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Expert System Diagnosing Gastroesophageal Reflux Disease (GERD) Using Certainty-Factor Method

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A R T I C L E I N F O

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ABSTRACT

GERD is one of the digestive system deseases that is often infected in the community, and people do not take this gastric disease seriously, this disease can cause inflammation of the throat due to stomach acid that always rises to the throat and if not treated seriously can lead to cancer. throat. The expert system in diagnosing GERD disease using the certainty-factor method is made to diagnose GERD disease early without having to go to a doctor for a diagnosis, besides this system can diagnose types of GERD disease in acute and chronic categories. This system uses the certainty-factor method because this method is suitable for measuring something that is certain or uncertain in diagnosing based on the symptoms caused. This system uses SDLC as its stage which has 5 stages including planning, analysis, design, implementation, and maintenance. besides this system is made using Mysql and PHP programming language.

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1. INTRODUCTION

An unhealthy lifestyle can cause a digestive system disease in which stomach acid will be produced in excess until there is a spike so that the excess gastric acid rises to the throat and causes irritation, this disease is called GERD. If this disease is not treated properly, the disease can lead to throat cancer (Assyifa, 2019).

According to the Map of Digestive Disorders and Diseases (2008) in Tarigan dan Pratomo (2019) that the percentage of the population affected by GERD in the United States, United Kingdom, Australia, China, Japan, Malaysia, and Singapore ranges from 15%, 21%, 10.4%, 7 ,28%, 6.60%, 38.8%, and 1.6%, but in Indonesia there is no exact data on the number of population data infected with GERD. However, the number of people's complaints in Indonesia about the disease needs to be a serious concern (Azwar, A., & Gorontalo, 2018).

An expert system is a computer-based application that is used to solve a problem that refers to the thoughts of experts (Santoso et al., 2020). According to Wicaksono et al. (2019) in Ilham, Wahyudin dan Hidayatullah (2020) the expert referred to here is someone who has an expertise or expert in a particular field so that the data or knowledge obtained from the expert will be entered into a system that will be built later.

Based on these problems, an expert system is needed that can diagnose GERD by using an expert system. The patients' suffering from GERD can diagnose their disease without having to go the hospital to be diagnosed by a doctor (Saputera & Budianto, 2017). The method used in this expert system is certainty-factor and is built using MySQL and PHP as the programming language. It is hoped that the construction of this expert system can help the community in overcoming GERD.

2. RESEARCH METHOD

This study uses the SDLC method to build the system, the following is a picture of the methodology in this study.

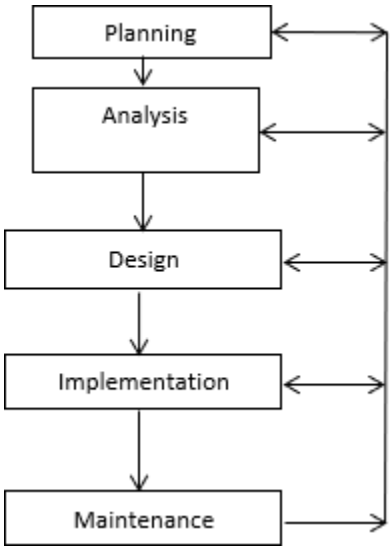

Figure 1. SDLC Method

In this method there are 5 stages including (Hidayat et al., 2019):

1. Planning
   In the planning stage in this research, it consists of formulating the background of the problem, determining case studies. The method to be used is the certainty-factor method, searching for literature studies related to the study, and interviews with experts.
2. Analysis
   The next stage is the analysis stage. This stage will get supporting data and information that will be used in the development of expert system research to be made.
3. Design
   The next stage is the design stage. In this stage it is carried out to create an expert system design in diagnosing GERD which will then be translated into a programming language.
4. Implementation
   After all the design stages have been completed. The next stage is to implement the design that has been made into a programming language (Alfatah et al., 2018).
5. Maintenance

At this stage, system maintenance will be carried out or it can be called maintenance which is carried out if a problem occurs in the previous stage.

Certainty-Factor

In an expert system, a method is needed so that the expert system runs. The method that will be used is the Certainty-Factor method (Tarigan & Pratomo, 2019). The Certainty Factor (CF) method is used to measure the certainty of facts or rules based on expert judgment. CF states the degree of certainty of facts or hypotheses (Wilsen, Wahyudin & Komalasari ,2020). Uncertainty is caused by three things, among others:

1. Error
2. Probability
3. Combination of symptoms

Probability is caused by the inability of an expert to formulate a rule or fact with certainty (Putri, 2018). The following is an explanation for finding the CF value, defined as follows:

$(H,) = (H,)(H,)$ Information :

- CF : Certainty factor in hypothesis H is influenced by E (evidence)
- MB : Measure of Belief or level of confidence in hypothesis H if given E (evidence)
- MD : Measure of Disbelief or the level of distrust of the hypothesis

H influenced by E (evidence)

- H : hypothesis or conclusion
- E : Evidence or facts.

If there are rules with similar conclusions (similiary concluded rules) or more than one symptom, then the CF will then be calculated with the following equation:

$= + (1)$

Meanwhile, to calculate the percentage, the equation is used

$= 100\%$

After getting the percentage value to get confidence, you can interview an expert or expert with CF rules (rule) based on the results that have been obtained. The CF value can be interpreted by "term", and converted to a certain value according to the following table (Saragih, 2018).

Table 1. CF Nilai Value Interpretation

Uncertain Term	CF
Definitely No	-0.1 to -0.79
Almost Definitely Not	-0.8 to -0.59
Most Likely No	-0.6 to -0.60
Probably not	-0.4 to 0.19
Don't know	-0.2 to 0.2
Possibility	0.4 to 0.59
Most likely	0.6 to 0.79
Almost Sure	0.8 to 0.89
Certain	0.9 to 1.0

3. RESULTS AND DISCUSSIONS

The data that has been collected regarding GERD, both types, symptoms, and solutions through an interview process with specialists in internal medicine and literature studies will then be made in the form of a table (Setiadi et al., 2019). The following is a table of results from data collection.

