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Peripheral intravenous cannulas for blood drawing: Nurses' views through content analysis

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ABSTRACT

Background: Peripheral intravenous cannulas are commonly used for blood sampling. Conflicting evidence on the safety and reliability of blood sampling from peripheral intravenous cannulas provides little support to guide practice of clinicians.

Aim: To elicit views of nurses working in acute care of their opinions on the safety and efficacy of obtaining blood samples from peripheral intravenous cannulas.

Methods: A cross-sectional electronic survey was utilised. Participants included nurses working in Australian acute care services nationally. The STROBE checklist was followed. The survey was distributed by two professional nursing bodies to their members between September and December 2017. Content analysis was used to analyse open-ended responses.

Findings: Of the 338 participants who completed the survey, 269 provided comments. Themes supporting the use of peripheral intravenous cannulas for blood sampling included 'efficiency', 'patient care', 'last resort', and 'other'. Reasons for not using a peripheral intravenous cannula for sampling provided themes of 'PIVC use', 'dwell time', 'test type required', 'patency/insertion site care', 'preference', and 'other'.

Discussion: The choice regarding method of blood sampling is left to the discretion of individual practitioners. Diverse rationales were provided by respondents to support their practice in sampling blood. This may be influenced by variations in hospital policies and conflicting research evidence to support or refute the practice.

Conclusion: Blood sampling from peripheral intravenous cannulas or venepuncture is practiced differently between nurses based on multiple rationales. Research is needed to provide evidence for safe practice and support hospital policies.

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PROBLEM

Large variations in practice are reported between nurses regarding blood collection through peripheral intravenous cannulas.

WHAT IS ALREADY KNOWN

Peripheral intravenous cannulas provide a convenient and less painful method of obtaining blood samples. There is limited

research available on which to base nursing practice when drawing blood from a peripheral venous cannula.

WHAT THIS PAPER ADDS

This paper provides the professional opinions of nurses as to why they choose to use a peripheral venous cannula for a blood draw or are against the procedure. By understanding the rationale further research can be used to provide evidence for the practice.

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INTRODUCTION

Blood sampling is an important investigation to enable diagnosis and help tailor effective management for patient conditions. Over 16 million haematology tests were collected in Australia in 2011/12 with an estimated 40% of these conducted in the public health sector (Pilbeam, Badrick & Ridout, 2013). Inaccurate samples can cause inappropriate changes to patient management thereby increasing the risk of harm to the patient and increasing the cost to health services (Abbas, Mukinda & Namane, 2017; Phelan et al., 2018). Errors identified in Australian pathology laboratories occur in 1.6% of pathology samples, with the majority of these due to pre-analytical factors such as incorrect documentation and collection or handling (Pilbeam et al., 2013). Currently there is variation and uncertainty among health care professionals regarding the use of peripheral intravenous cannulas (PIVC) for blood drawing, contributing to inconsistency, and potential errors in practice.

LITERATURE REVIEW

Venepuncture is the traditional, and most commonly used, way to collect blood samples. Venepuncture is effective, but it is also painful with hospital patients frequently reporting venepuncture as the most painful procedure they have undertaken, particularly when it is conducted repeatedly (Lesser, Lanham & Davis, 2020). Studies have shown that some patients feel resigned to the fact that they will experience painful venepuncture when they attend a hospital and feel that this is a necessary step towards recovery (Filbet et al., 2017).

Because pain is a subjective concept, patient experiences of pain during procedures that are considered routine can be ignored and their complaints viewed as frivolous by busy nursing staff (Filbet et al., 2017). Attitudes and beliefs of nurses towards pain have been shown to influence a person's behaviour (Knowles et al., 2015; Sussman & Gifford, 2019). A 2017 study in France examining the barriers to pain prevention in venepuncture, asked nurses to report on how they felt and responded when cancer patients expressed pain during venipuncture procedures. The study found that nurses felt it was inevitable for patients to experience pain during the procedure and that the nurses routinely downplayed the pain as minor and temporary (Filbet et al., 2017).

