



## Protocol

# Bundle-of-care interventions to improve self-management of patients with urinary catheters: Study protocol



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## ARTICLE INFO

## Article history:

Received 15 June 2021

Revised 31 July 2021

Accepted 12 August 2021

## Keywords:

Urinary catheter

Care bundles

Self-management

Self-efficacy

Smart phone

Clinical protocol

## ABSTRACT

**Background:** Community-based urinary catheter-associated complications contribute to avoidable, costly hospital presentations. To minimise catheter-associated complications and improve the quality of life of patients living in the community, it is essential to improve catheter self-management through increasing patients' and caregivers' knowledge and self-efficacy.

**Aim:** To co-design, develop and evaluate a bundle-of-care intervention to improve catheter self-management, reduce catheter-associated complications, and improved quality of life.

**Design:** Mixed methods design underpinned by the principles of Appreciative Inquiry, micro- and spaced-learning pedagogies.

**Methods:** A co-designed care bundle will be developed, to support both patients and nurses in improving catheter care in both acute and community settings. Intervention bundles for patients will be delivered using "GoShare Healthcare" and for nurses, using QStream. The underpinning pedagogical approaches of these two digital platforms focus on increasing knowledge retention and improving patient health outcomes.

A process evaluation of the intervention will be undertaken using data collected from surveys, electronic medical record audits, and participant interviews. The primary outcome is improved catheter self-management, and secondary outcomes are increased self-efficacy and patients' knowledge of catheter self-management.

**Discussion:** The IQ-IDC study applies a two-pronged approach to co-design a bundle-of-care intervention that addresses important gaps in current catheter management. This study will contribute to new knowledge on effective implementation strategies to optimise self-management in urinary catheter care.

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### Summary of relevance

#### Problem

Patients living with urinary catheters are often not equipped with the information essential for optimal catheter self-management.

#### What is already known

Many patients rely on the internet or use a 'learning as they go' approach to self-manage their catheters. Of concern, some of the available resources are erroneous and contribute to adverse incidents.

#### What this paper adds

This paper details the study design, methods, and intervention strategies to support patients and upskilling nurses in catheter management. This study will examine the effectiveness of co-designed bundle-of-care interventions delivered to both patients and nurses using two digital health platforms.

## 1. Introduction

Indwelling urinary catheterisation (IDC) is a common clinical procedure indicated for urinary retention or bladder outlet obstruction, acute injury or surgery management, as well as urinary incontinence management (Clinical Excellence Commission, 2013). The eponymous balloon-retained IDCs used around the world were designed by the American urologist Frederic Foley almost 85 years ago and continue to be used in clinical practice for bladder drainage despite the fact that these catheters can cause various infectious and non-infectious complications (Feneley, Hopley, & Wells, 2015). Insertion of IDCs are performed worldwide in hospital, community, clinic, and home-based settings, and a procedure most commonly performed by nurses. Globally, it is estimated that approximately 100 million urinary catheters are used annually (Nasr, 2010), and the majority of these catheters are unplanned insertions in acute hospital settings (Giles et al., 2019).

## 2. Background

Many patients start their journey of living with an IDC unexpectedly, requiring them to make significant physical and psychosocial adjustments to living with a catheter (De Jaeger, 2011). This process is often confronting and challenging, especially for those living with disability, as well as older or frail patients (Prinjha & Chapple, 2013; Prinjha, Chapple, Feneley, & Mangnall, 2016). Due to variability in the quality of education provision from healthcare professionals, many patients often rely on the internet (e.g., Dr Google) or adopt a "learning as they go" approach to self-manage their catheters (Mackay et al., 2018). Unfortunately, some of the available resources are not evidence-based or even erroneous and may indeed be harmful, contributing to an increased risk of developing catheter-associated urinary tract infection (CAUTI) (Prinjha et al., 2016).

It is critical to increase patients' and caregivers' knowledge and self-efficacy to prevent catheter-associated complications and improve the quality of life of patients living in the community with catheters. The IQ-IDC study aims to improve catheter self-management by means of a bundle of care intervention delivered to both patients and nurses using two digital platforms, "GoShare Healthcare" (GoShare, 2019) and Qstream (Qstream™, 2020) underpinned by micro-learning and spaced learning pedagogy. "GoShare Healthcare" is a digital platform that sends customisable bundle of care interventions, based on the patient's needs and is capable of monitoring the accessibility of the resources sent out, through push reminders, and feedback. Spaced distribution of these multimedia resources allows the recipient to utilise this information repeatedly and at the time suitable for them, which in turn im-

proves the patient's self-efficacy and self-care behaviours. Qstream is a scientifically proven micro-learning digital platform designed to increase clinicians' knowledge and transform their behaviour. Qstream is capable of analysing key areas of users' competency requirements and sends short case scenarios to challenge nurses' knowledge levels, capture their attention and provide them with multimedia resources, that support the provision of evidence-based catheter management practices. Unlike the traditional educational modalities, Qstream™ enables remote connection and engagement with nurses and enables the educator to access real-time actionable analytics for targeted coaching and preventing adverse clinical incidents. It is hypothesised that these interventions could improve health outcomes, including quality of life, by improving catheter self-management and standardise catheter care practices.

