

Evidence Profile

Recommendation Question 3: Should vascular access specialist teams be recommended?

Recommendation 3.1: The guideline panel suggests that acute care health service organizations implement vascular access specialists or vascular access specialist teams to support the insertion and management of vascular access devices.

Population: All persons with a vascular access device

Intervention: Insertion of vascular access devices by specialists (specialized training + ongoing competency)

Comparison: Insertion of vascular access devices by non-specialists

Outcomes: complications (e.g. phlebitis, infiltration, extravasation, infection, bleeding, embolism), insertion-related complications [not found in this literature], number of successful observed attempts

Setting: All practice settings where patients with vascular access devices are cared for (e.g., primary care, long-term care, acute care, community care)

Bibliography: 2980, 7946, 12012, Savage, Lynch & Oddera (2019), McDiarmid et al. (2017), Steere et al. (2019), 1183, 2489

Quality assessment							Study details		No. of participants		Reported effects/outcomes	Certainty	Reference
No of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Country	Intervention	Intervention	Control			
Number of successful observed attempts (<i>Assessed with: insertion success rate</i>)													
1	RCT (pilot)	Not serious ^a	Not Serious	Not serious	Serious ^b	Not detected	<u>12012:</u> Australia	<u>12012:</u> PVAD insertion by Vascular Access Specialist (VAS): The VAS for this pilot trial was a member of an intravenous therapy team for more than 20 years and an educator training clinicians to place PIVs in both a hospital and university program. Control: PVAD insertion by any nursing or medical clinician (generalist model)	<u>12012:</u> n=69 100% of PVAD in this group were successfully inserted. Mean insertion time= 2 mins	<u>12012:</u> n=69 75% (50/69) PVAD in this group were successfully inserted. Mean insertion time= 11 mins.	<u>12012:</u> There more successfully insertion in the intervention group compared with the control group. For every 100 people who receive intervention, 27 more people will have successful insertions (ranges from 14 more to 43 more) (RR 1.38 [1.19-1.60]). The insertion time was also longer in the control group.	⊕⊕⊕○ MODERATE	<u>12012:</u> Marsh et al., 2018
2	Non-RCT	Very serious ^c	Not serious	Not serious	Not serious	Not detected	<u>1183:</u>	<u>1183:</u> The intervention involved the			Both non-RCTs included for this outcome demonstrated a positive result (more successful insertion attempts) in the intervention group compared to the control group.	⊕⊕○○ LOW	<u>1183:</u>

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Quality assessment							Study details		No. of participants		Reported effects/outcomes	Certainty	Reference
No of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Country	Intervention	Intervention	Control			
							USA	<p>use of the Pediatric Peripheral Vascular Access Algorithm (PPVAA) with a dedicated VAT (PPVAA with VAT) to initiate peripheral IV. The VAT was composed of three pediatric clinical nurses with vascular access board certification and expertise in peripheral IV initiation. Primary responsibilities were initiation, assessment, and maintenance of PVADs and CVADs.</p> <p>Control: In the pre-intervention period, clinical nurses used the PPVAA-alone to initiate PVADs (no VAT). PVAD insertions were escalated to more experienced health provider as needed.</p>	<p>1183: N=294</p> <p>Number of attempts per episode: 1 - 203 (69%) 2- 59 (2.1%) 3- 18 (6.1%) 4- 7 (2.4%) 5+ 7 (2.4%)</p>	<p>1183:N=302</p> <p>Number of attempts per episode: 1 - 170 (56.3%) 2- 66 (21.9%) 3- 37 (12.3%) 4- 18 (6%) 5+ 11(3.6%)</p>	<p>use, first attempt and overall PVAD insertion success increased after VAT implementation 1st attempt success (PPVAA-alone vs. PPVAA w VAT = 52.0% vs. <67.7%, and 89.4% vs. 95.6% respectively).</p> <p>For every 100 people who receive intervention, 6 more people will have a successful PVAD insertion (ranges from 2 more to 11 more).</p>		Hartman et al., 2019
							<p>2489: USA</p>	<p>2489 Volunteers with at least 5 years' experience as bedside nurses (RNs) in the NICU were sought to participate in the creation and implementation of a dedicated PICC team. 5 individuals were selected for training, consisting of didactic lectures, simulation training, and minimum of three supervised sessions during which the trainee assisted an instructor (typically an attending neonatologist or neonatal nurse practitioner) in PICC insertion. Any infant admitted to our NICU during the study period, who required a PICC during their hospitalization, was included.</p> <p>Control: Pre-intervention period (PICC insertions done by neonatal-</p>	<p>2489:</p> <p>446 successful placements in 625 attempts.</p>	<p>2489:</p> <p>354 successful placements in 630 attempts.</p>	<p>2489:</p> <p>A decrease in the mean number of needle sticks per insertion attempt was observed in period 2 in the adjusted analysis.</p>		2489: Levit et al., 2020

