The Expert System uses the Certainty Factor (CF) Method to Detect the Level of Postpartum Depression

Muhammad Zulfadhilah
Universitas Sari Mulia
Department of Information Technology, Universitas Sari Mulia, Indonesia

Novalia Widiya Ningrum
Universitas Sari Mulia
Department of Midwifery, Universitas Sari Mulia, Indonesia

ABSTRACT
Currently, there are technological advances that are able to detect various diseases and psychological disorders in humans early. One of the innovations in the health sector is the existence of an expert system that utilizes expert knowledge to assist in the early diagnosis of a disease or disorder, both physical and psychological. In the research carried out, data was collected through interviews, observations and studies of relevant literature related to postnatal psychological disorders. At this stage the researcher involved experts as experts, namely a midwife. Postpartum psychological disorders are categorized into three levels of disorders: Post Partum Blues, Post Partum Depression, and Post Partum Psychosis. Data on symptoms of this disorder was obtained through data collection activities, especially from the practice experience of midwives. The collected data will be processed to facilitate manual testing of the methods used. Application development follows the System Development Life Cycle (SDLC) model, specifically the waterfall method, which follows a systematic sequential approach to software development. The main stages in the waterfall method include requirements analysis, system design, system implementation, and system testing. Implementation of the expert system application will use the Certainty Factor (CF) method.

Keywords
Certainty Factor, Expert System, Postpartum, Psychological

1. INTRODUCTION
Computers have gained extensive usage, particularly in the healthcare field. This has prompted experts to continually advance computer-based systems to assist and even surpass human capabilities in their work. Modern computer system technology is equipped with diverse capabilities that enable it to identify human movement conditions, facial expressions, and even evaluate the state of human health [1].

The health care system in Indonesia currently consists of primary health centers called hospitals and secondary health centers called “Puskesmas”. “Puskesmas” facilities are spread all over the country, including remote villages. Usually, hospitals are equipped with complete medical equipment to support special health services every day. In contrast, “Puskesmas” facilities mostly accommodate general practitioners and have limited equipment for specialized medical procedures. In addition, due to their limited expertise, general practitioners who diagnose a symptom of a disease or other health disorder may face challenges in accurately identifying or diagnosing a particular disease. Therefore, a support system is needed that can assist general practitioners in diagnosing ear disease and facilitate better decision making [2].

One of the health issues prevalent in society is mental health. Mental health, akin to physical health, is a significant aspect that necessitates attention. Unfortunately, mental health often gets overlooked by many individuals due to its distinct nature compared to the visible and readily recognizable aspects of physical health [3].

The prevalence of postpartum depression among women after childbirth raises concerns, particularly within the family environment. According to a study conducted by [4], the occurrence of postpartum depression is estimated to be 1 to 2 cases per 1000 births. Additionally, approximately 50 to 60% of mothers experience postpartum depression following the birth of their first child. Furthermore, around 50% of mothers with postpartum depression have a family history of mood disorders.

One application of the use of technology in the world of medicine and health is an expert system, this system adopts the expertise knowledge of medical professionals. Usually, expert in this context refers to a physician who often analyzes available information using expressions such as "maybe", "most likely", or "almost certain"[5], [6]. Expert knowledge, in the case of doctors, can be communicated through various means beyond public speeches. These include methods such as posters, social media platforms, electronic advertisements, and flyers. One effective approach is through the utilization of an expert system [7]. The utilization of expert systems for the early detection of postpartum psychological disorders would significantly assist mothers in anticipating and mitigating more severe occurrences.

The certainty factor (CF) method is a viable approach for addressing problems of uncertainty within an expert system. Various applications of expert systems have been developed using the certainty factor method, such as dental disease diagnosis, herbal medicine-based diagnosis for dogs, bipolar disorder diagnosis, viral infection diagnosis in children, goat disease diagnosis, Covid-19 diagnosis, and chronic kidney disease diagnosis. These studies demonstrate that the CF method yields accuracy values exceeding 70%. In comparison to the Bayes method, the certainty factor method exhibits a higher accuracy value of 66.67% [6], [8].

