions asked are answered, the system will display the results to identify that the user is suffering from uterine myoma disease or not. The Expert System with the certainty factor method was tested with a patient who entered the symptoms experienced and got the percentage of confidence in uterine myomas/fibroids of 98.70%. These results indicate that an expert system with the certainty factor method can be used to assist in diagnosing uterine myomas as early as possible.

Keywords: Disease diagnosis system, Expert System, Certainty Factor, Uterine Myomas

1. Introduction

Reproductive health problems in women can be said to be one of the important problems to get attention from all elements of society. So that health development is directed at improving the degree of public health, the quality of human resources, monitoring the reach of health services and the quality of health services life. In Indonesia as a developing country, there are about 25-50% of deaths of women of childbearing age caused by problems related to pregnancy and childbirth as well as reproductive system diseases such as uterine myomas [1]. Uterine fibroids are the most common neoplasm in women and it has been postulated that they occur in more than 70% of women at the beginning of menopause [2].

A study conducted by [3] states that the incidence of reproductive disorders in developing countries reaches 36% of the total burden of illness suffered during the productive period. It is estimated that the incidence of uterine myoma is about 20%-35% of all women in the world [3].

The factors that cause uterine myomas/fibroids are not known for certain, but there are studies which state that a family history of the disease can be inherited genetically. The results of the analysis conducted at RSUD Prof. Dr. W. Z. Johannes Kupang showed a relationship between family history and the occurrence of uterine myomas/fibroids, including age of menarche and parity [4].

Classically the characteristics of uterine myomas /fibroids and uterine anatomy are considered to be almost unique problems in gynecology and reproductive medicine. Decisions by improving clinical diagnosis for this type of pathology, allow for improved personal care, as well as a reduction in potential risks and unnecessary surgery [5].

Uterine fibroids (leiomyomas or myomas), benign monoclonal tumors, are the most common benign tumors in women. Heavy or prolonged menstrual bleeding, abnormal uterine bleeding, resulting anemia, abdominal pain, infertility, and / or recurrent pregnancy loss are commonly associated with uterine fibroids [6]. Uterine fibroids are one of the most important female reproductive health problems for prevention. For this reason, it is necessary to know what causes uterine myomas so that all women can do early detection. Therefore, it is necessary to promote health so that preventable/modifiable risk factors can be minimized to reduce the chance of developing uterine myomas.



Expert systems must be able to work in uncertainty. A number of theories have been found to resolve uncertainty, including the certainty factor. Certainty factor is a method to prove whether a fact is certain or uncertain in the form of a metric that is usually used in expert systems. This method is very suitable for expert systems that diagnose something that is not certain. The purpose of this study is to design an application for diagnosing uterine myomas with the certainty factor method to make it easier to determine whether a woman is suffering from uterine myoma based on the symptoms or complaints she experiences with the certainty factor method that has been made in this application.

2. Literature Review

Article [7] describes research with the method used is the Certainty Factor of ten diseases that can be diagnosed, namely haemorrhoids, nephrolithiasis, diabetes mellitus, hypertension, hepatitis, tuberculosis, bronchitis, sinusitis, gout, and rheumatism. The result of this research is a web-based expert system that is used to assist people in diagnosing diseases that can be cured by Bawang Dayak.

In research [8] describes gastritis which is divided into two, namely acute (develops quickly and suddenly) and chronic (developing slowly) with symptoms that often appear are pain, discomfort in the upper abdomen, nausea, vomiting, and indigestion. Most people do not understand the type of illness suffered because they do not have knowledge about that disease. Therefore, researchers recommend a system that can help people to be able to diagnose gastritis. The system used by the researcher is an expert system with certainty factor method. With this system, people who suffer from the symptoms of the disease and find it difficult to go to a hospital far from the home then can try this system to find out earlier before going to the doctor.

In the article [9] explains how certainty factors can be used in diagnosing dental and oral health. Periodontal disease is a gum disease caused by bacteria that damage the supporting tissues teeth and cause tooth loss. The certainty factor method used for calculations because the certainty factor method can solve the uncertainty of a problem by measuring one's beliefs. The result of this research is an expert system that can generate the name of the periodontal disease and the degree of certainty of the user's disease.

In addition, research [10] aims to develop system or software that can replace doctors for the identification process heart defects based on expert system. The expert system was developed with certainty factor with a double rule approach. In research [11], researchers make an android-based expert system application that can provide information to users about the disease that is being suffered through symptoms experienced by the user. Expert system creation processes the application uses a certainty factor method.

Based on previous research, it can be seen that expert systems with certainty factor methods can be used in diagnosing various diseases.

