PREVALENCE OF SEPSIS, OUTCOMES, AND ASSOCIATED FACTORS AMONG ADULT PATIENTS ADMITTED TO THE INTENSIVE CARE UNIT AT MUHIMBILI NATIONAL HOSPITAL.

Atala Abdallah, MD

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By

DR. ATALA ABDALLAH

A Dissertation submitted in (Partial) Fulfillment of the Requirements for the Degree Award of Master of Medicine (Anaesthesiology) at

Muhimbili University of Health and Allied Sciences.

October, 2024

CERTIFICATION

The under designed certify that they have read and hereby recommend for acceptance of dissertation entitled PREVALENCE OF SEPSIS, OUTCOMES AND ASSOCIATED FACTORS AMONG ADULT PATIENTS ADMITTED TO INTENSIVE CARE UNIT AT MUHIMBILI NATIONAL HOSPITAL in fulfillment of the requirements for the degree of Masters of Medicine in Anesthesiology of Muhimbili University of Health and Allied Sciences.

_____

Dr. Edwin Lugazia

(SUPERVISOR)

DATE; _____

_____

Dr. Raymond Oyugi

(CO-SUPERVISOR)

DATE_____

DECLARATION AND COPYRIGHT

I, **Atala Abdallah,** declare that this dissertation is my own original work and it has not been presented and will not be presented to any other University for a similar or any other degree award**.**

Signature……. Date…….

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DEDICATION

With deepest gratitude and affection, I dedicate this dissertation to my beloved family whose unwavering support and boundless love have been my guiding light throughout this academic journey.

I also, dedicate this to the courageous healthcare workers, particularly those tirelessly serving in the intensive care units around the world.

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LIST OF ABBREVIATIONS

AKI	Acute Kidney Injury
ARDS	Acute Respiratory Distress Syndrome
CKD	Chronic Kidney disease
EMD	Emergency Medicine Department
HICs	Higher-income countries
HCW	Healthcare workers
ICU	Intensive Care Unit
LMICs	Low- and Middle-Income countries
MEWS	Modified Early Warning Score
MNH	Muhimbili National Hospital
MUHAS	Muhimbili University of Health and Allied Sciences
NEWS	National Early Warning Score
SOFA	Sequential Organ Failure Assessment
SIRS	Systemic Inflammatory Response Syndrome
STG	Standard Treatment Guideline
SPSS	Statistical Package for Social Sciences
WHO	World Health Organization

DEFINITION OF TERMS

Sepsis is a life-threatening organ dysfunction caused by a dysregulated host response to infection.(1)

Septic shock is defined as a patient with sepsis and hypotension (mean arterial pressure (MAP) less than 65mmHg despite sufficient fluid resuscitation) usually with serum lactate greater than 2mmol/l, requiring vasopressors and inotropes to maintain a MAP of 65mmHg.(1)

ABSTRACT

Background

It is estimated there are 49 million cases of sepsis with 20% deaths each year globally with a high mortality in low- and middle-income countries. Despite the development of several strategies to alleviate this burden, sepsis has remained the leading cause of death in intensive care units and, it is responsible for approximately six million deaths worldwide.

Aim of the study

This study aimed to determine the prevalence of sepsis, outcomes, and factors associated among adult patients admitted to the Intensive Care Unit at Muhimbili National Hospital.

Methodology

A hospital-based analytical cross-sectional study was conducted at Muhimbili National Hospital in the Adult Intensive Care Units. The study was conducted for six months and involved 248 patients and 56 healthcare workers. Data was collected using standard checklists and a questionnaire. Statistical analysis was done using Statistical Package for Social Sciences (version 26), and proportion was used to determine prevalence and outcome. A Chi-square test and logistic regression were done to establish an association between patient outcomes and associated factors. A p-value ≤ 0.05 and a 95% confidence interval were used as a cutoff point for statistically significant variables.

Results

The prevalence of sepsis was 41.5% (103/248), with 55% mortality. After adjusting for confounders, the study showed early initiation of a broad-spectrum antibiotic (aPR=16.89; CI:2.32-122.86; p=0.005) was significantly associated with good patient outcomes. However, a higher SOFA score (aPR=0.61; CI:0.43-0.88; p=0.007) was significantly associated with poor outcomes.

The study also observed nonuse of specific guidelines in diagnosing and managing sepsis, a lack of important diagnostic tools, a lack of formal training, and inadequate knowledge in early recognition and management of sepsis among nurses.

Conclusion and recommendation

This study revealed a high prevalence of sepsis and case-related mortality. It also highlights the importance of early sepsis recognition and management, particularly proper screening, diagnosis of patients, and early initiation of broad-spectrum antibiotics. Challenges such as inadequate knowledge, lack of formal institutional training, lack of guideline use, and unavailability of necessary resources can impact patient care.

We recommend proper screening of patients for sepsis in the ICU to ensure early recognition and management. Also, providing comprehensive sepsis management training for healthcare workers, and ensuring essential medications and equipment are available to improve patient outcomes.

CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND.

The Third International Consensus for the definition of sepsis 2016 (Sepsis3) defines sepsis as "a life-threatening organ dysfunction resulting from a dysregulated host response to infection." Sepsis can progress to a severe form that has been reported to contribute to multiple end-organ damage and systemic complications such as septic shock which is marked by significant abnormalities in circulation, cellular, and metabolism abnormalities, acute renal failure, coagulopathy, acute respiratory distress and cardiac arrhythmias (1,2).

Although the exact pathophysiology is unknown, it is hypothesized that sepsis is caused by widespread cellular damage from an extensive immune response by activating innate immune cells, such as macrophages, resulting in the release of endotoxins, exotoxins, and inflammatory mediators, which in turn result in sepsis-induced intravascular inflammation and neutrophils. The extreme cellular damage from tissue ischemia, cytopathic injury, and altered apoptosis results in a systemic immunological response and organ failure (3–5).

Various sepsis screening tools have been developed to aid in early diagnosis and timely interventions; these tools were intended for use in various settings, including intensive care units, emergency departments, and inpatient wards. These were Systemic Inflammatory Response Syndrome criteria (SIRS), Sequential Organ Failure Assessment score (SOFA), quick Sequential Organ Failure Assessment score (qSOFA), National Early Warning Score (NEWS), and Modified Early Warning Score (MEWS) (6). However, the recent Sepsis-3 consensus advocated the use of SOFA scoring system for sepsis diagnosis and as a reliable prognostic tool in patients with sepsis. It is also widely used as a prognostic tool in critically ill patients in comparison to Acute Physiology and Chronic Health Examination II (APACHE II) and quick Sequential Organ Failure Assessment score (qSOFA). The score is comprised of several characteristics that characterize the extent of organ or system failure. These measures evaluate the cardiovascular, respiratory, central nervous, liver, and kidney systems.

A score of two or greater is required for the diagnosis of sepsis and is also used to determine the mortality risk, where a score of two or greater is associated with a mortality risk of more than 10% (1,2,7,8).

Sepsis being a global threat, several strategies have been published to improve patient outcomes and provide guidance on the management of sepsis. In 2017, the World Health Organization (WHO) developed methods for enhancing the prevention, diagnosis, and clinical management of sepsis, with the following key pillars: development of guidelines for sepsis prevention and management, raising awareness of the public health impact of sepsis and its estimated global burden, and establishments and implementations for standard management to reduce morbidity and mortality (9). The Surviving Sepsis campaign has also recently published guidelines and recommendations on the management of sepsis and sepsis-related complications. Their 2021 guideline of the management of sepsis has strong recommendations on standard approaches in the management of sepsis that include proper screening for patients, initial resuscitation, hemodynamics management, proper approach for patients confirmed with either bacterial, fungal, or viral infections, ventilation, the use of vasopressors, long-term outcome and goals to ensure improvement in the management of sepsis and also involvement of family and long-term complications.

In addition, Tanzania Standard Treatment Guideline (STG) 2021 published a guide on the management of sepsis that explains the criteria for diagnosis, important investigations, point of care diagnostics needed, non-pharmacological and pharmacological management. These investigations include blood gas analysis, point of care ultrasound to assess the status of the inferior vena cava and lungs, urine dipstick, and bedside electrocardiography (ECG). Pharmacological recommendations include fluids (crystalloids, colloids), vasopressors, antibiotics, and steroids (10).

According to Global Burden of Disease (GBD) 2017, it was estimated that 49 million cases of sepsis and 11 million deaths accounted for 20% of all global deaths yearly. 85 percent of all sepsis-related deaths occurred in low- and middle-income nations, mainly sub-Saharan Africa and South East Asia (11). In addition, the Intensive Care Over Nations (ICON) audit

in 2018 revealed that sepsis is one of the leading causes of intensive care unit (ICU) admissions and is associated with a high mortality rate (12). Patient-related clinical factors, institutional, and healthcare worker factors contributed to the poor clinical outcomes of these patients especially in LMICs. These factors include source of infection, comorbidities, interventions and management of patients, lack of knowledge, negative attitude and lack of standard guidelines for the recognition and management of sepsis and septic shock, lack of microbiologic and radiologic diagnostic facilities, and insufficiency of appropriate medications (13–16).

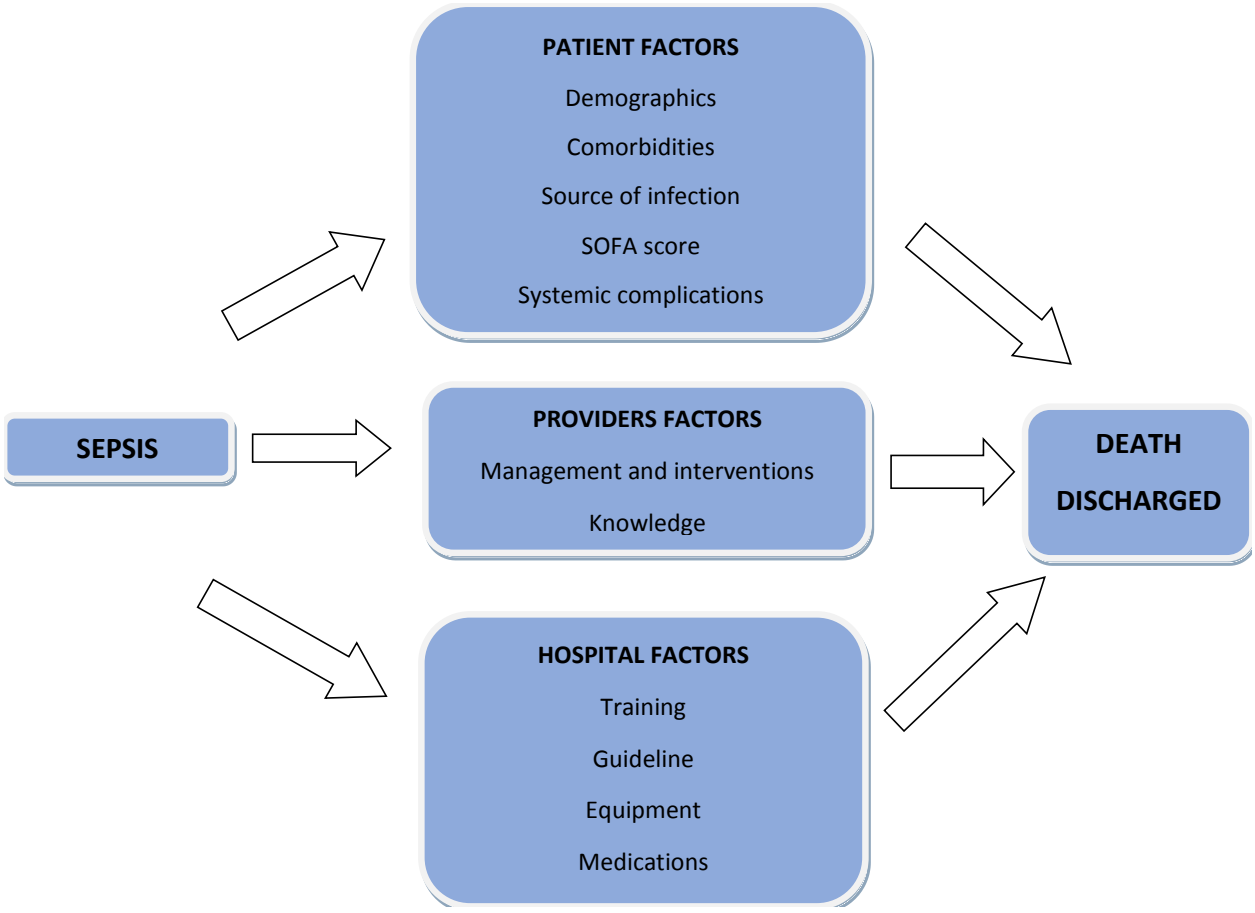
Several studies have been conducted to identify the obstacles and barriers to overcoming the burden of sepsis and improving patient outcomes, particularly in LMICs, and are reported to be associated with poor infrastructure, shortage of staff, poor knowledge of health care workers, and poor institutional support (17,18).

