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Vascular access specialist teams versus standard practice for catheter insertion and prevention of failure: a systematic review

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ABSTRACT

Objective Billions of vascular access devices (VADs) are inserted annually for intravenous therapy worldwide. However, their use is not without challenges. Facilitating the process and enhancing results, hospital authorities have created vascular access specialist teams (VASTs) with advanced competencies in the evaluation, insertion, care and management of VADs. The objective is to compare the effectiveness of VASTs versus standard practice regarding cannulation success and vascular access maintenance in hospitalised adults.

Design Systematic review, using the Mixed Methods Appraisal Tool.

Data sources We conducted a structured data search on Cochrane Library, MEDLINE, Web of Science, Scopus and EBSCOhost up to 31 May 2023. We did not impose a time limit regarding the date of publication.

Eligibility criteria Studies were eligible for inclusion in the review if they were randomised and non-randomised trials and observational studies.

Data extraction and synthesis We included studies that described or evaluated the activity of VASTs compared with clinical practitioners. The outcomes analysed were the success of the cannulation and the incidence of associated adverse effects.

Results The search strategy produced 3053 papers published between 1984 and 2020, from which 12 were selected for analysis. VASTs are heterogeneously described among these studies, which mainly focus on insertions, frequently for patients with difficult intravenous access. Some patients presented with specific needs or requirement for specific insertion technique or catheter type. Compared with usual practice, these studies indicate that the involvement of a VAST is associated with a higher effectiveness in terms of first attempt insertions and insertion success rates, and a reduction in catheter-associated adverse events. However, meta-analyses confirming this trend are not currently possible.

Conclusions It seems apparent that VASTS contribute to improving the health of patients during the administration of intravenous. VASTs seem to increase the effectiveness of VAD insertion and care and reduce complications.

PROSPERO registration number CRD42021231259.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This review analysed the significance of vascular access specialist teams (VASTs) in improving the success of vascular access device cannulation and reducing adverse events during intravenous therapy for hospitalised adults.
⇒ We used standards for the Preferred Reporting Items for Systematic Reviews and Meta-Analyses to guide our research. The Mixed Methods Appraisal Tool was used to analyse the risk of bias and methodological quality of the included studies.
⇒ Observational and experimental studies were screened for selection, which led to methodological diversity in the included studies. On one hand, this allowed us to represent a wide range of evidence available about VASTs. On the other hand, included studies are of high heterogeneity, which prevented data aggregation or meta-analyses.
⇒ Only published studies were considered for inclusion. This may lead to publication bias.

INTRODUCTION

Vascular access devices (VADs), the most common type of invasive device in clinical practice. They allow direct access to the bloodstream, playing a fundamental role in healthcare. Among these devices, peripheral intravenous catheters (PIVCs) are frequently used for the in-hospital administration of intravenous therapy. More than 1.2 billion PIVCs are inserted worldwide each year for fluid or medication administration, and in 59% of cases this procedure is performed in hospitals.[1] According to the European Centre for Disease Prevention and Control, 46.7% of hospitalised patients have a PIVC and 7.5% have a central venous catheter (CVC).[2]

The use of these devices presents some risk for patients, as issues associated with the insertion and maintenance of the device may appear, possibly delaying, complicating, or preventing diagnosis or treatment

administration. In addition, PIVCs may provoke care-related complications known to produce significant morbidity and mortality.[3–6] The complication most commonly associated with catheter insertion is that of cannulation failure, which can lead to multiple punctures being required and to subsequent degradation of the vascular tree,[6] and to increased pain and discomfort.[7] This, in turn, makes future punctures difficult.[8–11] Difficulty in peripheral cannulation affects approximately 10% of adult hospitalised patients, which can lead to an overall increase in the use of CVCs.[12] The success of the first puncture varies according to settings and population, ranging from 18% to 79% in adults.[13] The main complications associated with catheter maintenance are catheter-related bloodstream infections (CRBSIs), phlebitis, infiltration/extravasation occlusion, dislodgement, leakage and pain.[14–16] Of these outcomes, CRBSI, with a prevalence of 1.23% among Spanish hospitalised patients, is the most serious.[17] The use of a vascular catheter is associated with up to 60% of the cases of bacteraemia or fungaemia recorded in hospitals,[18–22] provoking a considerable increase in hospital morbidity and mortality, length of stay and the average cost of healthcare.[23–25]

