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Rapid Review

IV night teams: Impact on Infection rates, insertion success and deskilling

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Background

Dr Carlos Scheinkestel, Executive Director, Quality, Safety and Patient Experience has requested CCE provide a review of the evidence on IV night teams. The focus of the review will be on three outcomes, infection rates, insertion success rates and deskilling in relation to peripheral inserted central catheters (PICC). Infection rates related to IV therapy are increasing, however there is concern that the introduction of IV night teams may lead to deskilling.

The purpose of this is review is to better understand whether IV night teams could lead to a reduction in IV associated infections at Monash Health without problems with deskilling.

Objective

To identify whether IV teams are associated with a decrease in infection rates, insertion success and an increase in deskilling.

Summary of Findings

We searched 7 peer reviewed databases and 8 grey literature databases. In addition we screened Google and Google Scholar and electronically searched two journals: Journal of Vascular Access and Journal of Infusion Nursing. We also contacted two experts from the Avatar group (A research group specializing in highly credible scientific vascular access device research https://www.avatargroup.org.au/about-us.html).

We were unable to find anything relevant in IV night teams despite the use of multiple databases and a range of search terms.

What we did find:
IV teams and infection rates:

- Intravenous catheters initiated by IV team compared to non-IV team indicates that infection rates and phlebitis are less when IV teams insert the catheter. [1-5]
- We located a number of recent systematic reviews looking at IV teams and infection rates across a range of settings from neonatal to paediatric and adults in intensive care. *No reviews were specific to night teams and few of the included studies were RCTs*
- We found a high quality review describing the strengths of IV teams from the perspective of the patient, staff and the hospital. [6]

IV teams and de-skilling:

- The same review outlined challenges with IV teams including role conflict, deskilling, being seen as elitist and professional tensions.[6] We found two case vignettes that refer to deskilling in relation to IV therapy. [7,8]
- We found a study that looked at the day night prevalence of IV insertions [9] and one that looked at medications errors associated with IV insertions findings that the error rate was lower at night.[10]
- Finally we noted some concerns over night time care including a NICE Guideline that recommends that routine maintenance IV therapy not be given at night to facilitate sleep and the patient experience. [11]

IV teams and insertion success rates:

- Increased cannula insertion success rates were associated with levels of experience (of IV teams) with rates over 90% being achieved with IV teams. The majority of studies of insertion rate success are pre-post studies where an IV Team is

implemented into clinical practice and data is collected for comparison before and after implementation. A pilot study is currently underway in Queensland (Avatar group), comparing specialist IV teams with a generalist teams; however the results are not yet available.

- For new IV Teams, the success of insertion increased over time.

The academics and clinicians from with the Avatar group (and authors of a recent Cochrane review about the use of catheters) Prof Claire Rickard and Dr Peter Carr were consulted about this question and they indicated that they were not aware of any research on the effectiveness of IV night teams. They also indicated they would be happy to talk further with Monash Health.

FULL REPORT

Rapid Review: IV night teams: Infection rates and deskilling

Objective

To identify whether IV night teams are associated with a decrease in infection rates, increase in insertion success rates and an increase in deskilling.

Search strategy

The academics and clinicians from the Avatar group (and authors of recent Cochrane reviews about the use of catheters) Prof Claire Rickard and Dr Peter Carr were consulted about your questions and they indicated that they were not aware of any research on the effectiveness of IV night teams.

Scientific and grey literature databases were searched to find both synthesised and primary evidence on IV night teams, infection rates and deskilling. Articles were screened and selected according to the inclusion/exclusion criteria in Table A1 (appendix). Only articles published in English were considered. A summary of findings are included in Table A2 (in appendix).

Results

A summary of the findings from 6 systematic reviews and 5 primary studies is included in Tables A3 and A4 in the Appendix.

