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An italian retrospective multicentric audit on the traceability of vascular access devices procedures

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Abstract. *Background and aim:* Abstract. Background and aim: The traceability of nursing care in clinical documentation is a standard of good practice and provides a remarkable improvement in vascular access devices (VAD) and infusion therapy research. The study aims to describe the traceability of VAD practices in medical records and the level of adherence to EBP practice in vascular access management. *Research design and Methods*: a multicenter retrospective observational study was conducted in 30 healthcare facilities in 11 Italian Regions by analyzing medical records from medical, surgery, and intensive care units that use VADs for patient care. *Results:* by analyzing 2813 out of 3047 folders, a lack of documentation on the daily patient care records was found on several items: date of removal 70% (n.3.543); reason of removal 46% (n.2302); date of change dressing 19.9% (n.985); site monitoring/inspection 38.5% (n.1.943); evaluation using scales 12% (n.608) and complications 3% (n.133). *Conclusions:* Although constituting an integral part of the EBP of good care practice, recording the VAD procedures is still deficient in some areas thus requiring further enhancements. This study represents a contribution to increasing the VAD documentation within organizations using the clinical audit as a review tool among peers. (www.actabiomedica.it)

Key words: vascular access devices, clinical documentation, medical records, clinical audit, nursing, best practice

Introduction

The traceability of nursing care in clinical documentation represents a standard of good practice and provides a remarkable improvement in vascular access and infusion therapy research (1). Quality nursing documentation can potentially improve patient outcomes by recording the patient's condition and responses to nursing interventions (1). Therefore, measuring achieved results represents a significant improvement in nursing care. As known, the lack of registration of the assistance interventions makes it difficult to trace the care process carried out by nurses and, also, to measure the outcomes as specific results achieved by the patient by the assistance provided. The outcomes, together with the implemented processes and interventions, allow to qualify and quantify the results of the assistance to improve health status (2).

Contests and methods of recording nursing processes in clinical documentation are largely debated in literature; the low attendance of nursing care data seems to be influenced by many variables related to the context and the organization, staffing, and nursing skills (3), as well as the lack of a standardized language (4).

The lack of records compromises the valuation of the nursing contribution to adhesion to the vascular access management guidelines. Practice recommendations for documenting adherence to guidelines include recording in the medical record: the type of vascular devices, date insertion and removal, type of dressing and date change, monitoring exit site for assessment signs and symptoms of phlebitis or complications, type of therapy infusion, and flushing or locking. This is because central and peripheral venous access devices, called Vascular Access Devices (VAD), are inserted for therapeutic purposes such as the administration of intravenous (IV) fluids, medicines, blood transfusions, parenteral nutrition, and systemic anti-cancer therapy, and therefore they are essential for the safety of the patient.

Overall, it is estimated that up to 90% of hospitalized patients require a VAD (5). Furthermore, VADs are used for outpatients or day hospital patients (6). The choice of the most appropriate venous device is conditioned by several variables (5-7).

The guidelines and standards of good practice recommend recording all management procedures in the patient's record, from the choice of device to its management, removal, and eventual repositioning, as well as the registration of possible complications. The Infusion Nursing Society (INS), in the latest edition of 2021, renews and strengthens the standard of performing constant registration in the clinical documentation and the quality control of all devices (1). However, from the literature still emerges a gap between the interventions performed in patients' care with VAD and an accurate clinical record (7). Information about the placement, the insertion site evaluation, the monitoring of complications, and the post-insertion registrations, are constantly lacking and ignored in clinical records (8).

However, it is difficult to evaluate a documentation standard (9). Therefore, several studies have been conducted introducing an electronic record system (EPR/EHR electronic record) to improve the quality of medical record data in the management of VADs (10), to reduce central line-associated infections (11), and to ameliorate interprofessional communication (12). Improvement strategies include feedback and audits which enable the enrichment of clinical findings and documentation (8). The clinical audit is an established method to identify those areas of current practice that require changes to improve the quality of care (13). For this reason, various studies were conducted using the audit methodology in managing VADs, with the analysis of the medical records and the traceability of the performances carried out through Evidence-Based Practice (EBP) procedures. Previous studies conducted in pediatric (14) and adult (8) patients revealed poor recording of the management procedures and low compliance with clinical guidelines on VADs (8).

Despite the scientific evidence, the documents of good care practice, and the guidelines recommending the tracking and the recording of care procedures on the management of VADs in the clinical documentation, to our knowledge there are no multicenter studies that have been conducted in Italy, evaluating the traceability of VAD in medical records from hospitalized patients.

The study aims to describe the traceability of VAD practices in medical records and the adherence to EBP practice in vascular access management such: as date placement and types of devices during hospitalization, the insertion site evaluation, the dressing and monitoring of complications, and the post-insertion registrations.

Participants and method

Study design

A multicenter retrospective observational study was conducted in 30 Companies/Public health structures of 11 Regions of Italy. We used nonprobability sampling.

