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CBR METHOD EXPERT SYSTEM FOR FEMALE REPRODUCTIVE HEALTH PROBLEM DETECTION

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Abstract: Technological developments open up opportunities to improve health services, especially in the diagnosis of female reproductive health problems. This research discusses the development of an expert system at Utama General Hospital in Kisaran to assist in the early diagnosis of female reproductive diseases. The problems that occur in this article are the absence of knowledge about dangerous diseases, lack of awareness of reproductive health diseases, remote and hard-to-reach locations of health facilities, high costs for consultations and drugs, and long time to get diagnostic results. The method used in solving these problems is Case Based Reasoning (CBR), where the system uses the experience of previous cases to handle new cases. The process involves collecting patient data, building a knowledge base, and developing an expert system using the CBR approach. Test results show the system is able to provide accurate diagnosis based on the symptoms inputted by the user. Solutions for each disease are displayed, providing useful information for further treatment. In conclusion, the development of this expert system is expected to improve the accessibility and quality of women's reproductive health services by providing fast and appropriate solutions.

Keywords: case based reasoning (CBR) method; expert system; main public hospital kisaran; women's reproduction.

Abstrak: Perkembangan teknologi membuka peluang untuk meningkatkan layanan kesehatan, terutama dalam diagnosis masalah kesehatan reproduksi wanita. Artikel ini membahas pengembangan sistem pakar di Rumah Sakit Umum Utama Kisaran untuk membantu diagnosis dini penyakit reproduksi wanita. Masalah yang terjadi pada penelitian ini yaitu Tidak adanya pengetahuan tentang penyakit berbahaya, kurangnya kesadaran akan penyakit kesehatan reproduksi, lokasi fasilitas kesehatan yang terpencil dan sulit dijangkau, biaya tinggi untuk konsultasi dan obat, serta waktu yang lama untuk mendapatkan hasil diagnosa. Adapun metode yang digunakan dalam menyelesaikan masalah tersebut adalah Case Based Reasoning (CBR), di mana sistem menggunakan pengalaman kasus sebelumnya untuk menangani kasus baru. Proses melibatkan pengumpulan data pasien, pembentukan basis pengetahuan, dan pengembangan sistem pakar menggunakan pendekatan CBR. Hasil pengujian menunjukkan sistem mampu memberikan diagnosis akurat berdasarkan gejala yang diinputkan oleh pengguna. Solusi untuk setiap penyakit ditampilkan, memberikan informasi yang berguna untuk penanganan lebih lanjut. Kesimpulannya, pengembangan sistem pakar ini diharapkan meningkatkan aksesibilitas dan kualitas layanan kesehatan reproduksi wanita dengan memberikan solusi yang cepat dan tepat.

Kata kunci: metode case based reasoning (CBR); reproduksi wanita; rumah sakit umum utama kisaran; sistem pakar.

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INTRODUCTION

The rapid development of technology today has the potential to provide great benefits in the advancement of various fields [1]. With technology, it is possible to easily solve various problems, one of which is through the use of expert systems. Expert systems, which are part of the field of artificial intelligence, have developed along with the development of computer science [2]. To date, expert systems have been very useful in solving complex problems, decision-making, and even diagnosing diseases. This will be of great benefit to patients with health problems, especially those related to the female reproductive system [3].

The reproductive system includes aspects of physical, mental, and overall social well-being associated with reproductive functions and processes, not just health that is free from disease and disability [4]. Discussions about the reproductive system are often considered sensitive and rarely discussed, especially by women, because it is considered a very personal and intimate thing to talk about [5]. If not treated quickly, the consequences can be very serious and harmful, the diversity of diseases with similar symptoms makes it difficult for patients to distinguish the type of reproductive disease they are experiencing. This inevitably leads to misdiagnosis, especially if the patient has never consulted a specialist [6]. Absence of knowledge about dangerous diseases, lack of awareness of diseases, remote and hard-to-reach locations of health facilities, high costs for consultations and drugs, as well as long time to get diagnostic results are some of the factors that can prevent a person from having a health check-up.

Some diseases that often occur in women's reproductive health, such as Premenstrual Syndrome, Uterine Miyoma, Uterine Neck Cancer, Polycystic Ovarian Syndrome (PCOS) and Sexually Transmitted Diseases (STDs) [7]. In addressing this issue, technology is needed that allows women to more easily make an early diagnosis of their illness [8]. One alternative proposed to facilitate the exchange of information between health experts in specific fields and the general public is to create an expert system at Utama General Hospital Kisaran, with the expert being Dr. Janwar S Nst, M.Ked (OG) SpOG.

