



# Application of the Certainty Factor Method for the Expert System for Diagnosing ISPA Disease (Acute Respiratory Infection) in Children Based on the Website

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## Keywords

Expert System,  
Certainty Factor  
Method, ISPA Disease  
in Children, RSU  
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**Abstract.** ARI (Acute Respiratory Infection) is a common disease in the community, especially infants and children caused by rhinoviruses, RSV, adenovirus, influenza virus or parainfluenza virus. Most people do not know what are the symptoms arising from ARI suffered by children. Pediatricians have data on the symptoms caused by ARI, with which the data can identify the child's disease. However, the public must go to the doctor first to find out what ARI diseases are suffered by children based on the symptoms felt. Checking the symptoms of ARI disease is diagnosed directly by the medical party, namely the doctor by recording and analyzing manually. With conditions like this, of course, there are many obstacles that do not even rule out the possibility of different diagnoses of diseases experienced by patients. The expert system that will be built is intended to make it easier for someone to diagnose ARI disease by adopting human knowledge into the computer system so that the expert system is able to solve existing problems. This study aims to diagnose ARI in children using the certainty factor method based on the symptoms felt and find a solution or obtain confidence in the percentage of the disease suffered. The expert system is created by utilizing PHP and MySQL programming languages as databases. Data collection was carried out starting in August 2022, followed by data processing and analysis. The sample in this study was patients with ARI disease in children at RSU Imelda Pekerja Indonesia Medan. The sampling technique in this study is purpose sampling. Statistical analysis used one sample T-test. The targeted output is scientific publication in nationally accredited journals. TKT research proposed is as a technological research or experiment from existing theories in diagnosing ARI disease in children based on websites.

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## 1. INTRODUCTION

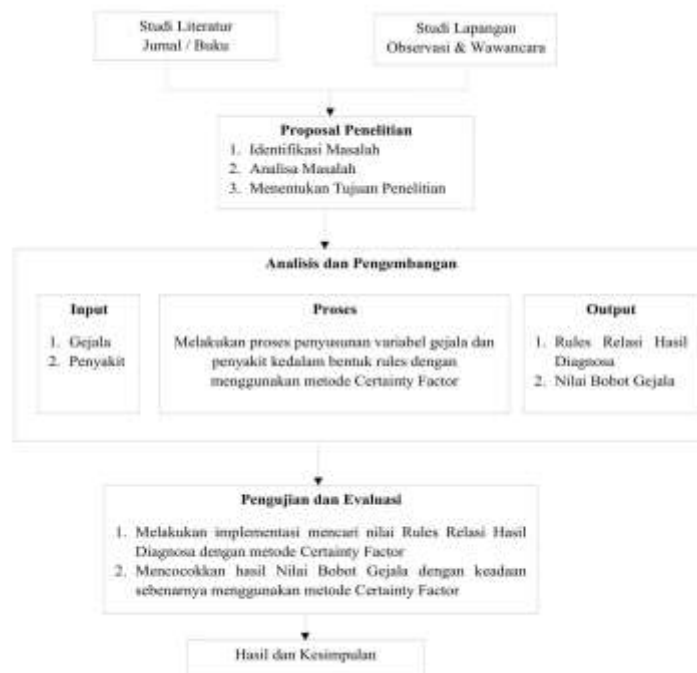
Advances in science and technology at this time have reached almost all fields of activity in human activities. All activities now cannot be separated from the role of computer devices. No exception in the health sector utilizes a lot of technology in providing health services. Almost in all fields related to health services began to use the use of computers to improve their performance. So far, the activity of diagnosing diseases still has to involve doctors directly by recording and analyzing manually[1]. With conditions like this, of course, there are many obstacles that do not even rule out the possibility of different diagnoses of diseases experienced by patients [2].

One disease that is often underestimated by some people is Acute Respiratory Infection (ARI). ARI disease is an infection that attacks one or more parts of the respiratory tract from the nose to elveoli including adnexa (sinuses, middle ear cavity, pleunara) caused by rhinoviruses, RSV, adenovirus, influenza virus, or parainfluenza virus [3]. Acute Respiratory Infection (ARI) is the main cause of morbidity and mortality of infectious diseases in Indonesia, nearly 4 million people die from ARI, especially in toddlers and children and 98% of them are caused by respiratory tract infections [4].

