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The Incidence and Risk Factors of Nosocomial Infections in Intensive Care Unit at Jenin Governmental Hospital

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Dedication

I dedicated this thesis to my dear homeland of Palestine, and to the great martyrs and prisoners who represent the symbol of sacrifice.

My great parents, who have always loved me and taught me to work hard for the things that I aspire to achieve. To all my family, and my friends who encourage and support me and all the people in my life who touch my heart, and to every CRNA nurse and everyone who has taught me, I dedicate this research.

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الاقرار

أنا الموقعة أدناه، مقدّمة الرسالة التي تحمل العنوان:

The Incidence and Risk Factors of Nosocomial Infections in Intensive Care Unit at Jenin Governmental Hospital

أقر بأن ما اشتملت عليه هذه الأطروحة إنما هو نتاج جهدي الخاص، باستثناء ما تمت الاشارة إليه حيثما ورد. وأن هذه الرسالة كاملة، أو اي جزء منها لم يقدم من قبل لنيل اي درجة او لقب علمي او بحثي لدى أي مؤسسة تعليمية أو بحثية أخرى.

Declaration

The work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification.

Student's Name: **اسم الطالبة:**

Signature: **التوقيع:**

Date: **التاريخ:**

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List of Abbreviations

NIs	Nosocomial Infections
ICU	Intensive Care Unit
WHO	World Health Organization
RTI	Respiratory Tract Infection
PN	Pneumonia
MV	Mechanical Ventilator
ETT	Endo-Tracheal Tube
VAP	Ventilator Associated Pneumonia
IAP	Intubation Associated Pneumonia
CVC	Central Venous Catheter
BSI	Bloodstream Infection
CLA-BSI	Central Line-Associated Bloodstream Infection
SSI	Surgical Site Infection
DM	Diabetes Mellitus
MDRO	Multidrug Resistance Organism
KPC	Klebsiella Pneumoniae Carbapenemase
E.Coli	Escherichia Coli
ESBL	Extended Spectrum Beta- Lactamase
MRSA	Methicillin Resistant Staphylococcus Aureus
CRE	Carbapenem Resistant Enterobacteriaceae
CDC	Center for Disease Control
UTI	Urinary Tract Infection
CAUTI	catheter associated urinary tract infection
NGT	Nasogastric Tube
TPN	Total Parenteral Nutrition
PPI	Proton Pump Inhibitor
SD	Standard Deviation
ECDC	European Centre for Disease Prevention and Control
LOS	Length of stay
CI	Confidence Interval 95%
P	Significance level
APACHE	Acute physiology And Chronic Health Evaluation
Me	Median
SPSS	Statistical package for the social science
IRB	Institutional review board

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Abstract

Introduction- Infections acquired when a patient is undergoing treatment at a healthcare facility are known as nosocomial infections. It's a global health problem with rising rates of incidence and high mortality rates associated with the infection and its complications.

Objectives- To determine the incidence of nosocomial infection, identify possible risk factors for these infections, clarify the distribution of the causative pathogens and to evaluate the outcome of the infected patients in terms of length of ICU stay and mortality.

Methodology-Prospective, observational study conducted from Agu 2020-Dec 2020 in ICU of Jenin Governmental Hospital. 80 patients staying for more than 48 hours in the ICU were included in the study. Epidemiologic characteristics of the patients, cultures, identification of isolates and antibiotic susceptibility tests were made based on standard microbiologic methods, invasive procedures and other risk factors, and outcome of the infected patients in terms of length of ICU stay and mortality were also noted.

Result- The incidence of nosocomial infection in our study was 54.7% of 44(55%) Infected Patients who have developed NIs, and 36(45%) Non-Infected Patients.

Regarding Infectious disease type diagnosed in our ICU were 42.2% of patients in the sample had the type Urinary Tract Infection especially (CAUTI), 38.6% had the type Respiratory Tract Infection especially (IAP), 20.5% had the type Blood Stream Infection that was 13.6% CLBSI and 6.8% had the type (Septicemia), 15.9% had the type Surgical Site Infection (SSI) and only one patient had other infection. Gram negative bacteria were the commonest pathogens isolated, especially Klebsiella pneumonia was43.2% the highest causative agent of the diagnosed infectious disease. Diabetes mellitus, Endotracheal tube use, Nasogastric tube, and Tracheostomy, were determined as independent risk factors for developing NI. Additionally APACHE II score and length of ICU stay (were found to be high in the NI group. Mortality percentage of patients who developed NI were 50% higher than that in Non-infected group were 25%.

Conclusion- Infection control steps should be considered to reduce these numbers due to the high incidence of NIs and widespread resistance among isolates species in the sample. Antibiotics must be used wisely in order to reduce antibiotic resistance in bacterial pathogens. Hospitalized patients' morbidity was increased by nosocomial infections. In our sitting , these results can be used to prepare a nosocomial infection surveillance program.

Keywords: Nosocomial infections, incidence, mortality.

Chapter One
Introduction

1.1 Overview

Nosocomial infections (NIs) are those infections acquire while patients receiving health care (Rao, et al 2020). Infections acquired in the hospital (nosocomial infections) are those that are not present or incubating at the time of admission. (Durgad, et al 2015).

Nosocomial infection (NI), also known as "hospital-acquired or health-care-associated infection," is a major public health problem that affects hundreds of millions of people each year around the world. (Wang, et al 2019)

Infections are a common complication in critically ill patients, with high morbidity and mortality rates. (Dasgupta, et al 2015).

The clinical performance of patients admitted to critical care units is heavily influenced by health-care-associated infection. (Datta, et al 2014)

Infections acquired in hospitals are known as nosocomial infections, and they are a major public health issue for both patients and health-care providers worldwide. The ICU setting, medical techniques used to treat the patient, and the patient's overall health can all help to promote the production of NIs. Intensive care units (ICUs) care for critically ill patients whose underlying illness and coexisting illnesses can contribute to the spread of healthcare-associated infections. (Rao, et al 2020).

According to a systematic review and meta-analysis conducted by the World Health Organization (WHO), the NI rate in adult ICUs in developing countries was 47.9 per 1000 patient-days (95 percent CI36. 7–59.1), which is at least three times higher than the rate registered in the United States. (Agaba,et al 2017)

The risk of contracting an infection is determined by the predisposing factors present during ICU stay, which include surgery, interaction with other patients and hospital staff, and the hospital climate. (Shao, et al2016).

While several critically ill patients ultimately become colonized with resistant bacterial strains, most nosocomial infections are caused by endogenous bacterial flora. Up to 35–40 percent of nosocomial infections occur in the urinary tract, which are typically caused by Gram-negative bacteria and are related to the use of indwelling catheters . Nosocomial pneumonias, which account for another 20–25 percent of NIs and are typically caused by Gram-negative species, account for more than 90% of pneumonias acquired when patients are mechanically ventilated (Agaba, et al2017). They are the leading cause of death in many ICUs and the second most common of NIs. (Durgad, et al 2015).

A big global healthcare crisis brought about by severe bacterial infections resistant to widely used antibiotics. (Soltani, et al 2016). One of the most contentious issues in the ICU is the administration of antibiotics and their extended use. Many efforts have been made to ensure proper antibiotic

stewardship in order to maximize antibiotic utilization while minimizing side effects. (Sula , et al 2019).

1.2 Problem Statement

Patients in the intensive care unit are often exposed to infection, many of which are caused by antimicrobial-resistant pathogens. These infections have a direct impact on patient treatment, prolong hospitalization time, and raise hospitalization costs, both of which may significantly increase the social-economic burden and have detrimental effects on patient prognosis.

Since the number of patients colonized or infected with multidrug resistant organisms (MDRO) when they arrive in ICUs is increasing, infection control measures and infection prevention recommendations are becoming increasingly relevant in everyday practice. (Durgad,et al 2015).

1.3 Significance of the Study

Data on infection occurrence, risk factors, causative microorganisms, and outcomes are needed to raise and sustain awareness of the effects of infection, as well as to aid in the creation of local and international recommendations for infection diagnosis and treatment, to reduce the cost of treatment as a result of a prolonged stay in the intensive care unit, to enable adequate and sufficient resource distribution, and to assist in the design of multicenter interventional studies.

This is the first study of its kind in the Jenin Governmental Hospital, and it focuses on surveillance. There are no published data on the incidence of nosocomial infections in our region. This information is needed to understand current epidemiology and to improve infection management in adult intensive care units.

We must prevent nosocomial infection by following guidelines that recognise sources of infection and implementing antibacterial measures such as floor in, isolation wards, and hand washing stations outside each bed in the ICU, because ICU-acquired infection has been shown to be an independent risk factor for hospital mortality.. Furthermore, based on the resources available, our hospital developed its own infection control guidelines. Daily updates to the guidelines should be made. Staff education on infection control techniques, as well as surveillance and continuous monitoring, are required.

1.4 Aims of the Study

The aims of the present study are to

1. Determine the incidence of nosocomial infections
2. Identify if the patients demographic data as age and gender , patients origin and APACHE II score had effect on the incidence of NI
3. Know the effect of prior use of antibiotics on developed NI
4. Identify possible risk factors for these infections

5. Clarify the distribution of the causative pathogens

6. Evaluate the outcome of the infected patients in terms of length of ICU stay, and mortality.

1.5 Research Hypotheses

1. There is a significant difference at a level of 0.05 related to the development of NIs and patients demographic data (age and gender).

2. There is a significant difference at a level of 0.05 related to development of NIs and patient origin before admission to ICU in hospital.

3. There is a significant difference at a level of 0.05 related to development of NIs and APPCHE II score.

4. There is a significant difference at a level of 0.05 related to prior antibiotics use and development of NIs.

5. There is a significant difference at a level of 0.05 related to possible risk factors such as DM ,nasogastric tube use , endo-tracheal tube use, and tracheostomy and development of NIs.

6. There is a significant difference at a level of 0.05 related to the outcome of the patients in terms of length of ICU stay, and mortality and development of NIs.

1.6 Definitions

A nosocomial infection is one that is not in its incubation phase when a patient is admitted to the hospital.

(NI) that an infection occurs after 48 hours in the hospital, 3 days after discharge, or 30 days after an operation. (Yesilbag, et al 2015).

The intensive care unit (ICU) is a hospital specialist unit that offers extensive and continuing care for critically ill patients who may benefit from treatment. (Durgad, et al 2015).

(ICU) is an area characterized by accepting chronically ill patients and delivering highly invasive treatment sufficient to satisfy the critical requirements of the disease process as well as the client's own critical condition., As a result, patients are more likely to contract infections, which may lead to a variety of issues on the patient's side as well as a lengthening of their stay in the hospital, a pause in their recovery, and a deterioration of their current clinical condition. The hospital units with the highest health-care-related infection rates are considered. As a result, the critical care unit is a high-priority area for infection prevention and control. (Hespanhol, et al 2019).

Pneumonia (PN) is characterized as an infection of the lung parenchyma caused by one or more pathogens (Mackenzie, 2016).

(Pneumonia) for patients with underlying cardiac or pulmonary disease, pneumonia is characterized as two or more serial chest X-rays or CT-scans with a suggestive picture of pneumonia. One definitive chest X-ray or CT-scan is appropriate in patients without underlying cardiac or pulmonary disease. At least one of the following is required: Without any other reason, you have a fever of more than 38 degrees Celsius. (4000 WBC/mm3 or) leukopenia (12000 WBC/mm3) leukocytosis, as well as one or more of the following: new onset of purulent sputum, or shift in sputum character (color, odour, quantity, consistency), cough, dyspnea, or tachypnea indicative of auscultation (rales or bronchial breath sounds), rhonchi, wheezing, deteriorating gas exchange, and according to the diagnostic method used. If an intrusive respiratory system was present (even intermittently) in the 48 hours prior to the onset of infection, pneumonia is known as intubation-associated pneumonia (IAP) or ventilator-associated pneumonia (VAP).

According to the Centers for Disease Control and Prevention (CDC), nosocomial bloodstream infection (BSI) in the ICU is described as blood cultures obtained more than 72 hours after admission to the ICU in the presence of clinical evidence of infection for a bacterium or fungus. (Prowle, 2011).

(Bloodstream infection) An infectious pathogen reaches the bloodstream by direct invasion of blood vessels, lymphatic vessels draining an infection focus (ie, abscess), or vascular devices such as catheter needles. It may also

happen without a specific mechanism, such as in some cases of complicated community-acquired Staphylococcus. aureus bacteremia. A patient has at least one positive blood culture for a recognized pathogen, or has at least one of the signs or symptoms mentioned below: Two positive blood cultures for a popular skin contaminant and a fever (>38°C), chills, or hypotension. (within 48 hours, from two different blood samples) (Kohpa, et al 2018).

CRIs (Catheter Related Infections) or CLABSI (Central Line Associated Blood Stream Infection) is characterized as a primary BSI in a patient with central lines (CLs) within the 48-hour span prior to the BSI onset, and the BSI is not related to any infection at other foci. (Chen, et al 2015). .

An infection of the urinary tract (kidneys, ureters, bladder, and urethra) is known as a urinary tract infection (UTI). The bladder and urethra are the most often infected areas of the urinary tract.

(UTI) A microbiologically confirmed symptomatic urinary tract infection in which the patient has at least one of the following symptoms with no other known cause: fever (>38°C), urgency, frequency, dysuria, or suprapubic tenderness, and a positive urine culture, i.e, >105/mL microorganisms per mL of urine with no more than two species of microorganisms. Hospital acquired (HAUTI) is consider when patients had a positive urine_culture more than two days after admission.

An indwelling urinary catheter must have been in operation for seven days before positive laboratory findings or signs and symptoms matching the requirements for UTI is evident in Catheter-Associated Urinary Tract Infection (CAUTI). (Kohpa, et al 2018)

APACHE II ("Acute Physiology And Chronic Health Evaluation II") is one of the ICU rating systems for determining the seriousness of a disease. It is used within 24 hours of a patient's admission to an intensive care unit (ICU) to determine an integer score from 0 to 71 based on various measurements; higher scores signify more serious illness and a higher risk of death.

(APACHE II) This score will be computed for all adult patients admitted to the intensive care unit for the first time. Although it isn't needed and won't help with patient management, it is a useful tool for risk stratification and comparing the treatment given to patients with similar risk profiles in different units. (Knaus et al., 1985)

Chapter Two
Background

The critical care unit is a hospital ward that provides comprehensive care for patients who are critically ill and need immediate attention. (Durgad, et al 2015).Modern intensive care units need invasive monitoring and different organ replacement treatment, which may tumble down normal of the defense mechanisms of the clients by entering the skin or by inhibiting normal ciliary action and tussive reflex in the RTS.(So the patients treated in ICU have the high susceptible rates of NI because of the effects of their underlying diseases that are as impairing effects and treatments on the immune system as well as the consequences of surgery that are not sudden in view of the fact that the patients in the intensive care are the morbid in the hospital. (Ylipalosaari, 2007).

Nosocomial infection are common adverse events in hospital and they are more severe in high technology units treat critically ill patients needing critical life support (Rejeb, et al 2016). ICUs have a higher rate of nosocomial infections than other parts of the hospital. NIs are five to ten times more likely to infect patients in intensive care than other hospital infections. (Inanc, et al 2018).

In the ICU clients are extremely exposed to infection, many of them attributed to antibiotics -resistant organisms (Daud-Gallotti, et al 2012). Also NIs are known to vary in different units in the same hospital setting in

terms of etiology, resistance pattern of organisms and risk factors.(Iwuafor, et al 2016).

Mortality rate at intensive care varies between 9 and 38% of which 60% could be related to healthcare associated infection (Rejeb, et al 2016).

In the hospitals especially in ICU, NI is a leading cause of rising rates of morbidity and mortality as high as 50%, in addition to prolonged stay in ICU and financial burden .In common the incidence of nosocomial infection as reported by many studies were from 3.6 to 12% in high-income countries, and ranged from 5.7 to 19.1% in low and middle-income countries. In a recent multicenter study in Europe, it was discovered that the proportion of clients with infection in a critical unit can be as high as51%; the majority of these are NI. (Iwusfor, et al 2016).

According to many studies, invasive procedures, use of invasive devices during care (Naidu, et al 2014), unnecessary antibiotic use, long hospital stay, and the presence of serious illness are all predisposing factors that contribute to an increased incidence of NI among ICU patients. (Wang, et al 2019).

Device associated healthcare acquired infection the most common in ICU were endotracheal tube and tracheostomy with MV rises the risk of hospital acquired pneumonia (IAP) through 6 to 21 times. 97% of all nosocomial BSI by Central venous catheterization. The risk factor for

acquisition of hospital infection as UTI is urinary indwelling catheter Other established risk factors include comorbidities. (Iwusfor, et al 2016)

There are two pathophysiologic factors that must exist for a nosocomial infection to develop: Inhibition of host defenses and invasion by bacteria or other pathogenic or non-pathogenic species. (Agaba, et al 2017)

The most common pathogens responsible for acquiring NIs are bacteria especially the gram negative bacteria.(Rao, et al 2020)The result of the common use of antimicrobial drugs in intensive care environment selection a pressure towards more multidrug resistance organism (MDRO) causing difficult-to-treat infections. (Ylipalosaari, 2007)

There is a close relationship between resistance of antibiotics and development of NIs. It is estimated that the NIs rate are about 15% and associated rate of mortality are about 5% , 30% of these result from infections caused by gram negative pathogen , they are one of the important causes of increase rate of death in developing countries. (Soltani., et al 2016). As a result, the use of empirical antibiotics is considered to have adverse effects, such as serious pathogenic infection. So, to facilitate the appropriate empirical antimicrobial therapy it is necessary for each hospital to possess local and update laboratory data in order to estimate the likely infecting organisms and the sensitivity profiles. (Agaba, et al 2017)

2.1 Manifestations of NIs

The most common manifestations of NIs at ICU are: pneumonia mainly VAP, UTIs mainly catheter related urinary tract infection (CAUTI), followed by systemic infections especially CLABSI . (Agaba, et al2017).