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								perinatal medicine fellows only)					
Complications (Assessed with: PVAD failure (catheter removal due to phlebitis, infiltration, occlusion, accidental removal or infection), CLABSI rates (from charts or hospital monitoring data), venous thrombosis rates, overall complication rate including phlebitis, infiltration, pain, catheter occlusion or accidental dislodgement)													
1	RCT (pilot)	Not serious ^d	Not Serious	Not serious	Very serious ^e	None	<u>12012:</u> Australia	<u>12012:</u> PVAD insertion by Vascular Access Specialist (VAS): The VAS for this pilot trial was a member of an intravenous therapy team for more than 20 years and an educator training clinicians to place PVADs in both a hospital and university program. Control: PVAD insertion by any nursing or medical clinician (generalist model)	<u>12012:</u> n=69 inserted PVAD Failure rate: 48% (217 per 1000 PVAD days)	<u>12012:</u> N= 50 inserted PVAD Failure rate: 54% (228 per 1000 PVAD days)	<u>12012:</u> There were more cases of PVAD failure in the control group compared to the intervention group. For every 100 people who receive intervention, 6 less people will have outcome (ranges from 21 less to 14 more) (RR 0.89 [0.62-1.26]). Even though this study was not powered to show effect, phlebitis was 5% higher in VAS-inserted catheters than for generalist insertions. Occlusion was 5% higher in generalist-inserted PVADs. There were no local or PVAD-related bloodstream infections in either group.	⊕⊕○○ LOW	<u>12012:</u> Marsh et al., 2018
6	Non-RCT	Very Serious ^f	Serious ^g	Not serious	Not Serious	Possibly detected ^h	<u>2980:</u> USA	<u>2980:</u> The 3-nurse team (2.4 full-time equivalents) places PICCs using the modified Seldinger technique with ultrasound. The team was started in January 2009 and is also responsible for difficult intravenous line starts, difficult lab draws, central line dressing changes, and education for patients and staff caring for patients with a vascular access device. Before a nurse-led pediatric vascular access team was established at the hospital,	<u>2980:</u> CLABSI rate 4 th quarter 2008: 9.12 per 1000 catheter line days 1 st quarter 2009: 6.2 per 1000 2 nd quarter 2009: 2.73 per 1000 2 nd quarter	2980: N/A	Complications decreased in all 6 non-RCT studies after implementation of a VAST. <u>2980:</u> There was a downward trend in CLABSI rate after the introduction of a specialized team. CLABSI rate decreased from 9.12 per 1000 catheter day in 2008 (pre-intervention) to 2.0 per 1000 catheter days in 2010 (post-intervention).	⊕⊕○○ LOW	<u>2980:</u> Pitts, 2013

