

# DESIGN OF MENTAL DISORDER CONSULTATION SYSTEM WITH DECISION TREE METHOD

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## ABSTRACT

*The expert system for diagnosing mental disorders that will be built can minimize doubts in determining the level or category of disorders suffered by patients, so patients can be dealt with quickly according to the level of the disorder they suffer. Diagnosing the level of mental disorders using the expert system will record the symptoms of the patient and will diagnose the level of the disorder based on the knowledge obtained from an expert, the mental disorder expert system uses the Decision Tree method. In general is a system that seeks to adopt human knowledge to computers, so that computers can solve problems as they are usually done by experts or before consulting a psychologist without reducing the expert role of the psychologist or in other words expert systems are systems that are designed and implemented with help certain programming languages to be able to solve problems as experts do quickly and efficiently. It is hoped that with this system, lay people can be more sensitive in recognizing the level of psychiatry in person. As for the experts of this system can be used as an assistant or supporting the performance of psychologist officers. Based on the results of the system tests that have been done, the accuracy of 97.5% results and system error 2.5% and the percentage of each diagnosis, 32% psychosis, 27% Neurosis, 17% Learning Soldered, 12% Juvenile Delinquency and Growth Flower 10%.*

**Keywords:** expert system, mental disorders, decision tree.

## 1. INTRODUCTION

### 1.1 Background Research

Psychology is to study the soul or mentally directly because of its abstract nature, but psychology limits the manifestations and expressions of the soul or mentality in the form of behavior and processes or activities with the ability to diagnose, design patients and follow cognitive behaviors. The word psychology can be interpreted as the science of the soul, taken from the Latin "psychology", first used in the late 15th century until the early 16th century by Marlo Marulic. Psychologists use several methods to conduct behavioral research in a large group, choose populations, and individuals in a family, work environment, school or institute. The function of the psychologist is to clarify or discuss in the form of descriptive descriptions, predict the results of counseling, and control behavior as expected, so that psychology can be defined as science that studies behavior and mental processes.

Problems Expert system is a system designed to be able to imitate the expertise of an expert in answering questions and solving a problem. The expert system will provide a solution to a problem obtained from dialogue with users. With the help of an expert system, someone who is not an expert or expert can answer questions to solve problems and make decisions that are usually made by an expert.

Decision tree is a tree that is used as a reasoning procedure to get answers to the problems entered. Trees that are formed are not always binary trees. If all the features in the data set use 2 types of categorical values, the tree shape obtained is a binary tree. If the feature contains more than 2 types of categorical values or uses a numeric type, the tree shape obtained is usually not a binary tree [1]. Flexibility makes this method attractive, especially because it provides the advantage of visualizing suggestions (in the form of a decision tree) that makes the prediction procedure observable. The concept of a decision tree is to convert data into decision trees and decision rules.

The development of decision support systems is facilitated by the growing use of expert systems in various fields. Expert System is one part of Artificial Intelligence that contains knowledge and experience that is entered by one or 2 many experts in a certain area of knowledge.

So that everyone can use it to solve various problems that are specific in this case is the consultation of psychological disorders (personality) of humans.

The author's consideration is to make the title "*Consultation Expert System Design Mental Disorders With the Decision Tree Method*" in SURABAYA PUSKEMAS TANAH KALI KENDINDING as a way to help patients or clients who need information that is fast, precise and efficient but does not ignore the role of psychologists. With media that can be accessed easily and affordable through web media with programming languages.

### 1.2. Purpose

The purpose of this final project is to make:

- 1) Create an application system for expert mental health consultancy as a tool in providing consultation services for mental disorders.
- 2) Implementing a mental disorder consultation expert application system with a decision tree method that can help diagnose psychological patients before consulting a specialist.

### 1.3. Scope of Problem

The limitations of the problem in the Mental Disorders Consultation Expert System are as follows:

1. In the application of the Mental Disorders Consultant Expert System, the consultations served are personality at productive age (10 to > 60 years).
2. There are 5 types of mental disorders (mental) described in this application, namely :
  - a) Psychosis.
  - b) Neurosa.
  - c) Growth and development.
  - d) Learning or School Problems.
  - e) Juvenile delinquency.
3. The method used in making this psychologist consultation application is Decision Tree.
4. The diagnosis of this system absolutely does not eliminate the role of the actual psychologist.