Many government organisations and public health institutions, including the Joint Commission International and the Centers for Disease Control and Prevention, have proposed measures to reduce the harmful effects of the use of VADs. However, these interventions are becoming increasingly complex, since they require precise and comprehensive knowledge of the human and material resources available, including different types of devices, and the use of puncture technologies such as ultrasound or near infrared light, as well as close surveillance and systems for the early detection of complications, among other factors.[26]

In this context, it has been proposed that vascular access specialist teams (VASTs) should be created, as multidisciplinary groups of healthcare professionals with advanced competencies in the evaluation, insertion, care and management of VADs.[27–29] The deployment of such teams could prevent catheter failure, improve cannulation performance, and reduce the appearance of the adverse effects and complications associated with the use of VADs. In addition to improving the success of cannulation by using techniques such as ultrasound, they could also achieve significant improvements in the patient's health, reduce the pain associated with cannulation and increase the level of perceived satisfaction.[30]

Historically, vascular access specialist professionals were oriented to VAD cannulation, specifically in situations of difficult venous access. Later, a team approach was proposed to increase the range of activities of the services, which was associated with an increase in first attempt cannulation success.[31]

In recent years, studies have described the implementation of VASTs in various settings, reporting significant improvements after their constitution.[31–33] However, few studies have focused on the efficacy of this approach. Indeed, one systematic review,[34] limited to randomised clinical trials, identified no studies with this design. Subsequently, a narrative review of the general benefits of VASTs for healthcare institutions concluded that few quality studies had been conducted and highlighted the need for a more precise analysis of the impact of VASTs on clinical outcomes.[35] Therefore, the present study intends to gather evidence from all available studies with different designs, to understand the impact of VASTs in clinical practice and outcomes.

A preliminary search of the PROSPERO register of systematic reviews, PubMed, the Cochrane Database of Systematic Reviews and the JBI Evidence-based Practice Database failed to identify any in-progress systematic reviews on the topic.

Aim

To compare the effectiveness of a VAST versus standard practice regarding cannulation success (proper insertion) and maintenance (prevention of failure) for adult inpatients.

METHODS

Design

This systematic review of published studies was carried out according to the protocol registered as PROSPERO.[36] The present report is structured in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (see online supplemental table 1).

Search process

Two members of the research team (IF-F and GP-G) independently conducted a structured data search in April 2021, following a previously designed strategy, after which their results were compared with ensure overall validity. The search was then replicated by a third researcher (MAR-C) in May 2023. The results of the three searches were compared in a team meeting (IF-F, GP-G, MAR-C and IB-M) to ensure validity. The terms used were based on the PICO question, together with the "AND", "OR" and "NOT" operators for interdomain, intradomain and marginal terms, respectively. The search was limited to studies of adult patients, published in English or Spanish. No restrictions by date of publication were imposed. The following databases were explored, adapting the strategy according to the resource used: MEDLINE (PubMed), Web of Science, Scopus and EBSCOhost. The main clinical trial registries were also reviewed, including the Cochrane Central Register of Controlled Trials, ClinicalTrials.gov and the EU clinical trials register. The search strategy was piloted prior to the start of the study by two investigators, using the MEDLINE database. The search strategy is summarised in online supplemental table 2.

In addition, we reviewed the bibliographic references included in the studies that met the selection criteria for inclusion, as well as those listed in other texts that do not properly constitute primary research (such as editorials

and review articles). All titles published in relevant journals, including the *Journal of Vascular Access* (2000 to present) and the *Journal of the Association for Vascular Access* (1998 to present), were also reviewed.