The selection was carried out through the regional Infectious Risk Specialist Nurses (ISRI), who contacted the nursing contact persons of the local Public health structures.

Setting and participants

Each Healthcare Company identified the Operating Units (OU) among those selected as the survey

population. The included OUs are the general medicine, geriatrics, long-term care/nursing, and oncological hematology areas for the medical area; general surgery, and orthopedics, for the surgery area; and the Intensive Care Unit (ICU), since VADs are more frequently employees for infusion therapy of patients longer time hospitalization and for different types of venous catheters are used (1; 6; 13).

For a greater opportunity to reach the OUs through the network of ISRIs that are more present in adults, the pediatric OUs were excluded from the study; as adult surgical and medical specialties and specialists in intensive care were excluded.

The included VADs are PVC, Midline and Mini-midline, PICC, and CICC; femoral catheters and implantable ports were excluded, as they are used for specific intravenous therapies and clinical conditions of patients.

For each OU, a maximum of 30 medical records of the first 30 patients discharged under ordinary hospitalization in December 2018 were obtained; data collection stopped when 20 medical records were reached. For the long-term hospital units, if the number of 20 patients discharged in December 2018 was not reached, the recruitment of additional records of the first discharged in January 2019 has been envisaged.

The nursing staff of the OU, under the supervision of the company contact person, viewed both paper and computerized health documentation, depending on the local management.

The preparation of the clinical audit required the contact person to recruit the list of 20 medical records for the OU; the identification of clinic nurses for each OU; to plan when and where to conduct the retrospective clinical audit; the illustration to the nurses of the aims of the study.

Investigation tool

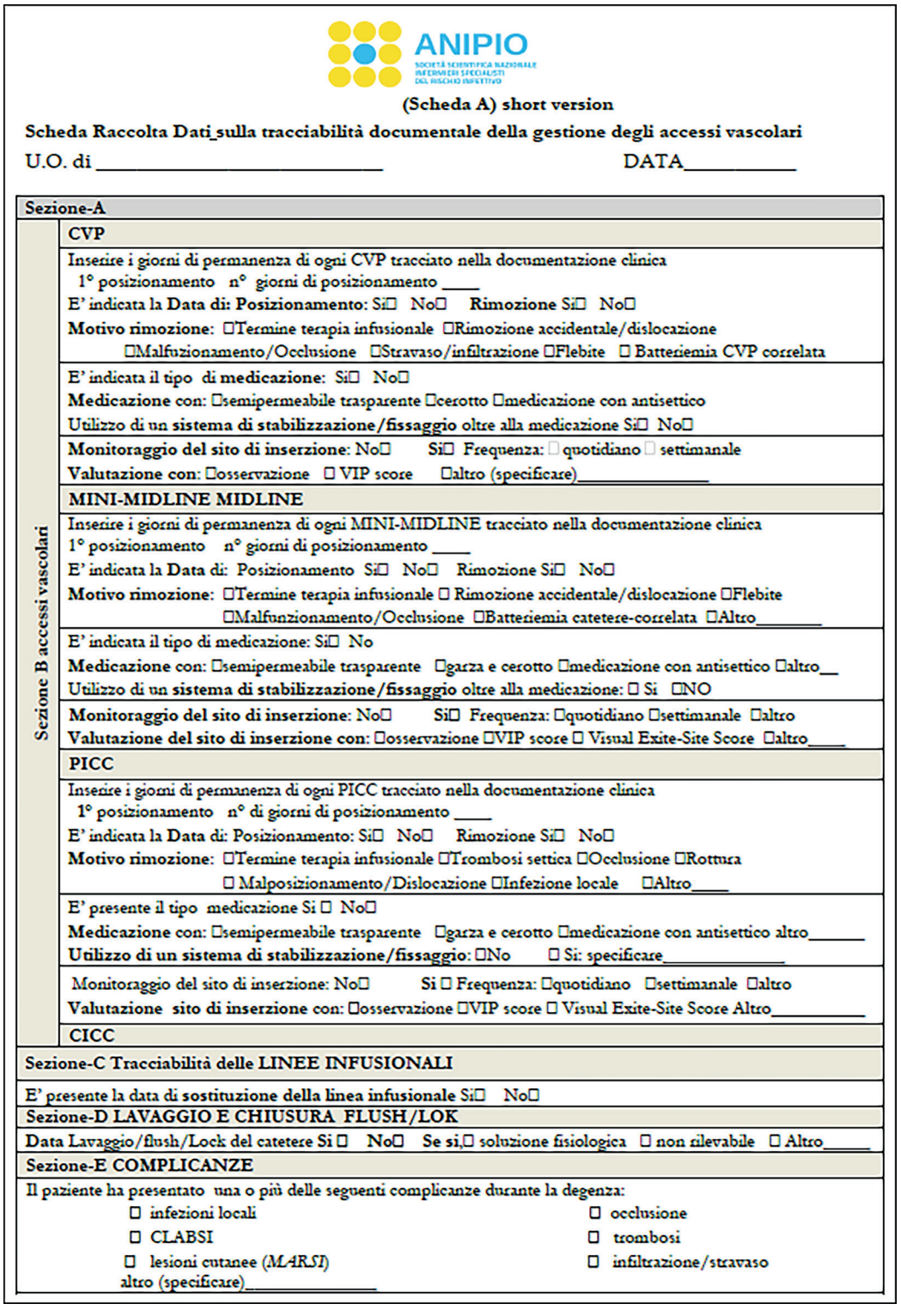
The medical records were examined using a data collection form (a checklist) that focuses on the traceability of "vascular access management" (Module A, Figure 1). The checklist was developed by experts in Infectious Risk and Specialist Nurses, and clinical nurses based on Evidence-Based Practice (EBP) reported in INS and RCN guidelines. The group of company representatives was then provided with this checklist to assess the representativeness and clarity of the elements that needed to be identified in the medical records. A pilot group of clinical nurses and the contact person from 3 different companies located in northern, central, and southern Italy, verified the consistency of the tool with the electronic format.