Bundle of care interventions are a group of evidence-based best practices, designed to improve patient outcomes, and have been shown to be effective in many clinical settings (Chaboyer et al., 2016; Hellyer, Ewan, Wilson, & Simpson, 2016; World Health Organization, 2018). There are bundled catheter care approaches specifically for minimising CAUTI in hospital settings and most of the interventions reported were single strategies (Davies et al., 2018; Parker et al., 2017), but there is no co-designed bundle of care intervention that exists focusing on self-efficacy and self-management for community-dwelling patients living with IDCs. Hence, the focus of this study is to co-design, develop, implement and evaluate a bundle of care intervention that includes both resources, information and education packages targeted towards patients, informal caregivers and nurses. These interventions will reinforce learning, improve knowledge retention, and enhance the quality of life and sustain catheter self-management practices.

### 2.1. Theoretical framework guiding the study

The study is guided by the principles of Appreciative Inquiry, which is a strength-based approach to empower and engage both patients and nurses to harness successes from previous experiences (Burbach & Amani, 2019). This will foster collective creativity in co-designing and delivering a bundle of care intervention that is specifically targeted to their needs. In addition to this theoretical principle, micro-learning and spaced learning pedagogy (Phillips, Heneka, Bhattacharai, Fraser, & Shaw, 2019) will be incorporated into the interventions to sustain knowledge retention, modify behaviours and improve the current catheter management practices.

### 2.2. Appreciative inquiry (AI)

Embedded in this pragmatic mixed methods approach, the IQ-IDC study will use inductive methods of Appreciative Inquiry (AI) in the exploratory and intervention phases. Instead of problems and deficits, the AI approach focuses on the strengths and rich experiences of nurses caring for these patients (Burbach & Amani, 2019). One of the key benefits of applying the AI principles in this study is the process of engaging nurses to initiate a collaborative approach in developing a bundle of care intervention from a strengths-based perspective and fostering collective creativity of nurses (Beattie, 2018). To incorporate AI into this study, the 4D phases of Discovery, Dream, Design and Destiny will be used in the exploratory and intervention phases of this study (Figure 2).

### 2.3. Micro-learning and spaced learning

IQ-IDC study will apply micro-learning and spaced learning principles in co-designing and delivering digital education interventions targeting the nurse cohort (De Gagne, Woodward, Park, Sun, & Yamane, 2019; Yeung et al., 2020). A small amount of

evidence-based information based on case studies contextualised to the learners' needs will be distributed regularly over a period of time to improve learners' long-term knowledge and performance. The short and relevant information pertinent to their practice settings aim to capture learners' attention and aids in the transfer of learning to clinical practice (Robinson et al., 2017). The spaced repeated distribution of a small quantity of educational content, and the convenience of accessing this information suits busy clinicians (Turner et al., 2018). These scientifically evidenced principles improve learners' engagement and knowledge retention and improve patient level outcomes (Phillips et al., 2019).

### 3. Methods

The study will adopt a pragmatic paradigm (Jirojwong, Johnson, & Welch, 2014) using a mixed methods approach to design interventions for improving catheter care, and develop an evidence-based practice to reduce hospital presentations related to catheter-associated complications. Using a mixed methods approach, findings from both the scoping review and needs analysis data collected at baseline will be used to design, implement and evaluate a bundle of care intervention targeting both patients and nurses to improve catheter management, delivered using two digital platforms, "GoShare Healthcare" (GoShare, 2019) and Qstream (QstreamTM, 2020).

#### 3.1. Study aim and objective

This study aims to improve the self-management and quality-of-life of patients living in the community with IDC, through empowering patients and carers to become well-informed consumers, and at the same time, focuses on upskilling nurses caring for these patients through the use of digital education technologies. Aims and process flow are described in Fig. 1.

This two-pronged approach in supporting both patients and nurses aims to:

- a Improve self-efficacy and self-management in catheter care of community-dwelling patients with IDCs
- b Upskill nurses in managing patients with IDCs to reduce variability, standardise nursing practice and improve the quality of care.
- c Reduce avoidable urinary catheter-related hospital presentations, including CAUTIs. The common non-infectious catheter-associated complications leading to hospital presentations are recurrent catheter blockages, urine leakage, and haematuria. Bleeding, erosion and tissue damage around the catheter site, lost SPC tract, urethral trauma or bladder perforation due to inappropriate catheterisation technique are other catheter-associated complications in addition to pain, discomfort and bladder spasms.

