Received: 2 November 2018 | Revised: 3 June 2019 | Accepted: 16 June 2019

DOI: 10.1111/jocn.14979

ORIGINAL ARTICLE

Journal of Clinical Nursing WILEY

Nurses' decision-making about intravenous administration set replacement: A qualitative study

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Funding information
The sponsor is Griffith University who is the employer (in part or full) of all the investigators. This work is supported by competitive grants from the Australian National Health and Medical Research Council (APP1008428), The Royal Brisbane and Women's Hospital Foundation, the Cancer Nurses' Society of Australia and the Australian College of Critical Care Nurses (Queensland).

Abstract

Aims and objectives: To explore nurses' decision-making regarding intravenous administration set replacement for vascular access device infusions in paediatric and adult clinical settings.

Background: Intravenous administration sets are routinely replaced at regular intervals in clinical practice with the goal of preventing catheter-related bloodstream infection; however, emerging evidence is challenging traditional hang-time durations. Nurses' perceptions and contextual factors affecting decision-making for administration set replacement have not been assessed previously.

Design: Qualitative study using focus groups with contextualism methodology and inductive analysis.

Method: During November–December 2016, eight semi-structured focus groups were conducted with 38 nurses at two metropolitan hospitals in Queensland, Australia. Interviews were audio-recorded and transcribed. Two authors independently reviewed transcripts and extracted significant statements using Braun and Clarke's 7-step method of thematic analysis. The COREQ checklist provided a framework to report the study methods, context, findings, analysis and interpretation.

Results: Five key themes emerged from the analysis: (a) infection prevention, (b) physical safety, (c) patient preference, (d) clinical knowledge and beliefs, and (e) workload. Administration set replacement can be a complex task, particularly when patients have multiple infusions and incompatible medications. Nurses drew on perceptions of patient preference, as well as previous experience, knowledge of peer experts and local policies, to aid their decisions.

Conclusions: Nurses use clinical reasoning to balance patient safety and preferences with competing workplace demands when undertaking administration set replacement. Nurses rely on previous experience, hospital and medication manufacturer policies, and peer experts to guide their practice.

Relevance to clinical practice: Nurses at times deviate from clinical guidelines in the interests of patient acuity, nurses' experience and workload. The findings of this study indicate nurses also balance considerations of patient preference and safety with these competing demands.

KEYWORDS
administration sets, catheterisation, intravenous, decision-making, focus group interviews, infusions, intravenous, qualitative research

1 | INTRODUCTION

Administration sets are used to deliver intravenous (IV) fluids and medicines, or monitor haemodynamic function, via a vascular access device (VAD) such as central venous catheter or peripheral intravenous cannula (Phillips & Gorski, 2014). In clinical practice, IV sets are routinely replaced at regular intervals with the goal of avoiding microbial colonisation and formation of biofilm along the tubing, and subsequent risk of catheter-associated bloodstream infection (CABSI). Since CABSI increases the risk of morbidity and mortality, leading to longer length of hospital stay and higher healthcare costs, with associated penalties in some health systems, it is considered a high priority for patients and healthcare systems alike (Russo, Cheng, Mitchell, & Hall, 2017).

What does this paper contribute to the wider global clinical community?

- Intravenous administration set replacement often requires complex decision-making, particularly for high-acuity patients and those with multiple infusions.
- Nurses balance patient preferences with competing patient safety and workload demands when performing administration set replacement.
- Nurses rely on previous experience, hospital and medication manufacturer policies, and peer experts to guide their practice when replacing administration sets.

2 | BACKGROUND

Administration sets include the fluid/medication container and infusion tubing with or without additional attachments such as burettes, pressure monitoring transducers, needleless connectors and/or extension sets connecting the fluid container to the patient's VAD (Phillips & Gorski, 2014). Clinical practice guidelines provide conflicting recommendations regarding the frequency of administration set replacement. For instance, the Royal College of Nursing Standards of Infusion Therapy (2016) advocate administration set replacement *every* 96 hr for continuous infusions, unless indicated otherwise by the manufacturer, or they become disconnected, or integrity is compromised. However, the Centers for Disease Control and Prevention (CDC; O'Grady et al., 2011) and Infusion Nurses Society Standards of Practice (2016) state that sets used to administer solutions other than lipids, blood or blood products should be changed *no more frequently than every* 96 hr, with the CDC adding that sets should be changed at least every 7 days. Other guidelines from the Society for Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA) recommend replacing IV sets not used for blood, blood products or lipids at intervals *not longer than* 96 hr, but they note the recommended frequency of set replacement is an unresolved issue (Marschall et al., 2014). The guideline in place at the hospitals in this study recommends a replacement interval of *up to* 96 hr for solutions not containing lipids, blood or blood products (Queensland Health, 2015). The variability in recommendations has implications for hospital policy developers and may create confusion and uncertainty for nurses. The most recent Cochrane review (Ullman et al., 2013) found no evidence of a difference in catheter-related or infusate-related bacteraemia or fungaemia between different frequencies of administration set replacement (24, 48, 72 or >96 hr).

