Examining Sepsis Incidence, Risk Factors, and Mitigation Efforts at PKU Muhammadiyah Gamping Hospital, Yogyakarta: A Retrospective Analysis

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KEYWORDS

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ABSTRACT

Sepsis poses a significant challenge in healthcare settings due to its association with heightened morbidity and mortality rates, prolonged hospitalizations, and increased healthcare expenditures. This study aims to investigate the incidence of sepsis, its associated risk factors, and the efficacy of various mitigation efforts implemented at PKU Muhammadiyah Gamping Hospital in Yogyakarta. Employing a cross-sectional, analytical observational design, this study examined a sample comprising patients diagnosed with sepsis at the hospital between January 2019 and December 2022, meeting predefined inclusion and exclusion criteria. Inclusion criteria encompassed patients diagnosed with sepsis in accordance with hospital protocols and those admitted between January 2019 and December 31, 2022, while exclusion criteria included patients with incomplete bacteremia diagnoses. Consecutive sampling was utilized for sample selection, with data extracted from patient records maintained in the hospital's medical archives. This study was conducted with the approval of PKU Muhammadiyah Gamping Hospital's ethical committee (permit number: 051/KEP-PKU/III/2023). Analysis of four years' worth of data revealed a total of 210 cases of sepsis, comprising 112 male and 98 female patients.

1. Introduction

Serious infectious diseases such as sepsis can induce systemic manifestations including fatigue, tachycardia, hyperventilation, hypo- or hyperthermia, and tachycardia. Age has been consistently identified as the primary risk factor for sepsis in various studies. This propensity for sepsis among the elderly can be attributed to the natural decline in organ function and immune system efficacy associated with aging. Among elderly populations, two prominent risk factors for sepsis are respiratory tract infections and endocrine disorders such as diabetes mellitus.[1] ―Sepsis symptoms are nonspecific and may resemble those of other illnesses, rendering its diagnosis challenging. Bedside physicians cannot rely solely on sepsis as the differential diagnosis in patients presenting with organ dysfunction, as there is a lack of definitive "gold standard" test for sepsis diagnosis. Remarkably, up to one-third of individuals initially diagnosed with sepsis ultimately manifest a noninfectious illness. Given the potential significant alteration in a patient's clinical trajectory post-hospitalization, which may either heighten or diminish the likelihood of a sepsis diagnosis, it is imperative to regularly reassess patients to determine whether alternative diagnoses become more or less plausible.[2]

The utilization of the Sequential Organ Failure Assessment score, commonly referred to as SOFA, represents the prevailing method recommended for diagnosing both sepsis and septic shock. SOFA provides a straightforward approach, employing readily accessible clinical measures to identify significant organ failure or dysfunction attributed to sepsis. Originating from expert consensus during a collaborative meeting, SOFA was designed to evaluate the physiological changes characteristic of a septic episode. Despite initial subjectivity, SOFA calibration has proven accurate and has been suitably adapted to reflect the patient's evolving clinical trajectory.[3]

Sepsis represents a potentially fatal, dysregulated systemic response to infection, precipitating organ failure, tissue damage, and mortality. In 2017 alone, the global incidence of sepsis reached 48.9 million

new cases, establishing it as a substantial contributor to the world's health burden. Sepsis patients typically endure hospital stays twice as long as their non-septic counterparts. Age, APACHE II score, hypotension, hyperlactatemia, respiratory tract infections, soft tissue infections, patient origin from other departments, surgical patients, individuals with COPD, liver cirrhosis, cancer, and chronic kidney disease emerge as significant factors influencing sepsis incidence, as revealed by statistical analysis.[5]

The study identified that among 2,025 adult patients presenting with probable infection and qSOFA < 2, 151 (7%) were diagnosed with sepsis. Notably, sepsis patients exhibited advanced age and displayed vital signs indicative of impending sepsis compared to their non-septic counterparts. Among patients with qSOFA<2, multivariable logistic regression analysis identified a number of risk factors linked to sepsis, including older age (adjusted odds ratio [OR], 1.92), comorbidities like diabetes mellitus, ischemic heart disease, and chronic kidney disease, receiving oxygen therapy at the time of emergency department admission, and sore throat as the primary complaint.[6]

