



Undergraduate nursing students' perceptions of the current content and pedagogical approaches used in PIVC education. A qualitative, descriptive study



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A B S T R A C T

Background: The peripheral intravenous catheter (PIVC) is the most frequently used invasive medical device. PIVCs fail for a variety of reasons and failure often results in serious adverse events leading to patient discomfort, delays in treatment, increased health care costs and even death. Undergraduate nurses assess and manage PIVCs as part of their clinical learning. To date, no study has explored undergraduate nurses' perceptions of the education they receive about PIVCs.

Aim: We sought to critically explore the current state of education regarding PIVCs from the perspectives of undergraduate nurses.

Methods: This qualitative study involved semi-structured interviews with third-year undergraduate nurses. Data were collected across two sites in Queensland, Australia. Fourteen face-to-face interviews were conducted and a modified 5-step qualitative content analysis was used to analyze the data.

Findings: We identified three key domains relating to participants' experiences of PIVC education: 1) Universities provide foundational knowledge about PIVC assessment, management and removal; 2) Clinical practice consolidates and drives undergraduate nurses' knowledge, skills and confidence about PIVCs; and 3) inconsistencies in clinical practice and between individual clinicians impedes learning and knowledge translation about PIVCs.

Conclusion: Nursing students benefit from theoretical content delivered in the university setting. Practical application of theory and skill development whilst on clinical placement is variable. The current undergraduate curriculum, related to management of patients with a PIVC, is disjointed and inconsistent and this inconsistency may negatively impact patient safety.

1. Background

The peripheral intravenous catheter (PIVC) is the most frequently used invasive medical device in the care of hospitalised patients (Alexandrou et al., 2015; Guembe et al., 2017). Up to 80% of patients have a PIVC during hospital admission (Alexandrou et al., 2018; Parker et al., 2017). The PIVC is the simplest, most effective way to gain vascular access a variety of clinical reasons support the use of PIVCs, including: medication administration, intravenous fluid administration, blood product administration and injection of contrast media (Alexandrou et al., 2018; Alexandrou et al., 2015; Wallis et al., 2014). Despite frequent use, PIVCs are associated with significant adverse events during insertion and treatment administration (Alexandrou

et al., 2015; Marsh et al., 2015), and have a high rate of failure including many associated with operator error (Wallis et al., 2014). Failure of PIVCs results in patient discomfort, adverse events, and increased health care costs (Rippey et al., 2016; Wong et al., 2018). One study identified that the cost of PIVC failure at one large metropolitan hospital in Australia was AU \$5.5 (US \$4.1) million annually (Marsh et al., 2018). Thus, the importance of optimal PIVC maintenance and care as a global health and safety issue cannot be underestimated.

PIVC insertion may be undertaken by doctors, nurses, paramedics or technicians (Alexandrou et al., 2018). However, nurses are primarily responsible for assessment, management and removal of PIVCs (Adair et al., 2014; Brown et al., 2015). Evidence-based guidelines and standards of practice for PIVC insertion and maintenance have been

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developed and published with the aim of improving patient safety (Gorski, 2017; Nicholson, 2018). Several researchers argue that nurses lack knowledge and understanding about these guidelines, preventing evidence-based practice and negatively impacting patient safety (Cicolini et al., 2014; Simonetti et al., 2019). A recent audit of clinical undergraduate education (Brown et al., 2015) identified that knowledge of intravenous medications was considered essential for safe practice, yet the audit did not identify PIVC assessment and care as a key nursing skill. Considering PIVC assessment and care is an important nursing responsibility, this oversight is both surprising and concerning. Inadequate assessment and inappropriate management of PIVCs can result in serious life-threatening complications (Capdevila-Reniu and Capdevila, 2017; Capdevila et al., 2016).