#### Study objective:

To investigate the effect of a co-designed bundle of care intervention on community dwelling patients' ability to self-manage their indwelling urinary catheters at home.

#### 3.2. Study design

This study will use pre-post surveys and individual semi-structured interview of patients and nurses, along with auditing demographic and clinical data extracted from patients' electronic medical records. Interviews will be recorded and transcribed verbatim. Findings from both the scoping review and the exploratory data will be used to inform the co-design of the bundle of care interventions targeting both patients and nurses in improving catheter care.

#### 3.3. Study setting and participants

This study will be conducted in one of the most populated and fastest growing local health districts (LHD) in NSW, Australia. Patients who are 18 years over and living with an IDC will be recruited for this study's exploratory and intervention phases from the five community health centres from this LHD. Nurses will be recruited from the five community health centres and Emergency Department, Medical and Surgical Wards from one hospital in this LHD.

#### 3.4. Study procedures

##### 3.3.1. Scoping review

Our published scoping review (Alex et al., 2020) explored the intervention strategies used for improving knowledge, confidence, and self-efficacy in self-management of urinary catheters for patients living with IDCs. This review revealed (i) scarcity of information provided to patients and caregivers; (ii) effectiveness of educational interventions in reducing catheter-associated complications and improving quality of life of patients living with IDCs; and (iii) a care bundle approach, co-partnering with clinicians and caregivers, was more effective in promoting patient self-management. Findings of this review provided the foundation knowledge on designing bundle of care interventions and also identified the inconsistencies and knowledge gap of both patients and nurses (Alex et al., 2020).

##### 3.3.2. Prepost surveys of patients and semistructured interviews with patients/carers

In this exploratory phase, the data will be collected from patients living in the community with IDCs. Individual semi-structured interviews and surveys will be used to collect participants' knowledge and confidence levels, attitudes, challenges, facilitators, behaviours, their current practices as well as experiences of living with IDC. These constructs were assessed using Urinary Catheter Self-Efficacy Scale (C-SE) and Catheter Self-Management Scale (C-SMG) (Wilde et al., 2016). These two instruments were developed by Wilde et al. (2015) based on the self-efficacy theory by (Bandura, 1993) were chosen for this study as self-efficacy contributes to self-management, an important behavioural capacity which led to patient outcome in people with chronic illness (Wilde et al., 2016). C-SE and C-SMG instruments were tested for psychometrics, theoretical and statistical appropriateness, and used in randomised clinical trial (Wilde et al., 2016). Reliability testing (Cronbach's alpha) was conducted for both scales and is deemed suitable for use in intervention research related to catheter self-management in patients living with long-term IDCs (Wilde et al., 2016). Copyright permissions have been sought to use these instruments from the creator. Two data collection methods will be used:

- (i) Patient survey: Patients with IDC will be recruited from the five (5) Community Health Centres across the Western Sydney Local Health District (WSLHD)
- (ii) Qualitative semi-structured interviews of patients/carers: Participant recruitment for the individual semi-structured interviews will also occur across the five sites in the WSLHD, conducted via by phone, zoom or pexip video conferencing.

##### 3.3.3. Prepost surveys of nurses and semistructured interviews

Pre-post surveys and semi-structured interviews, via phone, zoom or pexip video conferencing with nurses working in both community and hospital settings will be conducted to monitor current IDC management practices and the effectiveness of current strategies in minimising catheter-associated complications. Semi-structured interviews will explore nurses' attitudes, knowledge,