Challenges with identifying literature

Due to the difficulties in finding relevant literature, we expanded our search terms and searched additional peer reviewed and grey literature databases. We also spoke to Australian experts in IV therapy

IV night teams:

- Reference to night teams was uncommon.
- Reference was made to time of day when IV infusions were inserted but not to actual teams or infection rates.
- When we spoke with the two experts in the Avatar group, neither was aware of research specific to night teams although both indicated that it would be a good thing to evaluate night versus day teams

Deskilling:

- We found very few references to deskilling.
- One of the experts commented that deskilling would be unlikely given the number of IV lines that are inserted daily. She did not qualify her comment whether she was talking about deskilling IV teams or deskilling those not on teams

IV Therapy teams

The Centre of Disease Control and Prevention in its guidelines for preventing intravasuclar catheter-related infections states that specialised “IV Teams”, specialized, have shown unequivocal effectiveness in reducing the incidence of catheter-related infections, associated complications and costs [12].

Studies have shown that utilization of IV teams dedicated to insertion and maintenance of PICCs have reduced infection. These teams ensure that the catheters are inserted and cared for by healthcare professionals that are highly specialized. PICC lines are managed in a consistent manner that adheres to best evidence. The implementation of IV teams may assist in the standardization of technique and reduce infection. For an IV team to be effective, it would be comprised of members who would commit to being on the team for a prolonged stay. [1-5, 9, 12-16]

In some places the IV therapy teams may function as a broader vascular access team [17]

- Available 24 hours a day, 7 days a week for insertion, maintenance, and removal of all central lines.

- Goal to decrease patient wait time for line insertion
- Goal to increase the capacity to insert appropriate lines at the right time for the right patient.
- With vascular access team members being able to place multiple types of lines (eg, PICCs, CVCs, midlines, and intravenous lines) they are able to assess patients, speak to ordering providers, and place the best line possible for the situation

The HICPAC guidelines recommend the use of trained personnel to insert CVCs (Category IA). [12]

The strengths of IV therapy teams as outlined by Bolton is provided below. [6]

Patients	Staff	Hospital
Appropriate Vascular access devices (VAD) and vein selected • Insertion by skilled practitioner leading to high rates of insertion success • Decrease in cannulation insertion attempts • Decrease in pain and discomfort • Less complications • High rates of insertion success • Management of IV therapy by a skilled practitioner • Optimum dwell time of VAD achieved • Decrease in cannulation out of hours • Complications that do arise managed effectively • Reduction in waiting for a cannula to be placed • Decrease in missed medication • Decrease in Length of stay • Reduction in complaints from patients • Increased patient satisfaction as they are seen by an expert	• Can call a skilled practitioner to • cannulate • Access to improved education in IV therapy • Able to seek advice about VADs and IV therapy • Junior medical staff no longer called to cannulate out of hours • Decrease in stress • No longer waiting for a doctor to come to cannulate • Predictable adherence to evidence-based practices such as hand hygiene and maximal sterile barriers	• Reduction in risks and costs • Reduction of complaints • Reduction in HCAIs • Reduction in risks • Provision of evidence of consistent good practice • Reduction in costs • Reduction of waiting lists • More able to achieve target for Emergency Department waiting times

Challenges associated with IV teams [6]

- Team members losing nursing status
- Nurses becoming 'mini doctors'
- Professional tensions
- Deskilling of medical staff
- Role conflict
- IV team were seen as elitist.

Concerns over night time care of patients [7,11]

1. Out-of-hours night-time doctors are often over-stretched risking poor infection control practices.
2. That care provided during off hours (i.e., nights, weekends, holidays) often is more fragmented than care provided during daytime hours.
3. That intravenous infusions be stopped at night to allow better sleep
4. Staff considered the medications and procedures more likely to cause issues at night and, whenever possible, changed the timing of these interventions to minimize workload for night staff.

