- *Basic Research*

Impact of implementation of the I-DECIDED tool on the occurrence of bloodstream infection events in ICUs

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Abstract

Background: Patients admitted to intensive care units may be needed intravascular catheters for several purposes, but this device may be present without indication. Central or peripheral intravenous catheters are associated with local and systematic complications. Bloodstream infection event is categorized into bloodstream infection from the central line and non-central line. **Aims**: To explore the impact of the implementation of the I-DECIDED tool on bloodstream infection events in the ICU. **Research design**: A quasi-investigational research design was utilized. **Setting**: Intensive care units of Al-Behera hospitals in Egypt were included. **Population**: The total sample size included 120 patients, where the newly admitted adults aged ≥18 years are patients who are attached to the intravenous catheters. **The data gathering**: Two tools were developed, where the first one was the patient clinical assessment consisting of 4 parts and the second one was the clinical patient outcomes assessment. **Results**: Routine group had an increase in temperature than the intervention group. The routine group was a significantly high phlebitis score than the intervention one ($p< 0.001$). The routine group also had a higher Pitt score of 10.20±4.74 than the intervention one which was 7.95±5.52 with a significant among them ($p= 0.001$). A significant difference between routine and intervention groups in primary bloodstream infection, noncentral line infection, and central line infection was noted, orderly ($p_1=0.003$; $p_2=0.001$; and $p_3=0.014$). **Conclusion**: I-DECIDED is an innovation tool used to improve performance and modify nurses' behavioral changes and advocate for patient safety. **Recommendation**: Using I-DECIDED to care for peripheral venous catheters and help nurses to decide on early removal and detection of complications.

Keywords: Bloodstream Infection; Central Venous Catheter; Non- and Central line infection; Peripheral Cannula; ICU.

1. Introduction:

Patients who are admitted to intensive care units ICU or emergency unit need intravascular catheters for hemodynamic monitoring, medication administration, intravenous therapy, blood transfusion, obtaining a blood sample, and administration of parenteral nutrition (TPN). Central or peripheral intravenous routes are related to several obstacles namely, extravasation, dislodgment, occlusion, thrombosis, and other diseases. The World Health Organization (2017) reported that ~30% of nosocomial hospital infections are due to catheter-associated bloodstream infections (CRBSI). In addition, more than half of bloodstream infections are caused by CRBSI which increases morbidity and mortality rates and increases healthcare costs (Tatsuno et al., 2019; Despotovic et al.,.2020; Al Qadire & Hani, 2022).

According to Webster et al (2019), there is not enough evidence to support altering catheters every three to four days to reduce obstructions of the peripheral catheters. Instead, the site of insertion should be examined at each shift change, and the catheter should be removed if there are any indications of inflammation, infiltration, or blockage. Aloush M et al (2018) found that up to 40% of patients who used venous catheters had CRBSI, with a mortality rate of 27%. Austin et al (2016) reported that *staphylococcus aureus* bacteremia was the most common cause of peripheral intravenous catheters and had a significant increase in the duration of bacteremia duration and thrombophlebitis. Expenditures of longer ICU hospitalizations are estimated to be $28,000–56,000 per infection and up to $2.3 billion annually, and bloodstream infection is linked to an increase in these costs (Tatsuno et al., 2019). Al-Rawajfah et al (2013) reported that the incidence frequency of CRBSI was noted to be 17.7 for every 100 catheters daily.

Bloodstream infection event is categorized into bloodstream infection due to the presence of central line CLABSI and bloodstream due to the presence of non-central line non-CLABSI. N-CLABSI is a neglected concern that has been inadequately investigated (Zhu et al., 2019). One of the contributing factors to increased morbidity and death in healthcare is bloodstream infections (BSI). Promoting recognition of primary or secondary BSI is essential for identifying the source of infection and employing an appropriate therapy. BSI is described as the existence of an organism in the bloodstream, whether there are any infection signs or symptoms present. Primary bloodstream infection requires a confirmed laboratory infection of the bloodstream that is not brought on by an infection at another bodily location (Centers Control And Prevention, 2022; Malek et al., 2019).

According to CDC, BSI was categorized into 3 kinds of laboratories- approved BSI (LCBSI). The first criteria for LCBSI is recognition of the pathogen being cultured from one or more blood samples. The second criteria for LCBSI need to confirm clinical manifestations such as fever, hypotension, or chills in the patient and simultaneously 2 or

more blood cultures on distinct circumstances of no more than 1 calendar day. The third criteria is indications for signs and indicators that appear in children less than one year. Catheter-associated bloodstream infection CRBSI is more complex to define according to the Infectious Diseases Society of America; the presence of the same organism in percutaneous culture and catheter tip or hub and three-fold difference increase among them or positive culture at different times. Another meeting criterion is the presence of the positive culture of the same organism at 2 central line lumen or an increase three-fold in microorganism quantifications. CDC defines CLABSI as a patient with BSI with a positive culture in any permanent or temporary short- or long-term catheter for at least two calendar days with the deficiency of a recognizable source of BSI (Watson, 2014; Abdelrahman et al., 2020; Timsit et al., 2020; Fares et al., 2021; Centers Control And Prevention, 2022; Barrigah-Benissan et al., 2023; CDC et al., 2023).