The results of the different searches were presented to a reference management software (Mendeley, 2023 Elsevier), which eliminated duplicate entries. Two members of the research team (IF-F and GP-G) then reviewed the titles and abstracts independently and blindly, classifying the studies as 'excluded', 'unclear' or 'potentially eligible'. Those included in the latter two categories were obtained in full text and reviewed by the same researchers, who selected those that met the inclusion criteria. Any discrepancies were resolved with the assistance of a third researcher (IB-M or MAR-C), and consensus was reached in all cases.

Eligibility criteria

The documents included in this analysis consisted of randomised and non-randomised trials and observational studies, irrespective of their publication status, describing or evaluating the activity of VASTs compared with clinical practitioners (physicians or nurses). Studies with no such comparator were also considered eligible. Articles focused on vascular access for haemodialysis, arterial catheters or centrally inserted catheters were not considered for inclusion.

The results considered relevant for evaluation were adverse events associated with the use of VAD or intravenous therapy, and/or patient satisfaction. According to the study aim (to compare effectiveness of VASTs vs standard practice), review papers, expert opinions and qualitative studies were considered beyond the scope of this systematic review.

Context

This review focuses on studies carried out in any hospital context or unit where there is direct contact with patients, and where any kind of VAST or relevant healthcare professionals are included.

Participants

Studies with adult inpatients in need of a vascular access cannulation (both central or peripheral) and attended by a VAST were included. Studies with comparator should include similar groups of patients, attended by generalist or non-dedicated teams. Those with paediatric patients (under 18 years old) were excluded.

Definition of the intervention

The intervention was defined as the insertion or maintenance of a VAD, performed by a VAST (as described by the authors).

Data items of included studies

- Successful cannulation: insertion of a VAD where the venous return is observed, the infusion of fluid is achieved and the VAD is secured and ready to be used without risk,[37 38] or as described by authors.
- First-attempt success: successful cannulation on first puncture[37 38] or as described by authors.
- First-attempt failure[37 38]: failed cannulation on first puncture or as described by authors.
- Catheter failure: a catheter that is retired before the end of the treatment it was inserted for, or as described by authors.
- Patient satisfaction regarding the insertion and maintenance of VAD, measured by any validated satisfaction scale or as described by authors.
- Number of punctures or attempts to cannulation success, quitting,[37] or discontinuation of attempts,[38] or as described by authors.
- Adverse events associated with the use of VAD or intravenous therapy:
  - Phlebitis: inflammation of the wall of a vein. It may be characterised by persistent pain, erythaema, swelling, oedema or palpable thrombosis—the term thrombophlebitis is used instead when the inflammation is caused by a thrombus,[6] or as described by authors.
  - Infiltration or extravasation: unintended leakage of fluids from a vein into the surrounding tissues,[6 39] or as described by authors.
  - Obstruction or occlusion: the inability to aspirate blood from a VAD, to infuse a solution into a VAD or both[40] or as described by authors.
  - Thrombosis: formation, development or existence of a thrombus in the catheter or lumen of a vein, leading to catheter occlusion with or without clinical symptoms,[41] or as described in the study.
  - CRBSIs: with laboratory confirmation of the catheter culture and the blood culture as the same and the source of infection[18 42 43] or as described by authors.

Data collection

Two of the researchers (IF-F and GP-G) independently extracted the data from each study, to be compiled in Microsoft Excel tables. The results were then cross-checked for accuracy.

An initial descriptive analysis was carried out, examining the following parameters: study design, objectives and outcomes; the teams performing intravenous therapy and the nature of their activity/intervention; the population served; and the services or environments in which this activity was carried out.

The results for these variables were extracted to an Excel table. Due to the heterogeneity of the studies, these results are presented descriptively.

