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An integrative review**

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Pre-hospital peripheral intravenous catheter insertion practice: An integrative review

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Abstract

Background: Peripheral intravenous catheters (PIVCs) are widely used within healthcare settings. There is substantial hospital-based research, particularly in Emergency Departments, supporting the need to reduce inappropriate PIVCs due to associated risks. However, there is limited research into pre-hospital practice. This review aims to determine the rates of pre-hospital PIVC insertions, how many remain unused, and to explore paramedic PIVC decision-making.

Methods: A systematic search of research databases was undertaken using an integrative review methodology. Articles published between 2011 and April 2022 were included. The Mixed Methods Appraisal Tool was used to assess the quality of the studies.

Results: Fifteen studies were included. Rates of PIVC insertions ranged from 21-58%. Up to 72% of PIVCs remained unused in the pre-hospital setting. Paramedic decision-making was not well reported, though erring of the side of caution and inserting a “just in case” PIVC was identified.

Conclusion: There are limited articles on pre-hospital PIVC practice, particularly in Australian settings. Research is required to understand factors influencing practice and provide contemporary evidence to inform the development of guidance specific to the pre-hospital setting to reduce the numbers of inappropriate PIVCs.

Keywords: ambulance, emergency medical technicians, peripheral intravenous catheter, paramedic, vascular access device

Introduction

The insertion of peripheral intravenous catheters (PIVCs) is one of the most common invasive procedures performed by clinicians, and globally, over a billion PIVCs are inserted in hospitalised patients each year and prevalence ranges from 23-83%.¹ In Australia, around 7.7 million people in hospital will have a PIVC inserted per year² and in a recent point prevalence study, the prevalence of PIVCs was 55.2% (95%CI: 53.3-47.1%).³ In Australian Emergency Departments (ED) up to 71% of ED patients have at least one PIVC inserted.⁴

Despite their frequent use, one in three PIVCs will fail.^{5,6} The most frequent complications are occlusion (incidence 10-25%),^{7,8} infiltration (10-41%),^{9,10} pain (17.5-18.8%),^{10,11} and phlebitis (30.7 per 100 catheters).¹² An additional concern is dislodgement; a recent study found paramedic-inserted PIVCs were associated with an increased risk of dislodgement compared to doctor or nurse inserted PIVCs (HR, 1.78; 95% CI 1.03-3.06).⁵

Bacteraemia associated with PIVCs is a rare complication (0.02-0.18%)^{14,15} however, it accounts for 25% of all healthcare-associated *Staphylococcus aureus* bloodstream infections,^{16,17} which have a reported 30-day mortality rate of 22.8-26%.^{16,18,19} Additionally, there are significant costs from increased length of hospital stay and loss of beds, and treatment of the healthcare-associated infections is estimated to cost AU\$29,000 per episode.^{16,20}

The Management of Peripheral Intravenous Catheters Clinical Care Standard² recommends reducing patient risk by avoiding PIVC insertion when they are not needed. This aligns with the global campaign “Choosing Wisely”, which champions the reduction in unwarranted tests, treatments and procedures.²¹ However, high rates of unused and potentially unnecessary PIVCs are reported particularly in Australian ED patients where 22-50% of PIVCs remain unused.^{4,22-25} These studies excluded patients who had a paramedic-inserted PIVC despite 27% of all ED admissions being brought in by ambulance.²⁶ Paramedic PIVC insertion practice warrants further review to better understand the rates of

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PIVC insertions in the pre-hospital setting, how many PIVCs remain unused, and insertion reasons.

Globally many different terms are used to describe care provision outside hospitals and clinicians who specialise in this area. For this review, the terms paramedic, pre-hospital, and ambulance will be consistently used to align with current Australian terminology.

Aim

The review aim is to determine the reported proportion of PIVC insertions in patients attended to by paramedics in the pre-hospital setting, and how many remain unused during the paramedic episode of care. An additional aim is to review paramedic PIVC decision-making.