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No of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Country	Intervention	Intervention	Control			
							<p><u>7946:</u> USA</p> <p><u>Savage, Lynch & Oddera (2019):</u> USA</p>	<p>PICCs were placed using sedation or anesthesia and inserted by physicians, surgeons in the operating room, and radiologists in interventional radiology.</p> <p><u>7946:</u> The vascular access team was created in 2014 and is available 24 hours a day, 7 days a week for insertion, maintenance, and removal of all central lines. Registered RTs were also integrated into CVAD management.</p> <p><u>Savage, Lynch & Oddera (2019):</u> The hospital established a VAST in May 2016. The VAST's responsibilities included placement of short peripheral, midline, and peripherally inserted central catheters (PICCs); monitoring existing central and midline catheters; and staff education. The team was made up of 3 RNs.</p>	<p>2010: 2.0 per 1000</p> <p><u>7946:</u> CLABSI rate: 2013: 0.6 (15004 line days) 2014: 0.523 (15288) 2015: 0.34 (14496)</p> <p><u>Savage, Lynch & Oddera (2019):</u> CLABSI rate Jan 2015 - April 2016: 1.6 infections per 1000 central line days. May 2016- April 2017: 1 infection per 1000 central line days. May 2017 – Aug 2018: 0.32 infections per 1000 central line days.</p>	<p>7946: N/A</p> <p><u>Savage, Lynch & Oddera (2019):</u> N/A</p>	<p><u>7946:</u> There was a decrease in CLABSI rate after introduction of vascular access team. CLABSI rate decreased from 0.6 in 2013 (pre-intervention) to 0.34 in 2015 (post-intervention).</p> <p><u>Savage, Lynch & Oddera (2019):</u> There was a decrease in CLABSI rate after introduction of vascular access team. CLABSI rate decreased from 1.7 per 1000 central line days in 2015-16 (pre-intervention) to 0.32 in 2017-18 (post-intervention).</p>		<p><u>7946:</u> Johnson, Snyder, Strader, et al., 2016</p> <p>Savage, Lynch & Oddera, 2019</p>

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No of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Country	Intervention	Intervention	Control			
							McDiarmid et al. (2017); Canada	McDiarmid et al. (2017): The Central Vascular Access Program is led by an advanced practice nurse. All PICCs were placed by experienced registered nurses, each performing 400–500 PICC insertions annually. The central line insertion bundle, which consists of hand hygiene, barrier precautions and chlorhexidine skin antiseptics, was adhered to. Ultrasound technology was used for all PICC insertions.	Overall CLABSI rate improved 80%. McDiarmid et al. (2017); n=666 Median dwell time 45 (range 1-842 days). 4 cases of catheter-related bloodstream infection (0.6% [95% CI 0.17%–1.55%]) (0.07/1000 catheter days). 10 patients (1.5% [95% CI 0.83%–2.78%]) (0.17/1000 catheter days) had catheter-related deep venous thrombosis.	McDiarmid et al. (2017); Comparable baseline literature: incidence rates of catheter-related bloodstream infection of 2.1, 4.5 and 10.2 cases/1000 catheter days. Frequency of PICC-related deep venous thrombosis of 3.4% (95% CI 1.7%–5.19%) and an unweight	McDiarmid et al. (2017): Catheter-related blood stream infection rate was at least 1.5 per 1000 catheter days less than baseline literature reported by the study. Deep thrombosis rate was at least 1.5% less than the baseline literature reported by the study.		McDiarmid, Scrivens, Carrier, et al., 2017

