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Impact of Catheter-associated Urinary Tract Infection (CAUTI) Education Package on Nurses’ Knowledge and Practices

Monina Hernandez Gesmundo

A thesis submitted in partial fulfilment of the requirements for the degree Master of Nursing, the University of Auckland, 2016
Abstract

ABSTRACT

Objectives: The purpose of this study was to determine the impact of a catheter-associated urinary tract infection (CAUTI) education package on the knowledge and indwelling catheter management practices of nurses. Specific objectives include: to identify baseline data on nurses’ attitude, knowledge and catheter management practices and to develop an educational intervention aimed at addressing knowledge or care management deficits.

Methods: The study was conducted at two post-operative wards of a tertiary public hospital. A multi-phased mixed methods approach utilising focus group discussions, pre-test and post-test and document analysis of catheter maintenance checklists was conducted. The first phase was exploratory and focus groups were utilised to identify existing attitude associated with catheter management. Following this, an education session focusing on evidence-based guidelines was developed to address deficits from phase one. After the education session, pre-test and post-test was conducted to compare the nurses' level of knowledge on CAUTI prevention. Document analysis of checklists was conducted post-intervention to evaluate how knowledge gained translated into practice.

Findings: Focus groups revealed that nurses had diverse training, and had feelings of inadequacy and lack of confidence related to catheter management skills, hence the diversity in practices. Diversity in practice can be addressed by standardising organisational policies. Nurses feel responsible for catheter care and expressed the need for empowerment to make catheter care decisions. Fourteen participants completed the pre and post-test. Statistical analyses utilising paired t-test indicate a significant difference (p < 0.0001) in the overall score of participants between the pre and post-test, with a mean difference of 6.64 and 95% CI of (4.96, 8.33). Document analysis of catheter maintenance checklists revealed that while documentation is not optimal, nurses adhered to catheter care evidence-based guidelines. The checklist itself served as procedure prompt and improved care documentation.

Conclusion: The introduction of a CAUTI education package had a significant impact on nurse’s knowledge and indwelling catheter management practices. Effective CAUTI prevention education required that all components of catheter care be addressed. Catheter care involves collaborative care, thus, continuous education of nurses and everyone involved in catheter care utilising multi-faceted strategies is essential in CAUTI prevention.
ACKNOWLEDGEMENTS

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My gratitude also goes to the charge nurse managers, educator and staff of Manukau Surgery Centre for their valuable time and support in making this study possible.

I also acknowledge the support of the Infection Prevention and Control team of Counties Manukau Health, most especially to you (you know who you are) who took over my areas when I went on annual leave to concentrate on this study. I know that my work is in good hands with you around.

I would also like to thank my family – my dad and brothers, back home. Thank you for being there whenever I needed you most. You know that distance will never break our bond.

Finally, my deepest gratitude to Kala and Lay for bearing with me when I cannot do my home duties because of my deadlines, for tolerating my voice when I sing to de-stress, for inspiring me to work harder and for the positivity that abound at home. Young as you are, you inspire me to be a better person every day.
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Chapter 1 - Introduction

Chapter 1. INTRODUCTION

The prevention of catheter-associated urinary tract infection (CAUTI) is fundamental to patient safety. CAUTI is the most common healthcare-associated infection (HAI) worldwide (Siddiq & Darouiche, 2012). Forty percent of HAIs are due to urinary tract infections (UTI) and 80% of these UTIs are attributed to indwelling catheters (Saint & Chenoweth, 2003; Weber et al., 2011).

The most common CAUTI complications include infection of different parts of the genito-urinary tract such as cystitis, pyelonephritis, prostatitis, epididymitis, orchitis in males (Centers for Disease Control [CDC], 2013); and life-threatening gram-negative bloodstream infections (Saint & Chenoweth, 2003; Lo et al., 2014; Gould et al., 2009; CDC, 2013). Less common complications include endocarditis, vertebral osteomyelitis, septic arthritis, endophthalmitis, and meningitis (CDC, 2013).