Methods

An older review²⁷ reported that articles on vascular access in the pre-hospital setting come from a diverse range of sources, therefore an integrative review methodology was used as this supports the inclusion of both qualitative and quantitative research, thereby facilitating the broadest inclusion of studies.²⁸ A comprehensive literature search was undertaken using three electronic databases: Embase, Medline, and Cumulative Index to Nursing and Allied Health Literature (CINAHL). As "Paramedic" is not a recognised MeSH term, words pertaining to paramedics were taken from the prehospital search filter version 2 for the Cochrane Library²⁹ and cross-checked with paramedic search filters identified by Olausson et al (2017).³⁰ Using Boolean terms AND, OR a combination of the following keywords and subject headings were used: Paramedic*; Ambulance*; "Emergency Medical Service*"; "Emergency Medical Technician*"; Pre-hospital; Prehospital; "Pre hospital"; "Out of hospital"; "Out-of-hospital"; EMS; EMT; "First responder*"; "Peripheral intravenous catheter*"; "Peripheral intravenous cannula*"; "Peripheral cannula*"; "Peripheral catheter*"; PIVC*; PIV*; "IV cannula*"; "IV catheter*"; "IV access*"; "Intravenous access*"; "Intravenous cannula*"; "Intravenous catheter*"; "Venous access*"; "Venous catheter*"; "Venous

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cannula*"; "Vascular access". Publications were limited to original research published from 2011 onwards to ensure currency of practice and contemporary research.

Initial article titles and abstracts were manually screened by one reviewer and were filtered using the inclusion and exclusion criteria (Table 1). Duplications were removed.

Table 1

Inclusion and exclusion criteria

Inclusion	Exclusion
Pre-hospital PIVC insertion	Critically unwell patients only as PIVC
Pre-hospital PIVC use	insertion highly likely
Unused pre-hospital PIVCs	Intraosseous access
Paramedic PIVC decision-making	Quality improvement articles
Full text articles	Studies published before 2011
Published in English, peer reviewed journals	
Published between 2011 and April, 2022	

PIVC = Peripheral intravenous catheter

Selected abstracts underwent a second screening where the full publications were appraised, including the cited references, to find any further articles not identified through the initial literature search. The quality of the selected studies was assessed by two reviewers using the Mixed Methods Appraisal Tool (MMAT) version 2018³¹, which allows for appraisal of qualitative, quantitative, and mixed method studies.

The initial search identified 2094 titles; 645 were excluded due to duplication. After the initial screening of the 1449 remaining titles and abstracts, 1403 articles were excluded as they did not meet the inclusion criteria. Of the 46 articles remaining 33 were excluded

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after full text review. Three additional articles were identified through citation searching; one was excluded after screening. Fifteen articles were included in the final review. A systematic flow diagram (Figure 1), based on the Preferred Reporting for Systematic Reviews and Meta-Analyses (PRISMA)³² shows the search strategy and inclusion and exclusion process.