The NICE guideline: Fluid prescribing during daytime hours [11]

The GDG discussed that adequate sleep at night is crucial to patient recovery. While it was acknowledged that there may be instances where intravenous fluid therapy for routine maintenance may have to be given at night due to competing demands during the day, the aim should be to promote sleep and well-being for a complete recovery. The GDG also considered the implications of this recommendation to the effect of doctors requiring a clinical indication to restart the fluids which will lead to reduced inappropriate IV fluid prescribing, reduced work for nursing staff at night and improved patient mobility due to not being tied to a drip.

Day Night Insertions

Two studies collected data on the time of day, IV lines were inserted.

Study 1 [9]	57.8% of peripheral IV insertions occurred (day shift) 42.18% during night shift	The insertion data was divided into successful placement with one attempt, 57%; two attempts, 70%; and four attempts, 90 % (130/144). The time of day was divided fairly equally between day shift (7am-7pm) and night shift (7 pm-7 am) 46% and 54%, respectively
Study 2	51.9% of IV cannulations (day shift),	Cumulatively, 53% of all medical/surgical PIV insertions are successful on

[9]	48.9% (night shift).	the first attempt at cannulation, 67% within two attempts and 91% within four attempts.

IV Medication Errors

According to the literature, IV medications are associated with 54% of potential adverse events, and 56% of medication errors. IV infusions form an integral component of the care of critically ill patients. [10]

A prospective observational study was conducted to determine errors associated with IV infusions in a single medico-surgical ICU.

- The overall error rate was 14.3%, and the mean number of errors per infusion was 3.00.
- Errors due to incorrect or incomplete documentation were the most prevalent type of error observed (92.7%).

Errors of incomplete labelling were much more frequent during the day compared to the night.

- At night, staff may have more time to complete each task, ensuring greater accuracy and precision.

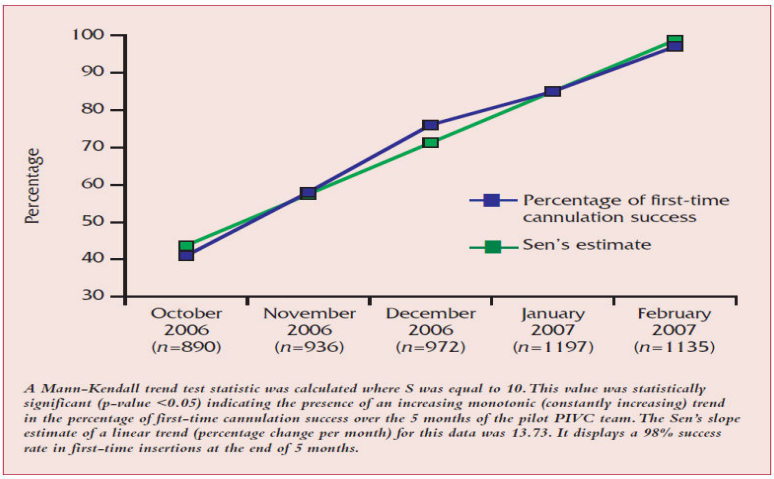
IV Teams and insertion success rates

Five studies examined insertion success rates. Overall insertion success was improved when cannulas were inserted by IV teams or IV nurse specialists. Where a team was formed for the first time, it took time for the proportion of first-time cannulation success to improve to that found with experienced teams. [28] The figure below entitled service efficacy – in first time cannulation success reports the success rate of a team newly formed and shows that it increased over a period of 5 months to nearly 100%.