While the primary purpose of IV set replacement is infection prevention, other situations during a patient's treatment may also necessitate set manipulations. Interruptions to the circuit occur during IV bag changes or when new tubing is connected for intermittent medications, blood products and total parenteral nutrition (Infusion Nurses Society, 2016). During inter- or intra-hospital patient transfers, IV sets may be disconnected to reduce the risk of adverse events, such as dislodgement or infiltration (Alamanou & Brokalaki, 2014). Maintaining aseptic technique during IV manipulations is paramount, and the manufacturer's recommendations must also be followed (Phillips & Gorski, 2014). Whenever contamination is suspected, the tubing should be changed (Infusion Nurses Society, 2016). Intensive care and acutely unwell patients can have multiple administration sets, with time-sensitive medication regimens (Kanji et al., 2013). Replacing IV sets can therefore be a challenging, expensive and time-consuming procedure, depending on the number of consumables and staff time required.

As IV set changes are predominantly a nursing responsibility, it is important to determine nurses' current practice before attempting to implement a policy or practice change. Although nurses' decisions regarding adherence to clinical guidelines and whether to leave or remove IV devices have been investigated and reported in the

literature (Cicolini et al., 2014; Jeffery & Pickler, 2014; Johansson, Pilhammar, Khalaf, & Willman, 2008; Johansson, Pilhammar, & Willman, 2009; Palese et al., 2011), nurses' decision-making regarding administration set replacement has not been previously assessed. Understanding the knowledge and practical considerations underpinning clinical decision-making is a vital component of laying the groundwork for knowledge translation (Yost et al., 2014).

Several clinical decision theories have been developed in the past two decades, and researchers can draw on these to understand how nurses juggle theoretical knowledge, personal and work experience, and the demands of their current situation when making clinical decisions. In addition to evidence-based guidelines and hospital policies, nurses base their clinical decisions on a combination of systematic reasoning and intuitive perception, depending on the experience level of the practitioner and the task complexity (Thompson, 1999). Decision-making never occurs in a vacuum, and the context of clinical practice, including ward environment, patient acuity, nurses' experience, workload and skill mix, must be considered (Gillespie, 2010; Gillespie & Peterson, 2009). Furthermore, clinical decision-making at each level may be affected by social, cultural, political, ideological, economic, historical, temporal and physical factors (Gillespie, 2010). "Knowing the patient," a process in which the nurse draws on her "understanding of the patient's experiences, behaviours, feelings and/or perceptions to select individualized interventions," has also been recognised as relevant to clinical judgement (Radwin, 1995, p. 18). Decision-making is achieved through careful consideration of evidence in the context of multiple factors (Blanco-Mavillard, Rodriguez-Calero, Castro-Sanchez, Bennasar-Veny, & De Pedro-Gomez, 2018). Therefore, we conducted these focus groups to explore nurses' decision-making relating to IV administration set replacement in paediatric and adult clinical practice settings. These findings will guide future knowledge translation activities.

3 | METHODS

As the overall aim was to investigate nurses' decision-making about IV administration set replacement, a qualitative study with focus groups was deemed a useful approach. The research methodology of contextualism enabled exploration of participants' experiences and inductive analysis of participants' perspectives and decisions regarding administration set changes in clinical practice (Braun & Clarke, 2013; Green & Thorogood, 2014; Krueger & Casey, 2014). The COnsolidated criteria for REporting Qualitative research (COREQ checklist: File S1) for interviews and focus groups provided a framework to report the study methods, context, findings, analysis and interpretation (Tong, Sainsbury, & Craig, 2007).

3.1 | Ethical considerations

Multi-site ethics approval was obtained from the human research ethics committee of the hospital (HREC/13/QRCH/185) and university (NRS/27/10/HREC).

3.2 | Study design

This study used a qualitative design with focus groups, using semi-structured questions to explore nurses' decision-making processes inherent in IV administration set replacement.

3.3 | Research team and reflexivity

Reflexivity is the hermeneutic process of turning the gaze back onto oneself and paying attention to how one's own situation and pre-existing assumptions affect the interview process, the data collected and interpretations of the data (Berger, 2015). Focus groups were facilitated by three independent senior nurse researchers (GR, AU, EL), all with postgraduate or doctoral qualifications and previous experience in vascular access research and conducting focus groups. The researchers had no authority or reporting relationship with attendees, thus allowing for open honest discussion. The researchers introduced themselves as research nurses with prior clinical experience and an understanding of IV management to establish a non-judgemental and nonthreatening relationship with the participants. Prior to the focus groups, the researchers, based on their own experience as clinical nurses, assumed the participants would be familiar with their own hospital policy for IV set replacement. The researchers' background knowledge of IV management and evidence-based guidelines was integral to the understanding and analysis of participants' responses.

3.4 | Setting

Focus groups were conducted at two metropolitan Queensland hospitals in November and December 2016.