Based on the above considerations, an expert system is needed that is able to detect ARI disease in children based on the website with the certainty factor method to make it easier for patients to find out early about the disease suffered without having to go to the hospital. The results of the study entitled Diagnosis of Respiratory Tract Infections in Children Using the Forward Chaining Method and Certainty Factor had an accuracy rate of the testing process of 90.91% [5]. Expert systems utilizing PHP and MySQL programming languages by measuring the certainty factor method are very helpful for people to detect diseases experienced based on perceived symptoms[6].

## 2. METHOD

The stages of research to identify ARI in children are in Figure 1 as follows:



**Figure.1** Research Framework

### 1. Literature and Field Studies

Search and learn from various kinds of literature, articles and documents that support this research, especially those related to expert systems to diagnose ARI in children based on perceived symptoms.

### 2. Research Proposal

#### a) Identify the problem

How to make an application for an ARI disease expert system in children based on a website and a working mechanism using the certainty factor method.

#### b) Problem Analysis

The time needed by technicians in making an expert system website application for diagnosing ARI disease in children varies according to the symptoms and diseases felt.

#### c) Research Objectives

The purpose of this study can help the public in identifying diseases based on perceived symptoms and determining the percentage of certainty factors of the actual disease (percentage of matches).

### 3. Analysis and Development

As for data analysis, these are the stages related to processing data in this research methodology are as follows:

#### a) Input

The variables that became input in this study were in the form of symptoms of ARI disease in children.

#### b) Process

The variable that has been inputted is then processed into the form of rules using the Certainty Factor method.

#### c) Output

The results of this study are in the form of the value of the Rules of Relation of Diagnostic Results and the Weight Value of Symptoms with the actual situation.

### 4. Testing and Evaluation

The system testing stage is carried out to observe the extent to which the system to be built can facilitate and speed up in diagnosing ARI disease in children. The initial stage of testing this system starts from the user inputting the symptoms of ARI disease in children, then the system will produce

an output in the form of Rules Value Relation to Diagnostic Results and Symptom Weight Value with the actual situation. The final evaluation carried out is to see the extent to which the system that has been designed and built can help the community in diagnosing ARI disease in children which will then be matched with the actual situation.

### 3. RESULTS AND DISCUSSION

From the output of this research, an output can be produced in the form of an ISPA disease expert system application in children to help the community identify diseases based on symptoms felt, especially at RSU Imelda Pekerja Indonesia Medan.

#### Problem Analysis

In the expert system, diagnosing asthma by the certainty factor method is a method in which analyzing with expressions such as may, most likely, be almost certain. To accommodate this, a certainty factor (CF) is used to describe the level of expert confidence in the problem at hand. In the previous chapter, some of the symptoms or signs of someone who has asthma have been described.

#### Symptoms of ARI in Children

Symptoms of the disease are indications of the presence of a disease in children, in the form of signs or characteristics of the disease that can be seen and felt. Symptom names based on the type of disease symptoms are generally shown in table 1 below.

Table 1 Symptom Table

NO	SYMPTOM ID	SYMPTOM NAME
1	G1	Cough
2	G2	Sore throat
3	G3	Runny nose or nasal congestion
4	G4	Body aches
5	G5	Headache
6	G6	Fever
7	G7	Merry
8	G8	Decreased appetite
9	G9	Difficulty breathing
10	G10	Hoarse voice
11	G11	Easily feel tired
12	G12	Breathing through the mouth
13	G13	The appearance of green or yellow linders from the nose
14	G14	Making sounds when breathing
15	G15	The cough lasts for 7 days or more
16	G16	Chest aches or pains when coughing
17	G17	Swallowing disorders
18	G18	Dry cough due to the lining of the lungs is irritated and mucus that appears in the bronchial is difficult to remove
19	G19	Hypoxia or lack of oxygen is characterized by blue skin and pain around parts of the body
20	G20	Pause between breaths lasting 20 seconds or more/ Shortness of breath
21	G21	Bad breath (halitosis)
22	G22	Limp
23	G23	Fussy
24	G24	Pain in the Face
25	G25	Decreased sense of smell
26	G26	Sore or swollen neck glands
27	G27	Nausea and Vomiting
28	G28	Snoring
29	G29	Excessive spitting
30	G30	Ear pain or discharge from the ear



31	G31	DIARRHEA
32	G32	Loss of appetite
33	G33	Joint Pain in the Muscles

### Analysis of the Certainty Factor Table Section

The CF value (Rule) is obtained from the interpretation of the "term" from the expert, which is converted into a specific CF value as in the following table:

**Tabel 2** Certainty Factor

Interpretation	Certainty Factor (CF)
Definitely not	-1.0
Almost certainly not	-0.8
Most likely not	-0.6
Probably not	-0.4
don't know	-0.2-0.2
Maybe	0.4
Likely	0.6
Almost certainly	0.8
Certainly	1.0

