Accredited SINTA 3

E-ISSN : 2541-2019
P-ISSN : 2541-044X

SinkrOn

JURNAL DAN PENELITIAN TEKNIK INFORMATIKA

Volume 5 | Number 1 | October 2020

Dipublikasi oleh :

POLITEKNIK GANESHA Medan

PREFACE

Praise the presence of Allah SWT, for blessings and mercy, in the successful publication of the Journal SinkrOn Volume 5 Number 1 for the October 2020 Period which refers to the rule for journal writing determined by Polytechnic Ganesha Medan.

SinkrOn as a media publication and a place to share scientific work in the field of Informatics Engineering which is published twice in a year, namely in October and April, and this edition is filled with contribution from a various institution in parts of Indonesia with research fields related to the field of Informatic Engineering from lectures and graduate students.

In this edition and beyond, SinkrOn is committed to continuously improving the quality of journals to be published. SinkrOn substantially tightens the entire review process to publish quality journals. Currently, SinkrOn has been accredited by RistekBRIN Sinta 3 and indexed DOAJ. SinkrOn has the vision to continue to improve accreditation to reach Sinta 1 in the next few years. Besides, SinkrOn also has the vision to enter the realm of international journals with the hope of reaching writers and readers from all over the world. In this edition, Sinkon has also involved several editors and reviewers from various countries such as Indonesia, Malaysia, India, Iraq, and Italy.

Our deepest gratitude to the authors, reviewers, editors, and all parties involved in publishing this journal. Hopefully, this journal can provide good benefits for all academics in the field of Informatics Engineering and still waiting for your brilliant work in the next edition.

Medan, 27 November 2020

Editor in Chief

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Kepala Badan Riset dan Inovasi Nasional
Nomor 148/M/KPT/2020
Peringkat Akreditasi Jurnal Ilmiah Periode II Tahun 2020
Nama Jurnal Ilmiah

Sinkron : Jurnal dan Penelitian Teknik Informatika

E-ISSN: 25412019

Penerbit: Politeknik Ganesha Medan

Ditetapkan sebagai Jurnal Ilmiah

TERAKREDITASI PERINGKAT 3

Akreditasi Berlaku selama 5 (lima) Tahun, yaitu
Volume 4 Nomor 2 Tahun 2020 sampai Volume 9 Nomor 1 Tahun 2025

Jakarta, 03 Agustus 2020
Menteri Riset dan Teknologi/
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Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 5, Number 1, October 2020
DOI : https://doi.org/10.33395/sinkron.v5i1.10653
e-ISSN : 2541-2019
p-ISSN : 2541-044X

Expert System for Monitoring Elderly Health Using the Certainty Factor Method

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Submitted : Sep 24, 2020 | **Accepted** : Oct 7, 2020 | **Published** : Oct 7, 2020

Abstract: A person who is in the elderly phase will experience various decreases, ranging from decreased memory or senility, hormone production, skin elasticity, muscle mass, bone density, strength and function of body organs, and the immune system. As a result, it is difficult for the elderly or the elderly to fight against various kinds of disease-causing bacteria or viruses, comorbidities, and adaptation to the social environment. Due to the complexity of this health problem, improvements can not only be made in the aspect of health services but also improvements in the environment and engineering of population factors or hereditary factors, but it is necessary to pay attention to behavioral factors that have a considerable contribution to the emergence of health problems. This research uses the certainty factor (CF) method which can provide a measure of belief in a symptom as a measure of how much the value is in the later diagnosis. The purpose of making this expert system is so that patients, patient families, and medical teams can monitor the health of the elderly daily. The results of this study indicate that using the CF method has an accuracy rate of 91 percent for the prediction of patients who have cholesterol

Keywords: Expert System; Certainty Factor; Health Monitoring; Elderly

INTRODUCTION

Everyone will experience aging. As we get older, the normal function of the body will decrease (Guizani & Guizani, 2020). We will become physically weak and even some organs have been declared damaged by doctors. This will have an impact on a person's daily activities. The low immune system in the elderly also makes them more susceptible to various diseases (Yoon et al., 2018) (Song & Yu, 2019).

Many people do not understand that the elderly are very susceptible to psychological problems, so they are prone to suffer from depression. The psychological problem of the elderly that is most often felt is loneliness. Loneliness arises as a result of being abandoned by spouses, peers, and families who have also passed away a lot, as well as children who have started living separately. This loneliness will cause grief and sadness to lead to depression(Kim, 2018)

The elderly are people aged 55 to 65 years and over and need special attention from family and the environment, especially their needs and health. Several aspects of the health of the elderly are increasingly vulnerable to various physical and psychological complaints (Piškur et al., 2014).