Therefore, early identification of unnecessary venous catheters and removal may reduce the CRBSI incidence. Recently, Hsueh et al (2022) noticed that bloodstream infection due to peripheral venous catheters remains a problem and caused up to one-third of the overall primary hospital-gained BSIs. Ray-Barruel et al (2018) also reported that up to 50% of peripheral venous catheters remain in a patient without use, and half of these catheters may stop working before finishing their purpose or become complicated, requiring new catheter insertion. Based on the nurses' education, clinical experience, evidence-based instructions, and hospital strategy, nurses should have the ability to decide for each patient individualized for removal of unnecessary venous catheters (Webster et al., 2019).

An evidence-based clinical decision-making tool for intravenous device assessment and removal is known by the abbreviation I-DECIDED. The lead author created the technique based on earlier PIVC evaluation work (Alexandrou et al., 2015; Marsh et al., 2015; Ray-Barruel et al., 2018, 2020; Ray-Barruel, 2022). The tool provides nurses with a step-by-step process for evaluating each element of device care and facilitating decisions on the need for catheters in consultation with the patient and the staff. Catheters should be removed as soon as possible to prevent hospital-acquired BSI, particularly CRBSI. To enhance nurses' performance and have a favorable influence on patient outcomes, this study uses a reliable and valid evaluation and decision framework. The I-DECIDED will be used to reduce the likelihood of bloodstream infection. Therefore, this study aims to explore the impact of the implementation I-DECIDED tool on the incidence of bloodstream infection events.

1.1 Significance of the study:

ICU patients are immunocompromised and attached to several invasive devices with unnecessary malfunctions that require immediate removal to decrease the risk of local and systematic complications. The peripheral line may be inserted into the patient in the emergency unit and transferred to ICU with the required CVC catheter or not according to

the condition. Early removal of the peripheral line can reduce the occurrence of non-central line bloodstream infection. Hence, the I-DECIDED tool may be helping nurse staff(Webster et al., 2019). CDC (2021) reported that catheter-related bloodstream infections are associated with increase independently hospital costs and ICU length of stay. That required healthcare professionals including physicians; nurses; infection control personnel to identify when to remove unnecessary intravascular catheters. Also, CDC (2023) recommended educating healthcare providers about the indication for each intravenous catheter and when to remove it to prevent bloodstream infection events. About 60% of hospital inpatients receive therapeutic IV medicines through PIC each year. As 6.2% of such frequency is directly attributable to the PIC, this could result in hospital-acquired bacteremia(Osti et al., 2019).

1.2. The study aim:

This study aims to explore the impact of the implementation I-DECIDED tool on the incidence of bloodstream infection events in the ICU**.**

1.3. Research hypotheses:

H0. There is no relationship between the implementation of the I-DECIDED tool and the occurrence of bloodstream infection events.

H1. Patients who experienced the I-DECIDED tool will have a lower rate of bloodstream infection events occurrence compared with a patient who experienced routine ICU care.

2. Subjects and Methods:

2.1 Research design:

A quasi-investigational research design was utilized. The current study included this research design to examine the study variables using the following: presence intervention; comparing of the study group with the control group; and lack of randomization.

2.2 Setting:

The current study was performed in intensive care units (ICUs) at the Al-Behera government in Egypt. These units received needy patients attached to invasive devices such as central venous catheters, nasogastric tubes, urethral catheters, and peripheral venous catheters that were used to monitor circulation and receive fluids and nutrients.

2.3. Subjects:

Convenience patients of ICU admitted newly to selected settings were used in the study.

2.3.1. Inclusion criteria: Adults aged ≥18 years patients who are attached to the intravenous catheters were included. G*Power was utilized to calculate the sample size. The total sample size included 120 patients which was satisfactory to distinguish the impact size at a power (1-β=0.95) of 95% at a level of significance <0.05. Based on the sample size estimates, each treatment group (control and intervention), would be equally divided into 60. patients.

2.3.2. Exclusion criteria: A patient who had definitive signs and symptoms of infection (increase WBC, fever, infection in the identifiable source of infection, hemodynamic unstable, and increased lactate acid within normal range), as well as a patient who had a length of stay of fewer than 7 days was uninvolved from our current study.

2.4. Data collection tools:

Two tools were developed after reviewing related literature (Marsh et al., 2015; Ray-Barruel et al., 2018; Abdelrahman et al., 2020; Ray-Barruel., 2020; Ray-Barruel, 2022; CDC et al., 2023;) and used for both intervention and control groups**. Tool one: Patient clinical assessment consisted of 3 parts, as follows: Part I** used to assess the patient's demographic and clinical data namely, age, gender, current diagnosis, history, Apache score, and previous hospitalization. Clinical data included vital signs, Glasgow coma scale, capillary refill, antibiotic use 48 before admission, and type of nutrition used (enteral - parenteral -oral). **Part II** is used to monitor clinical laboratory investigations such as hemoglobin, WBCs count, CRP, platelets count, SGOT, SGPT, blood urea nitrogen, urea, creatinine, and random blood sugar. **Part III: Vascular access device assessment form used to determine** vascular access device type: Peripheral cannula or central catheter, date of catheter insertion, number of catheter insertion attempts, reason(s) for catheterization, catheter size, and site of insertion.