Among hospitalized patients, sepsis, severe sepsis, and septic shock represent significant contributors to morbidity and mortality. Research has shown that individuals with sepsis who receive timely diagnosis and appropriate treatment exhibit improved prognoses. However, there remains considerable room for improvement, underscoring the critical importance of promptly administering focused care to patients with severe sepsis to effectively manage their condition.[7]

Organ failure and a mortality rate exceeding 10% constitute defining characteristics of severe sepsis, with potential progression to septic shock upon the development of refractory hypotension, leading to a fatality rate of approximately 40%. Despite the frequent occurrence and unfavorable outcomes associated with sepsis, the heterogeneity of infection types and host responses complicates early and accurate diagnosis. Agreement on a unified description of the clinical presentation of sepsis remains challenging, as evidenced by the most recent suggested redefinition of sepsis phases (sepsis 3).[8]Sepsis survivors who are discharged from the intensive care unit (ICU) face an elevated risk of long-term mortality and readmission to the ICU. Among the 2970 enrolled patients, those with sepsis (n = 2228) exhibited a significantly higher in-hospital death rate following ICU readmission compared to patients without sepsis (n = 742) (50.4% versus 30.7%, P < 0.001).[9]

This global prevalence study, encompassing over 7,000 children across 128 locations, reveals that 0.8% of critically ill children still experience severe sepsis. Despite the absolute number of cases of severe sepsis in children being reported as ten times lower than in adults, the incidence of 8.2% among Pediatric Intensive Care Unit (PICU) patients closely aligns with the proportion of individuals severely affected by sepsis. These findings suggest that, at any given time, a PICU with 16 beds is likely to care for at least one critically ill child with sepsis. Furthermore, the in-hospital mortality rate, which has sometimes been considered too low to warrant investigation in cases of severe pediatric sepsis, was found to be 25%, exceeding earlier epidemiological estimates based on retrospectively collected administrative data.[10]

The study examined the patient population, risk factors, and various initiatives aimed at reducing sepsis incidence at PKU Muhammadiyah Gamping Hospital in Yogyakarta. The intention is to furnish the infection prevention and control committee with pertinent information regarding patient demographics and risk variables. This data will enable the committee to devise strategies aimed at mitigating the occurrence of sepsis, thereby reducing treatment costs and morbidity rates.

Literature review

The study identified various risk factors associated with sepsis, encompassing pre-existing comorbidities, critical care interventions, surgery-related factors, demographic variables, and the severity of organ injury. Among demographic characteristics, older age and male gender were found to elevate the risk of sepsis in patients admitted to the intensive care unit (ICU). Enhancing surgical patient care and optimizing the management of critical care interventions could substantially reduce the incidence of sepsis among patients receiving ICU treatment. While age, gender, and comorbidities

represent fixed risk variables, factors related to surgery and critical care interventions are potentially modifiable.[11]

In this investigation, we explore in-hospital mortality, premature death, and associated risk factors among children with community-acquired septic shock in acute care hospitals. The study revealed a 32.1% in-hospital mortality rate. A cohort analysis of university hospitals, comprising 52 European and 12 American Pediatric Intensive Care Units (PICUs), demonstrated in-hospital mortality rates of 10% and 9% for children with community-acquired septic shock. Similarly, a Japanese observational study conducted across nine PICUs reported an 18% in-hospital mortality rate among 44 children afflicted with severe community-acquired sepsis and septic shock.[12]

A form of Systemic Inflammatory Response Syndrome (SIRS), known as sepsis, is triggered by toxins released by various pathogenic bacteria present in the blood or tissues. Common precipitating factors include trauma, burns, shock, infections, surgical procedures, and other clinically urgent conditions. Among the leading causes of mortality for critically ill patients are severe sepsis, septic shock, and multiple organ dysfunction syndrome, which may also afflict individuals with advanced diseases. It often arises as a consequence of complications from major surgeries, severe infections, shock, and traumatic injuries.[13]Severe organ dysfunction resulting from a dysregulated host response to infection is defined as sepsis, contributing to approximately one-fifth of all causes of death, equating to 11 million deaths annually. The burden has been further exacerbated by severe and critical cases of coronavirus illness (COVID-19), a form of viral sepsis, which has accounted for an estimated 6 million deaths worldwide. Sepsis not only escalates mortality rates but also substantially elevates short- and long-term morbidity, healthcare resource utilization, and associated costs.[14]