Prolonged catheter use is the major risk factor for CAUTI (Gould et al., 2009; Burton, Edwards, Srinivasan, Fridkin & Gould, 2011; Mohajer & Darouiche, 2013). With the catheter in place, the daily bacteriuria risk is about 3 to 7% (Tambyah, Halvorson & Maki, 2000; Rebmann & Greene, 2010; Institute for Healthcare Improvement [IHI], 2011). This risk increases to 25% when the catheter remains in place for one week and increases to nearly 100% when the catheter stays for up to a month (Tambyah, et al., 1999; IHI, 2011). Among those patients with bacteriuria, 10% will develop CAUTI while 3% will progress to bloodstream infection (Saint & Chenoweth, 2003; IHI, 2011). Patients with bloodstream infections associated with bacteriuria have a threefold higher chance of dying compared to patients without bacteriuria (Rebmann & Greene, 2010). Bloodstream infections result in discomfort, prolonged hospital stay, increased cost and sometimes, death (Saint & Chenoweth, 2003; Lo et al., 2008; Gould et al., 2009; CDC, 2013). CAUTI, indeed, has such a huge impact on the quality of patient care.

Catheter-associated urinary tract infections also create inefficiencies in relation to cost. The available literature from the US indicate that each CAUTI event costs between US $500 to $700; thereby annually costing the US $424 to $451 million in excess expenditures (Burton, et al., 2011; IHI, 2011). In the UK, each CAUTI episode costs around £1,968 (Ward, Fenton & Mayer, 2010), thereby annually costing the National Health Service £99 million (Davenport &
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Keeley, 2005). CAUTI events prove to be very costly not only for the patient, but for the healthcare system in general.

Various literatures on CAUTI surveillance cost and prevention have been published in other countries. In New Zealand (NZ) however, national reporting of CAUTI is yet to be institutionalised. Although HAIs are mapped as indicators of a system-level measure of adverse events; HAIs, including CAUTI, still require further work with regard to national data availability and understanding (Health Quality & Safety Commission [HQSC], 2012a).

The clinical consequences and economic burden of CAUTI makes it imperative for prevention measures to be implemented in order to improve patient care. A huge part of daily patient care is delivered by nurses, thereby enabling them to play a significant role in CAUTI prevention. Nurses are responsible for placing and maintaining the urinary catheter, including cleaning and other routine cares (Ribby, 2006). Although there is considerable variability in literature on ways of preventing CAUTI, a systematic review of clinical practice change interventions indicate that multifaceted interventions are more effective when compared to single interventions (Boaz, Baeza & Fraser, 2011). Multifaceted interventions such as those released by the CDC in 2009 outline evidence on various CAUTI prevention interventions such as nurse-focused education and guidelines, use of checklist and algorithm and performance feedback regarding catheter care (Gould et al.,2009). Specific aspects of this guideline are driven by nurses, in collaboration with infection prevention and control practitioners, and other members of the healthcare team for better patient outcomes.

Infection prevention and control practitioners play a significant role in reducing the incidence of CAUTI in acute care settings. Their responsibilities include policy and best practice subject matter expertise, surveillance, risk-assessment and facilitation of infection-related improvement projects (Rebmann & Greene, 2010). The author of this study is an infection prevention and control practitioner who works for Counties Manukau District Health Board. Part of her responsibilities is to undertake surveillance of hospital-acquired infections using epidemiologic principles and to lead, develop and deliver infection control education sessions for staff all over the organisation. In the past, the author has also worked for eight years as a university lecturer overseas, thus, the author believes that she is well placed to undertake this study.
Chapter 1 - Introduction

This study was conducted at Counties Manukau District Health Board (CMDHB). CMDHB provides hospital based services for the population of Counties Manukau and access to specialist or highly complex services to people referred from other District Health Boards (Counties Manukau District Health Board [CMDHB], 2013a). CMDHB is responsible for the promotion, protection and improvement of health of the Counties Manukau population which can be described as relatively young, culturally diverse - mostly coming from Māori Pacific and Asian background, and socio-economically deprived based on the NZ Deprivation Index 2006 (CMDHB, 2013a). Socio-economic deprivation is known to have a significant impact on health and health service provision.

This study aims to answer the research question, “What is the impact of a CAUTI education package on the knowledge and indwelling catheter management practices among nurses?”

The purpose of this study is to determine the impact of a CAUTI education package on staff nurses' knowledge and indwelling catheter management practices. The study was conducted at the two post-operative wards of Manukau Surgery Centre (MSC) of CMDHB. These wards were chosen based on the 2009 Centers for Disease Control (CDC) recommendation that highlights catheter removal within 24 hours for uncomplicated surgeries, unless the indication is documented (Gould et al., 2009; IHI, 2011).