1.2 PROBLEM STATEMENT

Despite the availability of various guidelines and strategies for the prevention, early recognition, resuscitation, and management of sepsis; it remains the leading cause of intensive care unit (ICU) admissions and is responsible for approximately 6 million deaths worldwide each year (19). In 2017, 20% of global deaths were attributed to sepsis, with 85% of these deaths occurring in sub-Saharan Africa (11). The WHO 2020 review reported a high prevalence of sepsis in LMICs and 42% mortality in sepsis-treated patients (20). In Tanzania, a study done at MNH reported sepsis being among the top five causes of ICU admission and was associated with higher mortality of 80.9% among ICU-admitted patients (21).

Muhimbili National Hospital, as a leading tertiary public hospital in Tanzania, is a key provider of care for critically ill patients admitted to ICU in the country. However, current data covering the prevalence of sepsis, outcomes, and associated factors among intensive care unit-admitted adult patients are lacking. The absence of these data substantially affects recognizing the magnitude of the problem, the quality of care provided, and its impact on the patient. This study aims to assess the prevalence of sepsis, outcomes, and associated factors among adult patients in the intensive care unit at MNH.

1.3 CONCEPTUAL FRAMEWORK



Source: Conceptualized by author

Figure 1: Conceptual framework

NARRATION OF CONCEPTUAL FRAMEWORK

The study determined the prevalence of sepsis in ICU among adult patients, their outcomes, and the factors associated with those outcomes. Prevalence and outcomes of these were the dependent variables and Patient, hospital and healthcare provider factors were the independent variables. Association between dependent (outcomes) and independent variables were evaluated.

1.4 RATIONALE.

The findings of this study would provide valuable insights into the prevalence of sepsis among critically ill patients at Muhimbili National Hospital. Furthermore, it would illuminate the outcomes experienced by these patients and the factors influencing those outcomes.

These findings can be incorporated into hospital committees' decision-making processes to enhance the quality of services offered, ultimately aiming to mitigate the morbidity and mortality associated with sepsis. Importantly, this study underscores the continual need for improvement in healthcare practices.

1.5 RESEARCH QUESTIONS

1. What is the prevalence of sepsis among adult patients admitted to the ICU at MNH from June to November 2023?
2. What are the outcomes of adult patients with sepsis admitted to the ICU at MNH from June to November 2023?
3. What are the factors associated with the outcome of adult patients with sepsis admitted to the ICU at MNH from June to November 2023?

1.6 OBJECTIVES

1.6.1 BROAD OBJECTIVE

To determine the prevalence of sepsis, outcome and associated factors among adult patients admitted to the ICU at MNH.

1.6.2 SPECIFIC OBJECTIVES

1. To determine the prevalence of sepsis among adult patients admitted to the ICU at MNH from June to November 2023.
2. To determine outcomes of adult patients with sepsis admitted to the ICU at MNH from June to November 2023.
3. To evaluate the factors associated with outcomes in adult patients with sepsis to the ICU at MNH from June to November 2023.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Prevalence of sepsis in adult patients admitted to the ICU.

The prevalence of sepsis ranges between 42.5% and 60.9% from prospective studies conducted in China) had sepsis (22) and Japan. (23). Another retrospective cohort study conducted at university and community hospitals in the United States reported a sepsis prevalence of 52.8%. (24). In Malawi, a study reported that 66% of patients had sepsis among patients admitted to the ICU(25), while a study conducted in Egypt found that among 403 ICU-admitted patients, 24.8% of patients were diagnosed with sepsis. (26).

A study conducted to identify the epidemiology of sepsis in rural sub-Saharan Africa reported that 17.4% of 491 adults admitted to the ICU had sepsis (27).All these studies reported a similar prevalence of sepsis regardless whether they were conducted in LMICs and HICs, however, there is no recent data on prevalence of sepsis in adult patient admitted in ICU at MNH.

2.2 Outcomes of adult patients with sepsis admitted to the ICU.

The outcome for ICU patients diagnosed with sepsis remains poor. A prospective study conducted in the adult ICU at a Jordanian university found that 57.8% of 194 sepsis patients died during treatment, while the remainder were discharged. Similarly, a 2021 study in Iraq reported that, among 100 ICU patients with sepsis, 55% died and 45% were discharged either to the ward or home. A multicenter observational study in a Vietnamese ICU showed a 33% mortality rate among 252 sepsis patients.

In China, a 2020 study on the prevalence, risk factors, and outcomes of critically ill ICU patients revealed a mortality rate of 27.2%. In Rwanda, a retrospective study involving two hospitals reported that 51.4% of 181 sepsis patients died, while 48.6% were discharged either to home or a district hospital. In Malawi, a prospective observational study found a 75% mortality rate among 76 sepsis patients. A similar outcome was observed in a study from

Cairo, Egypt, where 68% of 100 sepsis patients died. In Ethiopia, a retrospective study showed a hospital mortality rate of 44% among 98 sepsis patients

2.3 Factors associated with outcome in adult patients with sepsis admitted to the ICU

In a cross-sectional study conducted in Iraq, the highest prevalence of death among patients with sepsis was found in patients with systemic complications and comorbidities (83.3%, p=0.001; blood negative culture results and male patients (70.5%, p=0.001) (33). Another study conducted in Massachusetts involving six hospitals (3 tertiary hospitals and 3 community hospitals) on adult patients with sepsis found a significant association between increasing mortality and the presence of comorbidities, with metastatic cancer accounting for 20% of deaths, haematologic cancer accounting for 5.5%, severe chronic lung disease accounting for 4%, and the remaining percentage due to other diseases (24). Study done in USA on COVID -19 patients to asses SOFA score and mortality prediction in patients admitted in ICU reported that SOFA score of less than 2 were associated with 100% survival and those with SOFA score more than 11 to be associated with higher mortality (95%), showing a statistical significance of $P < 0.05$ (7). A study done in USA by Rhee 2019, reported that the majority of deaths in ICU were older individuals, but there was no significant link between age and gender in tertiary hospitals (24).

Additionally, a study done to determine the outcome of sepsis in critically ill patients in Vietnam in 2023, reported patients with higher SOFA score of more than 8 to be associated with mortality P=0.001 than those with SOFA score less than 8(30). Another study done in India 2017, to determine prognostic predictors of sepsis patients in ICU reported patients with higher SOFA score at the time of admission to be associated with poor outcome (death), cut off point being a score of 8 (P= 0.001) (34). A study done in India 2023 on surgical patients with sepsis showed similar results with most of the studies and reported a SOFA score more than 10 was associated with higher mortality (P=0.01) as compared to those with SOFA score less than 10 (35). A retrospective study done in Ethiopia in 2020 reported 60% of patients were admitted with one or more co-morbidities, with HIV infection being the most prevalent

(52.5%) Patients with co-morbid conditions were more likely to die from sepsis (AOR 4.7, P-value 0.02)(32).

Due to the global burden of sepsis, research done by Keeley AJ in 2021, on identifying barriers and solution to improve sepsis prevention, early recognition, and management in LMICs. The health system barriers, poor resources, and low public health resilience were the main contributors to the poor patient outcome and higher burden of sepsis in ICU, lack of personnel in intensive care unit, poor knowledge and competencies, lack of training and education, insufficient ICU capacity, and lack of relevant management guidelines were among the contributors of burden and outcome in comparison to HICs (14). A survey of 21 studies from resource-limited settings found that a number of factors were significantly associated with higher morbidity and mortality in sepsis patients. These factors included inadequate staffing, lack of monitoring and diagnostic equipment, and absence of a protocol for the management of sepsis (17).

A descriptive cross-sectional study conducted in Palestine found that the majority of physicians and nurses had poor to moderate knowledge on sepsis management, ranging from 47.7% to 51.0%, while only 1.2% had strong knowledge. Also, absence of monitoring equipment, paucity of staff in ICU, and lack of proper drugs were described of being a barrier to successful management of sepsis and a significant factor associated to poor outcomes(36). A study conducted to determine how to overcome obstacles and apply the Surviving Sepsis guideline revealed that the effectiveness of treatment of sepsis remains a difficulty, particularly in nations with limited resources. Multiple factors have contributed to these failures and higher morbidity and mortality, notably lack of resources both human and infrastructure, knowledge gaps in early identification and management of sepsis in ICU, poor or absent teaching and training and poor working conditions(18). A cross sectional study done in Italy 2018, to measure level of knowledge in early detection and management of sepsis found poor knowledge in 42.3% of nurses and 49.6% doctors (37). All these factors showed similar results in identifying the barriers or factors associated with poor outcome with more

similar results in LMICs such as poor resources, lack of skills and knowledge, as compared to HICs where patient factors were the main contributor to poor outcome.

CHAPTER THREE

3.0 METHODOLOGY

3.1 STUDY DESIGN

The study was a hospital-based analytical cross-sectional study conducted in the intensive care unit at Muhimbili National Hospital.

3.2 STUDY DURATION

The study was conducted for a period of six months from June 2023 to November 2023.

3.3 STUDY AREA

The study was conducted at Muhimbili National Hospital in Upanga, Ilala district, Dar es Salaam, Tanzania, a national hospital that also serves as a tertiary teaching and referral facility in Tanzania. With 1500 bed capacity, Attending an average of 2000 patients. It has Neonatal, Pediatrics, Obstetrics, Medical, and Surgical ICUs. The Medical and Surgical ICUs were the focus of the research. The Medical and Surgical ICUs have a total of 24 beds (11 beds surgical ICU and 13 beds in the medical ICU) and an average of 300 admissions of critically ill patients per year. It also has a total of 58 staff including 48 nurses, 4 intensivists, and 6 medical doctors.

3.4 STUDY POPULATION

This study involved two major study populations which included;

i. All patients admitted to ICU.
ii. All health care workers working in the ICU.

3.5 INCLUSION CRITERIA

i. All patients 18 years of age and above admitted to the ICU during the period of study and consented to participate.
ii. All healthcare workers in the intensive care unit that consented to participate in the study.

3.6 EXCLUSION CRITERIA

i. Patients with sepsis readmitted to ICU during the same hospitalization.

ii. Health care workers that were on leave during the period of study.

3.7 SAMPLE SIZE CALCULATION

For prevalence of sepsis in patients admitted in ICU, Kish and Leslie formula below was used to calculate sample size.

$$\frac{n = z^2 p\,(1-p)}{\varepsilon^2}$$

p = 61.3% (previous prevalence from a study done in Rwanda (25)

z = 1.96 (assuming 95% confidence interval)

ε = 5 % (maximum error allowed)

n =365

For a finite population using:

$$\mathbf{n_c}=\frac{n}{1+(\frac{n}{N})}$$

Where;

n= Calculated sample above

N= Finite sample size of study population during time of study (where there are 150 admissions in six months)

$$n=\frac{365}{1+(365/150)}$$

n=107

Therefore, minimum of 107 patients were included in the study.

The sample of health care workers was calculated using:

$$\frac{n \ = \ z^2 p \ (1-p)}{\mathcal{E}^2}$$

p = % (from a study done in Uganda (38) where 52.5% had good knowledge)

z = 1.96 (95% confidence interval)

ε = 5 % (margin of error)

n =384

For a finite sample using the formula below,

$$\mathbf{n_c}=\frac{n}{1+(\frac{n}{N})}$$

Whereby;

n= sample calculated

N= Finite sample size during time of study ((using number of available staffs in ICU. (58))

$$n= \frac{384}{1+(384/58)}$$

n=50

Adjusted sample size = n x 1/R

Whereby;

n = calculated sample size

R=Response rate,

Approximating non-response = 10%, then response rate is 90%

Adjusted sample size = 50 x 1/0.9 =56

Thus, the final sample size was 56 staffs.