In critical care units (ICUs), sepsis remains the leading cause of mortality, with shock presenting one of the highest fatality rates, approximately 50%, across several countries. Hence, timely detection and treatment are imperative. The gastrointestinal system has been traditionally implicated in the pathogenesis and manifestation of sepsis. During septic shock, blood is redirected to essential organs such as the kidneys, heart, and brain. However, initial hypoperfusion often impacts the gastrointestinal system first, serving as a common indicator of multiple organ failure.[15]

Between 2004 and 2018, the average age-adjusted yearly death rate per 1,000,000 individuals from pulmonary sepsis was 111.8; for abdominal and genitourinary sepsis, the corresponding rates were 46.7 and 52, respectively. Pulmonary sepsis was associated with a 22.4% increase in mortality, abdominal sepsis with a 28.0% increase, and genitourinary sepsis with a 53.2% increase. The overall steady mortality rates linked to sepsis may be attributed to improved identification and documentation of infection sites in sepsis patients. However, higher mortality rates associated with pulmonary, abdominal, and genitourinary sepsis were observed.[16]

2. Methodology

This study used a cross-sectional analytical observational research design for its research methodology. Patients who met the predetermined inclusion and exclusion criteria and were diagnosed with sepsis at the hospital between January 2019 and December 2022 made up the study sample. Inclusion criteria encompassed hospital inpatients diagnosed with sepsis according to hospital protocol between January 2019 and December 31, 2022. Patients with incomplete data but a confirmed diagnosis of sepsis were excluded from the study. Consecutive sampling was utilized for sample selection, with data extracted from patient records stored in medical archives. The study was conducted in accordance with the ethical guidelines of PKU Muhammadiyah Gamping Hospital, as indicated by ethical permit number 051/KEP-PKU/III/2023.

3. Results and Discussion

The characteristics of the respondents and the outcomes of statistical tests pertaining to the impact of age, gender, and duration of stay on the incidence of sepsis are displayed below.

Correlation and Odds Ratio of Diabetes Mellitus with the incidence of Sepsis.

Table 1. The results of the Chi-Square test are as follows.

Here is the table formatted correctly:

Sepsis	DM Yes	DM No	p-value	OR
	f	%	f	%
Yes	14	6.7	7	2.7
No	196	93.3	249	97.3

Source: primary data

Correlation of Outpatient Care and Gender to the Incidence of Sepsis

Table 2 The results of the Fisher Exact Test are the results below.

Variable	Sepsis				OR
	Yes	No	p-value		
	f	%	f	%	
Length of Treatment					
> 3 days	149	71.0	107	41.8	0.001
<= 3 days	61	29.0	149	58.2	
Gender					
Male	112	53.3	136	53.1	0.964
Female	98	46.7	120	46.9	
Primary data					

Based on the table above it can be explained as follows: (1) The Number of patients of Sepsis during 4 years of data collection was 210, with 112 being male and 98 females; (2)There is a correlation between DM and the incidence of sepsis with a value of p = 0.042 and OR = 2.541 meaning that DM patients are at risk of sepsis 2.5 times greater than patients without DM; (3) An OR value of 3.606 indicates that there is a 3.6-fold increase in the chance of acquiring sepsis for stays longer than three days compared to stays shorter than three days. The connection between the length of stay and the incidence of sepsis is p = 0.001; (4) There is no correlation between gender and the incidence of Sepsis with p = 0.964.

Discussion

Over the four-year data collection period of the study, 210 individuals with sepsis were identified, comprising 112 men and 98 women. A correlation was observed between the incidence of sepsis and diabetes mellitus (DM), with a p-value of 0.42 and odds ratio (OR) of 2.541. Similarly, a correlation was found between the length of stay and the incidence of sepsis, with a p-value of 0.001 and OR of 3.606. No significant relationship was observed between gender and the incidence of sepsis, indicated by a p-value of 0. These findings warrant comparison with outcomes from other nations for further analysis.There are two primary categories of risk factors associated with neonatal sepsis: those pertaining to the neonate and those related to the mother. Previous research has shown that birth weight, gestational age, gender, and Apgar score at birth are risk factors for neonatal sepsis. Additionally, maternal risk factors include a history of urinary tract infections, education level, socioeconomic status, frequency of antenatal care, mode of delivery, and history of premature rupture of membranes lasting longer than 12 hours.[17.]