The Certainty Factor (CF) represents the degree of trust in facts or hypotheses, supported by evidence. Ranging between -1 (indicating definite falsehood) and +1 (indicating definite truth), the CF value measures the level of confidence (positive number) or uncertainty (negative number) associated with the derived conclusions [9]. In research study [10] the Expert System using the Certainty Factor method achieved an accuracy rate of 86.67% in assessing women's skin aesthetics. According to the research conducted by [11], the CF method exhibits superior accuracy when compared to the Bayes Theorem method in diagnosing Candidiasis. Furthermore,

research study "A" reveals that the implementation of the Certainty Factor (CF) method in expert systems yields an impressive accuracy rate of up to 90% [12].

According to the provided description, the present study aims to utilize the Certainty Factor (CF) method implemented in an expert system for the early detection of depression levels among postpartum mothers.

2. RESEARCH METHOD

In this section, the author will explain the research flow and the use of the CF method in the implementation of an expert system for the detection of postpartum depression. According to Turban (Figure 1) "The expert system is composed by two main parts, namely: the development environment for the expert system environment and the consulting environment used by users who are not experts to obtain expert knowledge" [13].

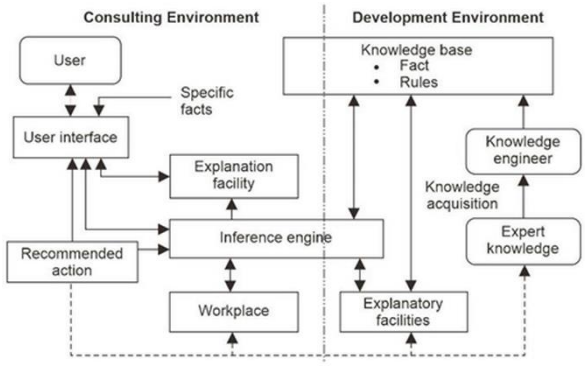

Figure 1: Expert System Architecture

Figure 2 depicts the flow of research carried out in the implementation of a postpartum depression level detection system using the Certainty Factor (CF) method. The use of CF values from experts and user participation in providing CF values allows the system to obtain results that are more accurate and relevant to individual conditions.

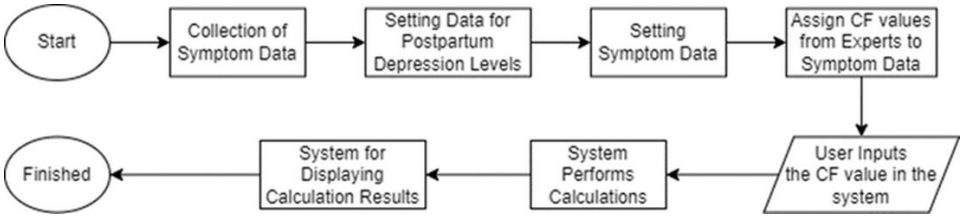

Figure 2 Research Flow

2.1 Collection of Symptom Data

Researchers collected symptom data relevant to the level of postpartum depression from various sources, including previous research, literature, and interviews with experts or related health experts. This data contains various symptoms that may be experienced by postnatal mothers which can be used as indicators of depression levels. In the symptom data collection process, data were obtained for 102 symptoms from 3 levels of postpartum depression.

2.2 Setting Data for Postpartum Depression Levels

Researchers determined the data for postpartum depression levels based on specific criteria or scales used in the study. For example, the depression level data could be categorized as Post Partum Blues, Post Partum Depression, and Post Partum Psychosis, or presented as numerical scores corresponding to the severity of each level. Based on the level of postpartum depression obtained, the levels are divided into 3, namely Post Partum Psychosis, Post Partum Depression and Post Partum Blues.