## 2. LITERATURE REVIEW

[1] Making a software to be able to diagnose eye disease in humans using an expert system engineering. So that every patient with eye disease can easily and quickly find out the type of eye disease without having to see a doctor first. The system later to replace the experts for the types of diseases and find solutions in treatment. Results of Data Researchers, from the results of system analysis carried out on making this software, the data are grouped according to certain classes to facilitate the making of the program. In addition there are some data that is stored.

[2] In channelling credit funds, banks found that there were a number of loans which were said to be substandard or bad loans which would then affect subsequent credit granting or could also affect the ability of banks to extend credit. One way that can be done by PD BPR BKK Gabus to prevent bad credit is to know the quality of credit early on. In this study, the authors conducted a credit analysis by exploring existing data on credit customer data based on its attributes with data mining techniques using the C 4.5 algorithm. Data mining is the process of analyzing data from different perspectives and concluding it into information - important information that can be used to increase profits, reduce expenditure costs or both. The C4.5 algorithm is a decision tree algorithm group.

[3] The expert system for diagnosing mental disorders that will be built can minimize doubts in determining the level / category of the disorder suffered by the patient, so that patients can be treated quickly according to the level of the disorder they are suffering from. The diagnosis of the level of psychiatric disorders using an expert system will record the symptoms of the patient and will diagnose the level of the disorder based on the knowledge obtained from an expert, Expert systems in general are systems that seek to adopt human knowledge into computers, so that computers can solve problems as is usually done by experts.

### **3. SYSTEM ANALYSIS DAN DESIGN**

#### **3.1 Identification of Problems**

Identification of problems that will be made in the expert system “Expert System Design Consultation Mental Disorders With Decision Tree Method” in PUSKEMAS TANAH KALI KENDINDING SURABAYA as a way to help patients or clients who need information that is fast, precise and efficient but does not ignore the role of psychologists. With media that can be accessed easily and affordable through web media. Consultation of Mental Disorders based on symptoms obtained and cone becomes a diagnosis of the disease. The main advantage of a decision tree is that it can simplify the process of knowledge acquisition. The tree used in this study is a forward chaining tree. This is related to the problem of diagnosis which is discussed in expert system research on disease diagnosis.

#### **3.2 Conceptual Stage**

In this conceptualization phase, it is determined what elements are related to the type of disease and the symptoms caused. This theory is based on the knowledge gained from the book reference and consultation with experts.

#### **3.3 Disease Data and Information**

Some disease data and information are:

1. Diagnosis of Psychosis  
Psychosis means the abnormal condition of the mind, and a generic psychiatric term for mental states is often described as involving "loss of contact with reality".
2. Diagnosis Neurosis  
Neurotic disorders, somatoform disorders and stress related disorders, are grouped together on the grounds that in history there is a relationship with the development of the concept of neurosis with various possible psychological causes.
3. Diagnosis of Juvenile Delinquency  
Adolescent behavior that is influenced by unruly, rebellious, sulky, get together, mimic, begin to fall in love, rah-rah and so on, is a series of behavioral patterns that always appear to overshadow the side of adolescent life.
4. Growth Diagnosis  
Growth is an increase in the number and size of cells in all parts of the body as long as these cells divide and synthesize new proteins, resulting in an increase in number and weight in whole or in part.
5. Diagnosis Learning disorder  
Another understanding of Learning disorder is a condition where the child's learning process is disrupted because of the emergence of conflicting responses so that children experience confusion to understand the learning material.

#### **3.4 System Design Flow Chart**

The whole system flow chart is a description of the processes related to the running of the system. At this stage, it is illustrated as shown in the following flow chart:

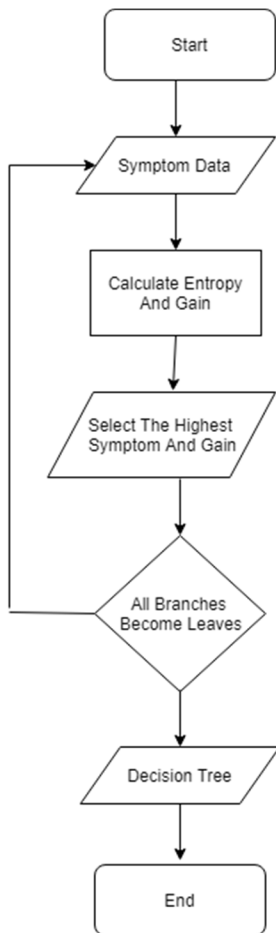


Figure 1 Clarification system design

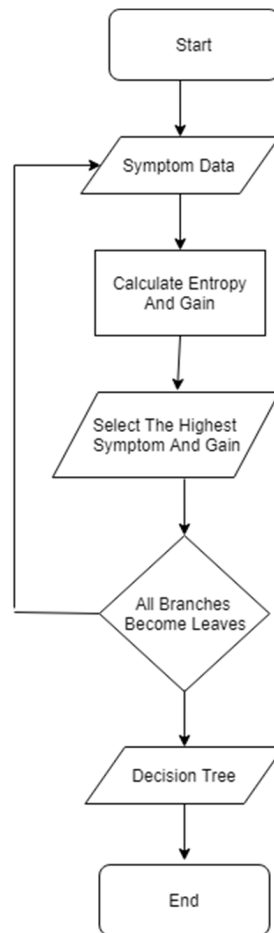


Figure 2 Formation Decision Tree Design

### 3.5 Explanation of the System in General

In brief, Decision Tree is one of the classification methods in Text Mining. Classification is the process of finding a collection of patterns or functions that describe and separate data classes or others, to be used to predict data that does not yet have a particular data class [4].

#### Algorithm 1. Decision Tree Induction

1. Starting from the root node.
2. For all features, calculate the entropy value for all samples (training data) on the node.
3. Select a feature with maximum gain information.
4. Use the feature as a node split into branches.
5. Do it recursively on each branch created by repeating steps 2 through 4 until all data in each node only gives one class label. Nodes that cannot be broken down again are leaves that contain decisions (class labels).

Entropy can be calculated using the following equation:

$$E(s) = - \sum_{i=1}^m p(w_i | s) \dots \dots \dots (4.1)$$

$p(w_i | s)$  is the proportion of  $i$ -class in all training data that is processed at the node  $s$ .  $p(w_i | s)$  obtained from the sum of all rows of data with class  $i$  labels divided by the number of rows of all data. While  $m$  is the number of different values in the data.

Entropy is used to determine which node will be the next training data solver. A higher entropy value will increase the potential for classification. Noteworthy is that if the entropy for a node has a value of 0, it means that all vector data are in the same class label and the node is a leaf containing the decision (class label). What also needs to be considered in the calculation of entropy is if one of the elements is 0, then the entropy is confirmed as 0 too. If the proportion of all elements of  $w_i$  is equal, then it is certain that entropy is certainly worth 1.

Gain is used to estimate the selection of the right features to be the solver on that node. The gain of the  $j$ th fitur is calculated using the following equation:

$$G(s,j) = E(s) - \sum_{i=1}^n p(v_i | s) \times E(s_i) \dots \dots \dots (4.2)$$

If defined, the binary logarithmic formula is as follows:

$$\text{Log}_2^n = \log_{10} n / \log_{10} 2 \dots \dots \dots (4.3)$$

$p(v_i | s)$  is the proportion of value of  $v$  appears in the class in the node.  $E(s_i)$  is the entropy of the value composition  $v$  from  $j$  class in  $i$  data node.  $n$  is the number of different values in the node.

At the beginning of the calculation taken from Table reference rules taken from the patient data recap as follows:

Table 1. Reference Rules

No	Symptom 1	Symptom 2	Symptom 3	Diagnosis
1	Depression (Stress)	Mood disorder	Phobia (excessive fear)	Neurosis (Stress)
2	Depression (Stress)	Hysteria	Phobia (excessive fear)	Neurosis (Stress)
3	Depression (Stress)	Mood disorder	obsessive compulsive (afraid)	Psychosis (Hallucinations)
4	Depression (Stress)	Delusion	Phobia (excessive fear)	Psychosis (Hallucinations)
5	Depression (Stress)	Concentration disorder	obsessive compulsive (afraid)	Psychosis (Hallucinations)
6	Depression (Stress)	Mood Disorder	Dementia (forgetful)	Psychosis (Hallucinations)
7	Depression (Stress)	Less parents attention	Obsessive compulsive (afraid)	Disorder (Messed up)
8	Depression (Stress)	Delusion	Dementia (forgetful)	Psychosis (Hallucinations)
9	Depression (Stress)	Fight parents	Phobia (excessive fear)	Juvenile delinquency
10	Depression	Substance abuse and illegal	Dementia	Juvenile

