THE EVIDENCE-BASED PRACTICE: ELECTRONIC SMART DEVICE SURVEILLANCE FOR SUSPECTED NOSOCOMIAL INFECTION AND ITS PATIENTS' OUTCOMES

Rasmia I. Abdalla[1], Mervat A. Abdel-Aziz[2], Amany O. Mohamed[3]
[1]Specialist Nursing – Infection Control Unit, Assuit University, Egypt.
[2]Professor - Critical Care and Emergency Nursing, Faculty of Nursing, Assuit University, Egypt.
[3]Professor – Chest Disease Medicine, Faculty of Medicine, Assuit University, Egypt.

Background: Infection surveillance is one of the cornerstones of infection prevention and control. Surveillance for healthcare-associated infections (HAIs) contains many of the elements as systematic observation and data collection, consolidation, and dissemination of the data with evaluation for temporal changes. **Aim:** The study designed to evaluate the evidence-based practice: electronic smart device surveillance for suspected nosocomial infection and its patients, outcomes. **Design**: Quasi-experimental research design utilized in this study. **Setting:** The study carried out in trauma and chest intensive care units (ICUs) at Assiut university hospital, Egypt. **Subjects**: The study comprised evaluation of 112 patients in intensive care units participated by electronic smart device surveillance. **Tools:** three tools utilized to collect data for the study: **Tool I**: Patient assessment sheet, **Tool II:** Smart device surveillance, and **Tool III:** Patient outcomes. **Methods**: the study conducted throughout three main phases, preparatory phase, implementation phase and evaluation phase. **Results** The current study revealed that there was; the infection type reported from device surveillance are pneumonia, blood stream infection (BSI), urinary tract infection (UTI), and surgical site infection (SSI) was (49.1, 39.2%,31.2%, and 3.5% respectively). (36.3%) Klebsiella was the most common organism causing CLABSI, and (16.3%) of E-coli, Klebsiella, and Acinetobacter for the pathogen from pneumonia. **Conclusion**: Based on findings of the current study, it can be concluded that the highest outcome for infection type of the patients died for pneumonia, blood stream infection (BSI), and urinary tract infection (UTI), were (65.4, 50, and 54.2, % respectively). **Recommendation**: continuing educational programs of nurses' performance for any electronic devices.

Key wards: evidence-based practice- surveillance- nosocomial infection - outcomes

Introduction

Nowadays, hospital acquired infections (HAIs) are regarded a major public health problem because of their high impact on the morbidity, mortality and quality of life of patients, as well as the financial burden on health services. According to the World Health Organization (WHO) has recognized HAIs as a global challenge in need of action and preventive measures as a priority. In order to accomblish these goals, collaborative efforts to improve patient care outcomes, enhance performance of healthcare system, and develop work teams to establish a patient safety culture are required. **(Paula T., et al., 2023)**

Healthcare-associated infections (HAIs) are related to the use of invasive devices such as a central lines, which can result in central line-associated bloodstream infection (CLABSI), Foley

catheters, which can cause catheter-associated urinary tract infection (CAUTI), and ventilators which can result in ventilator-associated pneumonia (VAP) and ventilator-associated events (VAE). However, additional HAIs are iatrogenic but non-device associated, including bloodstream infections (BSI), urinary tract infections (UTI), and pneumonia; or procedure-related, including surgical site infections (SSI), and other HAIs are connected to the dialysis procedures. **(National competitiveness center, 2024)**

Evidence-based practices are observed as a technique to providing health care that is more actual and important in healthcare settings. Nosocomial infection is an infection that appear from 48 to 72 hours after admission to supplementary healthcare settings. **(Riaz, S., et al., 2023)**

Infection surveillance is one of the cornerstones of infection prevention and control. Surveillance for healthcare-associated infections (HAIs) contains multiple elements such as systematic observation and data collection, consolidation, and dissemination of the data with evaluation for temporal changes. Surveillance is core functions of infection prevention and control (IPC), facilitating the assessment of compliance with process measures, involving hand hygiene and adherence to standard and transmission-based precautions, as well as the assessment of outcome measures, such as HAIs. (**Shenoy E.S., and Branch-Elliman W., 2023)**

Aim of the study

The aim of the study is to evaluate the evidence-based practice: electronic smart device surveillance for suspected nosocomial infection and its patients, outcomes.

Significance of the Study

Device-associated health care–associated infections (DA-HAIs) impact the quality of health care result in increased morbidity, mortality, and additional costs for patient care provision. DA-HAIs pose a severe threat to patients, despite prevention efforts that have resulted in a significant decrease incidence of infections**. (Fagan ,2016 and Iordanou et al., 2017)**

The Incidence of ICU-acquired infections per 1000 patient days in Assiut university hospitals in the Main hospital, from 01 January 2023 to 30 December 2023 according to Supreme council of universities in the chest ICU was (3.62%) including BSIs (1.81%), pneumonia (0.18%), and UTIs (1.63%), but incidence of Device-associated Infections per 1000 Device Days in the trauma ICU was (10.71%) including BSIs (6.15%), pneumonia (0.59%), and UTIs (3.97%). **(Supreme Council of University Hospitals, 2024)**

Significant increases in the national standardized infection ratios (SIRs) for central-line-associated blood stream infections (CLABSIs) (47.0%), catheter-associated urinary tract infections (CAUTIs) (18.8%), ventilator-associated events (VAEs) (44.8%), and MRSA bacteremia (33.8%) were observed in the last quarter of 2020. **(Geffers C., et al. 2022)**

Subjects and methods:

Study Design

Quasi-experimental research design was conducted over a fourteen-month period to comprehensively to suspected nosocomial infection and its patients, outcomes by electronic smart device surveillance. This design allowed the researcher to applied smart device surveillance on intensive care units.