The research with the title "Implemantation of Case Based Reasoning (CBR) for the Development of Expert Systems for Diagnosing Dental Diseases". This research aims to be able to help diagnose dental diseases experienced in order to get the right treatment. The Case Based Reasoning (CBR) approach involves problem-solving through recalling similar past events. Testing this method yielded an 82% similarity rate in diagnosing oral and dental diseases compared to known cases [9]. This method can aid in diagnosing dental diseases in patients, assisting specialist doctors in making precise and accurate decisions regarding disease management.

This research states that the Case Base Reasoning (CBR) method is very helpful in producing the right decisions with an accuracy rate of 82%. This supports this research, but this research uses an information system so that the CBR system can be accessed more easily and uses many alternatives and case studies so that the decision making

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process is very highly considered so that the decisions issued will be more accurate.

METHOD

Case Based Reasoning (CBR) is a method used to develop expert systems where decisions are made based on previous case experience to solve new cases [10]. The basic concept of the Case Based Reasoning (CBR) method is to use documented experiences to handle new problems. In using the Case Based Reasoning (CBR) method, one can solve new problems by referring to the similarities with the solutions of previous problems [11].

Following that, the analysis phase is conducted by employing the Case Based Reasoning (CBR) technique and utilizing the Nearest Neighbor algorithm [12]. The Case Based Reasoning method consists of four stages, comprising: (1) Retrieve, get or retrieve the case that most resembles/relevant (similar) to the new case. This retrieval stage begins by describing part of the problem, and ends if a match is found against the previous problem with the highest match rate. This part refers to the aspects of identification, initial match, search and selection and execution. (2) Reuse, modeling/reusing the knowledge and information of the old case based on the most relevant similarity weight into the new case, resulting in a proposed solution where adaptation to the new problem may be required. (3) Revise, evaluate the suggested solution and then test it on a real-life case through simulation. If required, refine the solution to suit the specifics of the new case. (4) Retain, incorporate or archive the new case, which has effectively acquired a solution, for future use by cases with similarities. However, if the new solution proves unsuccessful, analyze the failure, enhance the solution, and retest it [12]. The four processes each involve a number of specific steps, which are described in Figure 1.

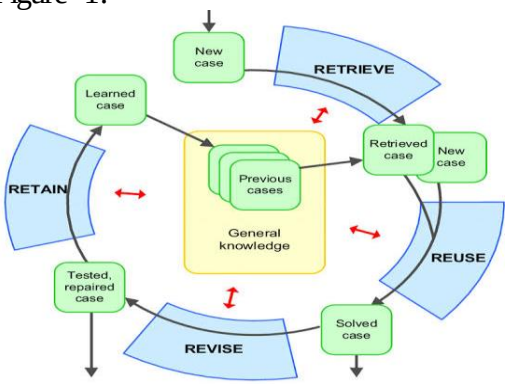

Image 1. Cycle of Case Based Reasoning Method

During the retrieval stage, weighting is conducted utilizing the Nearest Neighbor Retrieval (RNN) algorithm. At the onset of the diagnosis, users input their symptoms directly, without the need for extensive questioning. Subsequently, the system generates diagnostic outcomes by matching each symptom individually within the knowledge base. The system will calculate the similarity of the weights using the following formula.

Similitary (problem, case)

$$\frac{S_1 * W_1 + S_2 * W_2 + \ldots + S_n * W_n}{W_1 + W_2 + \ldots + W_n} \quad (1)$$

Describe:
S = Similarity (similarity value) i.e. 1 (same) and 0 (different)
W = Weight (weight given)

The higher the value obtained, the higher the closeness will be.

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Conversely, the lower the value obtained, the lower the closeness. In this application, a limit is determined, namely if the value obtained > = the predetermined value then the old case can be directly reused to solve the new case.

RESULTS AND DISCUSSION

Types of diseases affecting the female reproductive system

The object to be discussed in this article is about the symptoms found in the causes of female reproductive diseases. The grouping of symptoms can be divided into three, namely: (1) Mild symptom grouping with parameter weight (w): 1, (2) Moderate symptom grouping with parameter weight (w): 3, (3) Severe symptom grouping with parameter weight (w) : 5

Treatment Solution:

Exercise can alleviate the cramps, fatigue, and lack of energy that come with PMS. A sweaty body and activity can also boost your mood.