	(Stress)	drugs	(forgetful)	delinquency
11	Depression (Stress)	Autism	Obsessive compulsive (afraid)	Growth
12	Stress (Depression)	Concentration Disorder	difficult to spell	Neurosis (Stress)
13	Stress (Depression)	Hysteria	Obsessive compulsive (afraid)	Psychosis (Hallucinations)
14	Stress (Depression)	Delusion	Dementia (forgetful)	Neurosis (Stress)
15	Stress (Depression)	Concentration Disorder	Obsessive compulsive (afraid)	Disorder (Messed up)
16	Stress (Depression)	Delusion	Phobia (excessive fear)	Psychosis (Hallucinations)
17	Stress (Depression)	Concentration Disorder	Dementia (forgetful)	Psychosis (Hallucinations)
18	Stress (Depression)	Autism	Phobia (excessive fear)	Growth
19	Stress (Depression)	Fight parents	Dementia (forgetful)	Juvenile delinquency
20	Stress (Depression)	Substance abuse and illegal drugs	Obsessive Compulsive (afraid)	Substance abuse and illegal
21	Stress (Depression)	Motor Disorders	Dementia (forgetful)	Growth
22	Stress (Depression)	Motor Disorders	Phobia (excessive fear)	Growth
23	Hallucinations	Mood Disorders	Phobia (excessive fear)	Psychosis (Hallucinations)
24	Hallucinations	Delusion	Obsessive Compulsive (afraid)	Psychosis (Hallucinations)
25	Hallucinations	Concentration Disorder	difficult to spell	Disorder (messed up)
26	Hallucinations	Mood Disorders	Dementia (forgetful)	Neurosis (Stress)

27	Hallucinations	Hysteria	Phobia (excessive fear)	Neurosis (Stress)
28	Hallucinations	Motor Disorders	Phobia (excessive fear)	Growth
29	Hallucinations	Substance abuse and illegal drugs	Phobia (excessive fear)	Juvenile delinquency
30	Hallucinations	Autism	Dementia (forgetful)	Growth
31	Hallucinations	Fight Parents	Obsessive Compulsive (afraid)	Juvenile delinquency
32	Worry	Mood Disorders	Phobia (excessive fear)	Psychosis (Hallucinations)
33	Worry	Delusion	Phobia (excessive fear)	Neurosis (Stress)
34	Worry	Mood Disorders	Dementia (forgetful)	Neurosis (Stress)
35	Worry	Less Parents Attention	Difficult to spell	Disorder (messed up)
36	Worry	Fight Parents	Obsessive Compulsive (afraid)	Juvenile delinquency
37	Worry	Autism	Phobia (excessive fear)	Growth
38	Worry	Motor Disorders	Obsessive Compulsive (afraid)	Growth
39	Worry	Substance abuse and illegal drugs	Dementia (forgetful)	Juvenile delinquency
40	Worry	Motor Disorders	Dementia (forgetful)	Growth

### 3.6 Flowchart Expert System User

In the use of expert systems a user system flow diagram will be displayed using the forward chaining and backward chaining methods, as well as system expert flowcharts to edit data, namely in the process of adding, deleting or changing knowledge data to be updated.

#### a) Flowchart Patient System

The patient user system flow chart is a diagram that shows how the process flow occurs in the system during consultation. Patient user limits have the capacity as only users who are required to fill in identity data called registration as visitor data that will be inputted on patient data before consultation. The data will be combined with disease analysis data as consultation record data or history of the disease suffered by patients. In the consultation process the system will check and save the registration data after the user completes the consultation process, in this case finding the type of disease, because not all users will complete the consultation data process, only users who complete will be stored in historical data or record the consultation as a report. Explained to Figure 3.