The study utilised a multi-phased mixed methods approach to address the research objectives. Mixed methods approach uses both quantitative and qualitative data to answer the research question (Moule & Goodman, 2009; Creswell, Klassen, Plano Clark & Smith, 2011). This research explored the nurses’ existing attitude towards catheter care and looked into the impact of a CAUTI education package on the nurses’ knowledge and practices. The first phase was an exploratory phase in which focus groups were utilised to identify existing attitude, knowledge and practices associated with indwelling catheter management. Following this, an education session was planned as an intervention aimed at addressing deficits from phase one. Alongside the delivery of education session, a pre-test and post-test was conducted to measure and compare the nurses' level of knowledge on CAUTI prevention. Document analysis of the catheter maintenance checklist was conducted post-intervention to evaluate how knowledge gained translated into catheter management practice.

The education package involved a lecture on evidence-based indwelling catheter management guidelines; and, the introduction of a catheter management algorithm and a checklist that
contains procedure-specific evidence-based recommendations from the CDC. The checklist served as a procedure prompt and tool in measuring the nurses’ indwelling catheter management practices, whereas, the algorithm facilitated decision making in terms of catheter insertion and removal. Both the checklist and the algorithm are a novelty in catheter management in CMDHB. While CMDHB has existing policies on indwelling catheter management, none of the wards, including the setting for this research, has implemented the use of algorithms and checklists on indwelling catheter management.

This thesis has seven main chapters. The first chapter introduces the topic, states the research question and provides an overview of the study. The second chapter presents current literature that highlight trends in CAUTI prevention. The chapter starts with a definition of CAUTI, and proceeds with a discussion of CAUTI pathophysiology or how it occurs. This is followed by a discussion of the importance of prevention, the trends in reducing CAUTI risk factors and nurses’ role in this endeavor. Chapter two also identifies gaps in literature that justify the conduct of the study in CMDHB. The third chapter describes the methodology, methods of data gathering and the rationale behind these methods. Chapter three further describes how the data-gathering tool was pre-tested to improve its reliability and validity.

Chapters four to six present the findings of the study. Chapter four presents the key themes from the focused group discussions. Chapter five presents the pre-test ant post-test findings utilising graphical, tabular and textual presentations; and the results of hypothesis testing and statistical analysis. Chapter six presents the result of document analysis as applied to the use of self-administered indwelling catheter maintenance checklists. Finally, chapter seven presents an analysis of the findings in view of current literature and proceeds with the strengths and limitations of the study, conclusion and recommendations.

The clinical consequences and economic burden of CAUTI has a huge impact on patient care in general. Thus, it is imperative that CAUTI prevention measures be implemented in the hospital setting to reduce this burden. This study introduced and evaluated the impact of a multifaceted CAUTI prevention package that centred on the education of nurses at two post-operative wards in CMDHB. The study findings will potentially contribute to the growing literature on CAUTI prevention and serve as an impetus for the implementation of a quality improvement programme on CAUTI prevention in CMDHB.
Chapter 2 – Literature Review

Chapter 2. LITERATURE REVIEW

2.1 Introduction
There is a wealth of literature published on catheter-associated urinary tract infections (CAUTI), the associated risk factors and the ways of preventing CAUTI risks. This chapter provides an extensive review of evidence-based strategies to minimise CAUTI risks and nursing staff education as an implementation strategy to prevent CAUTI.

Chapter two starts with a discussion of the search strategy, followed by the definition of CAUTI and proceeds with a brief explanation of its pathophysiology. This is followed by a discussion of the various risk factors, with focus on the modifiable risks and how these relate to the recommended prevention strategies. The discussion of CAUTI prevention strategies starts with a review of evidence-based general strategies followed by a detailed examination of the four major components of indwelling catheter care. Proper indwelling catheter care requires education of health professionals and clients, along with reinforcement prior to and during implementation. Nurse-focused education and the use of a checklist and algorithm for proper catheter care were shown to significantly reduce CAUTI risk (Gould et al., 2009; IHI, 2011). Thus, literature on education and other multifaceted implementation strategies to prevent CAUTI is presented in this chapter. Finally, chapter two also provides a discussion of CAUTI prevention initiatives in New Zealand and how this relates to the need to conduct this study.