2.3 Setting the Symptom Data

After collecting symptom data, researchers organized the data into tables or matrices. Each row represented a subject (postpartum mother), and each column represented a specific symptom. The values in the table cells indicated the presence or severity level of each symptom in the respective subject.

2.4 Assign CF Values from Experts for Symptom Data

Researchers collaborated with experts or healthcare professionals to determine the Certainty Factor (CF) values for each symptom in the data. CF values depicted the level of confidence the experts had in each symptom as an indicator of different postpartum depression levels (Post Partum Blues, Post Partum Depression, or Post Partum Psychosis). CF values could range from -1 (definitely false) to +1 (definitely true).

2.5 User Input CF Values in the System

In the detection system, users (postpartum mothers or healthcare personnel) were prompted to input CF values for each relevant symptom they experienced. Users provided assessments based on the symptoms they encountered and the severity level of each symptom.

2.6 System Performs Calculations

After users input CF values, the system performed calculations using the Certainty Factor (CF) method. The system processed the symptom data and the CF values provided by users to compute the postpartum depression level for each subject.

2.7 System Displays Calculation Result

Upon completion of the calculation, the system presented the detection results of different postpartum depression levels (Post Partum Blues, Post Partum Depression, or Post Partum Psychosis) to users. The results could be in the form of depression level categories or numerical scores indicating the severity of each level.

3. RESULTS AND DISCUSSION

This research produces an expert system design that can assist postpartum mothers in conducting early examinations related to the level of postpartum depression. Before implementing the application, the researcher first creates a mathematical model to observe the results of the Certainty Factor calculation method using a spreadsheet/excel worksheet application. The formula employed in this research for Certainty Factor (CF) involves a user CF ranging from 0 to 1. The combined CF is

computed through the equation: Combined CF (CF1, CF2) = CF1 + CF2 – (CF1 * CF2). Moreover, the amalgamated CF is established by multiplying the user-provided CF with the expert's CF, using the formula: Combined CF = User CF * Expert CF. The CF calculation formula is a formula that has the condition that the list of symptoms is large and the list of diseases is large.

Table 1 provides an illustration of the CF formula results for Post Partum Blues depression level calculated in Excel. It outlines the CF computation, a fusion of user-input values and expert-determined values. Meanwhile, Table 2 exemplifies the computation of the combined CF value for each symptom concerning Post Partum Blues depression.

Table 1 Sample CF Calculation Combination Post Partum Blues

Symptom Code	Symptom Name	Depression Levels	CF User Value	Expert CF Value	Combination CF
PPB01	mood changes	Post Partum Blues	1.00	0.25	0.25
PPB02	sleep disorder		0.00	0.25	0
PPB03	weak		0.75	0.25	0.1875
PPB04	feeling useless		1.00	0.25	0.25
PPB05	easily offended		0.00	0.25	0
PPB06	nervous		1.00	0.25	0.25
PPB07	loss of appetite		1.00	0.25	0.25
PPB08	stress		0.00	0.25	0
PPB09	feel hopeless		0.00	0.25	0
PPB10	low income		1.00	0.25	0.25
PPB11	feeling anxious		1.00	0.25	0.25
PPB12	often feel guilty		1.00	0.25	0.25
PPB13	sad		0.00	0.25	0
PPB14	often cry		0.00	0.25	0
PPB15	decreased confidence level		0.00	0.5	0
PPB16	stress in marriage		1.00	0.5	0.5
PPB17	don't care about other people		1.00	0.5	0.5
PPB18	feeling tired after waking up		1.00	0.5	0.5
PPB19	breast milk production decreases		1.00	0.75	0.75
PPB20	afraid of childbirth		1.00	0.75	0.75
PPB21	panic attack		0.00	0.75	0

