

Document :

## **EARLY-PREDICTION-OF-SEPSIS**

### **Introduction of Sepsis :**

Sepsis is a life-threatening organ dysfunction caused by a dysregulated host response to infection. If not recognized early and managed promptly, it can lead to septic shock, multiple organ failure and death. It is most frequently a serious complication of infection, particularly in low- and middle-income countries where it represents a major cause of maternal and neonatal morbidity and mortality.

Sepsis often presents as the clinical deterioration of common and preventable infections. Sepsis also frequently results from infections acquired in health care settings, which are one of the most frequent adverse events during care delivery and affect hundreds of millions of patients worldwide every year.

Healthcare-associated infections are often resistant to antibiotics and can rapidly lead to deteriorating clinical conditions. Antimicrobial resistance is a major factor determining clinical unresponsiveness to treatment and rapid evolution to sepsis and septic shock. Sepsis patients with resistant pathogens have been found to have a higher risk of hospital mortality.

Implementing preventive measures against infections, such as good hygiene practices, ensuring access to vaccination programmes, improved sanitation and water quality and availability, and other infection prevention and control best practices both in the community and health care settings, are key steps in reducing the occurrence of sepsis.

Early diagnosis and timely and appropriate clinical management of sepsis, such as optimal antimicrobial use and fluid resuscitation, are crucial to increase the likelihood of survival. Even though the onset of sepsis can be acute and poses a short-term mortality burden, it can also be the cause of significant long-term morbidity requiring treatment and support. Thus, sepsis requires a multidisciplinary approach.

### **Keys :**

1. Sepsis is a syndromic response to infection and is frequently a final common pathway to death from many infectious diseases worldwide
2. Sepsis is a life-threatening organ dysfunction caused by a dysregulated host response to infection
3. Significant regional disparities in sepsis incidence and mortality exist; approximately 85.0% of sepsis cases and sepsis-related deaths worldwide occurred in low- and middle-income countries
4. In 2017, almost half of all global sepsis cases occurred among children, with an estimated 20 million cases and 2.9 million global deaths in children under five years of age
5. Since these infections are often resistant to antibiotics, they can rapidly lead to deteriorating clinical conditions.
6. Sepsis is the body's extreme response to an infection. It is a life-threatening medical emergency. Sepsis happens when an infection you already have triggers a chain reaction throughout your body. Without timely treatment, sepsis can rapidly lead to tissue damage, organ failure, and death

## **Who is at risk?**

Anyone affected by an infection, severe injury, or serious non-communicable disease can progress to sepsis but vulnerable populations are at higher risk including:

older persons,  
pregnant or recently pregnant women,  
neonates,  
hospitalized patients,  
patients in intensive care units,  
people with HIV/AIDS,  
people with liver cirrhosis,  
people with cancer,  
people with kidney disease,  
people with autoimmune diseases,  
and people with no spleen.

## **Signs and symptoms :**

**Sepsis** is a medical emergency and can present with various signs and symptoms at different times. Warning signs and symptoms include:

- fever or low temperature and shivering,
- altered mental status,
- difficulty breathing/rapid breathing,
- increased heart rate,
- weak pulse/low blood pressure,
- low urine output,
- cyanotic or mottled skin,
- cold extremities,
- and extreme body pain or discomfort

Suspecting sepsis is a first major step towards early recognition and diagnosis.

## **Common Causes**

In 2017, the largest contributors to sepsis cases and sepsis-related mortality across all ages were diarrhoeal diseases (9.2 to 15 million annual cases) and lower respiratory infections (1.8-2.8 million annually).

However, non-communicable diseases are on the rise; one-third of sepsis cases and nearly half of all sepsis-related deaths in 2017 were due to an underlying injury or chronic disease.

Maternal disorders were the most common non-communicable disease complicated by sepsis. Among children, the most common causes of sepsis-related deaths were neonatal disorders, lower respiratory infections, and diarrhoeal diseases

Group B streptococcus is the leading cause of both neonatal and maternal sepsis, though *Escherichia coli* is an emerging threat.

Both of these pathogens have displayed considerable resistance to treatment and are considered priority pathogens for research and development (R&D) of new antibiotics.

## Sepsis Prevention

There are two main steps to preventing sepsis:

1. Prevention of microbial transmission and infection
2. Prevention of an infection evolving into sepsis

## Research :

Early predictions of sepsis are potentially lifesaving, whereas late or missed predictions are potentially life threatening, The initial sepsis condition was identified using vital signs such as body temperature, pulse rate, and white blood cell (WBC) count.