Acta Biomed 2025; Vol. 96, N. 1: ISSN: 0392-4203 | eISSN: 2531-6745

Setting:

The study was conducted across the intensive care units of chest and trauma at Assiut University Hospital, Egypt, over a fourteen -month period (march 2023 and ending at the end of May 2024). The trauma intensive care unit of the hospital contains 17 beds. The patient \ nurses' ratio of the unit is 1:1. The numbers of patients are admitted to the trauma ICU every year are 160 patients (Assiut university hospital records). But the chest intensive care unit of the hospital contains 20 beds. The patient \ nurses' ratio of the unit is 2:1 and 3:1. The numbers of patients are admitted to the chest ICU every year are 150 patients. **(Assiut university hospital records)**

Participants

Sampling:

The current study enrolled a sample of 112 newly admitted critically ill patients' male and female in the intensive care units at Assuit university hospitals. The sample recruited for patients enrolled smart device surveillance was conducted by the researcher for the patients who suspect infection in the ICU.

Inclusion criteria will be:

-sex: both male and female.
-age: from 18:65 years old.
-patients with chest diseases, invasive and non-invasive mechanical ventilation, and trauma.
-recent admission to ICU.
-patients who suspect infection in the chest and trauma ICU who included in the surveillance.

data collection Tools:

Surveillance of device-associated, health care–associated infections (DA-HAI) is used according to National Safety Healthcare Network (NSHN), US Centers for central of disease Control (CDC) and Supreme council of universities, the Infection Control Team (ICT) under the Hospital Infection Control Committee (HICC).

three tools were utilized to collect data for this study:

Tool I: Patient assessment sheet: This tool was by researcher after review the relevant literatures adopted from **(Jasson et al., 2013)** to assess patient's status in ICU by Smart device surveillance. This tool includes three parts:

-part one: patient's demographic data such as age, sex, and marital status
- part two: APACHE II (Acute Physiology and Chronic health evaluation II) Score form Physiologic variables, this part was adopted from (**Radhakrishnan et al., 2021).**
- part three: hemodynamics status, this part contains two items assess vital signs, and Complete blood count. It was adopted from **(Dean H.F., 2020).**

Tool II: electronic smart device surveillance: It was adopted from **(Supreme council of universities, and Supreme IPC Committee, 2022)** which includes five parts:

-part one: admission details
-part two: infection type from electronic smart device surveillance

-part three: signs and symptoms for the type of suspected infection related to blood stream infection (BSI) and its investigation
-part four: signs and symptoms for the type of suspected infection related to pneumonia and its investigation
-part five: signs and symptoms for the type of suspected infection related to urinary tract infection and its investigation

Tool III: Patient outcomes.

Outcome of the patient from the Smart device surveillance is primary infection type, infection location, and outcome of this admission.

Methods

Preparatory phase: An Approval to conduct the study Official permission to conduct the study obtained from the hospital responsible authorities in the emergency medical unit after explaining the aim and the nature of the study. The tools used in this study were developed by the researcher based on reviewing the relevant literature.

Tools &reliability: The tools was tested for content of validity by jury of 5 experts in the field of critical care nursing and critical care medicine from a suit university hospital, the necessary modifications were done.

A pilot study will be conducted on ten percent (10%) of sample to test the feasibility, clarity and applicability of the tools and the time needed to collect the data (Cronbach's alpha = 0.87).

A validated questionnaire was distributed to determine suspected patients regarding electronic smart device surveillance.

Ethical considerations: -

•Research proposal was approved from Ethical Committee in the faculty of nursing.
• There was no risk for study subject during application of the study
• The study followed common ethical principles in clinical research.
• Written consent was obtained from patients or guidance that participated in the study, after explaining the nature and purpose of the study.
• Patient was assured that the data of this research was not be reused without second permission.
• Confidentiality and anonymity were assured.
• Patients had the right to refuse to participate or withdraw from the study without any rational at any time.

<u>Implementation phase</u>:

Implementation phase will involve the following:
1- The Smart device surveillance will be implemented in ICU; data will be collected and analyzed for patients' outcomes and its effect.
2-during implementation phase the researcher will assess the patient from the first day of admission until 7 days for 1st, 3rd, and 7th days every week in ICU by Smart device surveillance according to Supreme council of universities, and Supreme IPC Committee. three tools were used to collect data for this study as the following:

Tool I: Patient assessment sheet:

Acta Biomed 2025; Vol. 96, N. 1: ISSN: 0392-4203 | eISSN: 2531-6745

- patient's demographic data such as age, sex, and marital status
- APACHE II (Acute Physiology and Chronic health evaluation II) Score form Physiologic variables.
-hemodynamics status, this part contains two items assess vital signs as respiratory rate, heart rate, temperature, and Complete blood count as WBC_S.

Tool II: Smart device surveillance:

which include four items:

I-admission details as the name of the admitted ICU, diagnosis upon admitting to ICU, the patient undergo surgical operation, and insertion of a central venous line, a urinary catheter, and mechanical ventilator inserted at the onset of the signs and symptoms of the infection.

