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# Erythrocyte Sedimentation Rate (ESR) Values in Patients Pneumonia at Mohammad Noer Hospital, Pamekasan

**Rahmad Ronald David Fahrezi[1], Ellies Tunjung Sari[2*], Rahma Widya Astuti[2], Rinza Rahmawati Samsudin[1]**
**[1]Diploma III Medical Laboratory Technology, Muhammadiyah University of Surabaya, Indonesia**
**[2]Bachelor of Applied Medical Laboratory Technology of Muhammadiyah University of Surabaya**

***Corresponding author:** elliestunjung27@um-surabaya.ac.id*

## ABSTRACT
The trend of Pneumonia cases in 2019 in Pamekasan experienced a decline with the number of cases reaching 653 patients. However, in 2020 there was a spike again with the number of patients reaching 2,222 people. The cases spiked due to decreased body immunity after the COVID-19 pandemic in 2020, this number was obtained from a health census based on data obtained from the Pamekasaan Regency Health Profile. Data on the number of ESR (Erythrocyte Sedimentation Rate) values in patients diagnosed with pneumonia. Data collection is secondary data obtained and collected from medical records based on laboratory examination data using the Automatic ESR tool for patients diagnosed with Pneumonia at Mohammad Noer Pamekasan Hospital. The process of collecting secondary data or observations from the results of clinical pathology laboratories. Data based on gender in patients diagnosed with ESR at Mohammad Noer Pamekasan Hospital in January 2024 - June 2024, it was found that the results of examinations of male patients were 32 with a percentage of 49% while in female patients it was 33 with a percentage of 51%. more dominated by females. Based on the results of the research that has been carried out, the following conclusions were obtained: 1. The results of ESR levels in females are the most patients with a percentage of 51% and adults are the highest number with a percentage of 49%. 2. In the results of normal ESR levels, the highest percentage is 52% and ESR levels high as much as 49%. There are active lesions indicating changes in plasma proteins that occur in acute and chronic infections, as well as responses to tissue damage. Increased erythrocyte sedimentation rate (ESR) levels in pneumonia infections occur in the body, When infection occurs, the immune system activates macrophages and Helper cells that produce proinflammatory cytokines such as interleukin-6 (IL-6).

**Keywords**: Pneumonia; LED

## INTRODUCTION
Pneumonia is an acute infectious disease that attacks tissue (lungs). Lungs precisely in the alveoli. The cause can come from various microorganisms,such as viruses, bacteria, fungi, and others (Indonesian Ministry of Health, 2019). Pneumonia, as airborne diseases are a threat that must be addressed attention by global health. WHO (World Health Organization, 2020) stated that the disease is more severe in older people and can cause deaths reached 6.3 million people, with 92% of deaths occurring in developing countries developing. Infectious diseases, such as pneumonia (15%), diarrhea (9%), and malaria (7%), is the leading cause of death, occurring in 450

million people every year. Worldwide, 9.2 million people die from pneumonia each year, with 92% of cases occurring in Asia and Africa. In Indonesia, the prevalence of sufferers pneumonia reached 1.6 percent in 2013, but increased to 2.0 percent in 2018 (Ministry of Health of the Republic of Indonesia, 2018). Indonesian Risk Data 2019 showed that the prevalence of pneumonia increases with age. In the 55-64 age group, the prevalence reached 2.5%, in the 65-64 age group 65-74 years, 3.0%, and in the age group 75 years and over, the prevalence of pneumonia an average of 2.8%. This shows that pneumonia continues to increase along with age. The most significant risk factor for increased incidence is Money.

The prevalence of pneumonia increases with age. In age group 55-64 years, prevalence reached 2.5%, in the age group 65-74 years years, 3.0%, and in the age group 75 years and over, 2.8% on average. It is clear that the prevalence of pneumonia continues to increase with age.The most important risk factors for increased incidence and mortality the consequences of pneumonia in Indonesia and throughout the world are age, and people older age is one of these risk factors. Dehydration, bacteremia (sepsis), lung abscess, pleural effusion, and breathing problems are some of the complications pneumonia. (Awut & Fitri, 2022). According to research 2 of 106 patients who suffering from pneumonia, 73.3% complained of coughing, 24.8% complained of excessive sputum, 74% experienced shortness of breath, and as many as 86.7% experiencing rhonchi, the results of this study are the symptoms caused from ineffective breathingpatterns.

