

## APPLICATIONS BASED ON EXPERT SYSTEMS FOR EARLY DIAGNOSING ANEMIA IN PREGNANT WOMEN

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### Abstract

#### Article Info

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Anemia in pregnant women is commonly called iron deficiency anemia with hemoglobin levels in red blood cells 10.0 grams/100 milliliters (10 grams/deciliter). This type of anemia is prone to be experienced by pregnant women because pregnant women must require very high oxygen levels. This type of anemia is not so dangerous but can be dangerous if there are congenital abnormalities of the body. Therefore, the authors feel it is important to identify this type of anemia early because there is a dangerous potential. The author makes an application based on an expert system that early diagnoses a pregnant woman with iron deficiency anemia or not. The method used is Bayes' theorem. The results obtained are efficiency and speed in early diagnosis of anemia in pregnant women used in hospitals. Coal Inalum. With a situation where the hospital only has one doctor serving many pregnant women patients. With the application of an expert system for early diagnosis of anemia in pregnant women, it can help users (doctors) in knowing the early symptoms of whether a pregnant woman has iron deficiency anemia or not.

Keywords: Anemia, Application, System, Expert, Mother, Pregnant

### 1. Introduction

Expert System is a field of science that simulates expert knowledge in the form of a system entity or other application. Expert systems are often used in research in disease recognition environments. For example in the research of Daifirra., & Akbar, M. B. diagnosing Chronic Obstructive Lung Disease [4], Ikorasaki, F. diagnosing bone disease using expert system media [6], Puspita, K., & Tambunan, F. diagnosing diseases caused by Chlamydia bacteria. Trachomatis. There are also studies that diagnose diseases in plants, for example the research of David [5], Siregar, E. T [11] and Wahyuni, L., & Darma, S. [12]. As well as research identifying the psychiatric property of Sianturi, C. J. M [10].

While research on diseases in pregnant women with an expert system is found in Agusli, R., Iqbal, M., & Saputra, F [1], Mustafa, W. F., & Kusriani [7], Paramitha, N., Junianto, E., & Susanti, S. [8]. These three studies discuss diseases that are commonly diagnosed in pregnant women, not specifically only on anemia. Research on anemia in pregnant women has also been described by Amalia, S., Afriyani, R., & Utami, S, P. [2], and Damanik, S.[3]. The difference in this study is the symptoms used and the expert system method used. That is added symptoms of easy sleepiness.

The author makes an application based on an expert system that early diagnoses a pregnant woman with iron deficiency anemia or not. The method used is Bayes' theorem. The results obtained are efficiency and speed in early diagnosis of anemia in pregnant women used in hospitals. Coal Inalum. With a situation where the hospital only has one doctor serving many pregnant women patients. With the application of an expert system for early diagnosis of anemia in pregnant women, it can help users (doctors) in knowing the early symptoms of whether a pregnant woman has iron deficiency anemia or not.

## 2. Method

Research Methods in developing the author's application using the Waterfall method.

