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Promoting a research agenda for cancer treatment for intravenous devices with clinicians in Europe; the *PRACTICE* survey

Caitriona Duggan [a,b,c,*,1], Orlaith Hernon [a,c,2], Andrew J. Simpkin [d,3], Viktor Manasek [e,4], Julio C. de la Torre-Montero [f,5], Paulo Santos-Costa [c,g,6], Jonathan G. Moss [h], Christina H. Ruhlmann [i,7], Knut Taxbro [j,k,8], Miguel Angel Rodriguez- Calero [l,9], Rodrigo Oom [m,10], Rita Barroca [n,11], Onagh O. Grady [o], Jacqueline Daly [p,q], Ian Blanco-Mavillard [r,s,12], Nikolina Dodlek [t,u,13], Jiri Charvát [v,14], Saloa Unanue-Arza [w,x,15], Bibiana Krakovska [y], Peter J. Carr [b,c,16]

[a] *School of Nursing & Midwifery, University of Galway, Galway, Ireland*
[b] *Department of Oncology, Portiuncula University Hospital, Galway, Ireland*
[c] *Alliance for Vascular Access Teaching and Research (AVATAR) group, QLD, Australia*
[d] *School of Mathematical and Statistical Sciences, University of Galway, Ireland*
[e] *Oncology center and Vascular Access Center, Agel Hospital Novy Jicin, Czech Republic*
[f] *Comillas Pontifical University, San Juan de Dios School of Nursing and Physical Therapy, Fundación San Juan de Dios, Spain*
[g] *The Health Sciences Research Unit: Nursing (UICISA: E), Nursing School of Coimbra (ESEnfC), Coimbra, Portugal*
[h] *School of Cardiovascular & Metabolic Health, University of Glasgow, UK*
[i] *Department of Oncology, Odense University Hospital, Odense, Denmark*
[j] *Department of Anaesthesia and Intensive Care Medicine, Jönköping, Sweden*
[k] *Department of Biomedical and Clinical Sciences, Linköping University, Linköping, Sweden*
[l] *Torrecardenas University Hospital. Almería, Spain*
[m] *Instituto Português de Oncologia de Lisboa and Hospital da Luz de Lisboa*
[n] *Hospital Lusíadas de Lisboa, Lisbon, Portugal*
[o] *Public and Patient Involvement in Research Representative, Galway, Ireland*
[p] *Cancer Patients Europe, Rue de l'Industrie 24, Brussels 1000, Belgium*
[q] *Director of Services at East Galway & Midlands Cancer Support, Ballinasloe. Co, Galway, Ireland*
[r] *Healthcare implementation and Research Unit, Hospital Regional Universitario de Málaga, Spain*
[s] *C-13 Research Group, Instituto de Investigación Sanitaria de Málaga (IBIMA - Plataforma BIONAND), Málaga, Spain*
[t] *Cyprus University of Technology, Limassol, Cyprus*
[u] *Faculty for Dental Medicine and Health, Osijek, Croatia*
[v] *Medical Department, 2nd Faculty of Medicine, Charles University and Faculty Hospital Motol Prague, V Úvalu 84, Prague 5, Prague 15000, Czech Republic*
[w] *Biobizkaia Health Research Institute, Clinical Nursing and Community Health, Barakaldo, Bizkaia, Spain*
[x] *Department of Nursing I, Faculty of Medicine and Nursing, University of the Basque Country (UPV/EHU), Leioa 48940, Spain*

* Corresponding author at: School of Nursing & Midwifery, University of Galway, Galway, Ireland.
E-mail address: c.duggan23@universityofgalway.ie (C. Duggan).

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[y] 1st Department of Oncology and St.Eluizabeth Cancer Centre, Bratislava, Slovakia

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ABSTRACT

Aims: The *PRACTICE* survey aimed to characterize vascular access device (VAD) practices for systemic anti-cancer therapy (SACT) across Europe, addressing gaps in clinician decision-making, training, and complication management.

Methods: Conducted as a cross-sectional survey from May to October 2024, the study engaged healthcare professionals (HCPs) from 18 European countries, with 403 completing demographic questions and 166 responding to procedural and training-related queries.

Results: Results revealed significant variability in VAD selection, influenced by institutional protocols, geographic location, and the presence of vascular access teams (VATs). Oncologists were identified as primary decision-makers (36 %), though nursing staff played a pivotal role in daily management. Peripheral intravenous catheters (PIVCs) dominated in Ireland and Finland (43–49 %), while tunnelled implantable devices (TIVADs) were preferred in Belgium (65 %). Barriers to optimal VAD selection included insufficient training (80 % sought further education) and inconsistent guideline adoption (51 % reported institutional protocols).

Conclusion: The study underscores the need for standardised practices, interdisciplinary collaboration, and enhanced training. Findings highlight opportunities for integrating VAD selection into cancer care certification metrics and fostering partnerships between oncology and vascular access societies.

1. Introduction

In 2020, there were an estimated 4 million new cases of cancer and 1.9 million cancer-related deaths in Europe [1]. Despite Europe being home to 10 % of the world's population, it accounts for 25 % of all cancer cases globally [2]. A total of 571 cancer therapeutic products were granted regular and accelerated approvals by the Food and Drug Administration (FDA) Center for Drug Evaluation and Research (CDER) or Center for Biologics Evaluation and Research (CBER) from 1 January 2000–31 October 2022 [3]. Despite the increase in new therapeutics and a growing trend towards oral anti-cancer medications, the majority of drugs licensed over the last twenty years require intravenous (IV) administration. Considering the need for vascular access device (VAD) placement to administer such therapeutics, clinicians face a significant challenge in reducing the damage to patients' venous anatomy. The increasing demand in cancer care for IV treatments, the irritating nature of anti-cancer therapies, in addition to emerging modalities such as CAR-T-cell therapy, emphasise the need for clinical decision-making for this facet of cancer care to be underpinned by robust and reliable evidence. A recent scoping review around VAD type for systemic anti-cancer therapy (SACT) [4], identified a lack of research on factors that influence clinicians' decisions on the choice of VAD, their training and education regarding VADs, and the management of VAD-related complications. To address this gap, we conducted a cross-sectional survey on the VAD practices of healthcare professionals (HCPs) who care for cancer patients throughout Europe.

1.1. Objectives

1. Decision-Making and Practices: To assess factors driving VAD selection and characterise current practices in SACT delivery.
2. Training and Competency: To evaluate the availability and impact of training programs on clinician confidence in managing VAD-related complications.
3. Regional Variability and Barriers**:** To compare VAD preferences across European countries and identify systemic challenges

2. Materials and methods

2.1. Study design and study participants

The Promoting a Research Agenda for Cancer Treatment for Intravenous Devices with Clinicians in Europe (*PRACTICE)* cross-sectional census online survey design was conducted over 5 months between May 16th and October 18th, 2024. Eligible participants included European HCPs managing VADs for SACT. This included oncologists, haematologists, nurses, and allied professionals working in oncology/haematology settings.