Risk of bias

The methodological quality of the studies was examined by four of the researchers (IF-F, GP-G, IB-M and MAR-C), working independently and using the Mixed Methods Appraisal Tool version 2018.[44] This tool applies five design-sensible items with three potential responses: 'yes' (low risk of bias), 'can't tell' (uncertain/doubtful) and

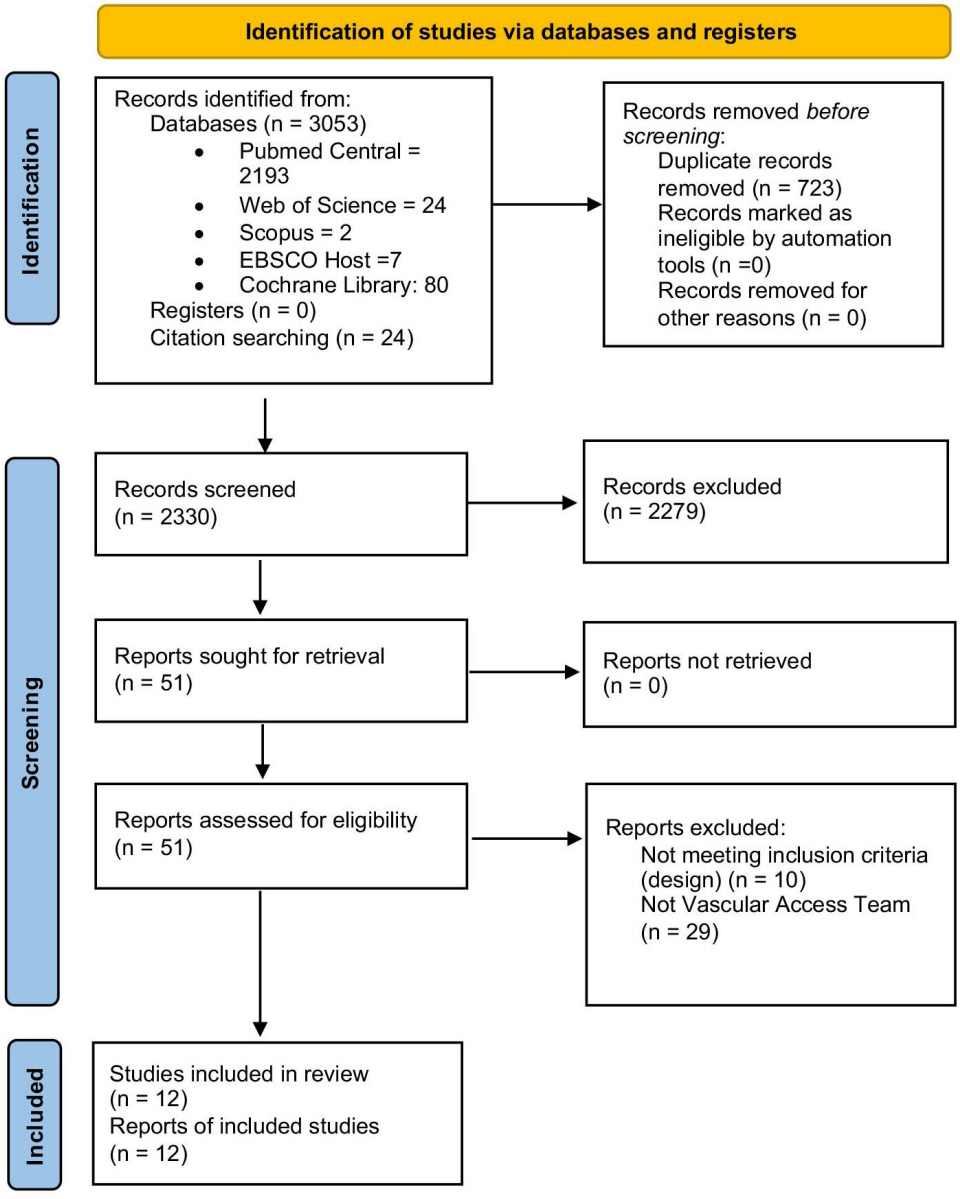

Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram.