II- Infection type from electronic smart device surveillance

A-signs and symptoms for the type of suspected infection related to blood stream infection (BSI) and its investigation include the patient complain of fever >38Oc with no other known cause, hypotension, chills, and oliguria <20mL/hr. **Investigation results from device for BSI** include a blood culture withdrawn from the patient, and name of pathogens.

B-signs and symptoms for the type of suspected infection related to pneumonia and its investigation include the patient complain of fever >38^{o}c with no other known cause, new onset or worsening cough, change in character of sputum, increased respiratory secretions or increased suction requirements, bronchial breath sounds on chest auscultation, wheezing, rhonchi, dyspnea, worsening gas exchange, tachypnea, and underlying cardiac or pulmonary disease. **Investigation results for pneumonia include** there any radiological tests performed to the patient**,** the patient have 2 or more serial chest x rays, any (Bronchial-alveolar lavage) BAL samples withdrawn and name of pathogen

C-signs and symptoms for the type of suspected infection related to urinary tract infection and its investigation include the patient complain of fever >38^{o}c with no other known cause**,** dysuria, frequency**,** urgency**,** suprapubic tenderness**,** and cost vertebral angle pain or tenderness. **Investigation results for UTI include** a urine culture taken, and name of pathogens.

Evaluation phase: Outcome of the patient from the Smart device surveillance include:

-primary infection type as pneumonia 1, pneumonia 2, central line-associated bloodstream infection (CLABSI), symptomatic urinary tract infection (SUTI), and surgical site infection (SSI)
-infection location as on hospital admission, ICU Acquired infection, hospital acquired infection, and surgical site infection (SSI)due to operation
-outcome of this admission as died, discharge, and transferred

Statistical analysis:

The computer software application was used to enter the data. Date entry, data analysis and interpretation were done using, a statistical program for the social sciences (SPSS), and version 22. Mean (standard deviation) was used to describe quantitative variables and frequency (percentage) was used to assess qualitative variables. the Fisher exact test or the chi-square test for categorical variables. Independent samples test, and paired samples test tests were used to

demonstrate the relationship between the variables. P-value was considered statistically significant at $P < 0.05$.

Results

Results of the present study will demonstrate the evidence-based practice: electronic smart device surveillance for suspected nosocomial infection and its patients, outcomes. The numbers of cases in this study are 112 cases (56 cases for control and 56 cases for study groups). The study will be carried out in intensive care units of chest and trauma at Assuit university hospital.

Table (1): Percentage distribution of demographic data about the patients in intensive care units (N=112)

Demographic data	**(N = 112)**	
	No.	**%**
Age: (years)		
≤25	17	15.1%
26 – 35	34	30.3%
36 – 45	47	41.9%
> 45	14	12.5%
Sex:		
Male	70	62.5%
Female	42	37.5%
Marital status:		
Single	21	18.7%
Married	67	59.8%
Divorced	12	10.7%
Widowed	12	10.7%

Table (2): frequency distribution of APACHE II: (Acute Physiology and Chronic health evaluation II) for the patients in intensive care units (n=112)

APACHE II	**Control (N = 56)**	**Study (N = 56)**	**P-value[1]**
	Mean ± SD	**Mean ± SD**	
1st day	13.68 ± 4.24	13.89 ± 5.12	0.810
3rd day	13.82 ± 4.26	13.15 ± 5.70	0.487
7th day	13.62 ± 3.34	13.23 ± 5.53	0.672
P-value[2]	0.444	0.044*	

P>0.05 Is Not Significance Independent samples test and paired samples test

P-value1: Comparison between Control and Study P-value2: Comparison with 1st day in each group

Acta Biomed 2025; Vol. 96, N. 1: ISSN: 0392-4203 | eISSN: 2531-6745

Table (3): Percentage distribution of clinical data from electronic smart device surveillance about the patients in intensive care units (N. =112)

Clinical data	**N=112**	
	No.	**%**
Sitting:		
Chest ICU	56	50%
Trauma ICU	56	50%
Diagnosis:		
Chronic obstructive pulmonary disease (COPD)	16	13.1%
Pneumonia	41	36.3%
Respiratory Failure (RF)	31	27.6%
Disturbed conscious level (DCL)	31	27.6%
Accident	29	25.8%
(Sub Arachnoid hemorrhage or hematoma) SAH	9	8.03%

Table (4): Percentage distribution of infection type from device surveillance for the patients in intensive care units (N. =112)

Clinical finding	**N=112**	
	No.	**%**
Pneumonia	55	49.1%
Blood stream infection (BSI)	44	39.2%
Urinary tract infection (UTI)	35	31.2%
Surgical site infection (SSI)	4	3.5%

Table (5): Percentage distribution of signs and symptoms for the type of suspected infection related to blood stream infection (BSI) for the patients in intensive care units (N. =44)

Items	**(N =44)**	
	No.	**%**
fever > 38c		
1st day	28	63.6%
3rd day	35	79.5%
7th day	28	63.6%
Hypotension		
1st day	17	38.6%
3rd day	22	50%
7th day	16	36.3%
Chills		
1st day	22	50%
3rd day	26	50.09%

7th day	19	43.1%
oliguria <20mL/hr.		
1st day	9	20.4%
3rd day	6	13.6%
7th day	4	9.09%