2.2. Survey development and validation

The first stage in developing and designing the questionnaire was our interaction with the Public and Patient Involvement (PPI) group affiliated with the University of Galway Cancer Research. Two authors, CD and PJC, met with the PPI group to discuss a range of topics concerning vascular access in September 2023. Themes including clinician competence, patient choice, insertion, management of complications, difficult intravenous access, and training emerged from the discussion. VADs for SACT have been the subject of prior international surveys; however, these were limited to particular cancer types, such as individuals with early-stage breast cancer [5], or specific VADs, such as the peripherally inserted central catheter (PICC) [6] or TIVADs [7]. However, no survey was identified that considered all cancer types or VADs. Consequently, components of the previously used surveys were used to create a validated survey (Appendix I). In the next phase of the survey development, initial questions and structure were further improved and verified using face and content validity [8].

Face validity was performed by two external experts in the field, one in clinical practice and one in academia, using a systematic validation technique [9]. Based on these findings, the questionnaire was modified. Thereafter, ten external experts checked the online survey's

[1] https://orcid.org/0000-0001-9127-0492
[2] https://orcid.org/0000-0002-8712-6583
[3] https://orcid.org/0000-0002-4975-444X
[4] https://orcid.org/0009-0007-4699-6025
[5] https://orcid.org/0000-0001-6843-8234
[6] https://orcid.org/0000-0003-0761-6548
[7] https://orcid.org/0000-0002-3728-273X
[8] https://orcid.org/0000-0001-8711-9044
[9] https://orcid.org/0000-0002-2468-5660
[10] https://orcid.org/0000-0002-5365-9410
[11] https://orcid.org/0000-0002-9843-2797
[12] https://orcid.org/0000-0003-2851-5631
[13] https://orcid.org/0000-0002-0534-721X
[14] https://orcid.org/0000-0001-9734-6638
[15] https://orcid.org/0000-0003-0918-5980
[16] https://orcid.org/0000-0003-4935-3256

functionality and content validity. The expert panel was requested to check the survey for clarity, relevance, and simplicity using a systematic approach, ABC of Content Validation [10]. A minimal content validity index (CVI) cut-off score of 0.78 was deemed acceptable, demonstrating the items' relevance to the study's objectives [10].

The survey consists of both closed and open-ended questions. Some of the closed questions have multiple-choice answers with the option of "other" to allow for answers that did not meet the pre-selected answers.

The survey underwent iterative refinement through the expertise of the European co-authors, ensuring its relevance and robustness. This online survey was created in English; however, to reach many HCPs and limit language barrier issues the survey was translated into Portuguese and Spanish. Translation was performed by the Spanish and Portuguese co-authors to maintain consistency and accuracy across participating countries.

2.3. Survey categories

The study was structured into five key categories: Demographics, Choice, Insertion, Training and Development, and Management of Complications. Each category was carefully designed to capture critical data relevant to the use of VADs in clinical practice. The *Demographics* section aimed to characterise participant profiles, while the *Choice* category explored decision-making processes. The *Insertion* and *Management of Complications* sections focused on procedural aspects and adverse event handling, respectively. Finally, the *Training and Development* category assessed educational, skill-building initiatives and the availability of guidelines.

Ethical approval for this study was granted by the Ethics Committee of the University of Galway (2024.01.005).

2.4. Survey dissemination

Non-probabilistic sampling strategies (purposeful and snowball sampling) were used in an attempt to increase the response rate by expanding the reach and establishing a connection with cancer specialists. When target groups are hard to reach in quantitative research, snowball sampling is a deliberate technique for gathering data [11]. Purposeful sampling, on the other hand, involves choosing participants based on predetermined standards to offer particular insights into a certain subject [11]. The survey was launched in Ireland on May 16, coinciding with European Cancer Nursing Day. The completed 47-item survey was sent via an online application (www.questionpro.com, QuestionPro, Austin, TX). Survey dissemination and data collection adhered to the CHERRIES (Checklist for Reporting Results of Internet E-Surveys) guidelines [12](Appendix II).

We included a consent step at the beginning of the survey, ensuring that respondents understood their participation and their rights. To boost the response rate and the representativeness of the countries, email reminders were sent to European oncology organisations, and frequent posts were made on social media.

2.5. Statistical analysis

Demographic data were described using descriptive statistics and frequencies. The Kruskal-Wallis test was used for continuous variables, while Fisher's exact or Pearson's Chi-squared test were used for categorical variables depending on sample size (i.e. expected cell counts below 5). Statistical significance was defined as a p-value of < 0.05. All statistical analyses were performed in R v4.3 [13]. Qualitative analysis of free-text input was conducted using NVivo software to derive key themes [14].

3. Results

3.1. Demographic characteristics of survey respondents

The findings in this paper reflect varying sample sizes resulting from participant attrition. Initially, 403 participants provided consent and responded to the first question. Of these, 147 discontinued after completing only the demographic questions (Q1–Q9), while 256 proceeded to complete the choice, insertion, and training and education sections (Q1–Q29). Ultimately, 166 participants completed the full survey.

The largest group of respondents (84 %, n = 338) cared for patients over 18 years of age. A lower proportion of medical professionals (13 %, n = 53) responded to the survey compared to nursing professionals (86 %, n = 348). Of the 403 respondents to the question regarding their institute, Half of the respondents (49 %, n = 199) reported that they were not working in a comprehensive cancer center, while 8 % (n = 32) were unsure and 63 % were from Oncology, n = 255, 11 % Haematology, n = 43, 26 % Other, n = 105. (Appendix II).

Key characteristics of responders (N = 256) and partial responders (N = 147) were compared (see Appendix III). Significant differences were observed in area of work ($p < 0.001$), years of experience in Oncology/Haematology ($p < 0.001$), country (p-value 0.002), and employment in comprehensive cancer centers (p-value 0.032). For instance, responders were more likely to be from Ireland (39 % vs. 23 %) or working in Oncology (72 % vs. 48 %).

The analysis primarily focuses on the 256 complete responses, as partial responders (N = 147) provided limited additional insights.

3.2. Variability in VAD usage patterns across Europe

Respondents came from 18 European countries displayed in a colour-intensity world map using Datawrapper with darker shades representing higher values (Fig. 1). Ireland (33 %, n = 133, Portugal (6.2 %, n = 25), Spain (34 %, n = 136), and Czechia (8.2 %, n = 33) were the top four participating countries. Respondents from the other countries were grouped under the term "rest of Europe" (19 %, n = 76) for comparative purposes.