The data collection forms were completed in electronic format. Module A was divided into 5 sections. Section A collected information relating to the traceability: days of hospitalization, VADs installed; section B collected information about the VAD management traceability, i.e., number of days of stay; type of dressing; listing site monitoring, evaluation methods (12), date and reason for device removing; section C collected the traceability of Infusion Lines; section D recorded the Wash and Flush/Lock closure; section E about Complications.

The information relating to the presence and the type of company documents adopted, the Region and the Health Authority, the company contact person, the medical record number, and the total number of folders viewed and excluded were collected by completing the Structure Form (Module B). Module B reported information on the Region, Companies/Public health structures, OU, total number of medical records included, viewed, and excluded; presence of procedure or protocol on the management of VADs; date of processing, presence of record sheet for exit site monitoring, dressing, administration set and complications.

Statistical analysis

Google Forms collected data; the database was created using Microsoft Excel and the statistical analysis was conducted with a Jamovi 2.2.5 including ANOVA statistical analysis. A descriptive statistic was performed, calculating the key cardinal variables' mean and standard deviations with a C.I. by 95%. Categorical variables were calculated through the cross tabulation, and differences were detected through the Chi-square.



ANIPIO
SOCIETÀ SCIENTIFICA NAZIONALE INFERMIERI SPECIALISTI DEL RISCHIO INFETTIVO

(Scheda A) short version

Scheda Raccolta Dati_sulla tracciabilità documentale della gestione degli accessi vascolari

U.O. di _____ DATA_____

Sezione-A

Sezione B accessi vascolari

CVP

Inserire i giorni di permanenza di ogni CVP tracciato nella documentazione clinica
1° posizionamento n° giorni di posizionamento ____
E' indicata la **Data di: Posizionamento**: Si☐ No☐ **Rimozione** Si☐ No☐
Motivo rimozione: ☐Termine terapia infusionale ☐Rimozione accidentale/dislocazione
☐Malfuzionamento/Occlusione ☐Stravaso/infiltrazione ☐Flebite ☐ Batteriemia CVP correlata

E' indicata il tipo di **medicazione**: Si☐ No☐
Medicazione con: ☐semipermeabile trasparente ☐cerotto ☐medicazione con antisettico
Utilizzo di un **sistema di stabilizzazione/fissaggio** oltre alla medicazione Si☐ No☐

Monitoraggio del sito di inserzione: No☐ Si☐ Frequenza: ☐ quotidiano ☐ settimanale
Valutazione con: ☐osservazione ☐ VIP score ☐altro (specificare)_____

MINI-MIDLINE MIDLINE

Inserire i giorni di permanenza di ogni MINI-MIDLINE tracciato nella documentazione clinica
1° posizionamento n° giorni di posizionamento ____
E' indicata la **Data di**: Posizionamento Si☐ No☐ Rimozione Si☐ No☐
Motivo rimozione: ☐Termine terapia infusionale ☐ Rimozione accidentale/dislocazione ☐Flebite
☐Malfunzionamento/Occlusione ☐Batteriemia catetere-correlata ☐Altro_____

E' indicata il tipo di medicazione: Si☐ No
Medicazione con: ☐semipermeabile trasparente ☐garza e cerotto ☐medicazione con antisettico ☐altro__
Utilizzo di un **sistema di stabilizzazione/fissaggio** oltre alla medicazione: ☐ Si ☐NO

Monitoraggio del sito di inserzione: No☐ Si☐ Frequenza: ☐quotidiano ☐settimanale ☐altro
Valutazione del sito di inserzione con: ☐osservazione ☐VIP score ☐ Visual Exite-Site Score ☐altro____