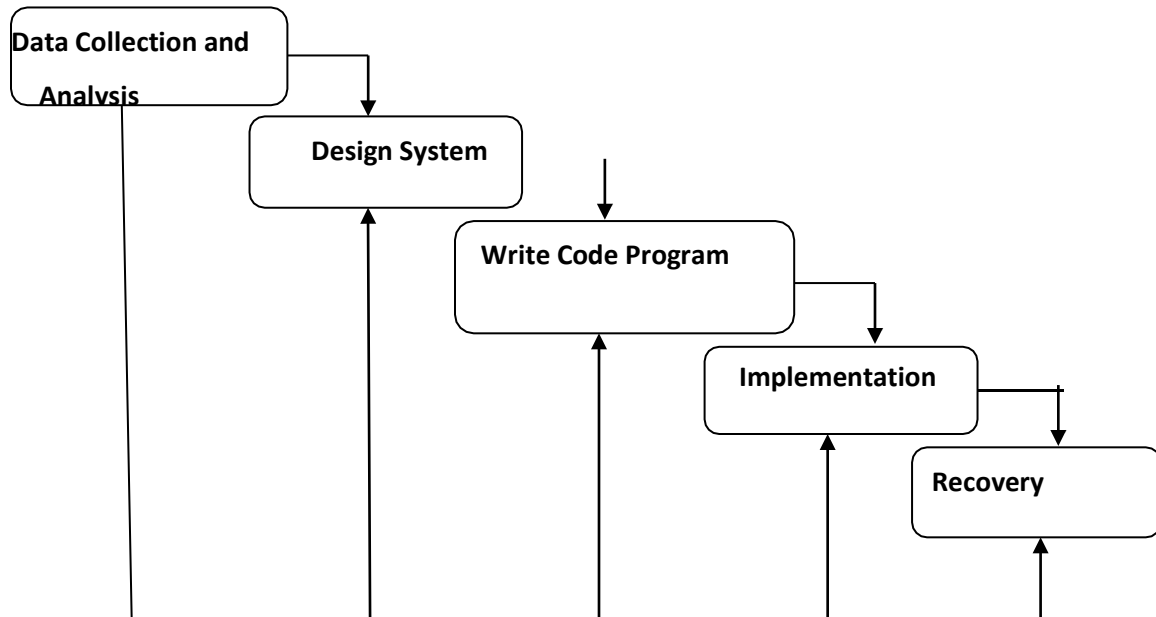


Figure 1. Water Fall Method

### Data Collection and Analysis

The data was taken at the Inalum Batubara Hospital in 2019 with 123 pregnant women cases and 32 patients suffering from anemia

### Design System

In making an expert system application to diagnose early pregnant women with anemia, the author uses a waterfall framework flowchart

### Write Code Program

Program code using PHP with MySQL database. In direct testing, it is used by a hematology specialist at the Inalum Batubara Hospital.

### Implementation

In the application of the expert system for early diagnosis of anemia in pregnant women applying the Bayes theorem method. This method has been widely used in research cases related to diagnosing disease

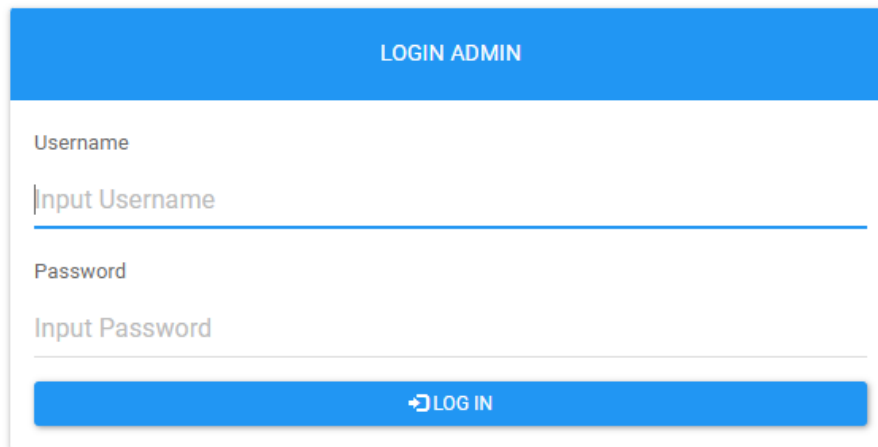
### Recovery

The author uses a maintenance system once every six months in the smooth use of the system

## 3. Results and Discussion

### Login Page Display

The Login page is the initial view seen by the user when accessing the expert system application. The following is an image of the home page display of this design which can be seen in Figure 2.