Tool two: Clinical patient outcomes assessment: this tool was developed after reviewing literature(Marsh et al., 2015; Ray-Barruel et al. 2018; 2020; Abdelrahman et al., 2020; Ray-Barruel, 2022; CDC et al., 2023). It consisted of three parts. Part one is the patients' systemic clinical manifestations such as infection including fever, chills, and/or hypotension. Pitt scale was used to assess bacteremia. It contained temperature, hypotension, vasoactive medications need, mechanical ventilation need, cardiac resuscitation need, and LOC were all assessed. Score range from 0 to 14 points high score indicated the presence of bacteremia. Part two is used to assess local vascular access complications such as occlusion, dislodgement, extravasation, and phlebitis and dressings used loose or soiled). Part three is used to assess the presence of primary and secondary bloodstream infection based on blood culture to determine the occurrence of bloodstream infection events and type of organism founded.

2.5. Validity and reliability:

The content validity was assessed by 5 critical care and emergency nursing professionals in the study's field. The reliability of tools I and II was done, and it was accepted (the alpha test was 0.81;0.84 respectively).

2.6. Pilot study:

A pilot study was done on 10% of included patients (12 patients) to assess the accessibility of two tools and needed adjustments were made.

2.7. Operational design:

2.7.1 Fieldwork:

Preparatory phase: After Ethical approval was obtained from Damanhour University's nursing faculty's ethics committee approval was taken. Hospital administrative authorities' permission to perform the study was acquired. Two tools were developed after reviewing the literature. Data were collected over 8 months starting from February 2022. Patients were observed and included from the admission day to the discharge date (die or discharge). The routine group was collected first to prevent bias in the intervention group. The control group follows the hospital policy for caring for peripheral venous catheters mainly the removal of PL after 72 hours and dressing every day during the morning shift. Part I and II of tool one was used to assess sociodemographic and clinical data for both the control and intervention group. Part III of tool one, the vascular access device assessment form was used for both groups.

Intervention phase: the intervention group was collected after the control group. The intervention included using the mnemonic of I DECIDE to care for the peripheral line in figure 1.

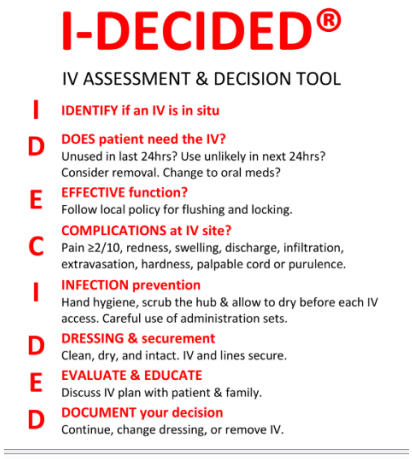

Figure 1: I DECIDE tool.

Evaluation phase: Tool two was used to assess clinical patient outcomes for both groups. Patients' systemic clinical manifestations were assessed and recorded in part I tool two. Pitt scale evaluated the presence of bacteremia. Local vascular access complications were assessed and recorded in part II tool two. Primary and secondary bloodstream infection was assessed and recorded in part III tool two. The first criterion for LCBSI is recognition of the pathogen being cultured from one or more blood samples. The second criteria for LCBSI need to confirm clinical manifestations such as fever, hypotension, or chills in the patient and simultaneously 2 or more blood cultures on distinct circumstances of no more than 1 calendar day.

2.7.2: Ethical Approval:

Ethical approval was obtained from Damanhour University's nursing faculty's ethics committee approval was taken (code no 52-b). After an explanation of the study's purpose, hospital administrative authorities' permission to perform the study was acquired from selected hospitals. Data privacy and privacy of the assembled data were kept throughout the completion of the study.

2.7.3. Statistical analysis:

With the aid of the IBM SPSS software package version 26.0, data were fed into the computer and evaluated. The Kolmogorov-Smirnov test was utilized to confirm the test normality, and the Chi-square test was employed to evaluate group comparisons for categorical variables. For normally distributed quantitative data, the student t-test was utilized to compare both groups, whereas the Mann-Whitney test was employed for normally skewed quantitative variables. The 5% level was used to determine the significance of the obtained data.

3. Results:

The current study shows in a **table (1)** that the mean age of the routine group was 47.38±13.04; while the DECIDE group was 47.40±13.06. 66.7% of the routine group is male, while half of the DECIDE group was male. 35% of routine group diagnoses as cardiac diagnoses and respiratory diagnoses in the DECIDE group. About 50% and 43.3% of the routine and DECIDE had a respiratory diagnosis, respectively. About the Apache score, the routine group was 18.73±5.41, and DECIDE group was 18.65±5.43. While the quick SOFA score was 2.20±1.09, whereas it was 2.18±1.07 in the routine group. 56.7% of the routine group had previous hospitalization, while 53.3% of DECIDE group had no previous hospitalization. The PC antecubital fossa was the most common route used to insert PC in the routine group with values of 48.3 and 60% in the DECIDE Group. Most of both groups had ETT, PC, CVC, and FUC invasive devices. No statistically substantial difference between both groups in age, sex, cause of admission, diagnosis, previous hospitalization, sit of PC insertion, a previous antibiotic used in admission, and route of nutrition supply.