Only one study reported on patient experience and the reduction in pain felt by patients. [5]

Miller, 1996 [5]	• A study Veterans' Affairs Medical Center reported 45 catheter-related bacteremia/4.6/1000 patient days on medical surgical units pre-IV team. • Post IV team: 16 catheter-related bacteremia and 1.5/1000 patient days. • Other benefits including reduced pain in patients related to IV insertions because of improved expertise
Lininger, 2003 [7]	• Prospective non-randomized study of 249 IV placements at a Childrens Hospital in the US • The calculated average number of PIV insertions per day= 3.67. • Average number of attempts to successfully obtain PIV insertion was 2.35. • 53% of all medical/surgical PIV insertions successful on first attempt, 67% within two attempts and 91% within four attempts.
Brown, 1984 [26]	• A study found that IV nurse specialists were more successful at IV insertion than non-IV nurse specialists (83% and 50%, respectively).
McDiarmid, 2017 [27]	• Retrospective analysis of a prospective cohort study that included consecutive patients undergoing a PICC insertion at The Ottawa Hospital (1/2013 - 12/2014). All PICCs placed by experienced registered nurses, each performing 400–500 PICC insertions annually. • No. of insertion attempts: first attempt 603 (91.9), second attempt 53 (8.1)
Carr, 2010 [28]	• An IV team introduced in a pilot scheme in a university teaching hospital. Service ran from 10/2006-12/2007. Team: 4 registered general nurses, led by a senior phlebotomist. A constantly increasing percentage of first-time cannulation success is displayed from the first five months of the study as displayed in *Figure*. below

Figure 2: Service efficacy – in first-time cannulation success – over first 5 months of pilot IV team.



A Mann–Kendall trend test statistic was calculated where S was equal to 10. This value was statistically significant (p-value <0.05) indicating the presence of an increasing monotonic (constantly increasing) trend in the percentage of first-time cannulation success over the 5 months of the pilot PIVC team. The Sen's slope estimate of a linear trend (percentage change per month) for this data was 13.73. It displays a 98% success rate in first-time insertions at the end of 5 months.

IV Teams and deskilling

Information on IV Teams deskilling was not readily available. Two case studies are briefly outlined. [7,8]

Case study 1	Case study 2
In the UK, Foundation Programme doctors often have the most regular contact with patients. The General Medical Council specifies the required outcomes of Foundation Year 1 (F1) training. Activities associated with FI work include: 'take peripheral blood cultures', 'prescribe intravenous (IV) fluids' and 'perform IV cannulation'. *When junior doctors do not regularly carry out activities, the possibility of deskilling eventuates and with it a potential increase in clinical risk. If deskilling is an issue, employer-led refresher training, with or without formal credentialing is recommended. The risk of learned skills atrophying with lack of practice – is a particular concern when activities are carried out infrequently. In a study of nurses on their possible contribution to the Foundation Programme, nurses expressed concern that their extended roles may risk deskilling junior doctors.*	*Critical care nurses that typically provided complete care to acute patients were opposed to the role of IV Therapy nurses. Despite the IV therapy team having a significant impact on the reduction of catheter-related nosocomial infections, the concern was that only a few highly trained nurses would become proficient in observing sterile technique associated with PICC insertion. The argument for IV therapy teams was the use of a small group of specialized IV nurses to perform dressing changes would make it easier to identify nurse-related practice variances.*

Discussion

Intravenous therapy (IV) is a common and essential intervention for patients in hospitals. Its purpose is to provide a channel for administering fluids, blood products, drugs and parenteral nutrients. Insertion of a peripheral intravenous catheter is an invasive procedure. These catheters are used when a patient requires treatment such as hydration, medication administration, nutrition, or in anticipation of an emergent need. Phlebitis, thrombosis and infections are associated with IV insertion.
Intravenous therapy teams were developed to meet the increasing demand of intravenous therapy and to ensure that a consistent quality of care was being rendered with respect to the insertion of cannulas.

Along with IV teams, evidence-based strategies to prevent catheter infections including hand hygiene, maximal sterile barriers during insertion, skin disinfection, selection of insertion site, dressings, aseptic non-touch technique, disinfection of catheter hubs/ports, administration set management, prompt removal of catheter, antibiotic locks, systemic antibiotic prophylaxis and chlorhexidine bathing. [16]

Specialized PICC insertion teams.