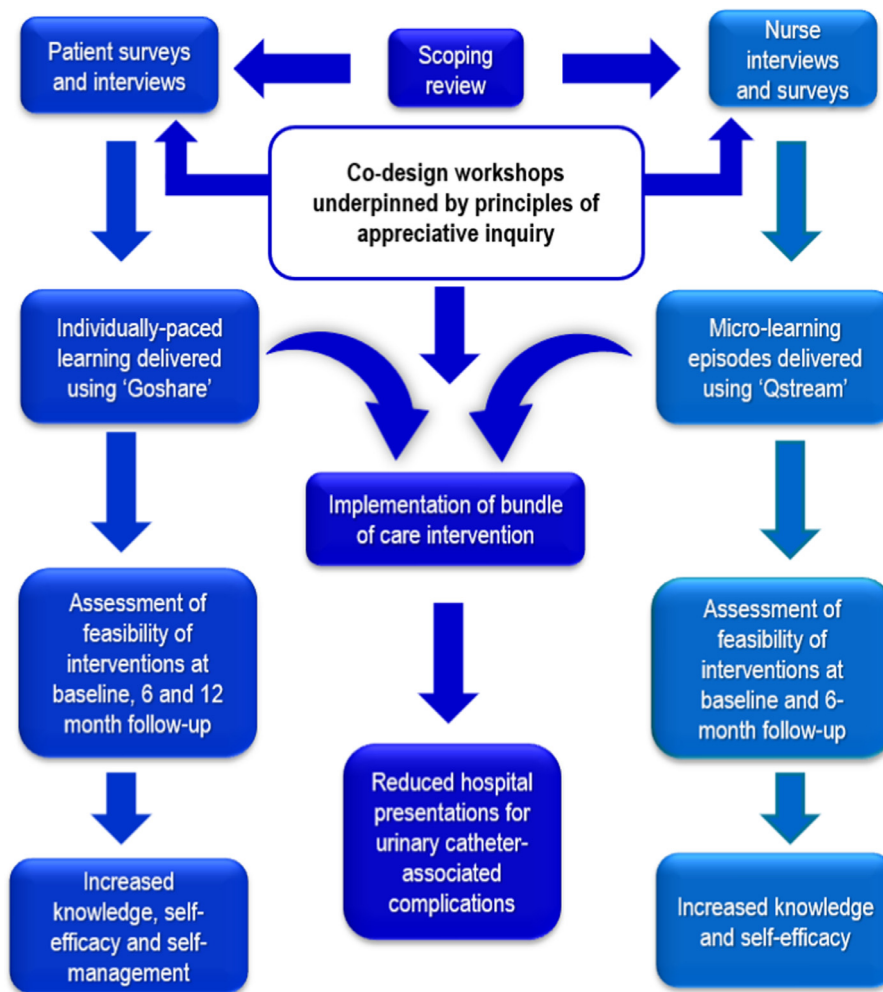


Fig. 1. Aims and process flow of IQ-IDC Study.

and confidence in IDC insertion, providing catheter-care education and managing common catheter-associated complications. Further, these interviews will examine the additional educational and training requirements of nurses to manage IDCs and the useful resources that may assist nurses in delivering catheter care education in a busy clinical setting. Data collected from nurses' perspectives will assist in developing learner-centred bundle of care interventions based on current evidence from those who are working in a busy clinical setting and the effectiveness of these interventions in upskilling nurses to improve patient outcomes. It will also add insights regarding the effectiveness of these interventions in upskilling nurses to improve patient outcomes.

A 26-item pre-post survey questionnaire will be administered to nurses examining important clinical practice domains including their clinical knowledge, practices regarding urinary catheterisation; their perceived opportunities and their motivations towards providing patient education.

### 3.3.4. Co-design and implementation of the bundle of care intervention

**3.3.4.1. Patients and Carers.** A bundle of care intervention focused on patients and caregivers will be co-designed from the findings of the literature review and exploratory data to optimise self-management of patients with a urinary catheter. Nurses, continence specialist nurses, nurse practitioners, educators and clinical nurse consultants from both community and hospital settings, academics, consumers and end-users will be invited to participate in a

2-hour co-design workshop. In total, there will be two workshops conducted four weeks apart to develop, design and review the care bundle interventions. These interventions will be underpinned by a pedagogical approach to increase self-efficacy and to improve self-management practices, whereby key content areas to be included will be decided. The learning resources will be developed and delivered on digital platforms, "GoShare Healthcare" (GoShare, 2019) (Refer to Box 1) to support patients and caregivers.

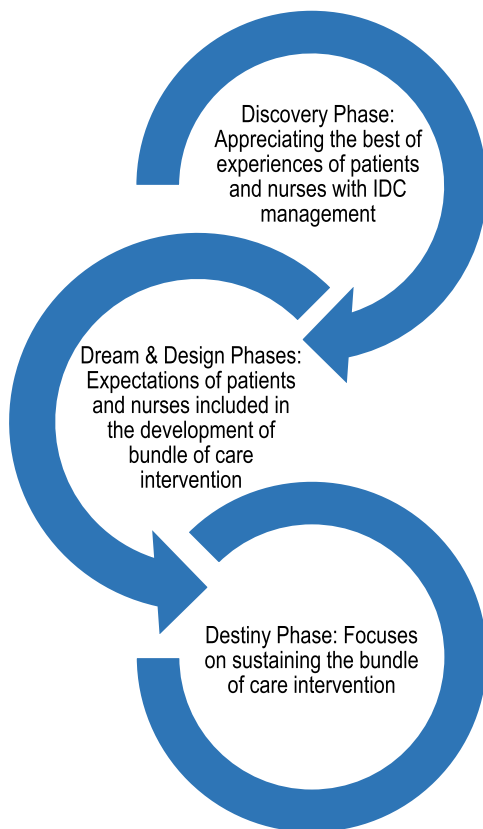
**3.3.4.2. Nurses.** A bundle of interventions for nurses underpinned by the evidence-based pedagogy using learning encounters known as "spaced learning" characterised by "repeated learning over time" (spaced educational pedagogy) and micro-learning learning (small, short burst of learning content to study at a convenient time) will be developed using codesign. End-users and an interdisciplinary expert panel will be invited as codesigners during the development of this intervention component. This pedagogical approach has been demonstrated in randomised control trials to increase clinicians' knowledge in specific areas that impacted on clinical practice (Ferguson et al., 2019). Qstream (QstreamTM, 2020) (Refer to Box 2) will be used to develop and implement spaced learning for nurses.