Table 2 shows a comparison between both groups regarding assessment and laboratory data. The routine group had an increase in temperature than DECIDE group on the observation days. A substantial difference between both groups in body temperature ($p<0.001$). The mean heart rate, respiratory rate, mean arterial pressure, Glasgow coma scale, and Capillary refill were 91.65±24.29, 28.89±3.42, 78.22±14.33, and 10.44±2.64 in the routine group, and orderly. While, the mean heart rate, respiratory rate, mean arterial pressure, Glasgow coma scale, and Capillary refill was 86.95±20.23, 28.06±3.26, 79.69±10.74, and 10.35±2.54 in the DECIDE group, respectively. Concerning laboratory results; there is no statistical significance difference between both groups regarding hemoglobin, WBCs, CRP, and blood glucose level ($p=0.713$, 0.277, 0.099, and 0.366). Most of the routine and DECIDE groups (96.7 and 98.3%) use a peripheral cannula for medication administration, and most of them for IV therapy (41.7 and 38.3%). Furthermore, there is no significant difference between both groups concerning peripheral cannula size. Regarding phlebitis score in the routine group was significantly higher than DECIDE group ($p< 0.001$); the routine group was 2.12±1.30, and the DECIDE group was 1.08±0.96. Regarding the Pitt score, the routine group was 10.20±4.74, and the DECIDE group was 7.95±5.52 and a significant difference between both groups was noted ($p= 0.001$). Regarding bloodstream infection clinical manifestations *e.g.,* fever, chills, hypotension, and bradycardia, no significant difference between both groups was also implied ($p=0.399$, 0.215, 0.699, 0.198, and 0.191, respectively).

Table 3 shows a comparison between routine and DECIDE intervention groups regarding bloodstream infection outcomes. A substantial difference between the routine and DECIDE intervention groups concerning primary bloodstream infection ($p=0.003$). 71.7% of the routine group had a primary bloodstream infection, in contrast to 27% of DECIDE in the intervention group. Concerning secondary bloodstream infection, a statistical significance variation between the routine and DECIDE intervention groups was found ($p=0.046$). 61.7% of the routine group had a secondary bloodstream infection, whereas 78.3% has occurred in the DECIDE intervention group. Considering, the source of secondary infection, a statistical significance variation between both groups in urinary tract infection, respiratory tract infection, and non-central line infection ($p<0.001$ individually) and central line infection ($p=0.017$) also happened. About central and peripheral blood culture, a statistical significance variance between both groups (p-0.046, and <0.001, correspondingly) has existed. The day of detection of the positive culture in the routine group was a significant difference in the DECIDE group ($p = 0.012$). Regarding the type of organism, *Acinetobacter* was found more highly in the routine group than in the DECIDE group with a statistical significance variance between both groups ($p =0.001$). The DECIDE intervention group (50%) experienced more culture with no organism growth than the control group (16.7%) at a statistically substantial variance of $p<0.001$. *Acinetobacter* and *Staphylococcus aureus* was also highly found in the routine group than in the DECIDE

group with a statistically substantial variance between both groups (p =0.001 and <0.001, orderly). The routine group had more duration length of stay (20.87±7.95) than the DECIDE group (16.68±6.75) at a statistically substantial variance of p=0.002. 63.3% of the routine group and 83.3% of the DECIDE group had discharge at statistically substantial variance among groups, p=0.013.

Table 4 shows a comparison between the routine and DECIDE intervention groups according to the I-DECIDE protocol vascular access device assessment form. The routine group experienced more complications related to peripheral cannula than the DECIDE intervention group. Occlusion, dislodgment, extravasation, and redness at the site of infection had substantial differences in both groups (p<0.001, 0.020, <0.001, and 0.002). Infection prevention significantly differed in both groups (p<0.001). It was found that 36.7% of the DECIDE intervention group needed to continue monitoring PC, where 21.7% of them needed to dress and securement change, and 48.3% of them needed to remove IV and document. 40% of the routine group needed to continue monitoring PC, where 16.7% of them needed dressing and securement change, and 51.1% of them need to remove IV and document. At the same time, about 32.25% of them had removed the peripheral catheter.

Table (1): Comparison between routine and DECIDE intervention groups to clinical and laboratory data.