3.5 | Participant selection

Focus group participants were registered nurses working in adult (oncology, haematology, surgical) and paediatric (intensive care, oncology, vascular access and pain services) settings. The wards chosen were clinical areas with high usage of vascular access devices. One paediatric ward did not respond to requests to participate. The nurse unit manager of each area was approached, and dedicated times were organised for staff to attend focus groups. A convenience sample of nurses scheduled to work at the arranged time were invited to attend a single 30-min session during shift changeover in an education room away from the clinical area. Full written explanations of the research aim and objectives were provided, with opportunities for questions. Participation was completely voluntary, and informed written consent was obtained. Only the interviewers and participants were present during the interview. Nurse unit managers did not attend the focus groups, nor were the findings revealed to them, thus ensuring there was no top-down pressure or coercion. Focus group interviews were audio-recorded and transcribed; nonidentifiable participant demographics (gender and years of experience in nursing) were also collected. Field notes were not

TABLE 1 Characteristics of focus group participants (*N* = 38)

Variables	Adult hospital (*n* = 22)	Paediatric hospital (*n* = 16)
Gender		
Female	21 (95.5)	16 (100)
Male	1 (4.5)	0 (0)
Nursing experience (years)		
0–5	10 (45.5)	2 (12.5)
6–10	8 (36.4)	3 (18.7)
11–15	1 (4.5)	2 (12.5)
16–20	2 (9.1)	5 (31.3)
>21	1 (4.5)	4 (25)
Area of specialty		
Adult surgical	5 (22.7)	—
Adult haematology and oncology	17 (77.3)	—
Paediatric vascular access and pain services (combined group)	—	5 (31.3)
Paediatric oncology	—	6 (37.4)
Paediatric intensive care unit	—	5 (31.3)

made. At each focus group, participants were asked if they agreed or disagreed with the discussion and if they had other perspectives to contribute. Focus groups were concluded when participants in each group had had the opportunity to answer all questions and they stated they had nothing more to add. Data saturation was reached when no new information was generated (Braun & Clarke, 2013). As the participants were not contactable after the focus group interviews, member checking was not conducted. However, at the end of every focus interview, a collective consensus was sought to the summary of the discussion.

3.6 | Interview guide

Focus group questions were developed by two of the authors (EL, AU), based on previous qualitative research conducted by the team. Semi-structured, open-ended questions asked of the focus group participants were as follows:

1. Why do you think administration sets are changed?
2. When/how often do you change administration sets in your ward/unit?
3. Are there any situations where you would deviate from your normal practice when changing administration sets?

3.7 | Data analysis

De-identified audio recordings were transcribed by an outside transcription agency. One researcher (GR) listened to all recordings and checked transcripts for accuracy. Transcribed focus groups were analysed for themes using Braun and Clarke's (2013) 7-step method of thematic analysis: 1. Transcription; 2. Reading and familiarisation with the data; 3. Coding; 4. Searching for themes; 5. Reviewing themes; 6. Defining and naming themes; and 7. Finalising the analysis and writing the report. Two researchers (GR, CW) independently reviewed transcripts line-by-line and identified emerging themes, extracted, analysed and coded data relating to decisions about administration set changes. For each research question, data were organised via Excel spreadsheet into significant statements, themes and formulated meanings, then the researchers met to discuss findings and achieve consensus.

4 | RESULTS

Eight focus groups were conducted with a total of 38 participants (37 females, 1 male): 22 nurses (4 groups) from the adults' hospital and 16 nurses (4 groups) from the children's hospital. Nurses at the paediatric hospital had more years of nursing experience than adults' hospital nurses. Focus group settings included three adult wards (surgical gastrointestinal; medical and radiation oncology; haematology and bone marrow transplant), two paediatric wards (oncology; intensive care unit) and the paediatric vascular access and pain services. The characteristics of the focus group participants are shown in Table 1.

4.1 | Themes identified from the analysis

Five major themes emerged pertaining to nurses' decision-making when replacing administration sets: (a) infection prevention, (b) physical safety, (c) patient preference, (d) clinical knowledge and beliefs, and (e) workload.

4.1.1 | Infection prevention

In all groups, nurses believed that infection prevention was the key reason for IV set replacement; however, nurses' perceptions of infection risk to the patient cohort varied by ward. Some nurses advocated for regular set changes to reduce the perceived risk of infection from contaminated tubing:

> I think we're very strict with line changes and things. It's a real rarity that anything gets left for four days … But usually we're pretty strict with days for line changes and things like that … because a lot of our patients are immunosuppressed as well, we're more conscious of … infection control.
>
> (Adult Haematology)

Conversely, nurses in another ward perceived that interrupting the closed circuit during set changes increased infection risk, particularly in immunosuppressed patients, and therefore, they preferred not to break the circuit unless there was a convincing reason to do so:

> Any time you open the line you're risking infection. So, the less you do that, the better.
>
> (Paediatric Oncology)

Other participants expressed uncertainty regarding the infection prevention benefits of replacing or continuing the administration set:

> I mean, what's worse? Is it leaving a line for more days or constantly changing that's going to introduce infection?
>
> (Paediatric ICU)