LOGIN ADMIN

Username

Input Username

Password

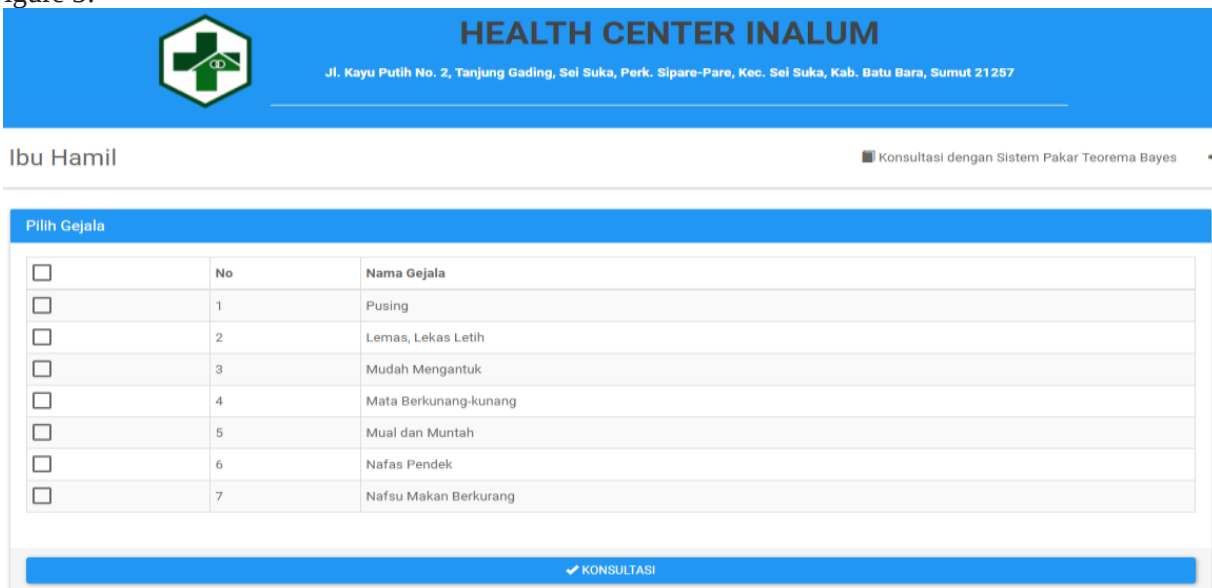
Input Password

LOG IN

Figure 2: Login Page

### Conculation Page View

The consultation page will appear when the user selects and clicks on the consultation menu with the Bayes theorem expert system. The following is an image of the consultation page display which can be seen in Figure 3:



**HEALTH CENTER INALUM**  
Jl. Kayu Putih No. 2, Tanjung Gading, Sei Suka, Perk. Sipare-Pare, Kec. Sei Suka, Kab. Batu Bara, Sumut 21257

Ibu Hamil

Konsultasi dengan Sistem Pakar Teorema Bayes

Pilih Gejala

| <input type="checkbox"/> | No | Nama Gejala           |
|--------------------------|----|-----------------------|
| <input type="checkbox"/> | 1  | Pusing                |
| <input type="checkbox"/> | 2  | Lemas, Lemas Letih    |
| <input type="checkbox"/> | 3  | Mudah Mengantuk       |
| <input type="checkbox"/> | 4  | Mata Berkunang-kunang |
| <input type="checkbox"/> | 5  | Mual dan Muntah       |
| <input type="checkbox"/> | 6  | Nafas Pendek          |
| <input type="checkbox"/> | 7  | Nafsu Makan Berkurang |

KONSULTASI

Figure 3. Conculation Page View

### Konsultasi

| Gejala Terpilih |                    |
|-----------------|--------------------|
| No              | Nama Gejala        |
| 1               | Pusing             |
| 2               | Lemas, Lemas Letih |
| 3               | Mudah Mengantuk    |
| 4               | Mual dan Muntah    |

| Probabilitas Penyakit Gejala |             |       |
|------------------------------|-------------|-------|
| Probabilitas                 | Nilai       | Hasil |
| $P(G01 P01) * P(P01)$        | $0.2 * 0.5$ | 0.1   |
| $P(G01 P02) * P(P02)$        | $0.7 * 0.7$ | 0.49  |
| $P(G01 P03) * P(P03)$        | $0.7 * 0.6$ | 0.42  |
| $P(G02 P01) * P(P01)$        | $0.9 * 0.5$ | 0.45  |
| $P(G02 P02) * P(P02)$        | $0.1 * 0.7$ | 0.07  |
| $P(G02 P03) * P(P03)$        | $0.2 * 0.6$ | 0.12  |
| $P(G03 P01) * P(P01)$        | $0.2 * 0.5$ | 0.1   |
| $P(G03 P02) * P(P02)$        | $0.7 * 0.7$ | 0.49  |
| $P(G03 P03) * P(P03)$        | $0.2 * 0.6$ | 0.12  |
| $P(G05 P01) * P(P01)$        | $0.2 * 0.5$ | 0.1   |
| $P(G05 P02) * P(P02)$        | $0.3 * 0.7$ | 0.21  |
| $P(G05 P03) * P(P03)$        | $0.2 * 0.6$ | 0.12  |