'no' (high risk of bias). Any discrepancies between them were resolved by consensus by group discussions until a consensus was reached.

Patient and public involvement

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

RESULTS

The bibliographic search produced 3053 titles, and a further 24 studies were identified by direct search. After the study selection process (summarised in figure 1), 12 published reports were selected for the present review.[30 31 45–54] These studies involve a total sample of 5213 patients and 54 152 catheters.

Characteristics of included studies

Most of the studies selected for analysis evaluated medical teams dedicated to the cannulation and/or administration of intravenous therapy and were published between 1984 and 2021. Five studies were observational designs, while only two were randomised controlled trials. Only three studies analysed a main outcome related to VAST activity versus a comparator or control. All the studies were published in the English language. Due to the methodological heterogeneity of these studies, meta-analysis was not possible, and so the results are presented narratively. The characteristics of each study are detailed in table 1.

Risk of bias

Our assessment of the risk of bias revealed significant methodological gaps in all of the studies considered. In

Table 1 Study characteristics

Author (country)	Design	Setting/population	Aim	Catheter type	Sample size (patients/catheters*)	Primary outcome
Bell and Spencer (USA)[46]	Non-randomised trial	Emergency department	To evaluate the implementation of an emergency department VAST	PIVC	NR/3351	First time cannulation success
Bellesi *et al* (Italy)[45]	Non-randomised trial	Blood stem cell transplantation for onco-haematological patients	To evaluate the feasibility and the safety of the use of PICCs during autologous peripheral blood stem cell transplantation	PICC	57/60	Catheter-related complications
Bosma and Jewesson (Canada)[47]	Retrospective observational	General hospital	To assess the characteristics of the service provided by infusion nurses under an infusion programme	PIVC CVC Other	250/NR	Consultation rates
Carr *et al* (Ireland)[31]	Prospective observational	General hospital	Pilot evaluation of cannulation team	PIVC	NR/5130	First time cannulation success
Corcuera Martínez *et al* (Spain)[53]	Prospective observational	General hospital	To analyse the performance of PICC devices inserted by the VAT	PIVC	275/275	► Reason for PICC removal ► Catheter-related complications rate (combined)
da Silva *et al* (Brazil)[48]	Non-randomised trial	General hospital	To review the benefits of establishing an intravenous cannulation team	PIVC	3131/3552	Number of catheters required
Martillo *et al* (USA)[30]	Retrospective observational	General hospital	To analyse the implementation of a vascular access service	PIVC CVC Tunnelled catheters	NR/9806	Cather-related bloodstream infection rate
Meier *et al* (USA)[49]	Non-randomised trial	Military medical centre	To examine the benefits of an intravenous therapy team		NR/NR	Cather-related bloodstream infection rate
Savage *et al* (USA)[54]	Non-randomised trial	General hospital	To examine whether the establishment of a vascular access team decreased the incidence of central line usage and CRBI	PIVC Midline PICC	NR/NR	► Cather-related bloodstream infection rate ► Central line insertion rate
Scalley *et al* (USA)[50]	Prospective observational	Acute-care hospital	To evaluate the benefits of creating an intravenous cannulation team	PIVC	NR/31 115	Phlebitis rate
Soifer *et al* (USA)[51]	Randomised trial	General hospital	To determine whether the use of an intravenous therapy team decreases catheter-related complications	PIVC	441/875	Catheter-related complications rate (combined)
Tomford *et al* (USA)[52]	Randomised trial	General hospital (medical inpatient units only)	To evaluate the effectiveness of an intravenous therapy team	PIVC	1059/863	Peripheral intravenous catheter-related complications rate

