






Healthcare practitioner perspectives and experiences regarding vascular access device data: An exploratory study

Jessica A. Schults, Christine Woods, Marie Cooke, Tricia Kleidon, Nicole Marsh, Gillian Ray-Barruel & Claire M. Rickard

To cite this article: Jessica A. Schults, Christine Woods, Marie Cooke, Tricia Kleidon, Nicole Marsh, Gillian Ray-Barruel & Claire M. Rickard (2020): Healthcare practitioner perspectives and experiences regarding vascular access device data: An exploratory study, International Journal of Healthcare Management, DOI: [10.1080/20479700.2020.1721750](https://doi.org/10.1080/20479700.2020.1721750)

To link to this article: <https://doi.org/10.1080/20479700.2020.1721750>

 View supplementary material 

 Published online: 30 Jan 2020.

 Submit your article to this journal 

 Article views: 1

 View related articles 

 View Crossmark data 



Healthcare practitioner perspectives and experiences regarding vascular access device data: An exploratory study

Jessica A. Schults^{a,b,c}, Christine Woods^{a,d}, Marie Cooke^{a,b}, Tricia Kleidon^{a,c}, Nicole Marsh^{a,b,e}, Gillian Ray-Barruel^{a,b,f} and Claire M. Rickard^{a,b}

^aAlliance for Vascular Access Teaching and Research Group (AVATAR), Menzies Health Institute Queensland, Griffith University, Queensland Australia; ^bSchool of Nursing and Midwifery, Griffith University, Queensland Australia; ^cDepartment of Anaesthesia and Pain Management, Queensland Children's Hospital, Queensland, Australia; ^dDepartment of Anaesthesia and Perioperative Medicine, Royal Brisbane and Women's Hospital, Queensland, Australia; ^eNursing and Midwifery Research Centre, Royal Brisbane and Women's Hospital, Queensland, Australia; ^fQueen Elizabeth II Jubilee Hospital, Brisbane, Australia

ABSTRACT

Background: A vascular access registry is a key strategy proposed to improve patient safety and quality, but its impact will be shaped by the attitudes, experience and resources of end-user stakeholders. This study aimed to examine stakeholders' perspectives and experiences regarding the feasibility and utility of a standardized platform to collect vascular access data and to identify potential barriers and facilitators of a vascular access clinical quality registry.

Methods: Individual ($n = 17$) and group ($n = 1$) semi-structured interviews were conducted between October–December 2018 with directors from various healthcare disciplines and policy makers in Australian healthcare facilities. Interviews were recorded, transcribed and analysed using inductive thematic analysis.

Results: Overall, participants supported the idea of a standardized platform to capture vascular access data. Three main themes were identified: (1) data challenges (sub themes: standardized data capture, data quality and data sharing); (2) staff capability (lack of resources and feeling unsupported); and (3) logistics (resource capacity and implementation challenges).

Conclusion: Stakeholder engagement and universal agreement on standardized vocabulary and data items are vital to registry development, implementation and sustainability. Continuous iterative cycles will be required to reflect upon, review and improve the processes around vascular access data collection using a standardized registry software platform.

ARTICLE HISTORY

Received 20 November 2019
Accepted 13 January 2020

KEYWORDS

Vascular access devices; standardized data collection; interview; clinical quality registries; outcome assessment



1. Introduction


Approximately 86% of hospital inpatients require the insertion of a vascular access (VA) device to facilitate medical treatment [1] as well as many in the community. Health purchasing data and population estimates indicate around 15 million vascular access devices are purchased in Australia alone each year [2]. Despite their ubiquitous use, rates of device complication and failure are high, with 1 in 4 centrally placed catheters, and 1 in 3 peripherally inserted devices failing from complications such as infection or blockage prior to indication cessation [3,4]. This high incidence of failure is a global patient safety issue contributing to significant patient harm and wasting scarce healthcare resources.

The provision of timely, reliable data on patient care processes and outcomes have been shown to drive improvements in the quality of health care [5–7]. At present, healthcare systems lack standardized methods for collecting, reporting, and benchmarking VA data to drive practice improvements [8,9]. Further, differences in local VA databases' vocabulary and items make

attempts to analyse comparable data challenging [8]. Clinical quality registries (CQRs) provide an opportunity to address these gaps, offering a standardized platform to monitor performance and benchmark practice nationally, with appropriate coverage. CQRs also provide an effective medium to conduct integrated randomized controlled trials.