Table 2. Post Partum Blues Combined CF Calculation

CF Combined Post Partum Blues	
CF(PPB01, PPB02)	**0.25**
(CF old,PPB03)	0.390625
(CF old,PPB04)	0.542969
(CF old,PPB05)	0.542969
(CF old,PPB06)	0.657227
(CF old,PPB07)	0.74292
(CF old,PPB08)	0.74292
(CF old,PPB09)	0.74292
(CF old,PPB10)	0.80719
(CF old,PPB11)	0.855392
(CF old,PPB12)	0.891544
(CF old,PPB13)	0.891544
(CF old,PPB14)	0.891544
(CF old,PPB15)	0.891544
(CF old, PPB16)	0.945772

(CF old, PPB17)	0.972886
(CF old,PPB18)	0.986443
(CF old,PPB19)	0.996611
(CF old,PPB20)	0.999153

In Table 3, there's a demonstration of Post Partum depression level calculation performed in Excel. Subsequently, Table 4 exhibits the computation of Combined CF for Post Partum Depression, representing the next level of depression.

Table 3. CF Calculation Combined Post Partum Depression

Symptom Code	Symptom Name	Depression Levels	CF User Value	Expert CF Value	Combination CF
DPP02	nervous	Post Partum Depression	0.00	0.25	0
DPP03	difficult to concentrate		0.00	0.25	0
DPP04	alone		0.00	0.25	0
DPP05	hard to get along with		0.00	0.25	0
DPP06	hopeless		0.00	0.25	0
DPP07	very sad		0.00	0.25	0
DPP08	weak		0.00	0.25	0
DPP09	feeling useless		0.00	0.25	0
DPP10	feel tired quickly		0.00	0.25	0
DPP11	easily offended		0.00	0.25	0
DPP12	crying continuously		0.00	0.25	0
DPP13	can not sleep		0.00	0.25	0
DPP14	loss of appetite		0.00	0.25	0
DPP15	easy to get angry		0.00	0.25	0
DPP16	severe headache		0.00	0.25	0
DPP17	anxiety during pregnancy		0.00	0.25	0
DPP18	guilt		0.00	0.25	0
DPP19	feel helpless		0.00	0.25	0
DPP20	do things that are out of the ordinary		0.00	0.5	0

Table 4. CF Calculation Combined Post Partum Depression

CF Combined Post Partum Depression	
CF(DPP01, DPP02)	0
(CF old, DPP03)	0
(CF old,DPP04)	0
(CF old,DPP05)	0
(CF old,DPP06)	0
(CF old,DPP07)	0
(CF old, DPP08)	0
(CF old,DPP09)	0
(CF old, DPP10)	0
(CF old,DPP11)	0
(CF old,DPP12)	0
(CF old, DPP13)	0
(CF old, DPP14)	0
(CF old, DPP15)	0
(CF old,DPP16)	0

(CF old,DPP17)	0
(CF old,DPP18)	0
(CF old,DPP19)	0
(CF old, DPP20)	0

Table 5 demonstrates the computation for the ensuing depression level, specifically Post Partum Psychosis. Meanwhile, Table 6 exemplifies the calculation of the Combined CF for Post Partum Psychosis.

Table 5. Calculation of CF Combination of Post Partum Psychosis

Symptom Code	Symptom Name	Depression Levels	CF User Value	Expert CF Value	Combination CF
PPP02	Feeling scared	Post Partum Psychosis	0.00	0.25	0
PPP03	Feeling suspicious		0.00	0.25	0
PPP04	Easy cry		0.00	0.25	0
PPP05	Less powerful		0.00	0.25	0
PPP06	Loss of appetite		0.00	0.25	0
PPP07	Nervous		0.00	0.25	0
PPP08	Hard to sleep		0.00	0.25	0
PPP09	anxious		0.00	0.25	0
PPP10	insomnia		0.00	0.25	0
PPP11	manic mood		0.00	0.5	0
PPP12	Withdraw from the environment		0.00	0.5	0
PPP13	Difficulty concentrating		0.00	0.5	0
PPP14	refuse to eat		0.50	0.5	0.25
PPP15	suspect		0.00	0.5	0
PPP16	irrational		0.70	0.5	0.35
PPP17	extreme mood swings		0.80	0.75	0.6
PPP18	Nervousness or believing in things that are not true and illogical (Delusion)		0.00	0.75	0
PPP19	Becomes very aggressive and rude		0.45	0.75	0.3375
PPP20	Feeling paranoid		0.00	0.75	0