Table (6): Percentage distribution of investigation results about blood Stream Infection "BSI" for the name of pathogen for the patients in intensive care units (N =44)

Name of pathogen	(N = 44)	
	No.	%
Klebsiella	16	36.3%
Acinetobacter	11	25%
Enterobacter	9	20.4%
Pseudomonas	3	6.8%
Staphylococcus	1	2.2%
Sphingomonas	1	2.2%
Acholeplasma	1	2.2%
Streptococcus	1	2.2%
Achromobacter	1	2.2%
Providencia	2	4.5%
Aeromonas encheleia	1	2.2%
Yeast	2	4.5%

Table (7): Percentage distribution of signs and symptoms the type of suspected infection related to pneumonia for the patients in intensive care units (N =55)

Items	N=55	
	No.	%
fever > 38oc		
1st day	46	83.6**%**
3rd day	51	92.2**%**
7th day	45	81.8**%**
Complain of new onset or worsening Cough		
1st day	40	72.7**%**
3rd day	43	78.1**%**
7th day	38	69.09**%**
new onset or change in character of sputum		
1st day	19	34.5**%**
3rd day	23	41.8**%**
7th day	23	41.8**%**
increased respiratory secretions or increased suction		
1st day	20	36.3**%**

Acta Biomed 2025; Vol. 96, N. 1: ISSN: 0392-4203 | eISSN: 2531-6745

3rd day	27	49.09%
7th day	27	49.09%
Crackles or bronchial breath sounds on chest auscultation		
1st day	39	70.9%
3rd day	44	80%
7th day	39	70.9%
Wheezing		
1st day	40	72.7%
3rd day	44	80%
7th day	39	70.9%
Rhonchi		
1st day	39	70.9%
3rd day	44	80%
7th day	38	69.09%
Dyspnea		
1st day	37	67.2%
3rd day	43	78.1%
7th day	39	70.9%
worsening gas exchange		
1st day	45	81.8%
3rd day	46	83.6%
7th day	40	72.7%
Tachypnea		
1st day	33	60%
3rd day	34	61.8%
7th day	28	50.9%
Underlying cardiac or pulmonary disease?		
1st day	3	5.4
3rd day	1	1.8
7th day	0	0

Table (8): Percentage distribution of investigation results from Smart device surveillance related to pneumonia for the patients in intensive care units (N =55)

Items	(N =55)	
	No.	%
Radiological tests	53	96.3
chest x rays	55	100
CBC or leukocytic count	54	98.1

leukopenia 400 WBC\mm or leukocytosis 15000 WBC\mm	52	94.5
Bronchial-alveolar lavage (BAL) samples	51	92.7

Table (9): Percentage distribution of investigation results about pneumonia for the name of pathogen for the patients in intensive care units (N =55)

Name of pathogen	(N = 55)	
	No.	%
E-coli	9	16.3
Klebsiella	9	16.3
Acinetobacter	9	16.3
Pseudomonas	7	12.7
Fungi	6	10.9
Enterobacter	5	9.09
Staphylococcus	5	9.09
Alpha-hemolytic streptococcus	1	1.81

Table (10): Percentage distribution of signs and symptoms the type of suspected infection related to urinary tract infection (UTI) for the patients in intensive care units (N =35)

Items	(N = 35)	
	No.	%
fever > 38oc		
1st day	25	71.4%
3rd day	32	91.4%
7th day	29	82.8%
Dysuria		
1st day	17	48.5%
3rd day	22	62.8%
7th day	20	57.1%
Frequency		
1st day	18	51.4%
3rd day	21	60%
7th day	19	54.2%
Urgency		
1st day	17	48.5%
3rd day	21	60%
7th day	19	54.2%
suprapubic tenderness		
1st day	17	48.5%
3rd day	21	60%
7th day	19	54.2%

Acta Biomed 2025; Vol. 96, N. 1: ISSN: 0392-4203 | eISSN: 2531-6745

cost vertebral angle pain or tenderness		
1st day	16	45.7%
3rd day	29	82.8%
7th day	18	51.4%

Table (11): Percentage distribution of investigation results about urinary tract infection (UTI) for the patients in intensive care units (n=35)

Items	**(N = 35)**	
	No.	**%**
Urine culture		
Yes	35	100.0%
3-Type of pathogen:		
Yeast	19	54.2
Klebsiella	7	20
Escherichia coli	4	11.4
Pseudomonas aurginosa	2	5.71
Fungi	2	5.71
Acholeplasma oculi	1	2.8
Achromobacter	1	2.8
Acintobacter	1	2.8
Aspergillus candidus	1	2.8
Klebsiella	1	2.8
Acinetobacter	1	2.8
Proteus	1	2.8
yersinia enterocolitica	1	2.8
Pseudomonas	1	2.8
Bacillus pseudomonas collides	1	2.8
Enterococcus faecium	1	2.8
Enteropathogenic	1	2.8

Table (12): Percentage distribution of infection type for the patients in intensive care units (n=112)

	N=112	
	No.	**%**
Primary infection type:		
Pneumonia 1	41	36.3%
Pneumonia 2	15	13.3%
central line-associated bloodstream infection (CLABSI)	38	33.9%
Symptomatic urinary tract infection (SUTI)	35	31.2%

surgical site infection (SSI)	4	3.5%
Device associated infections:		
catheter-associated urinary tract infection (CAUTI)	15	13.3%
central line-associated bloodstream infection (CLABSI)	17	15.1%
ventilator-associated pneumonia (VAP)	2	1.7%
Not related	77	68.7%
Infection location:		
On hospital admission	49	43.7%
ICU Acquired infection	39	34.8%
Hospital acquired infection	11	9.8%
surgical site infection (SSI)due to operation	3	2.6%