The development of information technology such as expert systems is needed to understand the world of health such as the elderly. Maintaining the physical health of the elderly to keep fit requires an expert system that will record and provide solutions to health workers or families, both current complaints, blood pressure, blood chemistry checks (cholesterol, blood sugar uric acid), and so on (Pramody, 2019). As well as monitoring the physical activity of the elderly and providing education about healthy lifestyles for the elderly.

The elderly will experience various decreased endurance and several diseases including tuberculosis, diarrhea, pneumonia, hepatitis, hypertension, stroke, Diabetes mellitus and arthritis, or rheumatism (Fatimah & Alfiah, 2015). These diseases make them worry and are confused about how to handle them properly when they get a disease. So that this expert system can help the elderly and families to overcome the problems that arise above(Ashari, 2014).

The increasing number of elderly people can cause various problems such as medical problems (comorbidities), mental psychological, and socioeconomic. To overcome this, an expert system was created to monitor the health of the elderly. This system was created because of the low knowledge of the elderly and their families regarding disease information such as diabetes, cholesterol, gout, lack of motivation for the elderly to go to health centers due to distance from home, difficult economy, and lack of family support and closed elderly attitudes and behavior

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e-ISSN : 2541-2019
p-ISSN : 2541-044X

LITERATURE REVIEW

Elderly

The elderly will usually experience aging which is marked by physical changes and decreased body function and several disease problems arise including (Marlinda, 2020)

1. Nutritional deficiencies, this problem is caused because the teeth are not working optimally so that the process of chewing food is not perfect. Other factors can also be caused by decreased function of soy sauce and smell which results in decreased appetite. Other factors such as living alone without accompanying family can also affect the nutritional intake of the elderly (Fatimah & Alfiah, 2015) (Nikou et al., 2020).
2. Complementary diseases, namely metabolic diseases caused by decreased bodily functions such as hypertension and Diabetes Mellitus or as a complication of other diseases suffered by(Pramody, 2019).
3. Decreased Thinking Ability, namely decreased cognitive or thinking abilities of elderly people with dementia (Ushuluddin & Samarinda, 2020).
4. Psychological problems feeling lonely because of the loss of a spouse, friends who begin to decrease, and children who do not live at home, feel unappreciated or respected and the emergence of diseases that limit movement so that the elderly lose their confidence(Tinggi & Amanat, n.d.) (Gingras, 2020).

When a person enters old age there will be physical, psychological, and social changes. Physical changes include stamina and appearance so that some elderly people experience depression in work and social roles (Yoon et al., 2018). Economic change is related to social status and prestige in society as a retiree; changes in income because his life depends on pension benefits. Typical conditions similar to this decreased ability will give rise to a common symptom in elderly individuals, namely a feeling of fear of aging as long as they are not properly prepared (Sari & Realize, 2019) (Padikkapparambil et al., 2020).

Certainty factor (CF)

The Certainty factor (CF) method is a method in the field of expert systems in part a clinical parameter value is given for the first time by MYCI to show the degree of trust in a field of expertise. This method can be used in the medical field to diagnose a disease (Padikkapparambil et al., 2020).

This uncertainty can be a probability that depends on the outcome of an event. Uncertainty results are caused by 2 factors, namely the uncertain rules of an uncertain user answer to a question posed by a system (Laksono et al., 2015). It can very easily be seen in a system for diagnosing a disease where the expert cannot define a relationship between symptoms and causes with certainty, and the patient cannot feel something with certainty, and ultimately generates many possible diagnoses (Sidabutar, 2019).

The CF method shows a measure of the certainty of a fact or rule. CF is a clinical parameter to indicate the magnitude of confidence (Yuhandri, 2018).

The advantages of the certainty factor method are:

1. CF method can measure something certain or uncertain in making decisions in the disease diagnosis expert system.
2. This method is suitable for use in expert systems that contain uncertainties in the medical field to diagnose a disease.
3. In one calculation process can only process two data so that the accuracy of the data can be maintained.

While the shortcomings of the certainty factor method are:

1. Uncertainty modeling using the certainty factor method is usually debated.
2. For data more than two pieces, data processing must be done several times.

METHOD

Certainty factor (CF) is a method in the field of expert systems in part a clinical parameter value that is given for the first time by the MYCI holder to show the trustworthiness in a particular field of expertise. This method can be used in the medical field to diagnose a disease (Yuhandri, 2018).