Large randomised controlled trials have shown that using specialised teams to insert and care for all peripheral intravenous catheters is effective in reducing the incidence of infections, associated complications including bacteraemia, and health care costs. Catheter placement by specialized teams leads not only to greater placement skills and reduced insertion complications, but also to reduced rates of institutional central-line associated bloodstream infections (CLABSI). The success of IV teams could potentially obviate the need to replace peripheral intravenous catheters at periodic intervals. A nursing-led PICC team approach ensures predictable adherence to evidence-based practices such as hand hygiene and maximal sterile barriers. [16]

The benefits of a dedicated vascular access team that has a broader remit than just PICC line insertions include reduction in CLABSIs, which results in decreased costs and increased efficiency, quality of care, and patient satisfaction; improved patient outcomes with proper device selection; 24 hours a day, 7 days a week specialized RRT and lines team availability; standardization of PICC and CVC insertions, maintenance, and removal; better workflow; and resource and cost center centralization. [15]

Specialist IV teams work both day and night. The literature indicates that approximately 40% of PICC are inserted between 7pm and 7 am. This is despite NICE guideline recommendations to minimize insertion at night in order to facilitate patient rest.

Most CLABSI relate to patients with short-term CVCs. Consequently, little is known regarding the adherence to or appropriateness of CLABSI prevention techniques when inserting and maintaining PICC lines. As PICCs are frequently placed in vulnerable populations such as children and those with cancer and are associated with important complications. In addition, considerably less attention has been devoted to the study and testing of best practices in maintaining long-term CVCs, such as PICCs. The risk of CLABSI is greatly influenced by the manner in which a CVC is handled and treated following insertion. [16]

We were unable to locate any literature evaluating the success just of IV night PICC teams. When we consulted two experts with the Avatar group, both indicated they were not aware of any research specific to night teams. With recent restrictions of hours for

junior doctors in the UK and the recognition that some tasks can be done by nonmedical staff, the night IV team is evolving. Moreover there is a push for junior doctors to do less at night

Deskilling

The possibility of an IV team leading to deskilling was considered both in terms of nursing staff and medical staff. A comprehensive assessment of the number of IV insertions will inform the likelihood of deskilling which is more a problem with activities infrequently performed. There is research in Australia currently underway to compare the effectiveness of expert versus generalist peripheral venous catheter insertion. As junior doctors move across specialties, skills like IV insertion may be lost. [13]

Methodological challenges

This review presented a number of methodological challenges

1. The use of multiple terms and definitions to describe IV therapy teams
2. That much of the research literature is very dated.
3. That the predominant study design is observational

Implications for practice

1. A comprehensive assessment of the number of IV insertions across a 24 hour period will inform the likelihood of deskilling which is more a problem with activities infrequently performed
2. There are multiple recommendations for CLABSI reduction practices of which IV teams are but one. A broad investigation to determine system failures over the range of CLABSI reduction practices is necessary to evaluate any increase in PICC catheter infections. A prevalence study is required with chart review of cases to establish if a specific source of infection could be determined. Specific information concerning site of IV access, conditions, and location of placement, who obtained access, what type of device was used, multiple use of the same catheter, staff shortage, proportion of elderly patients as they are more susceptible to infection needed should be collected. [13]