Table (13): Percentage distribution of outcome for infection type of the patients in intensive care units (n=112)

Outcome of this admission:	Pneumonia N=55		Blood stream infection (BSI) N=44		Urinary tract infection (UTI) N=35		Surgical site infection (SSI) N=4	
	No.	%	No.	%	No.	%	No.	%
Died	36	65.4	22	50	19	54.2	1	25
Discharge	10	18.1	10	22.7	11	31.4	1	25
Transferred	9	16.3	12	27.2	5	14.2	2	50

Table (14): frequency distribution of vital signs for the patients in intensive care units (n=112)

Vital signs	**Control (N = 56)**	**Study (N = 56)**	**P-value[1]**
	Mean + SD	**Mean + SD**	
RR:			
1st day	21.54 ± 6.84	22.27 ± 5.64	0.538
3rd day	22.04 ± 6.08	23.83 ± 5.36	0.106
P-value[2]	0.459	0.021*	
7th day	20.38 ± 5.08	23.30 ± 5.42	0.008*
P-value[2]	0.266	0.307	
HR:			
1st day	85.95 ± 16.85	93.36 ± 18.06	0.027*
3rd day	87.63 ± 13.67	98.11 ± 15.26	0.000*
P-value[2]	0.290	0.118	
7th day	86.85 ± 10.99	94.77 ± 18.27	0.012*
P-value[2]	0.368	0.778	
Temperature:			

Acta Biomed 2025; Vol. 96, N. 1: ISSN: 0392-4203 | eISSN: 2531-6745

1st day	37.46 ± 0.54	37.64 ± 0.93	0.202
3rd day	37.67 ± 0.67	37.94 ± 0.74	0.043*
P-value[2]	0.018*	0.041*	
7th day	37.69 ± 0.76	38.09 ± 0.94	0.026*
P-value[2]	0.035*	0.055	

P>0.05 Is Not Significance P<0.05 Is Significant P<0.001 Is Highly Significant
P-value1: Comparison between Control and Study P-value2: Comparison with 1st day in each group
Independent samples test and paired samples test

Table (15): frequency distribution of complete blood count (CBC) for the patients in intensive care units (n=112)

CBC	**Control (N= 56)**	**Study (N = 56)**	**P-value[1]**
	Mean + SD	**Mean + SD**	
WBCs:			
1st day	11.65 ± 5.79	16.06 ± 7.57	0.001*
3rd day	11.78 ± 6.39	15.44 ± 6.91	0.005*
P-value[2]	0.845	0.563	
7th day	11.76 ± 5.99	14.04 ± 6.64	0.082
P-value[2]	0.981	0.037*	

P>0.05 Is Not Significance P<0.05 Is Significant P<0.001 Is Highly Significant
P-value1: Comparison between Control and Study P-value2: Comparison with 1st day in each group
Independent samples test and paired samples test

Table (1) shows that (41.9%) are 36 – 45 years, (62.5%) are male and (59.8%) are married.

Table (2) that; there is significant statistical difference in APACHE II: (Acute Physiology and Chronic health evaluation II) for the patients in the 7th day in Comparison with 1st in each group with P-value (p<0.044*).

Table (3) shows that; half of patients from trauma and chest ICU, and (36.3, 25.8% respectively) of the patients have diagnosis of pneumonia and accident.

Table (4) shows that; the infection type reported from device surveillance are pneumonia, blood stream infection (BSI), urinary tract infection (UTI), and surgical site infection (SSI) was (49.1, 39.2%,31.2%, and 3.5% respectively).

Table (5) clarifies that; the signs and symptoms of the patients for fever > 38c, and chills in the third day (79.5 and 50.09% respectively) for the type of suspected infection related to blood stream infection (BSI).

Table (6) shows that; Klebsiella was the most common organism causing CLABSI, which Klebsiella, Acinetobacter, Enterobacter, and Pseudomonas with (36.3%, 25%, 20.4%, and 6.8% respectively)