This two-pronged approach aims to enhance scalability and sustainability in embedding catheter self-efficacy and self-management as "usual practice" in health care delivery for both acute and community settings. The bundle of care intervention model is described in Table 1.



**Table 1**  
Bundle of care intervention model.

Inputs	Activities	Outcomes	Impacts
<p><i>Resources available for developing bundle of care interventions</i></p> <p>Stakeholder resources</p> <p>Completed scoping review</p> <p>Specific sites for recruitment of patients and carers for surveys and interviews</p> <p>Local health district for recruitment of nurses for surveys and interviews</p> <p>Access to patients, nurses and clinical experts to conduct co-design workshops</p> <p>Material resources</p> <p>Access to two content distribution digital platforms: "Qstream"- for nurses" GoShare Healthcare"- for patients and carers</p> <p>Planned work</p>	<p><i>Adaptation to bundle of care interventions</i></p> <p>Patients</p> <p>Tailored and individualised interventions</p> <p>Email, text message or a hard copy delivery options depending on preferences</p> <p>Monitoring the access and usage of resources</p> <p>Measured, timely and periodic distribution of the resources and reminders</p> <p>Ongoing feedback and comments for improvement</p> <p>Nurses</p> <p>Distribution of measured (small) number of case scenarios electronically using micro-learning and spaced learning pedagogy to upskill nurses</p> <p>Individualised delivery of learning activities</p> <p>Ongoing feedback and comments for improvement</p>	<p><i>Effectiveness of bundle of Care interventions measured objectively</i></p> <p>Patients</p> <p>Primary outcome: self-management at baseline and 6-month follow-up</p> <p>Secondary outcomes: knowledge, self-efficacy, quality-of-life and satisfaction of living with a catheter at 6-month follow-up; admission for catheter-associated complications and use of antibiotics at 6-months and 12-month follow-up</p> <p>Nurses</p> <p>Knowledge and skills to provide catheter care and/or education to patients.</p> <p>Confidence and satisfaction in catheter care.</p> <p>Standardised evidence-based catheter care practices</p> <p>Intended results</p>	<p><i>Fundamental changes occurring as a result of the intervention</i></p> <p>Reduction in the number of potentially avoidable hospital presentations with catheter-associated complications.</p> <p>Translation of standardised urinary care protocol to policy locally and nationally</p>



**Fig. 2.** Applying the appreciative inquiry 4D cycle to the IQ-IDC project.

**3.3.5. Process evaluation of catheter care bundle**

A pre-post survey of patients will be conducted across the five community health centres in Western Sydney Local Health District at baseline and 6 months after implementing the bundle of care interventions to analyse the improvement of patients' knowledge level, self-efficacy, self-management and improvement in quality-

of-life. In addition to this, demographic and clinical data extracted from patients' medical records will be conducted at six months and 12 months to examine the rates of hospitalisations, ED presentations with IDC complications to monitor the effectiveness of the bundle of care interventions. Both quantitative and qualitative data collected from patient interviews, pre-post surveys and medical record audits will be used to analyse the need for catheter self-management and evaluate the effectiveness of delivery modalities, uptake and efficacy of these interventions. A pre-post survey of nurses will be conducted at baseline, completion of the educational interventions and at 6-month post intervention to analyse the efficacy of these interventions in upskilling nurses to deliver improved patient care. The data collected from nurses' interviews and pre-post surveys will be used to evaluate the practicality of these interventions in a busy clinical setting along with integration and application of knowledge gained to transform clinical practice. Process evaluation of the feasibility components of the bundle of care interventions are described in [Table 2](#).

**3.4. Ethical considerations**

Ethical awareness and competencies are essential for nurses to uphold the values of the nursing profession and respect the rights of patients and all stakeholders ([Schneider et al., 2016](#)). This study conforms with the declaration of Helsinki and Cantín (2018) is a low to negligible risk study with no foreseeable risks of harm to participants that is no greater than which they routinely experience in everyday practice. Informed witnessed verbal consent will be taken from all participants before study enrolment. Patient information sheet, explaining the study will be sent to all participants before interviews. Participants' consent will be recorded in the audio data before commencing the interview. Data including audio recording will be stored on the local health district's specific drive for research which is customised to have password protection and access authentication. Only authorised investigators will have access to the stored data files with access authenticated using staff ID and password. Stored data will be destroyed after five years of the study completion. Ethics approval was received from the Western Sydney Local Health District (HREC/2019/ETH12575) and