Increasing government and organizational investment in CQRs in recent decades has seen the establishment of several national/international registries such as the Australia and New Zealand Prostate Cancer Outcomes Registry [10], Australia and New Zealand Intensive Society Registries [11] and local jurisdiction registries such as the Victorian Cancer Registry, a population-based registry with more than 240 hospitals and 30 pathology laboratories contributing data [12]. A recent economic evaluation of five Australian CQRs demonstrated registries can be a cost-effective method for improving the quality of care and patient outcomes, finding a 2–7 times cost benefit from established registries [13].

CONTACT Jessica A. Schults  j.schults@griffith.edu.au  Department of Pain and Anaesthesia, Centre for Children's Health Research Queensland, 62 Graham Street, South Brisbane, Queensland, 4101, Australia

 Supplemental data for this article can be accessed <https://doi.org/10.1080/20479700.2020.1721750>

© 2020 Informa UK Limited, trading as Taylor & Francis Group

The development and implementation of a VA registry will optimize the collection and comparison of national VA data and drive improvements in patient care and outcomes. To date, no work has been conducted to explore key stakeholders' perceptions of a VA registry or factors that influence the sustainability or coverage of such a platform. This work is necessary to broaden the useability and benefits of a VA registry and promote equitable improvements in patient care and outcomes across national healthcare services in the field of VA [14]. Therefore, the objective of this study was to examine stakeholders' perspectives and experiences regarding the feasibility and utility of a standardized platform to collect VA data and to identify potential barriers and facilitators of a VA CQR.

2. Methods

2.1. Qualitative approach

A descriptive, exploratory study. Seventeen semi-structured interviews (1 group interview involving two stakeholders) were conducted with key individuals responsible for policy directives and VA data from a range of healthcare disciplines across Australia. The study is reported using the Standards for Reporting Qualitative Research (SRQR) [15].

Research questions

- (1) What are stakeholders' perspectives and experiences regarding the feasibility and utility of a standardized platform to collect VA data;
- (2) What are the potential barriers and facilitators of a VA CQR.

2.2. Researcher characteristics and reflexivity

The research team comprised four females including one research fellow, a senior research assistant and two Professors of Nursing (PhD). Interviews were facilitated by two independent senior clinical nurse researchers (JS, CW), both with postgraduate qualifications and previous experience in VA research and interviewing. The researchers had no authority or reporting relationship with attendees, thus allowing for open honest discussion. The stakeholder-researcher relationship was one that allowed the researcher to gain a deep understanding of the participants' perceptions and experiences while maintaining a professional relationship [16].

2.3. Setting

The study captured healthcare professionals' perspectives from four Australian states (Queensland, New South Wales, Victoria, Western Australia). Interviews were conducted in person, in an office outside of the clinical environment or via telephone. Only the

interviewer and participant were present during the interview.

2.4. Participant selection

A purposive sampling approach was used to recruit participants [17]. Stakeholders were invited to participate in the study if they had experience with the collection, analysis and reporting of VA data. An email was sent to professional organizations (e.g. Australian Vascular Access Society) advising them of the study and inviting participation. Contact details for the chief investigator (CI) were provided. Sample size was not defined *a priori*, and data were gathered until saturation was achieved, that is, when no new information was being identified in interview data [18,19]. This was determined through the use of field notes where the salient issues of each interview were noted and reviewed throughout the interview period until data saturation was reached.

2.5. Ethical considerations

Ethics approval was obtained from the University Human Research Ethics Committee (GU2019/329/HREC). Written informed consent was obtained prior to the interview which was audio recorded. Recorded responses were de-identified and audio transcripts did not contain identifiable information.

2.6. Data collection methods and instruments

Interviews were conducted from October to December 2018. To ensure consistency, an interview guide was used and participants were asked identical open-ended questions [18,20] (Supplementary material 1). The interviews included both descriptive and structured questions [21]. Questions ($n = 8$) were based on key areas related to vascular access derived from existing literature reviews and quality activities [8,22,23]. Follow-up questions and prompts were adapted based on participant responses during the interview, allowing a more individualized approach [24] and full exploration of participant experience. All interviews were independently transcribed verbatim for accuracy [16]. Interview duration was approximately 30 min.

2.7. Data analysis

Inductive thematic analysis was used to code and analyse interview data, in line with similar studies [25–27]. Analysis was as per Braun and Clarke's six phases of thematic analysis: (i) familiarizing with data, (ii) generating initial codes, (iii) searching for themes, (iv) reviewing themes, (v) defining and naming themes, and (vi) producing the report [28]. Following full transcription, interview data were coded by CW. Initial codes were generated using line-by-line coding (facilitating an audit trail) and a process of writing and

Table 1. Participant characteristics.