PICC

Inserire i giorni di permanenza di ogni PICC tracciato nella documentazione clinica
1° posizionamento n° di giorni di posizionamento ____
E' indicata la **Data di**: Posizionamento: Si☐ No☐ Rimozione Si☐ No☐
Motivo rimozione: ☐Termine terapia infusionale ☐Trombosi settica ☐Occlusione ☐Rottura
☐ Malposizionamento/Dislocazione ☐Infezione locale ☐Altro____

E' presente il tipo medicazione Si ☐ No☐
Medicazione con: ☐semipermeabile trasparente ☐garza e cerotto ☐medicazione con antisettico altro_____
Utilizzo di un sistema di stabilizzazione/fissaggio: ☐No ☐ Si: specificare_____

Monitoraggio del sito di inserzione: No☐ **Si** ☐ Frequenza: ☐quotidiano ☐settimanale ☐altro
Valutazione sito di inserzione con: ☐osservazione ☐VIP score ☐ Visual Exite-Site Score Altro_____

CICC

Sezione-C Tracciabilità delle LINEE INFUSIONALI

E' presente la data di **sostituzione della linea infusionale** Si☐ No☐

Sezione-D LAVAGGIO E CHIUSURA FLUSH/LOK

Data Lavaggio/flush/Lock del catetere Si ☐ **No☐** **Se si,**☐ soluzione fisiologica ☐ non rilevabile ☐ Altro_____

Sezione-E COMPLICANZE

Il paziente ha presentato una o più delle seguenti complicanze durante la degenza:

☐ infezioni locali
☐ CLABSI
☐ lesioni cutanee (*MARSI*)
altro (specificare)_____
☐ occlusione
☐ trombosi
☐ infiltrazione/stravaso

Figure 1. Form A schedule.

Results

3047 folders were examined and among them, 2813 were included while 234 were excluded as they did not report VAD traceability data. Overall, the sample was divided into 2772 forms, of which 42.6% (n=1182) came from the Healthcare Authorities of Northern Italy, 41.0% (n=1137) from the Center, and 16.4% (n =453) from the South.

OUs are classified by Italian hospital discipline identification code, 28.4% (n=786) data were collected from the intensive care (code 49), 19.6% (n=542) from the general surgery (code 09), 18.7% (n=519) from the general medicine (code 26), 16.1% (n=446) from the orthopedics (code 36), 7.2% (n=200) from the oncology (code 64), 5.1% (n = 141) from the geriatrics (code 21), 2.9% (n = 80) from the nurse-led long-term care (code 60), and 2.1% (n = 58) from the once-hematology (code 66).

The parametric calculation concerning the days of hospitalization for each OU (Table 1) shows a significant difference. The rehabilitation, medical, and specialist areas have a significantly higher average hospital stay in days than the surgical areas (p = <,0001).

Among the most used devices are the PVCs (78% (n = 2685) which remained in situ for an average of 3.70±3.26 days, followed by the CICCs (15.4%), remaining in situ for 10.03 ±13.49 days; the mini midline were instead the less used VADs (Table1).

Table 2 reports data on the traceability of the VADs, in the OU, showing significant differences (p =<0,0001). Intensive care, general medicine, and long-term care register the presence of vascular access at the time of admission with a percentage > 80% (R = 81.3 - 88.3), this value differs slightly during hospitalization with a percentage > 90% (R = 91.1 - 98.8). Instead, the surgical and oncological areas displayed a value of around 40% (R = 37.5 - 48.3) recorded at the time of hospitalization. During the hospitalization the values change and are significantly close to 100% (R = 97.5 - 100), effectively aligning with the remaining OU. The geriatrics registered values were in the range of 60.3%, at the time of hospitalization, shifting to 85.8%, during hospitalization. When the patient enters intensive care, in the medical, geriatric,

Table 1. Time of hospitalization for OU and exposure days for devices**.**

		n	M±SD	F	p value
Days of hospitalization for included cards	Total	2772	9,71±9,60	8,027	<,0001
	Cod.49	786	8,75±11,91		
	Cod.09	542	9,07±9,64		
	Cod.26	519	10,72±7,79		
–	Cod.36	446	8,58±6,53		
	Cod.64	200	10,94±7,96		
	Cod.21	141	12,54±8,73		
	Cod.60	80	13,78±9,72		
	Cod.66	58	11,90±11,31		
Days of exposure for device	Total	3441	6,19±14,38	249,465	<,0001
	PVC	2685	3,70±3,26		
	CICC	531	10,03±13,49		
	PICC	136	37,60±55,77		
	MIDLINE	67	10,99±9,53		
	MINI MIDLINE	22	7,41±5,69		

Abbreviations: N: number of cases; M±SD: sample mean and standard deviation; F = Fisher's F ratio.

Table 2. Traceability of devices during hospitalization in OU.