Table (7) shows that; the signs and symptoms for the type of suspected patients related to pneumonia in the first day as regard items for fever > 38oc, cough, crackles, wheezing, rhonchi, dyspnea, gas exchange, and tachypnea with (83.6, 72.7, 70.9, 72.7, 70.9, 67.2, 81.8, and 60% respectively).
Table (8) shows that; all the patients done chest x rays (item 2) with percentage (100%).
Table (9) shows that; (16.3%) of E-coli, Klebsiella, and Acinetobacter for the investigation results about pneumonia for the name of pathogen for the patients in intensive care units.
Table (10) shows that; the signs and symptoms for the type of suspected patients related to UTI in the seven day as regard all items clarifies more than half of higher percentage.
Table (11) shows that; as regard collect urine culture for all patients and have pathogens, also (34.2%) is the higher percentage of Yeast.
Table (12) shows that; (36.3 and 33.9% respectively) for Primary infection type of pneumonia 1 and LCBSI, while (43.7, 34.8% respectively) the infection location on hospital admission and ICU Acquired infection.
Table (13) shows that; the highest outcome for infection type for the patients in intensive care units was died for pneumonia, blood stream infection (BSI), urinary tract infection (UTI) (65.4, 50, and 54.2% respectively) but for surgical site infection (SSI) was transferred (50%).
Table (14) shows that; there is significant statistical difference in vital signs for the patients in intensive care units in respiratory rate (RR) in 7th the day with P-value ($p<0.008$*). While heart rate (HR) is significant statistical difference in all days with P-value ($p<0.027$*,0.000*, and 0.012* respectively). Also, temperature is significant statistical difference in in 3rd and 7th the day with P-value ($p<0.043$*and 0.026* respectively).
Table (15) shows that; there is significant statistical difference in complete blood count (CBC) for the patients in intensive care units for WBCs in the 1st and 3rd day with P-value ($p<0.001$* and 0.005* respectively). Also, there is significant statistical difference in RBCs in 3th and 7th in Comparison with 1st day in each group with P-value ($p <0.000$*and $p <0.004$* respectively) and ($p<0.000$*and $p<0.012$*respectively).

Discussion

Intensive care units (ICUs) are a major component of the health care an environment that becomes created that is occupied by critically ill patients, surrounded by monitors, ventilators, and other sophisticated technologies, with a large number of staff members, and the involvement of consultants from multiple specialties. Critically ill patients are characterized by the presence of actual and/or potential life-threatening problems, requiring continuous observation, intervention, and an extraordinary dependence on health care providers and possibly technology. **(Schell et al., 2024)**

Device-associated infections (DAIs) like ventilator-associated pneumonia (VAP), central-line-associated bloodstream infections (CLABSI), and catheter-related urinary tract infection (CAUTI) constitute predominant healthcare-associated infections (HAIs) in intensive care units (ICUs). **(Kashyap B., and Jhamb R., 2021)**

Acta Biomed 2025; Vol. 96, N. 1: ISSN: 0392-4203 | eISSN: 2531-6745

The present study was applied to 112 patients admitted in trauma and chest intensive care units. This study aimed to evaluate the evidence-based practice: electronic smart device surveillance for suspected nosocomial infection and its patients, outcomes, through assessment of the patient demographic and clinical data, APACHE II (Acute Physiology and Chronic Health Evaluation II) Score, smart device surveillance, hemodynamics status assessment, and patient outcomes.

Regarding demographic and clinical data were reported 47 patients (36 – 45) years (41.9%), 70 males (62.5%), 42 females (37.5%), and 67 married (59.8%). The study supported by **(Iordanou et al., 2017),** Surveillance of device- associated infections and mortality in a major intensive care unit in the Republic of Cyprus, where the surveillance data were collected for 73 females (36.9%) & 125 males (63.1%) patients hospitalized in the ICU.

Concerning APACHE II (Acute Physiology and Chronic Health Evaluation II) for the patients in intensive care units. The study supported by **(Iordanou et al., 2017),** Surveillance of device-associated infections and mortality in a major intensive care unit in the Republic of Cyprus, found that the median APACHE II score for patients was 22 vs 25 and 49 vs 48, respectively. There was no significant difference between the two scoring systems or the Device-associated health care–associated infections (DA-HAIs) positive and negative groups.

Regarding the infection type from device surveillance for the number of patients for the present study, it illustrates that BSI (44), pneumonia (55), UTI (35), and SSI (4). According to earlier research, (Dramowski, 2017), who applied a study on the alternative surveillance methods performed variably for detecting the four main HAI types: hospital-acquired pneumonia (HAP) (n=185), urinary tract infection (UTI) (n=45), laboratory confirmed bloodstream infection (LC-BSI) (n=41), and SSI (n=20). Compared with the reference method, repeated PPS detected <30% of the four main HAI types other than SSI, whereas laboratory surveillance achieved the highest proportional detection rates for UTI, SSI, and LCBSI. Antimicrobial prescriptions achieved the highest detection rates for HAP. **Congruent with previous findings (Izadi N., et al., 2020),** who conducted their study to assess the rate of the incidence of hospital-acquired infections in Iran based on the data of the national nosocomial infections surveillance, the most frequent HAIs were UTI (26.83%), VAP (20.28%), SSI (19.73%), and BSI (13.51%)**.**

According to research finding regarding about bloodstream infection (BSI) for the name of pathogen for the patients in intensive care units, the current study show that a higher percentage of pathogens for the patients' bloodstream infection (BSI) is Klebsiella, Acinetobacter, Enterobacter, and Pseudomonas, with (36.3%, 25%, 20.4%, and 6.8% respectively). This is line with both **(Sellamuthu R, et al., 2023) and (Singhal T., et al., 2019),** Risk Factors of Central Line-Associated Bloodstream Infection (CLABSI): A Prospective Study from a Pediatric Intensive Care Unit in South India, and the incidence, a etiology and antibiotic susceptibility of central line-associated bloodstream infections in intensive care unit patients were found to Klebsiella pneumonia 5 (15.6%), Acinetobacter baumani 4 (12.5%), and Coagulase-negative staphylococc 4 (12.5%). Overall, it was identify that the most prevalent organism causing CLABSI was Klebsiella pneumonia. A similar view was reported by **(Apostolopoulou et al., 2013),** who carried out their

study to evaluate Surveillance of Device-Associated Infection Rates and Mortality in 3 Greek Intensive Care Units, whereas Acinetobacter baumannii (37.8%) and Klebsiella pneumoniae (34.8%) were more prevalent in CLABSI (n = 66).