Table 1. Symptoms and Weights of Premenstrual Syndrome

Disease Name	Symptoms	Weight
Premenstrual Syndrome	Stomach cramps	1
	Body weakness	1
	Headache	1
	Acne appearance	1
	Unbearable stomach cramps	3
	Intense headache	5

Table 2. Symptoms and weights of uterine miyoma

Disease Name	Symptoms	Weight
Uterine Miyoma	Heavy menstruation	3
	Abdomen feels full and enlarged	3
	Discharge of miyoma through the cervix which is generally accompanied by severe pain	5
	Constipation due to myoma pressing on the lower part of the colon	5

Treatment Solution

The treatment approach involves utilizing paracetamol for pain relief alongside regular physical examinations and ultrasound scans, scheduled every 6-8 weeks to track the growth of the fibroids, assessing both their size and quantity. In case of stable growth, the patient undergoes observation every 3-4 months.

Table 3. Cervical Cancer Symptoms and Weights

Disease Name	Symptoms	Weight
Cervical Cancer	Irregular menstrual cycle	5
	Vaginal discharge that changes color, odor, especially if it comes out with blood	5
	Pain in the pelvic area may occur when the cancer has spread to surrounding organ tissues	3
	Pain or discomfort during sexual intercourse (dyspareunia)	3

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Treatment Solution

Radiotherapy, Treatment uses x-rays or other particles to destroy cancer cells. Radiotherapy can be an option for both early and advanced cancer. In some cases, radiotherapy may be given before or after surgery.

Table 4. Symptoms and Weight of Polycystic Ovarian Syndrome (PCOS)

Disease Name	Symptoms	Weight
Polycystic Ovarian Syndrome (PCOS)	Irregular menstrual periods	3
	Many cysts in the ovaries	5
	Disturbance in body weight	1
	Appearance of skin tags	3
	Difficulty getting pregnant	5

Treatment Solution

Eat nutritious food, exercise regularly, maintain weight, have regular medical check-ups.

Table 5. Symptoms and Weights of Sexually Transmitted Diseases (STDs)

Disease Name	Symptoms	Weight
Sexually Transmitted Diseases (STDs)	Changes in urine	3
	Pain during sex	5
	Pelvic or lower abdominal pain	1
	Vaginal burning or itching	3

Treatment Solution

Avoid having sexual intercourse with more than one person, regularly maintain vaginal hygiene, always use a safety device during intercourse.

Process Analysis

The analysis phase employs the Case Based Reasoning (CBR) method and integrates the Nearest Neighbor algorithm. Within the CBR method, four sequential stages are involved: retrieve, reuse, revise, and retain. This system typically operates under the guidance of its own knowledge base.

As an example of data on symptoms of female reproductive diseases entered by users in the expert system application can be seen in table 6:

Table 6. New Patient Cases (x)

Patient Inputted Symptoms (x)	Weight
Abdominal cramps	1
Heavy menstruation	3
Stomach feels full and enlarged	3

Retrieve Process

The retrieval process involves seeking resemblances between new cases and pre-existing cases within the knowledge base. This similarity search entails comparing the symptoms provided by the user with those documented in the knowledge base. During this retrieval phase, weighting is conducted using the Nearest Neighbor Retrieval (RNN) algorithm.

At the start of the diagnostic process, users provide all their symptoms at once, without the need for extensive questioning. Subsequently, they receive the diagnosis results. The system conducts weighting by comparing each symptom individually with those in the knowledge base.

The system calculates the weight similarity processing stage:

Similitary calculation of Premenstrual Syndrome cases.

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$$\text{Similitary (problem, case)} = \frac{1*1+0*1+0*1+0*1+1*3+0*5}{1+1+1+1+3+5}$$

$$= \frac{4}{12}$$

$$= 0{,}33 = 33\%$$

Similitary calculation of Uterine Miyoma cases

$$\text{Similitary (problem, case)} = \frac{1*3+1*3+0*5+0*5}{3+3+5+5}$$

$$= \frac{6}{16}$$

$$= 0{,}37 = 37\%$$

Reuse Process

From the calculations that have been carried out, there are 3 (three) cases that have similarity weights because the cases inputted are similar to the cases in the knowledge base. For cases that have the highest similarity weights are: (1) Cases in premenstrual syndrome with a value of 33%, where there are 1 (one) symptom inputted that is similar to the symptoms in the knowledge base. (2) Cases of miyoma uteri disease with a value of 37%, where there are 2 (two) symptoms that are inputted have in common with the symptoms in the knowledge base. (3) For six cases in other diseases have a value of 0%, because they have nothing in common with the symptoms in the knowledge base.