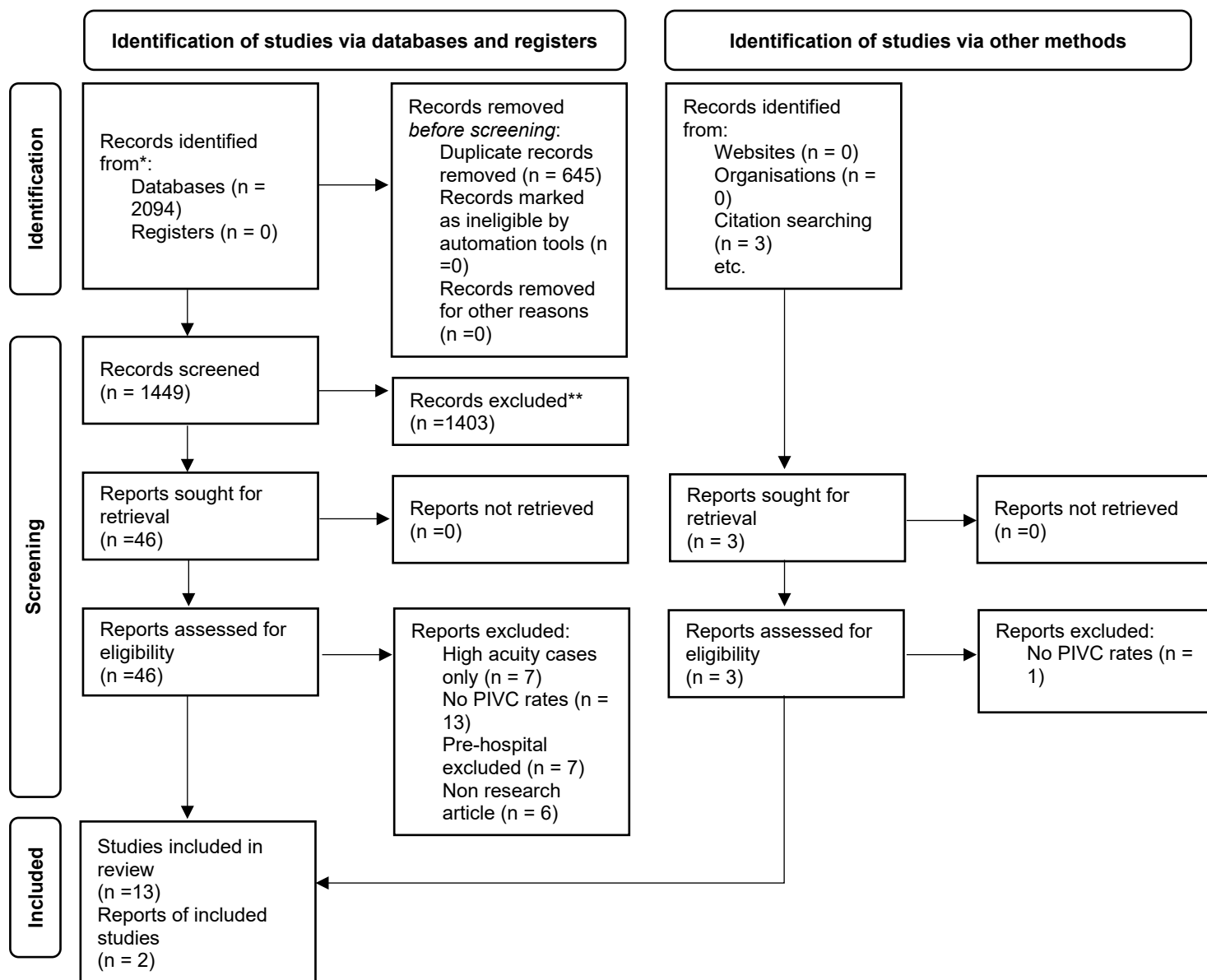


Figure 1. PRISMA flow diagram

Results

The 15 articles identified consisted of two qualitative and thirteen quantitative studies.

Six studies were from United States of America (USA), five from Australia, and the

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remainder were from Brazil, South Africa, Switzerland, and Sweden. Eight of the studies were specific to pre-hospital PIVC practice. Four studies were ambulance-based and reported on paramedic procedures. Three hospital studies focussed on PIVC practice and included pre-hospital PIVCs. Ten articles were either a single site or single ambulance service study and most of these data were collected from retrospective reviews of patient records and focussed predominately on adult populations. Two studies provided data specific to paediatric patients (18 years and under). Two studies focussed on older adults who were defined as either greater than 60 or 65 years of age. Two qualitative studies explored PIVC decision-making. In addition to the outcomes of interest, additional themes were identified related to PIVC size, insertion site, insertion success, PIVC use and PIVC justification. Table 2 summarises the study characteristics.

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Table 2

Study characteristics and findings.

Reference/year	Aim	Study design, population and location	Timescale	PIVC insertion and use rates	Unused PIVC rates	Limitations (2018)/MMAT
Barbosa et al 2021 ³³	To analyse the profile of clinical and trauma occurrences in elderly people attended by the pre-hospital services	Retrospective review of random sample of medical regulations forms in patients >60 years in one city in Brazil (n=359)	One year period July 2017 – 2018	45.9% (n=165) Use rates not reported	Not reported	Patient acuity not reported MMAT criteria for quantitative descriptive data met
Bester & Sobuwa 2014 ³⁴	To describe the use of IV therapy in the prehospital setting. To determine the proportion of prehospital IV cannulations considered unnecessary when graded against triage score	Retrospective review of patient report forms in patients >8 years attended to by one ambulance station in South Africa (n=242)	One month period April 2013	20.6% (242/1157) attempted with a success rate of 87% (207/242) 28% of PIVCs used (58/207), 18.8% for IV fluids and 9.2% (19/207) for IV medications	72% (n=149) not used And 42.3% (n=63/149) were considered not necessary	Limited data from single site Unclear if triage score can be used to identify if a PIVC was unnecessary MMAT for quantitative descriptive criteria 4.2 not met
Bourgault et al 2021 ³⁵	To explore clinician perceptions and practices related to idle PIVCs and clinician rationale underlying the practice of inserting and maintaining idle PIVCs	Focus groups across 3 acute care units at an adult, tertiary hospital, USA	Five focus groups, with a mean duration of 45 minutes		Major theme of “it depends”, expectations of others, organisational procedures, knowledge and skills and emotional responses, which included a “just in case” PIVC	Only 2 EMTs were part of the study MMAT for qualitative criteria met