Concerning investigation results about pneumonia for the name of the pathogen for the patients in intensive care units. According to the investigation's findings about pneumonia, the pathogens found in patients in intensive care units were 16.3% E. Coli, Klebsiella, and Acinetobacter. A similar viewpoint was reported by **(Apostolopoulou et al., 2013),** who carried out their study to assess Surveillance of Device-Associated Infection Rates and Mortality in three intensive care units in Greek, The major pathogens in the 3 Greek ICUs studied, both Klebsiella pneumoniae (23.5%) and Pseudomonas aeruginosa (22.6%) were common in patients with VAP (n = 115).

Regarding investigation results about urinary tract infection (UTI) for the patients in intensive care units, the actual study reported that the majority of CAUTIs were caused by yeast then Klebsiella**. Congruent with previous findings (Zakaria et al., 2022),** who carried out an interventional study to improve the emergency department catheter-associated urinary tract infection: evidence from a tertiary center, E. coli (n= 12, 22%), Enterococcus faecalis (n=8, 18%), and Pseudomonas aeruginosa (n=7, 13%) were responsible for the majority of CAUTIs. E. coli was responsible for up to 50% of nosocomial acquired UTIs, including catheter-associated urinary tract infections. Inconsistent with previous findings **(Apostolopoulou et al., 2013)**, who conducted their study in three Greek intensive care units to evaluate Surveillance of Device-Associated Infection Rates and Mortality in 3 Greek Intensive Care Units, patients with CAUTI (n = 24) had higher prevalence of Candida species (66.7%) and Acinetobacter baumannii (12.5%).

Regarding the outcome for infection type of the patients in intensive care units, there was the highest outcome for infection type was died from pneumonia, blood stream infection (BSI), urinary tract infection (UTI) (65.4, 50, and 54.2% respectively); however surgical site infection (SSI) was transfer (50%) and death (25%).The study supported by **(Duszynska et al., 2020),** who conducted their study to evaluate device- associated health care-associated infections monitoring, prevention, and cost assessment at the intensive care unit of the University Hospital in Poland, found that there is a significant increase in the mortality rate among infected patients (23.6%) with a P-value ($p<0.01$*). In agreement with previous results (**Reich N.E., et al., 2018),** who performed their study to assess barriers to clinical practice guidelines implementation for septic patients in the emergency department, the death rate of patients with SSI was 21.1% with a P-value ($p<0.0001$*).

In terms of vital signs of the patients in intensive care units, our study analysis revealed a significant statistical difference in vital signs for the patients in intensive care units in respiratory rate (RR) on 7th day with a P-value ($p<0.008$*). Heart Rate (HR)on the other hand, shows a significant statistical difference across all days with P-value ($p<0.027$*,0.000*, and 0.012* respectively). Additionally, the temperature on 3rd and 7th day have significantly different with P-value ($p<0.043$* and 0.026* respectively). This was stated with (**Abd EL Baky, 2014),** who carried out their study the effect of three standardized oral hygiene approaches on bacterial

Acta Biomed 2025; Vol. 96, N. 1: ISSN: 0392-4203 | eISSN: 2531-6745

colonization in mechanically ventilated patients, that the vital signs like temperature, pulse, and respiration, were highly significant with P-values (p<0.001, 0.003,0.001* respectively).

Limitations

-limited resources for personal protective equipment and for hand hygiene.

-limited number of nurses for the number of patients in the chest ICU.

-limited access to laboratory tests for culture.

-increase the rate of patients in the ICU.

-the workload and many efforts for nurses in the ICU

Conclusion

Based on the results of the present study, it can be concluded that:

-This study provides that the infection types reported from device surveillance are pneumonia, bloodstream infection (BSI), urinary tract infection (UTI), and surgical site infection (SSI), with percentage of 49.1, 39.2%,31.2%, and 3.5% respectively.

- The highest outcome for infection type of the patients in intensive care units died for pneumonia, bloodstream infection (BSI), and urinary tract infection (UTI), were (65.4, 50, and 54.2% respectively), but 50% surgical site infection (SSIs) was transferred.

Recommendation

Finally, in Assiut University Hospital, there is a lack of nursing personnel and professionals and resources for application. Indeed, Nurses must perform all appropriate preventative evidence-based practice interventions to fulfill these roles; nurses must be well educated on the preventative strategies and be able to putting that knowledge into performance.

References

Abd EL Baky M.M, Youssef A.I, El-Soussi H.A., Abd El- Aziz A.M., (2014), effect of three standardized oral hygiene approaches on bacterial colonization in mechanically ventilated patients, doctoral degree in critical care nursing, Assiut university, page 66-86.

Apostolopoulou E., asilios Raftopoulos V., Filntisis G., Kithreotis P., Stefanidis E., Galanis P., and Veldekis D., (May 2013), Surveillance of Device-Associated Infection Rates and Mortality in 3 Greek Intensive Care Units, AJCC (American Journal of Critical Care), Volume 22, No. 3

doi:http://dx.doi.org/10.4037/ajcc2013324 http://ajcc.aacnjournals.org.