	Routine G (n. = 60)		DECIDE G (n.= 60)		Test of sig.	p
	No.	%	No.	%		
Part I: Patient data						
Gender						
Male	40	66.7	30	50.0	χ^2 = 3.429	0.064
Female	20	33.3	30	50.0		
Age	47.38±13.04		47.40±13.06		t = 0.007	0.994
Diagnosis						
Cardiac	21	35.0	17	28.3	χ^2 = 0.616	0.432
Respiratory	20	33.3	21	35.0	χ^2 =0.037	0.847
Neurological	12	20.0	17	28.3	χ^2 =1.137	0.286
GIT	13	21.7	8	13.3	χ^2 =1.443	0.230
Trauma	8	13.3	8	13.3	χ^2 =0.00	1.00
History						
Cardiac	17	28.3	20	33.3	χ^2 =0.352	0.553
Respiratory	30	50.0	26	43.3	χ^2 =0.536	0.464
Neurological	9	15.0	10	16.7	χ^2 =0.063	0.803
GIT	0	0	0	0	–	-
No	10	16.7	10	16.7	χ^2 =0.0	1.000
Apache score	18.73±5.41		18.65±5.43		U = 1782.5	0.926
Quiz SOFA score	2.20±1.09		2.18±1.07		U = 1788.0	0.948
Previous hospitalization						
No	26	43.3	32	53.3	χ^2 = 1.201	0.273
Yes	34	56.7	28	46.7		

Table (1): Comparison between routine and DECIDE intervention groups to clinical and laboratory data Cont'd.

	Routine G (n. = 60)		DECIDE G (n.= 60)		Test of sig.	p
	No.	%	No.	%		
Site						
PC external jugular	23	38.3	13	21.7	□□ = 4.005	0.135
PC antecubital fossa	29	48.3	36	60.0		
PC dorsum of the hand	8	13.3	11	18.3		
Invasive devices						
ETT	38	63.3	41	68.3	□□ =0.333	0.564
PC	60	100.0	60	100.0	□	-
CVC	32	53.3	33	55.0	□□ =0.034	0.855
FUC	59	98.3	58	96.7	□□ =0.342	FEp = 1.000
Antibiotic						
No	27	45.0	30	50.0	□□ =0.301	0.583
Yes	33	55.0	30	50.0		
Nutrition						
Oral	21	35.0	21	35.0	□□ = 0.0	1.000
Enteral	39	65.0	39	65.0		
Parenteral	0	0.0	0	0.0		
Need for peripheral line						
No	41	68.3	41	68.3	□□ = 0.0	1.000
Yes	19	31.7	19	31.7		
Need for CVC						
No	27	45.0	29	48.3	□□ =0.134	0.714
Yes	33	55.0	31	51.7		

χ^2: Chi. square test FE: Fisher Exact t: Student. t-test.
U: Mann. Whitney test *: Statistically .significant at $p \leq 0.05$

Table (2): Comparison between routine and DECIDE intervention groups to assessment and laboratory data.

	Routine G (n. = 60)		DECIDE G (n.= 60)		Test of sig.	p
	No.	%	No.	%		
Temperature	37.57±0.45		37.24±0.29		t = 4.736*	<0.001*
HR	91.65±24.29		86.95±20.23		t = 1.154	0.251
RR	28.89±3.42		28.06±3.26		t = 1.359	0.177
MAP	78.22±14.33		79.69±10.74		t = 0.638	0.525
GCS	10.44±2.64		10.35±2.54		t = 0.186	0.853
Laboratory investigation						
HB	10.92±1.56		11.02±1.46		t = 0.369	0.713
WBC	10.58±1.94		10.17±2.14		t = 1.092	0.277
CRP	1.41±0.59		1.23±0.65		U = 1487.0	0.099
Glucose	216.25±71.91		204.18±73.76		t = 0.908	0.366
Reason(s) for PC catheterization:						
Medication	58	96.7	59	98.3	□□ =0.342	0.559
Feeding	5	8.3	1	1.7	□□ =2.807	0.094
IV therapy	25	41.7	23	38.3	□□ =0.139	0.709
Catheter size	18.77±2.99		18.77±2.99		t = 0.0	1.000
Phlebitis score	2.12±1.30		1.08±0.96		U = 1024.5*	<0.001*
Pitt score	10.20±4.74		7.95±5.52		U = 1160.5*	0.001*
Systemic clinical manifestations (bloodstream infection)						
No	13	21.7	17	28.3	□□ =0.711	0.399
Fever	47	78.3	41	68.3	□□ =1.534	0.215
Chills	19	31.7	21	35.0	□□ =0.150	0.699
Hypotension	37	61.7	30	50.0	□□ =1.656	0.198
Bradycardia	11	18.3	6	10.0	□□ =1.713	0.191

χ^2: Chi. square test t: Student .t-test
U: Mann. Whitney test *: Statistically. significant at $p \leq 0.05$

Table (3): Comparison between routine and DECIDE intervention groups for bloodstream infection.