Demographic data	Number of participants <i>n</i> = 19 (%)
Location	
Queensland	11 (58)
New South Wales	4 (20)
Victoria	2 (11)
Western Australia	2 (11)
Specialty	
Nursing	12 (63)
Medicine	4 (21)
Patient Safety	2 (11)
Healthcare Informatics	1 (5)
Position	
Executive/Director	6 (32)
Manager	4 (21)
Senior Clinician	7 (37)
Academic	2 (10)

grouping like ideas and patterns. Codes then informed concept formation, and themes and sub-themes were identified by consensus (CW, JS, MC). Themes were reviewed and defined with continued reference to codes and raw data via discussion with the project team [18].

2.8. Reliability

In a reflexivity exercise extracted themes were presented to all interviewees. This provided a degree of trustworthiness and confirmability of findings. Authenticity was addressed through fairness (transparent study recruitment process). Further the investigators maintained a degree of reflective awareness of preconceptions and expectations throughout the data collection period [29]. Further, investigators maintained a degree of reflective awareness of preconceptions and expectations throughout the data collection period [29].

3. Results

3.1. Sample characteristics

Table 1 outlines participant characteristics. The majority of participants originated from Queensland (*n* = 11, 58%). Most participants were from the discipline of nursing, however, participants filled executive, clinical and academic positions across health services, universities or affiliated patient safety organizations, including health informatics branches.

3.2. Themes

Overall, participants endorsed the idea of a vascular access CQR while identifying a number of perceived

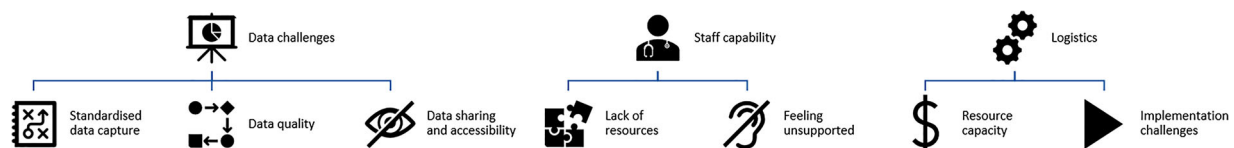
barriers and facilitators. Three major themes were identified: (1) data challenges; (2) staff capability; and (3) logistics. The final themes and subthemes are presented in Figure 1.

3.2.1. Data challenges

Standardized data capture. Participants perceived a lack of standardized VA data collection across health-care institutions ‘*There’s really nothing out there*’ (S08) and ‘*we don’t even know what our line days are*’ (S03). Across stakeholders, several local VA databases were identified, however, the majority of participants described their current approach to collecting VA data as ‘*none*’, ‘*ad hoc*’ or ‘*opportunistic*’. Overall, participants expressed frustration with current systems and a desire for ‘*... a standardised approach (to VA data collection) ... to benchmark practice*’ (S05). Universal agreement on item definitions was discussed, alongside the importance of standardizing which items to collect. There were notable exceptions to this, such as nationally-mandated central line-associated blood stream infection (CLABSI) surveillance; ‘*(we certainly monitor) CLABSI, because I have to report on that*’ (S05). Beyond infection outcomes, most participants believed few other VA outcomes were routinely tracked or benchmarked nationally.

Data quality. Of the ‘*very little*’ data routinely collected at participants’ healthcare institutions, concerns regarding data ‘*reliability*’ and ‘*quality*’ were described. ‘*It’s very hard to maintain or assess the quality, ... there’s no accountability*’ (S04). ‘*People are collecting the data*’, however, assessing the ‘*quality of the data*’ is difficult (S05). One participant stated, ‘*We currently rely on what people document, and that (at) the moment is incredibly poor*’ (S02), with another reporting ‘*People don’t ... document*’ (S06). Participants discussed the importance of ensuring data quality, accuracy and reliability, which they perceived would enhance data useability, particularly for reporting purposes that might influence practice/policy change.