2.2 Most common pathogens of nosocomial infection

The most common organisms are:

- Gram negative bacteria(such as KPC) the most causative pathogen.
- Then gram positive bacteria such as(Staphylococcus aureus).
- Then fungi (Candida species)and viruses (Mihaly, et al 2016).

There are many sources related to infection that found as:

1. Endogenous infection is when an organism infects itself. Infection can be acquired endogenously from bacteria present on the skin, in the nose, mouth, and throat, in the gastrointestinal tract, and in the female genital tract. These species enter the client's tissues whenever general or local resistance is reduced. In susceptible patients, such opportunistic infections are difficult to prevent and monitor. Prolonged ICU stays and the use of antimicrobial drugs, on the other hand, change the natural flora, both in terms of pathogen types and antibiotic sensitivity. According to studies, hospitalized patients have a higher rate of Pseudornonas aeruginosa faecal carriage than the general population, and intestinal carriage of multiply resistant Gram-negative bacteria is often the product of self-infection and cross infection.(Rao, et al 2020)

2. Cross-infection and infection from the environment are examples of exogenous or cross-infection.

Exogenous or environmental infection on staphylococcal carriage in hospitals has shown that some patients shed large numbers of organisms from their body surface, especially the perineum, and are referred to as 'dispersers.' These patients can also contaminate their hands, clothes, and other inanimate items. Human activity induces contamination of the atmosphere. As a result of contamination from human organic waste, pus, blood, and blood products, food, fluids, disinfectants, instruments, supplies, and wound dressing all serve as sources of infection.

In certain cases, free-living bacteria and saprophytic fungi extracted from the environment will infect vulnerable clients.. (Rao, et al 2020)

2.3 Etiology of NIs

Immune dysregulation, unavoidable invasive procedures, poor nutritional status and statuses, and severe underlying diseases have all been linked to NIs. Previous research had also shown that reduced host defenses and colonization by potentially pathogenic bacteria were two major pathophysiological factors for the production of NIs in ICUs. (Sula , et al 2019).

2.4 Risk factors of NIs

More studies have suggested that the use of invasive equipment , such as endotracheal tubing, venous catheters, and urinary catheters, is a significant

risk factor for the development of NIs in ICU patients. Although invasive procedures such as mechanical ventilation, CVC, total parenteral nutrition, indwelling urinary catheters, hemodialysis, and surgical intervention used in intensive care units are essential for patients' survival, they are also risk factors for the development of nosocomial infections because they can serve as an entry point for pathogenic microorganisms. (Yesilbag, et al 2015).

The main therapeutic points of the nosocomial infections are: appropriate prevention, quick detection, and effective therapy. (Iwuafor, et al 2016).

There is paucity of local data on intensive care acquired infections in our setting, thus there is an over dependence on information from other regions which don't frequently reflect the local realities (Iwuafor, et al 2016).

Because of an increase in the number of immune-compromised patients, increased antimicrobial resistance in pathogenic bacteria, increased rates of viral and fungal super infections, and an increase in the number of invasive procedures and invasive devices, NIs have recently become even more troublesome in the ICU. (Durgad, et al 2015). NI are more frequent among patients who are exposed to invasive healthcare procedures (Cheik, et al 2017).

Chapter Three
Literature review

Introduction

This chapter presents the studies that discuss the incidence of NIs among critical ill patients. Review of the international studies and relevant documents with the support of electronic search on the studies related to NIs

The literature review offers a basis for determining the study's significance. Several international research on nosocomial infection in intensive care units (ICUs) have been performed, some of which were prospective studies. Another research looked back at the rate of NIs risk factors, as well as the most common site of these infections and their outcomes..

A longitudinal research aimed to assess the NI incidence in an Intensive Care Unit, its correlation with clinical features, and occurrence sites found 383 NIs (20.3%). UTIs (37.6%), PNs (25.6%), sepsis (15.1%), SSIs (14.1%), and other infections were among the infections (7.7 percent). Patients with NI spent an average of 19.3 days in the hospital, while those with resistant microorganism colonization spent an average of 20.2 days. The mortality rate among patients with NI was 39.5 percent, suggesting a correlation between higher mortality rates and NI diagnosis.. The prevalence of NI was significantly correlated with the LOS of more than four days, the episode of community-acquired infection, the invasion by resistant pathogens, and the use of invasive devices..(Oliveria, et.al 2010)

a 1-year prospective evaluated the surveillance of NI was conducted in ICU by assessment of the etiology and risk factors of NIs, by Oznur Ak et al. The incidence rate of NI was 21.6 per 1000 patient days, and the rate of NI was 25.6 percent. The BSI most common site of ICU infection was 36.3 percent bacteremia, 30.4 percent VAP, 18.5 percent CAUTI, 7.4 percent CLABSI, 5.9% cutaneous infection, and 1.3 percent meningitis, according to this report. Gram-negative bacteria were found to be the most common cause of ICU infection in this study. 68.8% of the isolates were Gram-negative, 27.6% were Gram-positive, and 3.6 percent were fungi. The duration of ICU stay, CVC, MV, and tracheostomy were all established as statistically important ($p<0.05$)risk factors for developing NI. (AK, et al 2011).

In a retrospective study HAIs in the ICU were evaluated in terms of site of infection, distribution of causative species and their antibiotic susceptibility pattern, and risk factors for infection . NIs were found in 52 (65 percent) of the patients, with the most common NI being PN in the ICU, followed by BSI and UTIs. Gram-negative bacilli such as KPC, Pseudomonas aeruginosa, Acinetobacter spp., and E.Coli were the most common causative species isolated in patients with NIs. CVC, urinary indwelling catheter, NGT, drainage catheter, MV, enteral nutrition, TPN, hemodialysis, H2 receptor antagonist/proton pomp inhibitor (PPI) exposure during hospitalization, prolonged hospitalization for more than 10 days, and antibiotic exposure in the previous three months were all identified as

major risk factors for developing NIs in this research. (Yesilbag, et al 2015).

A study showed that NIs in critically ill pts are associated with hypoxemia, longer time of use of endo- tracheal tubes, chronic alcohol abuse, thrombocytopenia, hyponatremia and a bad outcome. Furthermore, the site of infection was the most common is PN followed by UTIs, cannula sepsis and SSI (Mihaly, et al 2016).

Another research looked at the role of nursing workload as a risk factor for NI in the long run. Patients were followed up on until they developed NI, were discharged, or died. Excessive workload was the most critical independent risk factor significantly associated with acquiring an NI among patients when evaluated alongside other invasive devices except MV. In NI patients, the average Nursing Activities Score (NAS) and the average proportion of noncompliance with nurses' patient care plans (NPC) were both significantly higher. (Daud-Gallotti, et al 2012).

Usage of antimicrobial drugs one month before ICU admission, surgery one month before ICU admission, urinary catheterization, ETT use, and patients site before ICU admission were all found to be statistically significant factors in NIs in the ICU. ICU-acquired infections did not appear to be affected by the severity of the illness or the length of time spent in the ICU. In this research, BSIs were the most frequently reported infections in the ICU (49.0 percent). In this analysis, 45 episodes of ICU infections were linked to 20 different pathogen species. Staphylococcus.

aureus was the most common cause of BSIs, accounting for 18.2 percent of cases., (Iwuafor, et al 2016).

In prospective observational study by Sugata, In 11.98 percent of the patients, NIs were discovered. The most prevalent infection was nosocomial PN, which accounted for 62.07 percent of all infections (both VAP and non-VAP). The length of stay in the ICU, previous antibiotic use, and the use of a urethral catheter were all found to be significant risk factors for the acquisition of NIs. Gram-negative bacteria The most commonly isolated species were Enterobacteriaceae, with Psedomonus aeruginosa being the most common causative pathogen. NIs in the ICU resulted in a statistically significant increase in ICU and hospital LOS, but no statistically significant increase in ICU or hospital mortality. (Dasgupta, et al 2015).

In another study, the prevalence of NI was 7.57%. The majority of infections were lower RTI, UTI and BSI (43.1%, 26.5%, and 20.6%) respectively. S. aureus (20.9 percent), KPC (16.4 percent), and Pseudomonas aeruginosa (10.7 percent) were the most commonly isolated species. The DA-HAI was found to be responsible for the majority of acquired infections (85.3%) in the respiratory care unit, with 28 (CAUTI), 12 (CABSI), and 47 (VAP) infections. The mortality rate in patients with NI was 2.32 times higher than in patients without NI. Stays of more than 10 days, immunosuppressive treatment, and MV use were all independent risk

factors for NI in their respiratory intensive care unit (RICU). (Wang, et al 2019).

According to a report, the incidence of NIs was 28 percent in an ICU in a Provincial Hospital in Southern Poland. The most common form of NI was PN, which had a 10% incidence rate, followed by BSIs, which had a 9% incidence rate, UTIs, which had a 3% incidence rate, and other forms of HAIs in the ICU in this report (6 percent). Clinical strains of Acinetobacter baumannii were most frequently isolated organisms from NI patients'. (Kolpa, et al 2016).

Incidence of patients with NIs was up to 32.48%, which was significantly high by Le-Wen Shao et al in this study, the rate of ventilator-related RTIs was up to 46.24%, BSIs was up to 7.07%, and the catheter-associated UTIs was 4.09%. Finally they observed that a variety of risk factors may be associated with the occurrence and development of NIs, including LOS, use of catheters (urinary catheter and blood catheter(CVC)) and MV. The mortality of paients with NIs was 12% . A total of 93 percent of NIs were caused by pathogens that could be classified as a genus. A total of 7% of NI infections were not reported microbiologically. Patients with NIs spent substantially more time in the ICU than those without NIs (p value 0.001). (Shao. et al 2016).

Another study found a 32.7 percent NI occurrence, with 116 patients diagnosed with at least one NI and a total of 204 NI episodes recorded.. UTIs (74 cases, 36.3 percent), BSIs (40 episodes, 19.6 percent), hospital-

acquired Clostridium. difficile infection (37, 18.1 percent), and PN (32 episodes, 15.7 percent) were the most common NIs observed. Skin infection (9 episodes), DA-HAI (8 episodes), central nervous system infection (3 episodes), and otitis externa (1 episode) were the most common HAIs observed. Increased patient age, admission diagnosis of a viral central nervous system infection, diabetes mellitus, cardiovascular disease, CVC, intubation, MV for > 48 hours, urinary catheter, and NGT were all reported as risk factors for HAI acquisition. The overall mortality rate of the patients included in the study was39.4%, and it was not found to be substantially higher in patients who had a NI compared to those who did not. (Despotovic, et al 2020).

According to Hespanhol, et al, respiratory tract infections (46.2 percent) and blood flow (26.6 percent) were the most common infections, drawing attention to PN associated with MV (35.2 percent). The study also reported that clinical, laboratory, and imaging diagnosis account for 62.4 percent of NI diagnoses, with cultures accounting for 37.5 percent of the total. As a result of this research, it can be concluded that the patients affected by NI in the sense investigated were of the female sex, aged 60 years or older, the majority of whom were classified as surgical, and they stayed for a long time.. In terms of infection types, those linked to the respiratory tract, bloodstream, and urinary tract predominated, drawing attention to VAP and its connection to a higher death rate among patients. The number of infections present and the number of pathogens isolated in each patient had

a clear and substantial relationship with the death outcome.(Hespanhol, et al 2019)

A research was carried out in a university hospital's academic ICU. Adult patients admitted to the ICU and using antimicrobial drugs were included in the study. Antimicrobial drugs were initiated prior to ICU admission in a total of 176 patients over a one-year period. In 83 percent (n=146) of the patients, it was discovered that the vast majority of critically ill patients had been exposed to antimicrobial drugs prior to ICU admission. When the incidence and result of ICU acquired infections were studied, it was discovered that the most common site of infection was the lungs, which occurred 64 percent of the time. (Kara, et al 2016).

In a prospective review, 93 ICU-acquired infections were assessed in 131 ICU patients. Infection rates were 70.9 per 100 patients and 56.2 per 1,000 patient days.. The most common infections were PN (35.4 percent) and BSIs (18.2 percent). The most commonly isolated pathogens were S. aureus (30.9%) and Acinetobacter spp. (26.8%). A high rate of NIs was discovered, and risk factors for ICU-acquired infections and mortality were discovered. The following are the effects of the risk factors for ICU-acquired infections: The length of stay in the ICU (>7 days), respiratory failure as the primary reason for admission, sedative drug, surgery (prior to or after admission to the ICU), age (>60 years), APACHE II score >15, intubation, and CVC were all found to be important risk factors for mortality. There was no statistically significant difference in mortality rates

between patients with ICU-acquired infection and those who were not infected (mortality rates: 42.3 and 45.6 percent , respectively). (Merci, et al 2005).

As a result, the total infection rate was 26.99 percent and the infection ratio was 23 percent. CLABSI was the most popular NI (13.08%), followed by UTI (10.61%) and VAP (10.61%). (5.69 percent). The 226 patients who took part in this study all had an indwelling urinary catheter. The number of UTI episodes among ICU patients with indwelling urinary catheters was found to be 24 (10.61%). There were 214 patients with CVC, with 28 (13.08 percent) of them having episodes of blood stream infection. A total of 211 patients were tracheostomized or intubated. A total of 12 (5.69%) episodes of VAP were found. Pseudomonas aeruginosa (34.48 percent), Enterococcus species (13.79 percent), KPC (13.79 percent), and Candida species were the most common pathogens isolated from urine (13.79 percent). KPC (32.26 percent), Acinetobacter species (29.03 percent), and Pseudomonas aeruginosa were the most common organisms isolated from blood (16.13 percent). The most common bacteria were Acinetobacter spp. (40.0 percent), Pseudomonas aeruginosa (33.33 percent), and KPC (13.33 percent) responsible for tracheal infections. Diabetes and COPD, as well as a stay in the ICU for more than 8 days, were found to be significantly linked to NIs.(Masih, et al 2016).

In a cohort study of 153 consecutively admitted patients in the medical-surgical ICU, 87 had a NI, according to a retrospective observational study of prospectively collected results (56.86 percent). The most common cause of infection was PN, followed by UTIs and BSI. KPC and E.coli were the bacteria responsible for the infection. There were no differences in age, gender, disease severity (APACHI II score), or comorbid conditions among the patients. The length of stay in the ICU and the duration of MV were both higher in the infected group than in the non-infected group (P 0.001). In terms of mortality, there was no statistically significant difference between the classes (46.15 percent infected group vs. 53.85 percent non - infected group). The multivariate analysis revealed that LOS, MV length, tracheal intubation duration, and urinary catheterization duration are all independent factors correlated with nosocomial infections in the ICU (P 0.001). (Choudhuri, et al 2017)

Chapter Four
Methodology

4.1 Overview

This chapter provides a brief description of the research methods used in this report. It entails the study's design, population, and sampling. The sampling methods, exclusion and inclusion criteria, site and setting, research instruments, data collection, data analysis method, and ethical considerations were all discussed. This section is crucial because it provides an understanding of the methods used.

4.2 Study Design

This research was conducted as a prospective cohort study. A prospective research was conducted in a medical-surgical ICU at the Governmental Hospital in Jenin, where a survey was conducted. These units have on average a day and night nurse patient ratio of 1:2.

4.3 Study site and setting

The research was carried out in the ICU department of the Jenin Governmental Hospital in the North West Bank, Palestine.

4.4 Study period

Data collection began in August 2020 and ended in December 2020.

4. 5 Study Sampling and Population

We conducted a 5-month prospective cohort study of the incidence of nosocomial infection in a combined medical and surgical ICU with four beds and one isolation bed at the Jenin Governmental Hospital. In this study, we opted to use a type of non-probabilistic sample known as a consecutive sample. This type of sample is the most suitable in our case since it focuses on picking up all of the subjects (Patients) who meet the pre-determined inclusion and exclusion requirements for this study (Patients who entered to ICU and aged more than 18)during a specific time period(Nursing Research and Statistics By Sharma Suresh, 2014). A total of 80 patients were chosen from a total of 199 patients who attended the hospital at ICU over the course of five months, including 23 patients under the age of 18 and 96 patients who had spent less than 48 hours in the hospital.

Infection surveillance was introduced on all patients who remained in the ICU for more than 48 hours and met the inclusion requirements during the study period, which ran from August 2020 to December 2020. A total of 260 beds are housed in the hospital's 5-bed combination medical and surgical ICU. Choosing all available participants (Patients) who met the preset inclusion and exclusion requirements for this study over a fixed time span.

4.6 Data Collection Methods and Instrument

The current study was carried out at the Jenin governmental hospital in Palestine's Northern West Bank. The IRB of An-Najah National University and the Ministry of Health praised it. After obtaining each participant's informed consent, a total of 80patients,were 40 patients males and40 females, APACHE II Score done at first 24 h of admission to ICU who were between 18 years old and above. All recruited patient assess for developed NI by filled data sheet for assess the incidence of NI. At admission, patients who met the inclusion and exclusion requirements were given a study number, and baseline data such as demographics, reason for admission, referral unit, and samples such as blood/tracheal aspirate/urine for culture and sensitivity were followed-up.