| Probabilitas Gejala |              |
|---------------------|--------------|
| Gejala              | Probabilitas |
| P(G01)              | 1.01         |
| P(G02)              | 0.64         |
| P(G03)              | 0.71         |
| P(G05)              | 0.43         |

| Probabilitas Penyakit Anemia Defisiensi Zat Besi |              |        |
|--------------------------------------------------|--------------|--------|
| Bobot Penyakit Gejala                            | Bobot Gejala | Hasil  |
| $P(G01 P03) = 0.1$                               | 1.01         | 0.099  |
| $P(G02 P03) = 0.45$                              | 0.64         | 0.7031 |
| $P(G03 P03) = 0.1$                               | 0.71         | 0.1408 |
| $P(G05 P03) = 0.1$                               | 0.43         | 0.2326 |
| Total                                            |              | 1.1755 |

| Probabilitas Penyakit Anemia Defisiensi Vitamin B12 |              |        |
|-----------------------------------------------------|--------------|--------|
| Bobot Penyakit Gejala                               | Bobot Gejala | Hasil  |
| $P(G01 P03) = 0.49$                                 | 1.01         | 0.4851 |
| $P(G02 P03) = 0.07$                                 | 0.64         | 0.1094 |
| $P(G03 P03) = 0.49$                                 | 0.71         | 0.6901 |
| $P(G05 P03) = 0.21$                                 | 0.43         | 0.4884 |
| Total                                               |              | 1.773  |

Figure 3. Next Concultation Page View

| Probabilitas Penyakit Anemia Defisiensi Vitamin C |  |              |        |
|---------------------------------------------------|--|--------------|--------|
| Bobot Penyakit Gejala                             |  | Bobot Gejala | Hasil  |
| P(G01 P03) = 0.42                                 |  | 1.01         | 0.4158 |
| P(G02 P03) = 0.12                                 |  | 0.64         | 0.1875 |
| P(G03 P03) = 0.12                                 |  | 0.71         | 0.169  |
| P(G05 P03) = 0.12                                 |  | 0.43         | 0.2791 |
| Total                                             |  |              | 1.0514 |

| Persentase |                               |        |        |
|------------|-------------------------------|--------|--------|
| Kode       | Nama                          | Bayes  | Persen |
| P01        | Anemia Defisiensi Zat Besi    | 1.1755 | 29.39% |
| P02        | Anemia Defisiensi Vitamin B12 | 1.773  | 44.33% |
| P03        | Anemia Defisiensi Vitamin C   | 1.0514 | 26.29% |
| Total      |                               | 4      |        |

Berdasarkan perhitungan, penyakit yang diderita adalah **Anemia Defisiensi Vitamin B12** dengan hasil 44.33%

### Solusi

Meningkatkan asupan makanan atau minuman yang sarat folat dan vitamin B12. Makanan yang dapat menjadi sumber vitamin B12 adalah telur, daging ayam, kerang, daging, serta susu. Sedangkan makanan yang kaya dengan kandungan folat, antara lain adalah buah jeruk, sayuran berdaun hijau, asparagus, kacang, toge, serta brokoli.

[KONSULTASI LAGI](#) [CETAK](#)

**Figure 3. Next Concultation Page View**

### Conculation Print Page View

The consultation print page will appear when the user clicks the print consultation result button on the consultation page. The following is an image of the consultation print page display which can be seen in Figure 4:

Hasil Diagnosa

Gejala Terpilih

| No | Nama Gejala        |
|----|--------------------|
| 1  | Pusing             |
| 2  | Lemas, Lemas Letih |
| 3  | Mudah Mengantuk    |
| 4  | Mual dan Muntah    |

Probabilitas Penyakit Gejala

| Probabilitas          | Nilai       | Hasil |
|-----------------------|-------------|-------|
| $P(G01 P01) * P(P01)$ | $0.2 * 0.5$ | 0.1   |
| $P(G01 P02) * P(P02)$ | $0.7 * 0.7$ | 0.49  |
| $P(G01 P03) * P(P03)$ | $0.7 * 0.6$ | 0.42  |
| $P(G02 P01) * P(P01)$ | $0.9 * 0.5$ | 0.45  |
| $P(G02 P02) * P(P02)$ | $0.1 * 0.7$ | 0.07  |
| $P(G02 P03) * P(P03)$ | $0.2 * 0.6$ | 0.12  |
| $P(G03 P01) * P(P01)$ | $0.2 * 0.5$ | 0.1   |
| $P(G03 P02) * P(P02)$ | $0.7 * 0.7$ | 0.49  |
| $P(G03 P03) * P(P03)$ | $0.2 * 0.6$ | 0.12  |
| $P(G05 P01) * P(P01)$ | $0.2 * 0.5$ | 0.1   |
| $P(G05 P02) * P(P02)$ | $0.3 * 0.7$ | 0.21  |
| $P(G05 P03) * P(P03)$ | $0.2 * 0.6$ | 0.12  |