Data sharing. Participants reported VA data were generally poorly communicated across the organization, and if data were shared it was typically in-house. ‘*It’s important for the clinicians to have a very visible awareness (of the data) particularly in the inpatient setting*’ (S11). The majority of participants felt there was little dissemination of data across facilities with the exception of CLABSI, a mandatory reporting

**Figure 1.** Final thematic map.

measure. There is ‘*poor access and visibility*’ (S09) of VA data across staff, departments and facilities. Participants reported needing VA data for CVAD, patient safety or executive meetings. However, ‘*the data, it’s just ours*’ (S06) indicates a lack of quality data to share and comparable data to show improvement. Participants expressed the desire to benchmark outcomes, but were concerned with data quality, standardisation of data items and an appropriate method of cross-institutional data sharing:

if there are problems with our outcomes ... and that’s picked up on that central registry, then I think that’s a bonus and that’s something that we can action and work on, but I guess if that was kind of used in a negative manner ... I think from an organisational perspective, they may have a few issues with that. (S13)

3.2.2. Staff capability

Overall, participants reported a lack of resources to facilitate VA data collection, despite expressing positive attitudes to the value of this data. Lack of funding and personnel were highlighted as key issues. Other issues described were the absence of registry software, standardized VA data items and vocabulary and analytical support to make ‘sense’ of the data. ‘*We currently don’t have the ability to run reports, ... there is some data available, but you would have to collect it manually and that would just be nigh impossible*’ (S02). Stakeholders perceived this data to be necessary to drive improvements in the quality of patient care related to VA. Describing the lack of resources to collect this data as ‘*very frustrating*’ (S02).

Several participants reported feeling unsupported to undertake VA data collection, explaining VA data collection is ‘*Not encouraged within (my discipline)*’ (S01), making it hard for clinicians to instigate routine, standardized VA data collection. Some stakeholders perceived the lack of support from upper management as reflecting a lack of awareness of the importance of tracking VA device and patient outcomes. ‘*My voice is quiet in the wilderness*’ and ‘*they don’t see the benefit (of collecting the data)*’ (S04). The perception ‘VA data collection is someone else’s problem’ arose when discussing who is responsible for collecting and reporting VA data: ‘*We would leave that for the vascular access service*’ (S09). There was an understanding that the organization and management of practice meant there was an ongoing need to develop structures and processes in this space, but there was not a clear sense of who would be responsible for the innovation. Clinical stakeholders reported the need to persevere in pushing for quality VA data: ‘*We will report back to whatever [sic] people we can get to listen*’ (S10), ‘*It’s a change management process*’ (S03) getting people on board, and ‘*We continue to remind people that we don’t (have) any meaningful data*’ (S02).

3.2.3. Logistics

Resource capacity. Across stakeholders, access to funding to support registry infrastructure was highlighted to be a pivotal driver in the development and implementation of a VA CQR. ‘*There is a lot of interest in this space*’ (S07), but ‘*we’re constantly told there’s no money*’ (S02). If registry software existed, participants expressed concern in relation to who would be responsible for the data collection: ‘*Who’s funded – to collect the information? It’s quite laborious*’ (S07); it would need ‘*data linkage*’ (S03). However, participants named multiple benefits of participation. Stakeholders reported a salient driver to engage in an established VA CQR was the ability to meet accreditation and national reporting requirements. A further motivator to engage in a VA CQR was the ability to improve VA practices and patient outcomes in their facility. However, engaging in a VA CQR was associated with considerable tangible and intangible costs, with discussion focussed on the electronic integration rather than individual operators to collect data.

Implementation challenges. Most participants believed there was positive interest in participating in a VA CQR, which would ‘raise the bar’ on the quality and safety of care patients requiring VA devices receive. There were reservations expressed regarding the challenges of implementing a VA registry. It must be ‘*sustainable*’ (S03). Participants described the need for multi-level buy-in ‘*for compliance and quality control*’ (S07) and to ensure the successful integration of the VA CQR in the clinical setting, ‘*It would have to come from the exec(utive), ideally need to be integrated into our systems, easily accessible*’ (S12).

Understanding the practice context and ‘*knowing your audience*’ was also highlighted by stakeholders as vital to ensuring the ongoing success and sustainability of the VA CQR. When asked what data they would want, stakeholders named a host of variables including device appropriateness, complications (infection, thrombosis, occlusions and cause of device failure), dwell time, idle catheters, number of insertion attempts, reason for removal and more. The importance of measuring the impact of the VA CQR was discussed, stressing the need for clear, consistent data outputs that can be disseminated at various system levels to quantify the benefit of the registry.

4. Discussion

To our knowledge, this is the first study to draw from a broad range of VA stakeholders within Australian healthcare facilities. A key finding of the study was that stakeholders perceived the current state of VA data collection to be sub-optimal. VA data collection occurred in siloed departments within some facilities; however, in other facilities VA data collection was non-existent. Furthermore, participants reported

diversity in the items collected and noted several challenges aggregating and comparing data. These findings align with international reports which describe a lack of standardized vocabulary and platforms to monitor VA care and outcomes [8,30]. This issue largely stems from a lack of standardized VA device nomenclature, core outcomes and consensus-derived quality indicators, which other disciplines have shown positively enhances clinicians' ability to compare patient and medical device data [31–33].