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No of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Country	Intervention	Intervention	Control			
							<p><u>Steere et al. (2019); USA</u></p> <p><u>2489:</u> USA</p>	<p><u>Steere et al. (2019):</u> Vascular access specialist team: PVADs were placed by infusion team nurses using ultrasound when necessary. The study also implemented the PIV5Rights bundle which standardized equipment for PVAD insertion, assessment and documentations.</p> <p>Control group: PVADs placed by generalist nurses or EMTs. Standardized PVAD care bundle not implemented.</p> <p><u>2489:</u> Volunteers with at least 5 years' experience as bedside nurses (RNs) in the NICU were sought to participate in the creation</p>	<p><u>Steere et al. (2019):</u></p> <p>N=113 Complication rate: 11%, p<0.001</p> <p>Total catheter failure: 12 (11%) p<0.001</p> <p>Complications resulting in catheter removal Phlebitis 5 (5) p=0.017 Infiltration: 4 (4%) p=0.212 pain: 2 (2%) p=0.013 catheter occlusion: 0 p=0.002 accidental dislodgement: 1 (1%) p=NA</p> <p><u>2489:</u></p> <p>Overall rate of complication</p>	<p><u>Steere et al. (2019):</u></p> <p>N=94 Complication rate: 40%,</p> <p>Total catheter failure: 80 (85%)</p> <p>Complications resulting in catheter removal Phlebitis 13 (14) Infiltration: 7 (8%) pain: 9 (10%) catheter occlusion: 8 (9%) accidental dislodgement: 1 (1%)</p> <p><u>2489:</u></p> <p>Overall rate of</p>	<p><u>Steere et al. (2019):</u> Total complication rate and catheter failure rate decreased in the intervention arm RR 0.26 [0.15-0.47] and RR 0.12 [0.07-0.21].</p> <p>For every 100 people who receive the intervention there would be 30 less complications (ranges from 34 less to 21 less) and 75 less catheter failures (ranges from 67 less to 79 less).</p> <p><u>2489:</u> The overall rate of PICC-related complications declined (RR 0.43, 95% CI: 0.29, 0.65), with the largest reduction noted in phlebitis (RR 0.10, 95% CI: 0.03, 0.29).</p>		<p>Steere, Ficara, Davis & Moureau (2019)</p> <p><u>2489:</u> Levit et al.</p>

Quality assessment							Study details		No. of participants		Reported effects/outcomes	Certainty	Reference
No of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Country	Intervention	Intervention	Control			
								and implementation of a dedicated PICC team. 5 individuals were selected for training, consisting of didactic lectures, simulation training, and minimum of three supervised sessions during which the trainee assisted an instructor (typically an attending neonatologist or neonatal nurse practitioner) in PICC insertion. Any infant admitted to our NICU during the study period, who required a PICC during their hospitalization, was included. Control: Pre-intervention period (PICC insertions done by neonatal-perinatal medicine fellows only)	s: 5.5 per 1000 line days Phlebitis rate: 0.5 per 1000 line days CLABSI: 0.3 per 1000 line days	complications: 12.8 per 1000 line days Phlebitis rate: 4.9 per 1000 line days CLABSI: 1.6 per 1000 line days	0.03, 0.31). Complications such as effusions, line occlusion, and infiltrates were infrequent in both periods.		(2019)

PVAD= peripheral vascular access device

PICC = peripherally inserted central catheter

RT= respiratory therapist

CLABSI= central line associated blood stream infection

CVAD = central vascular access device

CI = confidence interval

NICU = neonatal intensive care unit

N/A = not applicable

^a One RCT was rated as low risk of bias using the Cochrane ROB 2.0 tool. We did not downgrade.

^b Pilot RCT with total number of participants 138. We downgraded by 1 for low number of events (between 100 and 300).

^c Studies were assessed for risk of bias using the ROBINS-I tool. Both studies were rated as critical or serious risk of bias due to no controlling for confounding and unclear intervention details. We downgraded by 2.

^d One RCT was rated as low risk of bias using the Cochrane ROB 2.0 tool. We did not downgrade.

^e Pilot RCT with total number of participants 138. We downgraded by 2 for low number of events (less than 100) and wide confidence interval.

^f Studies were assessed for risk of bias using the ROBINS-I tool. All studies were rated as critical risk of bias due to no controlling for confounding, potential for co-intervention between groups and unclear intervention details. We downgraded by 2.

^g There was a variety of complications assessed although most assessed catheter-associated infections. We downgraded by 0.5.

^h One study (Steere et al., 2019) was noted to be industry sponsored. We did not downgrade.