References

1. Soifer NE, Borzak S, Edlin BR, et al. Prevention of peripheral venous catheter complications with an intravenous therapy team: a randomized controlled trial. Arch Intern Med. 1998 Mar 9;158(5):473-7.
2. Tomford JW, Hershey CO, McLaren CE, et al. Intravenous therapy team and peripheral venous catheter-associated complications. A prospective controlled study. Arch Intern Med 1984; 144(6):1191–4.
3. Scalley RD, Van CS & Cochran RS. The impact of an IV team on the occurrence of intravenous-related phlebitis. A 30-month study. J Intraven Nurs 1992; 15(2):100–9.
4. Zhang L, Cao S, Marsh N, Ray-Barruel G, et al. Infection risks associated with peripheral vascular catheters. J Infect Prev. 2016 Sep;17(5):207-213.
5. Miller JM, Goetz AM, Squier C, Muder RR. Reduction in nosocomial intravenous device-related bacteremias after institution of an intravenous therapy team. J Intraven Nurs. 1996 Mar-Apr;19(2):103-6.
6. Bolton D. Writing a business case for the expansion of service: expanding the IV therapy team, from start to finish Journal of Infection Prevention September 2009 VOL. 10 R SUPPLEMENT 1
7. Lininger RA. Pediatric peripheral i.v. insertion success rates. Pediatr Nurs. 2003 Sep-Oct;29(5):351-4.
8. Summa-Sorgini C, Fernandes V, et al. Errors Associated with IV Infusions in Critical Care. Can J Hosp Pharm. 2012 Jan;65(1):19-26.
9. Intravenous fluid therapy in adults in hospital. NICE Clinical guideline [CG174] Published date: December 2013 Last updated: May 2017
10. Brunelle D. Impact of a dedicated infusion therapy team on the reduction of catheter-related nosocomial infections. J Infus Nurs. 2003 Nov-Dec;26(6):362-6.
11. Morrison K, Holt KE. The Effectiveness of Clinically Indicated Replacement of Peripheral Intravenous Catheters: An Evidence Review With Implications for Clinical Practice. Worldviews Evid Based Nurs. 2015 Aug;12(4):187-98.
12. Marsh N, Webster J, Larson E, et al. Observational Study of Peripheral Intravenous Catheter Outcomes in Adult Hospitalized Patients: A Multivariable Analysis of Peripheral Intravenous Catheter Failure. J Hosp Med. 2018 Feb 1;13(2):83-89.
13. Johnson D, Snyder T, Strader D, et al. Positive Influence of a Dedicated Vascular Access Team in an Acute Care Hospital. 2017, Java , Vol 22, no 1
14. Carr PJ, Higgins NS, Cooke ML, et al. Vascular access specialist teams for device insertion and prevention of failure. Cochrane Database Syst Rev. 2018 Mar 20;3:CD011429.

15. O'Grady NP, Alexander M, Burns LA, et al. Guidelines for the prevention of intravascular catheter-related infections. Am J Infect Control. 2011 May;39(4 Suppl 1):S1–34. [
16. Identifying the work activities performed by doctors in the Foundation Programme. Research conducted for the General Medical Council. Gillian Vance, Bryan Burford, Sharmila Jandial, Jon Scott. School of Medical Education. Newcastle University. Final report. September 2015
17. Meier PA, Fredrickson M, Catney M, et al. Impact of a dedicated intravenous therapy team on nosocomial bloodstream infection rates. Am J Infect Control. 1998 Aug;26(4):388-92.
18. Cotogni P, Pittiruti M. Focus on peripherally inserted central catheters in critically ill patients. World J Crit Care Med. 2014 Nov 4;3(4):80-94.
19. Making Health Care Safer II: An Updated Critical Analysis of the Evidence for Patient Safety Practices. Evidence Reports/Technology Assessments, No. 211.Rockville (MD): Agency for Healthcare Research and Quality (US); 2013 Mar. Chapter 10, Prevention of Central Line-Associated Bloodstream Infections: Brief Update Review
20. Maki DG, Kluger DM, Crnich CJ. The risk of bloodstream infection in adults with different intravascular devices: a systematic review of 200 published prospective studies. Mayo Clin Proc. 2006 Sep;81(9):1159-71. Review.
21. Johansson E, Hammarskjöld F, Lundberg D et al Advantages and disadvantages of peripherally inserted central venous catheters (PICC) compared to other central venous lines: A systematic review of the literature, Acta Oncologica, 2013, 52:5, 886-892
22. Ho KH, Cheung DS. Guidelines on timing in replacing peripheral intravenous catheters. J Clin Nurs. 2012 Jun;21(11-12):1499-506.
23. Kramer RD, Rogers MA, Conte M, et al. Are antimicrobial peripherally inserted central catheters associated with reduction in centralline-associated bloodstream infection? A systematic review and meta-analysis. Am J Infect Control. 2017 Feb 1;45(2):108-114
24. Chopra V, O'Horo JC, Rogers MA, et al. The risk of bloodstream infection associated with peripherally inserted central catheters compared with central venous catheters in adults: a systematic review and meta-analysis. Infect Control Hosp Epidemiol. 2013 Sep;34(9):908-18.
25. Golombek SG, Rohan AJ, Parvez B, et al. Proactive" management of percutaneously inserted central catheters results in decreased incidence of infection in the ELBW population. J Perinatol. 2002 Apr-May;22(3):209-13.
26. Brown, P. (1984). An IV specialty team can mean savings for hospital and patient. *NITA, 7,* 387-388.
27. McDiarmid S, Scrivens N, Carrier M, Sabri E, Toye B, Huebsch L, Fergusson D. Outcomes in a nurse-led peripherally inserted central catheter program: a retrospective cohort study. CMAJ Open. 2017 Jun 30;5(3):E535-E539.
28. Carr PJ, Glynn, RW, Dineen,B et al. A pilot intravenous cannulation team: an Irish perspective. British Journal of Nursing, 2010 (Intravenous Supplement), Vol 19, No 10