*In some studies, inclusion criteria were catheter not patient. In some studies, more than one catheter per patient were included for analyses.
CBBI, catheter-related bloodstream infection; CVC, central venous catheter; NR, not reported; PICC, peripherally inserted central catheter; PIVC, peripheral intravenous catheter; VAST, vascular access specialist team.

most cases, these biases concerned the representativeness of the study samples and the replicability of the methods described. Eight of the included studies (66.6%) were classified as in high risk of bias.[48–51 53 54] All the non-randomised trials[45 46 48 49 54] (n=5; 41.6%) presented high risk of bias in controlling confusing factors. The evaluation of outcomes was considered as in high risk of bias in eight studies (66.6%).[34 46 48–51 53 54] The result of this evaluation is shown in online supplemental table 3.

Definition of the interventions

In these studies, the VASTs considered are described in varying ways, with notable differences in the aims and scope of the team, the target population, the nature of the professionals making up the team, the clinical performance achieved, the time dedicated to the procedure and other significant issues.

The teams mainly performed VAD insertions, 11 teams (91.6%) assumed or were exclusively dedicated to this activity, frequently for patients with difficult intravenous access (DIVA), or those with specific needs. In other cases, the team was specialised in a specific insertion technique or catheter type (six teams dedicated to PIVC and two peripherally inserted central catheter (PICC-teams). Some also carried out maintenance activities, conducted training programmes, managed quality control processes or engaged in innovation in infusion therapy. Table 2 summarises the main features of the VASTs included in this review.

Table 2 Definition of the VASTs

Author	Team name	Composition	Availability	Main activity
Bell *et al*[46]	Emergency department vascular access specialist team (EVAST)	5 RNs	24 hours, 7 days	DIVA insertion
Bellesi *et al*[45]	PICC team	MDs and RNs	NR	PICC insertion
Bosma *et al*[47]	Nurse consultation service for infusion programme	Infusion nurses, nurse educators and pharmacists	7 days	Insertion, usage, maintenance-related consultation
Carr *et al*[31]	Intravenous cannulation team	Team leader (senior phlebotomist) and 3 RNs	12 hours, 7 days	Peripheral insertion
Corcuera-Martínez *et al*[53]	Vascular access team	1 RNs and other staff	NR	PICC insertion
da Silva *et al*[48]	Intravenous team	Ward RNs forming a reference net	NR	Standardisation, education, follow-up
Martillo *et al*[30]	Vascular access service (VAS) composed of: PVAS (peripheral vascular access service), CVAS (central venous access service), VAST (vascular access tunnelled catheter service)	Intensivist MD, RNs, residents	NR	Central and peripheral insertion
Meier *et al*[49]	Intravenous team	11 RNs	75% working day	Peripheral insertions and maintenance, central line maintenance, staff education
Savage *et al*[54]	Vascular access team	3 RNs	NR	Peripheral insertions and maintenance, central line maintenance, staff education
Scalley *et al*[50]	Intravenous team	10 RNs	4, 6 full-time equivalents	Peripheral insertions and maintenance
Soifer *et al*[51]	Intravenous team	2 RNs	8 hours, 5 days a week	Peripheral insertions and maintenance
Tomford *et al*[52]	Intravenous team	NR	8 hours, 5 days a week	Peripheral insertions and maintenance

DIVA, difficult intravenous access; MD, medical doctor; NR, not reported; PICC, peripherally inserted central catheter; RN, registered nurse.

Outcomes of the VASTs

Table 3 summarises the outcomes defined by the studies in this review. The reporting of results is very heterogeneous, with important gaps in the comparability between studies. Only three studies[50–52] analysed a main outcome related to VAST activity versus a comparator or control, so a secondary analysis of the effectiveness of the interventions was appropriate.

In general, individual studies report that an implementation of the VAST produces a reduction in catheter-associated adverse events, mainly phlebitis and catheter-associated infection, but it was not possible to perform a meta-analysis to confirm this trend. Four studies reported a reduction in PIVC-related phlebitis,[48 50–52] and three studies reported a significant reduction in CRBSIs.[49 51 54] Cannulation success ranged from 90% to 100%, only one study assessed this variable in non-VAST patients resulting in 80% of success rate. First attempt success ranged from 81% to 98%.