One possible way to reduce the pain associated with repeated punctures required for blood draws is to draw the blood from a PIVC. Increasingly, it is becoming common practice for some health professionals to collect blood from PIVCs rather than conducting a fresh venepuncture for each blood sample (Davies, Coventry, Jacob, Stoneman & Jacob, 2019). Insertion of a PIVC is a common intervention for patients in acute health services to assist with management of conditions. Most PIVCs are inserted to administer intravenous fluids, medications or for the collection of blood for testing. It is estimated that up to 80% of hospitalised patients will require intravenous therapy at some point during their inpatient stay (Yagnik, Graves & Thong, 2017). Argument for obtaining blood samples from PIVC include decreased pain due to venepuncture, convenience of access, and appropriateness for certain populations, such as paediatrics and patients on anticoagulant therapy (Zengin & Enc, 2008) or those requiring multiple blood sampling (Carr et al., 2019; Seemann & Reinhardt, 2000). Several researchers have found blood collection through PIVCs acceptable practice with low rates of haemolysis and contamination (Corbo, Fu, Silver, Atallah & Bijur, 2007; Dietrich, 2014; Hambleton, Gómez & Andreu, 2014; Jeong et al., 2019; Kelly & Klim, 2013; Lesser et al., 2020; Ortells-Abuye, Busquets-Puigdevall, Díaz-Bergara, Paguina-Marcos & Sánchez-Pérez, 2014; Zlotowski, Kupas & Wood, 2001). Arguments against the practice include concerns regarding the qual-

ity of the blood samples as other researchers have found increased haemolysis in blood samples taken from newly inserted PIVCs (Coventry et al., 2019; Lowe et al., 2008), and existing PIVCs (Coventry et al., 2019; Grant, 2003).

There is a great degree of variance in practice of obtaining blood samples from PIVCs between health services, states in Australia and individual nurses. Some health services have guidelines against the practice of blood sampling from PIVC post-insertion (New South Wales Department of Health, 2013; Western Australia Department of Health, 2016) and yet evidence suggest this practice happens routinely in many health services (Davies et al., 2019). A comparison of the Australian state government policies on the use of PIVC for blood sampling has been published by Jacob, Jacob, Davies and Coventry (2020). Differences were found in quality of evidence used to develop the policies and recommendations regarding blood sampling from PIVCs (Jacob et al., 2020). This difference in policy recommendations may cause confusion for nurses as while some practices may be in line with one state, they may not match the state the clinician is working in. With nurses holding national registration in Australia, such discrepancies between state policies may become an increasingly poignant issue.

Literature reviews on the accuracy of sampling blood from PIVCs either supported the practice (Jeong et al., 2019; Lesser et al., 2020) or findings were inconclusive (Coventry et al., 2019). Research also suggests that appropriate education on methods of drawing blood from PIVCs may be an important factor in the success of taking blood from PIVCs (Dugan, Leech, Speroni & Corriher, 2005). However, many nurses have strong views on blood sampling and the way they undertake blood collection as a part of their professional role. Understanding clinicians' attitudes and beliefs towards specific behaviours and identifying factors that influence intention to perform a behaviour is important for enabling change in behaviours (Knowles et al., 2015).

Research question

What are the views of Australian nurses working in acute care of their opinions on the safety and efficacy of obtaining blood samples from PIVCs?

THE STUDY

Design

A cross-sectional electronic survey was used to examine the views of registered nurses working in acute healthcare settings across Australia. The STROBE EQUATOR checklist was used as a guideline for the project (Appendix 1). The research team was formed in response to questions from clinicians. As the user group for this research, clinicians were a valuable part of the research team and helped inform the study.

Method

The survey was created using Qualtrics Software (Experience Management, Seattle, WA). Questions for the survey were developed based on evidence from literature reviews on the practice of blood sampling from PIVC. Questions focused around blood sampling technique, and reasons for decisions to use PIVC for sampling. Open-ended questions were used to enable participants to provide individual insight into the practice. Pilot testing of the survey was conducted with four nurses working in acute care to ensure that the survey was easily understood by the respondent target group. The survey was distributed between September and December 2017 via personal networks and with assistance from Aus-

tralian Nursing and Midwifery Federation and the Australian College of Nursing to their nursing networks.

Ethics

Ethics approval was gained from a university Human Research Ethics Committee (Project Code 18384). The study conforms with the guidelines from the National Statement on Ethical Conduct in Human Research by the Australian National Health and Medical Research Council. The opening page of the survey included an information sheet related to the research. Completion of the anonymous survey was seen as implied consent. Electronic data from the surveys were stored in a cloud database which was accessible only with a password.

Participants

Participants included nurses working in Australian acute care services. Participants self-selected for the study by clicking on a link to the survey via an advertisement sent by their professional nursing body. The survey was accessed by 542 Australian Registered Nurses, of which 338 completed in full. The respondents had a median age of 38 years (IQR; 25th–75th percentile, 29–49 years), held a bachelor degree (33%) and had a median of 9 years (IQR; 25th–75th percentile, 4–21 years) nursing experience.

Responses were received from nurses in every state and territory in Australia. Nurses from Victoria represented 40.5% of the respondents. Participants practised in a large range of clinical areas including emergency, medical, surgical, critical care, oncology, community, and cardiac wards.