Table 6. Composite CF Calculation of Post Partum Psychosis

CF Combined Post Partum Psychosis	
CF(PPP01, PPP02)	0
(CF old, PPP03)	0
(CF old, PPP04)	0
(CF old, PPP05)	0
(CF old, PPP06)	0
(CF old, PPP07)	0
(CF old, PPP08)	0
(CF old, PPP09)	0
(CF old, PPP10)	0
(CF old, PPP11)	0
(CF old, PPP12)	0
(CF old, PPP13)	0
(CF old, PPP14)	0.25
(CF old, PPP15)	0.25

(CF old, PPP16)	0.5125
(CF old, PPP17)	0.805
(CF old, PPP18)	0.805
(CF old, PPP19)	0.8708125
(CF old, PPP20)	0.8708125

The analysis of the three delineated symptom levels reveals distinct Combined Certainty Factor (CF) values. Specifically, the Combined CF for Post Partum Blues is 0.999153, contrasting sharply with the 0.0 value for Post Partum Depression and the 0.8708125 value for Post Partum Psychosis. This data implies two Combined CF values nearing 1, underscoring the symptom similarity across different depression levels. However, a single value of 0 indicates a user with a total value of 0. Users of this application are advised to seek expert consultation for a thorough diagnosis. Nevertheless, the formula-calculated values highlight the prominence of the Combined CF value for Post Partum Blues at 0.999153, to be presented on the application interface, reflecting the predictive outcomes of the system's computations. In-depth manual calculations within the Excel framework underscore Postpartum Blues Depression as the predominant symptom among the three, offering crucial insights into the dynamics of postpartum psychological distress.

The testing phase involves a thorough evaluation by juxtaposing CF calculations with expert-derived results (refer to Table 7). Subsequently, a recalibration is executed utilizing the Confusion Matrix. This step is instrumental in gauging the system's accuracy, adhering to the formula established by [14].

Table 7. Recapitulation of Test Results with Experts

No	Depression Levels	Amount of Test Data Using CF	Identify the Truth According to Experts
1.	Post Partum Blues	8	7
2.	Depresi Post Partum	5	5
3.	Psikosis Post Partum	7	5
	Total	20	17

The following is the formula for calculating the Confusion Matrix:

$$Sensitivity: \frac{TP}{TP+TN} \quad (1)$$

$$Accuracy: \frac{TP+TN}{TP+FP+TN+FN} \quad (2)$$

Where:

TP = Number of positive/correct identification results for positive test data

FP = Number of negative/incorrect identification results for positive test data

TN = Number of positive/correct identification results for negative test data

FN = Number of negative/incorrect identification results for negative test data

Next, a CF calculation test was carried out by creating a Confusion Matrix based on the test results in table 7. Following is table 8, the results of the Confusion Matrix:

Table 8. Confusion Matrix

Identifikasi Jenis Depresi	Data Uji	TP	TN	FP	FN
Depresi Post Partum	20	17	0	3	0

$$Sensitivitas: \frac{17}{17+0} = 100\ \%$$

$$Akurasi: \frac{17+0}{17+3+0+0} = 85\ \%$$

The outcomes of the Confusion Matrix calculation reveal a sensitivity value of 100%, coupled with a system accuracy value of 85%. This underscores that computations employing the Certainty Factor (CF) method in the Expert System effectively discern the level of Post Partum Depression. This aligns with the findings of studies such as [15], indicating that the Certainty Factor (CF) method serves as a viable alternative for users to conduct early diagnoses of human disease symptoms, thereby enhancing knowledge and understanding in disease recognition and treatment. Other research by [16] affirms that the CF method effectively expresses the expert's confidence level in addressing the problem at hand. Moreover, its commendable accuracy is emphasized by [17], [18]. This high level of accuracy is further supported by research conducted by [11], asserting that the CF method outperforms the Bayes Theorem method in diagnosing Candidiasis

