

## Decision support system in predicting pneumonia transmission in toddlers based on life patterns

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### Abstract

The increasingly widespread spread of pneumonia during the Covid-19 pandemic that attacks children, especially toddlers, has caused the under-five mortality rate (IMR) to increase. Pneumonia is the most worrying thing for parents because it is an acute respiratory disease that attacks the lungs due to the lack of special health information for toddlers that parents get about lifestyle during the Covid-19 pandemic. With the health information from the government for toddlers through the media, especially in improving a healthy lifestyle, it is expected to minimize the transmission of pneumonia. The problem that occurs in the transmission of pneumonia among the general public is air pollution by the presence of bacteria, viruses, and fungi or parasites and the most common types of bacteria attack *Streptococcus Pneumonia* and *Haemophilus Influenzae Virus type b (Hib)*. The weakening of the condition of children with this disease due to lack of adequate oxygen intake so that children will feel pain in the esophagus area when breathing. To be able to predict the transmission of pneumonia in toddlers based on lifestyle, the Fuzzy Multiple Attribute Decision Making (Fuzzy MADM) method through a Decision Support System (DSS) is used.

**Keywords:** Decision Support System; Pneumonia; Fuzzy MADM; Lifestyle

### 1. Introduction

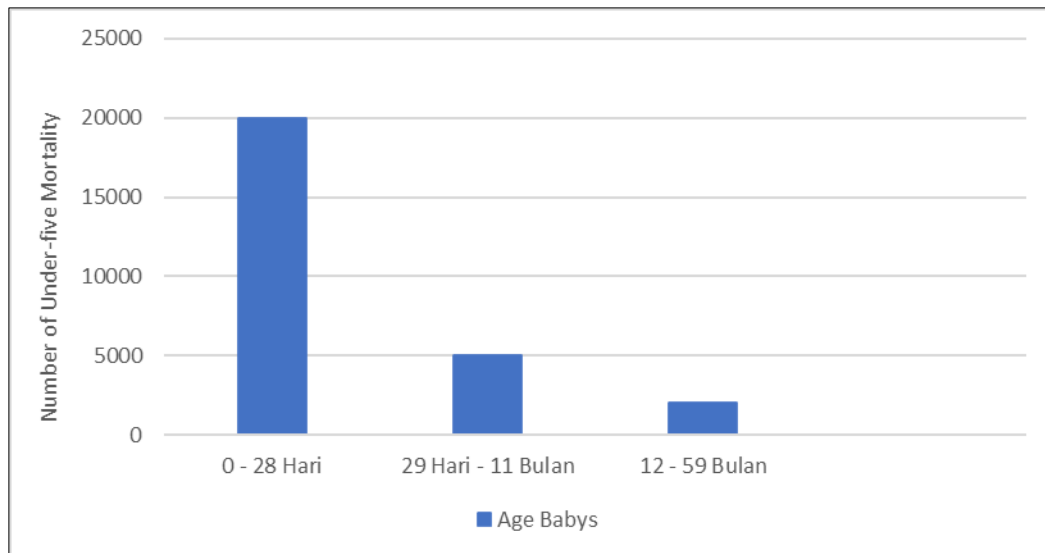
Pneumonia in toddlers is still one of the highest causes of death in the world [1],[2] during the Covid-19 pandemic [3]. The causes are bacteria, viruses, fungi, exposure to chemicals or physical damage to the lungs, as well as indirect effects from other diseases [4],[5]. The most felt impact is shortness of breath, runny nose, fever, fatigue and weakness so that toddlers are less active even though the process of growth and development in toddlers is very important. To maintain body resistance through healthy living behaviors, including consuming balanced nutritious foods and getting enough rest [6],[7].

According to WHO data in 2017, there were 25,481 under-five deaths due to acute respiratory infections and this puts Indonesia in seventh place in the world with the highest burden of pneumonia. The 25,481 under-five mortality rate shows that 17 percent of all world under-five deaths due to pneumonia are in Indonesia.

Infant mortality under five years old (toddlers) in Indonesia reached 28,158 people in 2020. Of that number, as many as 20,266 children under five (71.97%) died in the age range of 0-28 days (neonatal) [8].

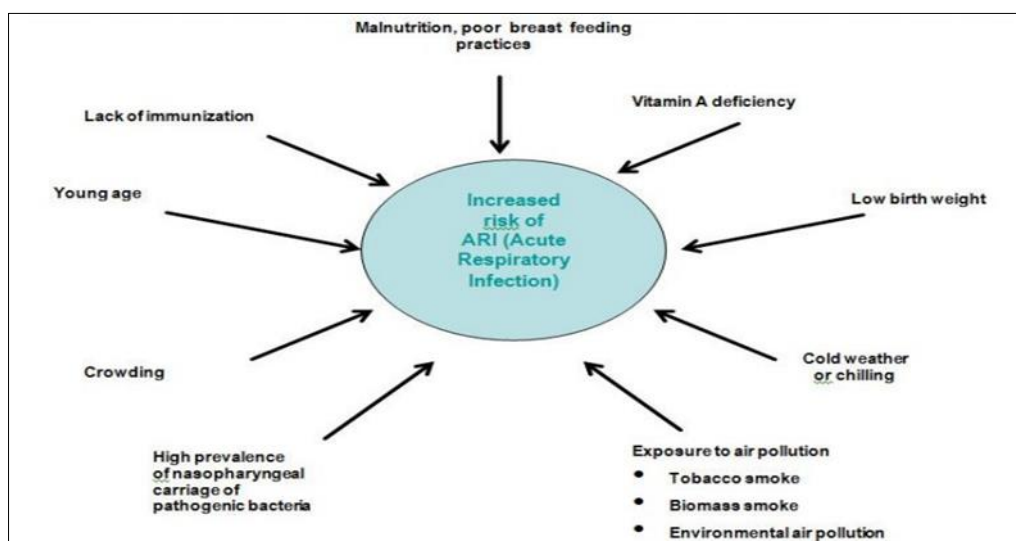
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Source: Central Bureau of Statistics.