Pneumonia is a lung disease in which the air sacs of the lungs are infected by various microorganisms, such as bacteria, fungi, mycobacteria, and viruses. Pneumonia is divided into community-acquired pneumonia, hospital-acquired pneumonia (nosocomial), pneumonia in immunocompromised hosts, and aspiration pneumonia. One method for Identifying pneumonia is by doing an X-ray. This procedure shows the condition of the lungs that are suffering from pneumonia and this diagnosis is evaluated by a specialist doctor to determine wheather or not there is pneumonia.

Pneumonia is a disease that is often suffered by most elderly age groups and population groups with chronic diseases, as a result of damage immune system. Infants and children are also susceptible to pneumonia because their immune response is not yet well developed. The cause of bacterial pneumonia is infection with gram-positive bacteria. S.pneumoniae. Although there are many species of bacteria, the World Health Organization has designated Enterococcus faecium, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa, and Enterobacter species, as a priority concern. These microorganisms are usually controlled by the body's defenses in the lungs. This disruption of host defenses allows externally transposed pathogenic microorganisms to grow and replace the normal flora, or allows the overgrowth of certain resident flora, thus causing infection. There is an increased role of respiratory tract infections due to Viruses are triggers for disruption of the normal lung microbiome, thus providing a way for pathogenic bacteria to multiply. However, the sensitivity pattern of these bacteria to antibiotics can be varies, some show high sensitivity to certain antibiotics, such as Netilmicin, Meropenem, and Sulbactam + Cefoperazone, while those others show high resistance to antibiotics such as Erythromycin, Ampicillin, Sulfamethroxazole Trimethroprime +, Tetracycline, and Chloramphenicol.

Streptococcus Pneumoniae

The Streptococcus group, family Streptococceae, includes Streptococcus pneumoniae. This bacterium colonizes the respiratory tract. S. pneumoniae has characteristics such as encapsulated

diplococcus and facultative anaerobes. Pneumonia, sinusitis acute, otitis media, conjunctivitis, meningitis, osteomyelitis, septic arthritis, endocarditis, peritonitis, pericarditis, cellulitis, and brain abscess are some of the disease that can be caused by Streptococcus pneumonia, Pneumonia meningitis, and bacteremia are diseases that are more easily experienced by individuals who have low immunity. As the main cause of sepsis throughout Worldwide, this bacteria is the leading cause of community-acquired pneumonia. (STAMP).

Klebsiella pneumoniae

The genus Klebsiella is a class of Gram-negative, encapsulated, non-spore-forming bacteria.motile, rod-shaped and oxidase-negative. Klebsiella spp is a pathogen opportunistic which is usually found in the flora of the nose, throat, skin, and the intestinal tract of healthy people, but can also cause various infections, including pneumonia, soft tissue and surgical wound infections, urinary tract infections, infections bloodstream and sepsis. Klebsiella genus currently consists of a diversity of species wide, including species belonging to the K. pneumoniae complex. species of the Klebsiella genus, K.pneumoniae, are very common in clinical collections, with an isolation rate of around 85%.3 K. pneumoniae is classified as one of the one organism that causes pneumonia.

Pneumonia is a type of infectious disease that is transmitted through air. People who suffer from pneumonia spread germs in the form of droplets into the air when they cough or sneeze. Then, the germs enter into the respiratory tract through inhalation, which means breathing in air, or through direct transmission, where a person with pneumonia inhales droplets which they release when they cough, sneeze, or talk directly. If a vulnerable person is exposed directly or indirectly to droplets of an infected person, then the susceptible person has possibility of getting infected In addition, lung infections caused by a weak immune system can also cause pneumonia which is also more susceptible to occur compared to healthy people. Infected individuals develops through a latent stage where the bacteria remain in the body but does not show any symptoms. The latent stage of Pneumonia is expected to lasts approximately three days. After the latent stage ends, the infected person can spread the disease and start showing flu-like symptoms such as headache, fever, cough, shortness of breath, and other common flu symptoms. In addition,The infection period usually ranges from three weeks to months, depending on the condition each infected individual. After recovery, humans acquire temporary immunity to disease for a certain period of time and disease. This decreases over time, after which humans become vulnerable against this disease again. If left untreated, this disease will develop into Lobar pneumonia, in which humans will go through four stages of inflammatory response.After recovery, humans gain temporary immunity to the disease. for a certain period of time, and the disease decreases over time,after that humans become susceptible to this disease again. If not treated, This disease will develop into lobar pneumonia, which can be divided into four stages of inflammatory response Factors that trigger infection include crowded, cool and relatively dry conditions. humidity is also associated with increased transmission rates. However, infections can be prevented by using masks and proper covering of the any skin surface that has abrasions as a measure to combat infection. This indicates transmission through objects consisting of surfaces or porous and non-porous objects, which can be contaminated with phlegmcontains pathogenic microorganisms and functions as a means of transmission. In addition it is significantly dangerous and it is estimated that most infections human respiratory tract is transmitted through contact with

contaminated hands with the mouth, eyes, and/or nostrils which will then lead to the networktargets in the oro- and nasopharyngeal areas.