This uncertainty can be in the form of probability which depends on the outcome of an event. Uncertain results are caused by two factors: the uncertain rules of an uncertain user answer to a question raised by a system. This can be very easily seen in systems for diagnosing diseases where the experts cannot define a relationship between symptoms and their causes with certainty, and patients cannot feel things with certainty, and in the end result in many possible diagnoses(Widodo et al., 2020)(Yoon et al., 2018).

CF has the following rules, which consist of:

Rule 1

Certainty Factor for rules with single symptoms (single premise rule).

$$[H,E]1 = CF[E] * CF[H] \qquad (1)$$

CF[H,E] : The certainty factor hypothesis which is influenced by evidence E (Facts) is known with certainty
CF[E] : Certainty factor hypotheses are influenced by evidence E (Facts) from the user/patient
CF[H] : Certainty factor hypotheses with the assumption of evidence known with certainty (Expert Value)

Rule 2
Certainty Factor for rules with similar conclusions (similary concluded rules) or more than one symptom

$$CFCombine\ CF[H,E]1,2 = CF[H,E]1 + CF[H,E]2 * (1 - CF[H,E]1) \quad (2)$$

CFcombine : The combined results of the hypothesis
CF[H,E]1 : Certainty factor initial or old hypothesis in the results table from evidence E which is known with certainty
CF[H,E]2 : The next symptom hypothesis certainty factor is in the results table from evidence E which is known with certainty

Rule 3
Converts the certainty value into a percentage for easier understanding:

$$Confidence\ Percentage = CF\_Combine * 100\% \quad (3)$$

RESULT

the monitoring study for the elderly only discussed three gout, cholesterol and Diabetes melitus melitus with twenty-three symptoms, as below:

Table 1
Disease

Code	Name of Disease
P01	gout
P02	Cholesterol
P03	Diabetes mellitus

In table 1 the discussion of an expert system consists of three diseases, namely gout, cholesterol, diabetes mellitus. This disease mostly affects the elderly at home or at-home health and can be seen by the symptoms in Table 2.

Table 2
Disease Symptoms

Code	Disease Symptoms
G01	Body temperature 36,5 - 37,2 C
G02	Blood pressure 80 - 120 mm Hg
G03	Blood sugar 70 - 130 mg/dl
G04	Cholesterol 200-239 mg/dl
G05	Gout 5,7 - 7,0 mg/dl
G06	Heart Pressure 60 - 100 BPM
G07	Feeling a headache
G08	Feeling Dizzy
G09	Blurred Vision
G10	Shortness of Breath
G11	nyctalopia
G12	pain in the joints
G13	Stiffness in bone joints.
G14	Chest pain
G15	Often tired
G16	A sense of aque in the nape
G17	Weak leg muscles

Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 5, Number 1, October 2020
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e-ISSN : 2541-2019
p-ISSN : 2541-044X

G18	Xanthelasma
G19	Frequent urination
G20	Fast hungry
G21	Weight loss drastically
G22	Hard-to-heal wounds
G23	Red and swollen gums

Table 2 of the expert system contains twenty-three common symptoms commonly suffered by the elderly, namely Body temperature 36.5 - 37.2 C, Blood pressure 80-120 mm Hg, Blood sugar 70-130 mg/dl, Cholesterol 200- 239 mg/dl, Gout 5,7 - 7,0 mg/dl, Heart Pressure 60 - 100 BPM, Feeling a headache, Feeling Dizzy, Blurred Vision, Shortness of Breath, nyctalopia, pain in the joints, Stiffness in bone joints, Chest pain, Often tired, Weak leg muscles, Xanthelasma, Frequent urination, Fast hungry, Weight loss drastically, Hard-to-heal wounds, Red and swollen gums, with each symptom, can be seen in table 3

Table 3
Expert Rule

Code Symptoms	Gout	Cholesterol	Diabetes Mellitus
G1	X	X	X
G2	X		
G3	X	X	X
G4	X	X	X
G5			X
G6			X
G7	X		
G8	X	X	X
G9	X		
G10			X
G11			X
G12			X
G13			X
G14	X	X	X
G15	X	X	X
G16	X	X	
G17	X		X
G18	X	X	X
G19	X		
G20	X	X	
G21	X		
G22	X		
G23	X	X	

Table 4
Prediction of Cholesterol disease symptoms

Code	Symptoms	Expert Value	Weight
G02	High Blood Pressure	0.8	0.2
07	Headaches are gradually becoming more frequent	0.4	0.8
G08	Dizziness, Nausea and vomiting without cause	0.4	1
G09	Visual impairment	0.5	0.6
G10	Shortness of Breath	0.6	0.6
G11	Tingling on the hands or feet	0.4	0.4
G14	Chest pain	0.4	1
G15	Frequent Fatigue	0.6	0.6
G16	A sense of a soreness at the nape	0.4	0.4
G18	Xanthelasma	0.4	0.2
G19	Frequent urination	0.6	0.2