**Figure 1** Number of Under-five Mortality by Age Group (2020)



Source: Epidemiology Window Bulletin (2010). Indonesian Ministry of Health

**Figure 2** Pneumonia Risk Factors in Toddlers

Air pollution from kitchen smoke plays a role in the risk of under-five mortality in several developing countries. About 1.6 million deaths are related to air pollution from kitchens. In addition, cigarette smoke pollution also acts as a risk factor and an unhealthy lifestyle in toddlers. Symptoms of pneumonia vary depending on the age of the patient and the cause of the infection [9]. Pneumonia due to bacterial infection usually causes a child to become seriously ill with a high fever and rapid breathing. Infections due to viruses are generally more gradual and can get worse over time. The diagnosis of pneumonia is confirmed by chest X-ray and lab tests, but in places that are not able to carry it out, suspected cases of pneumonia can be determined clinically from the existing clinical symptoms. The thing that must be considered if the child coughs and has difficulty breathing, to prevent it from becoming severe and death, the child must immediately get help according to the management guidelines [10].

The main problem in this study is the increase in cases of pneumonia in children under five due to bacteria, viruses, fungi, chemical exposure, physical damage to the lungs, as well as indirect effects from other diseases, which can be transmitted through the air, with the source of transmission from the patient. pneumonia that spreads germs in the form of droplets into the air when coughing or sneezing. The specific purpose of this study was to predict the transmission of pneumonia in infants based on lifestyle using the Fuzzy MADM method. The urgency of the feasibility

of this study is important in finding a new method or way to predict the transmission of pneumonia in children under five through SPK.

**Table 1** Guidelines for the Management of Pneumonia in Children

Symptom	Classified	Treatment
Fast breathing (*) Pull in the lower chest wall Stridor in children in a calm state	Severe Pneumonia	Refer to hospital immediately for antibiotic injections and oxygen if needed Give 1 appropriate dose of antibiotic
Fast breathing (*)	Less Severe Pneumonia	Give the right antibiotics to take Advise the mother and tell her when to return for a follow-up visit
No rapid breathing	Not Pneumonia (other lung disease)	Advise mother and tell when to return if symptoms persist or condition worsens

Source: Epidemiology Window Bulletin (2010). Indonesian Ministry of Health.

(\*) It is called rapid breathing, if:

Children <2 months of age breathe 60 or more times per minute

Children aged 2 months to 11 months breathe 50 or more times per minute

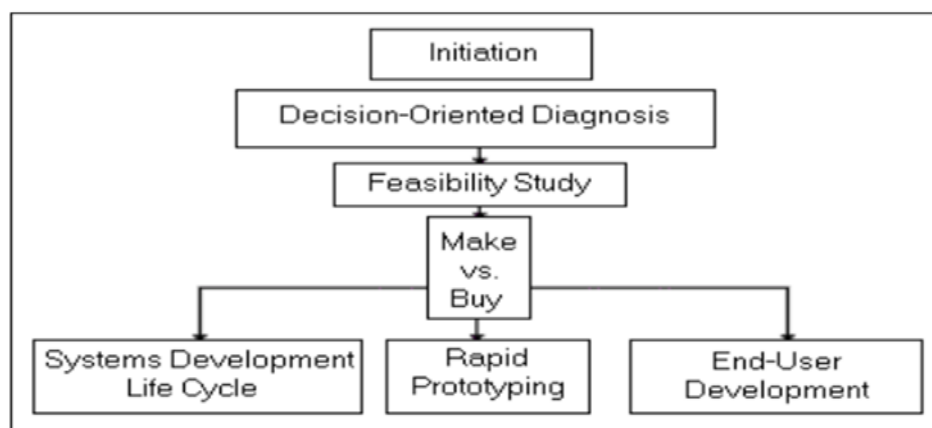
Children 12 months to 5 years of age breathe 40 or more times per minute

## 2. Literature Review

This research is sourced from Michael S. Scott Morton (1970) and Daniel J. Power (2002) who assume their views on the emergence of theory about the concept of DSS (Decision Support Systems).