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APPENDIX

Search Strategy

Table A1. Inclusion/Exclusion criteria

Table 1. Inclusion/Exclusion criteria	
Population	Include: All types of hospital patients Exclude: Community, Primary Care, Nursing Homes not with Monash Health
Concept	Include: IV teams, IV night teams, Infection rates, deskilling Exclude: Risk of Phlebitis and Thrombosis, routine versus clinical replacement of IV lines
Setting	Include: Hospitals, subacute (including residential care facilities) Exclude: Pre-hospital settings
Types of evidence	Include: Peer-reviewed, grey literature (synthesised and primary) Exclude: All other types of information, qualitative systematic reviews
Limits	Language: Published in English Date: No date limit
Databases	Medical: Pubmed Clinical queries, Medline Ovid, Embase, Pubmed, Scopus, Cinahl, Cochrane Grey Literature: Trip Database, Epistemonikos, Joanna Briggs Database, Google, Google Scholar, Kings Fund, AHRQ, Institute for Health care Improvement, Health Foundation. NICE
Journals electronically searched	Journal of Vascular Access, Journal of Infusion Nursing.
Contact with experts.	We made contact with two experts in the area of IV teams, Professor Claire Rickard, Dr Peter Carr from the Avatar Group in Queensland
Search terms	Initially: IV TEAMS, IV therapy teams, Intravenous teams and effectiveness Night, Nightshift, Night-time, Deskill, Deskilling Later: Vascular access teams, PICC line teams and effectiveness

***Study selection**: Search was performed according to terms listed in Appendix. Titles and abstracts identified were exported to EndNote X7 (Thompson, Reuters, Carlsbad, California, USA). Papers identified were screened using inclusion and exclusion criteria established a priori. Searches of Library databases, Grey Literature, the internet (using Google) and guideline websites were screened by one reviewer in consultation with colleagues as necessary. Literature was included based on the above criteria*

Table A2. Database searches

Source	Results
AHRQ	1
Cinahl	1
Cochrane	3
Embase	2
Epistemonikos	3
Google	2
Health Foundation	1
Institute for Health care Improvement	1
Joanna Briggs Institute	0
Kings Fund	0
Medline Ovid	5
NICE	2
Pubmed	0
Pubmed clinical queries	2
Scopus	0

Table A3 and A4. Summary findings from relevant systematic reviews and individual studies