Some nurses stated that bacteria could build up inside and outside the line, and therefore, they preferred changing the sets more regularly:

> They can drag their lines across the floor and they get food in them and when you hear that they've got E. coli and stuff in their lines, you're like, well I know I didn't give it to you.
>
> (Adult Haematology)

4.1.2 | Physical safety

Patients' physical safety was paramount for both adult and paediatric nurses, who reported that IV lines posed several patient safety concerns, including mobility hazards, IV device dislodgement and inadvertent medication dosage errors. The inherent patient safety risks of disconnecting or not disconnecting the IV set were discussed by all groups, with varying perspectives. From one point of view, disconnecting IV lines was seen as the safer option, particularly if patients were confused or agitated, noncompliant or likely to tamper with the IV pump while mobilising away from the ward:

> The confused ones, we might do intermittent lines.
>
> (Adult Oncology)

Several paediatric nurses stated it was safer to disconnect the IV set to allow small children to move about unimpeded by lines:

> You might be disconnecting them early for different reasons … Like if you get a child that moves around a lot … it's safer to have [IV sets] disconnected rather than continuously.
>
> (Paediatric Oncology)

Conversely, some nurses reported IV set interruptions could be a threat to patient safety and cited safety as a reason *not* to perform routine set replacement:

> The patient might be too unstable as well. So, if they've got lots of inotropes running … you can't take the risk of stopping the infusion or whatever that might be.
>
> (Paediatric Vascular Access)

4.1.3 | Patient preference

Nurses in all groups reported taking patient preference into consideration when deciding to continue or disconnect the IV administration set. However, nurses' perceptions of patient preferences were mixed, and it was evident that nurses' own perceptions of the benefits of disconnecting or continuing the set influenced the patients' outlook towards set replacement, which in turn affected the care received. This was particularly true in wards where patients were admitted for lengthy periods.

In one adult ward, nurses reported that the patients were notified when they were first connected to the lines that they would "get a break" after 3–4 days, and therefore, patients looked forward to periods of freedom when the IV set was disconnected, particularly for showers and during visiting times:

> It's usually the first thing they ask; if we're in for a line change today … because they like to shower without a machine. They like to have their four or five hours without any attachments.
>
> (Adult Haematology)

On another ward in the same hospital, where length of stay was usually shorter, patients were told that disconnecting the set increased their risk of infection, and consequently, patients were less likely to expect routine disconnection. Inconsistency with adherence to the administration set replacement policy between wards and sometimes between staff members in the same ward caused some concern, particularly when patients who had been in a ward that permitted intermittent disconnection then transferred into a ward where this practice was discouraged:

> "If the patient does just want to go for a shower but they've still got a full bag left, then I think most of us are pretty good at saying, 'No, you can't do that yet. You can have one tonight when you're due for a change, or you can't, you've got to shower with this on". Sometimes they'll say, "But the other ward I was on …"
>
> (Adult Oncology)

Some nurses expressed a personal opinion that paediatric patients preferred to be disconnected periodically from their IV lines:

> In kids, there's sometimes where you've got to disconnect because there's no point them being connected for 24 hours if they're just having three lots of antibiotics that's going to be infused over half an hour. You

might as well take them off to give them the freedom … to walk around and stuff.

(Paediatric Oncology)

Other nurses in the same ward perceived that less frequent IV set replacement would be preferable for children, parents and staff alike, and that patients preferred their lines to be left alone with less interference from staff:

I don't think some of the kids like line change. They go, do you have to? They like to just snuggle up in their beds and stay with their lines running.

(Paediatric Oncology)

4.1.4 | Clinical knowledge and beliefs

Nurses in all groups demonstrated clinical knowledge regarding the rationale for IV administration set replacement, such as medication precipitation in the line causing blockage or incompatible medications requiring dedicated lines. Several nurses correctly noted that some infusates such as glyceryl trinitrate or cyclosporine require a different type of low-sorb tubing, which would require new lines to be commenced:

Chemo drugs … and blood products and all the different variety of things that you're administering, so you have lines for each.

(Adult Haematology)

In the paediatric hospital, clinical resources such as dedicated vascular access clinical nurse specialists and information technology were reportedly available for guidance.

We've got actual VAD nurse specialists that sometimes we try and encourage the junior staff to use, or they can see the floor staff or clinical practice facilitators. Otherwise, we've got the information on [the clinical information system] about any kind of administration or line changes or how long fluid can be hanging, how stable it is and room temperature … That's just a matter of … showing them where to go source that information.

(Paediatric ICU)

Some nurses believed that line integrity decreases over time and replacement would overcome this concern:

The line can become compromised if it's, you know, frequently being used … Well, if you've taken it out of the machine and slide it back in sometimes … wear and tear.

(Adult Haematology)

4.1.5 | Workload

Administration set replacement could often be a complex procedure, depending on the number and type of infusions the patients were receiving. Workload priorities featured prominently, particularly for acutely ill patients on multiple infusions.