3.3. Choice

3.3.1. Regional variability in VAD

Participants were asked to rank the decision makers for selection of VADs - a score of 1 implies the most important decision maker, a ranking of 4 meant the person was not important (Table 2). Oncologists were ranked as the key decision makers (mean rank 2.21), followed by patients (mean rank 2.89) and Staff Nurses (2.93). There were significant differences between countries in ranking of haematologists, staff nurses, clinical nurse specialists and VAD team (all $p < 0.05$). The oncologist ranked highest in Ireland, Czechia and rest of Europe. This was followed in Czechia by the Vascular Access Team and in Ireland by the Clinical Nurse Specialist. In Portugal and Spain, the majority of the decisions for VAD selection are made by the staff nurse. Portugal and the rest of Europe ranked the patient second.

3.3.2. Timing of initial VAD choice

Our study revealed that clinicians primarily decide on the type of VAD at different stages in the treatment process, with n = 39 % of respondents choosing the device during the education session before therapy, and 31 % during the first consultation with the medical team, and 23 % at the first SACT session. Additionally, free text comments reported that clinicians often choose the device when "peripheral veins become unsuitable for treatment" or "when issues arise with gaining peripheral access".

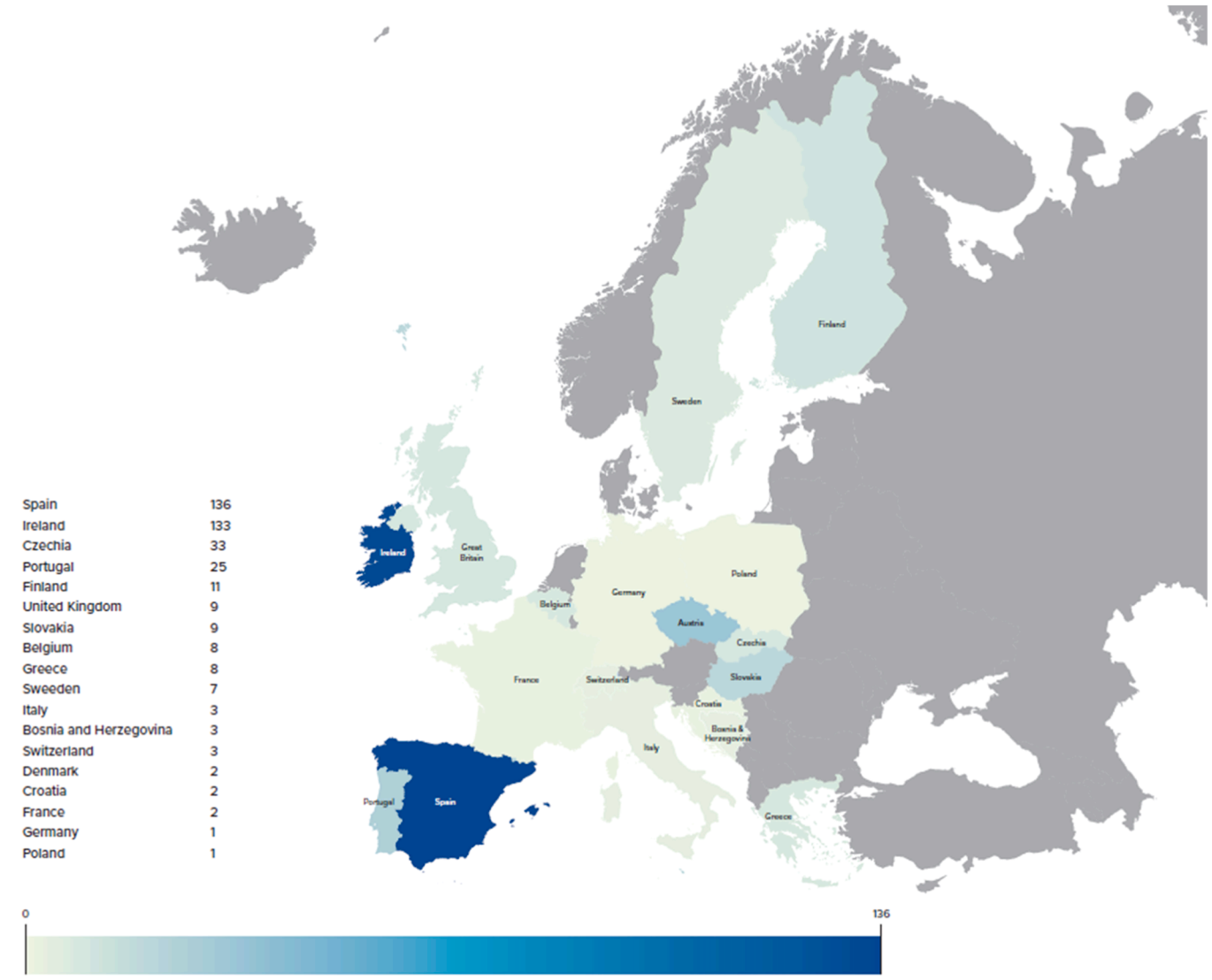

Fig. 1. Geographic Distribution of Survey Respondents Across Europe (source: authors, through https://www.datawrapper.de/).

Table 2
Country Responses on Ranking (1-4) the Decision-Makers for VAD. Lower scores reflect more important decision makers.

Decision maker	N	Mean rank (SD)	Czechia N = 33 [1]	Ireland N = 133 [1]	Portugal N = 23 [1]	Rest of Europe N = 76 [1]	Spain N = 136 [1]	p-value[2]
Patient	256	2.89 (0.89)	2.65 (0.93)	2.98 (0.83)	2.71 (0.92)	2.85 (0.96)	2.90 (0.90)	0.5
Oncologist	256	2.21 (1.13)	2.24 (1.09)	2.03 (1.10)	2.24 (1.25)	2.35 (1.20)	2.37 (1.10)	0.3
Haematologists	256	3.46 (1.01)	3.47 (1.07)	3.69 (0.78)	3.65 (1.00)	3.27 (1.13)	3.24 (1.13)	0.013
Staff Nurse	256	2.93 (1.25)	3.29 (1.21)	3.24 (1.10)	2.06 (1.09)	3.38 (1.09)	2.30 (1.27)	< 0.001
Clinical Nurse Specialist	256	3.32 (1.13)	3.76 (0.75)	2.58 (1.32)	3.59 (0.80)	3.63 (0.84)	3.96 (0.36)	< 0.001
Advanced Nurse Practitioner	256	3.85 (0.55)	4.00 (0.00)	3.78 (0.65)	3.94 (0.24)	3.90 (0.41)	3.85 (0.60)	0.4
Vascular access specialist team	256	3.56 (0.90)	2.59 (1.18)	3.92 (0.37)	4.00 (0.00)	3.06 (1.23)	3.56 (0.84)	< 0.001
Interventional Radiologist	256	3.88 (0.47)	4.00 (0.00)	3.85 (0.50)	3.88 (0.33)	3.83 (0.58)	3.93 (0.43)	0.3

[1]Mean (SD)
[2]Kruskal-Wallis rank sum test

3.3.3. Current practice in VAD use

According to the survey results, there is a great deal of variation in the usage of VADs for prolonged SACT depending on several factors, such as working in a comprehensive cancer centre, the presence of a vascular access team and the clinician's country (Table 3). The distribution of device use among clinicians employed by comprehensive cancer centres revealed tunnelled implantable vascular access device (TIVAD)-PICC-PORT showed a statistically significant difference in usage (p-value 0.013). The presence of a vascular access specialist team (VAST) significantly influenced device use, with higher PICC (p-value 0.002) and midline catheter ($p < 0.001$) use observed in centres with a dedicated VAST, while peripheral intravenous catheters (PIVCs) were

Table 3
Percentages of patients who receive prolonged (greater than 3 months) anti-cancer treatment for each device type, by factors such as working in a comprehensive cancer centre, the presence of a vascular access team, and the clinician's country [1] Mean (SD).