### 2.1. Intelligent MDS and DSS Theory

Intelligent MDS is an interactive computer-based system, helping decision makers to use data and various models in solving unstructured problems [11]. One of the powerful decision support tools includes data warehouse, OLAP, data mining and Web-based DSS [12]. Meanwhile, Intelligent DSS is able to create a credible, clinically acceptable, economical reference standard for the diagnosis of pneumonia, and to determine the overall accuracy of the system [13]. From this definition, there are four main characteristics of DSS, namely: 1) DSS combines data and models into one part; 2) DSS is designed to assist managers in the decision-making process of semi-structural problems; 3) DSS tends to be seen as supporting the manager's assessment by not replacing it; 4) DSS technique was developed to increase the effectiveness of decision making [14].



Source: Decision Support Systems (Daniel J. Power, 2002)

**Figure 3** DSS Design and Hierarchy Development

## 2.2. Fuzzy Logic Theory

Basically, fuzzy logic is the exact logic of imprecision and approximate reasoning. More specifically, fuzzy logic can be seen as a formalization/mechanisation of two extraordinary human abilities. First, the ability to speak, reason and make rational decisions in an environment of imprecision, uncertainty, incomplete information, conflicting information, biases of truth and biases of possibility - in short, in an environment of imperfect information. And second, the ability to perform various physical and mental tasks without any measurement and calculation [15],[16].

## 2.3. MADM is Running Away

This decision support system model uses the Fuzzy MADM approach, which is a method used to find the optimal alternative from certain alternatives. The essence of Fuzzy MADM is to determine the weight for each attribute, followed by a ranking process that will select the alternatives that have been given [17]. There are several methods that can be used to solve the Fuzzy MADM problem, including [18]: 1) Simple Additive Weighting Method (SAW); 2) Electricity; 3) Order Preference Technique Based on Similarity with Ideal Solution (TOPSIS); 4) Analytic Hierarchy Process (AHP). This method is used to predict the transmission of pneumonia in children under five, based on the classification of lifestyle as the criteria in this study.

## 3. Material and methods

### 3.1. Research data

The data used in this study were obtained from health centers and hospitals based on the recommendations of the health office that had been approved by the Balitang (Badan Penelitian dan Pengembangan) Medan City and the data was collected from 2018 to 2022. Preference value obtained in the DSS application.

#	Nama Alternatif	Usia	Keturunan	Asupan Gizi Balita	Berat Badan	Orang Tua Perokok	Polusi Udara	Action
1	Faith Emran Sakaan	1 thn - 5 thn	Ibu	Jajanan/Snack	10 - 15 kg	Perokok Aktif	Debu	Delete
2	Cindy Priscilla Harefa	1 thn - 5 thn	Ayah dan Ibu	Jajanan/Snack	10 - 15 kg	Perokok Aktif	Asap Kendaraan	Delete
3	Dora	1 thn - 5 thn	Tidak Ada	Makanan/Minuman Instan	15 - - kg	Tidak Ada	Asap Kendaraan	Delete
4	Aldean Syahret	1 bln - 1 thn	Tidak Ada	Susu	5 - 10 kg	Perokok Aktif	Asap Kendaraan	Delete
5	Alby Arrosid	1 bln - 1 thn	Tidak Ada	Susu	10 - 15 kg	Tidak Ada	Asap Kendaraan	Delete
6	Yan Christopher	1 thn - 5 thn	Tidak Ada	Jajanan/Snack	15 - - kg	Perokok Aktif	Asap Kendaraan	Delete
7	M. Hafiz Alfarizi	1 thn - 5 thn	Tidak Ada	Susu	15 - - kg	Perokok Aktif	Asap Kendaraan	Delete
8	Adzril Rizky Fadillah	1 thn - 5 thn	Tidak Ada	Susu	10 - 15 kg	Perokok Aktif	Asap Kendaraan	Delete
9	Sugeng	1 thn - 5 thn	Tidak Ada	Susu	15 - - kg	Perokok Aktif	Debu	Delete
10	Mathew Sihite	1 thn - 5 thn	Tidak Ada	Susu	15 - - kg	Perokok Aktif	Debu	Delete

Figure 4 Display of 10 Toddler Data from 90 Data Obtained

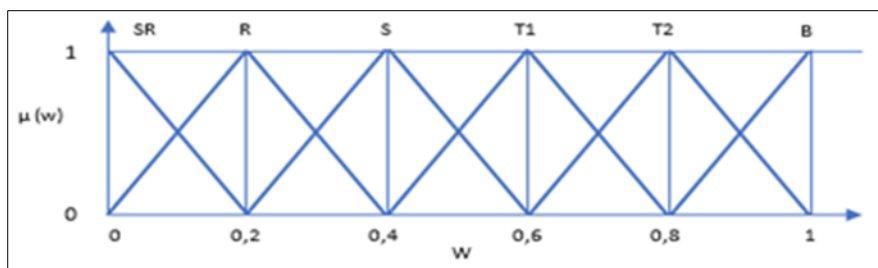
### 3.2. Process data

To predict the transmission of pneumonia in toddlers, the application of Fuzzy MADM is used in the design of the DSS application based on alternatives that arise from several criteria which will be shown in the following table:

**Table 2** Criteria

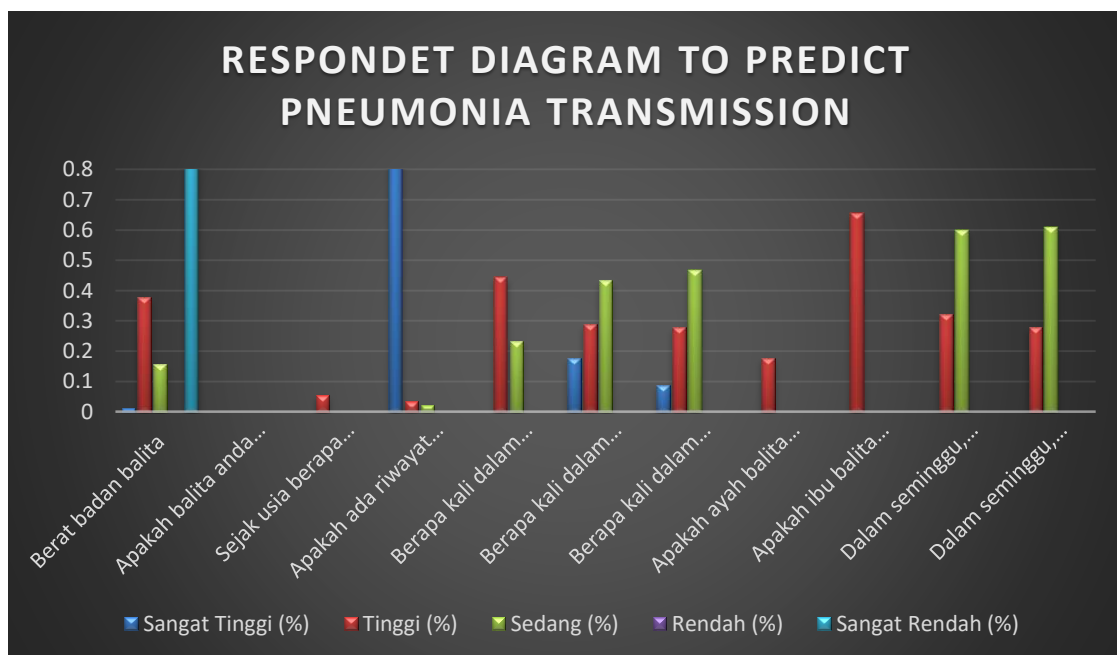
Criteria	Pneumonia Transmission Prediction
K1	Age
K2	Descendants
K3	Nutritional Intake of Toddlers
K4	Weight
K5	Smoking Parents
K6	Air Pollution

The graph in Figure 5 below is a variable from the criteria contained in table 3.



**Figure 5** Weighting Graph

The results of the questionnaire distribution in the following graph are ready to be processed using a Decision Support System (DSS) through Fuzzy Multiple Attribute Decision Making (FMADM).



**Figure 6** Respondent's Diagram for Predicting Pneumonia Transmission

The data analysis process consists of several stages. The following are the steps in making decisions with the Fuzzy MADM algorithm [16]:

- Provide alternative values (Ai) of each specified criterion (Ki).
- The weight value (W) is based on the crisp value.
- Determine the weight to be used for the ranking process.
- Matrix normalization.

After the alternative is obtained, the next step is to form a decision matrix based on the table above in order to be able to normalize the matrix by calculating the normalized performance rating (rij) value of the alternative Ai on the Kj attribute based on an equation that is adjusted to the type of attribute (cost attribute = Minimum). If it is a profit attribute, then the crisp value (Xij) of each attribute column is divided by the crisp Max value (Max Xij) of each column, while for the cost attribute the crisp Min (Xij) value of each column.

$$R_j = \frac{K_{ij}}{Max_{K_{ij}}}$$

- Ranking process.

$$R = \begin{bmatrix} r_{11} & \dots & r_{1j} \\ \vdots & \ddots & \vdots \\ r_{i1} & \dots & r_{ij} \end{bmatrix}$$

1. The preference value of each alternative (Vi).

$$V_i = \sum_{j=1}^n w_j r_{ij}$$

#### 4. Results

The results of this study were taken from data on toddlers who contracted pneumonia based on the criteria and variables obtained from questionnaire data that had been distributed to patients both at the puskesmas and patients in the hospital:

**Table 3** Alternative

No	Alternative	Research Result					
		K1	K2	K3	K4	K5	K6
1	Faith Emran Sakaan	0.8	0.6	0.8	0.6	0.8	0.6
2	Cindy Priscilla Harefa	0.8	0.8	0.8	0.6	0.8	0.8
3	Dora	0.8	0	0.6	0.8	0	0.8
4	Aldean Syahrel	0.6	0	0.4	0.4	0.8	0.8
5	Alby Arrosid	0.6	0	0.4	0.6	0	0.8
6	Yan Christopher	0.8	0	0.8	0.8	0.8	0.8
7	M. Hafiz Alfarizi	0.8	0	0.4	0.8	0.8	0.8
8	Adzril Rizky Fadillah	0.8	0	0.4	0.6	0.8	0.8
9	Sugeng	0.8	0	0.4	0.8	0.8	0.6
10	Mathew Sihite	0.8	0	0.4	0.8	0.8	0.6
11	Puput Ekasari	0.8	0	0.4	0.8	0.8	0.8
12	Ismayanti Siahaan	0.6	0	0.4	0.4	0	0.8
13	Viviana Sutejo	0.8	0	0.6	0.6	0.8	0.8
14	Joko Susanto	0.8	0	0.4	0.8	0.8	0.6
15	Pokana Ariska	0.8	0	0.4	0.8	0.8	0.8