If you've got a … patient who has 12 lines, it can take up a big chunk of your time … Especially if they've got [medications] going that you'd need a two-nurse check … At night … that's not able to happen sometimes. So, we will just go, oh we'll just do it tomorrow. Even though it's outside of that 3-day policy … it's going to be easier to do it during daytime hours when there's more staff …

(Adult Haematology)

Nurses also reported disconnecting stable patients from their IV sets during inter-hospital transfers, due to the impracticality of leaving other patients without a nurse.

I sent someone to […] today. There's no nurses in […] So, if I was to send him over there, I have to stay the whole time he was over there, which was like nearly two hours. I can't do that … I can't be off the ward for two hours just because he's got IV fluids running. [So, I disconnected the line]

(Adult Haematology)

5 | DISCUSSION

Replacement of IV administration sets is a routine nursing procedure in hospital settings, but this seemingly discrete task requires critical thinking and consideration of numerous patient and staff factors. Findings from the focus groups demonstrate that set changes can at times be quite a complex activity—particularly in challenging patient populations, such as paediatrics or confused patients, or patients receiving multiple time-sensitive medications and fluids—and nurses rely on a deft combination of their own experience, input from peers, intuitive reasoning, personal opinion and perceptions of patient preferences when performing this task. The findings of this paper clearly show that nurses do what they believe is in the patient's best interest, within time and workload constraints, rather than always adhering to the clinical guidelines. Indeed, we found that nurses primarily relied on their own judgement. While this is not unsurprising, given the lack of agreement among infusion guidelines, it was concerning that the participants in this study did not mention or appear to question the evidence behind their practice in changing IV administration sets.

This is the first study to explore nurses' decisions regarding replacement of IV administration sets. As suggested by the Medical

Research Council Complex Interventions Framework (Craig et al., 2008), prior to implementing practice changes in the workplace, it is important to determine current clinical practice. Previous studies of nurses' decision-making around IV devices focused on adherence to clinical guidelines (Jeffery & Pickler, 2014; Johansson et al., 2009; Palese et al., 2011). In this study, the researchers undertook focus groups to explore nurses' decisions relating to set replacement in adult and paediatric settings to lay the groundwork for future knowledge translation for potential policy changes. As with previous research, this study identified patient acuity and nurses' workload and experience as factors contributing to IV management decisions. However, none of the previous studies of IV management cited patient preference as a consideration in the nurses' decision-making. Radwin's (1995) theory of decision-making (incorporating "knowing the patient") is particularly pertinent to the findings of this study in analysing how nurses' balance their clinical experience, "gut feelings" and patient preferences. Nurses' personal opinions of patient preferences ranked highly in their decisions to change or not change sets.

This study adds to the literature exploring nurses' decision-making processes in clinical practice. It is well recognised that nurses make clinical decisions based on a combination of systematic reasoning and intuitive perception, depending on the experience level of the practitioner and the task complexity (Thompson, 1999). Decision-making is influenced by the nurse's own knowledge and perceptions, shaped by the clinical setting and individual patient needs. Nurses' decision-making for IV management has many levels, and evidence-based guidelines are only one feature in the overall decision process (Cicolini et al., 2014; Jeffery & Pickler, 2014; Johansson et al., 2008, 2009; Palese et al., 2011). Nurses employ flexibility in clinical practice, taking into consideration the patient's needs as well as their own workload and experience. Clinical decision-making is a combination of analysis and discernment, "a balancing act between minimising patient discomfort and preventing complications" (Johansson et al., 2009, p. 3,366).

Analysis of the focus group responses enabled the researchers to cluster the reasons for line changes into five key themes (three patient-centred and two nurse-centred): (a) infection prevention, (b) patients' physical safety, (c) patient preference, (d) nurses' clinical knowledge and beliefs, and (e) workload. Not surprisingly, infection prevention was a critical consideration for every group. All nurses were aware of the importance of using standard precautions and aseptic technique during set replacement, in accordance with hospital policy, and discarding sets after disconnection, as per local and international best practice guidelines. Enquiry regarding frequency of set replacement for infection prevention elicited strong responses, with some nurses advocating regular set replacement to reduce infection risk by removing and replacing potentially contaminated lines, and other nurses advocating fewer line interruptions and longer hang-time in the belief that breaking the circuit increased the risk of infection. In all discussions, the nurses' disparate viewpoints were underpinned by the belief (rather than research evidence) that replacing the administration set or leaving it intact was in the patient's best interests. In clinical areas where nurses associated breaking the circuit with an increased risk of infection, nurses were more likely to tell the patient they would not be disconnected from the lines. In other clinical areas, a routine break from the IV set was seen as beneficial to the patient's mental well-being and physical safety, particularly for confused or paediatric patients and during off-ward patient transfers when there would not be adequate supervision.

Nurses' clinical knowledge and critical thinking were evident in all focus group discussions.