Each year, over 1.7 million adults in the US are afflicted with sepsis, which can potentially lead to over 250,000 fatalities. Several studies have indicated that sepsis is present in 30% to 50% of

hospitalizations that culminate in death. A pressing concern for hospitals worldwide is the substantial number of sepsis patients and the belief that a significant portion of sepsis-related deaths could be preventable with improved care.[18]One non-conventional risk factor for cardiovascular disease could be sepsis. Additionally, this study identified a long-term relationship (within 6–12 months after admission) and an early relationship between sepsis and cardiovascular issues, both of which could serve as intervention targets. After sepsis hospitalization, patients with pre-existing cardiovascular conditions must promptly receive follow-up care during the post-discharge period. Employing this approach allows healthcare professionals to identify potentially preventable causes of readmission, such as inadequate or missing reconciliation of cardiovascular medications.[19]

Newborn sepsis continues to be a significant contributor to prolonged length of stay in the Neonatal Intensive Care Unit (NICU), as well as to mortality and morbidity, despite advancements in newborn care that have led to a decrease in its incidence. Based on the information presented in this article, risk factors for neonatal sepsis can be categorized into three groups: variables associated with the NICU, factors related to mothers, and neonatal factors. Consequently, it has been established that early membrane rupture and maternal infection are risk factors for mothers. Important neonatal risk factors identified include prematurity, low birth weight, poor Apgar score, meconium-stained amniotic fluid, birth asphyxia, delayed crying after birth, and the need for resuscitation.[20]

Sepsis management is still a major challenge for international health systems. In the US, there are currently 970,000 instances of sepsis treated annually, and this figure is rising. A study found that throughout the previous 20 years, the frequency of sepsis among hospitalized patients increased by 8.7% yearly in the US. Approximately 50% of hospital deaths are related to sepsis, and as the illness worsens, mortality rates dramatically rise: Sepsis: 10–20%, severe sepsis: 20–40%, and septic shock: 40–80%.[21]Neonatal sepsis refers to sepsis occurring within 28 days after birth. The criteria for diagnosing neonatal sepsis in clinical studies often involve various combinations of laboratory and clinical markers. Determining the precise frequency of neonatal sepsis is challenging due to disagreements regarding its definition; however, in high-income nations, the incidence is estimated to range between 1 and 12 per 1000 live births. Sepsis is more prevalent in middle-income nations; in Asia, the prevalence is estimated to be 38 cases per 1000 live births. Sepsis stands as one of the primary causes of illness and mortality in newborns.[22]

When the body's immune system reacts to an infectious process, it can lead to sepsis, a medical emergency that may result in end-stage organ failure and death. Sepsis remains a prominent cause of morbidity and mortality in numerous nations, notwithstanding significant advancements in understanding its biological mechanisms, hemodynamic monitoring systems, and resuscitation techniques. According to estimates, the annual incidence of severe sepsis and septic shock in the United States was 300 cases per 100,000 people, constituting 5.2% of all hospital spending in 2011 alone.[23]

Approximately 25% of pediatric fatalities, 40% of hospital stays, and emergency department visits are caused by infectious illnesses worldwide. While the majority of children only experience moderate illness and soon recover, around 5 million children globally experience life-threatening organ dysfunction or even pass away. To lessen the impact of sepsis, the World Health Organization's resolution on the disease creates quality improvement initiatives and public health measures at the local, national, and worldwide levels.[24] The clinical condition known as sepsis arises from an aberrant host response to an infection. Diagnosis of sepsis relies on clinical judgment and evidence of infection due to the absence of confirmatory diagnostic tests. Estimates of sepsis incidence and mortality have been derived from death certificates and health service consumption data; however, variations in estimates exist based on data sources and surveillance definitions. Utilizing the CDC's WONDER database, the CDC compared national estimates of sepsis-related mortality based on death certificates to underscore the challenges and variability associated with sepsis-related mortality estimates.[25]

The Global Sepsis Alliance (GSA) endeavors to raise awareness about sepsis and underscore its significance as a global health burden through initiatives such as World Sepsis Day and the World