16	Rohani Siti	0.8	0	0.4	0.8	0.8	0.8
17	Dwi Agustia	0.8	0	0.8	0.6	0.8	0.8
18	Suseno Andrian	0.8	0	0.4	0.8	0.8	0.8
19	Rinto Siregar	0.8	0	0.8	0.8	0.8	0.6
20	Alexander Naibaho	0.8	0	0.4	0.8	0.8	0.6
21	Hanny Siahaan	0.8	0	0.4	0.8	0	0.6
22	Susi Hariati	0.8	0.8	0.6	0.6	0.8	0.8
23	Hafiz Hasibuan	0.8	0	0.4	0.8	0	0.8
24	Olivia Felicia Simatupang	0.8	0	0.4	0.4	0.6	0.8
25	Midar Parapat	0.8	0	0.4	0.6	0.8	0.8
26	Tasya Nababan	0.8	0	0.4	0.8	0	0.6
27	Satria N	0.8	0	0.4	0.4	0.8	0.6
28	Joselin Atika	0.8	0	0.4	0.4	0.8	0.6
29	Denggan Ivander	0.8	0	0.4	0.4	0.8	0.8
30	Christian N	0.8	0	0.8	0.8	0.8	0.6
31	Nengsi Simanjuntak	0.8	0	0.4	0.8	0	0.6
32	Astrid Zendrato	0.8	0	0.6	0.4	0.8	0.8
33	Adella Sinurat	0.8	0	0.8	0.8	0.8	0.6
34	Albertini Sitinjak	0.8	0	0.4	0.8	0.8	0.8
35	Niko Heryanto	0.8	0	0.6	0.6	0	0.8
36	Suriani Winarty	0.8	0.6	0.4	0.6	0.8	0.8
37	Wiky Saputra	0.8	0	0.8	0.6	0.8	0.8
38	Amel Nainggolan	0.8	0	0.4	0.6	0.8	0.8
39	Widya Sari Sembiring	0.8	0	0.4	0.6	0	0.8
40	Kinos	0.8	0	0.4	0.6	0.8	0.8
41	Nining Dwi Kora	0.8	0.4	0.6	0.4	0.8	0.6
42	Dicky Sihotang	0.8	0	0.8	0.6	0.8	0.8
43	Edison Daniel Sitorus	0.8	0	0.6	0.6	0.8	0.8
44	Suzanna Dwina	0.8	0	0.8	0.6	0.8	0.8
45	Sri Wahyuni	0.8	0	0.6	0.8	0.8	0.8
46	Siska Swityna	0.8	0	0.6	0.8	0.8	0.8
47	Riska Sutrisna	0.8	0	0.8	0.6	0	0.8
48	Doni Sumargo Silitonga	0.8	0	0.8	0.8	0.6	0.8
49	Queenar	0.8	0	0.4	0.8	0.8	0.8
50	Wilson	0.8	0	0.6	0.6	0.8	0.8
51	Girson Malau	0.8	0.8	0.6	0.8	0.8	0.8
52	Valen Dina Sari	0.8	0	0.8	0.8	0.8	0.8
53	Dewi Sri Murti	0.8	0	0.6	0.8	0.8	0.8
54	Soni Suryadi	0.8	0	0.6	0.8	0.8	0.8