Nurses took a holistic approach to administration set replacement, considering clinical information (infection risk; patient condition; timing of IV medications and IV fluids), patient safety, patient preference and their own workload when making decisions regarding set replacement, in addition to the hospital guidelines and drug manufacturer recommendations. Nurses across clinical settings correctly identified that set changes are conducted for a range of reasons in addition to routine scheduled replacement, such as end-of-therapy, incompatible medication infusions, certain types of chemotherapy, blood transfusions and parenteral nutrition. All nurses reported being aware of the need for more frequent changes whenever blood products, parenteral nutrition or lipid solutions were infused, as per the local guidelines (Queensland Health, 2015). However, some nurses expressed beliefs that were not evidence-based, such as line integrity decreases over time.

Clinical guidelines and hospital policies promote evidence-based practice for the safe delivery of IV fluids and medicines; however, evidence is not available for every facet of clinical practice and many guidelines and policies are based on expert consensus, rather than high-level evidence (Ray-Barruel & Rickard, 2018). Adherence to guidelines can vary depending on clinicians' knowledge of and agreement with the guidelines once individual patient circumstances, resources and time required for the task are taken into consideration (Johansson et al., 2009). Furthermore, in the acute care environment, clinicians prefer to rely on other humans as an information source, rather than written materials, even when these are readily accessible, except in cases of complex procedure protocols or drug-related information (Thompson, Cullum, McCaughan, Sheldon, & Raynor, 2004; Thompson et al., 2001). Colleagues with experience are viewed as an accessible and trusted source of useful information (Thompson et al., 2004). We found that unit culture and context, rather than research evidence or years of nursing experience, strongly influenced nursing decisions to disconnect and replace administration sets. For instance, in some wards, patients were told they could expect regular line-free times, whereas in other wards, patients were told their lines should remain in situ. Such decisions were clearly based on unit culture, rather than evidence. Neither hospital had access to electronic clinical information systems at the bedside outside of the ICU, but nurses could access policies on desktop computers in the nurses' station. Nurses agreed that hospital and drug manufacturer guidelines available on the hospital intranet were useful in guiding decisions about administration set replacement.

A commonly reported concern by participants in this study was the amount of time it can take to perform administration set

replacement, particularly for high-acuity patients with multiple concurrent infusions. The amount of critical thinking that nurses perform in the preparation stage and during set replacement was evident. For instance, checking IV medications and infusion rates was usually done by two nurses, so the procedure needed to be delayed until two staff were available. The individual nurse's skill and experience in adeptly changing multiple administration sets and potentially incompatible medications and fluids was identified as a potential safety risk factor, and nurses stressed the importance of undertaking complex tubing changes when there was enough time and help available to perform the task safely, rather than rushing and trying to do things alone. Because of the reduced staffing levels on night shift, IV set replacement is generally not performed at night in these ward areas even if due. Our results indicate that less frequent set replacement would be welcomed by both patients and staff in acute critical settings. In longer-term settings, staff and patients would find reassurance with the freedom that comes with more regular breaks from VAD tubing. Robust research evidence to clarify both the risks and benefits of administration set replacement could assist in decision-making at the bedside.

When implementing clinical change, many factors need to be considered, including safety and quality, guidelines and policies, and clinical staff input, as all influence the outcome. Focus groups provide an opportunity to listen to the opinions of front-line stakeholders. As this is the first reported study investigating nurses' perceptions of administration set replacement, this paper provides a valuable contribution to understanding nurses' knowledge and adherence to hospital administration set policies, as well as identifying what happens in actual practice and possible reasons for deviation from guidelines. A limitation of focus groups is that individuals may feel pressured to conform to the group consensus and not feel empowered to speak up whether their opinion or clinical practice differs from the group (Litosseliti, 2003). However, all participants were reminded that their contributions would remain anonymous and we did not sense any reticence to contribute. Although the focus groups were all undertaken in one Australian city, we conducted focus groups sessions across a range of clinical adult and paediatric settings, and our findings were similar to previous studies of nurses' decision-making (Johansson et al., 2009; Palese et al., 2011; Thompson et al., 2004). Therefore, we believe the study findings are pertinent and informative to future efforts to implement knowledge translation activities regarding guidelines for administration set replacement. Regrettably, details of the participants' academic qualifications were not collected.

Conflicting recommendations among international, national and local guidelines and limited evidence for IV administration set replacement regimes creates uncertainty for nurses.

The findings from this study have revealed that nurses sometimes fail to question the evidence base behind the clinical guidelines and they often base their clinical decisions regarding IV set replacement on the nurses' own perceptions of patient preferences. Future research should expand upon this to identify actual patient preferences for IV care and management.

6 | CONCLUSIONS

Nurses' decision-making regarding IV administration sets entails balancing a combination of factors including infection prevention, patient safety and preferences, and nurses' knowledge and workload. Replacing IV sets can be a complex task, particularly when patients have multiple infusions and incompatible medications, and nurses rely on perceptions of patient preference, previous experience and knowledge to aid their decisions, in addition to clinical practice guidelines and hospital policies, to promote patients' well-being and optimal outcomes.