The pathogenicity of bacterial pneumonia is a public health problem that significant, especially in developing countries where resistance to common antibiotics high This resistance is often associated with repeated prescribing and the use of antimicrobials.Pathogenesis of pneumococcal pneumonia caused by Streptococcus pneumoniae involves the role of neutrophils and elastase in contributing to lung injury and immune subversion. The pathogenicity of these bacteria is further exacerbated by the release of membrane vesicles.bacteria, which can trigger inflammatory responses and mediate bacterial virulence. Bacterial membrane vesicles, such as outer membrane vesicles (OMVs) and endothelial vesicles membranes (MVs), have been identified as virulence mediators in pneumonia, challenging the respiratory epithelium and host immunity.

The pathogenic mechanisms of bacterial pneumonia in humans have multifaceted. Mycoplasma pneumoniae, a common cause of pneumonia, exploiting adhesion to host cells, direct cytotoxicity, and evasion immunity to cause infection. The pulmonary innate immune response plays a rolean important role in determining the severity of inflammation during pneumonia with the observed differences between pneumonia caused by bacteria Gram-positive and Gram-negative.The pathogenicity of bacterial pneumonia is influenced by various factors. Hypervirulent Klebsiella pneumoniae, for example, exploits multiple factors virulence, including capsules and siderophores, to increase its pathogenicity.

Erythrocyte Sedimentation Rate (ESR) is a laboratory test that measures how quickly red blood cells (erythrocytes) settle to the bottom of the tube blood sample within one hour. An increase in LED may indicate presence of inflammation in the body, including bacterial pneumonia infection. Speed blood sediment in pneumonia examination refers to the level at which the cells blood cells, especially erythrocytes, precipitate or settle in the sample. This process very important in diagnosing pneumonia because it can indicate the response inflammation and infection rates. Studies have shown that these factors such as surface tension and temperature can affect the sedimentation rate. erythrocytes, with lower surface tension correlated with increased sedimentation rate.There are various risk factors that cause high rates pneumonia mortality in toddlers in developing countries, including pneumonia that occur during infancy (age, gender, immune status, LBW, birth status) nutrition), maternal characteristics (maternal education, maternal knowledge about pneumonia, mother's occupation) and environmental factors (indoor air pollution, residential dense, distance to health facilities). LBW, poor and severe nutrition, not receiving Breast milk, indoor air pollution and dense settlements are definite risks factors or risk factors that are always present in pneumonia.

The government is trying to improve access, coverage and quality of comprehensive pneumonia interventions, including increased case finding pneumonia in toddlers and provision of funding for the implementation of efforts pneumonia control. The trend of pneumonia cases in Pamekasan in 2019 experienced an increase The decline in the number of cases reached 653 patients. But in 2020 experienced a spike again with the number of patients reaching 2,222 people. the cases spiked due to the combination of the COVID-19 pandemic in 2019 2020, this number was obtained from a health census based on data collected obtained in the Pamekasaan Regency Health Profile in 2021.Based on the literature study above, the researcher is interested in conducting descriptive research with the title

"Description of LED (Erythrocyte Sedimentation Rate) in Pneumonia Patients" at Mohammad Noer Pamekasan Regional Hospital.

## RESEARCH METHOD

The type of research used is quantitative descriptive research which aims to find out the picture of LED (Erythrocyte Sedimentation Rate) at Mohammad Noer Regional Hospital Pamekasan. The population in this study is the total laboratory results of the population. diagnosed with pneumonia who underwent an ESR (Erythrocyte Sedimentation Rate) examination at Mohammad Noer Pamekasan Regional Hospital. January-June 2024 period. The sample used in this study was 65 medical record data. from the laboratory results of pneumonia patients who underwent LED (Electrolysis Rate) examinations Blood Sedimentation) at Mohammad Noer Pamekasan Regional Hospital for the period January-June 2024.