Dramowski A., Cotton M. F., Whitelaw A., (January 2017), Surveillance of healthcare-associated infection in hospitalized South African children: Which method performs best? S Afr Med J, SAMJ, volume 107, number 1, pages 56-63

Fagan R.P., Edwards J.R., Park B.J., Fridkin S.K., and Magill S.S., (4 august 2016), Incidence trends in pathogen-specific central line-associated bloodstream infections in US intensive care units, 1990-2010, Infect Control Hospital Epidemiol, 34:893–899.

Available from: http://www.ncbi.nlm.nih.gov/ pubmed/23917902.

Geffers C., Schwab F., Behnke M., and Gastmeier P., (2022), No increase of device associated infections in German intensive care units during the start of the COVID-19 pandemic

in 2020, Antimicrobial Resistance & Infection Control, page 11:67. Available at: (https://doi.org/10.1186/s13756-022-01108-9)

Iordanou S., Middleton N., Papathanassoglou E., and Raftopoulos V., (2017), Surveillance of device associated infections and mortality in a major intensive care unit in the Republic of Cyprus, Bio Medical Central Infectious Diseases 17:607, page 2-8 . DOI 10.1186/s12879-017-2704-2

Izadi N., Eshrati B., Etemad K., Mehrabi Y. and Hashemi-Nazari S.S., (September 2020), Rate of the incidence of hospital-acquired infections in Iran based on the data of the national nosocomial infections surveillance, Department of Epidemiology, School of Public Health and Safety, Shahid Beheshti University of Medical Sciences, Tehran, Iran, Elsevier, New Microbes and New Infections, Microbe and New Infect, Volume 38: 100768, page 1-6. E-mail: saeedh_1999@yahoo.com

Kashyap B., and Jhamb R., (August 2021), The Trend of Device-Associated Hospital Acquired Infections in an Adult Intensive Care Unit of a Tertiary Care Hospital: A Need to Revamp Preventive Strategies, Hospital Practices and Research, University College of Medical Sciences, 6(3), page 98-104. Available at (DOI:10.34172/hpr.2021.19)

National Academies of Sciences, Engineering, and Medicine, (2023), Using Surveillance Data for Action, A Nationwide Framework for Surveillance of Cardiovascular and Chronic Lung Diseases. Washington, DC: The National Academies Press, Chapter: 7, page 107-108. Available at: (https://doi.org/10.17226/13145)

Paula T., Jose M.V. J., Elenara R., Karen C. C. D. S., Andrea K. F. G, Ethel M. S. T., Rafaela M. de M., Bruno M. T., and Cristiana M. P., (8 March 2023), A National Implementation Project to Prevent Healthcare-Associated Infections in Intensive Care Units: A Collaborative Initiative Using the Breakthrough Series Model, Healthcare-Associated Infections Control, Oxford University, Infectious Diseases Society of America, Page 1-10.

Riaz, S., Afzal, M., Ali, A. ., & Khan, S., (2023), Evidence-Based Practices of Nurses Regarding Nosocomial Infection in ICU. A Descriptive study, Practices of Nurses Regarding Nosocomial Infection in ICU, Pakistan Journal of Health Sciences, volume 4, issue 1, page 196-201.

DOI: https://doi.org/10.54393/pjhs.v4i01.105.

Radhakrishnan R., Soad R., Wig N., Sethi P., Soneja M., Kumar R., Nischal N., Biswas A., Pandey R.M., (August 2021), effect of training and checklist based use of ventilator associated pneumonia (VAP) prevention bundle protocol on patient outcome: A tertiary care Centre study, Journal of the association of physicians of india, volume 69, page 1-6.

Reich N.E., Then L.K., Rankin A.J., (November 2018), barriers to clinical practice guideline implementation for septic patients in the emergency department, emergency nurse's association, Elsevier, Journal of emergency nursing, volume 44, issue 6, page 552:562.

https://doi.org/10.1016/j.jen.2018.04.004

Schell, C. O., Kayambankadzanja, R., Beane, A., & Wellhagen, A. (2024), The hospital burden of critical illness across global settings : a point prevalence and cohort study in Malawi , Sri Lanka and Sweden. MedRxiv Preprint, 1(1), 1–12.

Sellamuthu R, Nair S, Chandrasekar J, Kesavan S., and Shivam V., (August 11, 2023), Risk Factors of Central Line-Associated Bloodstream Infection (CLABSI): A Prospective Study from a Pediatric Intensive Care Unit in South India, Cures, 15(8): e43349. DOI 10.7759/cureus.43349

Shenoy E.S., and Branch-Elliman W., (10 February 2023), Antimicrobial Stewardship & Healthcare Epidemiology, Automating surveillance for healthcare-associated infections, Cambridge University Press, Volume 3 Issue 1, page 1-33.
Available at (https://doi.org/10.1017/ash.2022.312)

Singhal T, Shah S, Thakkar P, Naik R: (2019), The incidence, a etiology and antimicrobial susceptibility of central line-associated bloodstream infections in intensive care unit patients at a private tertiary care hospital in Mumbai, India. Indian J Med Microbiol., 37:521-6. 10.4103/ijmm.IJMM_20_3.

Zakaria I. M., Ponnampalavanar S., and Bador M.K., (2022), an interventional study to improve the emergency department catheter associated urinary tract infection: evidence from a tertiary center, Academic Unit Trauma and Emergency Department, Faculty of Medicine, University of Malaya, Medical Research Ethics Committee (MREC), JUMMEC:25(1), page 44-52.