7 | RELEVANCE TO CLINICAL PRACTICE

Prior to implementing practice changes in the workplace, it is important to determine current clinical practice. It has been recognised that nurses at times deviate from clinical guidelines in the interests of patient acuity, nurses' experience and workload. The findings of this study indicate nurses also balance considerations of patient preference and safety with these competing demands.

ACKNOWLEDGEMENTS

The authors would like to thank the participants for their time and involvement in focus groups.

CONFLICT OF INTEREST

GRB has received research grant funding from Griffith University and the Australian College of Infection Prevention and Control. Griffith University has received on GRB's behalf: unrestricted research grants from 3M, BBraun and Becton Dickinson; and consultancy payments for educational lectures from 3M, Becton Dickinson, ResQDevices, Medline and Ausmed. CW: Nil conflict to declare. Griffith University has received on EL's behalf: a consultancy payment for an educational lecture from 3M; and an investigator-initiated research grant from Medtronic. Griffith University has received on NM's behalf: unrestricted research and educational grants from the following: 3M, Adhezion, Becton Dickinson, Centurion Medical Products, Cook Medical, Entrotech and Teleflex; and consultancy payments for educational lectures from Becton Dickinson. AU is supported by research grant funding from the National Health and Medical Research Council. Griffith University has received on AU's behalf unrestricted investigator-initiated research or educational grants from product manufacturers: 3M, Adhezion, AngioDynamics, BBraun, Becton Dickinson, Centurion Medical Products and FloMedical; and consultancy payments for educational lectures from 3M and Becton Dickinson. Griffith University has received on CMR's behalf unrestricted investigator-initiated research or educational grants from product manufacturers (3M, Adhezion, AngioDynamics; Bard, Baxter; BBraun, Becton

Dickinson, Centurion Medical Products, Cook Medical, Entrotech, ICU Medical, Medtronic, Smiths Medical); and consultancy payments from manufacturers (3M, Bard; BBraun, Becton Dickinson, ResQDevices, Smiths Medical). No commercial entity had any role in the design or undertaking of this study.

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REFERENCES

Alamanou, D. G., & Brokalaki, H. (2014). Intrahospital transport policies: The contribution of the nurse. *Health Science Journals*, *8*(2), 166–178.

Berger, R. (2015). Now I see it, now I don't: Researcher's position and reflexivity in qualitative research. *Qualitative Research*, *15*(2), 219–234. https://doi.org/10.1177/1468794112468475

Blanco-Mavillard, I., Rodriguez-Calero, M. A., Castro-Sanchez, E., Bennasar-Veny, M., & De Pedro-Gomez, J. (2018). Appraising the quality standard underpinning international clinical practice guidelines for the selection and care of vascular access devices: A systematic review of reviews. *British Medical Journal Open*, *8*(10), e021040. https://doi.org/10.1136/bmjopen-2017-021040

Braun, V., & Clarke, V. (2013). *Successful qualitative research: A practical guide for beginners*. London, UK: Sage.

Cicolini, G., Simonetti, V., Comparcini, D., Labeau, S., Blot, S., Pelusi, G., & Di Giovanni, P. (2014). Nurses' knowledge of evidence-based guidelines on the prevention of peripheral venous catheter-related infections: A multicentre survey. *Journal of Clinical Nursing*, *23*(17–18), 2578–2588. https://doi.org/10.1111/jocn.12474

Craig, P., Dieppe, P., Macintyre, S., Michie, S., Nazareth, I., Petticrew, M., & Medical Research Council Guidance (2008). Developing and evaluating complex interventions: The new Medical Research Council guidance. *BMJ*, *337*, a1655. https://doi.org/10.1136/bmj.a1655

Gillespie, M. (2010). Using the situated clinical decision-making framework to guide analysis of nurses' clinical decision-making. *Nurse Education in Practice*, *10*(6), 333–340. https://doi.org/10.1016/j.nepr.2010.02.003

Gillespie, M., & Peterson, B. L. (2009). Helping novice nurses make effective clinical decisions: The situated clinical decision-making framework. *Nursing Education Perspectives*, *30*(3), 164–170.

Green, J., & Thorogood, N. (2014). *Qualitative methods for health research* (3rd ed.). London, UK: Sage.

Infusion Nurses Society (2016). Infusion therapy standards of practice. *Journal of Infusion Nursing*, *39*(1S), Suppl.

Jeffery, A. D., & Pickler, R. H. (2014). Barriers to nurses' adherence to central venous catheter guidelines. *Journal of Nursing Administration*, *44*(7/8), 429–435. https://doi.org/10.1097/NNA.0000000000000094

Johansson, M., Pilhammar, E., Khalaf, A., & Willman, A. (2008). Registered nurses' adherence to clinical guidelines regarding peripheral venous catheters: A structured observational study. *Worldviews on Evidence-Based Nursing*, *5*, 148–159. https://doi.org/10.1111/j.1741-6787.2008.00105.x

Johansson, M., Pilhammar, E., & Willman, A. (2009). Nurses' clinical reasoning concerning management of peripheral venous cannulae. *Journal of Clinical Nursing*, *18*(23), 3366–3375. https://doi.org/10.1111/j.1365-2702.2009.02973.x

Kanji, S., Lam, J., Goddard, R. D., Johanson, C., Singh, A., Petrin, L., … Turgeon, A. F. (2013). Inappropriate medication administration practices in Canadian adult ICUs: A multicenter, cross-sectional observational study. *Annals of Pharmacotherapy*, *47*(5), 637–643. https://doi.org/10.1345/aph.1R414

Krueger, R. A., & Casey, M. A. (2014). *Focus groups: A practical guide for applied research* (4th ed.). Thousand Oaks, CA: Sage.