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Brown et al 2018 ³⁶	To describe the epidemiology of trauma in adult patients attended by ambulance paramedics and report the interventions performed by paramedics	Retrospective cohort study of patient care records, and WA death data All trauma patients ≥ 16 years attended to by St John WA paramedics Greater Metropolitan Perth, WA (n = 97,724)	Three-year period 2013 – 2016	31.5% (n =25,060/80,643) Use rates not reported The most common intervention was analgesia administration, 26.2% by IV route	Not reported, however most trauma patients were low acuity (75.5%)	Unclear whether trauma patients represent a large percentage of all cases PIVC use was not a major focus MMAT criteria for quantitative descriptive data met
Carlson et al 2016 ³⁷	To characterise the frequency of procedures performed by EMS providers	Data analysis from 2011 National Emergency Medical Services Information System Public Release Research Data Set. All patients ≥ 18 years USA (n=7,680,559)	One-year period Jan – Dec 2011	PIVC insertion the most common procedure (3,241,534/11,407,396 total procedures); 28.4% of total procedures with an average of 1.5 procedures per response	Not reported	Patient acuity related to individual procedures not reported MMAT criteria for quantitative descriptive data met
Duong et al 2018 ³⁸	To determine the characteristics of EMS care provided to older adults	Data analysis from 2014 National Emergency Medical Services Information System Public Release Research Data Set USA (n=16,11,219),	One-year period 2014	PIVC insertion the most common procedure performed on older and younger adults (32% and 26.6% respectively) Analgesics (4.75%), IV fluids (7.84%) and nebulised medications (22.51%) most commonly administered medications	Not reported Older adults and were more likely to be higher acuity	PIVC use not a major focus Unused PIVC rates were not reported MMAT criteria for quantitative descriptive data met

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Evison 2021 ³⁹	To describe contemporaneous PIVC insertion practices in pre-hospital and ED patient cohorts, with a focus on idle PIVC rates	Observational cohort study of patients ≥ 18 years. Single hospital and local ambulance service, Queensland, Australia (n=372 pre-hospital)	9 Feb-18 March 2017 and 5 Jan-4 Feb 2018	<p>Insertion rates not reported</p> <p>Pre-hospital use rates – 60.5% (225/372).</p> <p>Most commonly used for IV analgesia (40.6%) and IV anti-emetics (49.8%)</p> <p>ACF the most common insertion site (49.3%)</p> <p>Most common size 18g (39.2%) and 20g (44.5%)</p>	<p>39.5% (n=147) not used.</p> <p>Decreases to 19.9% when ED use of paramedic inserted PIVC is reported</p>	<p>No data collected on reasoning for PIVC insertion</p> <p>Data collected from one hospital only</p> <p>MMAT criteria for quantitative descriptive data met</p>
Evison 2022 ⁴⁰	To describe factors associated with clinicians' decision- making on whether to insert or use a PIVC in the emergency care setting	Individual semi-structured interviews Queensland, Australia	July-September 2020		<p>4 main themes: knowledge and experience; complicated and multifactorial; convenience; anticipated clinical course. Erring on side of caution and the potential need for a PIVC when in ED highlighted as reasons for pre-hospital PIVC insertion</p>	<p>Single centre study</p> <p>MMAT for qualitative criteria met</p>
Fry et al 2016 ⁴¹	To identify the proportion of ED patients that had a PIVC inserted, and whether this device was used within 72h of insertion	<p>Retrospective medical audit</p> <p>Patients >16 years who presented to ED at one tertiary metropolitan hospital, NSW, Australia</p> <p>(n=357)</p>	One month period July 2013	<p>58% (74/127)</p> <p>For all patients (n=375), 90.9% PIVCs were used in ED or within 72 hours on ward</p> <p>ACF most common insertion site (30%)</p> <p>Most common size 20g and 18g though 76% not known</p>	<p>Not reported, 79.6% of all patients were lower acuity based on the Australian Triage Score (levels 3-5)</p>	<p>Unused PIVC data not recorded specifically for Ambulance</p> <p>MMAT criteria for quantitative descriptive data met</p>