Sepsis Declaration. The alliance advocates for the establishment of global and national registries and emphasizes the need for extensive engagement with governments and legislators to improve data collection, care delivery, and outcomes for sepsis patients. In the UK, several initiatives have been implemented to enhance sepsis outcomes. Following an intensive campaign by healthcare professionals and policy leaders, Germany developed a national action plan for sepsis.[26]

The largest global efforts to lower the incidence of sepsis will eventually enhance public health and produce long-term health advantages. The main cause of the inadequate ability to identify, stop, and treat sepsis in low-resource areas is health disparities, which are mostly caused by differences in economic status. Poverty and health disparities must be taken into account in any public health program aimed at lowering the incidence of sepsis.[27]

Survival rates may be increased in sepsis patients who are properly managed and identified early. More adherence to the Surviving Sepsis Campaign guidelines was linked to a 25% lower relative risk of death, according to a multicenter study that included 218 locations in the US, Europe, and South America. Furthermore, a drop in sepsis mortality from 52% to 16% was linked to the creation of an instructional program to maximize healthcare professionals' adherence to sepsis packages and the deployment of quick reaction teams in Brazilian private hospitals. Furthermore, a multicenter study carried out in Brazil shown a correlation between death in the intensive care unit (ICU) and a lack of resources and noncompliance with the 6-hour Surviving Sepsis Campaign package. However, there is still a dearth of data from Latin American nations.[28]

Since bacterial infections are the most frequent cause of sepsis, antibiotics are frequently employed in the management of this condition. The UK's Academy of Medical Royal Colleges released a report in 2022 that includes suggestions for the early diagnosis and treatment of sepsis. The effect of health inequities on the diagnosis, treatment, and consequences of sepsis is one topic that is left out of this paper. Life expectancy, general health, and access to healthcare services can all be impacted by inequality. Levels of deprivation, ethnicity, and more vulnerable social groups such as the homeless are all factors linked to this disparity. The National Health Service Inequality Program was created in 2021 with the intention of assisting local governments and the National Health Service in lowering health inequities. According to the Index of Multiple Deprivation, the program's target audience is those who reside in the 20% of the most impoverished areas. Furthermore, it refers to local population groupings, which may include coastal communities, ethnic minority groups, people classified as having protected characteristics under the Equality Act 2010, or populations falling under inclusion health groups.[29]

We need to address the global issue of newborn mortality. Guidelines for preserving the lives of these newborns are desperately needed, since the number of neonatal fatalities among infants is rising. In light of this, WHO released recommendations to abide by. The death rate in this nation is higher than in both industrialized and developing nations, notwithstanding these recommendations. Thus, it is imperative that risk factors for neonatal sepsis be assessed. Previous research revealed that the majority of gram-negative germs cause sepsis to develop.[30]

In contrast to earlier epidemiological research that indicated lower and greater frequencies of positive isolates compared with our investigation, organisms were isolated from 61.6% of patients who had sepsis. Gram-negative germs infect almost 70% of patients, whereas gram-positive organisms infect only one-third of patients. It's interesting to note that Acinetobacter was isolated from 29.0% of sepsis patients, which is greater than the percentage reported in earlier research. This could be because the bacteria has multidrug resistance, is resistant to alternative control techniques, or is treated with broad-spectrum antibiotics. species of acinetobacter, particularly those that have strong carbapenem resistance. Even though hygienic practices and service quality have greatly improved, nosocomial infections continue to happen. The causes for the variance in the distribution of microorganisms in our study are unknown, however there were notable regional differences in the organisms isolated from culture. These findings could be related to the cultivation techniques and methodologies.[31]

Low- and middle-income countries (LMICs) have a high rate of newborn sepsis, and access to medical facilities and qualified medical professionals is often limited. In Sub-Saharan Africa, Latin America, and South Asia, newborn sepsis accounts for approximately 9.8% of cases of neonatal sepsis-related deaths in the first month of life. Even with prompt antibiotic treatment, 39% of afflicted individuals experience severe disability. infant sepsis accounts for 30–50% of infant fatalities in underdeveloped nations. Comparably, in Ethiopia, 44% of all infant deaths under five occurred during the first four weeks of life, with an estimated 89,000 neonates losing their lives during this time. The 2019 Ethiopian micro demographic health survey recorded a newborn mortality rate (NMR) of 30 deaths per 1,000 live births, which is nearly identical to the 29 deaths per 1,000 live births reported in the 2016 EDHS report. In Ethiopia, neonatal sepsis was determined to be the primary cause of newborn mortality.[32]