There were more nuanced perceptions of a VA registry, with participants describing the potential benefits and value-add of a standardized system. Despite this, key stakeholders highlighted some realistic challenges, including ensuring data integrity, flexibility for practice context, resource and policy implications, and having a transparent governance infrastructure. Given the resources required to establish and maintain a CQR, a pragmatic approach to registry implementation is needed when setting up a new system [34,35]. A standardized minimum dataset is the first step in developing a VA CQR [34], yet, achieving interoperability between the registry dataset and source data is a fundamental consideration that impacts the value and usability of the VA CQR. With the roll-out of electronic medical records across a number of Australian States and Territories it is important to consider how the registry's dataset maps with source systems, a consideration that has significant resource implications when tracking performance across institutions [36]. In recognition of this, several projects are being undertaken to improve interoperability between registries and EMR internationally, but much more work is needed in this space in the Australian context [37].

There are likely to be considerable patient, organization and health economic benefits from the implementation of a VA registry. To achieve high coverage across facilities, data items need to be developed in partnership with clinicians and consumers. Stakeholders reported a need for more comprehensive monitoring of VA outcomes beyond infection, particularly venous thromboembolism. This finding aligns with a recent scoping review that found comparative VA data assessment predominantly focuses on infectious hospital-acquired complications [8]. Further, using a predefined minimum dataset, registries enable the systematic and efficient collection of clinical data, which may include patient reported outcome measures (PROMs) that may otherwise not be assessed [38]. The ability of registries to standardize the capture of PROMs has been demonstrated nationally by the Victorian Prostate Cancer Registry and the Victorian Severe Trauma Registry, which collect PROMs during a time of clinical stability. Internationally, countries such as Sweden [39] and the UK [40] collect PROMs with hip or knee arthroplasties, with annual reports published on government or registry websites.

The establishment of a VA CQR has important policy and practice implications for Australian healthcare, as noted by the executive respondents in these interviews. Australia's Health Performance Framework (AHPF) includes a focus on technological advancement and efficiency, supported by health system infrastructure. Participants perceived a key driver of registry value was software interoperability with EMR and national surveillance systems. Accrediting bodies including the Australian Council on Healthcare Standards (ACHS) may see flow-on benefits from the establishment of a standardized data capture tool which facilitates mandatory reporting/surveillance of important quality measures such as CLABSI. For example, in 2020, the Australian Commission on Safety and Quality in Healthcare (ACQSHC) will release a new National Peripheral Venous Access Clinical Care Standard that will require data indicators against which compliance and ultimately organizational accreditation can be assessed [41]. An initial focus on accreditation outcomes may facilitate the early implementation of a VA CQR, through performance benchmarking.

5. Limitations

This study has some limitations. The study scope did not enable the ascertainment of perspectives outside of Australia, which limit the generalisability of study findings to other countries and healthcare contexts.

6. Implications

This study identified important implications for the establishment of a VA CQR. First, stakeholder engagement is crucial for the development, refinement and implementation of the system to ensure sustainability. The resource burden on individual participating centres should be minimized and interoperability between the registry software and EMR maximized. Second, standardisation of data items and registry processes is necessary to ensure data quality and useability. Finally, adding value to healthcare institutions through performance measurement, in particular, national surveillance and accreditation standards, will promote engagement with the registry.

7. Conclusion

Currently, there is a lack of comparative data in the Australian health system related to VA device insertions, complications and costs (personal for the patient and economic for the organization). The development of a VA CQR has the potential to provide important quality and safety data and a platform for improving patient outcomes and experiences. These insights should encourage the ongoing development of a VA

registry and inform processes to minimize potential barriers to its sustainability and ongoing use usability.

Acknowledgements

The authors gratefully acknowledge the clinicians and vascular access specialists who participated in this study. We also thank Associate Professor Amanada Ullman for providing content expertise.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Contributors: JS and CW conceived the study, developed the protocol, completed data collection and analysis, and drafted and revised the final manuscript. MC and CR, conceived the study, developed the protocol, assisted with data analysis and revised and approved the final manuscript. TK, NM and GRB assisted with protocol development and revised and approved the final manuscript.