Based on the number of available healthcare workers in ICU, the study included 4 intensivists, 5 medical doctors and 47 nurses.

3.8 SAMPLING TECHNIQUE

A consecutive sampling technique was used, which included all patients admitted to the medical and surgical ICUs who met the inclusion criteria during the study period. Consecutive sampling is a non-probability sampling technique in which each sample that satisfies the requirements of the study is included until the required sample size is reached.

3.9 STUDY VARIABLE

3.9.1 Dependent variables

The dependent variable was the prevalence of patients with sepsis in the ICU and outcomes (death and discharge).

3.9.2 Independent variables

The independent variables were the age of the patient, gender, source of infection, presence of comorbidities, systemic complications developed during ICU stay, SOFA score, interventions done, knowledge of health care workers management of sepsis, and availability of staff training program and guideline.

3.10 DATA COLLECTION TOOL

Data was collected using three study tools which included two structured questionnaires and a checklist.

The first questionnaire was used to assess patient demographics, clinical factors, and outcomes. It was adapted from a study done in Ethiopia (39) and had three sections. Section one contained general characteristics of a patient, and section two contained information on the source of infection and existing comorbidities. Section three contained information on the management of the patient according to recommended management protocols and section four contained information on the outcome of the patient with sepsis whereby the primary outcome was death and the secondary outcome was discharge.

A second questionnaire adapted from a study done in Gabon (44) was used to assess healthcare-related factors workers. Section one contained social demographic data (age,

gender, education level, and years of experience in the ICU. Section two contained multiple choice questions to assess knowledge of the management of sepsis.

A checklist was adopted from the WHO service availability manual (41) was used to assess the institutional-related factors that include: the availability of guidelines for the management of sepsis, staff training, diagnostic tools, equipment, and medications.

3.11 DATA COLLECTION PROCEDURE

Data was collected by the principal investigator and trained research assistants, who received prior training and information on the research topic, data collection tools, and obtaining consent to guarantee accurate data collection. Consent to collect data was obtained from ICU administration, healthcare workers, and patients. All patients admitted during the study period and those who developed sepsis in ICU were included.

Sepsis was defined using Sepsis 3(1) where a SOFA score of 2 or more and evidence of infection, were used to determine the diagnosis of sepsis. SOFA score was performed within 24 hours of admission or suspected diagnosis of sepsis. Since SOFA score was not used in ICU for diagnosis or predicting prognosis before this study, proper training was given to research assistants for accurate performance and data collection.

The infection source was determined through the patient's prior documentation, history, examination, laboratory tests, or radiological or microbiological investigations. ICU-acquired infection was defined as infection discovered at least 48 hours after ICU admission. Non-ICU-acquired infection was defined as infection present on admission or within the first 48 hours following ICU admission.

Systemic organ dysfunctions and complications were based on several characteristics; Acute kidney injury (AKI) and severity were categorized according to the Kidney Disease: Improving Global Outcomes (KDIGO) guidelines (42). According to the Berlin definition, acute respiratory distress syndrome (ARDS) was defined as a PaO2/FIO2 ratio <300 mmHg (43). Coagulopathy was defined by platelet count, an activated partial thromboplastin time

(aPPT) 15 > 40 seconds, an INR > 1.2, or a high d-dimer above the local reference ranges. Acute liver injury were defined in patients without preexisting cirrhosis or other liver disease were diagnosed if they experienced either encephalopathy, clinical assessment of jaundice, or INR >1.5 or a higher AST and ALT above local reference ranges (44). Myocardial infarction was determined by either clinical documentation, elevated creatine kinase-MB (CK-MB), or elevated troponin (elevations established depending on local reference ranges). Catheter-related sepsis was defined as at least one positive peripheral blood culture isolated from the catheter segment or isolated from the peripheral blood. Catheter-related indicates a central line either for hemodialysis or medication administration.

A self-administered questionnaire was given to healthcare workers to assess their knowledge regarding the recognition and management of sepsis. The questionnaire also included social demographics, experience working in ICU, use of guidelines in sepsis management, and if received any training on the management of sepsis and questions on knowledge on recognition and management of sepsis. A checklist was used to evaluate the availability of necessary equipment and medications to assess hospital factors.

Data was collected for six months from June 2023 to November 2023.

3.12 VALIDITY AND RELIABILITY

The data collection tool was pre-tested involving 10% of the sample size. These patients were not included in the final study population. The validity and reliability of the tool were assessed using Cronbach's alpha with a coefficient of 0.7 indicating the tool was valid and reliable.

3.13 DATA MANAGEMENT AND STATISTICAL ANALYSIS

Data was entered into Statistical Package for Social Sciences (SPSS) version 26. Data were cleaned and checked for consistency and missing data.

Prevalence expressed as a percentage was determined by calculating the number of patients with sepsis to the total number of admissions in the period of study.

Knowledge was expressed in percentage and was graded as adequate and inadequate, where a score of more than 75% was regarded as adequate knowledge and less than 75% as inadequate knowledge as other research done that was used to determine knowledge of sepsis.

The chi-square test was used to measure the relationship between the outcomes of patients with sepsis and patient factors. A p-value of< 0.05 was considered significant. Logistic regression analysis was used to assess the strength of association between outcomes and associated factors. A p-value of <0.05 was regarded to be statistically significant with 95% confidence intervals.

3.14 ETHICAL CONSIDERATIONS

Ethical clearance was obtained from MUHAS institution review board and permission to collect data was obtained from the Director of MNH. Participants were presented with a clear explanation of the significance of the study and their consent was based on their understanding. Confidentiality was maintained throughout the study. Participants were not identified by name to protect their confidentiality; they participated willingly and were able to withdraw from the study at any time at any point. For critically ill patients who were not able to consent, a request for waiver of consent was sought from the ethical review board to facilitate the inclusion of these patients in the study and be able to evaluate patient information.

3.15 DISSEMINATION OF RESEARCH FINDINGS

Findings from the study have been submitted for publication in various peer review journals. The study report has also been submitted to the MUHAS library for educational and future research purposes. Additionally, findings will be shared with MNH Management for institutional evaluation and improvement of services and will be presented at scientific conferences.

CHAPTER FOUR

4.0 RESULTS

4.1 Patient demographics

From June to November 2023, a total of 248 patients were admitted to the medical and surgical ICUs. The majority were male (55.6%), and 29% of all patients were at the age of more than 50 years, followed by (20%) aged 41-60 years and the least were between the age of 18-25 years (13.7%). (Table 1)

Table 1: Patient demographic characteristics (N=248)

Variable	Frequency (n)	Percent (%)
Age group (years)		
18 – 25	34	13.7
26 – 30	48	19.4
31 – 40	44	17.7
41 – 50	50	20.2
>50	72	29.0
Sex		
Male	138	55.6
Female	110	44.4
ICU		
Medical ICU	157	63.3
Surgical ICU	91	36.7

4.2 Prevalence of sepsis among adult patients with sepsis admitted to ICU

Among the 248 patients admitted to ICU during the study period, 103 (41.5%) were diagnosed with sepsis, having met the criteria.. The majority (62.1%) were men and among patients with sepsis, 48.5% were over the age of 50, followed by 31-50 years (28.2%), with 18-30 years accounting for only 23.3%. Among these patients, 50.5% were diagnosed at EMD; 36.9% were diagnosed in the ward and transferred to the ICU; and 12.6% acquired sepsis in the ICU. (fig 2 and 3)

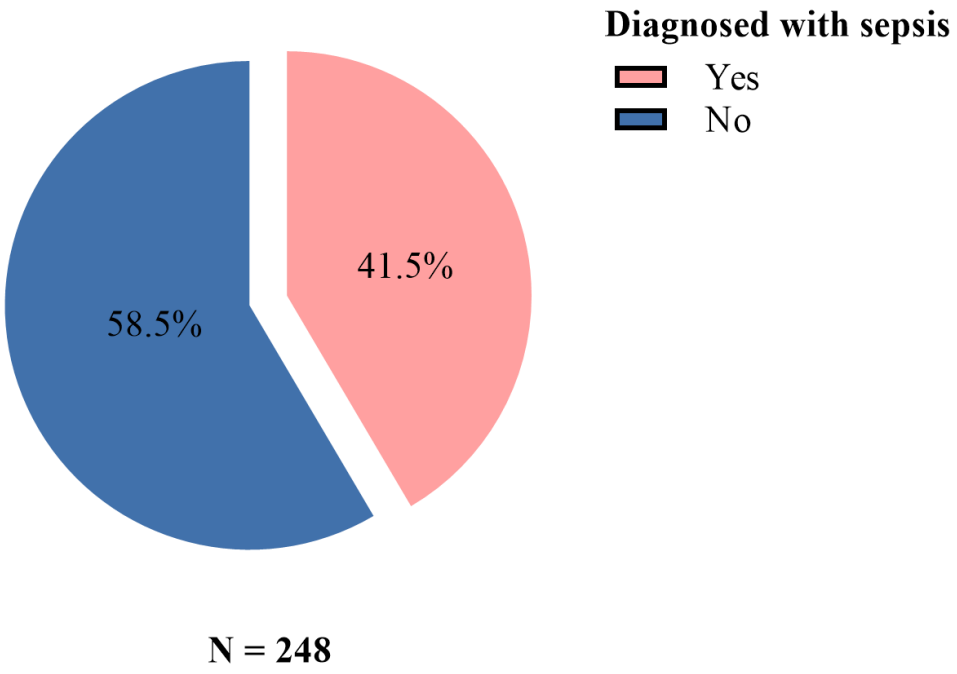


Figure 2: Prevalence of sepsis among adult patients admitted to ICU

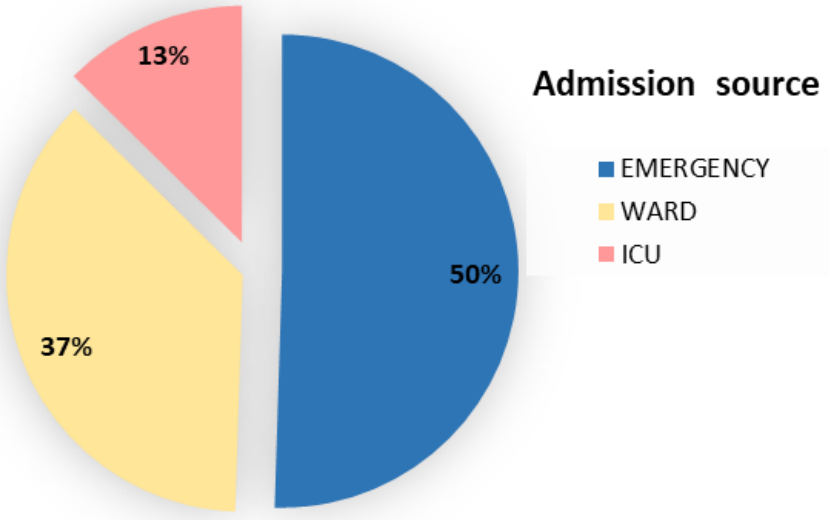


Figure 3: Patient source of admission

4.3 Patient clinical characteristics and interventions

The most common source of infection was respiratory (32%), followed by multiple infection sources of more than one (22.3%), Catheter-related (15.5%), and surgical site (11.7%). Among patients with sepsis, 81.6% of these had comorbidities, with hypertension (33.7%) being the most common, followed by CKD (18.1%) and diabetes (13.3%). Also, 35% of patients with sepsis developed systemic organ dysfunction, of which AKI was the most prevalent (36.1%) followed by ARDS (16.7%) (Table 2) (Fig.4)