	PIVC	PICC	Midline	TIVAD- Chest	TIVAD- PICC-PORT	Short CVC	Tunneled VAD (Hickman)	Umbilical catheters
Working in a Comprehensive Cancer Centre Yes/No/ Unsure (N = 256)Yes N = 172, No N = 199, Unsure N = 32								
Yes	33 (27)	25 (21)	1.9 (6.1)	29 (23)	4 (9)	4 (12)	3 (11)	0 (0)
No	38 (28)	24 (24)	1.0 (5.5)	27 (21)	3 (10)	4 (13)	3 (9)	0.087 (0.93)
Unsure	39 (27)	20 (22)	1.0 (4.0)	31 (27)	4 (20)	2 (8)	2 (6)	0(0)
p-Value[1]	0.2	0.4	0.075	0.8	0.013	0.7	0.5	0.5
Presence of Vascular Access Team (N = 166)Yes N = 84, No N = 73, Unsure N = 91, p-value								
Yes	29 (26)	29 (23)	2.44 (8.78)	26 (21)	4.7 (10.9)	4 (13)	4 (12)	0 (0)
No	50 (23)	17 (16)	0.03 (0.23)	27 (20)	2.0 (6.8)	2 (10)	2 (8)	0 (0)
Unsure	36 (27)	25 (31)	3.33 (6.78)	32 (22)	0.1 (0.3)	3 (9)	(4) 4	0 (0)
p-Value[2]	< 0.001	0.002	< 0.001	0.6	0.013	0.2	0.1	
By CountryCzechia N = 33, Ireland N = 133 [1] Portugal N = 25, Rest of Europe, N = 76, Spain N = 136								
Ireland	49(24)	21(18)	1.4(6.3)	23(15)	2(6)	1(4)	3(10)	0 (0)
Spain	27(25)	34(28)	2.3(7.3)	25(21)	4(11)	4(9)	5(12)	0.148 (1.9)
Czech Republic	22(23)	29(18)	0.6(2.4)	35(20)	12(24)	1(3)	0(0)	0 (0)
Portugal	39(27)	5(14)	0.0(0.0)	39(27)	4(10)	10(19)	33(13)	0 (0)
Rest of Europe	26(28)	19(21)	1.1(2.8)	38(30)	5(12)	7(20)	2(5)	0 (0)
p-Value[3]	< 0.001	< 0.001	0.03	0.006	<0.001	0.002	0.009	0.6

1 Kruskal-Wallis rank sum test comparing % use across whether respondent works in a comprehensive cancer centre (yes/no/unsure)
2 Kruskal-Wallis rank sum test comparing % use across whether respondent's workplace has a vascular accesss team (yes/no/unsure)
3 Kruskal-Wallis rank sum test comparing % use across respondent country

Table 4
Frequency distribution of barriers.

Theme	Sub-Theme	Count	% of Total	Example Responses
1. Structural Barriers		**72**	**67.3 %**	
	1.1 Service Access Limitations	38	35.5 %	"WAITING LIST FOR IR", "Time constraints"
	1.2 Staffing/Resource Gaps	22	20.6 %	"No CVAD team" "Lack of materials"
	1.3 Workflow Inefficiencies	12	11.2 %	"Poor planning around chemo"
2. Knowledge & Practice		**41**	**38.3 %**	
	2.1 Provider Knowledge	25	23.4 %	"Doctors stuck in past" "Lack of US training"
	2.2 Guideline/Patient Education	16	15.0 %	"No national guideline", "CNAs give bad advice"
3. Interprofessional		**33**	**30.8 %**	
	3.1 Power Imbalances	20	18.7 %	"Haematologists ignore nurses"
	3.2 Collaboration Failures	13	12.1 %	"MDs don't consult VAT"
4. Patient-Related		**28**	**26.2 %**	
	4.1 Preferences/Perceptions	16	15.0 %	"Body image concerns" "Patient refusal"
	4.2 Clinical Contradictions	12	11.2 %	"Anticoagulation history" "Low BMI"
5. Systemic & Policy		**14**	**13.1 %**	
	5.1 Infrastructure	8	7.5 %	"No IR department"
	5.2 Resource Allocation	6	5.6 %	"Financial constraints"

more frequently used in settings without such teams ($p < 0.001$). The TIVAD-PICC-PORT also demonstrated statistically significant variation in centres with a VAD team (p-value 0.013).

In relation to types of VADs for patients receiving prolonged (greater than 3 months) anti-cancer treatment. The United Kingdom, Ireland, Greece, and Finland report high usage of PIVC, with a range of 43 %-49 %. Italy, Spain, and Slovakia show a higher tendency toward PICC, with 34 %-45 % of clinicians choosing this device. Belgium, with a significant proportion of clinicians (65 %), overwhelmingly preferring TIVAD, whereas the Czech Republic and Sweden show moderate use (35 %-41 %). Portugal presented an interesting finding, with equal usage of both PIVC and TIVAD at 39 % each, highlighting a more balanced preference for these devices (Table 3).

3.3.4. Barriers to optimal VAD selection and use

A significant portion of clinicians across Europe reported experiencing barriers when selecting the most appropriate VAD for patients undergoing prolonged SACT. 136 people (53 %) said "yes," 87 % said "no," and 33 % said "unsure." The barriers identified spanned multiple domains, reflecting the complexity of VAD selection for SACT. A thematic analysis [15] of free-text responses was conducted using NVivo software (Version 12) [14], employing a hierarchical coding framework with parent and child nodes to categorise barriers into five core themes: (1) Structural Barriers, (2) Knowledge and Practice, (3) Interprofessional, (4) Patient-Related, and (5) Systemic and Policy barriers. All responses were systematically mapped to these themes, followed by a cross-tabulation of frequency counts to quantify their prevalence.