Inadequate undergraduate education of nurses has been identified as a barrier to evidence-based practice (Cruz et al., 2016; Mlinar and Rašković-Malnaršić, 2012; Mohammad Al Qadire et al., 2017). For example, a study investigating undergraduate nurses' knowledge found that students lacked sufficient knowledge about central venous catheter care (Mlinar and Rašković-Malnaršić, 2012). Whilst it is encouraging to see researchers explore undergraduate nurses' knowledge about central venous catheters, much less is known about student nurses' knowledge of how to care for the much more commonly used PIVC. This is disturbing, considering the majority of undergraduate nurses assess, access, maintain and remove PIVCs as part of their clinical learning experiences. The newly released Registered Nurse Accreditation Standards clearly articulate that programs delivered in Australia must prepare graduates for safe and ethical practice standards. (ANMAC, 2019).

Researchers have identified a theory practice gap exists in nursing education in relation to patient safety (Tyndall et al., 2018, Murray et al., 2018). Despite the importance of embracing a patient safety culture, 10–25% of hospitalised patients experience an adverse outcome (ACSQHC, 2017). Usher et al. (2017) undertook a survey to explore how patient safety content in Australian undergraduate nursing curricula was undertaken; they identified medication safety and preventing and controlling healthcare-associated infections were the most important components of patient safety, both of which are closely aligned and linked to management of PIVCs. The continued high prevalence of PIVC failure confirms a gap between evidence and practice, which may contribute to poor patient outcomes, adverse patient events, and ultimately patient safety. Despite the widely recognized importance of nursing student education to improve delivery of care to patients and promote patient safety and outcomes (Levett-Jones et al., 2020), there are no studies available assessing level of training, knowledge, and skills of nursing school graduates on PIVCs, nor is there literature exploring what is taught in undergraduate nursing programs about PIVCs. A clear understanding of the depth, breadth and efficacy of nursing education around PIVC is an essential element of ensuring the preparedness of graduates for safe and ethical practice (ANMAC, 2019). We believe that educational institutions have the opportunity, and responsibility, to refocus curricula to pay greater attention to specific elements of patient safety in the nursing curriculum. Yet, without a clear understanding of the evidence-practice gap, it remains difficult to define minimum standards, develop responsive, flexible curricula and evaluate student learning around PIVC management. In this exploratory, descriptive study, we aimed to understand the evidence-practice gap and identify strategies for improvement in education, planning and provision.

PIVC management is an essential element of safe and ethical practice, and a clear understanding of the depth, breadth and content of nursing education around PIVC care and management may advance future teaching and learning programs and thus nursing students' comprehensive preparation for graduate clinical roles.

In this study, we sought to answer the following research questions:

1. What are undergraduate nursing students' perceptions of the current

content and pedagogical approaches used in PIVC education?

2. What are the aspects of PIVC-related clinical practice for which undergraduate nursing students perceive they are well or poorly prepared?

2. Methods

A qualitative, descriptive approach was used (Sandelowski, 2000). The study is reported according to the Consolidated Criteria for Reporting Qualitative health research (COREQ) guidelines (Tong et al., 2007). Ethical approval was granted by University of the Sunshine Coast Human Research Ethics Committee (S181244) and Griffith University Research Ethics (2019/921).

2.1. Participant recruitment and selection

Participants were selected from one regional university and one metropolitan university in Southern Queensland, Australia. A purposeful sampling strategy was used to recruit potential participants (Coyne, 1997; Patton, 1990; Vasileiou et al., 2018), to identify participants “who can best help us understand the phenomenon” (Patton, 1990). Members of the research team (DM, MC, AC and GRB) contacted relevant course leaders at selected sites by email and invited them to upload the participant information sheet on the course online site. Undergraduate nurses who met the inclusion criteria (third-year undergraduate nursing student) contacted the Principal Investigator if they were interested in being interviewed. Participants were provided with a verbal explanation of the project and a participant information sheet (as per ethical requirements). Written consent was obtained prior to the interview. Recruitment and data collection continued until data saturation was achieved. Fusch and Ness (2015) describe data saturation as being achieved when no new categories emerge from the data.