Table 2: Clinical characteristics of the patients

Variable	Frequency (n)	Percent (%)
Source of infection		
Catheter-related	16	15.5
Respiratory	33	32.0
Urinary tract	8	7.8
Intraabdominal	6	5.8
Genital	2	1.9
Surgical site	12	11.7
Multiple sites (more than one site)	23	22.3
Undetermined	3	2.9
Comorbidity		
Hypertension	28	33.7
CKD	15	18.1
Diabetes	11	13.3
Congestive heart failure	5	6.0
Chronic liver failure	4	4.8
Leukemia	2	2.4
HIV	2	2.4
Multiple comorbidity (> 1)	16	19.3
Systemic complications		
Yes	36	35.0
No	67	65.0
Types of systematic complications (n = 36)		
AKI	13	36.1
Coagulopathy	4	11.1
Liver failure	3	8.3
Myocardial infarction	2	5.5
ARDS	6	16.6
Multiple complications	8	22.2

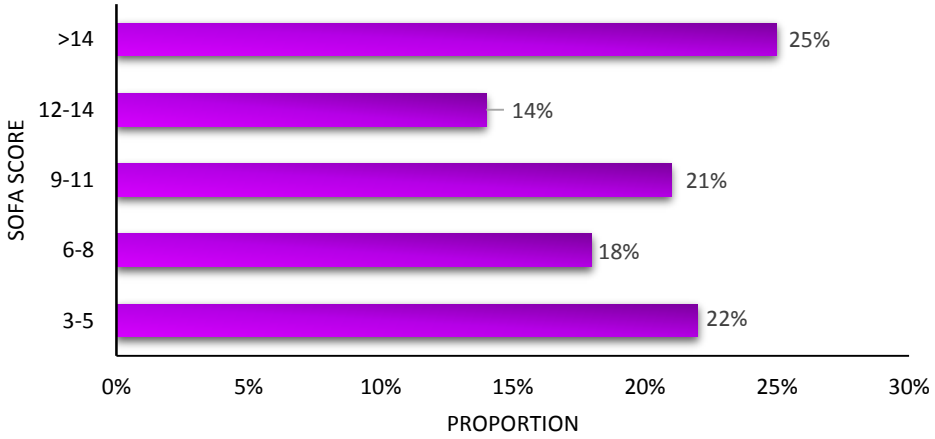


Figure 4: SOFA Score on Admission

All patients received crystalloids during treatment, however, only 52.4% received broad-spectrum antibiotics within 1 hour after sepsis recognition. Blood cultures were performed on 52.4% of patients, while urine cultures were performed on 38.8%. Among these patients with sepsis, 61.2% required mechanical ventilation. In addition, the use of vasopressors was administered to 57.3% of patients. The median length of stay in ICU was 9 days. (Fig 5)

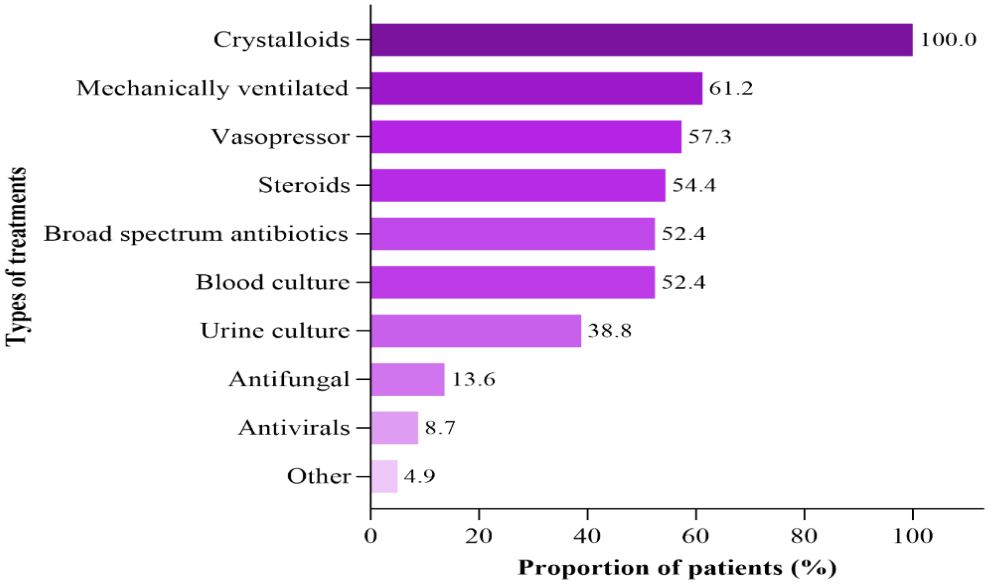


Figure 5: Treatment and interventions done in patients with sepsis admitted to the ICU

4.4 Outcomes of patients admitted to ICU with sepsis

Among 103 patients with sepsis, 55% died while 45% were discharged. (Fig.6)

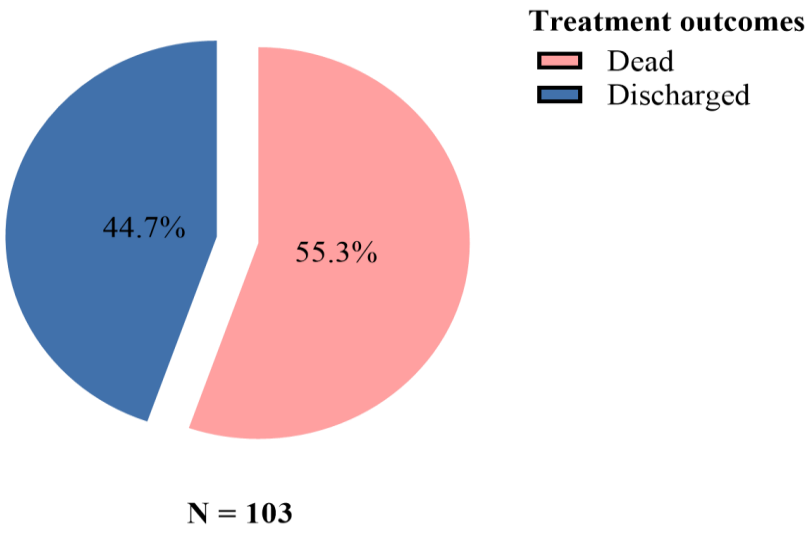


Figure 6: Outcomes of patients admitted to ICU with sepsis

4.5 Factors associated with outcome in patients with sepsis admitted to the ICU.

4.5.1 Patient demographics

Patient's age and sex were not found to be associated with the outcome in sepsis patients admitted to the ICU, their P-values were 0.865 and 0.56, respectively (Table 3)

Table 3: Demographics associated with the outcomes among patients with sepsis in ICU

	Treatment outcome		
Variable	**Died (%)**	**Discharged (%)**	**P - value**
Age group (years)			
18 – 30	10 (41.7)	14 (58.3)	0.258
31 – 50	16 (55.2)	13 (44.8)	
>50	31 (62.0)	19 (38.0)	
Sex			
Male	35 (54.7)	29 (45.3)	0.865
Female	22 (56.4)	17 (43.6)	
Admission source			
Emergency	29 (55.8)	23 (44.2)	0.384
Ward	23 (60.5)	15 (39.5)	
In ICU	5 (38.5)	8 (61.5)	
Admitted ICU			
Medical ICU	38 (51.4)	36 (48.6)	0.193
Surgical ICU	19 (65.5)	10 (34.5)	

4.5.2. Clinical Characteristics

SOFA score was reported to be significantly associated with mortality **(P<0.001)**. Having more than one source of infection, was significantly associated with mortality **(P =0.027)** while other sources of infection, such as catheter-related, urinary tract infections, and respiratory had no association with outcome. (Table 4)

Table 4: Clinical characteristics associated with the outcomes among patients with sepsis in ICU

	Treatment outcome		
Variable	**Died (%)**	**Discharged (%)**	**P - value**
SOFA Scores			
3-5	1 (4.3)	22 (95.7)	< **0.001**
6-8	3 (15.8)	16 (84.2)	
9-11	13 (61.9)	8 (38.1)	
12-14	14 (100)	0 (0.0)	
>14	26 (100)	0 (0.0)	
Catheter-related			
Yes	6 (37.5)	10 (65.5)	0.118
No	51 (58.6)	36 (41.4)	
Respiratory			
Yes	16 (48.5)	17 (51.5)	0.337
No	41 (58.6)	29 (41.4)	
Urinary			
Yes	3 (37.5)	5 (62.5)	0.462
No	54 (56.8)	41 (43.2)	
Intraabdominal			
Yes	3 (50.0)	3 (50.0)	1.000
No	54 (55.7)	43 (44.3)	
Surgical sites			
Yes	9 (69.2)	4 (30.8)	0.281
No	48 (53.3)	42 (46.7)	
Multiple sites (>1 site)			
Yes	18 (75.0)	6 (25.0)	**0.027**
No	39 (49.4)	40 (50.6)	
Length of stay in ICU			
2-7 days	26 (65.0)	14 (35.0)	0.143
8-14 days	21 (55.3)	17 (44.7)	
>14 days	10 (40.0)	15 (60.0)	

4.5.3 Patients comorbidities

The presence of CKD or more than one comorbid condition was significantly associated with a higher rate of ICU mortality with P-values of **0.008 and 0.023** respectively (Table 5)

Table 5: Comorbidities associated with outcomes among adult patients with sepsis admitted to ICU.

	Treatment outcome		
Variable	**Died (%)**	**Discharged (%)**	**P - value**
Hypertension			
Yes	16 (57.1)	12 (42.9)	0.822
No	41 (54.7)	34 (45.3)	
Diabetes mellitus			
Yes	6 (54.5)	5 (45.5)	1.000
No	51 (55.4)	41 (44.6)	
Congestive heart failure			
Yes	2 (40.0)	3 (60.0)	0.654
No	55 (56.1)	43 (43.9)	
Chronic kidney failure			
Yes	13 (86.7)	2 (13.3)	**0.008**
No	44 (50.0)	44 (50.0)	
Multiple co-morbidities (>1)			
Yes	13 (81.3)	3 (18.8)	**0.023**
No	44 (50.6)	43 (49.4)	

4.5.4 Interventions and Management

Initiation of broad-spectrum antibiotics within one hour of admission was associated with a higher rate of ICU discharge (P **<0.001)**. Other interventions such as blood culture (P=0.455), urine culture (P=0.093), mechanical ventilation (P=0.448), vasopressor (P=0.889), and steroids (P=0.997) did not show any statistical significance with discharge. (Table 6)

Table 6: Intervention and management factors associated with outcomes

	Treatment outcome		
Variable	**Died (%)**	**Discharged (%)**	**P - value**
Early initiation of broad-spectrum antibiotics			
Yes	15 (27.8)	39 (72.2)	< **0.001**
No	42 (85.7)	7 (14.3)	
Blood culture			
Yes	28 (51.9)	26 (48.1)	0.455
No	29 (59.2)	20 (40.8)	
Antifungal			
Yes	5 (35.7)	9 (64.3)	0.112
No	52 (58.4)	37 (41.6)	
Antivirals			
Yes	4 (44.4)	5 (55.6)	0.508
No	53 (56.4)	41 (43.6)	
Vasopressor			
Yes	33 (55.9)	26 (44.1)	0.889
No	24 (54.5)	20 (45.5)	
Mechanically ventilated			
Yes	33 (52.4)	30 (47.6)	0.448
No	24 (60.0)	16 (40.0)	
Steroids			
Yes	31 (55.4)	25 (44.6)	0.997
No	26 (55.3)	21 (44.7)	
Urine culture			
Yes	18 (45.0)	22 (55.0)	0.093
No	39 (61.9)	24 (38.1)	

4.5.5 Systemic complications

Having more than one systemic complication was significantly associated with ICU mortality (**P =0.004)**. A single systemic complication of ARDS (P=0.786), liver failure (P=0.114), coagulopathy (P=0.827), and myocardial infarction (P=0.114) did not show statistical significance with mortality. (Table 7)

Table 7: Systemic complications developed in ICU associated with outcomes

	Treatment outcomes		
Variable	**Died (%)**	**Discharged (%)**	**P - value**
Acute renal injury			
Yes	8 (61.5)	5 (38.5)	0.631
No	49 (54.4)	41 (45.6)	
Coagulopathy			
Yes	2 (50.0)	2 (50.0)	1.000
No	55 (55.6)	44 (44.4)	
ARDS			
Yes	3 (50.0)	3 (50.0)	1.000
No	54 (55.7)	43 44.3)	
>1 complication			
Yes	9 (100.0)	0 (0.0)	**0.004**
No	48 (51.1)	46 (48.9)	

4.6. Univariable and multivariable analysis of the factors associated with mortality

Univariable analysis of our study found that; a higher SOFA score (p=0.001), more than one infection sites (p=0.011), CKD (p <0.001), having more than one co-morbidity (p=0.003), and multiple systemic complications (p <0.001) were associated with high mortality whereas the early use of broad-spectrum antibiotics (p <0.001) was associated with favourable outcome (discharge).