3.3.5. Institutional and national/international guidelines for VAD selection in systemic anti-cancer therapy (SACT)

The results report over half of clinicians (51 %) are working in organisations where a formal policy or set of guidelines exists for selecting VADs, while 32 % reported no guidelines and 17 % were unsure if such documents exist. More specifically, when asked whether their hospital has specific guidelines on VAD insertion in patients with difficult IV access, 59 % of clinicians in Medicine reported that their hospital does not have specific guidelines and 14 % of medics were unsure about whether such guidelines exist. Of the Nursing respondents, 54 % reported that their hospital does not have specific guidelines and 20 % of nursing staff were unsure whether specific guidelines exist.

3.4. Insertion

3.4.1. Model of care for VAD selection and insertion and presence of a dedicated vascular access team

In relation to the question "Which best describes your current VAD service in your institution?", 46.9 % of respondents followed a

collaborative pre-treatment approach where clinicians and patients jointly decided the VAD type before initiating anti-cancer therapy. In 33.7 % of cases, oncology nurses were the first to attempt vascular access, escalating to other resources only if needed. A dedicated vascular access team handled all access procedures in 8.4 % of institutions, while medical doctors directly provided access in just 4.8 %. The remaining 6 % reported alternative service models.

We correlated the responses to "Does your hospital have a dedicated VAST with work setting (Comprehensive Cancer Center [CCC] vs. non-CCC) and geographical country. The data showed variation in VAST presence across countries. Spain, the UK, and Czechia report the highest rates of VASTs (70–80 %), while Portugal (13 %) and Ireland (36 %) report less. 51 % of respondents in the "Rest of Europe" reported having a vascular access specialist team, but responses varied widely (e.g., Germany: 100 %, Poland: 0 %).

The survey results revealed a significant association between working in a CCC and the presence of a dedicated VAST ($p = 0.003$). Among the 166 respondents, 58 % ($n = 42$) of those working in a CCC reported having a VAST, compared to 32 % ($n = 27$) of those not in a CCC and 33 % ($n = 3$) of unsure respondents.

3.4.2. Resources used for difficult venous access

The results indicate that, on average, 42.73 % of patients were described as having difficult intravenous (IV) access.

The most commonly used resource was *other colleagues* (15 %), Anesthetists were the second most frequently used resource (9.9 %), followed closely by ultrasound (9.6 %) and vascular access teams (9.1 %). Interventional radiologists were used in 6.1 % of cases, while vein visualisation technology was the least commonly reported resource (2.7 %). In countries with the presence of VASTs (e.g., Spain, Czechia), there was a higher use of VATs and interventional radiologists ($p < 0.001$). However, there was reliance on anesthetists and general colleagues in countries without VASTs (e.g., Ireland, Portugal) (p-value 0.002).

3.5. Training and education

We report a varied level of training offered for vascular access procedures, care, and management across different countries in Europe. The results show that countries like Ireland (75 %) and the Czech Republic (70 %) report higher levels of ongoing training offered in the workplace compared to Spain (57 %), Portugal (38 %), and the rest of Europe (65 %). In total, $n = 52$ % of respondents reported having taken part in ongoing training for vascular access in the last 3 years, with no significant difference in engagement between medical and nursing professions (p-value 0.2). Having a dedicated vascular access team in the clinical setting was not statistically significant in improving access to training and education (p-value 0.071). Overall, 65 % of institutions actively provide patients with information about VADs, however, 15 % of respondents are unsure whether such information is provided, and 20 % report that their institutions do not disclose this information. Hospitals with a VAST are more likely to provide information (72 %) than those without (56 %) with a trend towards significance (p- value 0.054).

3.6. Complication management and institutional support

The responses to the question, "Would you like to receive more training in managing complications of VADs for systemic anti-cancer therapy?" show that 80 % of respondents are very interested in learning more about this subject.

Almost half of the respondents (45 %) reported that their organisations have some form of registry/database for tracking VAD-related information, a significant portion of respondents (30 %) don't have one in place, and 25 % are unsure if a database exists.

Moreover, 78.4 % self-rated as Advanced/Expert (36 %/42 % respectively), reflecting strong PIVC self-reported competency among most clinicians. This was followed by PICC (Expert 39 %, Advanced 29 %) and TIVAD-chest (Expert 38 %, Advanced 33 %). There was lower confidence reported in Midline Catheters and PICC Ports, with 19 % rating themselves as "Expert" in both Midline and PICC PORTS (Fig. 2). With tunnelled Catheters (e.g., Hickman), 17 % reported as Expert, 20 % Advanced (but 33 % marked "Not Applicable"). The overall reported competence in managing complications with umbilical Catheters was even less, with < 5 % reporting as Expert, and > 50 % reporting "Not Applicable."

4. Discussion

4.1. Demographics and regional trends

Our multiprofessional European survey on VADs in Cancer identifies variation in VAD use across countries, reflective of differing healthcare systems, clinical guidelines, and patient demographics. It highlights an opportunity for standardised approaches to VAD for comprehensive cancer care. Specifically, the high use of PIVC in countries like Ireland and Finland might reflect a combination of preference and service-level limitations e.g., lack of access to trained staff or VAD insertion services, particularly for patients requiring frequent treatments. According to the Infusion Nurses Society (INS) guidelines, PIVCs are generally suitable for short-term therapies and certain types of chemotherapy that are non-vesicant or minimally vesicant [16]. The choice of vascular access should be guided by the type and duration of therapy, the patient's condition, and the risk of complications such as extravasation or phlebitis and availability of trained clinicians [17]. Some of the obstacles listed in Finland and Ireland would suggest that there are more service-related reasons why central venous access device use is lower such as "Insufficient resources of trained vascular access personnel", "access to professional to insert device in a timely fashion in order to facilitate prompt commencement of chemotherapy" and " medical power, poor nursing involvement".

Belgium's high percentage (65 %) of TIVAD-chest usage suggests that there may be a clinical trend toward choosing more durable, long-term solutions for patients undergoing prolonged treatment, likely driven by factors such as patient comfort and the need for extended therapy [18]. Such an approach is consistent with the findings from all of the RCTs published in the field [19], including the largest randomised control trial conducted in the UK comparing TIVAD, PICC, and Hickman, the CAVA trial, which found that TIVAD-chests are safer and more successful than both Hickman and PICCs [20]. Despite the findings of the aforementioned trial, it is interesting to note that respondents in the UK reported in our survey using PIVC and PICC more frequently than TIVAD-chest.

Countries like Italy and Spain favour PICC, which is often used for patients requiring more central access but not necessarily the permanence of a TIVAD. To aid in clinical decision-making, the Spanish Society of Medical Oncology (SEOM), the Foundation for Excellence and Quality in Oncology (ECO), and the Spanish Society of Oncology Nursing (SEEO) created a catheter selection algorithm in 2020 that is based on patient characteristics and treatment [21]. PICC offers a balance between accessibility and ease of use for longer treatment periods. The equal split in Portugal between PIVC and TIVAD (39 % each) might reflect a country where clinical practice allows for more flexibility, depending on patient needs or institutional protocols. There is prior, high-quality research that compares several central VADs, except PIVC [20,22]. Results of a Cochrane review will assess the effectiveness of PIVC with all VADS for the delivery of anti-cancer treatments therapies [23].