### Disease Table

This expert system application is built to diagnose the type of ARI disease that attacks toddlers. The source of knowledge and information in this expert system is taken from direct interviews with experts. Symptoms of ARI must be known first when diagnosing the type of ARI. Extension workers can provide a value of certainty of symptoms against the type of disease that attacks. Various types of ARI diseases in children that attack and can be seen in table 3

**Table 3** Disease Table

NO	DISEASE ID	NAME OF THE DISEASE
1	P1	Sinusitis
2	P2	Radang tenggorokan
3	P3	Epiglottitis
4	P4	Bronchitis
5	P5	Bronkiolitis
6	P6	Pneumonia
7	P7	Pleuritis
8	P8	Common Cold
9	P9	ILI ( <i>Influenza Like Illnes</i> )

### Application of the Certainty Factor Method

Certainty Factor (CF) is one of the techniques used to overcome uncertainty in decision making. Certainty Factor (CF) can occur with a variety of conditions. Among the conditions that occur is that there are several antecedents (in different rules) with the same consequences. In this case, it must aggregate the overall CF values of each existing condition. As for the logic of the certainty factor method in the system consultation session, consultation users are given answer choices, each of which has the following weight:

**Table 4** User Values

No	Information	User Value
1	Not	0
2	Don't know	0.1
3	A little sure	0.2
4	Sure enough	0.6
5	Believe	0.8
6	Very sure	1



A value of 0 indicates that the consulting user informs that the user is not experiencing symptoms as queried by the system. The more the consultation user is convinced that the symptom is indeed experienced by humans, then the calculation of the percentage of beliefs begins with the breakdown of a rule that has a compound premise, into rules that have a single premise. Then each rule, the CF value is combined.

**Table 5** Percentage Conclusion

Percentage Rate	The Value of Beliefs
0%-20%	Not having
21%-50%	Little possibility or small possibility
51%-79%	Most likely
80%-99%	Very Sure (suffered)

In expressing the degree of certainty, the certainty factor assumes the degree of certainty of an expert on a data. This concept is then formulated in the basic formulation as follows:

$$MB = MB_1 + (MB_2 \times (1 - MB_1))$$

$$MD = MD_1 + (MD_2 \times (1 - MD_1))$$

$$\text{Certainty factor (H,E)} = MB(H,E) - MD(H,E)$$

Calculation of MB value for strep throat for symptoms 1 and 2:

$$\begin{aligned} P1 &= MB_1 + (MB_2 \times (1 - MB_1)) \\ &= 0,6 + (1 \times (1 - 0,6)) \\ &= 1 \end{aligned}$$

The calculation of the 1st value will be MB 1 while in the next count the 3rd symptom:

$$\begin{aligned} P1 &= MB_1 + (MB_3 \times (1 - MB_1)) \\ &= 1 + (0,8 \times (1 - 1)) \\ &= 1 \end{aligned}$$

The calculation of the 1st value will be MB 1 while in the next count the 4th symptom:

$$\begin{aligned} P1 &= MB_1 + (MB_4 \times (1 - MB_1)) \\ &= 1 + (0,8 \times (1 - 1)) \\ &= 1 \end{aligned}$$

The calculation of the 1st value will be MB 1 while in the next count the 5th symptom:

$$\begin{aligned} P1 &= MB_1 + (MB_4 \times (1 - MB_1)) \\ &= 1 + (0,6 \times (1 - 1)) \\ &= 1 \end{aligned}$$

The calculation of the 1st value will be MB 1 while in the next count the 5th symptom:

$$\begin{aligned} P1 &= MB_1 + (MB_5 \times (1 - MB_1)) \\ &= 1 + (0,9 \times (1 - 1)) \\ &= 1 \end{aligned}$$

The calculation of the 1st value will be MB 1 while in the next count the 6th symptom:

$$\begin{aligned} P1 &= MB_1 + (MB_5 \times (1 - MB_1)) \\ &= 1 + (1 \times (1 - 1)) \\ &= 1 \end{aligned}$$

Calculation of MD values of pest thrips for symptoms 1 and 2:

$$\begin{aligned} P1 &= MD_1 + (MD_2 \times (1 - MD_1)) \\ &= 0,3 + (0,1 \times (1 - 0,3)) \\ &= 0,37 \end{aligned}$$

The calculation of the 1st value will be used as MD 1 while in the next count the 3rd symptom:

$$\begin{aligned} P1 &= MD_1 + (MD_3 \times (1 - MD_1)) \\ &= 0,37 + (0,3 \times (1 - 0,37)) \\ &= 0,559 \end{aligned}$$