After adjusting for confounding variables, multivariate logistic regression was done to analyze the strength of association between outcomes and patient factors. The study reported patients who had a higher SOFA score of more than nine were strongly associated with poor outcomes (p=0.005), however, patients that were started on antibiotics early were strongly associated with discharge (p=0.007). (Table 8)

Table 8: Univariable and multivariable analysis of the factors associated with mortality

		Univariable analysis			Multivariable analysis		
Variable	**Category**	**cPR**	**95% CI**	**P - value**	**aPR**	**95% CI**	**P - value**
Age	18 – 30	Ref					
	31 – 50	1.32	0.74 – 2.36	0.339	0.94	0.66 – 1.31	0.717
	>50	1.49	0.88 – 2.51	0.135	1.12	0.77 – 1.61	0.555
Sex	Male	0.97	0.68 – 1.38	0.864			
	Female	Ref					
Catheter-related	Yes	0.64	0.33 – 1.23	0.182	0.76	0.46 – 1.26	0.287
	No	Ref					
Respiratory	Yes	0.83	0.55 – 1.24	0.358			
	No	Ref					
Urinary	Yes	0.66	0.27 – 1.64	0.371			
	No	Ref					
Surgical sites	Yes	1.30	0.86 – 1.96	0.213			
	No	Ref					
Multiple sites	Yes	1.52	1.10 – 2.10	**0.011**	1.02	0.85 – 1.23	0.814
	No	Ref					
Admission source	Emergency	1.45	0.70 – 3.01	0.318			
	Ward	1.57	0.76 – 3.28	0.226			
	ICU	Ref					
Admitted ICU	Medical ICU	0.78	0.56 – 1.11	0.166	0.92	0.70 – 1.21	0.567
	Surgical ICU	Ref					
SOFA Scores ranges	>14	23.00	3.38 – 156.39	0.001	16.89	2.32 – 122.86	**0.005**
	12 – 14	23.00	3.38 – 156.39	0.001	15.73	2.13 – 116.22	**0.007**
	9 – 11	14.24	2.03 – 99.68	0.007	12.61	1.82 – 87.54	**0.010**
	6 – 8	3.63	0.41 – 32.13	0.246	3.41	0.42 – 28.02	0.253
	3 – 5	Ref					
Hypertension	Yes	1.05	0.71 – 1.53	0.820			
	No	Ref					
CKD	Yes	1.73	1.30 – 2.31	**< 0.001**	1.19	0.94 – 1.52	0.153
	No	Ref					
Multiple co-morbidities	Yes	1.61	1.17 – 2.20	**0.003**	1.14	0.81 – 1.60	0.456
	No	Ref					
Broad spectrum antibiotics	Yes	0.32	0.21 – 0.51	**< 0.001**	0.61	0.43 – 0.88	**0.007**
	No	Ref					
Antifungal	Yes	0.61	0.30 – 1.26	0.183	0.89	0.63 – 1.28	0.534
	No	Ref					
Vasopressor	Yes	1.03	0.72 – 1.46	0.889			
	No	Ref					
Mechanically ventilated	Yes	0.87	0.62 – 1.23	0.441			
	No	Ref					
Steroids	Yes	1.00	0.71 – 1.42	0.997			
	No	Ref					
Acute renal injury	Yes	1.13	0.71 – 1.81	0.609			
	No	Ref					
>1 complication	Yes	1.96	1.61 – 2.39	**< 0.001**	1.08	0.88 – 1.33	0.460
	No	Ref					

Key: cPR: Crude Prevalence Ratio, aPR: adjusted prevalence ratio, Ref: Reference category

4.7 Demographics and working characteristics of the health care worker

The following table represents the demographics and working characteristics of fifty-six Healthcare workers who were involved in the study. (Table 9)

Table 9: Demographic and working characteristics of the health care worker N = 56

Variable	Frequency (n)	Percent (%)
Age group (years)		
21 – 29	5	8.9
30 – 39	36	64.3
40 – 49	11	19.6
>50	4	7.1
Sex		
Male	30	53.6
Female	26	46.4
Profession		
Intensivist	4	7.1
General practitioner	5	8.9
Nurse	47	83.9
Years of working experience		
< 3 years	13	23.2
3 – 5 years	23	41.1
6 – 10 years	20	35.7
Received training		
In residency program	4	7.1
Online Education	19	33.9
None	33	58.9
Use of guideline		
Surviving sepsis guideline	13	23.2
Standard treatment guideline	22	39.3
No	21	37.5

4.8 Healthcare workers' knowledge of the management of sepsis.

All intensivists had adequate knowledge of sepsis identification and management, 50% of general practitioners, and Only 21% of nurses. (fig 7)

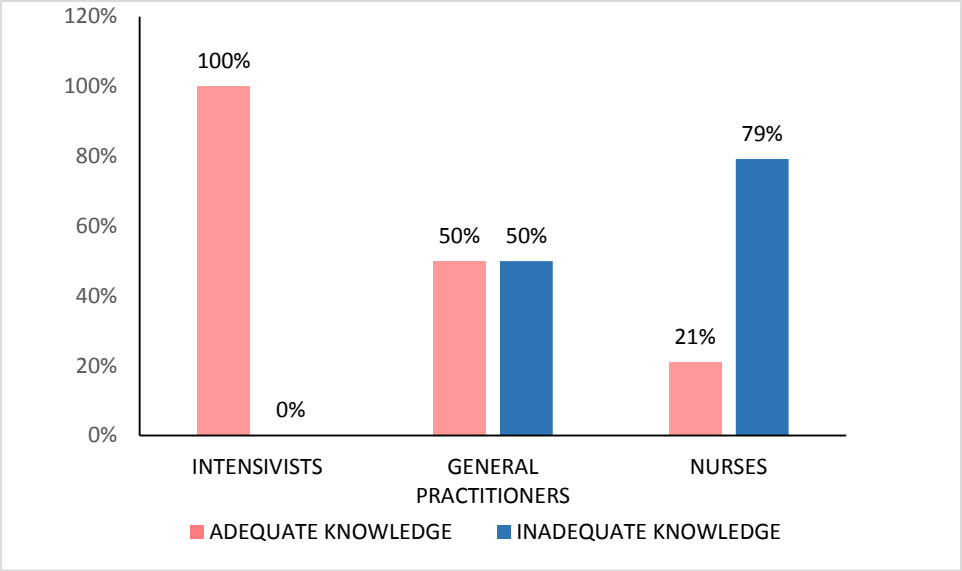


Figure 7: The proportion of healthcare worker knowledge of the management of sepsis

4.9 Hospital factors

The emergency cart in the ICU contained at least one of the emergency drugs such as norepinephrine, epinephrine, atropine, bicarbonates, calcium, potassium chloride, and insulin. Antibiotics, antivirals, and antifungals were reportedly available in the hospital pharmacy. A blood gas analysis machine and a point-of-care ECG were available but not working. Ultrasound and portable X-ray were not available. Furthermore, there was no use of specific guidelines for diagnosing or managing sepsis. It was also found that not one employee had undergone any sepsis management training in the previous 24 months.

CHAPTER FIVE

5.0 DISCUSSION

This study was a hospital-based cross-sectional study, conducted in the ICU at MNH for six months period. The aim was to determine the prevalence of sepsis, outcomes, and associated factors among adult patients admitted to the ICU.

5.1.1 Prevalence of sepsis among adult patients with sepsis in ICU

The study showed a prevalence of 41.5% of sepsis in ICU patients during the study period. Similarly, studies done in Rwanda and Egypt (25,45) reported a high prevalence of sepsis (61.3% and 66% respectively) similar findings to studies done in Brazil (43.9%) and China (42.5%) (22,46). Similarities in the findings from both LMICs and HICs suggest that sepsis is highly prevalent and a significant global challenge regardless of socio-economic status and preventive measures already put in place such as screening and early recognition of sepsis to reduce the burden of sepsis.

5.1.2 Outcomes of adult patients with sepsis admitted to ICU

This study reported that 55% of patients with sepsis died and 45 % were discharged. The outcomes are similar to the study done in Malawi where 50% of patients died (31). Additionally, two separate studies done in Ethiopia (32,47) revealed almost similar findings of sepsis-related ICU mortalities of 51% and 58%. Moreover, a publication on sepsis outcomes among ICU-admitted patients from Egypt (26) showed a relatively higher mortality of 68% during treatment. On the contrary, studies conducted in high-income countries such as China, the United States and Vietnam reported lower sepsis-related ICU mortalities of 16%, 25% and 33% respectively (22,24,30).

The observed differences in outcome among ICU-admitted patients with sepsis between developing and developed countries echo reports in this field associating high sepsis-related ICU mortalities in the LMICs. This may be due to the lack of formal training, lack of knowledge and skills, non-adherence to sepsis diagnosis and treatment guidelines, unavailability of standardized equipment and drugs in these countries compared to the HICs.

5.1.3 Outcomes and Associated factors among adult patients with sepsis in ICU

Our study reported that there was a significant association between SOFA score at the time of admission where a higher SOFA score was associated with death (p= <0.005). This is similar to , studies done in Ethiopia, Egypt, China, and Vietnam (22,26,30,47).These results emphasized the utilization of a well-established scoring tool for sepsis to help in the triage process. The tool is critical to classify patients, identify high-risk patients, and help in early management and intervention according to specific patients' conditions. Furthermore, the consistency of these results in different regions suggests that the SOFA score is reliable in risk stratification and management plan of our patients.

Moreover, our study reported that early initiation of broad-spectrum antibiotics within the first hour of sepsis recognition was statistically significantly associated with patient discharge (p= <0.001). Our study findings are in line with those of studies done in China and Vietnam (22,30) that showed early initiation of antibiotics within one hour of sepsis recognition was associated with discharge. These findings emphasize on early administration of broad-spectrum antibiotics within one hour of sepsis recognition. This observation is in line with the recommendation from the Surviving Sepsis guideline(48), which stresses on administration of antibiotics within the first hour of sepsis recognition. Nevertheless, the Chinese study also reported that the use of vasopressors in patients with sepsis was associated with better outcomes than when vasopressors were not used. On the contrary, our study did not find any association between vasopressor use and patient outcome. The severity of illness and timing of initiation of vasopressors could explain this difference.

In our study, there was no association between patients with comorbidities and those who developed systemic complications with outcomes, which differs from those in Ethiopia, Egypt, and Indonesia. Studies done in Ethiopia (47) and Indonesia (49) While, a study in Egypt (26) reported that patients who subsequently developed acute kidney injury and acute respiratory distress syndrome during their ICU stay were more likely to die, which aligns with findings in Ethiopia (39). The discrepancy may be attributed to several factors including differences in sample size and duration of the study. Although there were no strong associations in our study, it is crucial to consider the limitations of our study such as sample

size and confounding variables. Further research in our setting with a larger sample size may provide more comprehensive insight into the association between comorbid conditions and patients with systemic complications.

5.1.4 Healthcare worker and hospital factors

This study revealed that majority of doctors working in the ICU had adequate knowledge as compared regarding the management of sepsis compared to nurses. Also noted was lack of adherence to sepsis management guidelines and formal training on sepsis management among HCWs. This finding agrees with similar studies done in Uganda, Gabon, Palestine, and Pakistan which reported inadequate knowledge, especially among nurses in early intervention and management of sepsis.