Aim	No of studies	Study designs	Main findings
To better understand the absolute and relative risks of bloodstream Infection (BSI) associated with the various types of intravascular devices (IVDs) [17]	200	Prospective studies that combined inpatients and outpatients	Point incidence rates of IVD-related BSI were lowest with peripheral Intravenous catheters (0.1%, 0.5 per 1000 IVD-days). Higher rates were seen with short-term non cuffed and non medicated central venous catheters (CVCs) (4.4%, 2.7/1000 catheter-days). PICCs infection rate of 2.4%, 2.1 per 1,000 catheter days in hospitalised patients.
To design clinical guidelines on timing for replacing peripheral intravenous catheters, in an attempt to decrease complications and lower related expenditures. [18]	5	Discursive review Adults	Catheter-related blood stream bacteraemia: bacteraemia during the presence of intravenous catheters or up to 48 hours after removal without an explainable source of clinical or microbiological for the infection. The clinically indicated replacement of catheters led to a 43% decrease in CRBSI however result was >0.05.
Advantages and disadvantages of peripherally inserted central venous catheters (PICC) compared to other central venous lines [19]	11	Systematic review: Cohort studies with control group	Adult ICU patients, Children and adolescents being treated for cancer Findings: • Tendency towards increased risk for DVT • Decreased risk for catheter occlusion with PICC
To evaluate whether antimicrobial PICCs are associated with CLABSI reduction.[20]	8	Systematic review Adult and Paediatric patients from intensive care, long-term care, and general ward settings	Incidence of CLABSI. antimicrobial PICCs 0.2% (95% CI, 0.0%-0.5%), vs.non-antimicrobial PICCs. 5.3% (95% CI, 2.6%-8.8%). • Antimicrobial PICCs were associated with a significant reduction in CLABSI (relative risk [RR], 0.29; 95% CI, 0.10-0.78) when compared to non-antimicrobial. • Studies of adults at greater baseline risk of CLABSI experienced greater reduction in CLABSI (RR, 0.20; P = .003).
To compare risk of CLABSI between PICCs and CVCs.[21]	23	Systematic review and meta-analysis. Hospital and outpatients	Risk of bloodstream infections associated with PICCs as compared to central venous catheters and reported a rate of 5.2% (76/1473) for inpatients and 0.45% (117/25 822) for outpatients.

Table A4	
Meier et al, 1998 [5]	A study at the Iowa City Veterans Administration Center found that the rate of primary bloodstream infections was 1.1 infection/1000 patient days prior to implementation of a dedicated IV therapy team and decreased by 35% to 0.7 infections/1000 patient days following implementation including a 51% decrease in primary bloodstream infections with S. aureus.
Scalley et al, 1992 [3]	30-month study of intravenous catheters initiated by IV team and non-IV team nurses. Benefits included decreased volume and severity of phlebitis, and subsequent decrease in costs related to a reduction in infusion-related phlebitis. The infusion therapy benefit seems to correlate with the volume of therapy: The higher the volume, the more significant the benefit of an IV therapy team.
Soifer et al, 1998 [1]	Patients were randomized to undergo peripheral catheter insertion and/or maintenance either by the iv team or by medical house staff study in a university-affiliated hospital. Catheters started by house staff and maintained by ward nurses had more signs or symptoms of inflammation (21.7%) than did patients with catheters maintained by the IV team (7.9%) ($p<.001$). The IV team significantly reduced bacteremic complications related to peripheral intravenous catheter insertion, and that timely replacement of the peripheral catheters appeared to be the most important factor in reducing complications.
Tomford et al, 1984 [2]	The overall incidence of phlebitis in the ward staff-maintained IV catheters was 32% and 15% for those maintained by the IVT team. Study design: prospective controlled trial
Golombek et al 2002 [22]	Catheter infection rates dropped from 15.8 to 5.1/1000 catheter days following the implementation of a ''PICC maintenance team'' that took responsibility for insertion, daily monitoring, dressing changes and removal. Patient group: Neonates