Analysis

The survey contained a variety of multiple choice questions and spaces for open-text responses. Due to the amount of data collected in the survey, the reporting has been divided into quantitative and qualitative components. Reporting of the data in a single paper would limit the ability to expand on the comments of participants, which is important in understanding of nurses' views on the procedure of blood sampling from PIVCs. A full breakdown of the quantitative data collected in this survey has been published separately (BLINDED FOR PEER REVIEW). This paper reports on the qualitative findings from the survey.

The open-ended questions were analysed thematically using the process outlined by Jacob et al. (2015) in order to provide more in-depth insight. The content analysis of the open-ended questions was undertaken by two members of the research team (EJ & LS) who are experienced acute care nurses. Questions were inductively coded individually by the researchers based on content and then compared. Discrepancies in codes were discussed until consensus was reached. Coding was undertaken manually using paper and pen and then transcribed into a word document using the code ascribed and copies of the comments. This was formed into Tables 1–3 presented below. As responses could contain more than one code, the number of codes were greater than the number of responses. Coded responses were grouped into categories and then themes. As the data was from anonymous surveys, participant checking was not possible.

RESULTS

There were two questions in the survey that allowed a text response: 'What are the reasons why you would sample blood from a PIVC?' and 'Are there any specific circumstances where you would not sample blood from a PIVC?'. There was also space at the end of the survey for participants to write any further comments that

Table 1
Reasons for taking blood samples from a PIVC

Ranking	Categories	Code count n = 190)/Per- centage of code count (%)	Theme
1	On insertion	63 (33.1)	Efficiency
2	Patient comfort	34 (17.9)	Patient care
3	Speed- urgency	29 (15.3)	Efficiency
4	Specific patient types	18 (9.5)	Patient care
5	Difficult/limited access	12 (6.3)	Last resort
6	Convenience	8 (4.2)	Efficiency
6	Other	8 (4.2)	Other
7	Multiple sample collection	7 (3.7)	Patient care
8	Never use	11 (5.8)	Not appropriate

they wanted to provide. Each of these sections was analysed separately.

Reasons why you would sample from a PIVC

There were 125 participants who answered the question, 'What are the reasons why you would sample from a PIVC?', which yielded 190 codes within nine categories. Categories were grouped into five main themes. By far the most common theme was 'efficiency' (see Table 1).

Efficiency

The theme 'Efficiency' encompassed responses that dealt with issues of work flow. This theme included the categories of 'on insertion', 'urgency', and 'convenience'. 'On insertion' included responses relating to the exclusive use of newly inserted PIVCs for blood draws that were incidental to insertion and the use and insertion of PIVCs in cases of emergency. The emergency department was referred to as a place where blood samples are often taken from a PIVC, with one respondent commenting that it "usually occurs in ED/preadmission". Some respondents felt that using PIVC for blood draws is a "faster [way] to perform collection compared to venepuncture". One respondent stated that they would draw blood from PIVC when "there's not enough nurses and not enough time to get a fresh sample". Other respondents referred to the efficiency of using PIVC to draw blood from patients who required multiple samples or blood draws, particularly in a short amount of time.

Patient care

The second theme, 'Patient care' included responses that mentioned all references to the physical and psychological comfort or pain levels of patients and also referred to different choices for different types of patients. A participant reported that "It is significantly less painful and distressing for the patient to withdraw from a PIVC". One respondent clarified that "all RNs in my area are trained in venepuncture however due to the frequency of blood tests we prefer to use [a] PIVC for patient comfort". Respondents felt that taking blood through PIVC could be "less distressing for patient[s]" and "It should be utilised more frequently in the ward area by nurses to prevent multiple venepunctures". Patient fear and patient behaviour were also noted as reasons to use a PIVC. Specific patient type referred to responses that included specific patient groups where respondents felt that drawing blood from a PIVC would be appropriate. Paediatric and chemotherapy patients were both specifically referenced by multiple respondents. One respondent stated that they routinely "take the sample [from PIVC] after cannulation to check bloods pre-chemo". Other patient types mentioned included 'patients undergoing thrombolysis', those with needle phobias, diabetic ketoacidosis, patients taking anticoagulant medications and aggressive patients.

Table 2
Reasons for not sampling blood from a PIVC

Ranking	Category	Code count (n = 369)/Percentage of code count (%)	Theme
1	Infusion/medication running	98 (26.5)	PIVC in use
2	PIVC dwell time	62 (16.8)	Dwell time
3	Type of test	51 (13.8)	Test type
4	Phlebitis/tissuing	47 (12.7)	Patency/insertion site care
5	Personal preference	45 (12.2)	Preference
6	Risk to patency	24 (6.5)	Patency/insertion site care
7	Other	16 (4.3)	Other
8	Difficult cannulation	15 (4.1)	Patency/insertion site care
9	Small gauge cannula	11 (2.9)	Patency/insertion site care

Last resort

The theme 'Last resort' was used to cover responses that stated blood would rarely or hardly ever be drawn from a PIVC, only used in an emergency, if access was difficult or as a last resort. Respondents stated that PIVCs were used as a "last resort" with another saying that they would only be used for blood sampling "as a last resort after two nurses and two HMOs [hospital medical officers or hospital doctors] have attempted to take blood".