2.2. Data collection

Fourteen face-to-face or online video conference, semi-structured individual interviews were conducted in a quiet private room and were arranged at a date and time convenient for the participant. There was no prior relationship between the interviewers (MC, GRB, DM & AC) and participants. A semi-structured interview guide was used to elicit information about participants' experiences of PIVC education, and to promote flexibility and responsiveness to the experiences and the roles of participants (Craswell et al., 2020). We used an interview framework to guide the interviews, and this was informed by evidence-based PIVC care guidelines (Loveday et al., 2014; O'Grady et al., 2011). The interviews were completed between June and August 2019, digitally recorded and transcribed verbatim. Field notes were not collected. Participants were not offered the opportunity to review the transcript of their interview and none requested this. Transcripts were managed using the NVIVO 11 software (QSR International, Melbourne, VIC).

2.3. Data analysis

All interview transcripts were analyzed independently by two members of the research team (DM and AC) using qualitative, thematic analysis (Braun and Clarke, 2006), and findings were then compared. Any discrepancies were resolved by discussion and consensus with the research team. Data were interrogated for recurring concepts; these concepts were then interpreted. Finally, themes were developed in a constitutive pattern (Braun and Clarke, 2006; Patton, 1990).

2.4. Rigour

To ensure dependability, transferability, confirmability and credibility, clear analysis guidelines were used (Boyatzis, 1998; Guba and Lincoln, 1994). Prolonged engagement with the data through repeated

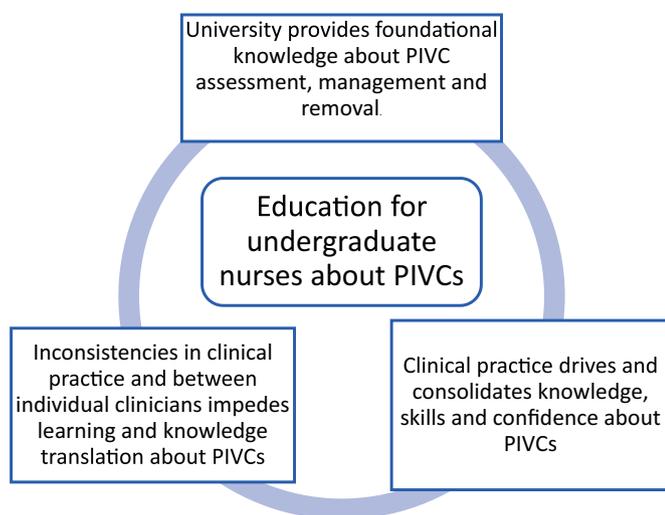


Fig. 1. Domains relating to participants' experiences of PIVC education and practice.

review and discussion of the interview transcripts by the research team enabled a deeper understanding of the data and helped ensure the credibility of the study. Independent review of the transcripts by two (AC & DM) researchers with different clinical and research lenses enhanced the veracity of the theme identification. Data from participants were collected to enable reviewers/readers to evaluate applications to other settings (transferability), and the findings. A clear and transparent audit trail facilitated the dependability of the study.

3. Findings

We identified three key domains relating to participants' experiences of PIVC education and practice: 1) Universities provide foundational knowledge about PIVC assessment, management and removal; 2) clinical practice consolidates and drives undergraduate nurses' knowledge, skills and confidence about PIVCs; and 3) inconsistencies in clinical practice and between individual clinicians impedes learning and knowledge translation about PIVCs (Fig. 1).

3.1. Domain one: university provides foundational knowledge about PIVC assessment, management and removal

Participants identified that the information they received about assessing, managing and removing PIVCs at university was often limited and lacking detail. This is clearly illustrated in narratives below, in which a participant outlines the lack of depth about PIVC education provided at university:

Honestly, no. I can list the things that's meant to be considered, but then we didn't really delve into it. They just said, "This is what a normal one should look like. Anything outside of that is not normal." And then it's kind of like, what do we do then if it's abnormal? Do we just go to the doctor, get a reg to put a new one in?

(P3)

Another participant illustrates in their narrative how PIVC education provided by the university was brief and disjointed:

I think we did get taught things at Uni but because it was so brief and it was just in a one-off type lab, it was very easy to just forget. And then going back on placements I feel like the buddy nurses reiterated everything.