	Cod.09	Cod.21	Cod.26	Cod.36	Cod.49	Cod.60	Cod.64	Cod.66	Tot.
	n = 542	n = 141	n = 519	n = 446	n = 786	n = 80	n = 200	n = 58	N = 2772
Device presence during hospitalization	540(99,6)	121(85,8)	473(91,1)	435(97,5)	744(94,7)	79(98,8)	200(100)	58(100)	2650(95,6)
Device types during hospitalization									
PVC	472(87,4)	77(63,6)	387(81,8)	403(92,6)	219(29,4)	55(69,6)	91(45,5)	22(37,9)	1726(65,1)
CICC	15(2,8)	5(4,1)	17(3,6)	1(0,2)	237(31,9)	3(3,8)	8(4,0)	--	286(10,8)
PVC; CICC	15(2,8)	2(1,7)	4(0,8)	1(0,2)	208(28,0)	2(2,5)	--	--	232(8,8)
PICC	2(0,4)	--	6(1,3)	--	10(1,3)	1(1,3)	51(25,5)	32(55,2)	102(3,8)
Other devices	7(1,3)	6(5,0)	29(6,1)	3(0,7)	45(6,0)	11(13,9)	19(9,5)	3(5,2)	123(4,6)
Not detectable	29(5,4)	31(25,6)	30(6,3)	27(6,2)	25(3,4)	7(8,9)	31(15,5)	1(1,7)	181(6,8)
Administration of IV therapy	523(96,5)	130(92,2)	489(94,2)	438(98,2)	731(93,0)	72(90,0)	195(97,5)	53(91,4)	2631(94,9)

rehabilitation, and oncological fields, the most used device is the PVC with a percentage >50% (R = 50.7 - 98.3). In one-hematology, the most used device is the PICC with 82.1% (n=23), followed by the oncology with a value of 26.7% (n=20).

As indicated in Table 3, 5049 device placements (at least 4 placements per device) were reviewed; among them, 3794 (75.1%) were related to PVC, 752 (14.9%) to CICC, 240 (4.7%) to PICC, and 263 (14.9%) 5.2%) to the Midline and the "mini-midline". Overall, 83.1% (n=4196) of devices reported the insertion date, 70.1% (n=3543) the removal date and 2302 cases the reason for removal. End of infusion therapy (31.8%), patient transfer (22.2%), accidental removal (8.9%), and malfunction or occlusion (8.7%) were the most common causes.

As regards the insertion site monitoring, out of 1943 (38.5%) supervised interventions, 84.8% (n=1648) took place daily, especially on "mini-midline", for 95.5% (n =21) and with percentages > 70% (R = 73.0 - 86.3) for the remaining devices. Evaluations were made for 28.3% (n=1427) with observation and with a percentage >10% using scales 10.3% (n=516).

The most common complications by the device were infiltration/extravasation, occlusion, and catheter-related bloodstream infections (CRBSI) each representing 24.1% (n = 32), followed by local infections for the 15.8% (n = 21), thrombosis and medical adhesive-related skin injuries (MARSI) both occurring for the 6.0% (n = 8) of the total.

Most complications were related to the use of PVC [66.9% (n = 89)] (p =0,0001); infiltration/extravasation, occlusion, and local infections, were reported in 16.9% (n = 15), CRBSI in 7.9% (n=7), skin lesions in 9.0% (n=8), and thrombosis in 4.5% (n=4). The CICC presented >10% of complications after the PVC. In contrast to the PVC, 85.7% (n = 12) of problems with this device were related to CRBSI. Even the association PVC CICC, while recording a complication rate <10%, for 75.0% (n = 6) the problems concerned CRBSI. As regards the PICC, on the other hand, while recording the same percentage of complications as the CICC, the 50.0% (n=3) of the problems concerned infiltrations/extravasations and occlusions and the 75% (n=5) discrete distribution between blood infections, local infections, and thrombosis. Midline complications were plotted in association with PVC and CICC in rates <5.0%.

About the OU, 34.6% (n=46) of the complications were observed in General Medicine, however, 47.8%

Table 3. Traceability of placement, removal, and dressing of vascular accesses by clinical areas.