Other

'Other' was the theme given to responses for times when blood would be sampled from a PIVC which did not fall into identified themes. This included comments such as 'for research', 'when told by a doctor to' and 'policy'.

Not appropriate

It is worth noting that seven respondents stated in this question that they would never use a PIVC to draw blood as it was 'not appropriate'. Accuracy was not a commonly cited issue, with only one person referring to accuracy and no respondents mentioning haemolysis as a reason for not using PIVC for blood collection.

Circumstances where you would not sample from a PIVC

The question 'What are the circumstances where you would NOT sample from a PIVC?' yielded 269 text responses generating 369 codes. Responses were analysed and broken down into nine categories across six main themes (see Table 2).

PIVC in use

"PIVC in use" or having a PIVC in use for administration of medications or fluids was the main reason given for not using it for blood sampling. Infusions in general, and some medications in particular, were seen as barriers to drawing blood samples, particularly when "infusion[s] can't safely be paused for time to take blood". Some respondents took this further, stating that they would not use a PIVC for blood draws at all "if medications or fluids have been given through that bung".

PIVC dwell time

'PIVC dwell time' was also a common reason for not taking a blood sample from a PIVC and covers responses relating to the length of time after a PIVC had been inserted following which respondents would no longer feel comfortable drawing blood from a PIVC. A number of respondents clearly specified that they would not draw blood from a cannula that was "not newly inserted". Other responses included specific ranges of time at which they would consider a PIVC too old for blood drawing. These times ranged from four to 72 h.

Test type

'Test type' or the type blood test required was another common reason for not using a PIVC for blood sampling as specific tests were felt to be more sensitive to contamination. The largest concern was related to blood cultures, but respondents also noted a number of specific tests that they would not conduct using samples from PIVC, these included "never for blood cultures" and "blood gasses". One respondent noted that bloods collected for police investigations are required to be taken by venepuncture.

Patency/Insertion site care

The theme 'patency/insertion site care' includes responses that mentioned damage or trauma to the cannula insertion site as a reason for not using it to draw blood. Respondents stated that they would not take blood from a PIVC site that was painful, infected, tissue or showing signs of phlebitis. One respondent stated they would not take blood from a PIVC if there was an "alteration in the presentation of the insertion site and if pain is recorded by the patient." Respondents appeared to be keen to ensure that difficult cannulations and 'precious' PIVCs remained patent and in place for patients, and this was a reason for not using them to draw blood. One respondent stated that they would not draw blood from a PIVC if the "line was very difficult to place or imperative it is kept in patent[sic]".

Personal preference

'Personal preference' was a recurring theme throughout the survey with many respondents clear that their decision for choosing whether to use a PIVC for blood sampling was a personal choice. Preferences were both for and against the practice and respondents did not provide any evidence to justify their position. As an example, comments varied from "I have always done this [blood sampling from PIVC] and will continue to do so" to "I prefer a fresh prick if possible, not a fan of using PIVC".

Other

The theme 'other' list responses that did not fit into the identified categories. It is worth noting that four respondents reported that they would not use a PIVC to sample blood from adult patients, while others reported that they would not use PIVC if they were told not to by a doctor, during resuscitation or if it was against hospital policy.

Further comment

The space for 'Further Comment' provided 98 individual text responses and 128 codes. Codes were grouped into nine categories and four themes (see Table 3). Codes that repeated themes reported in the first two questions were incorporated into the above counts to avoid repetition.

Table 3
Other comments on sampling blood from a PIVC

Ranking	Category	Code count (n = 63)/Percentage of code count	Theme
1	Technique	20 (31.7)	Patient safety
2	Accuracy	17 (26.9)	Patient Safety
3	Policy	11 (17.5)	Policy
4	Safety	10 (15.9)	Patient Safety
5	Education	5 (7.9)	Policy