55	Kardo Antoni	0.8	0	0.8	0.6	0	0.8
56	Mardongan Sibarani	0.8	0	0.4	0.8	0.8	0.8
57	Yuli Srianita	0.8	0	0.4	0.6	0.8	0.6
58	Hana Swita	0.8	0	0.8	0.8	0.8	0.8
59	Winda Sari Dwinatan	0.8	0	0.4	0.8	0.8	0.8
60	Dina Suryani	0.8	0	0.4	0.8	0.8	0.8
61	Danos Barata	0.8	0	0.4	0.6	0	0.8
62	Pardomuan Silitonga	0.8	0	0.4	0.6	0.8	0.8
63	Wahyuni Sriningsih	0.8	0	0.4	0.6	0.8	0.6
64	Rina Dianasari	0.8	0	0.6	0.6	0.8	0.8
65	Yuna Suriati	0.8	0.6	0.8	0.8	0.8	0.8
66	Sondang Habeahan	0.8	0	0.6	0.6	0.8	0.8
67	Wulan Siregar	0.8	0	0.8	0.8	0.8	0.8
68	Sari Surita	0.8	0	0.4	0.8	0	0.8
69	Wira Ferdinan	0.8	0	0.8	0.8	0.8	0.8
70	Salsa Harahap	0.8	0	0.4	0.6	0.8	0.8
71	Putri Rosmawati Ningsih	0.8	0.4	0.8	0.6	0.8	0.8
72	Zahra Havilia Lubis	0.8	0	0.4	0.6	0.8	0.8
73	Ayella Alby Elysia	0.8	0.8	0.8	0.4	0.8	0.6
74	Darlin Sinaga	0.8	0	0.4	0.6	0.8	0.8
75	Dolly Candra	0.8	0	0.4	0.8	0.8	0.8
76	Toty Manullang	0.8	0	0.4	0.8	0.8	0.6
77	Stevanni Jesika	0.8	0	0.8	0.8	0	0.8
78	Gala Sky	0.8	0	0.8	0.8	0.8	0.8
79	Samuel Emilio	0.8	0	0.6	0.4	0.8	0.8
80	Sofian	0.8	0	0.8	0.4	0.8	0.8
81	Bella Tobing	0.8	0	0.4	0.4	0.8	0.8
82	Grace Situmorang	0.8	0	0.4	0.4	0.8	0.6
83	Shera Manullang	0.8	0	0.4	0.8	0.8	0.6
84	Mayang Sari	0.6	0.8	0.4	0.4	0.8	0
85	Siska Lorena	0.8	0	0.4	0.6	0.8	0.8
86	Jonni Sandrio	0.8	0	0.4	0.6	0.8	0.8
87	Putri Atika	0.8	0	0.8	0.6	0.8	0.8
88	Putri Amanda	0.8	0	0.4	0.6	0.8	0.8
89	Joen Dirgahayu	0.6	0	0.4	0	0.8	0.8
90	Rodaneria	0.8	0	0.8	0.8	0.8	0.8



### 5. Discussion

In figure 7 below, it is clear that the identification of pneumonia transmission can be seen in the preference value. if preference  $\leq 0.33$  then the instruction given is in a safe condition (save), if preference  $\leq 0.66$  then the instruction given is in an unsafe condition (warning), and if the preference value  $> 0.66$  then the toddler's condition can be predicted infected with pneumonia.

Nilai perankingan setiap alternatif										
#	Nama Alternatif	K1 <sub>norm</sub>	K2 <sub>norm</sub>	K3 <sub>norm</sub>	K4 <sub>norm</sub>	K5 <sub>norm</sub>	K6 <sub>norm</sub>	Prefereksi	Kesimpulan	Rekomendasi
1	Faith Emran Sakaan	1	0.75	1	0.75	1	0.75	0.88	<span style="color:red">⚠️</span>	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
2	Cindy Priscilla Harefa	1	1	1	0.75	1	1	0.96	<span style="color:red">⚠️</span>	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
3	Dora	1	0	0.75	1	0	1	0.63	<span style="color:orange">⚠️</span>	Saran: Disarankan melakukan rontgen. Penanganan: Biasakan hidup sehat dan jaga lingkungan agar tetap bersih.
4	Aldcan Syahrel	0.75	0	0.5	0.5	1	1	0.63	<span style="color:orange">⚠️</span>	Saran: Disarankan melakukan rontgen. Penanganan: Biasakan hidup sehat dan jaga lingkungan agar tetap bersih.
5	Alby Arosid	0.75	0	0.5	0.75	0	1	0.5	<span style="color:orange">⚠️</span>	Saran: Disarankan melakukan rontgen. Penanganan: Biasakan hidup sehat dan jaga lingkungan agar tetap bersih.
6	Yan Christopher	1	0	1	1	1	1	0.83	<span style="color:red">⚠️</span>	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
7	M. Hafiz Alfarizi	1	0	0.5	1	1	1	0.75	<span style="color:red">⚠️</span>	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
8	Adzri Risky Fadillah	1	0	0.5	0.75	1	1	0.71	<span style="color:red">⚠️</span>	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
9	Sugeng	1	0	0.5	1	1	0.75	0.71	<span style="color:red">⚠️</span>	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
10	Mathew Sihite	1	0	0.5	1	1	0.75	0.71	<span style="color:red">⚠️</span>	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
11	Puput Elasari	1	0	0.5	1	1	1	0.75	<span style="color:red">⚠️</span>	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
12	Ismayanti Siahaan	0.75	0	0.5	0.5	0	1	0.46	<span style="color:orange">⚠️</span>	Saran: Disarankan melakukan rontgen. Penanganan: Biasakan hidup sehat dan jaga lingkungan agar tetap bersih.
13	Viviana Sutejo	1	0	0.75	0.75	1	1	0.75	<span style="color:red">⚠️</span>	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
14	Joko Susanto	1	0	0.5	1	1	0.75	0.71	<span style="color:red">⚠️</span>	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
15	Pokana Ariska	1	0	0.5	1	1	1	0.75	<span style="color:red">⚠️</span>	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
16	Rohani Siti	1	0	0.5	1	1	1	0.75	<span style="color:red">⚠️</span>	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
17	Dwi Agustia	1	0	1	0.75	1	1	0.79	<span style="color:red">⚠️</span>	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
18	Suseno Andrian	1	0	0.5	1	1	1	0.75	<span style="color:red">⚠️</span>	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
19	Rinto Siregar	1	0	1	1	1	0.75	0.79	<span style="color:red">⚠️</span>	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
20	Alexander Nabaho	1	0	0.5	1	1	0.75	0.71	<span style="color:red">⚠️</span>	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
21	Hanny Siahaan	1	0	0.5	1	0	0.75	0.54	<span style="color:orange">⚠️</span>	Saran: Disarankan melakukan rontgen. Penanganan: Biasakan hidup sehat dan jaga lingkungan agar tetap bersih.
22	Susi Hariati	1	1	0.75	0.75	1	1	0.92	<span style="color:red">⚠️</span>	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
23	Hafiz Hasibuan	1	0	0.5	1	0	1	0.58	<span style="color:orange">⚠️</span>	Saran: Disarankan melakukan rontgen. Penanganan: Biasakan hidup sehat dan jaga lingkungan agar tetap bersih.
24	Olivia Felicia Simatupang	1	0	0.5	0.5	0.75	1	0.63	<span style="color:orange">⚠️</span>	Saran: Disarankan melakukan rontgen. Penanganan: Biasakan hidup sehat dan jaga lingkungan agar tetap bersih.
25	Midar Parapat	1	0	0.5	0.75	1	1	0.71	<span style="color:red">⚠️</span>	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
26	Tasyo Nababan	1	0	0.5	1	0	0.75	0.54	<span style="color:orange">⚠️</span>	Saran: Disarankan melakukan rontgen. Penanganan: Biasakan hidup sehat dan jaga lingkungan agar tetap bersih.
27	Satria N	1	0	0.5	0.5	1	0.75	0.63	<span style="color:orange">⚠️</span>	Saran: Disarankan melakukan rontgen. Penanganan: Biasakan hidup sehat dan jaga lingkungan agar tetap bersih.
28	Joeslin Atika	1	0	0.5	0.5	1	0.75	0.63	<span style="color:orange">⚠️</span>	Saran: Disarankan melakukan rontgen. Penanganan: Biasakan hidup sehat dan jaga lingkungan agar tetap bersih.
29	Denggan Ivander	1	0	0.5	0.5	1	1	0.67	<span style="color:red">⚠️</span>	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
30	Christian N	1	0	1	1	1	0.75	0.79	<span style="color:red">⚠️</span>	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
31	Nengsi Simanjuntak	1	0	0.5	1	0	0.75	0.54	<span style="color:orange">⚠️</span>	Saran: Disarankan melakukan rontgen. Penanganan: Biasakan hidup sehat dan jaga lingkungan agar tetap bersih.