(P10)

Lack of time, large student numbers and the complexities of caring for a PIVC were also identified by participants as important factors for

the provision of foundational knowledge rather than more comprehensive, in-depth teaching about assessing and managing PIVCs.

There's probably not enough time in the labs to ensure confidence and competence across the board. I know we're only looking at this (PIVCS) but there's a lot of things that you have to do, and there's one tutor and there's a lot of students.

(P6)

The majority of participants had difficulty in recalling what they had been taught about PIVCs, when they had been taught about PIVCs, and if education occurred in lectures, tutorials, clinical simulation or clinical practice, or in which year during their degree PIVC education occurred. However, participants also identified that, although basic, the education they received about PIVCs was logical and relevant.

They did do it. I just don't have any memory of it. They definitely stepped us through how to care for a PIVC, properly, what to look for, and the steps to take when assessing it. But it has slipped my memory.

(P4)

3.2. Domain two: clinical practice drives and consolidates knowledge, skills and confidence about PIVCs

Participants clearly identified that the clinical environment was where they were able to consolidate their theoretical knowledge and apply this knowledge in practice. The narratives clearly outlined that the practice setting was where authentic learning occurred. This is clearly illustrated in the narrative below:

My buddy RN (RN responsible for supervising student during educational clinical placement) would come around with medications and then she'd watch us, and prompt us to do certain things. And if she (sic) looks like we're a bit unsure she'd step us through, just reminding us what we should be doing with the PIVCs. And always reminding us to wipe it down first before administering anything, and flushing because of those important components.

(P5)

Without exposure to the clinical setting, participants identified that learning and knowledge and skills related to PIVCs would remain superficial and the application of theory to practice would be difficult. Participants also identified that their RN buddy was important in assisting them to translate theory to practice:

On clinical, we always have the nursing buddies with us, and looking at administering medications or assessing the PIVCs, the nurse buddy would usually step us through on how we should manage the PIVCs. So, basically teaching us. We're watching them and they're showing us what we should be doing with them.

(P7)

3.3. Domain three: inconsistencies in clinical practice and between individual clinicians impedes learning and knowledge translation about PIVCs

Although the university provided foundational knowledge, participants recalled clearly that what they were taught at university was inconsistent. They also reported witnessing inconsistency in practice between clinicians that at times was not evidence-based. This inconsistency caused confusion and impacted their ability to translate best practice:

For example, we did our OSCE (Objective Structured Clinical Exam) assessment, we had to flush pre and post to make sure the PIVC is patent. But there's always a bit of confusion with that because you get told different things by different people. Some people say you can flush with a 5 ml, some people say you have to flush with a 10 ml. It's confusing. I was

taught by someone you have to do 10 ml pre and post but then in the next week's lab/tutorial I was taught, it only has to be 5 ml pre and post. So, I know me [sic] and some other students would be confused.

(P1)

They did say that because it's a cannula, or PIVC it's very small. A 5 ml flush is enough. I go 'okay, that's valid justification'. But then we get told by someone else to do 10 ml. It's like well, someone said to me the other week to do 5 ml. They're like, "No. You have to do 10ml as per the protocol," or whatever. We got a bit confused. Someone also said to me when you're flushing, doing the stop/starting. Yeah, and I've never read that.

(P8)

4. Discussion

In this study we aimed to describe undergraduate nurses' perceptions about the current content and pedagogical approaches used in PIVC education and aspects of PIVC related clinical practice that undergraduate nursing students perceive they are well prepared for. We identified three domains: 1) Universities provide foundational knowledge about PIVC assessment, management and removal; 2) clinical practice consolidates and drives undergraduate nurses' knowledge, skills and confidence about PIVCs; and 3) inconsistencies in clinical practice and between individual clinicians impedes learning and knowledge translation about PIVCs. There is increasing awareness of the role of undergraduate nursing education in promoting the patient safety agenda and producing graduates who are safe practitioners (ANMAC, 2019). Considering the complications associated with PIVCs (Alexandrou et al., 2018; Marsh et al., 2018; Miliani et al., 2017; Trinh et al., 2011), it is vital that education about the assessment of complications and maintenance is evidence-based and underpinned by best practice guidelines (Gorski, 2017; Nicholson, 2018). Interestingly, there is a wealth of research exploring education strategies about PIVC insertions (Glover et al., 2017; Higgins et al., 2015; Keleekai et al., 2016), but there is a significant gap in knowledge and understanding about the role education plays in the assessment and management of PIVCs. This is the first descriptive qualitative study to explore undergraduate nurses' perceptions of their education about PIVCs and thus makes a significant contribution to this clinical important area.