Patient safety

The theme 'Patient safety' included the categories of technique, accuracy and safety. Technique covered all references to specific technical components of blood drawing that were mentioned by respondents. Respondents suggested that they were aware of the need for blood draws to be conducted in ways that represent best practice, maintain hygiene principles and are consistent. One respondent stated that they could use PIVC for blood draw but "It's the technique that is the trouble. Some use excessive withdrawal pressure and poor choice of bung." The category of 'Accuracy' encompassed responses that questioned the ability to use PIVCs for blood draws, due to the impact on test accuracy. Respondents felt that the use of PIVCs may impact on the accuracy of blood cultures, provide false results and increase haemolysis rates. Respondents suggested they would not "draw blood from PIVC as it may give false reading due to dilution and increase chances of getting contaminated blood." Some responses linked technique and accuracy stating that there is a "need to understand technique to prevent haemolysis" while others thought PIVC "Seems easier. No understanding on whether it changes results though". From an alternative perspective, one respondent who worked in paediatrics stated that they would use a PIVC for blood sampling when they needed "a more accurate sample than can be obtained from a capillary sample". Responses varied in relation to infection, with one respondent feeling strongly that using a PIVC to draw blood reduces the risk of infection by reducing puncture sites while three other respondents were concerned that taking blood through a PIVC may increase the risk of infection.

Policy

The theme 'Policy' included references to the need for or the state of existing evidence, policies and educational programs. Sixteen respondents shared comments relevant to this theme, saying things such as "Staff need more education" or "I would love to see a guideline or policy". Respondents also picked up on what they perceived to be non-evidence-based policies, asking "Is there any research that shows it is detrimental to take blood from a non-new PIVC? If not, why are we stopped from doing this by our organisation?"

DISCUSSION

The findings from this study show variations exist in the opinion of nurses working in acute care across Australia on the practice of blood sampling from PIVCs. Nurses reported reasons for and against the practice. Yet, differences have been found in policies within Australia for the practice for different ward areas and patient groups (Jacob et al., 2020). There appears to be large inconsistencies that exist with the current opinions of nurses regarding the practice. Literature reviews on the practice of sampling blood from PIVCs supported the practice (Jeong et al., 2019; Lesser et al., 2020) or were inconclusive (Coventry et al., 2019). The lack of evidence on which to base practice and variations between practice guidelines makes it difficult for nurses to base their practice on evidence.

Reasons for use include efficiency of care and decreasing patient trauma. Efficiency of care was seen as vital in areas such as emergency where access to pathology results is essential for providing fast care (Davies et al., 2019). This practice of using PIVCs for blood sampling in emergency situations is supported in research (Decker et al., 2016; Dietrich, 2014) and by some health policies (Western Australia Department of Health, 2017). Again, the variations in policy recommendations within Australia make it difficult for nurses to make decisions based on evidence.

Decreasing pain was also provided as a reason for using PIVCs for blood sampling. Pain is subjective in nature and often rationalised away by nurses as a normal part of practice, or only a temporary pain Filbet et al. (2017). Despite this, nurses reported concern over the amount of pain some patients experienced during venepuncture and would instead choose blood sampling from a PIVC to avoid inflicting further pain.

Similar to other research, other reasons for using PIVCs for blood sampling included convenience of access for frequent sampling (Mulloy, Lee, Gregas, Hoffman & Ashley, 2018) and appropriateness for different patient types (Berger-Achituv, Budde-Schwartzman, Ellis, Shenkman & Erez, 2010). Patient types were similar to other studies, including paediatric populations (Berger-Achituv et al., 2010), patient on anticoagulation therapy (Zengin & Enç, 2008) and those requiring multiple blood samples (Seemann & Reinhardt, 2000). In contrast to previous research where a delay in patient treatment due the risk of a blood sample being haemolysed was a reason for not using a PIVC (Bodansky et al., 2017), several participants suggested that sampling blood from PIVC was undertaken to expedite treatment.

Reasons participants provided for not supporting the practice of blood sampling from PIVCs included the use of the PIVC for medication administration, accuracy of blood results, policy regulations and the length of dwell time of the PIVC. Haemolysis of blood samples, while not seen as a defining factor by participants, has been reported as a reason for not using PIVCs for blood sampling. Research on this is non-conclusive with studies reporting both a higher incidence of haemolysis when blood is sampled through a PIVC (Coventry et al., 2019; Grant, 2003; Wollowitz, Bijur, Esses & Gallagher, 2013) and no difference when haemolysis rates are compared with blood sampled by venepuncture (Jeong et al., 2019; Lesser et al., 2020; Seemann & Reinhardt, 2000; Stauss et al., 2012). Policy guidelines across Australia vary in their recommendation regarding this practice (Jacob et al., 2020). The conflicting evidence makes it difficult for nurses to determine the best practice for blood sampling.

Personal preferences were a strong reason that participants cited both for and against the practice of blood sampling from PIVCs. Mick (2000) suggests that personal preference may be used to determine nursing practice due to the absence of practice guidelines, limited evidence, or continuation of nursing traditions. The differences in recommendations for blood sampling from PIVC between different states and territories in Australia and lack of conclusive research evidence may lead nurses to determine their own preference for practice. Health workers require clear policy guidelines to direct practice.