Furthermore, these studies reported lack of adherence to guidelines for early recognition and management of sepsis in the ICU (13,38,40,50). The similarity of findings from these studies provides an overview of the challenges faced in LMIC's health settings, which may contribute to the negative impact on patients' outcomes. Addressing these issues through training programs and improved adherence to guidelines may contribute to improvement in sepsis management practices and ultimately improve patient outcomes.

5.2 STUDY STRENGTH AND LIMITATIONS

5.2.1 Study strengths

i. The study has presented the importance of using the recommended SOFA score to categorize patients and focus on early management of the patients for better outcomes.

ii. To the best of our knowledge, there is no published study in this field from MNH, specifically about sepsis, assessing its prevalence, patients' outcomes, and associated factors. Our findings will guide clinicians, hospital management, and other stakeholders in planning and executing interventions aimed at improving care among ICU-admitted patients with sepsis.

5.2.2 Study limitations

i. This was a single-center study thus, the research findings might not be representative of the entire population.

ii. There was no follow-up of patients after discharge from the ICU for further evaluation of the long-term complications associated with sepsis and ICU stay.

iii. SOFA score couldn't be followed up due to a lack of serial laboratory investigations due to hospital and patients' financial issues.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This study revealed a high prevalence of sepsis and case-related mortality. It also highlights the importance of early sepsis recognition and management, particularly proper screening, diagnosis of patients and, early initiation of broad-spectrum antibiotics. Challenges such as inadequate knowledge, lack of formal institutional training, lack of guideline use, and unavailability of necessary resources can impact patient care.

6.2 Recommendations

Proper use of standardized tools is essential for early recognition of sepsis, determining severity, and implementing timely intervention to prevent the development of complications and improve patient outcomes.

Early initiation of broad-spectrum antibiotics and adopting the use of guidelines in the management of sepsis to ensure consistency in management and deliver standardized care to all patients.

Conducting training and discussing the latest guidelines on sepsis management and also conducting continuous medical education (CME) on common diseases in the ICU including sepsis will help keep HCW updated and improve.

Ensuring the availability of all the necessary medications and equipment in the ICU such as ABG, bedside ECG, ultrasound machine, necessary drugs, and other equipment is crucial in managing these critically ill patients and is an important aspect contributing to good patient outcomes.

Conduct of similar study including pre-ICU settings in other healthcare facilities in the country.

REFERENCES

1. Evans L, Rhodes A, Alhazzani W, Antonelli M, Coopersmith CM, French C, et al. Surviving sepsis campaign: international guidelines for management of sepsis and septic shock 2021. Intensive Care Med. 2021 Nov 1;47(11):1181–247.

2. Seymour CW, Liu VX, Iwashyna TJ, Brunkhorst FM, Rea TD, Scherag A, et al. Assessment of Clinical Criteria for Sepsis: For the Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) HHS Public Access. JAMA. 2016;315(8):762–74.

3. Arora J, Mendelson AA, Fox-Robichaud A. Sepsis: network pathophysiology and implications for early diagnosis. Am J Physiol - Regul Integr Comp Physiol. 2023;324(5):R613–24.

4. Jacobi J. The pathophysiology of sepsis - 2021 update: Part 2, organ dysfunction and assessment. Am J Health Syst Pharm. 2022 Mar 15;79(6):424–36.

5. Becker JU, Theodosis C, Jacob ST, Wira CR, Groce NE. Surviving sepsis in low-income and middle-income countries: new directions for care and research. Vol. 9, The Lancet Infectious Diseases. Lancet Publishing Group; 2009. p. 577–82.

6. Songsangjinda T, Khwannimit B. Comparison of severity score models based on different sepsis definitions to predict in-hospital mortality among sepsis patients in the Intensive Care Unit. Med intensiva. 2020 May 1;44(4):226–32.

7. Fayed M, Patel N, Angappan S, Nowak K, Vasconcelos Torres F, Penning DH, et al. Sequential Organ Failure Assessment (SOFA) Score and Mortality Prediction in Patients With Severe Respiratory Distress Secondary to COVID-19. Cureus. 2022 Jul 16;

8. Ferreira FL, Peres Bota D, Bross A, Mélot C, Vincent JL, Vin-Cent JL, et al. Serial Evaluation of the SOFA Score to Predict Outcome in Critically Ill Patients.

9. Improving the prevention, diagnosis and clinical management of sepsis. 2017.

10. THE UNITED REPUBLIC OF TANZANIA STANDARD TREATMENT GUIDELINES AND NATIONAL ESSENTIAL MEDICINES LIST FOR TANZANIA MAINLAND.

11. Rudd KE, Johnson SC, Agesa KM, Shackelford KA, Tsoi D, Kievlan DR, et al. Global, regional, and national sepsis incidence and mortality, 1990–2017: analysis for the Global Burden of Disease Study. Lancet. 2020;395(10219):200–11.

12. Vincent JL, Marshall JC, Ñamendys-Silva SA, François B, Martin-Loeches I, Lipman J, et al. Assessment of the worldwide burden of critical illness: The Intensive Care Over Nations (ICON) audit. Lancet Respir Med. 2014 May 1;2(5):380–6.

13. Salameh B, Aboamash AEM. Predictors of Knowledge, Attitudes, Practices and Barriers Regarding Sepsis and Sepsis Management Among Emergency Nurses and Physicians in Palestine: A Cross-Sectional Analysis. Inquiry. 2022 Jan 1;59.

14. Keeley AJ, Nsutebu E. Improving sepsis care in Africa: an opportunity for change? Pan Afr Med J. 2021 Sep 1;40.

15. Atumanya P, Sendagire C, Wabule A, Mukisa J, Ssemogerere L, Kwizera A, et al. Assessment of the current capacity of intensive care units in Uganda; A descriptive study. J Crit Care. 2020 Feb 1;55:95–9.

16. Petti CA, Polage CR, Quinn TC, Ronald AR, Sande MA. Laboratory Medicine in Africa: A Barrier to Effective Health Care. Vol. 42, Clinical Infectious Diseases. 2006.

17. Ni P, Le YI. Challenges in the Management of Sepsis in a Resource-Poor Setting. Int J Clin Med. 2017;08(06):412–21.

18. Jit Singh Bajwa S, Sarna R, Sukhminder Jit Singh Bajwa P, No- H, Nagar R. EDITORIAL VIEW ANAESTHESIA, PAIN & INTENSIVE CARE Overcoming barriers to implement surviving sepsis campaign guidelines. Vol. 22, PAIN & INTENSIVE CARE. 2018.

19. Markwart R, Saito H, Harder T, Tomczyk S, Cassini A, Fleischmann-Struzek C, et al. Epidemiology and burden of sepsis acquired in hospitals and intensive care units: a systematic review and meta-analysis. Intensive Care Med. 2020;46:1536–51.

20. Current evidence, identifying gaps and future directions GLOBAL REPORT ON THE EPIDEMIOLOGY AND BURDEN OF SEPSIS. 2020.

21. Sawe HR, Mfinanga JA, Lidenge SJ, Mpondo BCT, Msangi S, Lugazia E, et al. Disease patterns and clinical outcomes of patients admitted in intensive care units of tertiary referral hospitals of Tanzania. BMC Int Health Hum Rights. 2014 Sep 23;14(1).

22. Wang M, Jiang L, Zhu B, Li W, Du B, Kang Y, et al. The Prevalence, Risk Factors, and Outcomes of Sepsis in Critically Ill Patients in China: A Multicenter Prospective Cohort Study. Front Med. 2020 Dec 17;7.

23. Endo K, Mizuno K, Seki T, Joo WJ, Takeda C, Takeuchi M, et al. Intensive care unit versus high-dependency care unit admission on mortality in patients with septic shock: a retrospective cohort study using Japanese claims data. J Intensive Care. 2022 Dec 1;10(1).

24. Rhee C, Jones TM, Hamad Y, Pande A, Varon J, O'Brien C, et al. Prevalence, Underlying Causes, and Preventability of Sepsis-Associated Mortality in US Acute Care Hospitals. JAMA Netw Open. 2019 Feb 1;2(2).

25. Hopkinson DA, Mvukiyehe JP, Jayaraman SP, Syed AA, Dworkin MS, Mucyo W, et al. Sepsis in two hospitals in Rwanda: A retrospective cohort study of presentation, management, outcomes, and predictors of mortality. PLoS One. 2021 May 1;16(5 May 2021).

26. Madkour AM, ELMaraghy AA, Elsayed MM. Prevalence and outcome of sepsis in respiratory intensive care unit. Egypt J Bronchol. 2022 Dec;16(1).

27. Kwizera A, Urayeneza O, Mujyarugamba P, Baelani I, Meier J, Mer M, et al. Epidemiology and Outcome of Sepsis in Adults and Children in a Rural, Sub-Sahara

African Setting. Crit Care Explor. 2021 Dec 16;3(12):e0592.

28. Abu-Humaidan AHA, Ahmad FM, Al-Binni MA, Bani Hani A, Abu Abeeleh M. Characteristics of Adult Sepsis Patients in the Intensive Care Units in a Tertiary Hospital in Jordan: An Observational Study. Crit Care Res Pract. 2021;2021.

29. Al-Wadees AAN, Al-Khayyat AN, Yaqoob QA. The Outcome of Sepsis Patients Admitted to the Intensive Care Unit: Experience of 100 Cases. Med Arch (Sarajevo, Bosnia Herzegovina). 2021 Feb 1;75(1):35–40.

30. Do SN, Luong CQ, Pham DT, Nguyen MH, Nguyen NT, Huynh DQ, et al. Factors relating to mortality in septic patients in Vietnamese intensive care units from a subgroup analysis of MOSAICS II study. Sci Rep. 2021 Dec 1;11(1).

31. Prin M, Onofrey L, Purcell L, Kadyaudzu C, Charles A. Prevalence, etiology, and outcome of sepsis among critically ill patients in Malawi. Am J Trop Med Hyg. 2020 Jul 1;103(1):472–9.

32. Shibru H, Muhie OA, Yesuf T, Shenkutie Greffie E, Mitiku T, Admasu Z, et al. Outcome of Septic Shock and Associated Factors at the University of Gondar Hospital: A Retrospective Cohort Study. J Intensive Crit Care. 2020;6(5).

33. Al-Wadees AAN, Al-Khayyat AN, Yaqoob QA. The Outcome of Sepsis Patients Admitted to the Intensive Care Unit: Experience of 100 Cases. Med Arch (Sarajevo, Bosnia Herzegovina). 2021 Feb 1;75(1):35–40.

34. Mohamed AKS, Mehta AA, James P. Predictors of mortality of severe sepsis among adult patients in the medical Intensive Care Unit. Lung India. 2017 Jul 1;34(4):330–5.

35. Thakur R, Naga Rohith V, Arora JK. Mean SOFA Score in Comparison With APACHE II Score in Predicting Mortality in Surgical Patients With Sepsis. Cureus. 2023 Mar 25;

36. Salameh B, Aboamash AEM. Predictors of Knowledge, Attitudes, Practices and Barriers Regarding Sepsis and Sepsis Management Among Emergency Nurses and

Physicians in Palestine: A Cross-Sectional Analysis. Inq (United States). 2022;59.

37. Nucera G, Esposito A, Tagliani N, Jane Baticos C, Marino P. Physicians' and nurses' knowledge and attitudes in management of sepsis: An Italian study. J Heal Soc Sci. 2018;3:13–26.

38. Nakiganda C, Atukwatse J, Turyasingura J, Niyonzima V. Improving Nurses' Knowledge on Sepsis Identification and Management at Mulago National Referral Hospital: A Quasi Experimental Study. Nurs Res Rev. 2022 Sep;Volume 12:169–76.

39. Teklemichael H. ASSESSMENT OF THE INCIDENCE AND TREATMENT OUTCOME OF SEPTIC SHOCK AMONG PATIENTS ADMITTED ADULT TO INTENSIVE CARE UNIT OF TIKUR ANBESSA SPECIALIZED HOSPITAL, ADDIS ABABA, ETHIOPIA.

40. Adegbite BR, Edoa JR, Rylance J, Jacob ST, Kawale P, Adegnika AA, et al. Knowledge of health workers relating to sepsis awareness and management in Lambaréné, Gabon. Acta Trop. 2021 Jul 1;219.