Undergraduate student nurses in this study perceived the education they received at university about PIVC was superficial, and they felt unprepared to assess and manage a PIVC in clinical practice, instead relying on their clinical teacher, RN buddy or preceptor to support their learning. Our study identified that there is potential for improvement and innovation in relation to how nurses are educated about assessment and management of PIVCs. There is a pressing need to explore and create links between foundational and applied knowledge and thus translate evidence into practice and embed patient safety into clinical practice. Some knowledge can be learned in the classroom and the application of this knowledge to clinical practice is important. Knowledge translation strategies that enable consolidation of complex theoretical constructs into the clinical arena need to be implemented.

PIVCs are the most commonly used invasive device (Alexandrou et al., 2015) and are responsible for a significant number of adverse events and patient discomfort (Cooke et al., 2018; Miliani et al., 2017). A recent study by Levett-Jones et al. (2020) identified that nurses have a key role in enhancing the quality and safety of care through recognition, management and reporting of issues that have, or could have, a negative impact on patient outcomes. Student nurses are responsible for assessing, managing and removing PIVCs as part of their work-integrated learning experiences under supervision. Thus, knowledge and skills related to PIVCs are an important element of ensuring patient safety, and we argue should be a significant element of the undergraduate nursing curriculum. Key professional bodies, both in Australia and internationally, need to clearly identify the minimum

standards required by undergraduate nurses to safely care for PIVCs, and these standards should be transparent in every nursing curriculum.

One solution to the identified gap in knowledge about curriculum content could be the incorporation of a structured and comprehensive approach to PIVC assessment and decision-making that enables student nurses to promote early detection of complications and prompt removal of intravenous catheters when no longer needed (Ray-Barruel et al., 2018). One such tool is I-DECIDED[®], which could be easily incorporated into undergraduate curricula (Ray-Barruel et al., 2020; Ray-Barruel et al., 2018). I-DECIDED[®] is a valid and reliable evidence-based IV assessment and decision tool that prompts patient education and participation and aims to reduce the number of redundant PIVCs and promote timely assessment, documentation and identification of complications (Ray-Barruel et al., 2020; Ray-Barruel et al., 2018).

The second domain we identified was that clinical practice consolidates learning and promotes knowledge translation. Access to a supportive and facilitative clinical teacher, mentor or preceptor is important in developing nursing students' clinical knowledge and skills (Papastavrou et al., 2016; Papp et al., 2003; Pitkänen et al., 2018; Raso et al., 2019). Participants in this study identified that whilst the education they received at university was often basic and foundational, they were able to consolidate and develop their knowledge during their clinical placement. This is reassuring and illustrates the value of providing theoretical knowledge that can then be applied in the clinical setting, and importantly demonstrates the alignment of theory to practice (Hussein and Osuji, 2017). Collaborative and collegial relationships between education providers and clinical partners are imperative in promoting quality clinical supervision for nursing students and to facilitate knowledge translation (Björk et al., 2013).