Table 2. Types of GERD

No	Disease Code	Disease Name	Solution
1	P01	Acute GERD	(1). Take antacids (if you want to relieve pain) immediately).
2	P02	Chronic GERD	(1).Take omeprazole or ranitidine (takes time to relieve but can be more effective). (2). Immediately consult a doctor if the symptoms do not improve.

Table 3. Symptoms of GERD

Symptoms Code	Symptoms
G01	Hot feeling in the chest
G02	Sour taste in the mouth
G03	Burning feeling in the pit of the heart
G04	Burning feeling in the throat
G05	Weight loss
G06	Nauseous
G07	Vomit
G08	Pain when swallowing
G09	Hoarseness

Table 4. GERD Relationship With Symptoms

Symptoms Code	Disease Code	
	P01	P02
G01	√	
G02	√	
G03	√	
G04	√	
G05	√	
G06		√
G07		√
G08		√
G09		√
G10		√

Application of Certainty-Factor to Diagnose GERD

1. Calculation of Acute GERD CF Value

Table 5. Data Cf Expert And User Of GERD Acute

Code	Symptoms	CF Expert	CF User	CF [H,E]
G01	Hot feeling in the chest	0.8	0.6	0.48
G02	Sour taste in the mouth	0.8	0.6	0.48
G03	Burning feeling in the pit of the heart	1	0.6	0.6
G04	Burning feeling in the throat	1	0.4	0.4
G05	Weight loss	0.4	0.4	0.16

To get the value of C [H,E] use the following formula (Samsudin, S., & Indriani, n.d.).
CF [H,E] =CF(E) * CF (rule)
= CF (User) * CF (Expert)

The following is a manual certainty-factor calculation to get the value of expert confidence in acute GERD (Maulina, 2020).
A. Old 1,2= 1 + 2 (1 1)
= 0.48 + 0.48 * (1 - 0.48)
= 0.48 + 0.48 * 0.52
= 0.48 + 0.24
CF Old 1 = 0.72

B. Old 1,3 = 1 + 3 (1 1)
= 0.72 + 0.6 * (1 - 0.72)
= 0.72 + 0.6 * 0.28
= 0.72 + 0.16
CF Old 2= 0.88

C. Old 2,4 = CF2 + CF4 * (1-CF2)
= 0.88 + 0.4 * (1 - 0.88)
= 0.88 + 0.4 * 0.12
= 0.88 + 0.04
CF Old 3 = 0.92

D. Old 3.5 = CF3 + CF5 * (1-CF3)
= 0.92 + 0.16 * (1 - 0.92)
= 0.92 + 0.16 * 0.08
= 0.92 + 0.01
CF Old 4 = 0.93

Based on the results of manual certainty-factor calculations that have been carried out, the results of the level of confidence in acute GERD based on CF Experts that have been obtained from experts and CFUser are assumed, it can be seen that the accuracy or confidence value for acute GERD is 0.93 or if it is converted into a percentage, namely 93%.

2. Calculation of Chronic GERD CF Value

Table 6. Data Cf Expert And User Of GERD Chronic

Code	Symptoms	CF Expert	CF User	CF [H,E]
G06	Nauseous	0.6	0.6	0.36
G07	Vomit	0.8	0.4	0.32
G08	Pain when swallowing	0.8	0.2	0.4
G09	Hoarseness	0.2	0.4	0.32
G10	Cramping stomach muscles	0.6	0.6	0.36

A. $CFCombine$ Old 1,2= $CF1 + CF2 * (1 - CF1)$
= 0.36 + 0.32 * (1 - 0.36)
= 0.36 + 0.32 * 0.64
= 0.36 + 0.20
CF Old 1 = 0.56

B. $CFCombine$ Old 1,3 = $CF1 + CF3 * (1 - CF1)$

= 0.56 + 0.4 * (1 - 0.56)
= 0.56 + 0.4 * 0.44
= 0.56 + 0.17
CF Old 2 = 0.73

C. *CFCombine* Old 2,4 = CF2 + CF4 * (1 - CF2)
= 0.73 + 0.32 * (1 - 0.73)
= 0.73 + 0.32 * 0.27
= 0.73 + 0.08
CF Old 3 = 0.81

D. *CFCombine* Old 3,5 = CF3 + CF5 * (1-CF3)
= 0.81 + 0.36 * (1 - 0.81)
= 0.81 + 0.36 * 0.19
= 0.81 + 0.06
CF Old 4 = 0.87

Based on the results of manual certainty-factor calculations that have been carried out, the results of the level of confidence in acute GERD based on the expert CF that have been obtained from experts and the assumed CFUser can be seen, it can be seen that the accuracy or confidence value of chronic GERD is 0.87 or if it is converted into a percentage, namely 87%.

Implementation System

1. Home Page

Figure 2. Home Page View

2. Diagnose Menu

Figure 3. Diagnose Menu

Figure 4. diagnostic results

3. History Menu

Figure 5. History Menu

4. Description Menu

Figure 6. Description Menu

4. CONCLUSION

Based on the results of the previous discussion that has been done, it can be concluded: 1) The expert system for diagnosing GERD with the certainty-factor method that has been built can help users to find out the disease the user is suffering from without having to go to the hospital for a diagnosis. 2) The expert system built is able to diagnose GERD disease using the certainty-factor method. To further improve the performance of this expert system in diagnosing GERD disease. It is hoped that further research can use methods other than certainty-factor and add the number of experts to get more data results better than before.

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