41. HEALTH FACILITY ASSESSMENT OF SERVICE AVAILABILITY AND READINESS Service Availability and Readiness Assessment (SARA) An annual monitoring system for service delivery Reference Manual. 2015.

42. Chen X. Chinese clinical practice guideline for acute kidney injury. Natl Med J China. 2023;103(42):3332–66.

43. Matthay MA, Arabi Y, Arroliga AC, Bernard G, Bersten AD, Brochard LJ, et al. A New Global Definition of Acute Respiratory Distress Syndrome. Am J Respir Crit Care Med. 2024;209(1):37–47.

44. Wendon J, Cordoba J, Dhawan A, Larsen FS, Manns M, Nevens F, et al. EASL Clinical Practical Guidelines on the management of acute (fulminant) liver failure. J Hepatol. 2017;66(5):1047–81.

45. Madkour AM, ELMaraghy AA, Elsayed MM. Prevalence and outcome of sepsis in

respiratory intensive care unit. Egypt J Bronchol. 2022 Dec;16(1).

46. Silva MMM, de Oliveira-Figueiredo DST, Cavalcanti A da C. Prevalence and factors associated with sepsis and septic shock in oncological patients in intensive therapy. Rev Bras Enferm. 2022;75(1).

47. Mulatu HA, Bayisa T, Worku Y, Lazarus JJ, Woldeyes E, Bacha D, et al. Prevalence and outcome of sepsis and septic shock in intensive care units in Addis Ababa, Ethiopia: A prospective observational study. African J Emerg Med. 2021 Mar 1;11(1):188–95.

48. Evans L, Rhodes A, Alhazzani W, Antonelli M, Coopersmith CM, French C, et al. Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock 2021. Crit Care Med. 2021 Nov 1;49(11):E1063–143.

49. Farhanah N, Supriadi S, Wahjono H, Hadisaputro S, Gasem MH. Predictors of Mortality in Sepsis Patients Resulting from Severe and Critical COVID-19. J Med Chem Sci. 2023;6(9):2018–27.

50. Ahmed F, Abbasi L, Herekar F, Jiwani A, Patel MJ. Knowledge and perception of Sepsis among Doctors in Karachi Pakistan. Pakistan J Med Sci. 2022;38:380–6.

APPENDICES

Appendix 1. Consent form

My name is Dr. Atala Abdallah. I am a Master of Medicine in Anaesthesiology candidate in my second year at Muhimbili University of Health and Allied Sciences. I am conducting research with a title: Prevalence of Sepsis, Outcome, and Associated Factors Among Adults Admitted to the Intensive Care Unit at Muhimbili National Hospital.

What does participation entail?

If you agree to participate, you will be required to complete a questionnaire and sign a consent form.

Confidentiality

Your personal information will be kept strictly confidential. There will be no mention of your name on the questionnaire or report. Discretion must be preserved.

Risk to participant

There is no anticipated risk or harm associated with participation.

Freedom to withdraw

This research can be terminated at any time, and participation is entirely voluntary.

Benefit

The information will assist in determining the level of knowledge, attitude, and practice of healthcare professionals regarding the management of sepsis and will aid in the implementation of training and education programs to improve patient outcomes.

If you have any questions or concerns regarding this study, please contact:

Principal Investigator
Dr. Atala Abdallah

Phone no +255 714 548 854
+255 629 539 556
E-mail: atala.jongo@gmail.com

Supervisor

Dr. Edwin Lugazia

Phone: +255 754 283 900

+255 713 283 900

E-mail: elugazia@gmail.com

OR

Director of Research, innovations and Publication

Dr. Nahya Salim

Tel. no 2150302-6.

SIGNING CONSENT.

I (initials).....have read and fully comprehended the information on this form and a satisfactory explanation has been provided that addresses all of my concerns. I consent to participate in this study.

Signature of participant.....

Kibali Swahili version
Utangulizi

Mimi ni Dk. Atala Abdallah, mwanafunzi wa Uzamili wa afya katika idara ya Anesthesiology katika Chuo Kikuu cha Afya na Sayansi ya Muhimbili. Ninafanya utafiti na unaohusu: Uwepo wa maambukizi ya damu (sepsis), matokeo na sababu zake zinazohusiana kati ya wagonjwa watu wazima waliolazwa katika chumba cha wagonjwa mahututi katika hospitali ya taifa ya Muhimbili.

Ushiriki gani utakuhusu

Ikiwa utaridhia kuhusika katika utafiti huu, utahitajika kukamilisha dodoso lililotayarishwa kwa utafiti huo na utahitajika kusaini fomu ya idhini.

Usiri

Habari yote iliyokusanywa kutoka kwako itahifadhiwa siri. Jina lako halitaandikwa kwa sehemu yoyote ya dodoso au ripoti. Usiri utazingatiwa.

Madhara kwa mshiriki

Hakuna hatari inayotarajiwa au madhara yanaweza kutokea kwa ushiriki.

Haki ya kujiondoa

Unaweza kuacha wakati wowote katika utafiti huu na ushiriki ni kwa hiari.

Faida

Habari hiyo itasaidia kuamua kiwango cha wafanyikazi wa afya ya maarifa, mtazamo wao na mazoezi ya usimamizi wa maambukizi yadamu (sepsis) na itasaidia kuchukua hatua juu ya mafunzo na ufundishaji ili kuboresha matokeo kwa wagonjwa.

Kwa maswali yoyote tafadhali wasiliana:

Mkuu wa utafiti

Dkt. Atala Abdallah
Simu namba +255 714 548 854
+255 629 539 556
Barua pepe: atala.jongo@gmail.com

Msimamizi wa utafiti

Dkt. Edwin Lugazia

Simu namba: +255 754 283 900

+255 713 283 900

Barua pepe: elugazia@gmail.com

AU

Mkurugenzi wa utafiti, ubunifu na uchapishaji

Dkt. Nahya salim

Simu; 2150302-6.

Kukubali kushiriki.

Mimi…… (herufi za kwanza), nimesoma na kuyaelewa yalioandikwa kwenye fomu hii na ninakubali kushiriki kwenye utafiti .

Saini ya mshiriki…….

ATALA ABDALLAH
P. O. Box 65001,
Dar- es- salaam.
20th February 2023.

Executive Director,
Muhimbili National Hospital,
P.O.BOX 65001,
Dar-es-salaam.

Dear Sir,

RE: REQUEST FOR WAIVER OF CONSENT FOR CRITICALLY ILL PATIENTS WHO WILL BE UNABLE TO CONSENT

The heading above is concerned.
I am Atala Abdallah, a second-year postgraduate student pursuing a Masters of Medicine in Anaesthesiology with registration number HD/MUH/T.04/2021. I am expecting to conduct a study titled PREVALENCE OF SEPSIS, OUTCOME AND ASSOCIATED FACTORS IN ADULT PATIENTS ADMITTED TO THE INTENSIVE CARE UNIT AT MUHIMBILI NATIONAL HOSPITAL. I am requesting permission to waive the consent form and to be able to include critically ill patients who will not be able to consent by obtaining patient information from the files. Data obtained from the study will be used for research purposes only and confidentiality will be observed.

I am looking forward to your kind consideration.

ATALA ABDALLAH

……

Appendix 2 . A questionnaire for assessment of patient factors and outcome
Patient serial number…….

Date of admission……..

Admission from ward …… Emergency……. In ICU…….

1. Medical ☐ 2. Surgical ☐

Gender

Male ☐

Female ☐

Age

1. 18-25 years ☐
2. 26-30 years ☐
3. 31-40 years ☐
4. 41-50 years ☐
5. >50 years ☐

SOFA score at the time of admission /during the first 24 hours of ICU admission(circle)

Variables/score	0	1	2	3	4
P_aO_2/FiO_2 (mmHg)	>400	≤400	≤300	≤200	≤100
Platelets ($\times 10^3$/uL)	>150	≤150	≤100	≤50	≤20
Bilirubin (mg/dL)	<1.2	1.2–1.9	2–5.9	6–11.9	>12
Cardiovascular (Hg/kg/min) –		MAP<70	Dop≤5	Dop>5 (Epi≤0.1)	Epi>0.1
Glasgow Coma Scale	15	13–14	10–12	6–9	<6
Creatinine (mg/dL)	<1.2	1.2–1.9	2–3.4	3.5–4.9	>5

MAP = mean arterial pressure; Dop = dopamine; Epi = epinephrine.
doi:10.1371/journal.pone.0031256.t002

Mechanically ventilated 1. Yes ( ) 2. No ( )

FiO2…… PaO2……

Source of infection

	YES	NO
1) Catheter related		
2) Respiratory		
3) Urinary tract		
4) Intraabdominal		
5) Genital		
6) Surgical site		
7) Multiple sites ≥ 2		

Comorbidity

	YES	NO		YES	NO
1) Hypertension			8) Hemorrhagic stroke		
2) Diabetes			9) Prostate Cancer		
3) Congestive heart failure			10) Cervical cancer		
4) Chronic kidney failure			11) lung cancer		
5) Chronic liver failure			12) leukemia		
6) HIV			13) Multiple ≥2		
7) Ischemic stroke			14) no comorbidity		
			15) Other		

Treatment and interventions provided

	YES	NO
1) Initiation of broad-spectrum antibiotics within 1 hour of recognition		
2) Blood culture		
3) Antifungal		
4) Antivirals		
5) Crystalloids		
6) norepinephrine		
7) adrenaline		
8) Mechanically ventilated		
9) Steroids		
10) Other		

Outcome

1. Dead ☐
2. Discharged ☐
3. Systemic complications ☐

	YES	**NO**
1) Acute renal injury		
2) coagulopathy		
3) liver failure		
4) Myocardial infarction		
5) Acute respiratory distress		
6) Other		

Date of death or discharge…….

Length of stay (days)……

Appendix 3. Questionnaire to assess knowledge and attitude health care workers on management of sepsis in intensive care unit

DATA COLLECTION TOOL

QUESTIONNAIRE No……

Section 1. Basic information

Gender: M [] F []

Age 21-29years ( ) 30-39years ( ) 40-49years( ) >50 years ( )

Profession: Intensivist ( ) Medical doctor ( ) nurse ( ) Others ( )

Years of work experience in ICU

<3years ( ) 3-5years ( ) 6-10years ( ) >10years

Section 2. Training and guideline

1. Have you ever received a training/continuous education on management of sepsis
a. In residency program ( )
b. Online education ( )
c. None ( )
2. Do you usually follow specific management protocol or guideline?
a. Surviving sepsis campaign guideline ( )
b. Standard treatment guideline (STG) ( )
c. No ( )

Section 3. Knowledge, attitude and practice on management of sepsis knowledge

1.Have you ever heard of the Third International Consensus on Definitions of Sepsis and Septic Shock (Sepsis-3) and qSOFA score?

□Yes □ No

2. What, in your opinion, is the best definition of sepsis?

a) Blood contamination by a germ

b) life-threatening organ failure resulting from a dysregulated host response to an infection

c) An infection-induced systemic inflammatory response

d) An allergic reaction to pathogens

3. Do you think the following symptoms and signs are associated with sepsis?

a) Fever □ Yes □ No or not sure

b) Hypothermia □ Yes □ No or not sure

c) Tachycardia □ Yes □ No or not sure

d) Tachypnea □ Yes □ No or not sure e) Hypotension □ Yes □ No or not sure

f) Altered state of consciousness □ Yes □ No or not sure

4. Which of the following is NOT a component of the qSOFA score?

a) Glasgow score <15

b) Respiratory rate ≥ 22 c / min

c) Tachycardia> 90 beats / min

d) Systolic blood pressure ≤100 mmHg

5. The blood culture must be requested in the event of any suspicion of sepsis

True □False □

6. Which patients should be monitored for the development of sepsis? (circle all that apply)

a) Patients with tuberculosis;

b) patients admitted to the emergency room with a severe infection

c) HIV-positive patients

d) all patient

e) I don’t know

7. Which of the following are urgently appropriate for the management of sepsis? (circle all that apply)

a. Secure large-bore IV access

b. If hypotension, initially resuscitate with crystalloid

c. Collect blood for blood culture and start broad-spectrum antibiotic therapy

d. Maintain good oxygen saturation

8. Do you think the following practice could be useful for the management of sepsis?

a) using of antibiotics □ Yes □ No or not sure

b) using of crystalloids □Yes □ No or not sure

c) using of vasopressors □Yes □ No or not sure

d) earlier identification of the source of infection □Yes □ No or not sure

Appendix 4. Assessment of hospital factors

RESEARCHERS INITIAL…… DATE……

SECTION 1. TRAINING

Has any of your staff received any training on the diagnosis and management of sepsis and complications of sepsis in the last 24 months?