Data on the number of LED (Erythrocyte Sedimentation Rate) values in patients with a diagnosis pneumonia data collection is secondary data obtained and collected from medical records based on examination results data laboratory using Automatic LED device for patients Pneumonia diagnosis at Mohammad Noer Pamekasan Regional Hospital.

The process of collecting secondary data or observations from the results clinical pathology laboratory as follows:

1) Make a letter of permission and introduction from the campus and proposal as a research requirement at Mohammad Noer Regional Hospital Pamekasan.
2) Search for data or examination results on the laboratory computer clinical pathologyby matching medical record numbers adjusted to the data collection from diagnosed patients Pneumonia.
3) After all the research sample data is obtained, the process then calculate and analyze the patient sample results Pneumonia
4) Then consult the results and ask for a sign hand over to the laboratory work unit coordinator and head Pathology Clinic Installation Engineering Section, Mohammad Noer Regional Hospital Pamekasan. that the results are worthy of being issued.

The data collection analysis carried out in this study was: taking secondary data from medical records of patients suffering from pneumonia period January - December 2023, after obtaining the results data LED (Erythrocyte Sedimentation Rate) examination on patients is then tabulated in diagram form.

## RESULT AND DISCUSSION

Based on the results of research on the Erythrocyte Sedimentation Rate levels in patients with Pneumonia diagnosis at Mohammad Noer Pamekasan Regional Hospital with a period of time in January 2024 to June 2024, the results presented were obtained below with the following gender classification:

By Gender

**Table 1**. Data Based on Gender in Patients with a Diagnosis of Pneumonia at Mohammad Noer Pamekasan Regional Hospital in January 2024 - June 2024

| Gender | Amount | Percentage |
|---|---|---|
| Man | 32 | 49% |
| Woman | 33 | 51% |
| Total | 65 | 100% |

In Table 1 Data based on gender in patients with a diagnosis.

Erythrocyte sedimentation rate at Mohammad Noer Pamekasan Regional Hospital in January 2024 - June 2024, it was found that the results of the examination of patients with this type male gender is 32 with a percentage of 49% while in the female gender female gender, which is 33 with a percentage of 51%. more dominated by female gender.

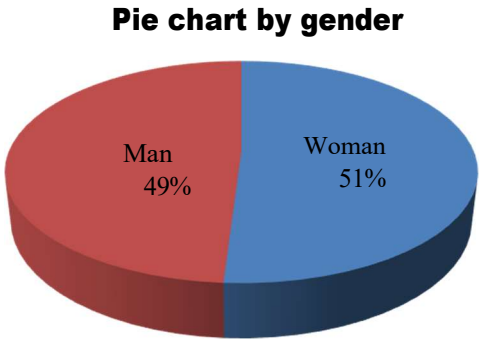


**Figure 1.** Data Diagram Based on Gender in Pneumonia Patients

In the age classification based on the results of the study of the Erythrocyte Sedimentation Rate levels in patients with a diagnosis of Pneumonia at Mohammad Noer Pamekasan Regional Hospital with a time period of January 2024 - June 2024, the results were presented as follows:

**Table 2.** Patient Data Based on Age in Patients with a Diagnosis of Pneumonia at Mohammad Noer Pamekasan Regional Hospital in July 2023 - June 2024

| Classification | Age (Years) | Amount | Percentage |
|---|---|---|---|
| Baby | <5 | 13 | 20% |
| Children | 5-9 | 1 | 2% |
| Mature | 19-59 | 32 | 49% |
| Elderly | > 60 | 19 | 29% |
| Total | | 65 | 100% |

In table 2, data based on age in patients diagnosed with pneumonia at the regional hospital Mohammad Noer Pamekasan in January 2024 - June 2024, it was found that the classification The age of pneumonia sufferers is in the age range of babies <5 years, as many as 13 patients with percentage of 20% and followed by children (5-9 years) with 1 patient with percentage of 2% and then in adulthood (19-59 years) with a percentage of highest 49%. In the elderly (>60 years) the second highest ranking was obtained with Percentage 29%.