Participants appeared to regard the technique used in the blood sampling as important to the success of the sample. The need for education on blood sampling technique was mentioned several times by participants. Sampling technique has been shown to affect the amount of haemolysis of a blood sample drawn from a PIVC (Coventry et al., 2019; Dugan et al., 2005). Sampling technique, training and personal competency affects the degree of damage to red blood cells and hence haemolysis and reliability of results obtained (Berg, Ahee, & Berg, 2011). A further study by Corkill (2012) demonstrated that reductions in haemolysis from blood sampling can be achieved through regular reminders of cor-

rect blood sampling techniques. Further research is required to be undertaken to provide solid evidence on which nurses can make decisions regarding patient care and determine the best method of safely sampling blood. Without further evidence, policy makers, educators and nurses are left to use personal opinion in determining patient care approaches.

Limitations

This research only considered the views of registered nurses and did not consider the views of other health professionals who routinely take blood from patients. A small sample of nurses chose to participate in this research, so the views may not be those of the broader nursing population. Participants self-selected, so nurses who chose to participate may have had a particular interest in the practice, positively or negatively, which may have influenced the results.

Conclusion

Large variations in practice and opinion exist regarding blood sampling from PIVCs amongst nurses throughout Australia. This may be in part due to the variations in policies and procedures throughout Australia which are based on limited or conflicting evidence. Efficiency, patient comfort and use for emergency access were the most common reasons for using this method of blood collection. Reasons for not using a PIVC for blood sampling included having a PIVC used for infusions or medication, the length of time following the insertion of the PIVC, maintaining patency of the PIVC, concerns regarding accuracy of blood samples collected via a PIVC and personal preference. Further research is needed into the sampling techniques to enable safe blood collection from PIVCs. Consistency of policy and procedure recommendations across Australia would reduce nurses' reliance on personal preference in determining blood collection methods and decrease variations in practice.

Author Contributions

Elisabeth R. Jacob: conceptualisation, methodology, investigation, data curation, writing- original draft, supervision, project administration, funding acquisition. Alycia M. Jacob: conceptualisation, methodology, investigation, data analysis, writing- original draft, funding acquisition. Hugh T. Davies: conceptualisation, methodology, investigation, writing – review & editing, funding acquisition. Laurita J. Stoneman: conceptualisation, data analysis, writing – review & editing. Linda Coventry: conceptualisation, methodology, writing – review & editing, funding acquisition.

Ethics statement

This research involved the collection of survey data from human participants. Ethical approval was received from Edith Cowan University (Project Code 18384) on the 4th of September 2017.

Conflict of interest

The authors declare no conflict of interest. Funding was provided for the project by the Western Australian Nurses Memorial Charitable Trust. The funders had no input into the undertaking or reporting from the study.