		PVC	CICC	PICC	MIDLINE	MINI-MIDLINE	Total
		n = 3794	n = 752	n = 240	n = 153	n = 110	N = 5049
Area							
	ICU	925(24,4)	610(81,1)	61(25,4)	35(22,9)	30(27,3)	1661(32,9)
	Medical area	1302(34,3)	89(11,8)	71(29,6)	95(62,1)	72(65,5)	1629(32,3)
	Surgical area	1354(35,7)	43(5,7)	10(4,2)	10(6,5)	6(5,5)	1423(28,2)
	Oncological area	213(5,6)	10(1,3)	98(40,8)	13(8,5)	2(1,8)	336(6,7)
Traceability date of removal		2766(72,9)	548(72,9)	138(57,5)	68(44,4)	23(20,9)	3543(70,2)
Traceability date of dressing		594(15,7)	262(34,8)	81(33,8)	33(21,6)	15(13,6)	985(19,5)
Dressing type Transparent semipermeable		420(70,7)	219(83,6)	78(96,3)	23(69,7)	15(100)	755(76,6)
Sterile gauze and plaster/plaster only		118(19,9)	2(0,8)	3(3,7)	8(24,2)	--	131(13,3)
TNT		41(6,9)	1(0,4)	--	--	--	42(4,3)
Dressing with antiseptic		5(0,8)	34(13,0)	--	--	--	39(4,0)
Yes, but the type of medication was not indicated		10(1,7)	6(2,3)	--	2(6,1)	--	18(1,8)
Listing site monitoring		1428(37,6)	329(43,8)	115(47,9)	49(32,0)	22(20,0)	1943(38,5)
When the monitoring							
	Daily	1217(85,2)	284(86,3)	84(73,0)	42(85,7)	21(95,5)	1648(84,8)
	Weekly	65(4,6)	26(7,9)	28(24,3)	5(10,2)	1(4,5)	125(6,4)
	With every infusion	64(4,5)	1(0,3)	--	--	--	65(3,3)
	In case of complications	6(0,4)	--	--	--	--	6(0,3)
	When PVC is replaced	4(0,3)	1(0,3)	--	--	--	5(0,3)
	From 2 to 5 days/ sporadic	61 (4,2)	16 (4,8)	3 (2,7)	2 (4,1)		82 (4,2)
	Other	11(0,8)	--	1(0,9)	--	--	12(0,6)
Evaluation							
	MISSING	2278(60,0)	410(54,5)	129(53,8)	104(68,0)	90(81,8)	3011(59,6)
	Observation	1070(28,2)	205(27,3)	91(37,9)	42(27,5)	19(17,3)	1427(28,3)
	Phlebitis score (VIP Score)	362(9,5)	--	1(0,4)	2(1,3)	1(0,9)	366(7,2)
	Visual Exit Site Score	84 (2,2)	137 (18,2)	16 (6,7)	5 (3,3)		242 (4,8)
	Survelliance form	--	--	3(1,3)	--	--	3(0,1)

(n=22) of the problems concerned infiltration/extravasation and occlusion. The ICU, instead, while recording 22.6% (n=30) of complications, displayed 70.0% (n=21) of the problems were of an infectious nature (CRBSI). Another OU maintained a complication rate of <15% and was mainly device-related such as infiltration/extravasation and device occlusion. The other OU maintained a complication rate of <15% and was mainly device-related such as infiltration/extravasation and device occlusion.

Table 4. Replacement of infusion lines in patients with VAD.

		Cod. 09	Cod. 21	Cod. 26	Cod. 36	Cod. 49	Cod. 60	Cod. 64	Cod. 66	Total
		n = 542	n = 141	n = 519	n = 446	n = 786	n = 80	n = 200	n = 58	N = 2772
Reason for the infusion replacement:										
Pharmacological infusion		96(17,7)	46(32,6)	147(28,3)	100(22,4)	364(46,3)	16(20,0)	53(26,5)	30(51,7)	852(30,7)
Infusion of blood products		23(4,2)	8(5,7)	24(4,6)	48(10,8)	150(19,1)	2(2,5)	18(9,0)	8(13,8)	281(10,1)
Propofol infusions		17(3,1)	--	--	15(3,4)	154(19,6)	--	--	--	186(6,7)
NPT lipid infusions		12(2,2)	1(0,7)	19(3,7)	1(0,2)	145(18,4)	1(1,3)	2(1,0)	2(3,4)	183(6,6)
Traceability of washing/ flush of the catheter and lock closure		51(9,4)	2(1,4)	100(19,3)	51(11,4)	164(20,9)	1(1,3)	55(27,5)	46(79,3)	470 (17,0)
Type of flushing	Not detectable saline	25(49,0)	2(100)	47(47,0)	1(2,0)	21(12,8)	--	2(3,6)	14(30,4)	112(23,8)
	saline	26(51,0)	--	53(53,0)	50(98,0)	143(87,2)	1(100)	52(94,5)	32(69,6)	357(76,0)
	Heparinized solution	--	--	--	--	--	--	1(1,8)	--	1(0,2)

Table 4 shows the results on infusion lines, regarding traceability to infusion line change; results report drug solution [30.7% (n = 852)], blood products [10.1% (n = 281)], propofol solution [6.7% (n = 186)] and lipid/NPT solutions [6.6% (n = 183)]. Traceability of catheter washing/flushing was found in 17.0% (n=470) files and resulted particularly significantly in onco-hematology [79.3% (n=46)]; closure/lock of the catheter was reported in 343 (12.4%) forms. Also in this case, 81.0% (n=47) of the onco-haematological forms included the data: 76.0% (n = 357) in flushing and 65.0% (n = 223) in closure type using saline. In the latter case, however, 41.3% (n=19) of samples from the oncology department used the heparin solution in the closure/lock of the catheter.