Jessica Schults reports investigator-initiated research grants from Becton Dickinson unrelated to this project.

Christine Woods reports no conflicts of interest.

Marie Cooke reports investigator-initiated research grants and speaker fees provided to Griffith University by vascular access product manufacturers (Baxter, Becton Dickinson, Entrotech Life Sciences), unrelated to this project.

Tricia Kleidon reports investigator-initiated research grants and speaker fees provided to Griffith University from vascular access product manufacturers (3M, Angiodynamics; Baxter; BBraun; BD-Bard; Cardinal Health; Cook Medical; Medical Specialties Australia; Smiths Medical), unrelated to this project.

Nicole Marsh reports investigator-initiated research grants provided to Griffith University by vascular access product manufacturers Becton Dickinson and Cardinal Health and a consultancy payment provided to Griffith University from Becton Dickinson for clinical feedback related to catheter placement and maintenance (unrelated to the current project).

Gillian Ray-Barruel reports investigator-initiated research grants, speaker fees and consultancy payments provided to Griffith University by product manufacturers (3M, Becton Dickinson, Medline) and education providers (Ausmed, Wolters Kluwer), unrelated to this project.

Claire Rickard reports investigator-initiated research grants and speaker fees provided to Griffith University from vascular access product manufacturers (3M, Angiodynamics; Baxter; BBraun; BD-Bard; Medtronic; ResQDevices; Smiths Medical), unrelated to this project.

Ethical Approval: Ethics approval was obtained from the University Human Research Ethics Committee (GU2019/329/HREC).

Notes on contributors

Ms Jessica Schults is a paediatric critical care nurse and researcher with Griffith University School of Nursing and Midwifery and Queensland Children's Hospital, Australia.

Ms Christine Woods is a research manager within the department of anaesthetics at Royal Brisbane and Women's Hospital, Australia, responsible for project deliverables and research outcomes and a Research Assistant with Griffith University School of Nursing and Midwifery.

Dr Marie Cooke is a Professor of Nursing in the SoNM at GU. She also has visiting scholar appointments with a number of tertiary hospitals in SE Queensland. She has extensive experience in research related to vascular access devices, qualitative research and quality and safety projects.

Ms Tricia Kleidon is a paediatric vascular access nurse practitioner at Queensland Children's Hospital and research fellow with Griffith University. Tricia is an experienced vascular access clinician involved in insertion and care and maintenance of all vascular access devices and has been involved in various vascular access research projects focused on reducing catheter failure and improving first time insertion success.

Dr Nicole Marsh is the Nursing and Midwifery Director, Research at the Royal Brisbane and Women's Hospital. The focus of her research has been on improving the insertion and maintenance of peripheral intravenous catheters.

Dr Gillian Ray-Barruel is a Senior Research Fellow in the School of Nursing and Midwifery at Griffith University and Queen Elizabeth II Jubilee Hospital, Brisbane, Australia. Her research focuses on improving assessment and decision-making by bedside clinicians to prevent patient complications and improve healthcare outcomes.

Dr Claire Rickard is a Professor of Nursing in the School of Nursing and Midwifery at Griffith University. She is the co-lead of the Alliance for Vascular Access Teaching and Research at Menzies health Institute Queensland, and a Visiting Scholar with a number of Queensland hospitals. She is an expert in the prevention of complications in vascular access devices.

ORCID

Tricia Kleidon  <http://orcid.org/0000-0001-8369-3970>

Gillian Ray-Barruel  <http://orcid.org/0000-0001-8875-7523>

References

- [1] Blauw M, Foxman B, Wu J, et al. Risk factors and outcomes associated with hospital-onset peripheral intravenous catheter-associated staphylococcus aureus bacteremia. *Open Forum Infect Dis*. 2019;6(4). doi:10.1093/ofid/ofz111.
- [2] Tuffaha HW, Marsh N, Byrnes J, et al. Cost of vascular access devices in public hospitals in Queensland. *Aust Health Rev: Publ Aust Hosp Assoc*. 2018. Epub 2018/09/05. PubMed PMID: 30176985. doi:10.1071/ah18102.
- [3] Ullman AJ, Marsh N, Mihala G, et al. Complications of central venous access devices: a systematic review. *Pediatrics*. 2015;136(5):e1331–e1344. Epub 2015/10/16. PubMed PMID: 26459655. doi:10.1542/peds.2015-1507.
- [4] Rickard CM, McCann D, Munnings J, et al. Routine resite of peripheral intravenous devices every 3 days did not reduce complications compared with clinically indicated resite: a randomised controlled trial. *BMC Med*. 2010;8(53). Epub 2010/09/14. PubMed PMID: 20831782; PubMed Central PMCID: PMC2944158. doi:10.1186/1741-7015-8-53.
- [5] Liu FX, Rutherford P, Smoyer-Tomic K, et al. A global overview of renal registries: a systematic review. *BMC Nephrol*. 2015;16:31. Epub 2015/04/18. PubMed