Study protocol

The APACHE score was measured using 12 physiological variables at the end of the first 24 hours after admission to the ICU. The worst values of each variable were given points according to the APACHE-II scoring method calculation protocol. Age and chronic health were also granted points in the same way, resulting in a total APACHE ranking.

During the first 24 hours of ICU admission, all patients are screened for septic workup.

Clinically relevant samples were taken for culture and exposure testing after 48–72 hours in the intensive care unit. All of the samples were checked in the same hospital's microbiology lab.

Sample collection, handling and processing

Swabs of 70 percent alcohol and 1 percent povidone-iodine were used to swab sites for blood sampling. Five to ten milliliters of the sample were collected in bactec bottles, transported to the lab, and mounted in bactec instruments. The microbiologist Gram stained the positive bottles, subcultured them, and tested their sensitivity.

Suctioning the endotracheal tube or tracheostomy tubes with a sterile suction catheter mounted in a sterile jar and sent to the laboratory, where chocolate and MacConkey agar were used by the laboratory technician. Isolates were identified in positive cultures, and sensitivity cultures were performed.

A sterile jar was used to obtain mid-stream urine or urine from a sampling port on an indwelling catheter using an aseptic technique. MacConkey agar was inoculated with the samples. Positive cultures were Gram stained, subcultured, and sensitivities checked..

Pus or wound swabs were collected from ulcers and septic wounds. MacConkey and chocolate agar were inoculated, incubated, and treated as described above in the laboratory.

Quality control

The researcher devised the study protocol, which was based on knowledge from the intensive care unit's archives. It was checked by the supervisor and experts, who recommended some improvements.

Prior to the start of the study and during the study, all research assistants were educated. Before beginning the actual data collection, the data sheets were reviewed.

Data was cleaned and entered on a daily basis, and the data was analyzed on a regular basis. Both sheets were saved in a protected location so that they could be recovered in the event of data loss.

4.7 Inclusion criteria

1. Admission to the intensive care unit
2. 2-Patients with both male and female genders
3. stay for more than 48h
4. Age 18 years old and above
5. all patients who admitted from the same hospital departments and from other hospital

4.8 Exclusion criteria

1. Age less than 18 years.
2. If the patients were supposed to remain in the ICU for less than 48 hours.

4.9 Study Measures (Variables)

- Independent variable
    1. Demographic data like age and gender
    2. prior use of antibiotics.
    3. patients diagnose at admission
- Dependent variables
    1. Duration of ICU stay
    2. Incidence of infection
    3. outcome
    4. possible risk factors
    5. APACHE II score

4.10 Statistical Analysis

After data collection, data will be analyzed using frequencies and percentages, statistical package for social science (SPSS), descriptive statistics to describe the study sample via mean, median, and range**.**

1. Chi-Square test: tests the differences between Infected and Non-Infected groups of patients for qualitative variables such as(Gender, Age, Location before ICU admission, Prior use of antibiotic before admission, Used Antibiotic, Antibiotic administration during ICU admission, Possible risk, factors, Outcome).

2. Two Independent Samples T test (Adjusted for Unequal variances): tests the differences between Infected and Non-Infected groups of patients for quantitative variables such as (Total duration of ICU stay (days), Length of days in ICU before infections was diagnosed, Duration of administration (days) of antibiotics during ICU admission, Duration of administration (days) Prior use of antibiotic before admission).

In this research we chose to follow a type of non-probabilistic samples called the consecutive sample, this type of samples is the most appropriate sample in such our case since it depend on picking up all the subjects(Patients) that are available who are meeting the preset inclusion and exclusion criteria that specified for this research(Patients who entered to ICU and aged more than 18….) during a specific time period(Nursing Research and Statistics By Sharma Suresh, 2014)

4.11 Reliability and validity

Reliability and validity: Reliability is the degree to which an instrument tests the same way each time it is used under the same conditions for the same subjects.. Validity refers to whether the data sheet or survey measures what it intends to measure .The study protocol will be developed by the researcher; will be based on the information in the files used in the ICU, and according to study variables. It will be reviewed by the supervisor, and experts, who suggested changes in some items.

4.12 Ethical considerations

Since the thesis included human subjects, strict ethical guidelines must be followed. The participants were asked to agree and were told that their involvement or knowledge would not be used against them.

They were also guaranteed their right to privacy.

The data's confidentiality was ensured by preventing unauthorized access.

All patients who participate in the study would be fully informed about the research's intent, and their privacy would be retained in the review and reporting of the results.

The patients who took part in the study or their families signed a written consent form. The ethics committees in the hospitals where the study was conducted must also give their approval. Both participants must be briefed

about the study's intent and nature, and they must have the option to withdraw at any time.

1. The university obtained permission from the Institutional Review Board IRB. (See Annex 2)

2. Jenin Government Hospital provided a consent form. (See Annex 5)

3. Each patient signed a consent document, and participants were informed that all data collected was confidential, voluntary, and protected the patients' privacy.(Annex3)

Chapter Five
Results

5.1 Overview

This chapter presents the study results containing the features of the respondents and the average percentages of the responses for each of the survey's items.

This chapter presents the study result, these results were obtained from analyzed the data sheet which contained seven sections:

- Section one: Demographic data.
- Section two: clinical details.
- Section three: Prior use of antibiotic before admission.
- Section four: antibiotic details during ICU stay.
- Section five: Infectious disease type diagnosed at admission to ICU and in ICU (cultures) and its sensitivity profile.
- Section six: Possible risk factors.
- Section seven: Outcome details.

5.2 Section one: demographic data

In this study, we were able to recruit 80 patients**,** of 40 Males and 40 Females **while** all patients were 18 years and above.

The following tables show the demographic characteristics for the research sample:

Table 1: Frequencies and percentages of demographic characteristics for the research sample (Gender and Age).

Variable	Category	Frequency	Percentage
Gender	Male	40	50.0%
	Female	40	50.0%
	Total	80	100.0%
Age	less than 40	7	8.8%
	40-59	30	37.5%
	60-79	36	45.0%
	80 or more	7	8.8%
	Total	80	100.0%

A sample of 40 Males and 40 Females selected in this research, 7 patients aged less than 40 years by (8.8%), 30 patients aged (40-59) by 37.5%, 36 patients aged (60-79) by 45%, and 7 patients aged 80 years or more by 8.8% from the total sample size.

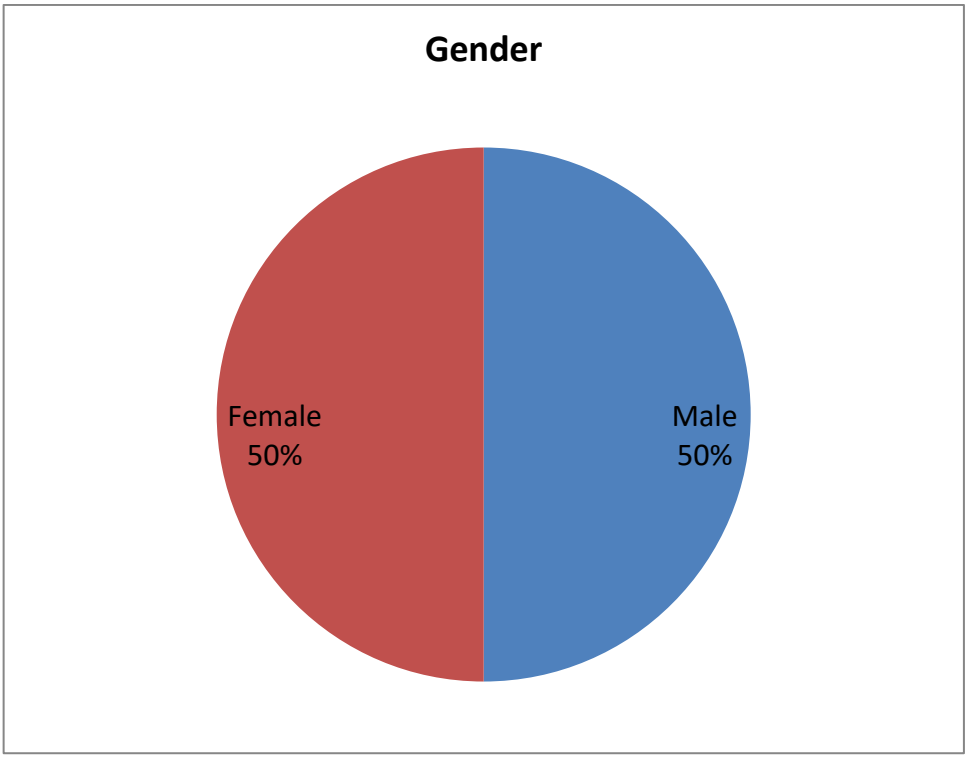

Fig (1): distribution of patient regarding to gender.

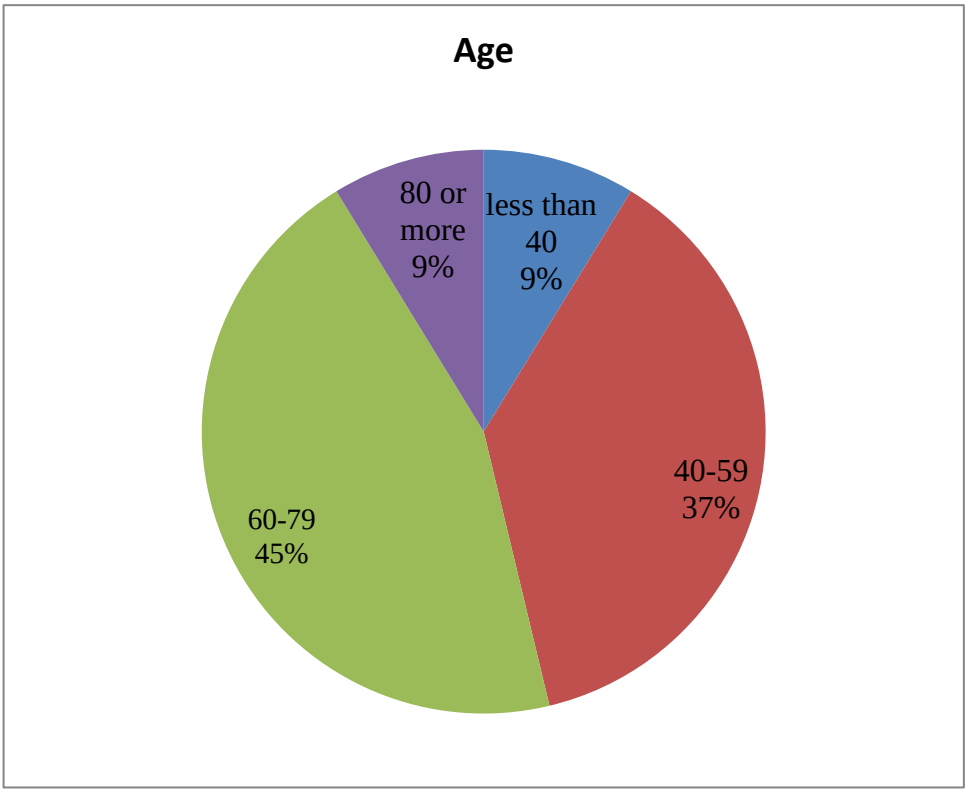

Fig (2): distribution of patient regarding to age.

5.3 Section tow: Clinical Details.

The majority of the ICU admission diagnosis Cerebrovascular reason, Respiratory reason and Surgical reason accounted for (25%, 22.5% and 13.8%, respectively).table(2)

Table 2: Main reason for ICU admission.

Main reason for ICU admission	Frequency	Percentage
Cardiovascular	9	11.3
Respiratory	18	22.5
Surgical	11	13.8
Cerebrovascular	20	25
Gastrointestinal	10	12.5
Metabolic	2	2.5
Renal	2	2.5
Sepsis	3	3.8
Cancer	5	6.3
Total	80	100.0

The results in the table above show that 25% of the patients came for ICU admission because of Cerebrovascular reason, 22.5% of the patients came for ICU admission because of Respiratory reason 13.8% of the patients came for ICU admission because of Surgical reason, 12.5% of the patients came for ICU admission because of Gastrointestinal reason, 11.3% of the patients came for ICU admission because of Cardiovascular reason, 6.3% of the patients came for ICU admission because of Cancer reason, 3.8% of the patients came for ICU admission because of Sepsis reason, 2.5% of the patients came for ICU admission because of Metabolic or Renal reason.

Regarding patients location before ICU admission the distribution was as a following 43.8% of the patients came from home (ER)before ICU admission, 52.5% of the patients were in the other ward in the same hospital before ICU admission, and only 3 patients by 3.8% came from other hospital. table(3)

Table 3: Location before ICU admission.

Location before ICU admission	Frequency	Percentage
Home	35	43.8
Hospital	42	52.5
Other Hospital	3	3.8
Total	80	100.0

The results in the table above show that 43.8% of the patients came from home before ICU admission, 52.5% of the patients were in the hospital before ICU admission, and only 3 patients by 3.8% came from other hospital.

Culture diagnosed at admission to ICU in the first 24h and its sensitivity profile. During the study regarding to Culture & Sensitivity at admission for 80 patients.

The results of Culture & Sensitivity prior to admission for 80 patients the result was positive for 14 patients the organism isolated were Candida and Psedomonus spp were isolated for 1 patient(7.1%), CRE and ESBL and Staphylococus aureus were isolated for 2 patients(14.3%), and E.coli and MRSA were isolated for 3 patients(21.4%).table(4).

Table 4: What organism was isolated at admission? (N=14)

	Frequency	Percent
Candida	1	7.1
CRE	2	14.3
E.coli	3	21.4
ESBL	2	14.3
MRSA	3	21.4
Psedomonus spp	1	7.1
Staphylococus aureus	2	14.3

Table 5: Sensitivity profile for cultures at admission.

Antibiotic	**Yes N(%)**	**No N(%)**
Imepinenem/Meropenem	7(8.8)	4(5)
Piperacillin & Tazobactam	5(6.3)	5(6.3)
Ceftriaxone	6(7.5)	5(6.3)
Cefotaxime	5(6.3)	5(6.3)
Cefuroxime	7(8.8)	4(5)
Ceftazidime	6(7.5)	4(5)
Ciprofloxacin	5(6.3)	5(6.3)
Ampicillin	6(7.5)	4(5)
Gentamicin	7(8.8)	3(3.8)

The results of the table above show that 7 patients in the sample given a sensitivity profile on Antibiotics Imepinenem/ Meropenem, Cefuroxime, and Gentamicin. The results also show that 6 patients in the sample given a sensitivity profile on: Ceftriaxone, Ceftazidime, and Ampicillin. Finally, the results show that 5 patients in the sample given a sensitivity profile on Antibiotics: Ciprofloxacin, Cefotaxime, Piperacillin & Tazobactam.

5.4 Section three: Prior use of antibiotic before admission

Table 6: Prior use of antibiotic before admission.

Prior use of antibiotic before admission	Frequency	Percentage
No	39	48.7
Yes	41	51.3
Total	80	100.0

The results in the table above show that 41 patients(51.3%) had prior use of antibiotic before admission, while 39 patients(48.7%) have not.

Table 7: Frequencies and percentages of antibiotics used before admission.

Name	N(%), Total = 41
Cefotaxime	1(2.4%)
Ceftriaxone	20(48.8%)
Ceftazidime	1(2.4%)
Cefuroxime	4(9.8%)
Ciprofloxacin	2(4.9%)
Amoxicillin+Clavionic acid	3(7.3%)
Meropenem	5(12.2%)
Metronidazole	8(19.5%)
Pipracillin+Tazobactum	2(4.9%)
Vancomycin	3(7.3%)
Azithromycin	6(14.6%)
Colistin	1(2.4%)
Gentamycin	1(2.4%)
Cefazolin	1(2.4%)
Levofloxacin	1(2.4%)

Regarding those 41 patients who had prior use of antibiotic before admission, the results of the table above show that 20 patients(48.8% of 41) used Ceftriaxone, 8 patients (19.5%) used Metronidazole, 6 patients (14.6%) used Azithromycin, and 5 patients (12.2%) used Meropenem.

From the other hand, the table show that most of the other antibiotic were used before admission by only one or 2 patients by (4.9%) or (2.4%) such as: Ciprofloxacin, Cefotaxime, Ceftazidime, Pipracillin+Tazobactum, Colistin, Gentamycin, Cefazolin, Levofloxacin.

Table 8: Route of administration for antibiotics before admission (N=41).

Route of administration	Frequency	Percent
Oral	8	19.5
Parental	31	75.6
Oral+Parental	3	7.3

Regarding Route of administration, the results of the table above show that it was oral for 8 patients (19.5%), Parental for 31 patients (75.6%), and Oral+Parental for 3 patients (7.3%).

5.5 Section four: Antimicrobial Details during ICU stay

Table 9: Antibiotic administration during ICU admission.

Antibiotic administration during ICU admission	Frequency	Percent
Yes	78	97.5
No	2	2.5
Total	80	100.0

The results of the table above show that 78 patients have taken Antibiotics during ICU admission, the percentage is (97.5%) from the sample

Table 10: Antibiotics given during ICU admission (N=78).