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Gentges et al 2016 ⁴²	To ascertain the frequency of PIVCs placed in the ED for any treatment	Retrospective chart review of medical records of patients who presented to one academic ED in an urban setting, USA (n=509)	2-week period in June 2014	54.8% of ED patients (n=509), 53 inserted in pre-hospital setting Use rate not reported. Most commonly used for IV medications (72%), IV fluids (67%) and contrast (19%)	Not reported Pre-hospital placement did not significantly affect line use rates	Descriptive data for Ambulance patients limited, PIVC insertion rates for all ambulance presentations not reported MMAT criteria for quantitative descriptive data met
Gonvers et al 2020 ⁴³	To establish the proportion of pre-hospital PIVC insertion and its use with regard to both the severity of the cases and the primary impression by the paramedics involved	Retrospective chart review of patient records attended to by Paramedics in one state in Switzerland (n=33,055)	1 year period January - December 2017	26% (8603/33055) in total: >18 years – 27%, ≤ 18 years – 12%	45.9% (3948/33055) unused, with 66.5% of these patients having a low severity score	Unclear if triage score can be used to identify if a PIVC was unnecessary MMAT criteria for quantitative descriptive data met
Göransson & Johansson 2011 ⁴⁷	To identify the underlying decisions regarding prehospital PIVC insertion in adult patients; ascertain PVC insertion rate and explore (within 24 hours of insertion) pharmaceutical treatment via PIVCs	Convenience sample adult patients >18 years, review of patient care records and questionnaire Sweden (n=345)	One month period October 2008	41% (143/345) attempted with a success rate of 94.4% (135/143) 59% (79/135) used, most commonly for analgesics and IV fluids Most common size 20g (49.6%)	41% (56/135) not used pre-hospital Unused rate 22% (30/135) when ED/hospital use of paramedic inserted PIVC is reported The decision for PIVC based on paramedics' intention to use it	Data collection dependent on crews' willingness to complete the survey Only one ED used for data collection Data collected 10 years+ old. MMAT criteria for quantitative descriptive data 4.2 not met

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Mason et al 2022 ⁴⁴	The prevalence of insertion of PIVCs and IO devices and to describe the patient-related and service-related characteristics of these devices, inserted by paramedics, in an Australian state ambulance service	Retrospective analysis of patient electronic medical records and the computer-aided dispatch database of 709,217 events, from state-wide Queensland Ambulance service, Australia	1 year 1 July 2016 – 30 June 2017	20.4% (144,627/709,217) 89.2% successful on first attempt Use not reported Most common site RACF (36.1%)	Not reported	Unused PIVCs not a focus of the study MMAT criteria for quantitative descriptive data met
Seymour et al 2012 ⁴⁵	To determine the association between out-of-hospital intravenous access and hospital mortality in a population-based cohort of adult, non-injured, non-cardiac arrest EMS patients	Review of EMS patient care records and the state-wide database of all hospitalisations. USA (n=56,332)	5-year period 2002-2006	50% (28,078/56,332)	Not reported however 13% (n=3639) of all patients who had PIVC classed as non-urgent	Included central and peripheral access. Data collected nearly 15 years old MMAT criteria for quantitative descriptive data met
VanderKooy 2018 ⁴⁶	To assess the association of prehospital IV catheter placement with EMS scene time and to assess the frequency with which the pre-hospital IV catheter is utilized for medication or fluid delivery in the prehospital setting and during later treatment in the ED in Paediatric patients	Retrospective chart review of patient care records Random sample patients <18 years who were conveyed to ED by ambulance, at one hospital, USA (n=545)	One year period Jan-Dec 2013	27.3% (149/545) attempted with a success rate of 74.4% (111/149) 42.3% (47/111) used, most commonly for IV medications (43%)	77.4% unused (86/111) PIVC insertion was appropriate in 34.2% of patients 14/149 patients where a PIVC was attempted, were triaged as 4 or 5	Data from only one ED Decision as to whether an IV attempt was warranted based on investigators consensus – triage tools not used MMAT criteria for quantitative descriptive data met

PIVC = Peripheral intravenous catheter; MMAT = Mixed Methods Appraisal Tool; IV = Intravenous; EMT = Emergency Medical Technician; WA = Western Australia; EMS = Emergency Medical

Service; ED = Emergency Department; IO = Intraosseous

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PIVC insertion rates

Across all ages pre-hospital insertion rates were reported in 11 studies, either as a percentage of patients^{33,34,36,38,41,43,45-47} or total procedures^{37,44} with a wide range of results. A small cohort study reported the lowest insertion rate (20.6%), while four studies reported rates of 26-32%.^{36,38,43,46} Three international studies reported higher rates (41-50%).^{33,45,47} The highest was in an Australian study where 58% of patients received a pre-hospital PIVC.⁴¹ Both the highest and lowest PIVC insertion rates were reported in small single site/service studies in which data were collected over one month.