Sinkron : Jurnal dan Penelitian Teknik Informatika
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p-ISSN : 2541-044X

Table 5
Combined CF Calculations

CF1	CF2	(1 - CF1)	CF2 * (1-CF1)	CF2 * (1-CF1) + CF1
0.32	0.40	0.68	0.27	0.59
0.59	0.00	0.41	0.00	0.59
0.59	0.36	0.41	0.15	0.74
0.74	0.00	0.26	0.00	0.74
0.74	0.40	0.26	0.10	0.84
0.84	0.00	0.16	0.00	0.84
0.84	0.16	0.16	0.03	0.87
0.87	0.00	0.13	0.00	0.87
0.87	0.30	0.13	0.04	**0.91**
0.91	0.00	0.09	0.00	**0.91**

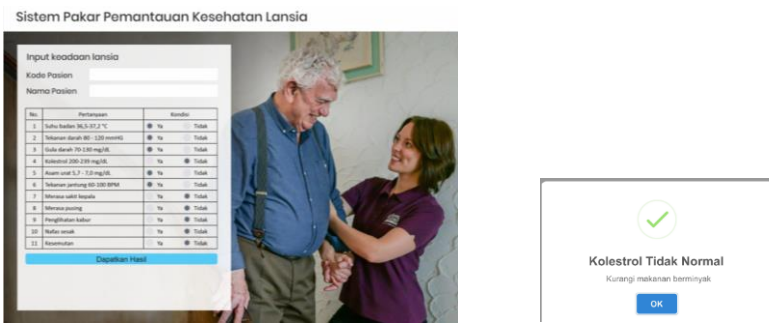

Fig. 1 Health Monitoring of Cholesterol elderly

Interface image 1, explaining the application of elderly expert system with abnormal Cholesterol results

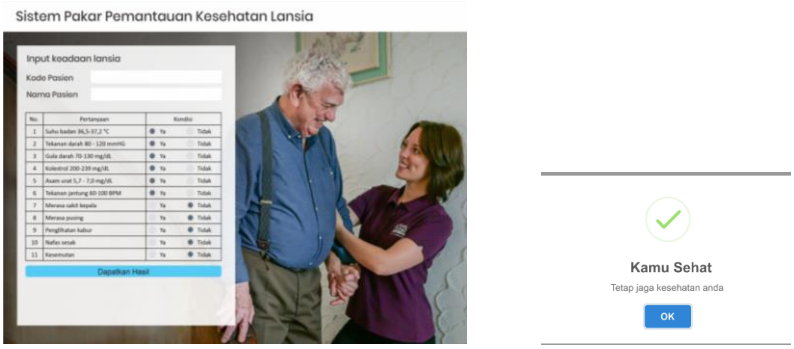

Fig. 2 Health Monitoring for healthy elderly

Interface image 1, explaining the application of the elderly expert system with the results of healthy seniors.Based on the above calculation obtained confidence prentasi for seniors who fill in the table above with high cholesterol condition of 91 percent

DISCUSSIONS

This paper applies a theoretical model of the adoption of digital health care technology that facilitates the independent living of the elderly. In particular, this system addresses health resource technology, giving people the freedom to live their lives in the way they see fit. The abilities that the elderly, families, and health workers acquire in the use of digital health care technology can provide the ability to live independently at home. In the following sections, we describe theoretical findings and contributions based on an expert theory using the Certainty factor method. We then discuss the research implications for practice, limitations, and suggestions for future research..

CONCLUSION

This expert system can monitor the health of the elderly with common symptoms they face such as Body temperature 36.5 - 37.2 C, Blood pressure 80-120 mm Hg, Blood sugar 70-130 mg/dl, Cholesterol 200-239 mg/dl, Gout 5,7 - 7,0 mg/dl, Heart Pressure 60 - 100 BPM, Feeling a headache, Feeling Dizzy, Blurred Vision, Shortness of Breath, nyctalopia, pain in the joints and others, if this system is filled by elderly people, nurses or family, the information will come out, the elderly are in good health or experiencing symptoms of diseases such as gout, cholesterol, and diabetes mellitus so that the elderly can be monitored for their health. The elderly can enjoy life, do sports regularly, have a healthy lifestyle, get enough rest. Based on respondents who filled in the expert system using the CF method, it was obtained calculations with results with a confidence level of 91 percent for predicting elderly patients who had cholesterol.

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