Antibiotic	Frequency	Percent
Amikacin	3	3.8
Ceftriaxone	24	30.8
Ceftazidime	4	5.1
Cefuroxime	3	3.8
Amoxicillin+Clavionic acid	5	6.4
Meropenem	42	53.8
Trimethoprim-Sulphamethoxazole	1	1.3
Azithromycin	7	9.0
Pipracillin+Tazobactum	15	19.2
Colistin	6	7.7
Vancomycin	8	10.3
Metronidazol	10	12.8

The results in the table above show that Meropenem is the most Antibiotics given during ICU admission to patients by 53.8%, the next was Ceftriaxone which given to 24 patients by 30.8%, the next was Pipracillin+Tazobactum given to 15 patients by 19.2% .

The results also show that Metronidazol was given to 10 patients by 12.8%, Vancomycin given to 8 patients by 10.3%, Azithromycin given to 7 patients by 9%, Colistin given to 6 patients by 7.7%. The other Antibiotics were given for 4 patients or less.

Table 11: Route of administration for antibiotics during ICU admission (N=78).

Route of administration	**Frequency**	**Percent**
Parental	72	92.3
Oral+Parental	6	7.7

Regarding Route of administration for antibiotics during ICU admission, the results of the table above show that it was Parental for 72 patients (92.3%), and it was Oral+Parental for 6 patients (7.7%).

Table 12: Differences between the Infected and the Non-infected groups of patients in Prior use of antibiotic before admission.

Variable	Category	Group		P-value
		Not Infected	Infected	
		N(%)	N(%)	
Prior use of antibiotic before admission	No	19(52.8%)	20(45.5%)	0.514
	Yes	17(47.2%)	24(54.5%)	
Used Antibiotic:	Cefotaxime	1(2.8%)	0(0%)	0.266
	Ceftriaxone	10(27.8%)	10(22.7%)	0.604
	Ceftazidime	0(0%)	1(2.3%)	0.363
	Cefuroxime	2(5.6%)	2(4.5%)	0.837
	Ciprofloxacin	2(5.6%)	0(0%)	0.113
	Amoxicillin+Clavionic acid	1(2.8%)	2(4.5%)	0.679
	Meropenem	3(8.3%)	2(4.5%)	0.486
	Metronidazole	4(11.1%)	4(9.1%)	0.764
	Pipracillin+Tazobactum	0(0%)	2(4.5%)	0.195
	Vancomycin	0(0%)	3(6.8%)	0.110
	Azithromycin	1(2.8%)	5(11.4%)	0.147
	Colistin	0(0%)	1(2.3%)	0.363
	Gentamycin	0(0%)	1(2.3%)	0.363
	Cefazolin	0(0%)	1(2.3%)	0.363
	Levofloxacin	1(2.8%)	0(0%)	0.266

The results in the table above show that there are no significant differences between the Infected and the Non-infected groups of patients in Prior use of antibiotic before admission and in Used Antibiotics, since all P-values are higher than 0.05. The results also show that 17 patients (48.6%) from the Non-infected group had Prior use of antibiotic before admission and 24 patients (55.8%) from the Infected group had Prior use of antibiotic before admission.

Table 13: differences between the Infected and the Non-infected groups of patients regarding Antibiotic administration during ICU admission.

Variable	Category	Group		P-value
		Not Infected	Infected	
		N(%)	N(%)	
Antibiotic administration during ICU admission	No	2(5.6%)	0(0%)	0.113
	Yes	34(94.4%)	44(100%)	

The results in the table above show that there is not significant differences between the Infected and the Non-infected groups of patients regarding Antibiotic administration during ICU admission , since the P-value is higher than 0.05. The results also show that all patients from the two groups had Antibiotic administration during ICU admission except 2 patients from the non-infected group.

5.6 Section five: Incidence of infection during ICU stay.

The study sample contained 44(55%) Infected Patients who developed NI, and 36(45%) Non-Infected Patients who don’t developed NI.

Table 14: Frequencies and percentages of the group of Patients regarding to infection.

Variable	Category	Frequency	Percentage
Gender	Infected	44	55%
	Non-Infected	36	45%
	Total	80	100.0%

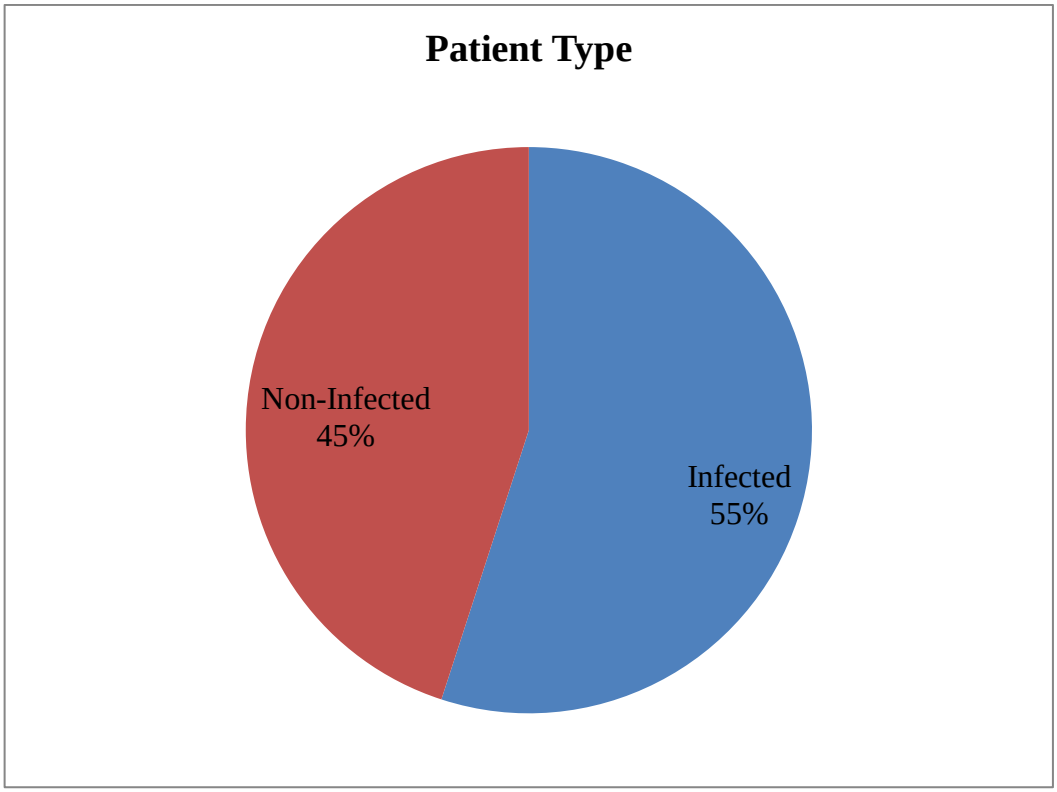

Fig (3): Patient type regarding to infection.

The urinary tract, lower respiratory tract, and bloodstream accounted for the majority of the ICU-acquired infections (43.2,38.6, and 20.4%, respectively).Fifty three pathogens were isolated and identified from the 44 infections, 42 g-negative bacilli and 9 g-positive cocci and 2 fungi. The highest Causative agent of the diagnosed infectious disease was (klebeilla spp) by 19(43.2%) and the lowest isolated pathogens of infection in ICU were (Enterococus, CRE, Proteus spp) by 1(2.3%) for each one.

Table 15: Infectious disease type diagnosed in ICU(N=44).

Infectious disease type diagnosed in ICU	Frequency	Percent
CAUTI	19	43.2
CLBSI	6	13.6
IAP	17	38.6
Septicemia	3	6.8
SSI	7	15.9
Swab	1	2.3

Regarding Infectious disease type diagnosed in ICU, the results of the table above show that 19(43.2%) of patients in the sample had the type (CAUTI), 17(38.6%) had the type (IAP), 7(15.9%) had the type (SSI), 5(11.4%) had the type (CLBSI), 3(6.8%) had the type (Septicemia), and only one patient had the type (Swab).

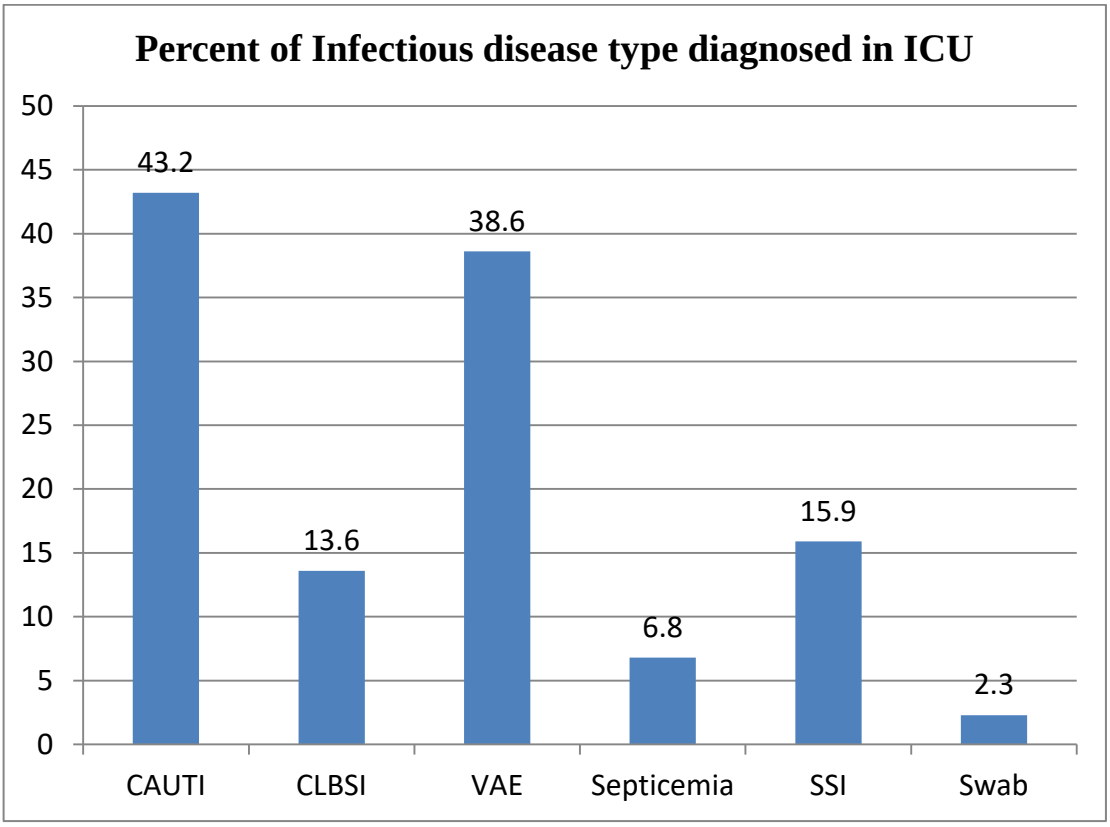

Fig (4): Diagram (1).

Table 16: Site of infection in ICU (N=44).

Site of infection	Frequency	Percent
Abcess	1	2.3
Blood	9	20.5
Sputum	17	38.6
Urine	19	43.2
Wound	7	15.9

The results of the table above show that the highest Site of infection in ICU was (Urine) by 19(43.2%) and (Sputum) by 17(38.6%), and the lowest Site of infection in ICU was (Abcess) by 1(2.3%) .

Table 17: Causative agent of the diagnosed infectious disease (N=44).

Causative agent	Frequency	Percent
Acentobacter bamuni	5	11.4
E.coli	55	11.4
Ecoli+ESBL	3	6.8
Enterococus	1	2.3
klebseilla spp	19	43.2
MRSA	3	6.8
CRE	1	2.3
Proteus spp	1	2.3
pseudomonas spp	6	13.6
staphylococococcus aureas	3	6.8
staphylococus epidermis	2	4.5
Yeast	2	4.5

The results of the table above show that the highest Causative agent of the diagnosed infectious disease was (klebeilla spp) by 19(43.2%) and the lowest Site of infection in ICU were (Enterococus, CRE, Proteus spp) by 1(2.3%) for each one.

Table 18: percentage of gram negative and gram positive infection.

Type of Organism / Type of infection	CAUTI 19	IAP 17	CLABSI 6	Septicemia 3	SSI 7	Skin and soft tissue 1
Gram negative bacteria	15/44=34.1% Maximum=7 Minimum=0	16/44=36.4% Maximum=6 Minimum=0	4/44=9.1% Maximum=2 Minimum=0	0/44=0% Maximum=0 Minimum=0	7/44=15.9% Maximum=5 Minimum=0	0/44=0% Maximum=0 Minimum=0
Acinetobacter baumannii	1	5	0	0	0	0
Klebsiella pneumonia	7	6	1	0	5	0
Pseudomonas spp	2	3	2	0	0	0
Escherichia.coli	2	2	0	0	1	0
Proteus spp	1	0	0	0	0	0
E.COLI+ESBL	2	0	0	0	1	0
CRE	0	0	1	0	0	0
Gram positive Bacteria	3/44=6.8% Maximum=2 Minimum=0	0/44=0% Maximum=0 Minimum=0	2/44=4.5% Maximum=1 Minimum=0	3/44=6.8% Maximum=2 Minimum=0	0/44=0% Maximum=0 Minimum=0	1/44=2.3% Maximum=1 Minimum=0
Staphylococcus aureus	1	0	1	1	0	0
Staphylococcus epidermis	0	0	0	2	0	0
Enterococcus spp.	0	0	0	0	0	1
MRSA	2	0	1	0	0	0
Yeast	1	1	0	0	0	0

The percentage of the most common infectious agent was the gram negative organism that cause NI during the study period was 95.5%.

gram-negative rods predominated, followed by gram positive cocci yeast in ICU-acquired infections, Gram-negative rods (most often Pseudomonas aeruginosa, and Klebsiella) have been shown to predominate in respiratory, urinary tract infections, and surgical site infections while gram positive organisms (most often, Staphylococcus aureus) mainly cause catheter-related, bloodstream.

Table 19: Sensitivity Profile for positive culture during ICU stay (N=42).

Sensitivity Profile	S= Sensitive		R= Resistance	
	N	%	N	%
Amikacin	17	40.5%	25	59.5%
Amoxicillin+Clavionic acid	10	23.8%	32	76.2%
Ampicillin	10	23.8%	32	76.2%
Cefoxitin	11	26.2%	31	73.8%
Cefotaxime	11	26.2%	31	73.8%
Cefuroxime	13	31.0%	29	69.0%
Ceftazidime	15	35.7%	27	64.3%
Ceftriaxone	14	33.3%	28	66.7%
Cefepime	13	31.0%	29	69.0%
Ciprofloxacin	15	35.7%	27	64.3%
Chloramphenicol	10	23.8%	32	76.2%
Co-trimoxazole	10	23.8%	32	76.2%
Erythromycin	10	23.8%	32	76.2%
Oxacillin	10	23.8%	32	76.2%
Tetracycline	10	23.8%	32	76.2%
Penicillin G	10	23.8%	32	76.2%
Gentamicin	15	35.7%	27	64.3%
Imepenem	23	54.8%	19	45.2%
Piperacillin +Tazobactam	21	50.0%	21	50.0%
Meropenem	27	64.3%	15	35.7%
Vancomycin	17	40.5%	25	59.5%
Colistin	42	100.0%	0	0.0%

The results in the table above show that the Sensitivity Profile result was Sensitive for 42 patients from Colistin by 100%, the results was Sensitive as the following : Meropenem for 27 patients by (64.3%), Imepenem for 23 patients by (54.8%), Piperacillin +Tazobactam for 21 patients by (50%), Amikacin for 17 patients by (40.5%), and also Vancomycin for 17 patients by (40.5%), Ceftazidime for 15 patients by (35.7%), and also Ciprofloxacin for 15 patients by (35.7%), Gentamicin for 15 patients by (35.7%), Ceftriaxone for 14 patients by (33.3%), Cefuroxime for 13 patients by (31%), and also Cefepime for 13 patients by (31%), Cefoxitin for 11 patients by (26.2%), and also Cefotaxime for 11 patients by (26.2%), and for 10 patients by (23.8%) for each one of the following antibiotics: Amoxicillin + Clavionic acid, Ampicillin, Chloramphenicol, Co-trimoxazole, Erythromycin, Oxacillin, and Tetracycline.

From the other hand, results show that results was Resistence as the following: Amoxicillin+Clavionic acid, Co-trimoxazole, Ampicillin, Erythromycin, Oxacillin, Tetracycline, Penicillin G, Chloramphenicol were for 32 patients by (76.2%), Cefoxitin and Cefotaxime for 31 patients by (73.8%), Cefuroxime and Cefepime for 29 patients by (69%), Ceftriaxone for 28 patients by (66.7%), Ceftazidime and Ciprofloxacin and Gentamicin for 27 patients by (64.3%), Amikacin and Vancomycin for 25 patients by (59.5%), Piperacillin +Tazobactam for 21 patients by (50%), Imepenem for 19 patients by (45.2%), Meropenem for 15 patients by (35.7%).

Table 20: Differences between the Infected and the Non-infected groups for Gender, Age, and Location before ICU admission variable.