Two studies provided insertion rates as a percentage of total procedures performed and reported rates of 28%³⁷ and 20.4%.⁴⁴ Both were specific to the pre-hospital setting and were larger scale studies that collected data over a year, but in different countries (USA and Australia).

Seven studies had specific data for adult populations. Two Australian studies^{36,41} included people greater than 16 years while international studies^{37,38,43,45,47} defined adults as greater than 18 years. Insertion rates ranged from 26-58%. Two studies reported data specific to the older adult population with rates of 32% in adults over 65 years³⁸ and 46% in adults over 60 years.³³ For persons under the age of 18 years, two studies reported insertion rates of 12%⁴³ and 20%.⁴⁶

Successful insertion rates

Three studies reported on insertion success^{34,44,47} with rates of 87-94%. Only one study⁴⁴ reviewed the number of attempts and reported a first-time success rate of 89%. Women were found to be at slightly higher risk of first-time insertion failure (5.6% compared to 5% in men). In the paediatric study⁴⁶ the success rate in children younger than six years was less than 60% but increased to 80% for older children.

PIVC site and size

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The antecubital fossa (ACF) was the most common insertion site.^{39,41} In a recent Australian study⁴⁴ the right ACF was the most common site accounting for 36.1% of all PIVCs inserted by the Queensland Ambulance Service. The most common PIVC sizes used were 18g and 20g.^{39,41,47}

PIVC use

Use of PIVCs ranged from 28-61%.^{34,39,46,47} In the Swiss study, PIVCs were used in 68% of patients under 18 years, compared to 54% in over 18 years.⁴³ Pre-hospital PIVCs were mostly used to administer intravenous (IV) medications, most frequently IV analgesia and anti-emetics, and IV fluids.^{36,38,39,42,43,46,47}

Unused PIVCs

The highest rates of unused PIVCs were in the South African study³⁴ where 72% of PIVCs remained unused, and in the paediatric study⁴⁶ where 77.4% were unused. Other studies reported lower rates of 39.5-45.9%.^{39,43,47}

Two studies reported on whether the PIVC was used in ED or within 24 hours of hospital admission; of the 40% of unused pre-hospital PIVCs, half were later used by hospital staff.^{39,47} In the paediatric study, a third of unused PIVCs were used within 30 minutes of ED arrival.⁴⁶

Justification for PIVC insertion

Two studies used triage scores to assess the suitability for PIVC insertion with the rationale that a lower severity of illness or injury suggests a PIVC is not indicated.^{34,43} In the South African study³⁴ the authors concluded that 42.3% of unused PIVCs were not justified as the patients were assessed as low acuity. The Swiss study⁴³ reported that 66.5% of PIVCs were not used in lower acuity patients, however stated that lower acuity is not an absolute contraindication to PIVC insertion but should be used as a prompt to reassess the necessity of the procedure.

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One Australian study³⁹ reported 48.6% of unused PIVCs were in patients with a lower acuity level (Australian Triage Score of 3-5). The authors highlighted that there is currently no accepted definition of when an unused PIVC is clinically indicated, therefore all unused PIVCs are inappropriate.

In the paediatric study,⁴⁶ researchers decided whether a PIVC was indicated based on criteria determined by the researchers, which included an assessment of patient acuity and whether the PIVC was used either by paramedics or within 30 minutes of ED arrival. Nearly two-thirds of PIVCs did not meet the criteria for insertion.

Paramedic decision-making

Two qualitative studies explored PIVC decision-making and described similar themes: the knowledge and experience of the clinicians; the perceived clinical trajectory of the patient; the convenience of having a PIVC; and that the decision is complex and multi-factorial. A driver for pre-hospital PIVC insertion is erring on the side of caution in case of patient deterioration.⁴⁰ Other factors included longer transport times, anticipation of ED use of the PIVC and skills maintenance.⁴⁰

One Swedish survey⁴⁷ found that 70% of patients had a PIVC inserted due to the paramedics' intention to administer IV treatment. No PIVCs were inserted for training purposes and anticipated use in ED did not influence practice. It was reported that 23% of patients received a PIVC as a "security action", however the authors did not define this term.