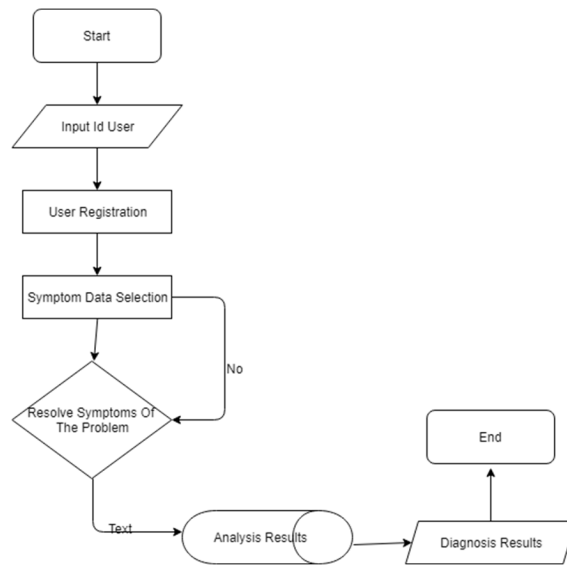


Figure 3. Patient flowcharts in expert systems

b) Flowchart admin system

This flowchart describes how the admin does the system process. Admin is an expert who has the capacity as manager of required knowledge. Login expert data as management data that will be verified with planned data, after which it can continue to be able to initiate the management process or update knowledge data and see patient consultation reports called medical records. . For the system flow the admin user is explained in Figure 4.

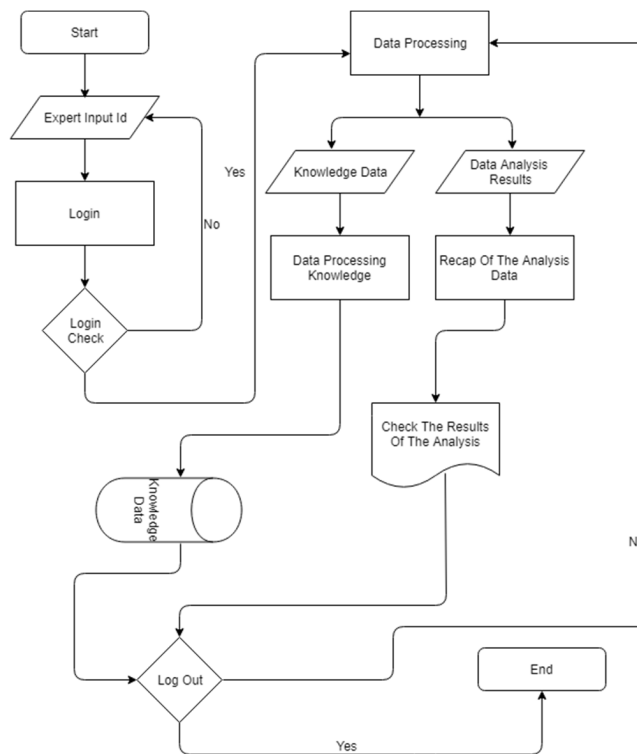


Figure 4. Flowchart admin system

4. RESULTS AND DISCUSSION

4.1 System Implementation

Implementation is the creation of an expert system for diagnosing mental disorders that have been explained in previous chapters. In this chapter, the system is explained and explained with a screenshot of the program's display



and system source code. Implementation of a system of diagnosing mental disorders is divided into two parts, namely the implementation of the interface and the implementation of the coding process.

Making an interface or Graphical User Interface (GUI) for this application using Dreamweaver, and its development using PHP.

#### 4.2 Program View

In the user view contains menus that are needed by the patient, in the user view consists of the main page (home), the user menu for consultation and a list of diseases, and assistance that explains the program system and program maker profile.



Figure 5. Program View

#### 4.2 Program Trial

The program was tested by analyzing the consultation of 40 Tanahkali Kedinding Health Center Patients. Patient consultation data obtained from answers that correspond to patient complaints. Various complaints obtained from consultations in the Mental Disorders Consultation Expert Program.

Experiments conducted on Tanahkali Kedinding Puskesmas patients as a start in assessing the performance of expert system programs. Display the consultation menu on the expert system of diagnosing mental disorders is the initial appearance of the system, where the patient carries out consultation that connects to the system program window. The consultation menu connects to the Symptom process experienced later showing the results of the diagnosis. The purpose of testing the system is to find out whether the system that has been made functions according to what was planned. The way the system is shown is the screen shoot system display.

In the patient consultation Symptom analysis of patients included in the consultation which will be in the form of reports on the results of patient diagnoses complete with Symptom diagnoses and solutions or therapies that must be undertaken by patients based on disease diagnosis. Consultation Steps:

- Enter the patient's complete data in the User Consultation Menu, fill in the Name, Gender, Address and Occupation fields.
- At the consultation stage there are Symptom questions on each existing Symptom classification, after all classifications are filled, a report on the results of the diagnosis of the disease diagnosis has been performed. The report contains patient data, disease diagnoses, information, examinations and solutions.
- The results of the analysis are stored and can be seen on the expert menu database, the table contains patient data, diagnosis results, the parent number and date of consultation. If there is an error in the consultation in the Symptom classification, the expert or expert can change the analysis in the consultation recap view.