Variable	Category	Group		P-value
		Not Infected	Infected	
		N(%)	N(%)	
Gender	Male	20(55.6%)	20(45.5%)	0.369
	Female	16(44.4%)	24(54.5%)	
Age	less than 40	5(13.9%)	2(4.5%)	0.099
	40-59	16(44.4%)	14(31.8%)	
	60-79	11(30.6%)	25(56.8%)	
	80 or more	4(11.1%)	3(6.8%)	
Location before ICU admission	Home	16(44.4%)	19(43.2%)	0.910
	Hospital	17(47.2%)	25(56.8%)	0.393
	Other Hospital	3(8.3%)	0(0%)	0.026
Location before ICU admission	Home+same Hospital	33(42.9%)	44(57.1%)	0.026
	Other Hospital	3(100%)	0(0%)	

The results in the table above show that there are significant differences between the Infected and the Non-infected groups of patients for patients who came from other hospitals before ICU admission, since the P-value is lower than 0.05. The results show that 3 patients in the Non-Infected group (8.3% from all Non-Infected patients) came from Other hospital while there are no patients in the Infected group came from Other hospitals, in other words, 44 patients from Home and the same hospital were infected (57.1% from all patients came from Home+same Hospital) while no patient came from Other hospital were infected.

The results in the table above show that there are no significant differences between the Infected and the Non-infected groups of patients in Gender and Age and Location before ICU admission except for the patients from the other hospitals, since all P-values are higher than 0.05. The results show that 20 Males by 55.6% were in the Non-Infected group and 20 Males by 45.5% were in the Infected group, the distribution of females was 16

(44.4%) in Non-Infected group and 24 (54.5%) in the Infected group. The distribution of ages were 5(13.9%) in the Non-infected group, for patients aged (less than 40) and 2 (4.5%) in the Infected group, for patients aged (40-59), the distribution was 16 (44.4%) in the Non-infected group and 14(31.8%) in the Infected group, for patients aged (60-79), the distribution was 11(30.6%) in the Non-infected group and 25(56.8%) in the Infected group, and for patients aged (80 or more), the distribution was 4(11.1%) in the Non-infected group and 3(6.8%) in the Infected group.

The distribution of Location before ICU admission were 16(44.4%) in the Non-infected group, for patients came from Home and 19(43.2%) in the Infected group, for patients from the Hospital, the distribution was 17(47.2%) in the Non-infected group and 25(56.8%) in the Infected group, for patients from other hospital, the distribution was 3(8.3%) in the Non-infected group and 0(0%) in the Infected group.

5.7 Section six: Possible risk factors

Table 21: Is the patient on ventilator support?

The patient on ventilator support	Frequency	Percent
Yes	46	57.5
No	34	42.5
Total	80	100.0

The results of the table above show that 46 patients were on ventilator support by (57.5%), and 34 patients were not by (42.5%).

Table 22: differences between the Infected and the Non-infected groups of patients regarding whether patient on ventilator support.

Variable	Category	Group		P-value
		Not Infected	Infected	
		N(%)	N(%)	
Is the patient on ventilator support?	Yes	15(41.7%)	31(70.5%)	0.010
	No	21(58.3%)	13(29.5%)	

The results in the table above show that there are significant differences between the Infected and the Non-infected groups of patients regarding whether patient on ventilator support, since the P-value is less than 0.05. The percentage of patients on ventilator support in the Infected group 31(70.5%) is significantly higher than the percentage of patients on ventilator support in Non-infected group 15(41.7%).

Table 23: Frequencies and percentage of Possible risk factors for NI.

Possible risk factors	Frequency	Percent
Surgery	19	23.8
Chronic renal failure	19	23.8
Chronic lung disease	6	7.5
Neutropenia	1	1.3
Dialysis	13	16.3
Malignancy	8	10.0
Diabetes mellitus	46	57.5
Long term steroid use	3	3.8
Endotracheal tube use	37	46.3
Drainage catheters	23	28.8
Urethral catheters use	78	97.5
Central venous catheters	38	47.5
Gastrostomy	3	3.8
Nasogastric tube	60	75.0
Tracheostomy	9	11.3
H2 antagonist/PPIs drug	80	100.0
Alcoholic abuse	1	1.3

The results of the table above show that the most Possible risk factor was (H2 antagonist/PPIs drug) for all patients, the next was (Urethral catheters use) for 78 patients by (97.5%), the next was (Nasogastric tube) for 60

patients by (75%), then the (Diabetes mellitus) and (Endotracheal tube use) for 46 by (57.5%).

The (Central venous catheters) and (Endotracheal tube use) were for 38 and 37 patients by (47.5%) and (46.3), the (Drainage catheters) was for 23 patients by (28.8%), the (Surgery) and (Chronic renal failure) were for 19 patients by (23.8%), the (Dialysis) was for 13 patients by (16.3%), the (Tracheostomy) was for 9 patients by (11.3%), the (Malignancy) was for 8 patients by (10%), the (Chronic lung disease) was for 6 patients by (7.5%), the (Long term steroid use) and (Gastrostomy) was for 3 patients by (3.8%) and the (Neutropenia) and (Alcoholic abuse) were for 1 patient by (1.3%)

Table 24: Differences between the Infected and the Non-infected groups of patients only regarding Possible risk factors.

Possible risk factors :	Group		P-value
	Not Infected	Infected	
	N(%)	N(%)	
Surgery	9(25%)	10(22.7%)	0.812
Chronic renal failure	8(22.2%)	11(25%)	0.771
Chronic lung disease	2(5.6%)	4(9.1%)	0.550
Neutropenia	0(0%)	1(2.3%)	0.363
Dialysis	6(16.7%)	7(15.9%)	0.927
Malignancy	4(11.1%)	4(9.1%)	0.764
Diabetes mellitus	16(44.4%)	30(68.2%)	0.033
Long term steroid use	2(5.6%)	1(2.3%)	0.442
Endotracheal tube use	15(41.7%)	30(68.2%)	0.017
Drainage catheters	11(30.6%)	12(27.3%)	0.747
Urethral catheters use	34(94.4%)	44(100%)	0.113
Central venous catheters	16(44.4%)	22(50%)	0.621
Gastrostomy	0(0%)	3(6.8%)	0.110
Nasogastric tube	23(63.9%)	37(84.1%)	0.038
Tracheostomy	1(2.8%)	8(18.2%)	0.030
H2 antagonist/PPIs drug	36(100%)	44(100%)	----
Alcoholic abuse	1(2.8%)	0(0%)	0.266

The results in the table above show that there are significant differences between the Infected and the Non-infected groups of patients only

regarding Diabetes mellitus, Endotracheal tube use, Nasogastric tube, and Tracheostomy, since the P-values are less than 0.05. The percentage of patients with Diabetes mellitus in the Infected group 30(68.2%) is significantly higher than that in Non-infected group 16(44.4%). The percentage of patients with Endotracheal tube use in the Infected group 30(68.2%) is significantly higher than that in Non-infected group 15(41.7%). The percentage of patients with Nasogastric tube in the Infected group 37(84.1%) is significantly higher than that in Non-infected group 23(63.9%). The percentage of patients with Tracheostomy in the Infected group 8(18.2%) is significantly higher than that in Non-infected group 1(2.8%).

5.8 Section Seven: Outcome Details:

Table 25: Duration of ICU stay after acquisition of ICU infection (days) N=44.

Duration of ICU stay after acquisition of ICU infection (days)	Frequency	Percent
<=5	27	61.4
<=10	9	20.5
<=15	1	2.3
>=20	7	15.8

The results of the table above show that 27 patients stayed (<=5 days) in ICU after acquisition of ICU infection by 61.4%, 9 patients stayed (<=10 days) in ICU after acquisition of ICU infection by 20.5%, only 1 patient stayed (<=15 days) in ICU after acquisition of ICU infection by 2.3%, and 7 patients stayed (>=20 days) in ICU after acquisition of ICU infection by 15.8%.

Table 26: frequency and percentage of patients Outcome.

Outcome	Frequency	Percent
Discharged	49	61.3
Died	31	38.8
Total	80	100.0

The results of the table above show that 49 patients discharged from the hospital by 61.3%, and 31 patients died by 38.8%.

Table 27: Differences between the Infected and the Non-infected groups of patients only regarding Outcome.

Variable	Category	Group		P-value
		Not Infected	Infected	
		N(%)	N(%)	
Outcome:	discharged	27(75%)	22(50%)	0.022
	died	9(25%)	22(50%)	

The results in the table above show that there are significant differences between the Infected and the Non-infected groups of patients only regarding Outcome, since the P-value is less than 0.05. The percentage of discharged patients in the Infected group 22(50%) is significantly lower than that in Non-infected group 27(75%), and the percentage of died patients the Infected group 22(50%) is significantly higher than that in Non-infected group 9(25%).

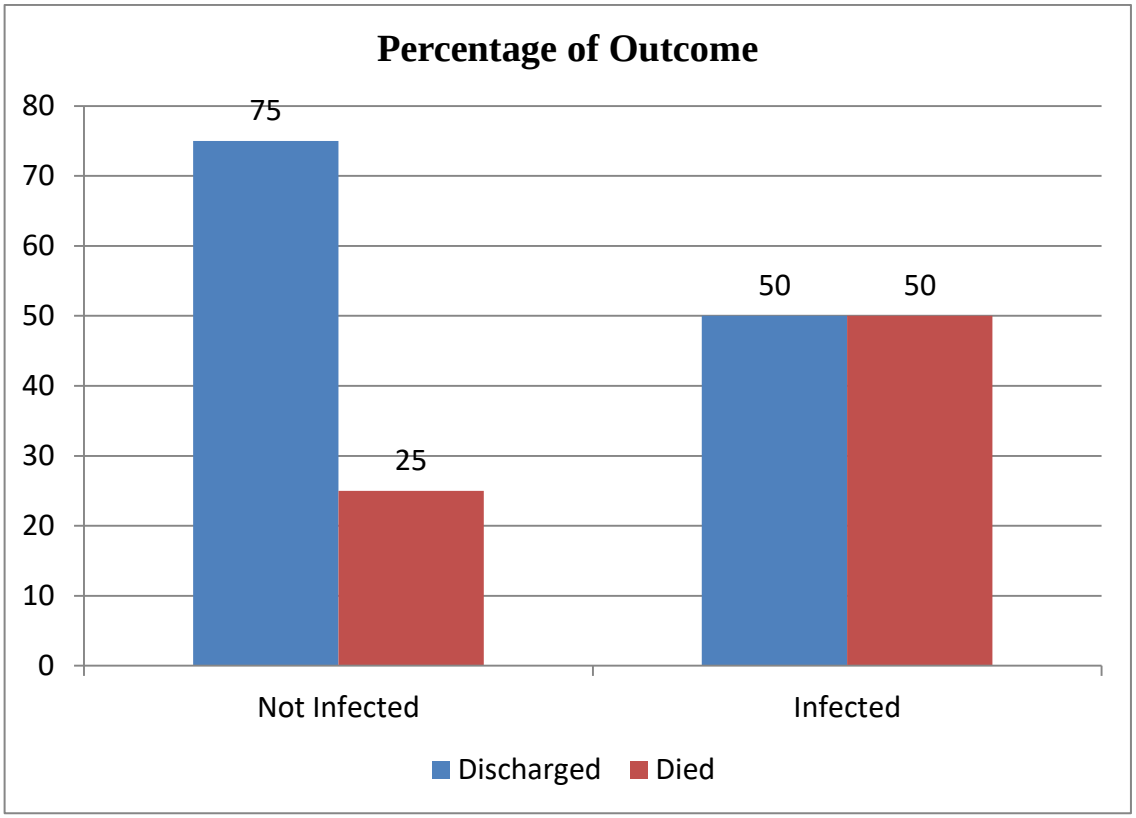

Fig (5): Diagram (2)

Table (28): Differences between the Infected and the Non-infected groups of patients regarding Duration of administration (days) Prior use of antibiotic before admission Length of days in ICU before infections was diagnosed Duration of administration (days) of antibiotics during ICU admission and Total duration of ICU stay (days).

Variable	Group				
	Not Infected		Infected		
	N	Mean ± S.D	N	Mean ± S.D	P-value
Duration of administration (days) Prior use of antibiotic before admission	17	5.35 ± 3.2	24	5.67 ± 5.01	0.824
Length of days in ICU before infections was diagnosed	0	----	44	4.89 ± 4.7	----
Duration of administration (days) of antibiotics during ICU admission	34	5.15 ± 2.03	44	7.36 ± 3.74	0.001
Total duration of ICU stay (days)	36	5.81 ± 2.67	44	10.57 ± 9	0.003
APACHE II SCORE	36	8.97 ± 2.06	44	23.52 ± 4.74	<0.001

The results in the table above show that there are significant differences between the Infected and the Non-infected groups of patients only in Total duration of ICU stay (days), and in Duration of administration (days) of antibiotics during ICU admission, since the P-values are less than 0.05. The mean of Duration of administration (days) of antibiotics during ICU admission in the Infected group was (7.36) is significantly higher than that in Non-infected group (5.15), and the mean of Total duration of ICU stay (days)in the Infected group was (10.57) is significantly higher than that in Non-infected group (5.81).

The results also show that there are no significant differences between the Infected and the Non-infected groups of patients only in Duration of administration (days) Prior use of antibiotic before admission, since the P-value is higher than 0.05, the mean of Duration of administration (days) Prior use of antibiotic before admission in the Infected group was (5.67) and that in Non-infected group (5.35).

The results in the table above show that there are significant differences between the Infected and the Non-infected groups of patients in APACHE II SCORE, since the P-value is less than 0.05. The mean of APACHE II SCORE in the Infected group was (23.52) is significantly higher than that in Non-infected group (8.97).

5.9 Research Hypotheses

1. There is a significant difference at a level of 0.05 related to the development of NIs and patients demographic data as age and gender. no significant differences between the Infected and the Non-infected groups of patients in Gender and Age

To make sure of this hypothesis, percentages and frequencies tests Sig. (2-sided) were made.

The results in the table (20) show that there are no significant differences between the Infected and the Non-infected groups of patients in Gender and Age. The results show that 20 Males by 55.6% were in the Non-Infected group and 20 Males by 45.5% were in the Infected group, the distribution of females was 16(44.4%) in Non-Infected group and 24(54.5%) in the Infected group. The distribution of ages were 5(13.9%) in the Non-infected group, for patients aged (less than 40) and 2(4.5%) in the Infected group, for patients aged (40-59), the distribution was 16(44.4%) in the Non-infected group and 14(31.8%) in the Infected group, for patients aged (60-79), the distribution was 11(30.6%) in the Non-infected group and 25(56.8%) in the Infected group, and for patients aged (80 or more), the distribution was 4 (11.1%) in the Non-infected group and 3(6.8%) in the Infected group.

2. There is a significant difference at a level of 0.05 related to development of NIs and admission from another hospital. There are significant differences between the Infected and the Non-infected groups of patients for patients who came from other hospitals before ICU admission, since the P-value is lower than 0.05.

The results in the table(20) above show that there are significant differences between the Infected and the Non-infected groups of patients for patients who came from other hospitals before ICU admission, since the P-value is lower than 0.05. The results show that 3 patients in the Non-Infected group (8.3% from all Non-Infected patients) came from Other hospital while there are no patients in the Infected group came from Other hospitals, in other words, 44 patients from Home and the same hospital were infected (57.1% from all patients came from Home+same Hospital) while no patient came from Other hospital were infected.

The results in the table (20)above show that there are no significant differences between the Infected and the Non-infected groups of patients in Location before ICU admission except for the patients from the other hospitals, since all P-values are higher than 0.05.

The distribution of Location before ICU admission were 16(44.4%) in the Non-infected group, for patients came from Home and 19(43.2%) in the Infected group, for patients from the Hospital, the distribution was 17(47.2%) in the Non-infected group and 25(56.8%) in the Infected group,

for patients from other hospital, the distribution was 3(8.3%) in the Non-infected group and 0(0%) in the Infected group.

3. There is a significant difference at a level of 0.05 related to development of NIs and APACHE II score . There are significant differences between the Infected and the Non-infected groups of patients in APACHE II SCORE, since the P-value is less than 0.05.

The results in the table(27) above show that there are significant differences between the Infected and the Non-infected groups of patients in APACHE II SCORE, since the P-value is less than 0.05. The mean of APACHE II SCORE in the Infected group was (23.52) is significantly higher than that in Non-infected group (8.97).

4. There is a significant difference at a level of 0.05 related to prior antibiotics use and development of NIs. There are no significant differences between the Infected and the Non-infected groups of patients in Prior use of antibiotic before admission and in Used Antibiotics, since all P-values are higher than 0.05.

The results in the table(12) above show that there are no significant differences between the Infected and the Non-infected groups of patients in Prior use of antibiotic before admission and in Used Antibiotics, since all P-values are higher than 0.05. The results also show that 17 patients (48.6%) from the Non-infected group had Prior use of antibiotic before

admission and 24 patients(55.8%) from the Infected group had Prior use of antibiotic before admission.

5. There is a significant difference at a level of 0.05 related to possible risk factors such as DM ,Nasogastric tube use , Endo-tracheal tube use, and Tracheostomy and development of NIs. There are significant differences between the Infected and the Non-infected groups of patients only regarding Diabetes mellitus, Endotracheal tube use, Nasogastric tube, and Tracheostomy, since the P-values are less than 0.05

The results in the table (24) above show that there are significant differences between the Infected and the Non-infected groups of patients only regarding Diabetes mellitus, Endotracheal tube use, Nasogastric tube, and Tracheostomy, since the P-values are less than 0.05. The percentage of patients with Diabetes mellitus in the Infected group 30(68.2%) is significantly higher than that in Non-infected group 16(44.4%). The percentage of patients with Endotracheal tube use in the Infected group 30(68.2%) is significantly higher than that in Non-infected group 15(41.7%). The percentage of patients with Nasogastric tube in the Infected group 37(84.1%) is significantly higher than that in Non-infected group 23(63.9%). The percentage of patients with Tracheostomy in the Infected group 8(18.2%) is significantly higher than that in Non-infected group 1(2.8%).