4.2. Choice of VAD

Despite the availability of comprehensive guidelines and protocols such as the INS standards of care [16], GloVANet/WoCoVA [24],

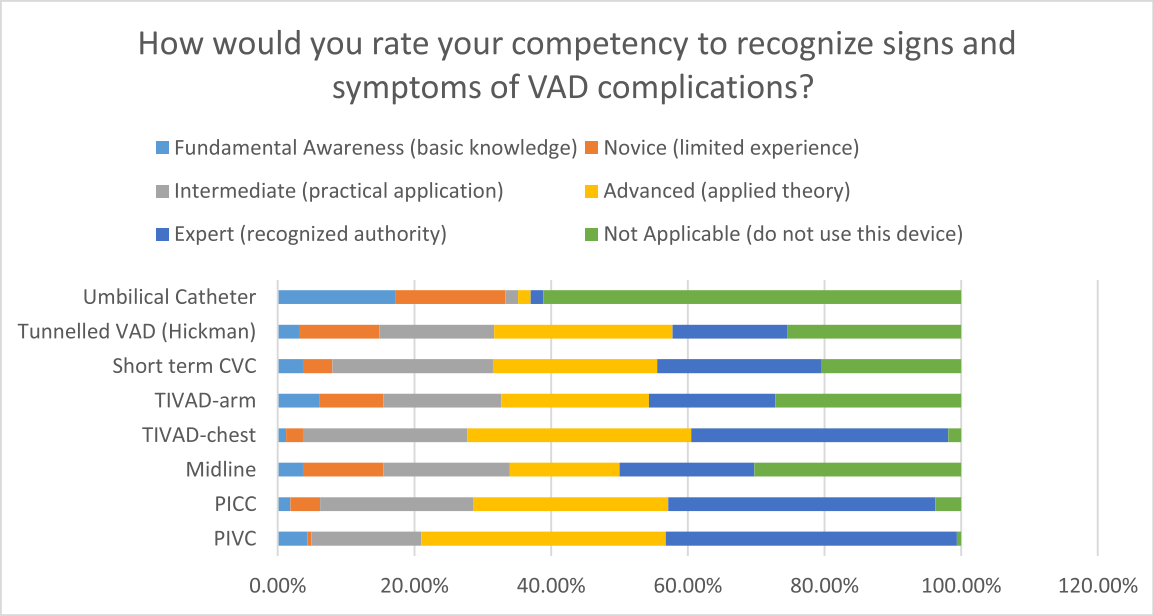

Fig. 2. Cluster bar chart showing Self-Reported Competency Levels in Recognising VAD Complications by Device Type.

GAVeCeLT recommendations [25], and others, a preference for peripheral VADs remains, even for patients undergoing long-term therapy. Decision making appears disjointed, 36 % believe that oncologists make the final decision about the type of VAD, while 22 % reported staff nurses and 6 % of decisions are made by a vascular access team. This reflects a hierarchical model where oncologists/haematologists and nurses collaborate to identify the need for a central line, but surgeons ultimately perform the procedure. Such practices may stem from historical norms or resource allocation, where VAST are either absent or less influential.

The disparity between recommendations and VAD selection may be caused by a number of variables, including healthcare workers' lack of information and expertise. This lack of familiarity can make it difficult for them to make fully informed decisions about the most appropriate type of vascular access, even though they are responsible for initiating and delivery of treatment. Further investigation is needed to ascertain the mechanisms used for guidance on device selection. Peripheral VADs are often seen as more convenient for short-term [26] or less invasive treatments, particularly if there is a time pressure to commence treatment, which could influence oncologists' decision-making even for patients who need longer-term access. This could be a factor of familiarity and availability with peripheral access, despite the risks of complications over time. There may be a gap in communication between oncologists and other healthcare providers such as nurses, interventional radiologists, and vascular access specialists, who are more experienced in managing VADs as our results reported medical doctors only directly provided access in just 4.82 %. This could lead to oncologists not being as involved in the decision-making process related to VADs and, in turn, may lead to suboptimal choices being made.

Oncologists and Haematologists often face numerous priorities when managing cancer treatment, and the choice of a VAD might not be viewed as critical as other therapeutic decisions. However, oncologists are ultimately responsible for treatment indication, which includes selecting the appropriate VAD to minimise complications and optimise patient outcomes. Nurses play a pivotal role in the daily administration of SACT and in managing the patient's vascular access throughout treatment [27]. Our survey highlighted however that nurses don't feel responsible or central to the decision-making process regarding VAD selection, with oncologists ranked as the primary decision-makers. This may be due to several factors, perceived role boundaries or lack of awareness or training. Further research is required into this area which could include exploring the use of simulated learning to enhance nurses' confidence and competence in contributing to VAD decisions or examine how hospital or clinical policies and protocols influence the involvement of nurses in VAD decision-making. The Organisation of European Cancer Institute's standards [28] could integrate VAD selection and management as a measurable metric in cancer centre certifications for example, auditing adherence or outcomes with VADs for vesicants. Additionally, an opportunity exists for this to be carried out in tandem with vascular access societies and cancer organisations such as the European Society of Medical Oncology, European Oncology Nursing Society and Multinational Association of Supportive Care in Cancer to implement joint SACT safety guidelines to include explicit, evidence-based criteria for VAD selection.

4.3. *Implications for clinical practice and policy*

The development of protocols to ensure a safe vascular access journeys of patients undergoing treatment, particularly those receiving SACT, is an important cornerstone in clinical care [21,29]. It is one that requires continuous advancement with evidence such as clinical trials.

We suggest that healthcare organisations may not have fully implemented or communicated the importance of standardising the VAD selection process, as 51 % of clinicians report being unaware of the guidelines. Additionally, further efforts are required to ensure that guidelines are not only in place but also accessible and understood by all relevant clinical staff, given that 14 % of clinicians in Medicine and 20 % in Nursing were unsure whether their hospital has such guidelines. The absence of government-endorsed or nationwide guidelines in some regions, such as Portugal [30], and poor awareness of existing protocols lead to fragmentation, potentially resulting in suboptimal device selection and risk to patient safety/patient outcomes [31]. The 17 % of clinicians who were unsure about the presence of guidelines for VAD selection and 19 % who were unsure if their hospital has specific guidelines for VAD insertion in patients with difficult IV access may suggest a lack of communication or awareness within some healthcare organisations. Future research using implementation science methodologies could indicate inconsistencies in the implementation or visibility of the guidelines, even if they do exist in some form. Targeted strategies should be implemented to ensure uptake, improve the dissemination,

rigour, and accessibility of VAD selection guidelines [32,33], to improve the effectiveness and efficiency of guideline implementation [34]. This could include adopting a unified evidence-based guideline, aligned with OECI standards, while allowing for local and regional adaptations, particularly in CCCs, to balance best practices with contextual needs. This could involve ensuring that all healthcare staff are aware of existing guidelines and receive training on how to apply them effectively in clinical practice [32]. Future research should encourage more interdisciplinary collaboration, where health care professionals are better informed about the different types of VADs, national and international guidelines, and potential complications.