4. CONCLUSION

The successful execution of Certainty Factor (CF) calculations through Excel signifies a pivotal achievement in developing an

Expert System tailored for early detection of Postpartum Depression (PPD) levels. The meticulously designed user interface delivers comprehensive information, aiding users in comprehending their experiences and guiding subsequent steps. This application aims to empower postpartum mothers to promptly identify their depression levels, mitigating potential adverse consequences associated with untreated depression. Looking ahead, future enhancements could include integration with mobile health platforms, incorporation of machine learning algorithms for improved accuracy, expansion of symptom analysis, continuous monitoring and follow-up features, seamless integration with healthcare systems, iterative user-centered design improvements, and cross-cultural adaptations to address the unique challenges faced by postpartum mothers globally. These advancements will contribute to creating a comprehensive, accessible, and effective tool for early identification and management of postpartum depression, fostering healthier outcomes for mothers and their families.

5. ACKNOWLEDGMENTS

The research expresses gratitude to the Institute for Research and Community Service (LPPM) at Sari Mulia University for their support in conducting the study titled "Design and Development of an Expert System for Early Detection of Postpartum Depression Levels".

6. REFERENCES

[1] M. Zulfadhilah, "Sistem Pakar Untuk Diagnosa Gangguan Psikologis Anak Dengan Algoritma Breadth First Search (BFS)," *JITEKH*, vol. 7, no. 1, pp. 15–22, 2019.

[2] I. Gede, P. Suta Wijaya, H. Mulyana, H. Kadriyan, D. Yudhanto, and R. Y. Fa'rifah, "The Design of Convolutional Neural Networks Model for Classification of Ear Diseases on Android Mobile Devices," *JOIV : Int. J. Inform. Visualization*, vol. 7, no. 1, pp. 84–91, 2023, [Online]. Available: www.joiv.org/index.php/joiv

[3] A. Rahmadhani, F. Fauziah, and A. Aningsih, "Sistem Pakar Deteksi Dini Kesehatan Mental Menggunakan Metode Dempster-Shafer," *Sisfotenika*, vol. 10, no. 1, p. 37, 2020, doi: 10.30700/jst.v10i1.747.

[4] R. A. Sari, "Literature Review: Depresi Postpartum," *Jurnal Kesehatan*, vol. 11, no. 1, pp. 167–174, 2020, doi: 10.26630/jk.v11i1.1586.

[5] I. Y. Panessai, *Arsitektur Sistem Pakar*. Batam: PT. LAMINTANG, 2021.

[6] Y. Permana, I. G. P. S. Wijaya, and F. Bimantoro, "Sistem Pakar Diagnosa Penyakit Mata Menggunakan Metode Certainty Factor Berbasis Android," *Journal of Computer Science and Informatics Engineering (J-Cosine)*, vol. 1, no. 1, p. 1, 2018, doi: 10.29303/jcosine.v1i1.11.

[7] N. Othman, N. Arbaiy, and H. Mohd Rahman, "An Expert System for Pneumococcal Prognosis," *JOIV : Int. J. Inform. Visualization*, vol. 3, no. 2, pp. 204–208, 2018.

[8] S. Febriani and H. Sulistiani, "ANALISIS DATA HASIL DIAGNOSA UNTUK KLASIFIKASI GANGGUAN KEPRIBADIAN MENGGUNAKAN ALGORITMA C4.5," *Jurnal Teknologi dan Sistem Informasi (JTSI)*, vol. 2, no. 4, pp. 89–95, 2021.