Litosseliti, L. (2003). *Using focus groups in research*. London, UK: Continuum.

Marschall, J., Mermel, L. A., Fakih, M., Hadaway, L., Kallen, A., O'Grady, N. P., … Yokoe, D. S. (2014). Strategies to prevent central line-associated bloodstream infections in acute care hospitals: 2014 update. *Infection Control and Hospital Epidemiology*, *35*(7), 753–771. https://doi.org/10.1086/676533

O'Grady, N. P., Alexander, M., Burns, L. A., Dellinger, E. P., Garland, J., Heard, S. O., … Saint, S. (2011). Guidelines for the prevention of intravascular catheter-related infections. *American Journal of Infection Control*, *39*(4 Suppl 1), S1–S34. https://doi.org/10.1016/j.ajic.2011.01.003

Palese, A., Cassone, A., Kulla, A., Dorigo, S., Magee, J., Artico, M., … Sclauzero, P. (2011). Factors influencing nurses' decision-making process on leaving in the peripheral intravascular catheter after 96 hours: A longitudinal study. *Journal of Infusion Nursing*, *34*(5), 319–326. https://doi.org/10.1097/NAN.0b013e3182290a20

Phillips, L., & Gorski, L. (2014). *Manual of IV therapeutics: Evidence-based practice for infusion therapy* (6th ed.). Philadelphia, PA: FA Davis.

Queensland Health (2015). *Peripheral intravenous catheter: Maintenance – Point of care tool*. Retrieved from https://www.health.qld.gov.au/__data/assets/pdf_file/0030/444756/icare-pivc-pointofcare-maintain.pdf

Radwin, L. E. (1995). Conceptualizations of decision making in nursing: analytic models and "knowing the patient". *International Journal of Nursing Terminologies and Classifications*, *6*(1), 16–22. https://doi.org/10.1111/j.1744-618X.1995.tb00274.x

Ray-Barruel, G., & Rickard, C. M. (2018). Helping nurses help PIVCs: Decision aids for daily assessment and maintenance. *British Journal of Nursing*, *27*(8), S12–S18. https://doi.org/10.12968/bjon.2018.27.8.S12

Royal College of Nursing (2016). *Standards for infusion therapy*. London, UK: Royal College of Nursing.

Russo, P. L., Cheng, A. C., Mitchell, B. G., & Hall, L. (2017). Healthcare-associated infections in Australia: Tackling the 'known unknowns'. *Australian Health Review*, *42*(2), 178. https://doi.org/10.1071/AH16223

Thompson, C. (1999). A conceptual treadmill: The need for 'middle ground' in clinical decision making theory in nursing. *Journal of Advanced Nursing*, *30*(5), 1222–1229.

Thompson, C., Cullum, N., McCaughan, D., Sheldon, T., & Raynor, P. (2004). Nurses, information use, and clinical decision making—the real world potential for evidence-based decisions in nursing. *Evidence-Based Nursing*, *7*(3), 68–72. https://doi.org/10.1136/ebn.7.3.68

Thompson, C., McCaughan, D., Cullum, N., Sheldon, T. A., Mulhall, A., & Thompson, D. R. (2001). Research information in nurses' clinical decision-making: What is useful? *Journal of Advanced Nursing*, *36*(3), 376–388. https://doi.org/10.1046/j.1365-2648.2001.01985.x

Tong, A., Sainsbury, P., & Craig, J. (2007). Consolidated criteria for reporting qualitative research (COREQ): A 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*, *19*(6), 349–357. https://doi.org/10.1093/intqhc/mzm042

Ullman, A. J., Cooke, M. L., Gillies, D., Marsh, N., Daud, A., McGrail, M. R., … Rickard, C. M. (2013). Optimal timing for intravascular administration set replacement. *Cochrane Database Systematic Review*, *9*, Cd003588. https://doi.org/10.1002/14651858.CD003588.pub3

Yost, J., Dobbins, M., Traynor, R., DeCorby, K., Workentine, S., & Greco, L. (2014). Tools to support evidenceinformed public health decision making. *BMC Public Health*, *14*, 728. https://doi.org/10.1186/1471-2458-14-728

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

How to cite this article: Ray-Barruel G, Woods C, Larsen EN, Marsh N, Ullman AJ, Rickard CM. Nurses' decision-making about intravenous administration set replacement: A qualitative study. *J Clin Nurs*. 2019;28:3786–3795. https://doi.org/10.1111/jocn.14979