The body's out-of-control reaction to an infection can result in sepsis, a potentially fatal condition. Every year, millions of people worldwide are impacted by this illness. Sepsis ranks as the tenth leading cause of death in the US. According to a study done on American hospitalized patients, sepsis rates rose by about 8% year. Sepsis also contributes to over half of hospital mortality, underscoring its negative effects on patient care and healthcare systems. There has been a lot of research done to find risk factors for sepsis diagnosis and death, however the mortality from reduced blood pressure from sepsis remains mostly unexplored. In order to build predictive tools, a number of research have examined the treatment needs of these individuals as well as the risk factors that are connected to them. Infection-related sepsis frequently results in immunological system issues as well as clinical manifestations like heart, kidney, and coagulation failure, raising the likelihood of fatality. Additionally, hypoperfusion symptoms are present in patients with reduced blood pressure brought on by sepsis. Based on real experience in clinical practice, blood pressure lowering from sepsis is linked to poor clinical outcomes. Given that this condition poses a greater risk to life than sepsis alone and that this cohort study would be extremely beneficial.[33]

Severe sepsis is a prevalent, sometimes fatal clinical illness seen in intensive care units that affects 20–30 million people year globally. Severe sepsis is a leading cause of death for patients in intensive care units and can directly lead to multiorgan failure. Sepsis resulting from acute kidney injury (SAKI) is a frequent and dangerous sepsis complication. Acute kidney injury (SAKI)-related sepsis has an incidence rate of 47.5%. Acute organ dysfunction syndrome, or SAKI, is a frequent consequence in individuals with severe illness. Every year, there are about 6 million cases worldwide. In ICU patients, SAKI is linked to extended hospital stays, elevated mortality rates, and elevated medical expenses. Hemodynamic abnormalities, endothelial cell damage from cytokines and oxygen free radicals, aberrant coagulation, and energy metabolism are all part of the etiology of SAKI. The pathophysiology of SAKI is still not completely understood, though. Early fluid resuscitation, antibiotics, and kidney replacement are the mainstays of treatment for SAKI. Given the complexity of the SAKI pathophysiology and the importance of prompt therapy, it is imperative that a doctor diagnose SAKI as soon as possible. Up until recently, urine volume and serum creatinine were the main markers used by clinicians to determine whether a patient had AKI. Serum creatinine and urine volume, however, have certain limits when it comes to SAKI diagnosis. Because many patients lack baseline data, elevated serum creatinine concentration is an insensitive sign of renal damage.[34]

One of the risk factors that leads to the development of newborn sepsis is intramuscular fever. According to our findings, babies born to women who experienced a fever during childbirth had a 3.42 times higher risk of developing sepsis compared to babies born to women who did not. Previous research carried out in Ethiopia (2016) and Pakistan (2014), two distinct corners of the world, also showed similar results. Intramuscular fever is a sign of an infection that typically results in early sepsis and is frequently passed to the fetus by gastrointestinal tract transit. Smelly alcohol is another risk factor for newborn sepsis.Neonatal sepsis was 3.64 times more likely to occur in babies born to moms who drank odorous liquor during childbirth, according to multivariate analysis. This result is also in line with other research projects carried out in Bangladesh (2011), Nepal (2006), and Ghana (2014). Due to the breakdown of bacterial metabolic products, foul-smelling liquid is a distinctive feature of

chorioamnionitis. The infection is easily passed to the fetus in the womb.[35]

The most serious type of acute infection is sepsis, which is defined by a complex syndrome that can cause multiple organ failure and, in 30 to 50% of cases, patient mortality. One of the top 10 causes of death in the US is sepsis, which is a major cause of sickness and death worldwide. Sepsis seems to be becoming more common. In the United States, over 164,000 cases of sepsis were documented each year throughout the 1970s. According to research done by the National Center for Health Statistics, the number of sepsis cases per 100,000 individuals jumped from 221 in 2000 to 377 in 2008. This is a 7%–8% annual increase.This is a 7%–8% annual increase. According to a Taiwanese study, this is a 7%–8% yearly increase. According to a study done in Taiwan, there was an annual increase of almost 3.9% in the incidence of severe sepsis, which went from 135 cases per 100,000 people in 1997 to 217 cases per 100,000 people in 2006. The rising requirement for medical supplies, technology, and healthcare services targeted at enhancing sepsis outcomes has resulted in higher costs related to treating sepsis.[36]