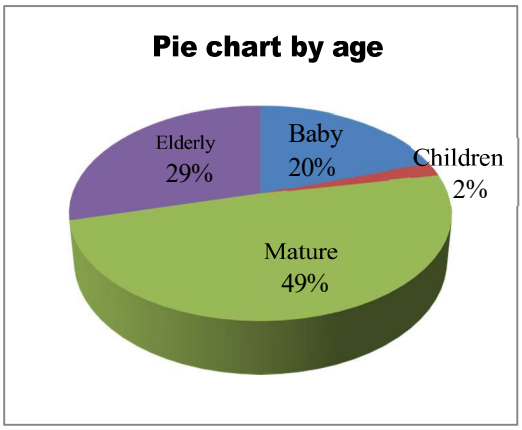


**Figure 2.** Data Diagram Based on Age in Pneumonia Patients

Based on specific data on normal and high levels of research results on Erythrocyte Sedimentation Rate levels in patients diagnosed with pneumonia at Mohammad Noer Pamekasan Regional Hospital with a period of time in January 2024 to June 2024, with the results presented as follows:

**Table 3.** Data on Erythrocyte Sedimentation Rate Levels in Patients with a Diagnosis of Pneumonia in 2018 at Mohammad Noer Pamekasan Regional Hospital In January 2024–June 2024

| Mark | Amount | Percentage |
|---|---|---|
| Tall | 31 | 48% |
| Normal | 34 | 52% |
| Total | 65 | 100% |

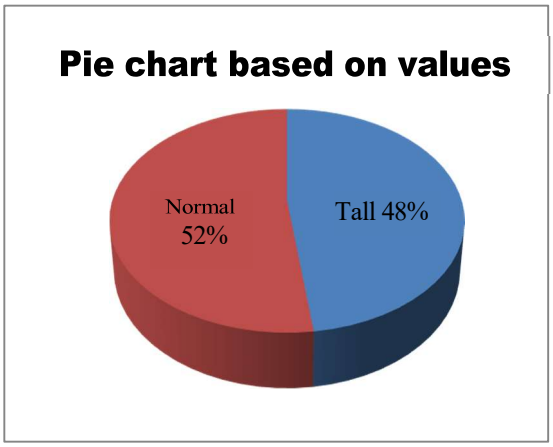


**Figure 3.** Data diagram based on blood sedimentation rate values

From the results of the study based on

the gender of patients with a diagnosis of Pneumonia in Mohammad Noer Pamekasan Regional Hospital from January to June 2024 can be seen in Table 2. The results of the study found that there were 34 female pneumonia patients, with a percentage of 51%, which is higher than men by 31 people with a percentage of 49%. Results This research is the same as the results of a study conducted by21The results of the study showed that patients female pneumonia as many as 27 people, with a percentage of 55.1%, which is higher than There were 22 male patients (44.9%) Women may be more susceptible to pneumonia because of the size of their lung airways. Smaller lungs, which can impede oxygen exchange. The size of the respiratory tract smaller children are susceptible to pneumonia because their alveoli are smaller and more easily filled with pus and fluid, which causes shortness of breath and reduces oxygen intake. Pneumonia is an acute respiratory infection that attacks the lungs. lungs, and smaller alveoli in children make them more likely to develop pneumonia because the alveoli are more easily filled by microorganisms such as viruses, bacteria,fungi, and parasites.

In the age classification, they are grouped into four groups consisting of infant patients (<5 years), Children (5-9 years), Adults (19-59 years) and Elderly (>60 years). Infant Patients as many as 13 people with a percentage of 20% are in third place, child patients as many as 1 person with a percentage of 2%, the smallest number among the age groups Pneumonia sufferers. Adult patients as many as 32 patients with a percentage of 49% are the patients most exposed to Pneumonia, while in the elderly age group.

A score of 19 patients was obtained with a percentage of 29%, occupying the second highest position among the age classifications of Pneumonia sufferers. In the research conducted in accordance with research conducted by21Age characteristics are grouped into two groups, namely consisting of adult patients (18 – 59 years) and elderly (≥ 60 years)13. There were 28 adult patients people with a percentage of 57.10% more than elderly patients as many as 21 people with a percentage of 42.9%. In the results of research conducted by22find the proportion adult pneumonia patients amounted to 54.1% and elderly patients amounted to 45.9%. Adults, especially the elderly, are more susceptible to pneumonia due to several factors.

First, the immune system weakens with age, reducing the ability body fights infection. Second, many elderly people have comorbidities such as lung disease. chronic obstructive pulmonary disease (COPD) or heart disease, which increases the risk of developing pneumonia

In addition, exposure to microorganisms that cause pneumonia is also higher in this age group. Kristanti et al., (2022) also concluded that the highest number of pneumonia patients in 2020 was age group 46-55 years, namely 52 patients (28.42%). From 2020, it can be seen that the age of 46 years and above have a greater risk of developing pneumonia. In adult patients, the incidence of Pneumonia is highest in the elderly age group, this is because in the elderly changes in physiology and anatomy due to the aging process have important consequences for functional lung reserve, the ability to cope with decreased lung compliance and increased resistance of the respiratory tract to infection and decreased immunity. Patients geriatrics are more susceptible to pneumonia due to impaired gag reflex, weakened immunity, impaired temperature regulation response and varying degrees of cardiopulmonary abnormalities.