Discussion

There are limited published articles on pre-hospital PIVC practice. Of the articles included, a wide range PIVC insertion rates were reported, potentially due to the wide variability of study design, from large scale, service-wide studies that included broad patient populations, through to smaller single site/ambulance service studies or those that focussed on specific groups. It remains unclear if the reasons for the large variation in insertion rates was due to differing patient acuities or differing clinician practices or guidelines.

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When compared to adults generally, higher insertion rates were reported with older adults potentially due to increased complexity of health conditions and higher acuity levels in this cohort.⁴⁸ Studies on paediatric patients reported the lowest PIVC insertion rates, which likely reflects ambulance specific guidelines cautioning against PIVC insertion in children due to the difficulty in performing this procedure.⁴⁹

Older studies have reported insertion rates of 57-60%,⁵⁰⁻⁵² which is at the higher end of the rates found in this review. This suggests pre-hospital insertion rates may be declining however, only three of the included articles reported on Australian data,^{36,41,44} and only one specifically reviewed vascular access in the pre-hospital setting.⁴⁴ It remains unclear if this decreasing trend reflects contemporary Australian pre-hospital practice.

There are reported high rates of paramedic PIVC insertion success, however, only one study reported on the number of attempts needed and reported a first-time success rate of 89%,⁴⁴ which aligns with previous research findings.^{53,54} In all of these studies, data were obtained from retrospective reviews of patient records, or completion of questionnaires therefore under-reporting of PIVC insertion failures is possible. Observational studies report lower first-time success rates of 73-79% in emergency settings.^{53,55,56}

There are limited studies on unused PIVCs, and differences in definitions of an unused PIVC were noted. Several studies considered if the PIVC was used by hospital staff.^{39,46,47} Arguably, if the unused PIVC is later used by ED staff the PIVC is clinically indicated.^{43,46} However, the presence of a pre-hospital PIVC may encourage ED staff to use the IV route out of convenience rather than using less invasive routes.^{41,46} There is a lack of standardised nomenclature in vascular access,⁵⁷⁻⁵⁹ therefore the development of a definition for unused pre-hospital PIVCs would expedite assessment and benchmarking of clinical practice.

Patient acuity determined by triage tools has been used to assess whether unused PIVCs are clinically justified, as higher acuity patients are potentially high risk for clinical

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deterioration, therefore PIVC insertion reflects critical pre-emptive clinical decision-making. Conversely, there are a cohort of low acuity patients where a PIVC may not be clinically appropriate, particularly when non-invasive alternatives, such as intranasal fentanyl have been shown to be feasible and safer in emergency settings.^{60,61} Analgesic and anti-emetic medications are widely available for administration by Australian paramedics via non-invasive routes,⁶²⁻⁶⁵ however, it is not currently known if these are frequently utilised.

An additional argument supporting the reduction in unused PIVCs is that pre-hospital PIVC insertions are not without risks to both patients and ambulance personnel. Pre-hospital challenges include uncontrolled, mobile and sometimes hostile working conditions, poor lighting and space limitations, which may lead to potential breaches in aseptic technique, and exposure to body fluids for paramedics.⁶⁶⁻⁶⁹

Limitations

Most studies involved a retrospective review of patient care records, therefore there may be missing or inaccurate data.⁷⁰ Due to the limited number of publications identified, and the heterogeneity of the populations, study aims and design, the generalisability of the findings to contemporary Australian practice is limited particularly with international studies. Of the five Australian studies included in this review, three were from Queensland and only one collected state-wide data. Due to differing ambulance services models across jurisdictions, it is unclear whether the findings from these studies reflect practice across other states and territories. Grey literature including pre-hospital clinical practice guidelines was not included in this review, which may have limited findings particularly related to paramedic decision-making.

Conclusion

There are a limited number of contemporary studies into pre-hospital PIVC practice, with a wide range of reported PIVC insertion rates. Unused PIVCs rates and paramedic decision-making is not well reported. There is a paucity of pre-hospital PIVC research in

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Australian settings, particularly outside of Queensland. Further research from other jurisdictions is required to understand factors influencing Australian practice and provide contemporary evidence to inform the development of guidance specific to the pre-hospital setting to reduce the numbers of inappropriate PIVCs.

Conflicts of interest

There are no conflicts of interest.

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