	Routine G (n. = 60)		DECIDE G (n.= 60)		Test of sig.	p
	No.	%	No.	%		
Primary bloodstream infection						
No	17	28.3	33	55.0	χ^2 =8.777*	0.003*
Yes	43	71.7	27	45.0		
Secondary bloodstream infection						
No	37	61.7	47	78.3	χ^2 = 3.968*	0.046*
Yes	23	38.3	13	21.7		
Source of secondary infection						
No	9	15.0	8	13.3	χ^2 =0.069	0.793
Surgical site	0	0.0	2	3.3	χ^2 =2.034	FEp=0.496
Urinary tract	12	20.0	33	55.0	χ^2 =15.680*	<0.001*
Respiratory tract	15	25.0	36	60.0	χ^2 =15.038*	<0.001*
N-CLABSI*	49	81.7	25	41.7	χ^2 =20.306*	<0.001*
CLABSI*	24	40.0	12	20.0	χ^2 =5.714*	0.017*
Central Blood Culture						
Negative	37	61.7	47	78.3	χ^2 = 3.968*	0.046*
Positive	23	38.3	13	21.7		
Day of detecting positive culture	4.47±2.17		2.95±3.15		U = 1339.0*	0.012*
Blood Culture (Culture PC)						
Negative	10	16.7	47	78.3	χ^2 = 15.00*	<0.001*
Positive	50	83.3	13	21.7		
Type of organism						
Clostridium difficile	0	0.0	1	1.7	χ^2 =1.008	FEp = 1.000
Klebsiella spp	11	18.3	6	10.0	χ^2 =1.713	0.191
Acinetobacter	25	41.7	9	15.0	χ^2 =10.506*	0.001*
Pseudomonas	5	8.3	4	6.7	χ^2 =0.120	FEp =1.000
Staphylococcus aureus	36	60.0	22	36.7	χ^2 =6.541*	0.011*
Escherichia coli	12	20.0	5	8.3	χ^2 =3.358	0.067
No growth	10	16.7	30	50.0	χ^2 =15.0*	<0.001*
Length of stay	20.87±7.95		16.68±6.75		U = 1218.0*	0.002*
Patient outcome						
Die	22	36.7	10	16.7	χ^2 = 6.136*	0.013*
Discharge	38	63.3	50	83.3		

χ^2: Chi. square .test FE: Fisher Exact
U: Mann .Whitney test ***: Statistically ,significant at p ≤ 0.05** *central line associated blood stream infection
* Non central line associated blood stream infection

Table (4): Comparison between routine and I DECIDE intervention group to vascular access device assessment form.

I DECIDE items	Routine G (n. = 60)		DECIDE G (n.= 60)		Test of sig.	p
	No.	%	No.	%		
I- Identify if any.IV is in a situation						
In the past 48hours	11	18.3	12	20.0	χ^2 =0.054	0.817
Any sign of post-infusion phlebitis.	17	28.3	15	25.0	χ^2 =0.170	0.680
No	37	61.7	38	63.3	χ^2 =0.036	0.850
D- Does the patient need the IV						
Change to oral medication	17	28.3	18	30.0	χ^2 =0.040	0.841
No change	43	71.7	42	70.0		
E- Effective function						
No	32	53.3	33	55.0	χ^2 =0.034	0.855
Yes	28	46.7	27	45.0		
C- Complication as IV site:						
No	6	10.0	14	23.3	χ^2 = 3.841*	0.049*
Occlusion	38	63.3	16	26.7	χ^2=16.296*	<0.001*
Dislodgement	18	30.0	12	20.0	χ^2 =1.600	0.206
Infiltration	20	33.3	12	20.0	χ^2 =2.727	0.099
Extravasation	26	43.3	14	23.3	χ^2 =5.400*	0.020*
Misplacement	10	16.7	7	11.7	χ^2 =0.617	0.432
Redness of surrounding tissue	31	51.7	8	13.3	χ^2=20.095*	<0.001*
Palpable cord	12	20.0	1	1.7	χ^2=10.439*	0.002*
I- Infection prevention:						
Hand hygiene	0	0.0	60	100.0	χ^2 =120.0*	<0.001*
scrub hand	0	0.0	60	100.0	χ^2 =120.0*	<0.001*
keep site dry after each IV access	31	51.7	60	100.0	χ^2=38.242*	<0.001*
D- Dressing and securement:						
Clean dry intact	21	35.0	26	43.3	χ^2 =0.874	0.350
Change if soiled change if loose	27	45.0	18	30.0	χ^2 =2.880	0.090
secure IV & tubing	1	1.7	13	21.7	χ^2=11.644*	0.001*
Loose	12	20.0	13	21.7	χ^2 =0.051	0.822
E- Evaluation and Educate						
Patient	0	0.0	5	8.3	χ^2 =5.217	^{FE}p = 0.057
Family	0	0.0	5	8.3	χ^2 =5.217	^{FE}p = 0.057
Staff	0	0.0	55	91.7	χ^2=101.53*	<0.001*
D- Document						
Continuous to monitor	24	40.0	22	36.7	χ^2 =0.141	0.707
Dressing /securement change	10	16.7	13	21.7	χ^2 =0.484	0.487
Remove IV and document above	31	51.7	29	48.3	χ^2 =0.133	0.715
Actual Removed PC	10	32.25	29	100	χ^2=90.53*	<0.001*

χ^2: Chi. square test FE: Fisher Exact
*: Statistically. significant at $p \leq 0.05$

4. Discussion:

The I-DECIDED is an innovative tool that exhibits strong content validity and high consistency, feasibility, and suitability to provide comprehensive care and early identification for removing invasive devices that are no longer needed (Ray-Barruel et al., 2020). This study investigated the impact of the application of this tool in the occurrence of bloodstream events including central-line bloodstream infection and noncentral-line bloodstream infection. Thus, the present study accepts the alternative hypothesis as a patient who experienced the I-DECIDED tool associated with decreased bloodstream infection events occurrence compared with a patient who experienced routine ICU care.