6. There is a significant difference at a level of 0.05 related to development of NIs and patient outcome in term length of stay in ICU and mortality.

The results in the table(28) above show that there are significant differences between the Infected and the Non-infected groups of patients only in Total duration of ICU stay (days), since the P-values are less than 0.05. The mean of Total duration of ICU stay (days)in the Infected group was (10.57) is significantly higher than that in Non-infected group (5.81).

The results in the table(27) above show that there are significant differences between the Infected and the Non-infected groups of patients only regarding Outcome, since the P-value is less than 0.05. The percentage of discharged patients in the Infected group 22(50%) is significantly lower than that in Non-infected group 27(75%), and the percentage of died patients the Infected group 22(50%) is significantly higher than that in Non-infected group 9(25%)

Chapter Six
Discussion

6.1 Overview

The results of this study revealed patient data and variable outcomes, with a focus on putting guidelines into action based on the findings. This, in turn, will ideally pave the way for planners and decision-makers in the West Bank to adopt the guidelines for both nurses and practitioners, resulting in improve healthcare conditions and becoming more efficient and successful for their patients and institutions.

Results of the study were termed as the Incidence (rate of patients who had a positive culture as blood ,urine ,sputum or others after 48h from admission to ICU), related risk factors of Nosocomial Infections, and patients outcome in Intensive Care Unit.

6.2 Incidence of NI

The study sample contained 44(55%) Infected Patients, and 36(45%) Non-Infected Patients**.**

The incidence of NI in our study was 55 %

Incidence rate was derived by dividing the number of new NIs acquired in a period by total number of patient days for the same period *1000

- Results of the study were termed as the Incidence (rate of patients who had a positive culture as blood, urine, sputum or others after 48h from

admission to ICU), related risk factors of Nosocomial Infections ,and patients outcome in Intensive Care Unit.

- In prospective observational study by Sugata, In 11.98% of the patients, NIs were discovered (Dasgupta, et al 2015).another one found that the incidence of patients with NIs was up to 32.48%, which was significantly high by (Shao. et al 2016).

Regarding Infectious disease type diagnosed in our ICU, the results 19(43.2%) of patients in the sample had the type (CAUTI), 17(38.6%) had the type (VAE), 7(15.9%) had the type (SSI), 5(11.4%) had the type (CLBSI), 3(6.8%) had the type (Septicemia), and only one patient had other infection.

While urinary tract infections (CAUTI) 43.2%are the most common nosocomial infection in our study follow by RTI (IAP) 38.6 then BSI20.4% (CLABSI 13.6% and septicemia 6.8%) then SSI 15.9% and other infections 2.3%.

Same previous studies found result as our study result, that UTIs to be the most common NI:

Regarding to the commonest type of in infection a study conducted in Barazil by (Oliveria. et.al 2010) UTI was the commonest type of NI with 144 cases (37.6%), followed by PN (n=98; 25.6%), sepsis (n= 58; 15.1%), SSI (n=54; 14.1%) and others site of infection (n=29; 7.7%).

UTI 45.5% is the most common NI, soft tissue infection 30.6%, Bloodstream infection 20.1%, and RTI 3.5% in the study (Dayyab.2018)

Another study had the same result as UTI (28%) was the commonest nosocomial infection to be found in the intensive care unit among 100 patients who had NIs followed by 22% lower respiratory tract infection, 20% catheter related BSI, 16%Soft tissue infections a study conducted by (Durgad.et al 2015).

Other study had a different finding regarding the type of NI there the most frequent site of infection was RTI (47.95%) followed by UTI (25.3%) (Akhtar. 2010). And was the BSI 49.0% and UTI 35.6% were the most common infections that result by (Lwuafor. et al 2016). Another study found a different result by (Ak. 2011) NIs distribution were (36.3%) bacteremia, (30.4%)VAP, (18.5%) CAUTI,(7.4%) CLABSI, (5.9%) cutaneous infection, and (1.3%) meningitis.

The highest Causative agent of the NI was (klebseilla spp) by 19(43.2%) and the lowest agent of infection in ICU were (Enterococus, CRE, Proteus spp) by 1(2.3%) for each one. Gram negative bacteria were the predominant pathogens isolated in this study, same result detected in many study such (Durgad. et.al 2015)and another study found that the most common pathogens implicated in NIs are gram negative organisms by (Rao. et.al 2020) .Same our finding the common isolated spp Klebsiella pneumonia (30%) was the most frequently isolated bacteria by (Agaba. et. al 2017).

A total of 144 bacteria were isolated in 100 patients with NIs ,the most frequently isolated organism was KPC (27.1%) (Dayyab.2018), other study KPC (30.2%).(Akhtar.201

6.3 Hypothesis of the study

First hypothesis

In this study, the mean age of patients identified with NI was considerably higher than that of the non-infected patients. Patients 70 ≤ age 53.8% from total patients include in the study. The results in this study that there are **no** significant differences between the Infected and the Non-infected groups of patients in Gender and Age, since all P-values are higher than 0.05.

That the answer of the first hypothesis in our study that was - There is no a significant difference at a level of 0.05 related to the development of NIs and patients demographic data as age and gender. Comparing our results with former published data as a study by (Mihaly. 2016) found that there were no significant differences between the infected and non-infected patients regarding to gender and age.

Second Hypothesis

There is a significant difference at a level of 0.05 related to development of NIs and location before ICU admission .In our study the results shown that there were a significant differences between the Infected and the Non-infected groups of patients for patients who came from other hospitals before ICU admission, since the P-value is lower than 0.05. The results

show that 3 patients in the Non-Infected group (8.3% from all Non-Infected patients) came from Other hospital while there are no patients in the Infected group came from Other hospitals, in other words, 44 patients from Home and the same hospital were infected (57.1% from all patients came from Home+same Hospital) while no patient came from Other hospital were infected.

The results in the table above show that there are no significant differences between the Infected and the Non-infected groups of patients in Location before ICU admission except for the patients from the other hospitals, since all P-values are higher than 0.05.

The distribution of the clients with and without infection was found in a study most patients (n=1.075) were hospitalized at the studied hospital prior to admission in the critical care, and among them 177 (16.5%) developed HAI. Those came from the hospital ER unit were more likely to have infection ($p<0.05$), than those who came from the community. Also, a relative risk of 1.9 $p<0.05$) was verified for those who came from another units within the same hospital, when compared with those who came from the community (Oliveria. et.al 2010).

Another study found different result that was among continuous variables stay in another units before ICU were found to be significantly high in the patients with NIs p value<0.001(Yesilbag et al 2015).

Third Hypothesis

There is a significant difference at a level of 0.05 related to development of NIs and APPCHE II score. There are significant differences between the Infected and the Non-infected groups of patients in APACHE II SCORE, since the P-value is less than 0.05.

The same finding in a study that the severity of patient's clinical condition (APACHE II SCORE) was also significantly associated with HAI (p: 0.002). (Daud-Gallotti, et .al 2012).Other study found that Among continuous variables APACHE II score, found to be significantly high in the patients with NIs p value<0.001(Yesilbag et al 2015).

Another study found deferent result that was when the infected and non-infected patients were compared according to APACHE II scores there was no significant difference (p>0.05). (AK.et al 2011)

Fourth Hypothesis

There is a significant difference at a level of 0.05 related to prior antibiotics use and development of NIs. In our study there are **no** significant differences between the Infected and the Non-infected groups of patients in Prior use of antibiotic before admission and in Used Antibiotics, since all P-values are higher than 0.05.

The study by (Dasgupta. et al 2018)found that the use of antimicrobial drugs one month before ICU admission was independently associated with acquisition of ICU infections P value was <0.001.

Fifth Hypothesis

Risk Factors

There were significant differences between the Infected and the Non-infected groups of patients only regarding Diabetes mellitus, Endotracheal tube use, Nasogastric tube, and Tracheostomy, since the P-values are less than 0.05. The percentage of patients with Diabetes mellitus in the Infected group 30(68.2%) is significantly higher than that in Non-infected group 16(44.4%). The percentage of patients with Endotracheal tube use in the Infected group 30(68.2%) is significantly higher than that in Non-infected group 15(41.7%). The percentage of patients with Nasogastric tube in the Infected group 37(84.1%) is significantly higher than that in Non-infected group 23(63.9%). The percentage of patients with Tracheostomy in the Infected group 8(18.2%) is significantly higher than that in Non-infected group 1(2.8%).Additionally APACHE II score and prolong stay in ICU were shown to be high in the infected group.

In a study conducted by (Ak.O 2011)found that prolong stay in ICU , CVC used, endo-tracheal intubation and tracheostomy were statistically significant as risk factor for acquiring infection .

The episode of community infection, the colonization by resistant pathogens, and the use of invasive devices were significantly with the occurrence of NI, with high relative risk factors for NI this finding

regarding to possible risk factors (Oliveira, et .al 2010) a study conducted in Brazil.

Most of the ICU pts were on at least one invasive device . 71.4% of the patients used long term indwelling urinary catheters,71.42% used MV, and out of 100 patients, 22(22%) had DM were relative risks factors for NI this finding regarding to possible risk factors(Durgad. et al 2015).

Use of antibiotics (p 0.03) and surgery (p< 0.05) in the month prior ICU admission as well as urinary catheterization (p< 0.05), endo-tracheal intubation (p<0.05) patients' location before ICU admission (p< 0.05)and an APACHE 11 score value greater or equal to 20 (P <0000) were risk factors for infection in a study conducted in Nigeria by (Iwuafor. et al 2016)

Prior antibiotic use, PPI use, hypoalbuminemia, malnutrition, urethral catheterization, endo-tracheal intubation, re-intubation, tracheostomy, positioning of nasogastric tube, mechanical ventilation, APACHE II score value>13, and prolonged ICU stay were all found to have a statistically significant association with nosocomial infection in a study by (Dasgupta. et al 2018).

Sixth Hypothesis

- **ICU Length of Stay**

There is a significant difference at a level of 0.05 related to development of NIs and duration of stay at ICU.

In our study the results show that there are significant differences between the infected and the non-infected groups of patients in Total duration of ICU stay (days), since the P-values are less than 0.05, the mean of Total duration of ICU stay (days) in the Infected group was (10.57) is significantly higher than that in Non-infected group (5.81).

prolonged ICU stay found not significant to be risk factors for ICU-acquired infections among patients analysed in this study. (Iwuafor. et al 2016)

prolong of ICU stay were found to be significant associated with NI in a general learning hospital of Eastern India (Dasgupta. et al 2018).

- **Outcome: death and discharge**

The results in our study that there were significant differences between the Infected and the Non-infected groups of patients only regarding Outcome, since the P-value was less than 0.05. The percentage of discharged patients in the Infected group 22(50%) was significantly lower than that in Non-infected group 27(75%), and the percentage of died patients the Infected

group 22(50%) was significantly higher than that in Non-infected group 9 (25%).

Among the 195 deaths rate were (10.3%), 39.5% (n=77) were patients who had NI, information consistent with findings of others researches that found a significant relation between higher mortality rates and development of HAI.

There was no significant difference between the hospital mortality rates among the patients with and without NI (P value 0.181) (Dasgupta.et al 2018)

During a study in Tunisia, 24 patients died. NI-associated mortality rate was 35.8% no significant associations between mortality and all studied factors were detected (Rejeb . 2016).

Study limitations and strengths

There were several limitations to the current study:

1. The data was collected from single hospital.
2. This was the first analysis of the incidence of NI in the Jenin hospital's ICU.
3. The data collection duration was shortened due to a lack of time, and the pandemic corona virus caused several outbreaks during the study period.

4. In our hospital, there was no specific infection management procedure.

5. Culture results must be followed for 3-5 days.

6. The research population is small, which reflects the limited number of ICU beds available and the fact that healthcare in the study area is largely out of pocket. This, we suspect, may have contributed to the study's inability to detect some significant relationships from our results.

7. While the consecutive sampling methodology we used made it easier to reach our study participants, it could have introduced sampling bias, distorting a good representation of the entire population.

Strengths in our study were

The prospective nature and systematic quest for various infections on admission and during the stay in the ICU (single adult medical-surgical ICU) are two of the study's strengths. A member of the ICU team was an infectious disease specialist, and the diagnosis and treatment of various infections were given particular attention in the daily routine.. Throughout the report, we attempted to record all infections in a more systematic manner. Since a statistician has been a member of the research team since the beginning of the project, statistical considerations were already taken into account during data collection. In addition, to answer the study hypothesis, sufficient and flexible tests were performed.

Conclusions

The study found a high rate of NIs in the ICU and identified risk factors for nosocomial infection acquisition in the ICU. To improve our understanding of the various risk factors and their relationships, further prospective observational and multicenter studies are required.

There is a direct correlation between infection and duration of ICU stay and mortality, as well as an important inverse association between infection prevalence and government health-care spending. In terms of the prevalence of diseases, the types of infecting microorganisms, and mortality rates, there are major variations between countries. These crucial data paint an image of infection rates around the world, which can help improve understanding of global and regional variations and pointers for better infection prevention and management.

Recommendation

Based on this study, the following recommendation can be made:

In workshops, clinical meetings, or training sessions, we recommend that the healthcare team address NI rates, the resistant microorganism profile at the hospital, and the mortality rate associated with them on a regular basis. These activities will help with healthcare management, provide an analysis of infection patterns and fluctuations, and provide data for the development and evaluation of infection control plans.

The findings of this research reinforce the findings of other NI studies and reaffirm the value of a successful infection prevention program involving healthcare workers. The study adds to our understanding of ICU infection rates and stresses the importance of controlling outcomes such as patient risk, mortality, and the occurrence of resistant microorganisms.

More room per bed, special air handling provisions for clean air without recirculation, hand wash area, special anti-bacterial methods of flooring, air curtains, isolation wards, and hand wash area outside each bed in the ICU are all ideal ways to avoid nosocomial infection. Based on the resources available, each hospital should develop its own infection management guidelines. “The instructions should be updated on a regular basis.” Surveillance and continuous monitoring are required, as well as staff education on infection control procedures.

To reduce the spread of microorganisms from equipment and the atmosphere, proper washing, disinfecting, and sterilization procedures should be implemented, and every visitor should use the hand rub solution before entering the ICU.

- Lack of an antibiotic stewardship program in the study center, lack of qualified ICU nurses, regular turnover of ICU nurses, low nurses to patient ratio, no defined infection management policy, poor hand hygiene, high bed occupancy rates, and high levels of human traffic in the ICU(relatives, students, HCWs) are all possible causes of NI. Antibiotic stewardship initiatives seek to increase patient safety by

maximizing adequate antibiotic care while minimizing antibiotic resistance. Antibiotics should not be used prophylactically unless there is a strong indication, and antibiotics should be adapted until culture data is available.

- During their stay in the ICU, about a quarter of our patients developed an infection. In our ICU, CAUTI was the most commonly found ICU-acquired infection.. As a result, catheter-induced urinary infection prevention primarily involves taking steps such as inserting a catheter only when required, avoiding excessive catheterization, using aseptic procedure during catheterization, and removing the catheter as soon as possible. The lower the rate of infection, the shorter the catheterization time.

When COVID-19 became a major concern in the county, our health-care staff were given additional training on proper PPE use, donning and doffing procedures, cleaning equipment after use, and the value of hand hygiene before and after patient interaction. This training took place during 5-minute huddles at the start of each shift. Furthermore, educational flyers containing this knowledge were strategically placed near clock-in areas and break rooms. COVID-19 patients should be diagnosed and isolated as soon as possible to avoid transmission. During the study period, patients who complained of COVID-19 were transferred to another unit.

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Appendix

Appendix 1

Article	Aims	Methods	Results	Conclusion
1-Nosocomial infections and risk factors in intensive care unit of a university hospital	To evaluate NIs in ICU in terms of site of infection, distribution of causative pathogens and their antibiotic susceptibility pattern and the risk factors for developing infection.	80 patients over 18 years of age who had stayed more than 48 hours in our ICU were included in the study conducted in the ICU of Istanbul University Istanbul Faculty of Medicine between March-August 2010 after the study has been approved by the ethics committee	prospective study **-Inclusion criteria** : patients > 18 years of age who had stayed more than 48 hours in ICU **-Exclusion criteria:** patients who were not followed up from the first day of admission to ICU **-Risk factors:** Hemodialysis, enteral nutrition, total parenteral nutrition and prolonged hospitalization , central vascular line, urinary catheter, nasogastric tube, drainage catheter, mechanic ventilation, H2 receptor antagonist/proton pomp inhibitor (PPI) exposure during hospitalization, and antibiotic exposure in last 3 months .	The most frequently encountered NI was pneumonia in ICU, followed by bloodstream infections and UTIs. Klebsiella pneumoniae, Pseudomonas aeruginosa and Acinetobacter spp. were found as the most frequent causative microorganisms, respectively. VRE was found the most common pathogen among Grampositive cocci, and all of the Acinetobacter species were found to be resistant to carbapenems. It was determined that high . Hospitalization in ICU, prolonged hospitalization in other units before ICU, hemodialysis, enteral nutrition and TPN are independent risk factors for development of NIs. It was considered that each hospital should apply infection control measures by determining own causative microorganisms, antibiotic

				resistance patterns and risk factors with regular surveillance cultures and should apply invasive procedures in correct indications.
2- The Incidence and Risk Factors of Nosocomial Infections in ICU	to assess the incidence of nosocomial infections and to identify the risk factors.	The study include 125 consecutive patients hospitalized between 1st October 2014 – 30th of April 2015 at Anesthesia and Intensive Care Units at Emergency County Hospital and in the Cardiovascular Surgery Targu Mures .	prospective, clinical observational study. Inclusion criteria: all patients who did not show any laboratory signs of infection. Risk factors: chronic alcohol abuse medical diseases Lower mean arterial pressure, high body temperature and decreased sodium levels inappropriate oxygenation increased platelet count and longer time of use of tracheal tubes, catheters	The incidence of nosocomial infection in study was 19.1% the most common pathogen being Acinetobacter baumanii The development of these infections favors patients admitted for medical diseases rather than surgical ones. Lower mean arterial pressure, high body temperature and decreased sodium levels on admission correlate with the presence of a nosocomial infection. The presence of inappropriate oxygenation and the increased platelet count should raise an alarm. A longer time of use of tracheal tubes, catheters may increase significantly the incidence of nosocomial infections.