[9] A. Andriani, A. Meyliana, Sardiarinto, W. E. Susanto, and Supriyanta, "Certainty Factors in Expert System to Diagnose Disease of Chili Plants," in *2018 6th International Conference on Cyber and IT Service Management, CITSM 2018*, Institute of Electrical and Electronics Engineers Inc., Mar. 2019. doi: 10.1109/CITSM.2018.8674264.

[10] S. Chandra, Y. Yunus, and S. Sumijan, "Sistem Pakar Menggunakan Metode Certainty Factor untuk Estetika Kulit Wanita dalam Menjaga Kesehatan," *Jurnal Informasi dan Teknologi*, vol. 2, no. 4, pp. 105–111, Dec. 2020, doi: 10.37034/jidt.v2i4.70.

[11] Z. Panjaitan and R. I. Ginting, "Perbandingan Metode Certainty Factor dan Theorema Bayes dalam Mendiagnosa Penyakit Kandidiasis pada Manusia Menggunakan Metode Perbandingan Eksponensial," vol. 5, no. 3, pp. 1097–1106, 2021, doi: 10.30865/mib.v5i3.3078.

[12] I. Efendi, R. K. Niswatin, and I. N. Farida, "Penerapan Metode Certainty Factor Untuk Sistem Pakar Diagnosa Penyakit Burung Puyuh Berbasis Web," in *Seminar Nasional Inovasi Teknologi*, Kediri: UN PGRI Kediri, Jul. 2020, pp. 1–10.

[13] A. K. Suhendar, "Sistem Pakar Diagnosa Kerusakan Mesin Robot Take Out Menggunakan Metode Forward Chaining Dan Penelusuran Depth First Search (Studi Kasus : Pt. Dynaplast)," *J Chem Inf Model*, vol. 110, no. 9, pp. 1689–1699, 2020.

[14] Minarni and I. Warman, "Sistem Pakar Identifikasi Penyakit Tanaman Padi Menggunakan Case-Based Reasoning," *Seminar Nasional Aplikasi Teknologi Informasi (SNATi)*, pp. 28–32, 2017.

[15] T. Hidayat, H. N. Nasution, S. W. R. Nasution, and R. Fauzi, "SISTEM PAKAR UNTUK MENDIAGNOSA PENYAKIT LUPUS DENGAN MENGGUNAKAN METODE CERTAINTY FACTOR," *Jurnal Education and Development*, vol. 7, no. 3, pp. 114–117, 2019, doi: 10.37081/ed.v7i3.1201.

[16] A. H. Aji, M. T. Furqon, and A. W. Widodo, "Sistem Pakar Diagnosa Penyakit Ibu Hamil Menggunakan Metode Certainty Factor (CF)," *Jurnal Pengembangan Teknologi Informasi dan Ilmu Komputer*, vol. 3, no. 5, pp. 2127–2134, 2018, [Online]. Available: http://j-ptiik.ub.ac.id/index.php/j-ptiik/article/view/1556

[17] P. Sari Ramadhan and U. Fatimah Sitorus Pane, "Analisis Perbandingan Metode (Certainty Factor, Dempster Shafer dan Teorema Bayes) untuk Mendiagnosa Penyakit Inflamasi Dermatitis Imun pada Anak," *Sains dan Komputer (SAINTIKOM)*, vol. 17, no. 2, pp. 151–157, Aug. 2018, doi: 10.53513/jis.v17i2.38.

[18] N. Ratama, "Analisa Dan Perbandingan Sistem Aplikasi Diagnosa Penyakit Asma Dengan Algoritma Certainty Factor Dan Algoritma Decision Tree Berbasis Android," *Jurnal Informatika: Jurnal Pengembangan IT*, vol. 3, no. 2, pp. 177–183, 2018, doi: 10.30591/jpit.v3i2.848.