Inconsistencies in clinical practice and between individual clinicians were the third finding that emerged from analysis of the interview data. Participants in this study spoke about how they observed different practices between individual clinicians and what they had been taught at university. Best practice guidelines have been developed (Gorski, 2017; Loveday et al., 2014; Nicholson, 2018; Simonetti et al., 2019) to promote safe practice in relation to PIVC assessment and management, yet in this study we identified nursing practice discrepancies. This finding has also been identified by previous studies (Keogh et al., 2016; Quinn et al., 2020; Ray-Barruel et al., 2018) and these inconsistencies negatively impact patient outcomes (Quinn et al., 2020). Ray-Barruel et al. (2018) argue that PIVC flushing practices remain inconsistent, with evidence of a diverse range of flushing practices and a lack of documentation in relation to PIVC assessment and management; participants in our study also confirm this finding. The reasons for continued inconsistencies in clinical practice and between clinicians are unclear, but may be related to a lack of knowledge and understanding about clinical guidelines (Mohammad Al Qadire et al., 2017; Ryu et al., 2012; Simonetti et al., 2019) or how the guidelines are interpreted or accessed in clinical practice (Quinn et al., 2020). Further research addressing guideline implementation and inconsistency in practice and education is warranted.

A limitation of the study was that participants were interviewed retrospectively about their experiences and perceptions in relation to their education about PIVCs, so it is possible that participants' recall may have been affected by this delay. The data analyzed were based on self-reported perceptions that may or may not reflect actual clinical practice. We also only interviewed third-year student nurses; perhaps if we had interviewed first- and second-year student nurses their perceptions of their education about PIVCs may have been very different. However, as third-year students are in the final stages of preparation for graduate practice, we felt it was important to focus on this cohort.

5. Conclusion

PIVCs may be the most commonly used invasive medical device involved in the care of hospitalised patients, but they also contribute to

adverse events and negatively impact patient outcomes. Educating nursing students about the assessment and management of PIVCs is complex and poorly understood. We identified that undergraduate nursing student's benefit from theoretical content delivered in the university setting. This content then needs to be applied in the clinical setting. In this study, we also identified that current undergraduate curriculum related to management of patients with a PIVC is disjointed and inconsistent. This inconsistency negatively impacts patient safety. Reasons for these inconsistencies have not been explored and are poorly understood. It is important to understand what is currently being taught to undergraduate nurses about PIVCs because this enables the development and evaluation of educational programs aimed at improving student nurses' knowledge of PIVCs. This supports the overarching aim of improving patient safety and health services outcomes.

CRediT authorship contribution statement

Debbie Massey, Conceptualization, methodology, data collection and analysis, original manuscript preparation, writing reviewing and editing, **Alison Craswell**, Conceptualization, methodology, data collection and analysis, writing reviewing and editing, **Gillian Ray-Barruel**, Conceptualization, methodology, data collection, writing reviewing and editing, **Amanda Ullman**, Conceptualization, methodology, analysis, writing reviewing and editing, **Nicole Marsh**, Conceptualization, methodology, writing reviewing and editing, **Marianne Wallis**, Conceptualization, methodology, data analysis, writing reviewing and editing, **Marie Cooke**, Conceptualization, methodology, data collection and analysis, manuscript preparation, writing reviewing and editing.

Declaration of competing interest

Amanda Ullman

Amanda Ullman reports investigator-initiated research grants and speaker fees provided to Griffith University from vascular access product manufacturers (3M Medical, Angiodynamics, and Becton Dickinson), unrelated to the current project.

Nicole Marsh

Marsh previous employer Griffith University has received on her behalf investigator-initiated research grants and unrestricted educational grants from Becton Dickinson, and Cardinal Health and a consultancy payment provided to Griffith University from Becton Dickinson for clinical feedback related to vascular access device placement and maintenance (unrelated to the current project).

Marie Cooke

Marie Cooke reports investigator-initiated research grants and speaker fees provided to Griffith University from vascular access product manufacturer, Becton Dickinson, unrelated to the current project.

Gillian Ray-Barruel

Ray-Barruel, has received research grant funding from Griffith University and the Australian College of Infection Prevention and Control. Griffith University has received on Dr. Ray-Barruel behalf: unrestricted research grants from 3M, BBraun, and Becton Dickinson; and consultancy payments from Ausmed, 3M, Becton Dickinson, ResQDevices, Medline, and Wolters Kluwer (all unrelated to the current project).

Debbie Massey

None to declare.

Marianne Wallis

None to declare.

Alison Craswell

None to declare.

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