The disease symptoms of Sepsis like

Temp > 100.9 F or < 96.8 F Pulse Rate > 90 bpm Respiratory Rate > 20 rpm WBC > 12,000 or <4,000 (mm3) or > 10% band . Which also the trace of COVID-19 symptoms

- *Data*

*used eICU Collaborative Research Database. The eICU Collaborative Research Database is a large multi-center critical care database made available by Philips Healthcare in partnership with the MIT Laboratory for Computational Physiology.*

- *algorithm used*

For the disease prediction, Random forest algorithm is used to predict diseases using patient treatment history, biomarkers read through sensors and user input data for accurate prediction of disease.

## Project goal :

In this project, we used eICU Collaborative Research Database. The eICU Collaborative Research Database is a large multi-center critical care database made available by Philips Healthcare in partnership with the MIT Laboratory for Computational Physiology.

Devising and applying a novel Computational approaches promise to improve the early detection of sepsis. Such approaches typically apply machine learning techniques to clinical data with the goal of making real-time predictions up to a day before clinical recognition of sepsis and helps in reducing infection causes tissue damage, organ failure, or death

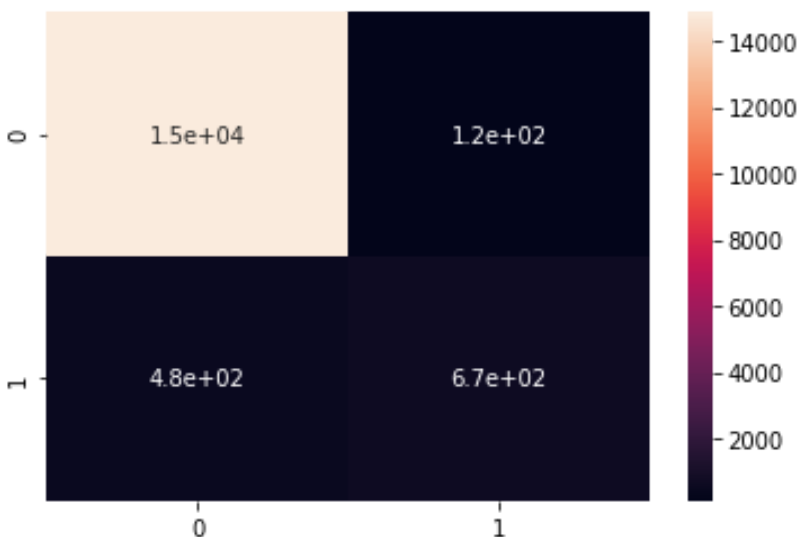
## Project application :

Automatic comparative data analysis is done between the biomarkers read through sensors, user input data with sepsis disease symptoms dataset to extract accurate information for predicting disease. This hidden information in the healthcare dataset can be used for affective decision making to calculate the probability of sepsis. The accuracy of disease prediction is 84.5% and the system is able to give the risk associated with disease which is lower risk of sepsis or higher.

**Project output :**  
**result of training set :**

```
#training the model
model1.fit(x_train, y_train, validation_data=(x_test, y_test), epochs=10, batch_size=128)

Epoch 1/10
190/190 [=====] - 341s 2s/step - loss: 0.2138 - accuracy: 0.9212 - val_loss: 0.1360 - val_accu
Epoch 2/10
190/190 [=====] - 338s 2s/step - loss: 0.1319 - accuracy: 0.9650 - val_loss: 0.1322 - val_accu
Epoch 3/10
190/190 [=====] - 337s 2s/step - loss: 0.1346 - accuracy: 0.9628 - val_loss: 0.1492 - val_accu
Epoch 4/10
190/190 [=====] - 337s 2s/step - loss: 0.1256 - accuracy: 0.9636 - val_loss: 0.1782 - val_accu
Epoch 5/10
190/190 [=====] - 338s 2s/step - loss: 0.1199 - accuracy: 0.9656 - val_loss: 0.1364 - val_accu
Epoch 6/10
190/190 [=====] - 338s 2s/step - loss: 0.1065 - accuracy: 0.9682 - val_loss: 0.1440 - val_accu
Epoch 7/10
190/190 [=====] - 339s 2s/step - loss: 0.0981 - accuracy: 0.9701 - val_loss: 0.1508 - val_accu
Epoch 8/10
190/190 [=====] - 338s 2s/step - loss: 0.0732 - accuracy: 0.9764 - val_loss: 0.1557 - val_accu
Epoch 9/10
190/190 [=====] - 342s 2s/step - loss: 0.0579 - accuracy: 0.9821 - val_loss: 0.1900 - val_accu
Epoch 10/10
190/190 [=====] - 338s 2s/step - loss: 0.0345 - accuracy: 0.9891 - val_loss: 0.2214 - val_accu
<tensorflow.python.keras.callbacks.History at 0x7f164e527a50>
```



**Project github :**

<https://github.com/jotheshjolly/EARLY-PREDICTION-OF-SEPSIS>