#### 4.2 System Testing

After conducting an experiment in running a system of expert mental disorders. And considered to be good in providing the results of consultations by the psychologist himself and of course very helpful performance of the

psychologist's own staff. The final stage is to run the system in patients in Tanahkali Kedinding Surabaya for the initial stage of consultation.

Registration Number	Name	Date of Birth	Gender		Address	Symptoms	System Diagnosis	Solutions	Expert Diagnosis	Conclusion	
			M	F						S	TS
0307	Dian Purwati	2-9-1992		x	Pagot 10	Less Parents Attention	Psychosis	Psychosis can be treated by a combination of psychological therapy with medication. Depending on the cause, psychosis therapy can be different for each patient. Some types of psychological therapy that are often used to deal with this condition are cognitive behavioral therapy (CBT), catharsis and family therapy (family therapy). While the drugs used are antipsychotics that have the efficacy to reduce Symptom-Symptom Psychosis with a long term.	Psychosis	x	
0308	Trilik Marlana	7-2-1985		x	Nambangan No.31	Mood Disorder, Phobia cockroach	Psychosis	Psychosis can be treated by a combination of psychological therapy with medication. Depending on the cause, psychosis therapy can be different for each patient. Some types of psychological therapy that are often used to deal with this condition are cognitive behavioral therapy (CBT), catharsis and family therapy (family therapy). While the drugs used are antipsychotics that have the efficacy to reduce Symptom-Symptom Psychosis with a long term.	Psychosis	x	
0310	Tirta R.S	21-1-2011		x	Bulakcupat Bar 3	Less mentorous from parents	Growth	Disorders in children, adolescents and adults are influenced by several factors in growth and development disorders. at this time the process of	Growth	s	

							perfecting physical growth and psychological development. Need to develop character well			
0311	Siti Latifah	7-2-1985		x	Kedinding tengah 9A No.37	Delusion, excessive worry	Neurosis	In addition, in order to be more successful, the treatment of neurosis must be supported by family, friends, partners, and others. Anti-anxiety or anti-depression drugs usually only provide a temporary healing effect. In fact, if these drugs are consumed without control, dependence can occur and exacerbate neurosis. Therefore, the use of drugs is only intended for severe cases of neurosis, it also must receive strict control from a doctor or psychiatrist.	Neurosis	x

## 5. CONCLUSIONS AND RECOMMENDATIONS

### 5.1 Conclusion

Based on the testing and analysis that has been done and discussed in the previous chapter, the following conclusions are obtained:

- Mental disorders expert system applications can only be used by Tanahkali Kedinding Health Center in Surabaya, because the data that is processed and processed is only data obtained from the health center.
- The application of this mental disorder expert system can be used to consult early diagnoses of the disease and how therapeutic solutions must be undertaken by the patient, without ignoring the actual role of the psychologist.
- The results of the diagnosis of mental disorders using the Decision Tree method as a result of decision making from Symptom and diagnosis.

From the mental system expert testing conducted by 40 patients the percentage of results obtained from each diagnosis are as follows:

$$1) \text{ Psikosis} = 13 \text{ Pasien} \div \text{Jumlah pasien} \times 100 \\ = \frac{13}{40} \times 100 = 32\%$$

$$2) \text{ Neurosis} = 11 \text{ Pasien} \div \text{Jumlah pasien} \times 100 \\ = \frac{11}{40} \times 100 = 27\%$$

$$3) \text{ Learning Disolder} = 7 \text{ Pasien} \div \text{Jumlah pasien} \times 100 \\ = \frac{7}{40} \times 100 = 17\%$$

$$4) \text{ Kenakalan Remaja} = 5 \text{ Pasien} \div \text{Jumlah pasien} \times 100 \\ = \frac{5}{40} \times 100 = 12\%$$

$$5) \text{ Tumbuh Kembang} = 4 \text{ Pasien} \div \text{Jumlah pasien} \times 100 \\ = \frac{4}{40} \times 100 = 10\%$$

## 5.2 Recommendation

This application is made from real data from the Health Center of Tanahkali Kedinding Surabaya, so that the development can be done with the approval of the parties concerned. In its development, it can be done by adding Symptom and diagnosis or grouping Symptom every psychologist's diagnosis. Thus this expert system will be more perfect as an artificial intelligent application in helping human performance.

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