DISCUSSION

To our knowledge, the present review is the first to incorporate and critically appraise both experimental and observational designs that examine the impact of VASTs on the health of hospitalised adults. The information collected facilitates decision-making regarding the development of these teams and identifies gaps in the evidence currently available.

Our review highlights the heterogeneous nature of the activities performed by the VASTs; as a result, these teams are essentially not comparable. In this respect, we corroborate Cortés-Rey *et al*,[33] who observed important differences among VASTs depending on the country, size and characteristics of the institution concerned. In this regard, most of the studies included in this review were conducted in North America (USA or Canada), thus relevant differences in professional education and training compared with other countries or regions may influence VASTs' interventions and outcomes. Nevertheless, these teams are becoming well established worldwide, and the question is arousing great interest among health institutions and scientific entities.[22 33] Among other reasons, this is because VASTs satisfy an important need in hospital care by improving key processes in intravenous therapy, such as the optimal selection of devices, the cannulation of patients with DIVA, adherence to local policies and data management and feedback. However, despite the growing interest in this topic, the available evidence on the impact of VASTs on patient outcomes is limited and heterogeneous. In fact, this lack of evidence was a contributing factor to dismantling some of the teams initially created. Accordingly, there is a need for further clinical trials to evaluate their efficacy in different contexts. In this respect, a pilot randomised controlled trial, not included in this review as they were not constituted in a dedicated team, showed that peripheral insertion by accredited clinicians can reduce the rate of catheter failure and adverse events, in comparison with interventions by generalist clinicians, which highlights the potential offered by the VAST model.[55]

Our findings show that VASTs mainly perform the cannulation of intravenous devices. However, they also act as knowledge brokers within their context,[56] providing knowledge facilitation functions such as staff education, the standardisation of procedures and expert consultation. Other activities may also be related to these teams, in areas such as research, material procurement or the evaluation and implementation of equipment and technologies, but these are not identified in the studies analysed in our review. It is generally accepted that the involvement of VASTs in interventions related to vascular access significantly improves the health of patients fitted with vascular devices, reduces the associated complications and decreases healthcare costs.[57–60] The constitution and implementation of these teams, therefore, are of crucial importance in improving health and optimising clinical results, especially because many professionals find it difficult to keep up to date and align their practices with current recommendations and standards of practice.[61] In this respect, several studies refer to the impact of new technologies in the field of vascular access; for example, the use of different materials and devices,[62 63] vascular tree visualisation technologies[64 65] or catheter tip localisation methods,[66] all of which represent major advances in patient safety and in reducing healthcare costs, could be optimised if performed by specialist personnel.

All the studies included in this review report improvements in health outcomes, health team structures and in-hospital care processes for patients who require intravenous therapy. Seven of these studies observed a fall in rates of CRBSIs,[30 34 45 49 51 53 54] which is the most serious complication associated with VAD and a major problem in patient safety, producing significant human, social and economic impacts, worldwide.[67 68] According to several studies, CRBSI is an independent cause of hospital morbidity and mortality, with each episode increasing hospital stay by 10–20 days and healthcare costs by US$4000–56 000.[42 69–72]

All the VASTs described in these studies were acting primarily in hospital settings. None were reported to be present in prehospital emergency services—although the incidence of DIVA in this environment is known to be high[73]—or in home-based hospitalisation, where multimorbidity patients with specific long-term vascular access needs are frequently treated.[74]

Given the different activities conducted by VASTs worldwide, a guidance document on how to establish, implement and assess their cost-effectiveness could be very useful for healthcare professionals and managers who wish to introduce such a figure in their organisation. Furthermore, additional studies should be undertaken to evaluate the cost efficiency and effectiveness, among other aspects, of the interventions carried out by VASTs. Despite the heterogeneity of the studies considered, our review highlights various scenarios in which VASTs have