Consequently, a significant difference between the routine and intervention groups in primary and secondary bloodstream infection in the same way as non-central line infection and central line infection was highlighted. This may be because all patients in the DECIDE intervention group experienced early detection of the unnecessary peripheral catheter and decided to remove it, while the actual removal of the peripheral catheter in the routine group was not the same which led to the increase in local and systematic complications. For local complication, the routine group experienced high score than the phlebitis score than the intervention group, as well as in systemic complication, the Pitts score increased in the routine group than the intervention group as an indicator of bacteremia.

Also, the routine group experienced more than the intervention group about the results of the central and peripheral culture. This may be because all patients in the DECIDE intervention group experienced early detection of unnecessary peripheral catheters and decided to have them removed, whereas the actual removal of peripheral catheters in the routine group was not the same resulting in increased local and systemic complications. For local complications, the routine group had a higher phlebitis score compared to the intervention group, and for systemic complications, the routine group had a higher Pitts score than the intervention group as an indicator of bacteremia. The routine group also experienced more than the intervention group about central and peripheral cultural outcomes.

These results well matched with Ray-Barruel et al., (2018) who showed that the user of the I-DECIDE tool reduces unnecessary pain and discomfort, reducing the risk of bloodstream infection and the length of stay and hospital costs. Hogle et al (2022) also reported that peripheral catheter-associated bloodstream infections occur in more than one-third of the total primary hospital-acquired BSIs. Using a broader strategy to decline the total hospital-acquired BSI from all vascular access devices is recommended. Webster et al. (2019) reported that the patient show positive peripheral blood culture with infection clinical manifestation with no other bloodstream infection source, where a positive intravenous

catheter tip culture colonization with the same organism was found. Ruiz-Giardin et al. (2019) reported that peripheral phlebitis is correlated with a risk of infection. A central catheter has a highly significant increase in the time of use than that in peripheral catheters. Phlebitis also increased the risk between the second and the third day. Lin et al (2018) found that using central line bundle multimodal interventions decreases CLABSI and CRBSI incidence rates for patients admitted to ICUs and there is a significant change in the incidence rates from the admission data to the intervention period of both CLABSI and CRBSI. It was recommended by CDC 2011 guideline to replace peripheral catheters from 24 to 48 hours which were found to increase complications, such as phlebitis and localized vein inflammation characterized by pain, erythema, and tenderness at the site of insertion(Patel et al., 2017). PIC is more frequently linked to localized infection than systemic infection. Thrombophlebitis and infection are frequent PIC side effects(Osti et al., 2019).

Intravascular devices caused nosocomial bacteremia between 15 and 30% of ICU patients. According to EPINE, nosocomial bacteremia in about 49% of patient due to venous catheters (EPINE, 2016; Ruiz-Giardin et al., 2019). Bacteremia due to invasive catheters especially peripheral venous catheters has increased (Delgado-Capel et al., 2012). Peripheral venous catheters are more commonly used than central catheters. The bacteremia rate due to central catheters is also higher than that of bacteremia due to peripheral catheters. It was found that 23% of peripheral catheters caused bacteremia compared with 77% of central catheters (EPINE, 2016).

The routine group shows a positive culture on the fourth day while the intervention group shows positive culture from the second to the third day. This may be due to the intervention group experiencing more incidence of the respiratory tract and urinary tract infections. This may be due to patients who may commonly experience a source of infection including the respiratory tract and inserted catheters, especially central venous catheters. Additionally, if urinary tract infections remain untreated in a patient in ICU most commonly cause bacteremia (Nehring., 2022). Rodríguez-Acelas et al (2017) and Klavs et al (2016) reported that the presence of invasive devices such as FUC, CVCs, and nasogastric tubes is considered to be the most significant risk factors for an increased prevalence of hospital-acquired infection.

The patient experienced significant positive blood culture within 48- 72 h after hospitalization that indicated nosocomial bacteremia. Microorganisms may also change over time (Ünlü et al., 2022). This may be due to the statistically significant difference between both groups in urinary tract infection, and respiratory tract infection over hospitalization days. A statistical significant difference between both groups regarding the central and peripheral blood culture was noted. This may be due to a routine group showing

more positive culture than the intervention group. This can interpret as due to the routine group experiencing more complications *e.g.,* occlusion, Dislodgment, extravasation, and redness at the site of infection with a significant difference from the intervention group.

Regarding organism type, *Acinetobacter* was found in the routine group culture than in the intervention group with a statistical significance difference between both groups. The intervention group experienced more culture with no organism growth than the control group. *Acinetobacter* and *Staph. aureus* was also found in the routine group than in the intervention group with a statistical significance difference between both groups. Lin et al (2018) reported that the main pathogens causing CLABSI were gram-negative bacteria. Despotovic et al (2020) reported that *Clostridium*, *Klebsiella*, and *Acinetobacter* were the most organisms that caused the hospital-acquired infection. Another supporting study by Austin et al (2016) reported that *Staph. aureus* infection in peripheral intravenous catheters caused bacteremia and a life-threatening complication.