Probabilitas Gejala

| Gejala   | Probabilitas |
|----------|--------------|
| $P(G01)$ | 1.01         |
| $P(G02)$ | 0.64         |
| $P(G03)$ | 0.71         |
| $P(G05)$ | 0.43         |

Probabilitas Penyakit Anemia Defisiensi Zat Besi

| Bobot Penyakit Gejala | Bobot Gejala | Hasil  |
|-----------------------|--------------|--------|
| $P(G01 P03) = 0.1$    | 1.01         | 0.099  |
| $P(G02 P03) = 0.45$   | 0.64         | 0.7031 |
| $P(G03 P03) = 0.1$    | 0.71         | 0.1408 |
| $P(G05 P03) = 0.1$    | 0.43         | 0.2326 |
| Total                 |              | 1.1755 |

Probabilitas Penyakit Anemia Defisiensi Vitamin B12

| Bobot Penyakit Gejala | Bobot Gejala | Hasil  |
|-----------------------|--------------|--------|
| $P(G01 P03) = 0.49$   | 1.01         | 0.4851 |
| $P(G02 P03) = 0.07$   | 0.64         | 0.1094 |
| $P(G03 P03) = 0.49$   | 0.71         | 0.6901 |
| $P(G05 P03) = 0.21$   | 0.43         | 0.4884 |
| Total                 |              | 1.773  |

Probabilitas Penyakit Anemia Defisiensi Vitamin C

| Bobot Penyakit Gejala | Bobot Gejala | Hasil  |
|-----------------------|--------------|--------|
| $P(G01 P03) = 0.42$   | 1.01         | 0.4158 |
| $P(G02 P03) = 0.12$   | 0.64         | 0.1875 |
| $P(G03 P03) = 0.12$   | 0.71         | 0.169  |
| $P(G05 P03) = 0.12$   | 0.43         | 0.2791 |
| Total                 |              | 1.0514 |

Persentase

| Kode  | Nama                          | Bayes  | Persen |
|-------|-------------------------------|--------|--------|
| P01   | Anemia Defisiensi Zat Besi    | 1.1755 | 29.39% |
| P02   | Anemia Defisiensi Vitamin B12 | 1.773  | 44.33% |
| P03   | Anemia Defisiensi Vitamin C   | 1.0514 | 26.29% |
| Total |                               | 4      |        |

Berdasarkan perhitungan, penyakit yang diderita adalah **Anemia Defisiensi Vitamin B12** dengan hasil **44.33%**

#### Solusi

Meningkatkan asupan makanan atau minuman yang sarat folat dan vitamin B12. Makanan yang dapat menjadi sumber vitamin B12 adalah telur, daging ayam, kerang, daging, serta susu. Sedangkan makanan yang kaya dengan kandungan folat, antara lain adalah buah jeruk, sayuran berdaun hijau, asparagus, kacang, toge, serta brokoli.

Figure 4: Conculatation Print Page View

## 4. Conclusions

The conclusions that can be drawn from the description above are The web-based expert system for diagnosing anemia in pregnant women at Inalum Hospital is designed and built using the PHP programming language and MySQL database so that it can be accessed online by users. Applying the Bayes theorem method to diagnose anemia in pregnant women at Inalum Hospital can provide the best solution and overcome anemia suffered by pregnant women. The application of the Bayes theorem expert system helps the Inalum Hospital to diagnose anemia in pregnant women by displaying the causes of anemia and the handling process so as to minimize the occurrence of errors caused by humans and Suggestions that can be in the form of: It is hoped that further researchers can perform calculations using other methods such as the Forward

Chaining and Certainty Factor methods so that they can find differences in the comparison results of several methods. The expert system is still designed using the PHP programming language and it is hoped that innovation can be provided by using other programming languages such as the CodeIgniter Framework.

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