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References

- Abbas, M., Mukinda, F. K., & Namane, M. (2017). The effect of phlebotomy training on blood sample rejection and phlebotomy knowledge of primary health care providers in Cape Town: a quasi-experimental study. *African Journal of Primary Health Care & Family Medicine*, 9(1), e1–e10. <https://doi.org/10.4102/phcfm.v9i1.1242>.
- Berger-Achituv, S., Budde-Schwartzman, B., Ellis, M. H., Shenkman, Z., & Erez, I. (2010). Blood sampling through peripheral venous catheters is reliable for selected basic analytes in children. *Pediatrics*, 126(1), e179–e186.
- Berg, J. E., Ahee, P., & Berg, J. D. (2011). Variation in phlebotomy techniques in emergency medicine and the incidence of haemolysed samples. *Annals of Clinical Biochemistry*, 48, 562–565. <https://doi.org/10.1258/acb.2011.011099>.
- Bodansky, D. M. S., Lumley, S. E., Chakraborty, R., Mani, D., Hodson, J., Hallissey, M. T., & Tucker, O. N. (2017). Potential cost savings by minimisation of blood sample delays on care decision making in urgent care services. *Annals of Medicine and Surgery*, 20, 37–40.
- Carr, P. J., Rippey, J. C. R., Cooke, M. L., Higgins, N. S., Trevenen, M. L., Foale, A., et al. (2019). Derivation of a clinical decision-making aid to improve the insertion of clinically indicated peripheral intravenous catheters and promote vessel health preservation. An observational study. *PLoS One*, 14(3). <https://doi.org/10.1371/journal.pone.0213923>.
- Corbo, J., Fu, L., Silver, M., Atallah, H., & Bijur, P. (2007). Comparison of laboratory values obtained by phlebotomy versus saline lock devices. *Academic Emergency Medicine*, 14(1), 23–27. <https://doi.org/10.1197/j.aem.2006.06.053>.
- Corkill, D. (2012). Testing the effects of educational toilet posters: a novel way of reducing haemolysis of blood samples within ED. *Australasian Emergency Nursing Journal: AENJ*, 15(1), 31–36 Epub 2012 Jan 31. PMID: 22813621. <https://doi.org/10.1016/j.aenj.2011.11.001>.
- Coventry, L., Jacob, A., Davies, H., Stoneman, L., Keogh, S., & Jacob, E. (2019). Drawing blood from peripheral intravenous cannula compared with venepuncture: a systematic review and meta-analysis. *Journal of Advanced Nursing*, 75(11), 1–27. <https://doi.org/10.1111/jan.14078>.
- Davies, H., Coventry, L., Jacob, A., Stoneman, L., & Jacob, E. (2019). Blood sampling through peripheral intravenous cannulas: a look at current practice in Australia. *Collegian*, 27, 219–225. <https://doi.org/10.1016/j.colegn.2019.07.010>.
- Decker, K., Ireland, S., O'Sullivan, L., Boucher, S. L. K., & Mitra, B. (2016). Peripheral intravenous catheter insertion in the Emergency Department. *Australasian Emergency Nursing Journal*, 19, 138–142. <https://doi.org/10.1016/j.aenj.2015.10.12.1003>.
- Dietrich, H. (2014). One poke or two: can intravenous catheters provide an acceptable blood sample? A data set presentation, review of previous data sets, and discussion. *Journal of Emergency Nursing*, 40(6), 575–578. <https://doi.org/10.1016/j.jen.2012.11.002>.
- Dugan, L., Leech, L., Speroni, K. G., & Corriher, J. (2005). Factors affecting hemolysis rates in blood samples drawn from newly placed iv sites in the emergency department. *Journal of Emergency Nursing*, 31(4), 338–345. <https://doi.org/10.1016/j.jen.2005.05.004>.
- Filbet, M., Larkin, P., Chabloz, C., Chirac, A., Monsarrat, L., & Ruer, M. (2017). Barriers to venipuncture-induced pain prevention in cancer patients: A qualitative study. *BMC Palliative Care*, 16(1), 5. <https://doi.org/10.1186/s12904-016-0180-x>.
- Grant, M. S. (2003). The effect of blood drawing techniques and equipment on the hemolysis of ED laboratory blood samples. *Journal of Emergency Nursing*, 29(2), 116–121. <https://doi.org/10.1067/men.2003.66>.
- Hambleton, V. L., Gómez, I. A., & Andreu, F. A. B. (2014). Venipuncture versus peripheral catheter: do infusions alter laboratory results? *Journal of Emergency Nursing*, 40(1), 20–26. <https://doi.org/10.1016/j.jen.2012.03.014>.
- Jacob, A., Jacob, E., Davies, H., & Coventry, L. (2020). Are current clinical guidelines on the use of Peripheral Intravenous Cannula for blood draws supported by evidence? An organisational case study. *Nursing Open*. <https://doi.org/10.1002/nop.2.559>.
- Jacob, E., Raymond, A., Jacob, A., Jones, J., Drysdale, M., & Isaacs, A. (2015). Exploration of nursing degree students' content expectations of a dedicated Indigenous health unit. *Collegian: The Australian Journal of Nursing Practice, Scholarship and Research*. <https://doi.org/10.1016/j.colegn.2015.06.001>.
- Jeong, Y., Park, H., Jung, M. J., Kim, M. S., Byun, S., & Choi, A. Y. (2019). Comparison of laboratory results between two blood samplings: Venipuncture versus peripheral venous catheter – a systematic review with meta-analysis. *Journal of Clinical Nursing*. <https://doi.org/10.1111/jocn.14918>.
- Kelly, A.-. M., & Klim, S. (2013). Taking blood cultures from a newly established intravenous catheter in the emergency department does not increase the rate of contaminated blood cultures. *Emergency Medicine Australasia*, 25(5), 435–438. <https://doi.org/10.1111/1742-6723.12121>.
- Knowles, S., Lam, T. L., McInnes, E., Elliott, D., Hardy, J., & Middleton, S. (2015). Knowledge, attitudes, beliefs and behaviour intentions for three bowel management practices in intensive care: Effect of a targeted protocol implemen-