- PMID: 25886028; PubMed Central PMCID: PMC4377012. doi:10.1186/s12882-015-0028-2.
- [6] Stey AM, Russell MM, Ko CY, et al. Clinical registries and quality measurement in surgery: a systematic review. *Surgery*. 2015;157(2):381–395. Epub 2015/01/27. PubMed PMID: 25616951. doi:10.1016/j.surg.2014.08.097.
 - [7] Gliklich RE, Dreyer NA, Leavy MB, editors. *AHRQ methods for effective health care*. Rockville (MD): Agency for Healthcare Research and Quality (US); 2014.
 - [8] Schults JA, Rickard CM, Kleidon T, et al. Building a global, pediatric vascular access registry: a scoping review of trial outcomes and quality indicators to inform evidence-based practice. *Worldviews Evid Based Nurs*. 2019;16(1):51–59. Epub 2019/01/04. PubMed PMID: 30604496. doi:10.1111/wvn.12339.
 - [9] Baskin KM, Durack JC, Abu-Elmagd K, et al. Chronic central venous access: from research consensus panel to national multistakeholder initiative. *J Vasc Interv Radiol: JVIR*. 2018;29(4):461–469. Epub 2018/02/20. PubMed PMID: 29456059. doi:10.1016/j.jvir.2017.12.009.
 - [10] [10] Prostate Cancer Outcomes Registry Australia and New Zealand (PCOR-ANZ) 2019 [cited 2019 29 October]. Available from: <https://prostatecancerregistry.org/>.
 - [11] ANZICS CORE Registries: ANZICS CORE; 2019 [cited 2019 29 October 2019]. Available from: <https://www.anzics.com.au/anzics-registries/>.
 - [12] Victorian Cancer Registry: Cancer Council Victoria and The Victorian Government; 2019 [cited 2019 29 October]. Available from: <https://www.cancervic.org.au/research/registry-statistics/vcr>.
 - [13] Australian Commission on Safety and Quality in Health Care. Economic evaluation of clinical quality registries: final report. Sydney: ACSQHC; 2016.
 - [14] Australian Commission on Safety and Quality in Health Care. Framework for Australian clinical quality registries. Sydney: ACSQHC; 2014.
 - [15] O'Brien BC, Harris IB, Beckman TJ, et al. Standards for reporting qualitative research: a synthesis of recommendations. *Acad Med*. 2014;89(9):1245–1251. Epub 2014/07/01. PubMed PMID: 24979285. doi:10.1097/acm.0000000000000388.
 - [16] Seale C, Silverman D. Ensuring rigour in qualitative research. *Eur J Public Health*. 1997;7(4):379–384. doi:10.1093/eurpub/7.4.379.
 - [17] Palinkas LA, Horwitz SM, Green CA, et al. Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Adm Policy Ment Health*. 2015;42(5):533–544. PubMed PMID: PMC4012002. doi:10.1007/s10488-013-0528-y.
 - [18] Norwood SL. *Research essential: Foundations for evidence-based practice*. New Jersey: Pearson; 2010.
 - [19] Guest G, Bunce A, Johnson L. How many interviews are enough? An experiment with data saturation. *Family Health Int*. 2015;18(1):59–82. doi:10.1177/1525822X05279903.
 - [20] Gall MD, Gall JP, Borg WR. *Educational research: An introduction*. 7th ed. Boston (MA): A & B Publications; 2003.
 - [21] Bevan MT. A method of phenomenological interviewing. *Qual Health Res*. 2014;24(1):136–144. Epub 2014/01/15. PubMed PMID: 24413767. doi:10.1177/1049732313519710.
 - [22] Takashima M, Schults J, Mihala G, et al. Complication and failures of central vascular access device in Adult critical care settings. *Crit Care Med*. 2018;46(12):1998–2009. Epub 2018/08/11. PubMed PMID: 30095499. doi:10.1097/ccm.0000000000003370.
 - [23] Kleidon TM, Rickard CM, Schults JA, et al. Development of a paediatric central venous access device database: a retrospective cohort study of practice evolution and risk factors for device failure. *J Paediatr Child Health*. 2019; Epub 2019/08/23. PubMed PMID: 31436918. doi:10.1111/jpc.14600.
 - [24] Creswell JW. *Qualitative inquiry and research design: Choosing among five approaches*. Thousand Oaks (CA): SAGE; 2007.
 - [25] Schults JA, Cooke M, Long D, et al. “When no-one’s looking,” the application of lung recruitment and normal saline instillation with paediatric endotracheal suction: An exploratory study of nursing practice. *Aust Crit Care*. 2019;32(1):13–19. Epub 2018/05/13. PubMed PMID: 29752213. doi:10.1016/j.aucc.2018.03.002.
 - [26] Casey JR, Hanson CS, Winkelmayer WC, et al. Patients’ perspectives on hemodialysis vascular access: a systematic review of qualitative studies. *Am J Kidney Dis*. 2014;64(6):937–953. Epub 2014/08/15. PubMed PMID: 25115617. doi:10.1053/j.ajkd.2014.06.024.
 - [27] Ritchie M, Kelly LJ, Moss J, et al. Exploring attitudes towards a randomised controlled trial of venous access devices – a nested pre-trial qualitative study. *J Vasc Access*. 2015;16(5):407–412. doi:10.5301/jva.5000447.
 - [28] Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol*. 2006;3(2):77–101.
 - [29] The SAGE Encyclopedia of Qualitative Research Methods. Given LM, editor: SAGE; 2012.
 - [30] Reed TL, Drozda Jr. JP, Baskin KM, et al. Advancing medical device innovation through collaboration and coordination of structured data capture pilots: report from the medical device epidemiology network (MDEpiNet) specific, measurable, achievable, results-oriented, time bound (SMART) think tank. *Healthc (Amst)*. 2017;5(4):158–164. Epub 2016/12/13. PubMed PMID: 27939170. doi:10.1016/j.hjdsi.2016.10.004.
 - [31] McGrath PJ, Walco GA, Turk DC, et al. Core outcome domains and measures for pediatric acute and chronic/recurrent pain clinical trials: PedIMPACT recommendations. *J Pain*. 2008;9(9):771–783. Epub 2008/06/20. PubMed PMID: 18562251. doi:10.1016/j.jpain.2008.04.007.
 - [32] Slater A, Shann F, McEniery J. The ANZPIC registry diagnostic codes: a system for coding reasons for admitting children to intensive care. *Intensive Care Med*. 2003;29(2):271–277. Epub 2003/01/24. PubMed PMID: 12541153. doi:10.1007/s00134-002-1600-3.
 - [33] Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR). Hip, knee & shoulder arthroplasty: 2019 annual report. Adelaide: AOA: AOANJRR; 2019.
 - [34] Evans SM, Scott IA, Johnson NP, et al. Development of clinical-quality registries in Australia: the way forward. *Med J Aust*. 2011;194(7):360–363. Epub 2011/04/08. PubMed PMID: 21470087.
 - [35] Ullman AJ, Kleidon T, Rickard CM. The role of the vascular access nurse practitioner in developing evidence, promoting evidence-based vascular access