Training and continuous education on the role and importance of vascular access could improve decision-making and ensure that patients receive the most appropriate care [35]. The high percentage (80 %) of respondents expressing interest in further training on managing complications indicates a significant gap in current knowledge or experience. It draws attention to a possible weakness in the training programs that are currently in place as well as a glaring opportunity to improve knowledge and proficiency in this field. This suggests that retraining could be necessary. If retraining is currently being offered, who delivers it, how is it standardised and how is it measured are important question to ask. Effective training and retraining programs should leverage evidence-based educational strategies, such as high-fidelity simulation, e-learning modules, and interdisciplinary workshops, to reinforce both technical and decision-making skills. Among these, simulation-based training, particularly in situ simulations (conducted in real clinical environments), has been shown to improve team performance, reduce errors, and—most importantly—lead to measurable improvements in patient morbidity and mortality [36].

4.4. Difficult intravenous access (DIVA)

Studies have highlighted that structured guidelines and tools, such as the DIVA tool, can reduce complications and improve the patient experience [37,38]. However, the findings that a significant portion of clinicians—59 % in Medicine and 54 % in Nursing—report the absence of specific guidelines for VAD insertion in patients with difficult IV access suggest a notable gap in practice. This further highlights the need for standardised guidelines to ensure consistency and safety across all clinical settings. To improve the management of DIVA patients, existing, well-regarded tools such as the DIVA assessment should be translated and culturally adapted to national clinical settings [39]. Government-endorsed or hospital-based guidelines should formally incorporate these tools into their recommendations, and patient health records, whether paper or digital— should be designed to allow healthcare professionals to document and track DIVA status over time. Likewise, nursing and medical students should receive comprehensive training to recognise, assess, and manage patients with a DIVA diagnosis, ensuring a standardised approach across all levels of care. Ensuring that the DIVA tool is available in all clinical facilities where peripheral cannulas are inserted could improve the identification of patients who are at risk for difficult access [39]. Educational programs on the use of the DIVA tool, as well as clinical practice guidelines and escalation pathways for managing difficult vascular access, are critical to provide more effective and less traumatic care for patients [38]. However, further research is needed to assess the impact of DIVA protocols and training programmes on insertion-related complications and patient experience [40]. The data on the resources used for obtaining difficult venous access provides important insights into the variety of approaches clinicians take when faced with challenging vascular access situations. Fifteen percent of respondents reported using other colleagues for difficult venous access. This reflects the collaborative nature of clinical practice. Among respondents, 9.6 % reported using ultrasound for difficult venous access, making it the most commonly used tool. This aligns with clinical best practices, as ultrasound guidance improves accuracy and reduces complications in challenging cases [41].

4.5. Limitations

Despite linking with large oncology organisations and key personnel across Europe, the recruitment process for the PRACTICE survey faced several challenges.

The high dropout rate (58.8 % by the end of the survey) raises concerns about data completeness and potential non-response bias. Early dropouts (36.5 % within the first ten questions) suggest that the survey's length or complexity may have discouraged participation, particularly among busy healthcare professionals. Given that the survey contained 47 items, survey fatigue, in which respondents disengage due to excessive length, repetitive questions, or perceived burden, may also have been a factor [42]. This could skew results if respondents who completed the survey differed systematically from non-respondents; for instance, if only highly motivated or specialized clinicians provided full responses. The varying sample sizes across questions (403 for demographics vs. 166 for procedural/training questions) further limit the robustness of conclusions in later sections.

Selection bias is another critical limitation due to using non-probabilistic sampling (snowball and purposeful sampling). While effective for reaching niche groups, this method may overrepresent certain countries, such as Ireland and Spain, or institutions with stronger professional networks, underrepresenting others. The survey was available only in English, Spanish, and Portuguese, excluding non-English-speaking regions and potentially biasing results toward countries where these languages are prevalent. Additionally, nursing professionals (86 % of respondents) were overrepresented compared to physicians (13 %), which may not reflect the true distribution of decision-making roles in clinical practice.

Generalisability is compromised by the uneven geographic distribution of respondents, with Ireland (33 %), Spain (34 %), and Czechia (8.2 %) dominating the sample, while other European regions were grouped as "Rest of Europe" (19 %). This limits the ability to extrapolate findings to all European healthcare systems, particularly in underrepresented countries. The lack of engagement from some English-speaking nations perhaps reinforces the lack of importance this topic is given in cancer care. Furthermore, the survey's focus on clinicians affiliated with comprehensive cancer centers (43 %) may not capture practices in smaller or rural hospitals where resource constraints could lead to different VAD selection trends. Time constraints and competing priorities among healthcare professionals, particularly in high-demand cancer settings, could have hindered participation [43].

5. Conclusion

The *PRACTICE* survey provides a comprehensive European perspective on VAD practices for SACT, addressing key gaps in clinician decision-making, training, and complication management. The results reveal significant variability in VAD selection across countries, influenced by institutional protocols, geographic location, and the presence of VASTs. Oncologists emerged as primary decision-makers, though nursing staff played a critical role in daily management, highlighting the need for interdisciplinary collaboration. Barriers such as insufficient training and inconsistent guideline adoption underscore the urgency for standardised practices and enhanced educational initiatives. Geographic disparities in VAD preferences—such as the high use of PIVCs in Ireland and Finland versus the preference for TIVADs in Belgium—further emphasise the need for evidence-based, context-sensitive guidelines. The findings advocate for integrating VAD selection into cancer care certification metrics and fostering partnerships between cancer care and vascular access societies to improve patient outcomes. By addressing these challenges, healthcare systems can optimise vascular access strategies, reduce complications, and enhance the quality of care for cancer patients across Europe.