Table 3 Outcomes associated with the existence of a VAST

Author	Cannulation success (first attempt success)	Catheter failure	Phlebitis	Infiltration or extravasation	Occlusion	Thrombosis	Infection
Bell *et al*[46]	80% mean team and 90% experienced members (88%)	NS	NS	NS	NS	NS	NS
Bellesi *et al*[45]	NS (95%)	30% (n=18)	NS	0%	1.6% (n=1)	5% (n=3) 2.3/1000 PICC days	3.3% bactaeremia (n=2) 1.5/1000 PICC days
Bosma *et al*[47]	96% (NS)	NS	31% (n=78)	NS	NS	NS	NS
Carr *et al*[31]	100% (98%)	NS	NS	47.1% (49)	NS	NS	8% painful infection
Corcuera Martínez *et al*[53]	NS (88.6%)	13.6% (n=37)	0.4% (n=1)	NS	NS	2.5% (n=7)	1.1% (n=3) bactaeremia
da Silva *et al*[48]	NS (NS)	1.7% (n=51)	► 0.47% (pre) ► 0.35% (post)	2.69% post (n=25)	0.44% post (n=4)	NS	NS
Martillo *et al*[30]	NS (NS)	NS	NS	NS	NS	NS	1.037 infections/1000 catheter days
Meier *et al*[49]	NS (NS)	NS	NS	NS	NS	NS	► 1.1 infections/1000 catheter days (pre) ► Post 0.7 infections/1000 catheter days (post)
Savage *et al*[54]	NS (NS)	NS	NS	NS	NS	NS	► 1.6 infections/1000 catheter days (pre) ► 0.32 infections/1000 catheter days (post)
Scalley *et al*[50]	NS (NS)	NS	► 8%–10% (VAST) ► 10%–15% (usual practice)	NS	NS	NS	NS
Soifer *et al*[51]	NS (81% VAST)	► 7.9% VAST (n=58) ► 21.7% control (n=30)	► 0.1% VAST (n=1) ► 1.4% control (n=2)	► 0.5% VAST (n=4) ► 5.1% control (n=7)	NS	NS	► 0 cases VAST ► 2.2% control (n=3)
Tomford *et al*[52]	NS (NS)	NS	► 13% VAST ► 25% Control	Control 6% Intervention 5%	NS	NS	0%

NS, outcome not studied; PICC, peripherally inserted central catheter; VASTs, vascular access specialist teams.

proven useful and practical, overcoming real-world problems in intravenous treatments.

Limitations

Our review is subject to certain limitations. First, the VASTs studied vary greatly in terms of composition, availability, functions and target population, and so their results cannot be analysed jointly. In addition, there is considerable methodological heterogeneity and a high risk of bias in some areas, which would account for the variability observed in the results presented. Finally, our review found no recent, well-designed experimental studies performed to assess the current efficacy of VASTs.

CONCLUSION

The present review is the first to critically assess the impact of VASTs in enhancing the effectiveness of VAD insertion, management, and maintenance, thus reducing complications and adverse events. Our analysis shows that VAST activity is heterogeneous. Moreover, the studies evaluated are of low general quality. In consequence, further clinical trials must be designed to properly determine the impact of these teams on patients' health and on the organisations in which they are implemented. VASTs are mainly concerned with the cannulation of VADs to facilitate intravenous treatment for hospital patients, but they may also play a valuable role in knowledge dissemination, extending the awareness and implementation of best practices. Although the evidence is limited, it seems apparent that VASTS contribute to improving the health of patients during the administration of intravenous therapy, and thus are useful and applicable in clinical practice as they increase the effectiveness of VAD insertion and maintenance, reducing complications. These results are relevant for hospital managers and vascular access specialists interested in the development of vascular access specialised teams.

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