3- Nosocomial infections in the intensive care unit: Incidence, risk factors, outcome and associated pathogens in a public tertiary teaching hospital of Eastern India	to determine the incidence of nosocomial infection, identify possible risk factors for these infections, to clarify the distribution of the causative pathogens and to evaluate the outcome of the infected patients in terms of length of ICU and hospital stay and mortality.	prospective observational study in the 12 bed combined medical and surgical ICU of a tertiary care medical college hospital between January 1 and June 30, 2012 242 patients staying for more than 48 h in the ICU were included in the study.	prospective observational study **Inclusion criteria:** patients staying for more than 48 h in the ICU **Risk factors:** Length of ICU stay, prior antimicrobial therapy ,antimicrobial therapy, antacid use, hypoalbuminemia, malnutrition, urinary catheterization, endotracheal intubation, re-intubation, tracheostomy, placement of nasogastric tube, mechanical ventilation, APACHE II score >13 and length of ICU stay	Intensive care unit acquired nosocomial infections were detected in 29 patients (11.98%) most frequently diagnosed nosocomial infection was nosocomial pneumonia (62.07%) Urinary tract infection was diagnosed in 8 (27.59%) central venous catheter related blood stream infection was detected in 3 (10.34%) patients the most commonly isolated organisms were Gram-negative Enterobacteriaceae followed closely by Pseudomonas species Length of ICU stay, prior antimicrobial therapy and urinary catheterization were found to be significant risk factors The acquisition of nosocomial infections in the ICU resulted in significantly increased length of ICU and hospital stay, but did not result in statistically significant increase in ICU or hospital mortality..

4- Incidence, Clinical Outcome and Risk Factors of Intensive Care Unit Infections in the Lagos University Teaching Hospital (LUTH), Lagos, Nigeria	To determine the prevalence, risk factors, clinical outcome and microbiological profile of hospital-acquired infections in the intensive care unit of a Nigerian tertiary hospital.	prospective cohort study, patients were recruited and followed up between September 2011 and July 2012 until they were either discharged from the ICU or died. Antimicrobial susceptibility testing of isolates was done using CLSI guidelines.	prospective cohort and observational study. Inclusion criteria: All patients that were>15 years of age whose surrogates gave informed written consent. Exclusion criteria: patients whose anticipated stay In the ICU would be less than 48 hours or those unwilling or whose surrogates did not give consent. Risk factors: -Use of antibiotic one month before hospital admission -Surgery one month before admission -Urethral catheterization -Endotracheal intubation -Location before admission	. Bloodstream infections (BSI) 49.0% (22/71) Staphylococcus aureus was the most common cause of BSIs, responsible for 18.2% of cases, and urinary tract infections (UTI) 35.6% (16/71 skin-soft tissue %)9.8(4 infections RTIs) 6.7 (% 3
5- Mortality among Patients with Nosocomial Infections in Tertiary Intensive Care Units of Sahloul Hospital, Sousse, Tunisia	to determine nosocomial infection-associated mortality in Tunisian intensive care units and identify its risk factors.	This study was conducted in the surgical ICU (SICU) with 26 beds and medical ICU (MICU) with 5 beds Study patients All patients hospitalized for more than 48 hours in the ICUs Between 1 July 2010 & 30 June 2011	Prospective cohort study Inclusion criteria: All patients hospitalized for more than 48 hours in the ICUs Exclusion criteria: patients with an ICU stay less than 48 hours and those who died following an infection upon admission to ICU. Risk factors : age, gender, SAPS II prior exposure to antimicrobials, admission diagnosis (trauma, surgical, medical), immunosuppression,	NI were identified in 67 pts Nosocomial bacteremia was the most frequent infection (86.6%) NI-associated mortality rate was 35.8% .

			infection upon admission to ICU, type of ICU and length stay in ICU, use of invasive devices (intubation and mechanical ventilation, central venous catheterization (CVC), urinary catheterization). .	
6- Epidemiology and characteristics of nosocomial infections in critically ill patients in a tertiary care Intensive Care Unit of Northern India	.to describe the epidemiology and characteristics of nosocomial infections in ICU including risk factors, causative microorganisms and the impact of such nosocomial infections on the ICU mortality, and length of stay.	.153 consecutively admitted patients in the seven bedded mixed medical-surgical ICU between July 2014 and December 2015.	a retrospective observational study of prospectively collected data Inclusion criteria: Patients whose length of stay in the ICU was more than 48 h Risk factors: duration of stay duration of mechanical ventilation duration of tracheal intubation and duration of urinary catheterization	87 pts had an ICU-acquired nosocomial infection (56.86%). The most common organism responsible for infection was Klebsiella pneumoniae (37%), and the most common infection was pneumonia (33%) Majority of the infections were due to pneumonia followed by UTIs and blood stream spread study found a high incidence of nosocomial infections in the ICU which did not affect overall ICU mortality
7- Device-associated infection rates, mortality, length of stay and bacterial resistance in intensive care units in Ecuador: International Nosocomial Infection	To report the results of the International Nosocomial Infection Control Consortium (INICC) study conducted in Quito, Ecuador.	prospective surveillance, cohort study made on all the patients admitted, between October 2013 and January 2015, to 2 adult medical/surgical ICUs from 2 medium-sized hospitals (1	prospective surveillance study	. The central line-associated bloodstream infection (CLABSI) rate was 6.5 per 1000 central line (CL)-days, the ventilator-associated pneumonia (VAP) rate was 44.3 per 1000 mechanical ventilator (MV)-

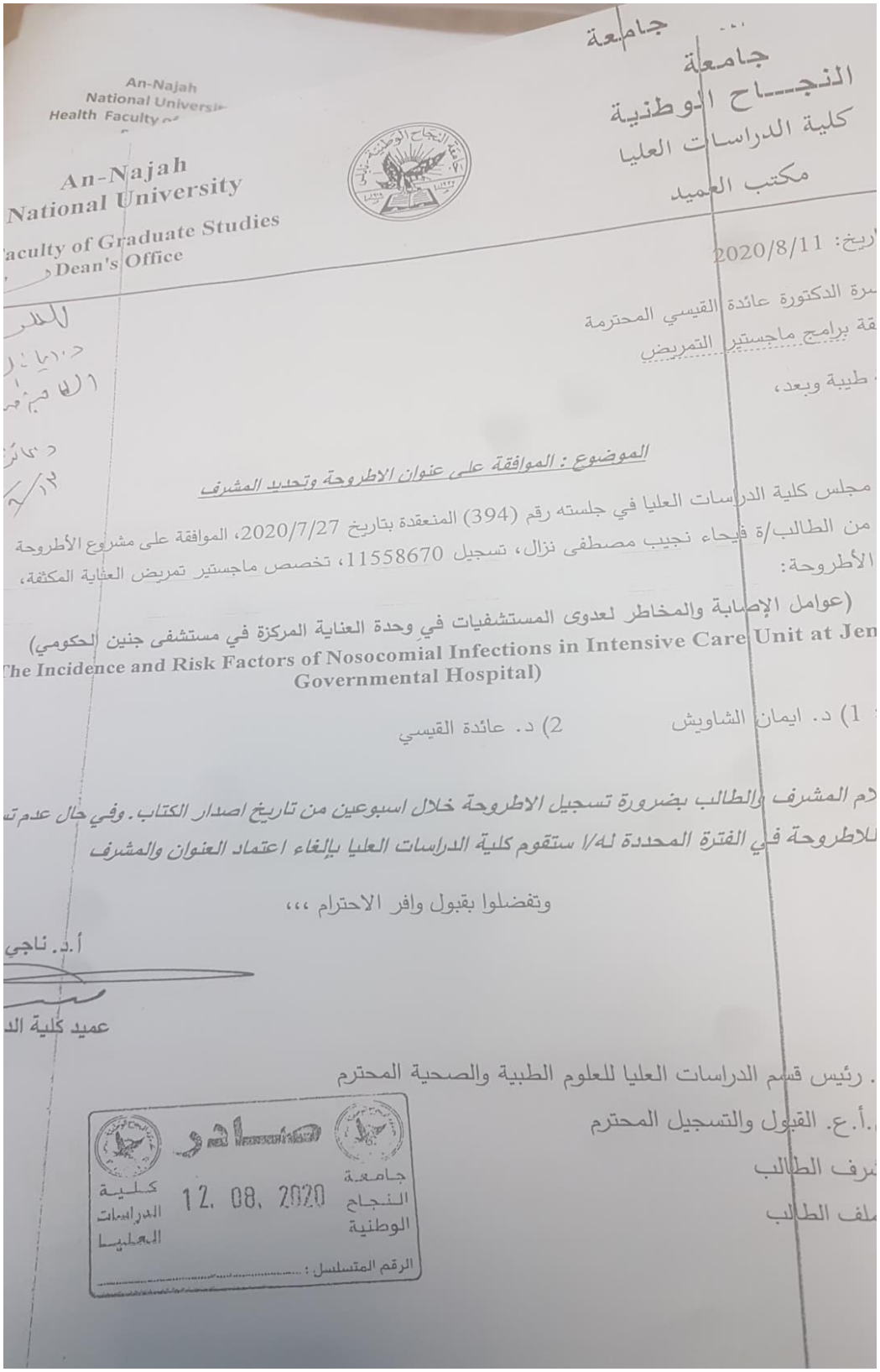
Control Consortium's findings		private and 1 public hospital) in Quito, Ecuador 776 patients were admitted to the 2 participating medical/surgical ICUs, for a total of 4818 bed days		days, and the catheter-associated urinary tract infection (CAUTI) rate was 5.7 per 1000 urinary catheter (UC)-days. CLABSI and CAUTI rates in our ICUs were similar to INICC rates [4.9 (CLABSI) and 5.3 (CAUTI)] and higher than NHSN rates [0.8 (CLABSI) and 1.3 (CAUTI)] - although device use ratios for CL and UC were higher than INICC and CDC/NSHN's ratios. Excess crude mortality in ICUs was 30.9% for CLABSI, 14.5% for VAP and 17.6% for CAUTI.
8-Incidence, Risk Factors, and Attributable Mortality of Secondary Infections in the Intensive Care Unit After Admission for Sepsis	To determine the incidence, risk factors, and attributable mortality of ICU acquired infections in patients admitted with sepsis. Additionally, in exploratory analyses, we sought to determine differences in the host response to the inciting sepsis event between patients who did and those who did not develop an	consecutive patients admitted from January 2011 to July 2013 with an ICU length of stay of more than 48 hours were selecte in the mixed ICUs of 2 tertiary teaching hospitals in the Netherlands	a prospective observational study Inclusion criteria: ,all consecutive patients admitted from January 2011toJuly 2013 with an ICU length of stay of more than 48 hours Exclusion criteria: .Patients with infection onset between 24 and 48 hours after ICU admission. Risk factors: Use of a central venouscatheter ,and mechanical ventilation	Intensive care unit–acquired infections occurred in 13.5% of sepsis ICU admissions (n = 232) and 15.1% of nonsepsis ICU admissions (n = 291) The population attributable mortality fraction of ICU-acquired infections in patients with sepsis was 10.9% without sepsis 21.1%

	ICU-acquired infection by analyses of the whole-genome transcriptome in blood leukocytes .The study also assessed the incidence and attributable mortality of ICU-acquired infections in critically ill patients admitted for noninfectious disease during the same study period.			
9-Nosocomial infections and risk factors in the intensive care unit of a teaching and research hospital	To Assess the etiology and risk factors of NIs in the ICU during a 1-year period	total 25-bed combined medical and surgical ICU of the Kartal Teaching and Research Hospital in Istanbul, Turkey. total of 450 patients. Infection surveillance was implemented for all patients staying longer than 48 hours in the ICU during the study period from January 1, 2008, to December 31, 2008 .Samples were cultured for isolation of bacteria using standard microbiological methods	prospective cohort study Inclusion criteria: patients who stayed >48 h in the ICU Exclusion criteria : Patients coming from ICUs of other hospitals or transferred to the ICU from another clinic in the same hospital, or staying less than 48 hours in the ICU Risk factors: Central venous catheterization, mechanical ventilation, tracheostomy and longer stay in ICU.	Of the 450 patients, only 115 patients acquired nosocomial infections .The incidence rate of nosocomial infections was 21.6 in 1000 patient-days, and the infection rate of NI was 25.6% The most frequent site of ICU-acquired NI in our study was the bloodstream %),36.3 9 49 ,(followed the respiratory system (41, 30.4%), the urinary tract (25, 18.5%), and catheter-related infection was diagnosed only in 10 patients, (7.4%)

10-Nursing Workload as a Risk Factor for Healthcare Associated Infections in ICU	to evaluate the role of nursing workload in the occurrence of HAI in medical intensive care units, using a specific scoring system	All the patients aged 12 years or more admitted to these units were included in the study during the period from May 25, 2009 to August 25, 2009 in 3 Medical ICU The patients were followed-up until a HAI occurred,	Prospective Cohort study Inclusion criteria: All the patients aged 12 years or more admitted to these units Risk factors : -Excessive nursing workload -Severity of clinical condition -invasive devices.	195 patients were included and 43 (22%) developed HAI: 16 pneumonia, 12 urinary-tract, 8 bloodstream, 2 surgical site, 2 other respiratory infections and 3 other. . excessive workload was the most important risk factor for HAI when evaluated together with other invasive devices-
11-Nosocomial Infections in Intensive Care Unit: Pattern of Antibiotic-resistance in Iranian Community	to determine bacterial prevalence of nosocomial infections and also the pattern of antibiotic-resistance of the most prevalent germs in ICUs of our local are.	All patients hospitalized in the ICU of Alzahra Hospital (referral hospital of Isfahan, center of Iran) during the years 2007–2010 who were complicated by nosocomial infections were included into the study.. A questionnaire was fulfilled for any specific patient with nosocomial infection	Retrospective study Inclusion criteria: All patients hospitalized in the ICU of Alzahra Hospital (referral hospital of Isfahan, center of Iran) during the years 2007–2010 who were complicated by nosocomial infections Risk factors: Kind of surgery and duration of hospitalization	. Our data revealed that Pseudomonas aeruginosa (13.9%), Klebsiella (11%), and Escherichia coli (6.4%) were the most prevalent bacterial infections. The most common sites of nosocomial infections in the ICU were respiratory system (399 cases, 37%), urinary system (230 cases, 21.4%), and blood (102 cases, 9.5%)
12-Nosocomial Infection in an Intensive Care Unit in a Brazilian University Hospital	to determine the nosocomial infection (NI) incidence in an Intensive Care Unit (ICU), its association with clinical characteristics and occurrence sites	This prospective study	It was carried out among 1.886 patients admitted in an ICU of a University Hospital, from August 2005 to January 2008. Inclusion criteria: all the patients who were admitted in the ICU Exclusion criteria:	There were 246 NIs (20.3%). The infections Urinary infection was the commonest type of NI with 144 (37.6%) cases, followed by pneumonia (n=98; 25.6%), sepsis (n= 58; 15.1%),

			uncompleted medical records Risk factors: length-of-stay for more than four days the episode of community infection, the colonization by resistant microorganisms, and the use of invasive devices	surgical site (n=54; 14.1%) and others (n=29; 7.7%) (vascular, eye, ear, mouth, nose and throat, skin, reproductive and gastrointestinal systems) Hospitalization average was 19.3 days for patients with NI and 20.2 days for those with colonization by resistant microorganisms. The mortality was 39.5% among patients with NI.(

Appendix 2



جامعة النجاح الوطنية
كلية الدراسات العليا
مكتب العميد

An-Najah National University
Faculty of Graduate Studies
Dean's Office

التاريخ: 2020/8/11

سرة الدكتورة عائدة القيسي المحترمة
قة برامج ماجستير التمريض

طيبة وبعد،

الموضوع : الموافقة على عنوان الاطروحة وتحديد المشرف

مجلس كلية الدراسات العليا في جلسته رقم (394) المنعقدة بتاريخ 2020/7/27، الموافقة على مشروع الأطروحة من الطالب/ة فيحاء نجيب مصطفى نزال، تسجيل 11558670، تخصص ماجستير تمريض العناية المكثفة، الأطروحة:

(عوامل الإصابة والمخاطر لعدوى المستشفيات في وحدة العناية المركزة في مستشفى جنين الحكومي)
The Incidence and Risk Factors of Nosocomial Infections in Intensive Care Unit at Jen Governmental Hospital)

1) د. ايمان الشاويش 2) د. عائدة القيسي

لام المشرف والطالب بضرورة تسجيل الاطروحة خلال اسبوعين من تاريخ اصدار الكتاب. وفي حال عدم ت للاطروحة في الفترة المحددة له/ا ستقوم كلية الدراسات العليا بالغاء اعتماد العنوان والمشرف

وتفضلوا بقبول وافر الاحترام ،،،

أ.د. ناجي

عميد كلية الد

. رئيس قسم الدراسات العليا للعلوم الطبية والصحية المحترم
.أ.ع. القبول والتسجيل المحترم
شرف الطالب
ملف الطالب

صادر
12. 08. 2020
جامعة النجاح الوطنية
كلية الدراسات العليا
الرقم المتسلسل :

Appendix 3

نموذج الموافقة

حالات الإصابة وخطر الإصابة بالتهابات المستشفيات في وحدة العناية المركزة في مستشفى جنين الحكومي سيتم شرح محتويات نموذج الموافقة للمرضى باللغة التي يفهمونها بشكل أفضل.