2.2 Search strategy
Several databases such as CINAHL Plus (Cumulative Index to Nursing and Allied Health Literature), Cochrane Database of Systematic Reviews, MEDLINE and PubMed were searched for relevant articles on catheter-associated urinary tract infection and prevention strategies. Limits were set using years of publication (2004-2014), English language, and also the Boolean operators “AND” and “OR”. The original search terms used were “urinary catheter”, “indwelling urinary catheter”, “foley catheter”, “long-term urinary catheter”, “infection”, “risks”, “effects”, “complications” and “outcomes”. The primary search resulted in a large number of articles that were combined with the words “prevention”, “reduction”, “elimination”, “control”, “limit”, “stop”, “strategies”, “intervention”, “programme”, “project”, “education”, “training”, “lecture”, “teaching”, “instruction”, “guidance”, “guide”, “guideline”, “policies”, “protocols”, “healthcare workers”, “health workers”, “health professionals”, etc.
“nurses”, “staff” and “doctors” to limit the search. The website of the Centers for Disease Control and Prevention (CDC) was also manually searched for relevant guidelines, recommendations and list of references. The CDC is the leading national public health institute of the United States of America and is recognised globally for the guidance that it provides in protecting public health and safety through disease prevention and control. Additional manual searches were done using the reference lists of relevant articles and suggested articles linked with relevant articles. Seminal papers were included regardless of year of publication. The references were further expanded to include those published in 2015 to keep the discussion current. The current study was conducted in an adult acute inpatient setting, thus, research done in paediatric and adult community settings were also excluded.

2.3 CAUTI definition

The definition of CAUTI varies around the world as does the criteria for identifying CAUTI. One of the more commonly used definitions by various organisations worldwide is that of the National Healthcare Safety Network (NHSN), the patient safety surveillance system of the CDC. The NHSN is the United States of America’s leading and most widely used infection tracking system. The NHSN provides organisations with data needed to identify problems, measure progress of prevention programmes and eliminate healthcare-associated infections.

The infectious diseases service of the current research setting adapts definitions and guidelines from the NHSN and the CDC for organisational use. The CDC published its CAUTI definition together with guidelines for CAUTI prevention in 1981 and these were consequently updated in 2009 (Gould et al., 2009), 2014 (Lo et al., 2014) and in 2015 (CDC, 2015).

The NHSN define CAUTI as urinary tract infection in a person with indwelling catheter for more than two days and at least one of the following criteria: with catheter still in place, the person develops at least one of the following – fever (> 38°C), suprapubic tenderness, costovertebral angle pain, and, a positive urine culture of ≥ 10^5 colony-forming units (CFU)/ml with no more than two species of microorganisms; or, with catheter removed the day prior to or on the day the person manifests at least one of the following – fever (> 38°C), urgency, frequency, dysuria, suprapubic tenderness, costovertebral angle pain, and, a positive urine culture of ≥ 10^5 CFU/ml with no more than two species of microorganisms (CDC, 2015). Asymptomatic bacteriuria was removed from the definition in January, 2009 because of the absence of signs and symptoms in the patient (Press & Metlay, 2013).
2.4 CAUTI pathogenesis

Indwelling urinary catheters are used therapeutically to facilitate urinary elimination; however, inappropriate use also poses as mechanical and physiologic risk (Siddiq & Darouiche, 2012). Urinary catheters mechanically erode the bladder mucosa aside from causing ischemic damage when distention occurs due to catheter blockage (Trautner & Darouiche, 2004; Siddiq & Darouiche, 2012). Urinary catheters also provide an ascending route of bacterial entry from the colonised perineum to the sterile bladder at its internal and external surfaces (Trautner & Darouiche, 2004; Gould et al., 2009; Rebmann & Greene, 2010; Siddiq & Darouiche, 2012; Chenoweth & Saint, 2013). Sixty-six percent of CAUTI are due to microorganisms that colonise the perineum and intestinal tract (Chenoweth & Saint, 2013), while 34% are due to urine collection systems contaminated by healthcare personnel hands (Saint & Chenoweth, 2003). Bacterial multiplication is enhanced when urine accumulates in the bladder or catheter itself due to mechanical blockage (Saint & Chenoweth, 2003; Trautner & Darouiche, 2004; Siddiq & Darouiche, 2012). Thus, it is common to see bacteriuria associated with multiple microorganisms in patients with prolonged catheter use (Rebmann & Greene, 2010).