One of the most frequent causes of admission to an intensive care unit (ICU) is septic shock, which affects up to 750,000 people annually in the US. Septic shock remains a major cause of death even with breakthroughs in therapy; hospital mortality rates range from 20% to 45%. While early detection and treatment are key components of our current therapeutic paradigm, the majority of prior research has been on mortality in hospitals or over longer time periods. This makes it challenging to distinguish between deaths attributed to untreated organ failure and ongoing weakness following initial stabilization or recovery, as well as deaths resulting from secondary trauma like nosocomial infections, and deaths directly attributable to refractory shock. Investigations of early-stage sepsis-related deaths have not often been conducted before. Specifically, very few research report on the incidence of premature death or the risk factors for premature death.[37]

Usually brought on by bacteria, neonatal sepsis also known as a bloodstream infection occurs in babies younger than 28 days of age. Neonatal sepsis has been found to be a neurological risk factor for early-life development that can impact neurodevelopmental and developmental outcomes in infancy and later life. In children under five years old, neonatal anomalies accounted for 25.7% of cases of sepsis in 2017. According to estimates, newborn sepsis has a greater prevalence in LMICs and has a significant role in neonatal mortality and morbidity. In East Africa, a pooled prevalence of 29.76% was observed by a meta-analysis.According to one study, if newborn sepsis cases were properly prevented or treated, 5.29–8.73 million disability-adjusted life years would be spared yearly in sub-Saharan Africa. The region also projects that the yearly economic cost might be anything from $10 and $469 billion. Sepsis in newborns is four to ten times more common in South Asia than it is in affluent nations.[38]

The three primary causes of the 2.5 million newborn deaths that occurred globally in 2018 were infections, intrapartum hypoxia, and difficulties from premature birth. Approximately one-third of neonatal deaths were attributable to these three causes. Nonetheless, the reasons behind newborn deaths differ between nations and geographical areas. Severe sepsis infections account for about half of all neonatal mortality fatalities in nations with high rates; hence, sepsis is a major cause of hospitalization and mortality in low- and middle-income countries (LMICs). infant sepsis is the leading cause of infant mortality in Sub-Saharan Africa, yet current preventative measures fall short of expectations. To improve prevention and care guidelines, a deeper comprehension of the main causes of newborn sepsis is required.The development of management guidelines and preventative efforts for neonatal sepsis has been guided globally by the evidence gathered from risk factor reviews. If the mother has a fever greater than 38°C before or during delivery, the amniotic fluid has an unpleasant or purulent odor, or the membranes rupture more than 18 hours before delivery, the WHO advises antibiotic treatment for babies within 48 hours after delivery. Nonetheless, risk factors could vary depending on where you live. The authors of a 2020 study on neonatal mortality came to the conclusion that clinical guidelines tailored to the circumstances of Sub-Saharan Africa should be created for the prevention and treatment of neonatal sepsis.[39]

The primary cause of newborn deaths worldwide is neonatal sepsis, which is also a major contributing

factor to the high neonatal mortality rate. Five million newborns die from neonatal sepsis each year; most cases are identified in underdeveloped nations with lower levels of development, like Brazil. Low birth weight patients who received invasive operations while hospitalized in the Neonatal Intensive Care Unit were the most affected group of individuals. Early onset infections can happen in the first 48 hours of life; infections after this time have a late onset and are typically brought on by contact with infections contracted after birth. The symptoms are vague, may take some time to manifest, and might be mistaken for illnesses common to this stage of life, such as preterm respiratory problems. In addition, many newborns are suspected of having clinical sepsis for every baby that has sepsis. Furthermore, there are currently no unified data available in Brazil about the occurrence of infections, particularly sepsis, in newborn facilities. There are only data from regional studies accessible, and even those can differ significantly based on the data that the institution has. Published national research indicates that this infection is linked to the use of central venous catheters, birth weight, and length of time spent on mechanical ventilation.[40]