**Table 2**  
Evaluation plan.

Aim	Evaluation component	Process evaluation	Data source	Timing of data collection
Improve knowledge, self-efficacy, self-management and quality-of-life of patients.	Quantitative Data Knowledge: IQ-IDC study questionnaire (Questions 38-41) Self-efficacy: C-SE scale Self-management: C-SMG scale Qualitative data Attitudes, beliefs, previous experiences, environmental and social factors (barriers and enablers) influencing the intended behaviour change and adjustment of life with a catheter.	Process evaluation of the following components of feasibility (Bowen et al., 2009) Demand: Needs analysis assessment for catheter self-management interventions, Implementation: Delivery modalities and sustainability of the interventions, Acceptability: Uptake and efficacy of interventions	Quantitative Data Prepost patient surveys and usage of interventions captured via 'GoShare Healthcare'. Qualitative data Patient interviews and feedback on the interventions via 'GoShare Healthcare'.	Baseline and at the 6-month follow-up.
Upskill nurses to adhere to evidence-based practice, reduce variability, and standardise catheter care.	Quantitative Data Knowledge & skills: Prepost intervention survey, 6-months post-intervention survey and 'Qstream data' Qualitative data Opportunities and enablers to upskill practice in alignment with evidence-based catheter care.	Process evaluation of the following components of feasibility (Bowen et al., 2009) Practicality: Microlearning is feasible in view of resources, time constraints and staff commitment Integration: Access to Qstream application and access to mobile internet device in clinical practice. Limited-efficacy testing: Application of knowledge gained from interventions in clinical practice.	Quantitative Data Prepost intervention survey, 6-months post-intervention survey and uptake of interventions captured via 'Qstream'. Qualitative data Combination of nurses' interviews, ongoing feedback of the educational interventions via Qstream.	Pre-post intervention survey and at the 6-month post-intervention survey.
Reduce potentially avoidable urinary catheter-related hospital presentations, including CAUTIs.	Quantitative Data Prepost intervention data: Number of catheter-associated complications, iatrogenic incidents, hospital presentations/stay and antibiotic usage. Cost analysis based on the utilisation of resources.	Statistical analysis of pre-post intervention data in relation to service delivery and resources/cost saving.	Quantitative Data Demographic and clinical data extracted from the electronic medical records, pre-post intervention surveys and auditing patient's electronic medical records.	Baseline and at the 6-month and 12-month follow-up.

Western Sydney University Research Ethics Committee (RH13650). In addition, this study has received the approval of Australian New Zealand Clinical Trials Registry. All study personnel have completed the Good Clinical Practice (GCP) training as per local guidelines. The findings of this study will be disseminated through peer-reviewed publications and presentations at national and international conferences.

**4. Validity and reliability**

To improve the trustworthiness of the qualitative component of this project, the following criteria will be used to address credibility, transferability, dependability and confirmability (Schneider et al., 2016). Individual reflection and peer debriefing will assist in a timely assessment of the findings and the research methods. Findings of this project can be transferred to other local health districts and aged care facilities. The study sites' contextual details, participants, and the interview and/or survey questions will be analysed to ensure transferability. An audit trail will be maintained to record all the methodological decisions and data collection steps. All data will be digitally recorded, systematically evaluated by multiple investigators, and confirmed by participants. Measures will be taken to verify that the interviews' information is solely from the participants and not influenced by the researcher's presumptions and thoughts.