32	Astrid Zendrato	1	0	0.75	0.5	1	1	0.71	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
33	Adella Sinurat	1	0	1	1	1	0.75	0.79	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
34	Albertini Sitingjak	1	0	0.5	1	1	1	0.75	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
35	Niko Heryanto	1	0	0.75	0.75	0	1	0.58	<b>Warning</b>	Saran: <b>Disarankan</b> melakukan rontgen. Penanganan: Biasakan hidup sehat dan jaga lingkungan agar tetap bersih.
36	Suniani Winarty	1	0.75	0.5	0.75	1	1	0.83	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
37	Wily Saputra	1	0	1	0.75	1	1	0.79	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
38	Amel Nainggolan	1	0	0.5	0.75	1	1	0.71	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
39	Widya Sari Sembiring	1	0	0.5	0.75	0	1	0.54	<b>Warning</b>	Saran: <b>Disarankan</b> melakukan rontgen. Penanganan: Biasakan hidup sehat dan jaga lingkungan agar tetap bersih.
40	Kinos	1	0	0.5	0.75	1	1	0.71	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
41	Nining Dwi Kora	1	0.5	0.75	0.5	1	0.75	0.75	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
42	Dicky Sihotang	1	0	1	0.75	1	1	0.79	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
43	Edison Daniel Sitorus	1	0	0.75	0.75	1	1	0.75	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
44	Suzanna Dwina	1	0	1	0.75	1	1	0.79	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
45	Sri Wahyuni	1	0	0.75	1	1	1	0.79	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
46	Siska Swityna	1	0	0.75	1	1	1	0.79	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
47	Riska Sutrisna	1	0	1	0.75	0	1	0.63	<b>Warning</b>	Saran: <b>Disarankan</b> melakukan rontgen. Penanganan: Biasakan hidup sehat dan jaga lingkungan agar tetap bersih.
48	Doni Sumargo Silitonga	1	0	1	1	0.75	1	0.79	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
49	Queonar	1	0	0.5	1	1	1	0.75	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
50	Wilson	1	0	0.75	0.75	1	1	0.75	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
51	Girson Malau	1	1	0.75	1	1	1	0.96	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
52	Valen Dina Sari	1	0	1	1	1	1	0.83	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
53	Dewi Sri Murti	1	0	0.75	1	1	1	0.79	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
54	Soni Suryadi	1	0	0.75	1	1	1	0.79	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
55	Kardo Antoni	1	0	1	0.75	0	1	0.63	<b>Warning</b>	Saran: <b>Disarankan</b> melakukan rontgen. Penanganan: Biasakan hidup sehat dan jaga lingkungan agar tetap bersih.
56	Mardongan Sibarani	1	0	0.5	1	1	1	0.75	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
57	Yuli Srianita	1	0	0.5	0.75	1	0.75	0.67	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
58	Hana Swita	1	0	1	1	1	1	0.83	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
59	Winda Sari Dwinatan	1	0	0.5	1	1	1	0.75	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
60	Dina Suryani	1	0	0.5	1	1	1	0.75	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
61	Danos Barata	1	0	0.5	0.75	0	1	0.54	<b>Warning</b>	Saran: <b>Disarankan</b> melakukan rontgen. Penanganan: Biasakan hidup sehat dan jaga lingkungan agar tetap bersih.
62	Pardomuan Silitonga	1	0	0.5	0.5	1	1	0.67	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
63	Wahyuni Sriningsih	1	0	0.5	0.75	1	0.75	0.67	<b>Danger</b>	Saran: <b>Diharuskan</b> melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.