According to research conducted by Kurniawati et al., (2022), age is also a factor. which affects the immune system. As we get older, immune cells will also decrease. activity. Like other cells, immune cells are generally at their peak activity when entering adulthood. As we grow older, immune cells including the ability to

produce proteins for fighting viral infections (interferon) will decrease.

In the results of the analysis of the erythrocyte sedimentation rate levels in patients diagnosed with pneumonia in Mohammad Noer Pamekasan Regional Hospital found that there were 34 patients with a percentage of 52% had normal Erythrocyte Sedimentation Rate levels, while 31 patients with 48% of the population had high erythrocyte sedimentation rate levels. These results are in accordance with research that conducted by Hoffman, nd (2023) LED levels in normal pneumonia before treatment are around 10-20 mm/hour. Increased LED values may indicate a bacterial infection,while normal LED values may indicate a viral infection or other unexplained condition.associated with bacterial infections. Erythrocyte Sedimentation Rate (LED) levels in pneumonia are often normal or slightly elevated, especially in atypical pneumonia caused by pathogens such as viruses. so leukocytes only a little comes out and the inflammatory response does not show any increase or only slightly increased from normal values.LED (Blood Sediment Erythrocyte) values remain normal in patients with pneumonia due to infection. pneumonia usually does not cause severe inflammation in the blood. The main inflammation occurs in the lungs, and this inflammation does not directly affect the LED value. However,In more severe cases or more severe infections, LED values may increase due to the presence of more widespread inflammation in the body.

Different immune responses to bacterial and viral infections. In bacterial pneumonia, more aggressive infections and more leukocytes involved in the inflammatory process causes an increase in LED, while in viral pneumonia, a milder immune response and fewer leukocytes are involved resulting in a lower or normal LED. Ishiokaet al., (2020) Erythrocyte sedimentation rate (ESR) cannot effectively determine the severity of pneumonia.Research shows that LED has no significant relationship with the degree of severity of pneumonia, which is consistent with the finding that LED values do not always reflect clinical condition of patients with pneumonia Daradjat, (2023).LED (Erythrocyte Sedimentation Rate) increases in pneumonia due to hypoxia, decreased blood volume blood, and increased airway pressure. Hypoxia causes increased production of erythrocytes, which then undergo infiltration into the lung alveoli. Decreased blood volume and increased airway pressure also affects the formation and permeation of erythrocytes. Elevated LED is an important clinical sign in the diagnosis of pneumonia, especially in bacterial infections.

High LED (Blood Sediment Erythrocyte) values in pneumonia patients are due to the presence of inflammation that causes an increase in the number of white blood cells (leukocytes) in the blood. This increase in leukocytosis is the body's response to infection, which is often seen on complete blood count Ineffective antibiotic resistance can lead to persistent inflammation and increase LED values. Studies show that antibiotic resistance can increase risk of patient morbidity and mortality, as well as prolonging recovery time from pneumonia. Wahidah et al., (2020).

The patient data table shows several LED values that are very high, due to severe infection, these results are in accordance with research conducted28Severe pneumonia can causes intense inflammation, resulting in increased LED.

## CONCLUSION AND RECOMMENDATION

Based on the results of the research that has been carried out, several conclusions were obtained as follows:

1. The results of LED levels in females are the most common patients with percentage 51% and adults are the highest number with a percentage of

49%.

2. In the LED levels, the normal number had the highest percentage, namely 52% and the levels LED high by 49%

From the research conclusions above, there are several suggestions that can be given by researchers are as follows:

For Medical Laboratory Technology Science The results of this study can be used as a consideration and reference in perform similar laboratory tests on patients diagnosed with pneumonia For Educational Institutions.The results of this study are expected to be used as reference material in the materials learning and references for educational institutions that are the same as the educational history researcher.

Further researchers can conduct a review to determine how long patients experience pneumonia, as well as the effects that arise due to infection with the disease Pneumonia. For further researchers, they can also use supporting examination variables in the diagnosis of pneumonia, bacterial infections and acute inflammation cases.

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