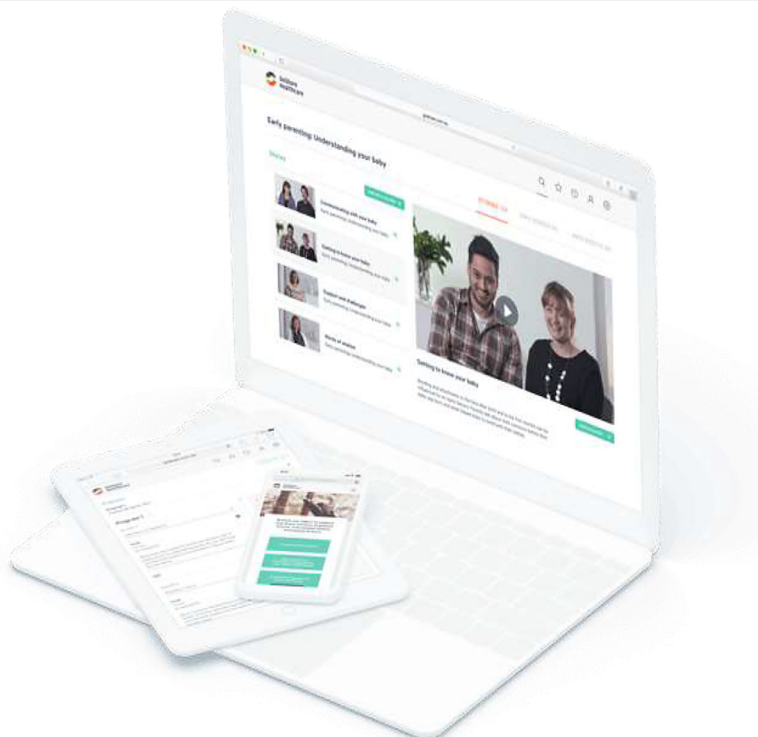
**5. Discussion**

Community based urinary catheter-associated complications contribute to avoidable, costly hospital presentations (Parker et al., 2017). For example, in Australia, an estimated 380,600 additional public hospital bed days annually, are attributed to healthcare-associated urinary tract infections, and these are primarily due to CAUTI (Mitchell, Ferguson, Anderson, Sear, & Barnett, 2016). Catheter-associated complications such as recurrent urinary tract infections, catheter blockages, and urine leakage are common adverse events experienced by patients with long-term catheters (Wilde et al., 2013), and result in significant patient- and healthcare-related burden (Agency for Clinical Innovation, 2016), as they adversely impact on patients' quality of life, morbidity and mortality (Gilbert, Naidoo, & Redwig, 2018). From the perspective of economic expenditure, each incidence of CAUTI is estimated to cost between \$1,200 and \$4,700 USD (Umscheid et al., 2011). The expenditure and negative impact on health outcomes could be averted with structured, quality education provided by nurses on self-management practices, which have been reported to increase patients' sense of control, self-efficacy, and facilitate adjustment to living with an IDC (Wilde et al., 2013).

Insertion and management of IDCs are one of the commonly performed nursing skills in clinical practice and highly regarded as being within the nursing domain and scope of prac-

**Box 1**

Digital based education- “GoShare Healthcare” for patients.



This digital platform will enable efficient and measurable distribution of evidence-based interventions and/or resources tailored to patients' information needs (GoShare, 2019). The use of this digital information-sharing platform for patients has been shown to enhance patients' self-efficacy and self-care behaviours (Campbell, Dunt, Fitzgerald, & Gordon, 2015). Another advantage of using this digital platform is the convenience and speed of delivering patient information (Hebden et al., 2014), as most IDC insertions occur in acute inpatient settings (Giles et al., 2019). Patients can repeatedly access this information using an application available to be sent to their smartphone, as an email, or short message service (SMS). Message timing and content can be tailored to their needs after discharge from the hospital. This digital platform can also collect data for nurses to monitor patient engagement, of posted learning resources, as part of the bundle of care intervention (GoShare, 2019).

tice (Newman, 2007). Nurses are often at the frontline of health care delivery and uniquely positioned to prepare, educate, counsel and support the patients in the hospital and community settings to adjust to life with a catheter (Godfrey, 2008; Prinjha et al., 2016). Nurses are the main providers of IDC patient education, however, little is known about nurses' understanding and awareness of the information their patients are accessing or information that may be readily available for patients (Mackay et al., 2018). Recent studies identified the knowledge gap amongst nurses, especially in monitoring the ongoing need of IDC, and their unwillingness to remove the catheter as soon as it is no longer required (Clinical Excellence Commission, 2013; De Jaeger, 2011; Giles et al., 2019). In addition, previous studies reported variability in nurses' knowledge levels and confidence in the decision-making process, in terms of the indication for an indwelling urinary catheter, insertion technique, providing education about catheter care and managing catheter-associated complications (Agency for Clinical Innovation, 2016; Mackay et al., 2018). Therefore, co-designing interventions that will better equip nurses to provide patient education regarding IDC care, coupled with interventions that aim to improve patient's self-management and self-efficacy, will help improve clinical outcomes and quality of life of patients with IDC.

There is often inadequate documentation about the indication for urinary catheter insertion, ongoing care or when the catheter can be removed (Clinical Excellence Commission, 2013; De Jaeger, 2011), contributing to an increased risk of catheter-associated complications. Although previous research has addressed the knowledge gap and skills of junior medical officers

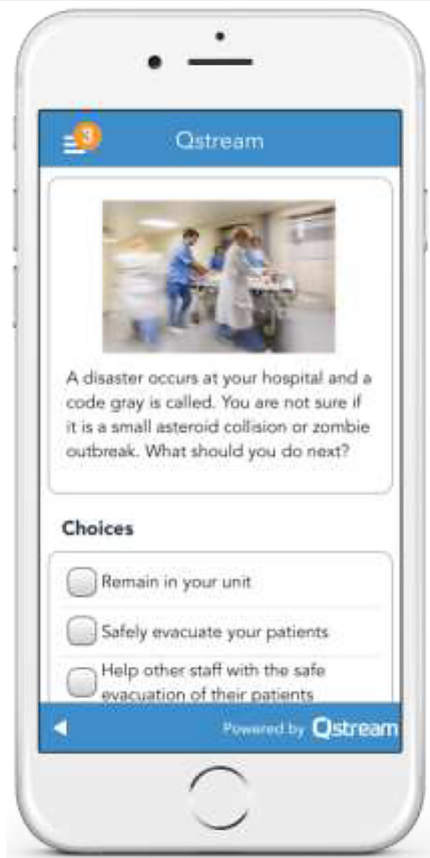
in IDC insertion (Manalo, Lapitan, & Buckley, 2011), to date there is little available literature that explores the nurse's knowledge, skills and confidence in IDC management (Carr, Celenza, & Lake, 2009; Manalo et al., 2011). It is critical to equip nurses with the confidence and competence to perform the catheterisation procedure safely, while simultaneously preparing them to provide the best possible support to patients with best practice catheter self-management.