3. Method

Certainty factor is a belief in an event (fact or hypothesis) based on evidence or expert judgment. To get the level of confidence (CF) of a rule is obtained by interviewing an expert. The CF value (Rules) comes from the interpretation of the expert, which is converted to a certain CF value according to the following table I [7]:

Table 1. Certainty Factor Value And Interpretation

Uncertain Term	Value of CF
Definitely not	- 1.0
Almost certainly not	- 0.8
Probably not	- 0.6
Maybe not	- 0.4
Unknown	- 0.2 to 0.2
Maybe	0.4
Probably	0.6
Almost certainly	0.8
Definitely	1.0

Table 1 above shows the Certainty factor using the value of an expert to assume a level of confidence in the data. The certainty factor is also used to determine the confidence value of the initial facts given by the users.

In the system to be built, identification of the users involved in this expert system has been carried out. In data processing and decision making for uterine myoma disease diagnosis, Certainty Factor has the following IF E THEN H rules [12]:

$$CF(H,e) = CF(E,e) * CF(H,E) \quad (1)$$

$$CF_{combine}CF[H,E]_{1,2} = CF[H,E]_1 + CF[H,E]_2 * [1 - CF[H,E]_1] \quad (2)$$

$$CF_{combine}CF[H,E]_{old,3} = CF[H,E]_{old} + CF[H,E]_3 * (1 - CF[H,E]_{old}) \quad (3)$$

Information:

CF(E,e) = Certainty Factor E evidence that is influenced by evidence e

CF(H,E) = Certainty Factor hypothesis assuming evidence is known with certainty, namely when

CF (E, e) = 1

CF(H,e) = Certainty Factor hypothesis that is influenced by evidence e

The following is a table of diseases consisting of uterine myomas and ovarian cysts. Ovarian cysts have some symptoms similar to uterine myomas/fibroids, so they are added for comparison.

Table 2. Type of Disease

No	Disease Code	Disease Name
1	P01	Uterine Myomas/Fibroids
2	P02	Ovarian Cyst

Table 2 is the type of disease to be diagnosed. To determine the symptoms felt by the user or sufferer, a code is made for each of these symptoms as shown in the following table:

Table 3. Symptoms of Disease

Symptom Code	Symptom Name
S01	Heavy menstrual bleeding
S02	Menstrual periods lasting more than a week
S03	Pelvic pressure or pain
S04	Frequent urination
S05	Difficulty emptying the bladder
S06	Constipation
S07	Backache
S08	Leg pains
S09	Pain during intercourse
S10	Infertility
S11	Miscarriage
S12	Discomfort in the lower abdomen
S13	Enlarged belly
S14	Menstrual disorders such as irregular menstrual periods
S15	Nausea and vomiting
S16	The stomach feels bloated
S17	Pain during sexual intercourse
S18	Back and thigh pain
S19	Pain in breast
S20	Fever
S21	Body feels weak
S22	Very annoying pelvic pain

Table 3 above is a table of symptoms of the disease that may be felt by the user or sufferer. These symptoms are symptoms that can occur in uterine myomas and or ovarian cysts.

Table 4: Rule Symptoms Table

Symptom Code	P1	P2
S01	X	
S02	X	X
S03	X	
S04	X	
S05	X	
S06	X	
S07	X	
S08	X	
S09	X	
S10	X	
S11	X	
S12	X	
S13	X	X
S14	X	
S15		X
S16		X
S17		X
S18		X
S19		X
S20		X
S21		X
S22		X

Table 3 above is a table of symptoms of the disease that may be felt by the user or sufferer. These symptoms are symptoms that can occur in uterine myomas/fibroids and or ovarian cysts.

Table 5: CF Expert Value

Symptom Code	CF Expert
S01	0.4
S02	0.8
S03	0.8
S04	0.6
S05	0.6
S06	0.6
S07	0.6
S08	0.8
S09	0.6
S10	0.6
S11	0.4
S12	0.8
S13	0.8
S14	0.6
S15	0.4
S16	0.4
S17	0.6
S18	0.6
S19	0.6
S20	0.4
S21	0.6
S22	0.8

Table 3 above is a table of symptoms of the disease that may be felt by the user or sufferer. These symptoms are symptoms that can occur in uterine myomas and or ovarian cysts.

4. Result and Discussion

The following is an example of a known case of patient x who is 45 years old who wants to carry out a self-diagnosis process whether he suffers from uterine myoma with symptoms of the disease as follows: pelvic pain, leg pain, back pain, constipation, enlarged stomach size, frequent urination, menstrual period lasts more than a week.

Table 6. Table Example Case

No	Symptoms	Disease	
		P1	P2
1	Pelvic pain	S03	
2	Leg pain	S08	
3	Backache	S07	
4	Constipation	S06	
5	Enlarged belly	S13	S13
6	Frequent urination	S04	
7	Menstrual periods lasting more than a week	S02	S02

Table 6 above is data from patients grouped by symptom code and possible disease.