One of the leading causes of illness and mortality in infants worldwide is neonatal sepsis. In the first month of life, sepsis claims the lives of 2,000 newborns in the US each year; most of these deaths happen in the first week. Even those who survive, nevertheless, may encounter potentially fatal complications. Early-onset sepsis (EOS), which is challenging to diagnose early, is defined as sepsis that occurs within the first three days (72 hours) of birth. The only proven treatments for sepsis are supportive care and antibiotic therapy. Diagnostic test repeatability and positive predictive value are not up to par, which leads to a low index of clinical suspicion and a rise in empirical antimicrobial therapy. While a clinical suspicion is necessary for the diagnosis of sepsis, only about 9 percent of blood cultures show positive pathogenic bacteria, according to some research. This number is reported as 30%–40% in other studies. To effectively establish strategies for early-stage diagnosis, it is imperative to comprehend the risk factors associated with newborns who are at high risk for sepsis. There is still confusion about the possibly modifiable risk factors that are common in neonatal EOS, despite mounting evidence to the contrary. The National Institute for Health and Clinical Excellence (NICE) released updated guidelines in August 2021 for the care of newborns with EOS risk factors. The original guidelines were issued in 2012. NICE developed a method based on 26 risk factors and clinical signs for the early detection of newborn sepsis.[41]

Globally, the ageing population is growing, with each nation's share and quantity of senior citizens rising. For the first time in history, the number of senior people will surpass that of younger people by 2050, with people 80 years of age and beyond expected to expand at the quickest rate in the US. Elderly folks who are weak and vulnerable are more likely to have infectious infections. Furthermore, major infectious diseases—which account for one-third of all deaths among those 65 and older—pose a greater risk of death for these individuals.Furthermore, the prevalence of sepsis rises with age, peaking in individuals over 80 years of age, and is linked to a very high death rate. Urinary tract infections are also more common in the elderly population. Bacteriouria affects at least 20% of women and 10% of men over the age of 80. Fifty percent of instances of bacteremia in individuals eighty years of age or over are caused by UTIs, which are the most common cause of bacteremia in the elderly. According to earlier research, septic shock constituted a separate risk factor for death in individuals 80 years of age and older.[42]

Research findings indicate that sepsis triggers the development of acquired immunosuppression through the activation of intricate pro- and anti-inflammatory pathways. Patients with this type of immune weakness are more susceptible to contracting new infections or finding it difficult to eliminate underlying infections. We hypothesise that the patterns of subsequent infection vary depending on the type of organism. While new gram-negative bacteria are less likely to induce sepsis later on, new viruses and different gram-positive species attack the host. According to a study, E. Coli can recolonize the bladder and urethra after being removed from the urinary tract, which can lead to recurrent urinary tract infections. It can also persist in the fecal flora. According to reports, decreased antibiotic susceptibility patterns in comparison to prior infections are the primary cause of recurrent gram-

negative bacterial infections. Antibiotic resistance and type-related pathogen risk factors should be the focus of future study. Furthermore, our findings imply that the majority of patients who were readmitted for sepsis did so because of an infection at the same location. This might be the result of sepsis's localized consequences, such as the alteration of the microbiota and anatomy that makes it simple for pathogenic organisms to reappear. These findings align favorably with the study conducted by DeMerle et al. They hypothesised that bacterial translocation, indwelling catheters, and invasive procedures caused by intestinal hypoperfusion and reperfusion resulted in recurrent sepsis in patients. The most common and recurring infections in our study were hepatobiliary tract infections, namely cholangitis, which were most likely brought on by invasive and frequent drainage procedures.[43]

Research limitations

The limitation of this research is that there is a type of quantitative data, in this research there is no qualitative data so there are limitations when interpreting the research results. For further research, it will be better when the data taken, apart from quantitative data, also qualitative data, qualitative data can be taken by interviews, observations or focus group discussions.

4. Conclusion and future scope

Over a 4-year period, 210 individuals experienced sepsis; duration of stay and diabetes mellitus were determined to be major risk factors. The incidence of sepsis reduction must be the top priority for the program.

In fact, theoretically there are quite a lot of risk factors for sepsis, it turns out that the positive risk factors in this study were a history of diabetes mellitus and length of treatment. This is possibly because the references are in other countries, while the characteristics of diseases in various countries are not the same as those in Indonesia, it could also be because the data collection took less time.

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A Conflict of Interest

This study does not contain any conflicts of interest.

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