## 6. Limitations

Potential limitations of this proposed study are exclusion of children and intermittent catheter users. Careful selection of the co-design members will be conducted with academic experts, based on participants' knowledge, background, and motivations to facilitate a collaborative approach in transforming the knowledge to design and develop care bundle interventions. Cultural diversity and patient's health literacy levels will be considered, and measures will be taken to improve patients' participation and engagement in data collection, delivery and evaluation of interventions. Patient surveys developed based on the C-SE and C-SMG instruments will be tested and modified based on the patient's feedback and recommendations. High attrition and low adherence to the interventions will be managed with periodic reminders, breaking down the complex learning contents to smaller pieces and spaced distribution of the bundle of interventions based on participants needs. To support engagement in the educational interventions, a robust onboarding process will be implemented at commencement

**Box 2**

Digital based education - Qstream for nurses.



Qstream is a clinically proven micro-learning digital platform demonstrated to increase clinician's knowledge and behaviour change (Qstream™, 2020). Nurses who participate in the study using Qstream will be presented with multiple-choice questions via smartphone or email, in relation to indications, monitoring to prevent complications and patient education strategies, along with in-depth clarification of answers, take-home messages and resources based on current evidence. In a busy hospital or community setting with increasing demands on direct and indirect patient activities, delivering small quantities of educational content in repeating patterns over time is more efficient than the traditional educational modalities (Phillips et al., 2019). The pedagogical benefit of spaced distribution of educational content enhances knowledge retention and the online or SMS delivery of educational topics are ideal for nurses due to workplace context and constraints (Ferguson et al., 2019; Phillips et al., 2017).

where a research team member will provide training to participants on the interventions.

## 7. Conclusion

Findings from our published review consistently showed patients living with an IDC are not equipped with the essential information for catheter self-management. Of concern, some patients are discharged home from hospital with an IDC but provided with little pertinent information upon discharge to self-manage their IDC. Not surprising, patients living with IDCs in community settings are often anxious or fearful about accidental removal of the catheter, urine leakage, pain and discomfort, in addition to the adverse impact on their self-image and quality of life, of having to live with an IDC. Nurses are at the frontline of health care delivery and uniquely positioned to prepare, educate, and support the patient to adjust to living with the catheter. Yet, little is known about nurses' understanding and awareness of the information their patients are accessing, or information that may be readily available for patients. Hence, to improve patient outcomes of those living with an IDC in the community, this study aims to design, implement and evaluate a bundle of care intervention that includes both

resources, information and education packages for patients, carers and nurses.

## Author contribution statement

JA, YS and CF were responsible for the study conception and design. JA, YS, CF, LR and JM were responsible for drafting the manuscript. All authors (JA, YS, CF, LR, JM & LL) made critical revisions to the paper for important intellectual content.

## Funding

JA is funded through a 2018 Western Sydney Local Health District Research & Education Network Nursing & Midwifery Kick-starter Grant, a 2019 Integrated and Community Health Research Launchpad Grant and a 2020 Westmead Charitable Trust Nursing & Midwifery Career Development Grant.

CF is funded through a Postdoctoral Research Fellowship (Ref: 102168) from the National Heart Foundation of Australia and receives funding from the National Health & Medical Research Council Investigator Grant 2020-2025 (APP1196262).



## Ethical statement

Ethics approval was received from the Western Sydney Local Health District (HREC/2019/ETH12575) and Western Sydney University Human Research Ethics Committee (RH13650). In addition, this study has received the approval of Australian New Zealand Clinical Trials Registry (ACTRN12621000683831).

## Conflict of interest

No conflict of interest has been declared by the authors.

## Acknowledgements

This research was supported by Western Sydney University and Western Sydney Local Health District. We thank Western Sydney Nursing and Midwifery Research Centre for assistance and support. We would also like to show our gratitude to Juanita Taylor and Jennifer Fitzsimons (Director of Nursing, Midwifery & Clinical Governance, Integrated and Community Health), Rose Roco (Nurse Manager, Integrated and Community Health) and our nursing colleagues for sharing their pearls of wisdom with us during the course of this research.

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