YES ☐ NO ☐

SECTION 2. GUIDELINE

Do you have national or international guidelines for the diagnosis and management of sepsis?

YES, OBSERVED ☐ REPORTED AVAILABLE NOT SEEN ☐ NO ☐

SECTION 3. EQUIPMENT AND DIAGNOSTICS

Please tell me if the following equipment and diagnostics are available and functioning.

	AVAILABLE			FUNCTIONING		
	OBSERVED	REPORTED BUT NOT SEEN	NOT AVAILABLE	YES	NO	I DON'T KNOW
POINT OF CARE ECG						
BEDSIDE USS						
URINE DIPSTICK						

	AVAILABLE	NOT AVAILABLE
BLOOD CULTURE		
X RAY MACHINE		
BLOOD GAS ANALYSIS		
DNA/RNA PCR		

4. MEDICATIONS

Check to see any one of each medicine is valid (not expired)

	OBSERVED AVAILABLE		NOT OBSERVED		
	ATLEAST ONE IS VALID	AVAILABLE NOT VALID	REPORTED AVAILABLE, NOT SEEN	NOT AVAILABLE TODAY	NEVER AVAILABLE
NORADRENALINE					
DOBUTAMINE					
HYDROCORTISONE					
DEXAMETHASONE					
AMPICILLIN INJECTION					
CLOXACILLIN INJECTION					
CEFTRIAXONE INJECTION					
FLUCONAZOLE					
METRONIDAZOLE INJECTION					
PIPPERACILLIN INJECTION					
MEROPENEM					
VANCOMYCIN					
CLINDAMYCIN					
0.9Nacl FLUID					
RINGERS LACTATE					

Appendix 5; Approval for ethical clearance

UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

OFFICE OF THE DIRECTOR – RESEARCH, PUBLICATIONS AND INNOVATION

In reply quote;
Ref. No.DA.282/298/01.C/ Date: 14/03/2023

MUHAS-REC-03-2023-1575

Atala Abdallah,
MMed Anesthesiology,
School of Medicine
MUHAS

RE: APPROVAL FOR ETHICAL CLEARANCE FOR A STUDY TITLED: PREVALENCE OF SEPSIS, OUTCOME AND ASSOCIATED FACTORS AMONG ADULT PATIENTS ADMITTED TO THE INTESIVE CARE UNIT AT MUHIMBILI NATIONAL HOSPITAL.

Reference is made to the above heading.

I am pleased to inform you that the Chairman has on behalf of the University Senate, approved ethical clearance of the above-mentioned study, on recommendations of the Senate Research and Publications Committee meeting accordance with MUHAS research policy and Tanzania regulations governing human and animal subjects research.

APPROVAL DATE: 14/03/2023
EXPIRATION DATE OF APPROVAL: 13/03/2024

STUDY DESCRIPTION:
Purpose:
The purpose of this study is to determine the prevalence of sepsis, outcome, and associated factors among adult patients with sepsis admitted to the intensive care unit at Muhimbili National Hospital.

The approved protocol and procedures for this study is attached and stamped with this letter, and can be found in the link provided:
https://irb.muhas.ac.tz/storage/Certificates/Certificate%20-%2014511.pdf and in the MUHAS archives.

9 United Nations Road; Upanga West; P.O. Box 65001, Dar Es Salaam: Tel. G/Line: +255-22-2150302/6; Ext. 1038; Direct Line:+255-22-2152489;Telefax:+255-22-2152489;E-mail:drp@muhas.ac.tz;Web:https://www.muhas.ac.tz

The PI is required to:

1. Submit bi-annual progress reports and final report upon completion of the study.
2. Report to the IRB any unanticipated problem involving risks to subjects or others including adverse events where applicable.
3. Apply for renewal of approval of ethical clearance one (1) month prior its expiration if the study is not completed at the end of this ethical approval. You may not continue with any research activity beyond the expiration date without the approval of the IRB. Failure to receive approval for continuation before the expiration date will result in automatic termination of the approval for this study on the expiration date.
4. Obtain IRB amendment (s) approval for any changes to any aspect of this study before they can be implemented.
5. Data security is ultimately the responsibility of the investigator.
6. Apply for and obtain data transfer agreement (DTA) from NIMR if data will be transferred to a foreign country.
7. Apply for and obtain material transfer agreement (MTA) from NIMR, if research materials (samples) will be shipped to a foreign country,
8. Any researcher, who contravenes or fail to comply with these conditions, shall be guilty of an offence and shall be liable on conviction to a fine as per NIMR Act No. 23 of 1979, PART III section 10 (2)
9. The PI is required to ensure that the findings of the study are disseminated to relevant stake holders.
10. PI is required to be versed with necessary laws and regulatory policies that govern research in Tanzania. Some guidance is available on our website https://drp.muhas.ac.tz/.



Dr. Kasusu Nyamuryekung'e
Ag. Chairman, MUHAS Research and Ethics Committee

cc. Director of Postgraduate Studies,
MUHAS

9 United Nations Road; Upanga West; P.O. Box 65001, Dar Es Salaam: Tel. G/Line: +255-22-2150302/6; Ext. 1038; Direct Line:+255-22-2152489;Telefax:+255-22-2152489;E-mail:drp@muhas.ac.tz;Web:https://www.muhas.ac.tz

Appendix 6; Introduction letter

UNITED REPUBLIC OF TANZANIA
MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY
MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
OFFICE OF THE DIRECTOR – POSTGRADUATE STUDIES

In reply quote;
Ref. No. HD/MUH/T.04/2020

16th March, 2023

The Executive Director,
Muhimbili National Hospital,
P.O. Box 65000,
DAR ES SALAAM

RE: INTRODUCTION LETTER OF ATALA ABDALLAH

We would like to inform you that the bearer of this letter is Atala Abdallah with Reg. No. HD/MUH/T.04/2021 is a student at School of Diagnostic Medicine in the Muhimbili University of Health and Allied Sciences (MUHAS) " pursuing MMed Anaethesiology.

As part of her studies, she will be diong an elective research titled: "***Prevalence of Sepsis, Outcome and Associated Factors Among Adult Patients Admitted to the Intesive Care Unit at Muhimbili National Hospital.***" She is being supervised by **Dr. Edwin Lugazi from MUHAS** Department of Anaethesiology and **Dr. Raymond Oyugi** from Department of Anaethesiology MNH

The Ethical Clearance for doing the said research has been given by the university.

Kindly request your necessary assistance and coorperation to our student.

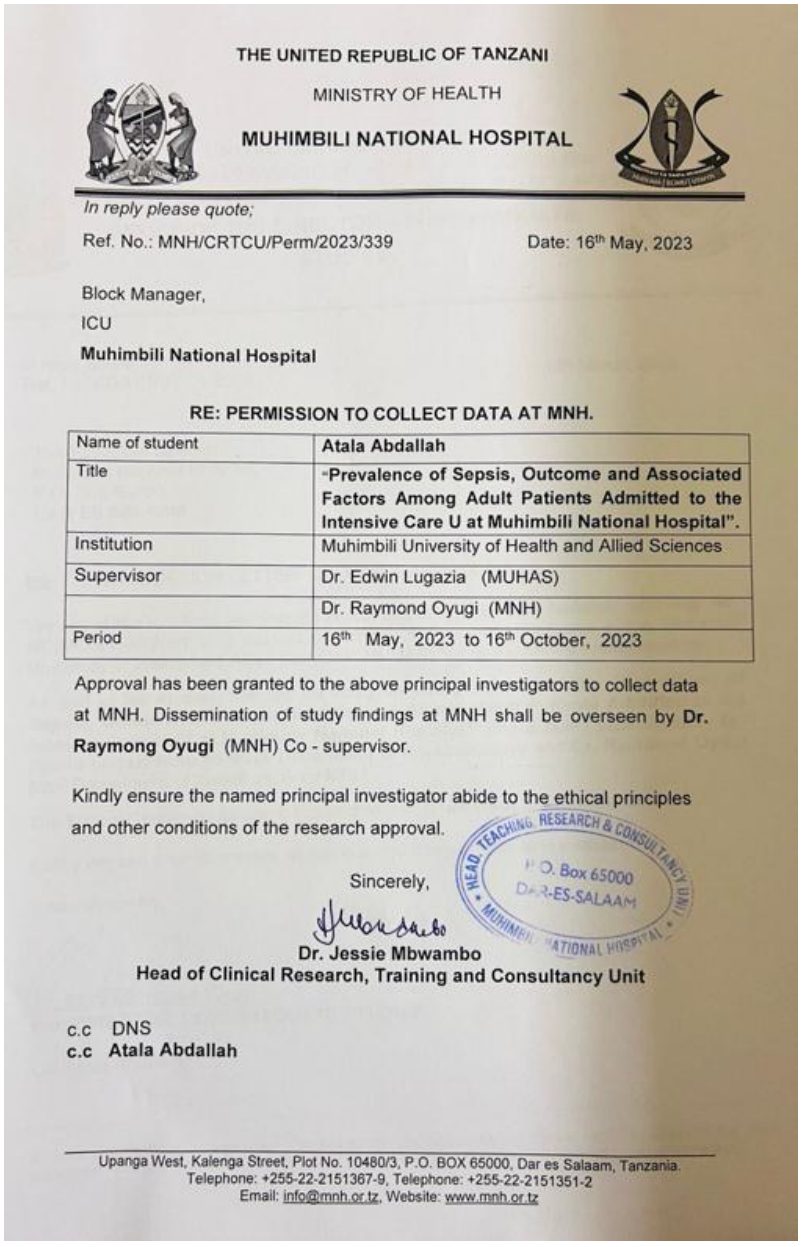
Yours Sincerely.

Mr. Sebe Mohamed Yusuf
For: DIRECTOR, POSTGRADUATE STUDIES

Cc: Atala Abdallah

9 United Nations Road; Upanga West; P.O. Box 65001, Dar Es Salaam: Tel. G/Line: +255-22-2150302/6; Ext. 1015; Direct Line:+255-22-2151378;Telefax:+255-22-2150465;E-mail:dpgs@muhas.ac.tz;Web:https://www.muhas.ac.tz

Appendix 7; Letter of permission for data collection



THE UNITED REPUBLIC OF TANZANI

MINISTRY OF HEALTH

MUHIMBILI NATIONAL HOSPITAL

In reply please quote;

Ref. No.: MNH/CRTCU/Perm/2023/339 Date: 16th May, 2023

Block Manager,
ICU
Muhimbili National Hospital

RE: PERMISSION TO COLLECT DATA AT MNH.

Name of student	**Atala Abdallah**
Title	**"Prevalence of Sepsis, Outcome and Associated Factors Among Adult Patients Admitted to the Intensive Care U at Muhimbili National Hospital".**
Institution	Muhimbili University of Health and Allied Sciences
Supervisor	Dr. Edwin Lugazia (MUHAS)
	Dr. Raymond Oyugi (MNH)
Period	16th May, 2023 to 16th October, 2023

Approval has been granted to the above principal investigators to collect data at MNH. Dissemination of study findings at MNH shall be overseen by **Dr. Raymong Oyugi** (MNH) Co - supervisor.

Kindly ensure the named principal investigator abide to the ethical principles and other conditions of the research approval.

Sincerely,

Dr. Jessie Mbwambo
Head of Clinical Research, Training and Consultancy Unit

c.c DNS
c.c Atala Abdallah

Upanga West, Kalenga Street, Plot No. 10480/3, P.O. BOX 65000, Dar es Salaam, Tanzania.
Telephone: +255-22-2151367-9, Telephone: +255-22-2151351-2
Email: info@mnh.or.tz, Website: www.mnh.or.tz