The calculation of the 1st value will be used as MD 1 while in the next count the 4th symptom:

$$\begin{aligned} P1 &= MD_1 + (MD_4 \times (1 - MD_1)) \\ &= 0,559 + (0,7 \times (1 - 0,559)) \\ &= 0,87 \end{aligned}$$

The calculation of the 1st value will be used as MD 1 while at the next count the 5th symptom:

$$\begin{aligned} P1 &= MD 1 + (MD 5 \times (1 - MD 1)) \\ &= 0,87 + (0,5 \times (1 - 0,87)) \\ &= 0,935 \end{aligned}$$

The calculation of the 1st value will be used as MD 1 while in the next count the 6th symptom:

$$\begin{aligned} P1 &= MD 1 + (MD 5 \times (1 - MD 1)) \\ &= 0,935 + (0,2 \times (1 - 0,935)) \\ &= 0,95 \end{aligned}$$

The calculation of the 1st value will be used as MD 1 while in the next count the 7th symptom:

$$\begin{aligned} P1 &= MD 1 + (MD 6 \times (1 - MD 1)) \\ &= 0,95 + (0,1 \times (1 - 0,95)) \\ &= 0,96 \end{aligned}$$

The results of the MB and MD values will then look for the Certainty Factor value of Strep Throat.

$$\text{Certainty Factor} = MB - MD$$

$$\text{Certainty Factor} = 1 - 0,96$$

$$\text{Certainty Factor} = 0,04$$

The final calculation result for strep throat is 0.04 or 4%.

## Design Results

The following is an interface display of the application of the certainty factor method for the expert system Diagnosis of ispa disease (acute respiratory tract infection) in children based on the website.

### 1. Web User Main Page

This main page is the initial display when visitors (users) visit the web system expert on ARI disease in children. The menu on this web is like Home, About ARI, Diagnosis. It can be seen in Figure 2.



**Figure 2** Main Page

### 2. About ARI page for toddlers

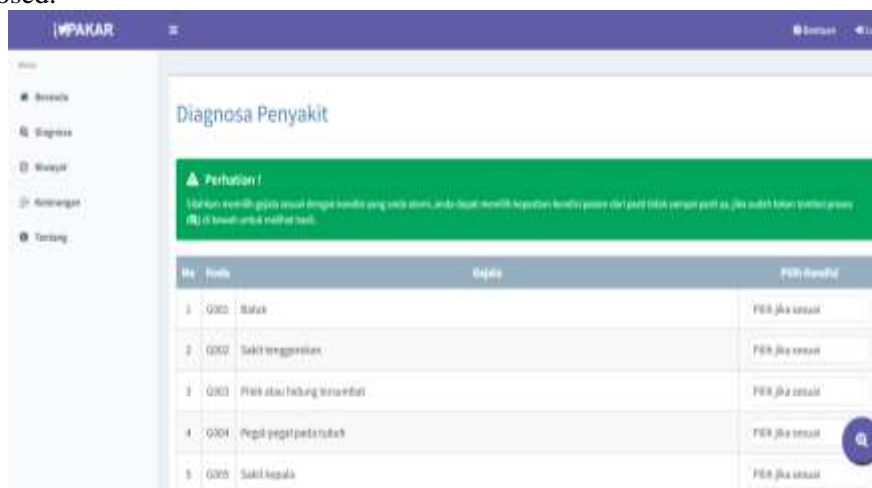
The About page is information about the explanation of ARI disease in toddlers. Can be seen in Figure 3



**Figure 3** Page Description

### 3. Diagnosis Page

On the user diagnosis page, let you immediately enter any symptoms experienced by the patient and then diagnosed.



**Figure 4** Disease Diagnosis Page

## 4. CONCLUSION

The solution of the problem formulation in this study concluded that the creation of an expert system for web-based diagnosis of children's diseases using the Codeigniter Framework with the method applied is Certainty Factor. The system has been able to produce information on how to deal with the disease being experienced. The knowledge base has been developed dynamically, so that updating data on symptoms, diseases and rules can be done at any time if needed. Users can print diagnostic results. Based on testing the results of system diagnostics with experts, the results are in accordance with expert knowledge. 6. Based on the manual calculation of the program with the system, this Certainty Factor method is able to provide results based on the weight of symptoms that have been selected by the user on the system and can provide answers in cases that are uncertain of the truth such as the problem in this study, namely the diagnosis of a disease.

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