During the reuse process, the system selects the solution with the highest similarity weight among existing cases in the knowledge base and the new case. Based on the calculated weights, the case with the highest similarity value is uterine fibroids, with a percentage of 37%.

Revise Process

This step involves evaluating the proposed solution, testing it on a real case through simulation, and potentially revising the solution to align with the specifics of the new case.

Retain Process

The retain process involves integrating or storing the new case, enabling it to serve as a reference for updates in the subsequent knowledge base.

Testing Results

Assessing the implementation of the expert system involves evaluating the interface of the completed program. Below are the visual outcomes of the expert system application designed for diagnosing female reproductive diseases utilizing the Case Based Reasoning (CBR) method:

Image 2. Expert System Home Page

The first page displayed when the user opens the system or accesses the female reproductive expert system page. The system will show a doctor, the address of the assignment along with the address of the doctor's practice and the details

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Image 3. Expert Information Page

The expert information page displays expert information that plays a role in determining the rules of this expert system.

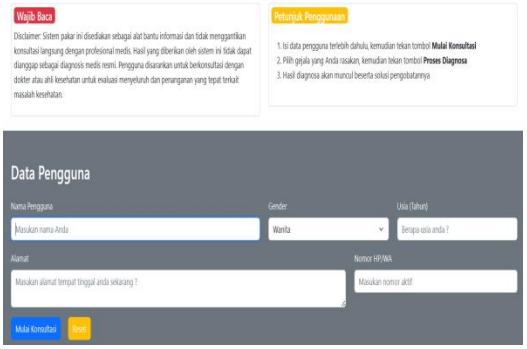

Image 4. Consultation

This page is the starting page for the patient or user to start the consultation.

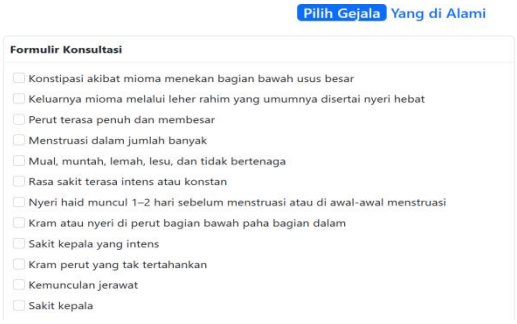

Image 5. Consultation Process

This consultation process page contains a list of symptoms that may be felt by the patient.

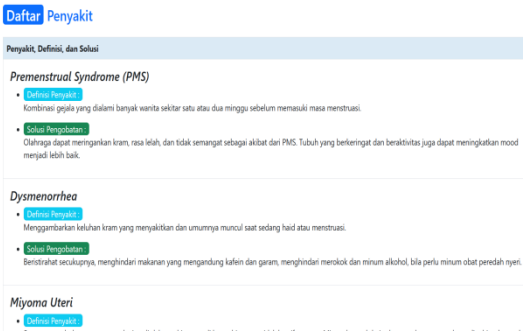

Image 6. Disease Data

The disease information page is a page used to display information on female reproductive diseases in the expert system.

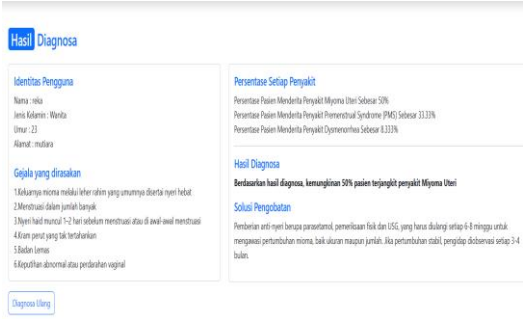

Image 7. Diagnosis Result

The diagnosis result displays the user's identity, then displays the symptom information selected at the consultation stage, and the diagnosis result by displaying the name of the detected disease.

CONCLUSION

This research can be concluded that by using the Case Based Reasoning (CBR) approach, the expert system at the Main General Hospital in Kisaran can assist in increasing women's access to early diagnosis of female reproductive health disorders. This system utilizes the direct knowledge and experience of an expert in the field of female reproductive health to provide

faster and more precise services.

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