أنا الممرضة فيحاء نزال ممرضة في قسم العناية المركزة في مستشفى جنين الحكومي. أقوم بإجراء موضوع البحث المذكور أعلاه (الذي أقرته لجنة البحوث والأخلاقيات) لاستقصاء أسباب العدوى في وحدة العناية المركزة في المستشفى، وكذلك كيفية تأثير هذه العدوى على المرضى الذين تم قبولهم من حيث الإقامة في المستشفى والتعافي.

خلال هذا التمرين، سأطلب منك أن تخبرني لماذا أتيت إلى المستشفى والأدوية التي تتناولها. يمكن أخذ عينات من الدم (5–10 ملل) والبول ومسحة الجرح والبلغم منك، في اليوم الأول عند الدخول وبعد 48 ساعة. عملية أخذ العينة لن تسبب لك أي ألم أو إصابة إضافية لأن الاختبارات ستشكل التحقيقات الروتينية اللازمة لعلاجك. أكثر من ذلك، لن تكون هناك حاجة لدفع ثمن الاختبارات.

اضافة الى ذلك ستبقى المعلومات التي تقدمها سرية للغاية وستكون مفيدة للقسم ولتحسين العلاج للمرضى الذين يعانون من حالات مماثلة.

أنت حر في رفض المشاركة في هذه الدراسة و لديك الحق في الانسحاب في أي وقت إذا اخترت ذلك، ولن يتم المساس بجودة الرعاية التي تتلقاها بأي شكل من الأشكال.

الممرضة: فيحاء نزال الهاتف:0562402089/ 0597266249

التوقيع

.....

اوافق على المشاركة في البحث.

.....

توقيع المريض /المرافق

.....

Appendix 4

Data sheet

Intensive Care Unit Infections in Jenin Governmental Hospital,

1- PATIENT'S DETAILS:

A- Study number _____

B- Hosp number _____

C- Date _____

D- Age (years) _____

E- Gender: male ◇ female ◇

2- CLINICAL DETAILS:

A- Date of admission _____

B- Indication (diagnosis) for admission _____

C- Location before ICU admission ◇ Home ◇ Hospital

◇ Other hospitals

If referred from hospital;

which ward in the hospital? _____

Nasal swab _____ Rectal swab _____

D- Prior use of antibiotic before admission ◇ No ◇ Yes

D1- If yes; names ◇ amikacin ◇ cefotaxime ◇ ceftriaxone

Ceftazidime ◇ cefepime ◇ cefuroxime ◇

Ciprofloxacin ◇ cloxacillin ◇ co-amoxiclav ◇

Meropenem ◇ trimethoprim-sulphamethoxazole ◇

Any other (specify) ◇ _____

D2- Route of administration ◇ oral ◇ parenteral

D3- Duration of administration (days) _____

E- Culture & sensitivity prior to admission: Yes

No

E1- Was culture sample taken before giving antibiotics: Yes or No

E2- What organism was isolated? _____

E3- What was the sensitivity profile? _____

Antibiotic	**Sensitive Yes 0r No**
Imepinenem/Meropenem	
Piperacillin & Tazobactam	
Ceftriaxone	
Cefotaxime	
Cefuroxime	
Ceftazidime	
Ciprofloxacin	
Ampicillin	
Gentamicin	

F- Infectious disease type diagnosed in ICU _____

F1- Site of infection in ICU _____

G1- Date of specimen collection _____

G2- Causative agent of the diagnosed infectious disease _____

G- Length of days in I CU before infections was diagnosed _____

3- ANTIMICROBIAL DETAILS:

A- Antibiotic administration during ICU admission ◇No ◇ Yes

A1- If yes; names◇ amikacin◇ cefotaxime ◇ ceftriaxone

Ceftazidime ◇ cefepime ◇ cefuroxime ◇

Ciprofloxacin◇ cloxacillin ◇ co-amoxicla◇

Meropenem ◇ trimethoprim-sulphamethoxazole ◇

Any other (specify) ◇ _____

A2- Route of administration ◇ oral ◇ parenteral

A3- Duration of administration (days) _____

sensitivity profile

S:sensitive

R:resistance

Blood organism	**Isolate sensitivity**		**Isolate sensitivity**	
Antibiotic	**1st S or R**	**2nd S or R**	**3rd S or R**	**4th S or R**
Amikacin				
Augmentin				
Ampicillin				
Cefoxitin				
Cefotaxime				
Cefuroxime				
Ceftazidime				
Ceftriaxone				
Cefepime				
Ciprofloxacin				
Chloramphenicol				
Co-trimoxazole				

Erythromycin				
Oxacillin				
Tetracycline				
Penicillin G				
Gentamicin				
Imepenem				
Piperacillin Tazobactam				
Meropenem				
Vancomycin				
Urine organism	**Isolate sensitivity**		**Isolate sensitivity**	
Antibiotic	**1st S or R**	**2nd S or R**	**3rd S or R**	**4th S or R**
Amikacin				
Augmentin				
Ampicillin				
Cefotaxime				
Cefuroxime				
Ceftazidime				
Ceftriaxone				
Cefepime				
Ciprofloxacin				
6Chloramphenicol				
Co-trimoxazole				
Erythromycin				
Oxacillin				
Tetracycline				
Penicillin G				
Gentamicin				
Imepenem				
Piperacillin Tazobactam				
Meropenem				
Vancomycin				

Sensitivity profile

Tracheal organism	**Isolate sensitivity**		**Isolate sensitivity**	
Antibiotic	**1st S or R**	**2nd S or R**	**3rd S or R**	**4th S or R**
Amikacin				
Augmentin				
Ampicillin				
Cefotaxime				
Cefuroxime				
Ceftazidime				
Ceftriaxone				
Cefepime				
Ciprofloxacin				
Chloramphenicol				
Co-trimoxazole				
Erythromycin				
Oxacillin				
Tetracycline				
Penicillin G				
Gentamicin				
Imepenem				
Piperacillin Tazobactam				
Meropenem				
Vancomycin				

Swab organism	**Isolate sensitivity**		**Isolate sensitivity**	
Antibiotic	**1st S or R**	**2nd S or R**	**3rd S or R**	**4th S or R**
Amikacin				
Augmentin				
Ampicillin				
Cefotaxime				
Cefuroxime				
Ceftazidime				
Ceftriaxone				
Cefepime				

Ciprofloxacin				
Chloramphenicol				
Co-trimoxazole				
Erythromycin				
Oxacillin				
Tetracycline				
Penicillin G				
Gentamicin				
Imepenem				
Piperacillin Tazobactam				
Meropenem				
Vancomycin				

Is the patient on ventilator support: Yes or No

Possible risk factors :if patient has any risk press ◇

◇ Immunosuppression ◇ Surgery ◇ Chronic renal failure

◇ Chronic lung disease ◇ Neutropenia ◇ Dialysis

◇ Malignancy ◇ Diabetes mellitus ◇ Long term steroid use

◇ Endotracheal tube use ◇ Drainage catheters ◇ TPN Urethral

◇ catheters use ◇ Central venous catheters

◇ Gastrostomy ◇ Nasogastric tube ◇ Tracheostomy

◇ H2 antagonist/PPIs drug ◇ Alcoholic abuse

4- OUTCOME DETAILS:

Total duration of ICU stay (days) _____

Duration of ICU stay after acquisition of ICU infection (days):

≤5 ◇ ≤ 10 ◇ ≤ 15 ◇ 20 ≤ ◇

Outcome: ◇ discharged ◇ died

Date of death or discharge from ICU _____

ACUTE PHYSIOLOGICAL AND CHRONIC HEALTH EVALUATION (APACHE II) SCORE

1. Age (years)

<44	0
45-54	2
55-64	3
65-74	5
>74	6

2. History of severe organ insufficiency or immunocompromised?

Yes, and non-operative or emergency post-operative patient	5
Yes, and elective post-operative patient	2
No	0

3. Temperature (Celsius)

>40.9	4
39-40.9	3
38.5-38.9	1
36-38.4	0
34-35.9	1
32-33.9	2
30-31.9	3
<30	4

4. Mean arterial pressure (mmHg)

>159	4
130-159	3
110-129	2
70-109	0
50-69	2
<50	4

5. Heart rate

>179	4
140-179	3
110-139	2
70-109	0
55-69	2
40-54	3
<40	4

6. Respiratory rate (Non-ventilated or ventilated)

>49	4
35-49	3
25-34	1
12-24	0
10-11	1
6-9	2
<6	4

7. Oxygenation (Use PaO_2 if FiO_2 <50%, otherwise use A-a gradient)	
A-a grad >499	4
A-a grad 350-499	3
A-a grad 200-349	2
A-a grad <200 (if FiO_2 >49%) or PO_2 >70 (if FiO_2 <50%)	0
pO_2 =61-70	1
pO_2 =55-60	3
pO_2 <55	4
8. Arterial pH	
>7.69	4
7.60-7.69	3
7.50-7.59	1
7.33-7.49	0
7.25-7.32	2
7.15-7.24	3
<7.15	4
9. Serum Sodium (mMol/L)	
>179	4
160-179	3
155-159	2
150-154	1
130-149	0
120-129	2
111-119	3
<111	4
10. Serum Potassium (mMol/L)	
>6.9	4
6-6.9	3
5.5-5.9	1
3.5-5.4	0
3-3.4	1
2.5-2.9	2
<2.5	4
11. Serum Creatinine (mg/100mL)	
>3.4 and Acute renal failure	8
2-3.4 and Acute renal failure	6
>3.4 and Chronic	4
1.5-1.9 and Acute renal failure	4
2-3.4 and Chronic	3
1.5-1.9 and Chronic	2
0.6-1.4	0
<0.6	2
12. Haematocrit (%)	
>59.9	4
50-59.9	2
46-49.9	1
30-45.9	0
20-29.9	2
<20	4

13. White blood count (Total/mm^3 in 1000's)

>39.9	4
20-39.9	2
15-19.9	1
3-14.4	0
1-2.9	2
<1.0	4

14. 15 minus Glasgow coma scale ( )

TOTAL SCORE _____

Appendix 5

State of Palestine
Ministry of Health - Nablus
General Directorate of Education in Health

دولة فلسطين
وزارة الصحة– نابلس
الإدارة العامة للتعليم الصحي

Ref.: ....
Date:..................

الرقـــم: عحا/١٠٩٥/٢٠٢٠
التـاريخ: ٨/٩/٢٠٢٠

الأخ مدير عام الادارة العامة للمستشفيات المحترم،،،

تحية واحترام،،،

<u>الموضــوع: تسهيل مهمة بحث</u>

لاحقاً لموافقة معالي وزيرة الصحة، يرجى تسهيل مهمة الطالبة: **فيحاء نجيب نزال، برنامج ماجستير تمريض العناية المكثفة، جامعة النجاح**، لاجراء بحث رسالة الماجستير بعنوان:

" The Incidence and Risk Factors of Nosocomial Infections in Intensive Care Unit at Jenin Governmental Hospital"

حيث ستقوم الباحثة بجمع المعلومات من ملفات المرضى ومن غرف العناية المكثفة، وتعبئة استبانة الدراسة، مع العلم ان مشرفة الدراسة: د. ايمان الشاويش، وذلك في:

- **مستشفى جنين**

حيث سيتم الالتزام بأساليب واخلاقيات البحث العلمي.

وتقبلوا فائق الاحترام،،،

د. أمل ابو عوض
مدير عام التعليم الصحي

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جامعة النجاح الوطنية

كليه الدراسات العليا

عوامل الإصابة والمخاطر لعدوى المستشفيات في وحدة العناية المركزة في مستشفى جنين الحكومي

إعداد

فيحاء نزال

إشراف

د. إيمان الشاويش

قدمت هذه الأطروحة استكمالا لمتطلبات الحصول علي درجه الماجستير في برنامج تمريض العناية المكثفة، من كلية الدراسات العليا، في جامعة النجاح الوطنية، نابلس– فلسطين.

2021

عوامل الإصابة والمخاطر لعدوى المستشفيات في وحدة العناية المركزة في مستشفى جنين الحكومي

اعداد

فيحاء نزال

اشراف

د. إيمان الشاويش

الملخص

مقدمه: تُعرف العدوى المكتسبة عندما يخضع المريض للعلاج في منشأة للرعاية الصحية باسم عدوى المستشفيات. إنها مشكلة صحية عالمية مع ارتفاع معدلات الإصابة ومعدلات الوفيات المرتفعة المرتبطة بالعدوى ومضاعفاتها.

هدف الدراسة :تهدف هذه الدراسة الى تحديد مدى حدوث عدوى المستشفيات، وتحديد عوامل الخطر المحتملة لهذه العدوى، وتوضيح توزيع مسببات الأمراض وتقييم نتائج المرضى المصابين من حيث مدة الإقامة في وحدة العناية المركزة والوفيات.

تصميم الدراسة وطريقتها: تم استخدام دراسة رصدية مستقبلية أجريت منذ أغسطس 2020- ديسمبر 2020 في وحدة العناية المركزة بمستشفى جنين الحكومي. تم تضمين 80 مريضا يقيمون لأكثر من 48 ساعة في وحدة العناية المركزة في الدراسة. تمت ملاحظة الخصائص الوبائية للمرضى، والثقافات، وتحديد العزلات واختبارات الحساسية للمضادات الحيوية بناءً على الطرق الميكروبيولوجية القياسية، والإجراءات الغازية وعوامل الخطر الأخرى، كما لوحظت نتائج المرضى المصابين من حيث مدة الإقامة في وحدة العناية المركزة والوفيات.

النتائج: كانت نسبة الإصابة بعدوى المستشفيات في دراستنا 54.7٪ من 44 (55٪) من المرضى المصابين الذين طوروا عدوى المستشفيات و36 (45٪) غير مصابين.

فيما يتعلق بنوع الأمراض المعدية التي تم تشخيصها في وحدة العناية المركزة لدينا، كان 42.2٪ من المرضى في العينة لديهم نوع عدوى المسالك البولية خاصة التهاب المسالك البولية المصاحب للقسطرة (CAUTI)، و38.6٪ لديهم نوع عدوى الجهاز التنفسي خاصة الالتهاب الرئوي المصاحب للتنبيب (IAP)، و20.5٪ لديهم نوع عدوى مجرى الدم الذي كان 13.6٪ (CLBSI) عدوى مجرى الدم المرتبطة بالخط المركزي و6.8٪ مصابون بالنوع (تسمم الدم)، 15.9٪ مصابون بنوع عدوى الموقع الجراحي (SSI) ومريض واحد فقط لديه عدوى أخرى. كانت البكتيريا سالبة الجرام هي أكثر الممرضات المعزولة شيوعاً، وخاصةً الالتهاب الرئوي Klebsiella حيث كانت نسبة 43.2٪ من أهم العوامل المسببة للأمراض المعدية التي تم تشخيصها. تم تحديد داء السكري واستخدام الأنبوب الرغامي والأنبوب الأنفي المعدي وفغر القصبة الهوائية كعوامل خطر مستقلة لتطوير عدوى المستشفيات. بالإضافة إلى ذلك، كانت درجة علم وظائف الأعضاء الحادة وتقييم الصحة المزمنة (APACHE II)، وطول مدة الإقامة في وحدة العناية المركزة (تم العثور عليها مرتفعة في مجموعة عدوى المستشفيات. كانت نسبة وفيات المرضى الذين طوروا عدوى المستشفيات أعلى بنسبة 50٪ من المجموعة غير المصابة بنسبة 25٪.

الخاتمة والتوصيات: يجب النظر في خطوات مكافحة العدوى لتقليل هذه الأعداد بسبب ارتفاع معدل الإصابة بـ عدوى المستشفيات والمقاومة واسعة النطاق بين أنواع العزلات في العينة. يجب استخدام المضادات الحيوية بحكمة لتقليل مقاومة المضادات الحيوية في مسببات الأمراض البكتيرية. تم زيادة مراضة المرضى في المستشفى بسبب التهابات المستشفيات. في جلستنا، يمكن استخدام هذه النتائج لإعداد برنامج مراقبة عدوى المستشفيات.