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CRediT authorship contribution statement

Rita Barroca: Writing – original draft, Writing – review & editing. **Saloa Unanue-Arza:** Writing – original draft, Writing – review & editing. **Rodrigo Oom:** Writing – original draft, Writing – review & editing. **Ian Blanco-Mavillard:** Writing – original draft, Writing – review & editing. **Rodriguez-Calero Miguel:** Data curation, Writing – original draft, Writing – review & editing. **Paulo Santos-Costa:** Methodology, Resources, Writing – original draft, Writing – review & editing. **Knut Taxbro:** Writing – original draft, Writing – review & editing. **de la Torre-Montero Julio:** Resources, Validation, Writing – original draft, Writing – review & editing. **Caitriona Duggan:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **Bibiana Krakovska:** Writing – original draft, Writing – review & editing. **Jacqueline Daly:** Conceptualization, Validation, Writing – original draft, Writing – review & editing. **Jiri Charvát:** Writing – original draft, Writing – review & editing. **Onagh O Grady:** Conceptualization, Investigation, Validation, Writing – original draft, Writing – review & editing. **Nikolina Dodlek:** Writing – original draft, Writing – review & editing. **Ruhlmann Christina:** Writing – original draft, Writing – review & editing. **Viktor Manasek:** Conceptualization, Writing – original draft, Writing – review & editing. **Moss Jonathan:** Writing – original draft, Writing – review & editing. **Simpkin Andrew J:** Data curation, Formal analysis, Validation, Writing – review & editing. **Carr Peter J:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Visualization, Writing – original draft, Writing – review & editing. **Orlaith Hernon:** Data curation, Methodology, Supervision, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix I

Previous surveys related to vascular access and anti-cancer therapy

Study Topic	Country/ Year	Sample selection	No of respondents	Type of VAD
Optimizing VAD practices for early stage breast cancer [44]	Canada 2018	A Survey of Oncology Nurses and Physicians	25 physicians and 57 oncology nurses	PIVC, PICC, TIVAD
Pattern of use of VADs in the clinical setting and the criteria used for their utilization [45]	43 countries 1998	602 Multinational Association of Supportive Care in Cancer (MASCC) members, all cancers	227 medical and nursing professionals	PIVC PICC TIVAD Hickman
Vascular access device usage patterns in recipients of hematopoietic stem cell transplants [46]	world-wide 2007	445 centres	163 respondents	Dual-lumen plasmapheresis/ haemodialysis Three-lumen pheresis/ haemodialysis/infusion catheter Multilumen long-term cuffed tunneled catheters
Vascular nursing experience, practice knowledge, and beliefs [6]	United States 2016	172 received invitations, 140 completed the survey	140 completed the survey	PICC
To evaluate infusion nursing access events for these 2 different TIVADs [7]	Canada 2016	145	139	Non power-injectable and power-injectable PORT
Oncology nurses' level of knowledge on the administration of chemotherapy via peripheral and central venous catheters [47]	Turkey 2017	568 nurses	165 respondents	PIVC PICC TIVAD

Appendix II. Cherries Checklist [12]

Cherries Checklist			
	Item	**Description**	**Page/Section**
1	Informed Consent	Participants consented electronically before proceeding.	Methods, Survey Dissemination
2	Data Protection	Anonymized data; GDPR-compliant storage (QuestionPro).	Methods, Statistical Analysis
3	Completeness Checks	Partial responses (e.g., demographics-only) were included in descriptive analyses but excluded from procedure/training-related analyses if incomplete	Page/Section
4	Handling Incomplete Data	Missing data were reported as 'unknown' in tables; sensitivity analyses compared complete vs. partial responders (Appendix III).	Methods, Survey Dissemination
5	Ethical Approval	Approved by the University of Galway Ethics Committee (Ref: 2024.01.005).	Methods, Statistical Analysis
6	Survey Development	Pilot-tested with experts; face/content validity performed	Methods

Appendix III. Research Study Demographics: Characteristics of Complete vs. Incomplete Survey Respondents

Characteristic	**complete** N = 256[1]	**missing** N = 147[1]	**p-value**[2]
Which best describes your area of work?			< 0.001
Haematology	28 (11 %)	15 (10 %)	
Oncology	185 (72 %)	70 (48 %)	
Other	43 (17 %)	62 (42 %)	
What patient group do you care for?			0.3
Both	28 (11 %)	23 (16 %)	
Minors until the age of 18	10 (3.9 %)	4 (2.7 %)	
Over 18 s	218 (85 %)	120 (82 %)	
How long have you worked in Oncology/Haematology ?			< 0.001
10–20	77 (30 %)	39 (27 %)	
2–5 years	39 (15 %)	22 (15 %)	
5–10	47 (18 %)	17 (12 %)	
Less than 2 years	24 (9.4 %)	41 (28 %)	
More than 20	69 (27 %)	28 (19 %)	
What is your professional registration?			0.2
Medicine	36 (14 %)	17 (12 %)	
Nursing	220 (86 %)	128 (87 %)	
Other	0 (0 %)	2 (1.4 %)	
How many years have you been practising in your current role?			0.2
5–10	53 (21 %)	20 (14 %)	
10–20	60 (23 %)	31 (21 %)	
2–5 years	73 (29 %)	41 (28 %)	
Less than 2 years	45 (18 %)	34 (23 %)	
More than 20	25 (9.8 %)	21 (14 %)	
country			0.002
Czechia	17 (6.6 %)	16 (11 %)	
Ireland	99 (39 %)	34 (23 %)	
Portugal	17 (6.6 %)	8 (5.4 %)	
Rest of Europe	52 (20 %)	24 (16 %)	
Spain	71 (28 %)	65 (44 %)	
Do you work in a comprehensive cancer centre?			0.032
No	115 (45 %)	84 (57 %)	
Unsure	25 (9.8 %)	7 (4.8 %)	
Yes	116 (45 %)	56 (38 %)	

1 n (%)

2 Pearson's Chi-squared test; Fisher's exact test

Supplementary file

Contributor Roles (CRediT Taxonomy, As included in ANSI/NISO Z39.104-2022, CRediT, Contributor Roles Taxonomy https://www.niso.org/publications/z39104-2022-credit**)**

Conceptualization: Caitriona Duggan, Dr. Peter J. Carr

Data curation: Prof. Andrew Simpkin

Formal analysis: Prof. Andrew Simpkin

Funding acquisition: Caitriona Duggan, Dr. Peter J. Carr

Investigation: Caitriona Duggan, Dr. Peter J. Carr

Methodology: All authors collaborated on methodology design and model creation

Project administration: Caitriona Duggan, Dr. Peter J. Carr and Dr Orlaith Hernon were involved in the management and coordination responsibility for the research activity planning and execution.

Resources: University of Galway (provided QuestionPro access)

Software: Access received to Questionpro from the University of Galway

Supervision: Dr. Peter J. Carr, Dr Orlaith Hernon

Validation: Dr. Julio C. de la Torre-Montero was involved in the content validity process.

Visualization: All co-authors were involved in the preparation, creation of the published work, specifically visualization/data presentation

Writing- Original draft Writing: Dr. Julio C. de la Torre-Montero carried out Translation to Spanish. Dr. Paulo Santos-Costa carried out the translation to Portuguese.

Review and editing: All co-authors participated in the preparation, creation, and/or presentation of the published work, specifically through critical review, commentary, or revision.

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