- practice and improving health services. *Vasc Access*. 2015;1(1):10–20.
- [36] Blumenthal S. The Use of Clinical Registries in the United States: a landscape survey. *EGEMS* (Wash DC). 2017;5(1):26. PubMed PMID: 29930965. doi:10.5334/egems.248.
- [37] Blumenthal S. Improving interoperability between registries and EHRs. *AMIA Jt Summits Transl Sci Proc*. 2018;2017:20–25. PubMed PMID: 29888033.
- [38] Gliklich R, Dreyer N, Leavy M. Registries for evaluating patient outcomes: a user's guide [Internet]. 3rd ed. Rockville (MD): Agency for Healthcare Research and Quality (US); 2014.
- [39] Paulsen A. Patient reported outcomes in hip arthroplasty registries. *Dan Med J*. 2014;61(5):B4845. Epub 2014/05/13. PubMed PMID: 24814747.
- [40] NHS. Patient Reported Outcome Measures (PROMs): NHS Digital; 2019 [cited 2019 29 October]. Available from: <https://digital.nhs.uk/data-and-information/data-tools-and-services/data-services/patient-reported-outcome-measures-proms>.
- [41] Australian Commission on Safety and Quality in Health Care. Peripheral venous access clinical care: ACSQHC; 2019 [cited 2019 25 October]. Available from: <https://www.safetyandquality.gov.au/standards/clinical-care-standards/peripheral-venous-access-clinical-care-standard>.