Table 5 summarizes the results of the EBP core components on the levels of adherence to the traceability of clinical-care practice in the management of VADs in the analyzed documentation. Compared to the traceability that the Guidelines recommend to be reported in medical records, we recorded an adherence of 83.1% for placement date, 70% for date removal, 46% for reason removal, only 19.9% for type dressing, site monitoring/inspection 38.5%, the use of scales for monitoring exit site only 12%; the complication was recorded only 3%; the date of replacement infusion set in 54.1%, and flush in 17% record consult.

Conclusion

This study aimed to provide an overview of the traceability of EBP practices on VAD management and promote clinical audits to improve nursing practice. This is the first retrospective audit carried out in 30 healthcare facilities distributed throughout Italy which investigated the traceability of EBP in managing VADs; it is also the first study that attempted to deepen the theme of nursing documentation.

The recording of the examined procedures, from the insertion to the management and removal of VADs, are strongly recommended by INS (1) and RCN (15) and constitute an integral part of the evidence-based packages of good care practice (8;14). Although the traceability in the clinical records of

Table 5. Percentage of adherence of the EBP core components documentation.

EBP core components documentation	Compliance with guidelines	
Placement date	83.1%	(n.4.196)
Date of removal	70%	(n.3.543)
Reason of removal	46%	(n.2302)
Type of dressing	19.9%	(n.985)
Site Monitoring/Inspection	38.5%	(n.1.943)
Evaluation using scales	12%	(n.608)
Complications	3%	(n.133)
Infusion line replacement date	54.1%	(n.1.502)
Flush	17%	(n.470)

procedures performed on patients with VAD is considered a standard, as far as we know, no studies including peripheral and central devices in the analysis in the various OU have been conducted in Italy.

From the audit conducted on the analysis of the medical records of the OU and in line with the literature (16), vascular ports were placed during hospitalization, particularly in the surgical and oncology areas, increasing from 40% to 100% of devices in situ. Compared to the OU a substantial difference emerges between the devices inserted, with the PVC as the most used, unlike the oncological areas.

In general, the audit conducted with the nurses of the OU provided greater clarity on the areas of intervention to be improved in the medical record, highlighting the critical points of the lack of traceability and registration of the procedures performed on assisted patients. Each intravenous device, peripheral or central, represents a risk for the patient, exposing him to possible adverse events.

Complications caused by infections are one of the major adverse events related to VADs. CRBSI accounts for approximately 40% of all bloodstream infections (17), representing a significant cause of morbidity and mortality; further they are responsible for lengthening hospitalization times and increasing costs for the healthcare system, mainly related to infections in the CVC (10-11). Other complications, mainly found at the (PVC), are phlebitis, infiltrations and extravasations, occlusions, thrombosis, dislocations, and ruptures (18). These adverse events impact the patient's care in terms of treatment delay, and extension of hospitalization, but also on the patient's experience during hospitalization with increased anxiety due to exposure to further venipunctures, pain, and dissatisfaction (19) with care facility and health care providers, as well as medication waste and costs, associated with recurrent VAD use (20).

Our results are like the first audit conducted by McGuire (8) in medical divisions toward poor recording of the date of removal, particularly for CVPs. This would also require actions to improve traceability in clinical documentation.

The studies conducted by Förberg (14) and Alquvist (13) demonstrate how these data can improve even with PVCs that require complete information from the insertion site to the caliber and the limb chosen for placement, as well as improve records on the number of entries attempts (18).

Based on our data, considering the number of peripheral accesses recorded, we assume that 27.1% of PVCs may have been removed and repositioned but the removal has not been documented. This is consistent with other studies reporting rates of 'no longer required' PVCs in situ of 28,2% (21). We also hypothesize that PVCs can be left in situ even when no longer useful (22), although we cannot be certain as the number of PVCs detected due to exposure to the devices is reduced.

It was difficult to find the date of placement even for the central devices and only the nurses' knowledge about the documentation improved the data regarding traceability. There is the risk that VADs may remain in place without a clear medical indication, particularly when discharged from the ICU (23). In the study by Chopra et al., 21% of physicians were unaware that the patient had a central device. In line with McGuire's audit, our findings also need to incentivize insertion and removal date logging; although the second audit, conducted by the same author in 2019, displayed a significant improvement in adherence to EBPs, documentation, VIP scoring, and timely removal yet need to be improved (24). Indeed, in our study, the result does not reach the standard of traceability in

the practice of infusion therapy (24) which should be promptly improved to optimize management, support the prescriptions of infusion therapies, and improve interprofessional communication, as in the study of Linnè et al. (12). The date of placement and removal represents a standard of traceability of infusion therapy and our results still seem inadequate. This could compromise interprofessional communication and, consequently, the prescription of infusion therapies needed by patients (12).

Recording of a patient with VAD is critical to reducing CRBSI, this allows the operators to identify the device in situ easily, especially if the patient is transferred to other departments.