Table 7. Patient X Symptom Input Data

Symptom Code	CF User	CF Expert	Final CF (CF User x CF Expert)
S03	0.8	0.8	0.64
S08	0.6	0.8	0.48
S07	0.4	0.6	0.24
S06	0.6	0.6	0.36
S13	0.8	0.8	0.64
S04	0.4	0.6	0.24
S02	0.6	0.8	0.48

Table 7 above is the next step is to change the patient's answer into a CF value (CF User) whose weight can be seen in table 7 below. After that the CF User value is multiplied by the CF expert value which will produce the final CF value. Based on the final CF value, the combined CF value is calculated based on equations (2) and (3).

CF Uterine Fibroids (P1) :

$$CF_{combineCF[H,E]1,2} = CF[H,E]1 + CF[H,E]2 * [1 - CF[H,E]1] = 0 + 0.48 (1-0) = 0.48$$

$$CF_{combineCF[H,E]old,3} = CF[H,E]old + CF[H,E] 3 * (1 - CF[H,E] old) = 0.48 + 0.64 (1-0.48) = 0.8128$$

$$CF_{combineCF[H,E]old,4} = CF[H,E]old + CF[H,E] 4 * (1 - CF[H,E] old) = 0.8128 + 0.24 (1-0.8128) = 0.857728$$

$$CF_{combineCF[H,E]old,5} = CF[H,E]old + CF[H,E] 5 * (1 - CF[H,E] old) = 0.857728 + 0 (1-0.857728) = 0.857728$$

$$CF_{combineCF[H,E]old,6} = CF[H,E]old + CF[H,E] 6 * (1 - CF[H,E] old) = 0.857728 + 0,36 (1-0.857728) = 0.908946$$

$$CF_{combineCF[H,E]old,7} = CF[H,E]old + CF[H,E] 7 * (1 - CF[H,E] old) = 0.908946 + 0,24 (1-0.908946) = 0.930799$$

$$CF_{combineCF[H,E]old,8} = CF[H,E]old + CF[H,E] 8 * (1 - CF[H,E] old) = 0.930799 + 0,48 (1-0.930799) = 0.964015$$

$$CF_{combineCF[H,E]old,9} = CF[H,E]old + CF[H,E] 9 * (1 - CF[H,E] old) = 0.964015 + 0 (1-0.964015) = 0.964015$$

$$CF_{combineCF[H,E]old,10} = CF[H,E]old + CF[H,E] 10 * (1 - CF[H,E] old) = 0.964015 + 0 (1-0.964015) = 0.964015$$

$$CF_{combineCF[H,E]old,11} = CF[H,E]old + CF[H,E] 11 * (1 - CF[H,E] old) = 0.964015 + 0 (1-0.964015) = 0.964015$$

$$CF_{combineCF[H,E]old,12} = CF[H,E]old + CF[H,E] 12 * (1 - CF[H,E] old) = 0.964015 + 0 (1-0.964015) = 0.964015$$

$$CF_{combineCF[H,E]old,13} = CF[H,E]old + CF[H,E] 13 * (1 - CF[H,E] old) = 0.964015 + 0.64 (1-0.964015) = 0.987046$$

$$CF_{combineCF[H,E]old,14} = CF[H,E]old + CF[H,E] 14 * (1 - CF[H,E] old) = 0.987046 + 0 (1-0.987046) = 0.987046$$

So, the percentage of confidence in uterine myoma/fibroid is: Confidence Percentage= CF * 100% = 0.987046 * 100% = 98,70%

Based on the symptoms of the disease above, it can be concluded that the disease suffered by the patient was uterine myoma/fibroid with a percentage of 98.70%. A diagnostic application that has been provided as a place for users to diagnose uterine myomas or ovarian cysts by selecting predetermined symptoms, so that conclusions will be made about the type of disease suffered.

No	Code	Symptom	Select Condition
1	S01	Heavy menstrual bleeding	If appropriate, please select
2	S02	Menstrual periods lasting more than a week	If appropriate, please select
3	S03	Pelvic pressure or pain	If appropriate, please select
4	S04	Frequent urination	If appropriate, please select

Fig 1. Disease diagnosis application form

5. Conclusion

The expert system with the certainty factor method has been tested on a patient who enters data on complaints or symptoms he feels. Then the results obtained are the percentage of confidence in uterine myomas/fibroids of 98.70%. Based on the results obtained and the analysis carried out for the design of an expert system application with a certainty factor in diagnosing a person's illness, it can be concluded that the certainty factor method can make it easier to determine whether a woman has uterine myoma based on the symptoms or complaints she feels.

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