64	Rina Dianasari	1	0	0.75	0.75	1	1	0.75	Danger	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
65	Yuna Suriati	1	0.75	1	1	1	1	0.96	Danger	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
66	Sondang Habeshan	1	0	0.75	0.75	1	1	0.75	Danger	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
67	Wulan Siregar	1	0	1	1	1	1	0.83	Danger	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
68	Sari Surita	1	0	0.5	1	0	1	0.58	Warning	Saran: Disarankan melakukan rontgen. Penanganan: Biasakan hidup sehat dan jaga lingkungan agar tetap bersih.
69	Wira Ferdinan	1	0	1	1	1	1	0.83	Danger	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
70	Salsa Harahap	1	0	0.5	0.75	1	1	0.71	Danger	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
71	Putri Rosmawati Ningsih	1	0.5	1	0.75	1	1	0.88	Danger	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
72	Zahra Havilia Lubis	1	0	0.5	0.75	1	1	0.71	Danger	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
73	Ayella Alby Elysia	1	1	1	0.5	1	0.75	0.88	Danger	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
74	Darlin Sinaga	1	0	0.5	0.75	1	1	0.71	Danger	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
75	Dolly Candra	1	0	0.5	1	1	1	0.75	Danger	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
76	Toty Manullang	1	0	0.5	1	1	0.75	0.71	Danger	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
77	Stevanni Jesika	1	0	1	1	0	1	0.67	Danger	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
78	Gala Sky	1	0	1	1	1	1	0.83	Danger	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
79	Samuel Emilio	1	0	0.75	0.5	1	1	0.71	Danger	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
80	Sofan	1	0	1	0.5	1	1	0.75	Danger	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
81	Bella Tobing	1	0	0.5	0.5	1	1	0.67	Danger	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
82	Grace Situmerang	1	0	0.5	0.5	1	0.75	0.63	Warning	Saran: Disarankan melakukan rontgen. Penanganan: Biasakan hidup sehat dan jaga lingkungan agar tetap bersih.
83	Shera Manullang	1	0	0.5	1	1	0.75	0.71	Danger	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
84	Mayang Sari	0.75	1	0.5	0.5	1	0	0.63	Warning	Saran: Disarankan melakukan rontgen. Penanganan: Biasakan hidup sehat dan jaga lingkungan agar tetap bersih.
85	Siska Lorena	1	0	0.5	0.75	1	1	0.71	Danger	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
86	Jonni Sandrio	1	0	0.5	0.75	1	1	0.71	Danger	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
87	Putri Atika	1	0	1	0.75	1	1	0.79	Danger	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
88	Putri Amanda	1	0	0.5	0.75	1	1	0.71	Danger	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.
89	Joem Dirgahayu	0.75	0	0.5	0.5	1	1	0.63	Warning	Saran: Disarankan melakukan rontgen. Penanganan: Biasakan hidup sehat dan jaga lingkungan agar tetap bersih.
90	Rodanoria	1	0	1	1	1	1	0.83	Danger	Saran: Diharuskan melakukan rontgen. Penanganan: Perbanyak konsumsi makanan dan minuman yang sehat seperti susu dan telur.

Figure 7 Identification of Pneumonia Patients

## 6. Conclusion

The rate of transmission of pneumonia in children under five has increased, especially since COVID-19 hit the city of Medan, Indonesia, so that the Infant Mortality Rate (IMR) is unavoidable due to a lack of parental understanding and the lack of technology-based health information from the government that reaches the lowest levels of society regarding cases. pneumonia in this toddler. Therefore, the development of science in the field of information technology through a Decision Support System (DSS) is very necessary as an initial action for prospective patients before carrying out further medical actions such as chest X-rays, because the effects of X-rays are very dangerous, especially for toddlers

with an age range of 0 – 5 yrs. Hopefully in the future this application can be used for the community in general and the health workers in particular to assist government programs in suppressing the Infant Mortality Rate (IMR) due to pneumonia.

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## Compliance with ethical standards

### *Disclosure of conflict of interest*

The authors declare no conflict of interest.

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