There is poor information about the management of post-insertion VADs regarding the monitoring and inspection of the insertion site, the use of ladders, catheter washing, the detection of complications, and the replacement of the administration set. Monitoring the insertion site is one of the standards of care to prevent local or systemic infections, promptly identifying possible phlebitis, extravasation, or infiltration. PVCs are known to be the most frequently used invasive devices, and, although less frequently associated with BSIs, the incidence of PVC-BSI is estimated around 0.2-0.7 per 1000 device days. Record of daily catheter site inspection in clinical records does not improve with central accesses, not even reaching 50% compared to PICC and CICC patients. Consistent with the study of prevalence performed on peripheral and central VADs (21), we find this result in day-to-day VAD care to ensure patient safety. Although our data on insertion site monitoring is slightly higher than Ullman's CVAD audit but comparable to McGuire's first audit, we believe this is a specific area for improvement as it is a focal point for healthcare professionals who manage the VADs. Furthermore, monitoring the insertion site requires the use of instruments with VIP score, found in only 12% of medical records examined, to guarantee the reliability of a standard of care and traceability.

As previously reported, post-admission is essential to CRBSI prevention strategies and associated cost reductions (18; 26).

According to Hawthorn et al (16), vascular device insertion, lavage, and infusion procedures appear to be associated with changes in intravascular fluid dynamics, which may explain mechanisms contributing to vascular access failure.

The traceability of the VAD dressing, date of replacement, and type of dressing applied which are essential criteria to indicate to the nurse when to replace the patient's dressing, is very low; this is rather surprising because we expected nurses to pay more attention to EBPs, particularly when central devices are concerned (28). Also, in this case, the data does not improve for PICC and CICC and decreases for drug traceability, for the PVC and the Midline and "mini-midline".

Therefore, recording nursing procedures can provide additional information for conducting studies, increase knowledge, and improve patient outcomes. Outcome data must be collected, analyzed, and used to change clinical practice at a more complex organizational level (29).

From the analysis of medical records of our study, for nurses was difficult to find the information reported in the checklist, and many key information was not even available. Therefore, nursing documentation needs to be improved, particularly in post-insertion, as key information about the safe handling of VADs is not tracked. Evidence about the problem of the poor traceability of the procedures carried out in the management of VADs is reported in the literature, probably hindered by various factors such as the lack of time available for documentation, the lack of an effective registration system which does not allow good nursing documentation (20).

Efforts to improve documentation, as reported by other studies, can help pay attention to patients' complications or problems experienced by patients thus leading to better patient outcomes (10-12) and reducing the lack of data (24). Particularly useful is the adoption of programs that include the use of electronic health records and provide for the integration in the audit of health professionals involved in the VAD management process. The variability of behaviors in managing VADs and the lack of standardization are still challenges that compromise patient safety. Prevention of VAD-related complications is still a healthcare priority and if optimally managed, VAD placement may improve patient outcomes (30-31).

The usage of evidence-based tools such as bundles; the presence of company documents including the availability of material to facilitate the application of the procedures and standardize the management of the VADs; the constant training of health professionals; the presence of dedicated teams (Vascular Access Team-VAT) (23); the compliance with the guidelines; an accurate local system of surveillance of complications (25), feedback, the registration in medical records (12), and a strategy of training with audit (24), are among the main strategies that have proven effective in ensuring patient safety and testifying to the high quality of care.

Concerning the rate of adherence to the study between the north, center, and south, in our opinion this can be attributed to the different distribution and presence of the ISRIs in the health authorities. As shown, in fact, by the national census of Anipio carried out in 2019, the number of regional ISRIs in the south (n.75) is significantly lower than the regions in the north and center, moreover, not all regions participated, such as Calabria and Basilicata (27).

Results shown in this study are certainly not sufficient to fill the gaps recorded in the management of VADs, but they could represent a contribution to improve the nurse's documentation, such as Form A used during the audit, attached, within organizations in the traceability of the applied EBPs.

We acknowledge that the audit conducted with nurses of the same OU could have led to reporting more data than they would have found in the medical records but we believe that the main purpose of this first audit was to use it as a tool for verifying the traceability of nursing procedures to improve compliance with the evidence and consequently at the documentation in the management of patients with VAD.

This study has several limitations. The missing data in the medical records do not necessarily reflect the lack of adherence to EBP procedures in the management of patients with VAD but the omission of the traceability to be included in the medical records. Some data were undetectable or missing. There was no mandatory field in the checklist items that would prevent the absence of missing data in the medical record from being able to continue recording.

The revision of the procedures as a corporate policy adopted for managing VADs, although constituting part of the requested information, was not included in this first analysis of the study. We deferred to another group of ISRIs since it is a qualitative assessment. These data were sent back to the individual OUs to allow them to evaluate the results according to their intervention priorities.

The nurses could use the clinical audit as a review tool among peers and design educational interventions to foster greater competence in clinical documentation and to improve nursing practice in the VADs.

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