- tation for nursing and medical staff. *BMC Nursing*. <https://doi.org/10.1186/s12912-015-0056-z>.
- Lesser, F. D., Lanham, D. A., & Davis, D. (2020). Blood sampled from existing peripheral IV cannulae yields results equivalent to venepuncture: A systematic review. *Journal of the Royal Society of Medicine Open*, 11(5), 1–7. <https://doi.org/10.1177/2054270419894817>.
- Lowe, G., Stike, R., Pollack, M., Bosley, J., O'Brien, P., Hake, A., et al. (2008). Nursing blood specimen collection techniques and hemolysis rates in an emergency department: analysis of venipuncture versus intravenous catheter collection techniques. *Journal of Emergency Nursing*, 34(1), 26–32. <https://doi.org/10.1016/j.jen.2007.02.006>.
- Mick, D. J. (2000). Folklore, personal preference, or research-based practice. *American Journal of Critical Care*, 9(1), 6–8. Retrieved from <http://ezproxy.ecu.edu.au/login?url=https://search-proquest-com.ezproxy.ecu.edu.au/docview/227896646?accountid=10675>.
- Mulloy, D. F., Lee, S. M., Gregas, M., Hoffman, K. E., & Ashley, S. W. (2018). Effect of peripheral IV based blood collection on catheter dwell time, blood collection, and patient response. *Applied Nursing Research*, 40, 76–79. <https://doi.org/10.1016/j.apnr.2017.10.12.1006>.
- New South Wales Government (2013). Guideline for PIVC insertion and post insertion care in adult patients http://www1.health.nsw.gov.au/pds/ActivePDSDocuments/GL2013_013.pdf accessed 14th June 2018.
- Ortells-Abuye, N., Busquets-Puigdevall, T., Díaz-Bergara, M., Paguina-Marcos, M., & Sánchez-Pérez, I. (2014). A cross-sectional study to compare two blood collection methods: direct venous puncture and peripheral venous catheter. *BMJ Open*, 4(2), Article e004250. <https://doi.org/10.1136/bmjopen-2013-004250>.
- Phelan, M. P., Reineks, E. Z., Schold, J. D., Hustey, F. M., Chamberlin, J., & Procop, G. W. (2018). Preanalytic factors associated with hemolysis in emergency department blood samples. *Arch Pathol Lab Med*, 142(2), 229–235. <https://doi.org/10.5858/arpa.2016-0400-OA>.
- Pilbeam, V., Badrick, T., & Ridoutt, L. (2013). *Best practice pathology collection for Department of Health*. Australia: Canberra.
- Seemann, S., & Reinhardt, A. (2000). Blood sample collection from a peripheral catheter system compared with phlebotomy. *Journal of Intravenous Nursing*, 23(5), 290–297.
- Stauss, M., Sherman, B., Pugh, L., Parone, D., Looby-Rodriguez, K., Bell, A., & Reed, C.-R. (2012). Hemolysis of Coagulation Specimens: A comparative Study of Intravenous Draw Methods. *Journal of Emergency Nursing*, 38(1), 15–21. <https://doi.org/10.1177/0146167218801363>.
- Sussman, R., & Giddord, R. (2019). Causality in the theory of planned behaviour. *Personality and Social Psychology Bulletin*, 45(6), 920–933. <https://doi.org/10.1177/0146167218801363>.
- Western Australia Department of Health. (2016). *Insertion and management of peripheral intravenous cannulae in Western Australian healthcare facilities policy* https://ww2.health.wa.gov.au/~/_/media/Files/Corporate/Policy%20Frameworks/Public%20Health/Policy/Insertion%20and%20Management%20of%20Peripheral%20Intravenous%20Cannulae/MP38-Insertion-and-Management-of-Peripheral-Intravenous-Cannulae.pdf accessed 14 June 2018.
- Wollowitz, A., Bijur, P. E., Esses, D., & Gallagher, J. (2013). Use of butterfly needles to draw blood is independently associated with marked reduction in hemolysis compared to intravenous catheter. *Academic Emergency Medicine*, 20(11), 1151–1155.
- Yagnik, L., Graves, A., & Thong, K. (2017). Plastic in patient study: prospective audit of adherence to peripheral intravenous cannula monitoring and documentation guidelines, with the aim of reducing future rates of intravenous cannula-related complications. *American Journal of Infection Control*, 45(1), 34–38. <https://doi.org/10.1016/j.ajic.2016.09.008>.
- Zengin, N., & Enç, N. (2008). Comparison of two blood sampling methods in anticoagulation therapy: venipuncture and peripheral venous catheter. *Journal of Clinical Nursing*, 17(3), 386–393. <https://doi.org/10.1111/j.1365-2702.2006.01858.x>.
- Zlotowski, S. J., Kupas, D. F., & Wood, G. C. (2001). Comparison of laboratory values obtained by means of routine venipuncture versus peripheral intravenous catheter after a normal saline solution bolus. *Annals of Emergency Medicine*, 38(5), 497–504. <https://doi.org/10.1067/mem.2001.118015>.