Bacteremia due to invasive catheters may lead to increase hospital stays, costs, morbidity, and mortality (Zimlichman et al., 2013). Osti et al., (2019) reported that more than half of them had peripheral to left Peripheral catheters as no signs and symptoms of infection appear and less than one quartile reported resetting a new cannula. The routine group experienced a longer duration length of stay than the intervention group. Therefore, the intervention group experienced more hospital discharges than the routine group. Fares et al (2021) recommended that healthcare providers should be educated about catheter use indications, insertion, and maintenance of intravascular catheters, and infection control measures properly to prevent intravascular catheter-related infections. Nurses play a vital role in the prevention of bloodstream infection events. The overall majority of nursing interventions and prevention measures, including setting, inspecting, and evaluating a peripheral venous catheter (PVC) site, are part of standard nursing practice(Osti et al., 2019). Bloodstream infection requires nurses to be knowledgeable and skilled in every area to prevent it. The I-DECIDED tool aims to improve technical innovation which motivates staff behavioral changes to be more advocates for patient safety. Therefore, the current study recommended using the I-DECIDED tool to care for any invasive devices and help nurses decide on any invasive devices.

Limitation of the study: one of the key limitations of our study is the sample size is small, and the setting was limited to one government hospital which hinders generalization.

Conclusion:

The current study can conclude that I- DECIDED innovation improvement tool that encourages staff behavioral adjustments to be greater patient safety advocates for invasive devices care. When compared to patients who received traditional ICU care, those who used the I-DECIDED tool had a lower incidence of bloodstream infection events. A notable

difference in the incidence of primary and secondary bloodstream infections, as well as non-central line infections and central line infections, between the two groups was noted. In this investigation, *Staph. aureus* and *Acinetobacter* were frequent causes of infection. The I DECIDE tool is more effective to decrease non-central line and central line infections in the intervention group than in the control group. Noncentral bloodstream infection may ignored issue compared with central bloodstream infection. I-DECIDE studied group had a lower incident rate of non-central bloodstream infection than the routine group with high phlebitis and Pitt score in the control group. Despite the peripheral catheter in the routine group had no longer needed; less than half of them were removed which increased the complications associated with the peripheral catheters.

Recommendation:
This study suggested utilizing I-DECIDED to manage the peripheral venous catheter and assist nurses in making decisions for early removal and complication detection. Inform nursing staff about the I-DECIDED tool for the evaluation and management of any invasive devices. The focus of the hospital's administrative power ought to be on nursing courses and seminars regarding bloodstream events. Further research into other invasive devices including FUC, ETT, and CVC is required. Create the I-DECIDED tool poster or brochure for nurses' staff to facilitate memorization and made a decision. Adding the I-DECIDED tool to the nurse's student curriculum to assess and care for invasive devices is essential.

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5. References

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الملخص العربي

تأثير تنفيذ أداة *I-DECIDED* على حدوث أحداث عدوى مجرى الدم داخل وحدات العناية المركزة

يحتاج مرضى وحدة العناية المركزة إلى قسطرة الشريان داخل الأوعية لعدة أغراض، ولكن هذا القسطرة قد يكون موجودًا دون هدف. ترتبط القسطرة الوريدية المركزية أو الطرفية بمضاعفات موضعية ومنهجية. يتم تصنيف حدث عدوى مجرى الدم إلى عدوى مجرى مركزية وغير مركزية.

الأهداف: استكشاف تأثير تطبيق أداة *I-DECIDED* على حدوث عدوى مجرى الدم في وحدة العناية المركزة.

تصميم البحث: تم استخدام تصميم شبة تجريبية **الإعداد**: أجريت دراستنا في وحدات العناية المركزة بمستشفيات البحيرة في مصر.

السكان: اشتمل الحجم الإجمالي للعينة على 120 مريضًا، حيث كان البالغون الذين تم قبولهم حديثًا والذين تتراوح أعمارهم بين 18 عامًا هم مرضى مرتبطون بقسطرة الشريان الويدية المركزية والطرفية.

جمع البيانات: تم تطوير أداتين، الأولى كانت التقييم السريري للمريض المكون من 4 أجزاء والثانية لتقييم النتائج السريرية للمريض.

النتائج: كان للمجموعة الروتينية زيادة في درجة الحرارة من مجموعة التدخل. كانت المجموعة الروتينية درجة عالية بشكل ملحوظ في التهاب الوريد من مجموعة التدخل ($P <0.001$). كان لدى المجموعة الروتينية أيضًا درجة البكتريا الموجودة بالدم أعلى بمتوسط حسابي 10.20 ± 4.74 من مجموعة التدخل التي كانت المتوسط الحسابي لها 7.95 ± 5.52 مع وجود أهمية كبيرة فيما بينها ($p = 0.001$). لوحظ وجود فرق كبير بين المجموعات الروتينية والتدخلية في عدوى الدم المركزية والامركزية بشكل فارق.

الخلاصة: *I-DECIDED* هي أداة تستخدم لتحسين التعامل مع القساطر التدخلية في المريض التي تدعو إلى سلامة المرضى. توصية: استخدام هذه الاداه يقرر الطريقة الاحسن للتعامل مع القسطرة الوريدية المحيطية ومساعدة الممرضات على اتخاذ قرار بشأن الإزالة المبكرة ومضاعفات الموجودة.