The presence of a urinary catheter also disrupts the normal defence mechanism of the bladder (Siddiq & Darouiche, 2012; Chenoweth & Saint, 2013). When present in the urinary system, bacteria binds to the sterile mucosa thereby initiating an inflammatory response characterised by influx of neutrophils and shedding of epithelial cells where the bacteria is bound (Trautner & Darouiche, 2004). However, this normal defence mechanism, is bypassed when bacteria binds to catheter surfaces and forms a biofilm (Trautner & Darouiche, 2004; Chenoweth & Saint, 2013).

Biofilms are film-like slimy structures attached to a surface. It is composed of communities of microorganisms that secret a polysaccharide mixture that confer cover and protection to allow microbial proliferation (Habash, & Reid, 1999; Mah & O’Toole, 2001; Nikolaev & Plakunov, 2007). Biofilm formation is central in CAUTI development (Trautner & Darouiche, 2004). Three components are needed in biofilm formation, namely: microbial attachment either to a surface, such as a urinary catheter, or to each other; genetic material exchange, and extracellular matrix formation made out of host components and secreted microbial products (Saint & Chenoweth, 2003; Trautner & Darouiche, 2004; Nikolaev & Plakunov, 2007).
Chapter 2 – Literature Review

Biofilm forms when a conditioning film composed of host urinary components such as proteins, electrolytes and other organic material accumulate (Habash, & Reid, 1999; Trautner & Darouiche, 2004; Siddiq & Darouiche, 2012) and attach itself to a surface such as a urinary catheter. Urinary catheters develop biofilm in their inner and outer surfaces after insertion (Saint & Chenoweth, 2003). This traps free-swimming microorganisms which then multiples, attracts more bacteria and further secretes extracellular matrix (Trautner & Darouiche, 2004; Siddiq & Darouiche, 2012). Biofilm microorganisms function as a community and communicate closely with one another (Watnick & Kolter, 2000; Nikolaev & Plakunov, 2007; Siddiq & Darouiche, 2012). Intercellular communication directs the formation of loosely packed organic structure with fluid channels to allow nutritional and waste material exchange (Nikolaev & Plakunov, 2007; Siddiq & Darouiche, 2012). Some microorganisms also detach from the biofilm and seed the urine (Trautner & Darouiche, 2004; Siddiq & Darouiche, 2012). Biofilms are also shown to migrate to the bladder within one to three days (Saint & Chenoweth, 2003). An electron microscopy study of 50 indwelling urinary catheters that stayed in situ for a mean of 35 days showed that 44 of the catheters had biofilms ranging from a depth of three to 490 microns with visible bacterial cells up to 400 cells deep (Ganderto, Chawla, Winters, Wimpenny & Stickler, 1992).

Biofilms provide survival advantage to microorganisms through: resistance to being swept away by shear forces, resistance to being engulfed by other cells and resistance to antimicrobial agents (Nikolaev & Plakunov, 2007; Siddiq & Darouiche, 2012). Studies have shown that antimicrobial agents do penetrate biofilms; however, the slow growth of microorganisms in a biofilm confers antimicrobial resistance (Mah & O’Ttoole, 2001; Trautner & Darouiche, 2004; Chenoweth & Saint, 2013). The affinity of microorganisms with each other in a biofilm also permits exchange of antimicrobial resistance genes (Trautner & Darouiche, 2004), thereby increasing the risk for other CAUTI complications.

2.5 Risk factors associated with CAUTI

The risk factors associated with CAUTI can be divided into two major groups: non-modifiable risk factors and modifiable risk factors. This study focuses on the modifiable risk factors to prevent CAUTI.
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2.5.1 Non-modifiable risk factors
At the patient level, non-modifiable risk factors identified in the literature include: female sex (gender), severe underlying illness, age of more than 50 years, diabetes mellitus (Burton et al., 2011; King et al., 2012), prior stroke, length of hospital stay (King et al., 2012), lack of antimicrobial exposure (Gould et al., 2009) and admission in an Orthopaedic or urological service (Mohajer & Darouiche, 2013). Serum creatinine greater than 2 mg/dl, which may be an indicator of renal insufficiency, has also been identified as another factor (Burton et al., 2011; King et al., 2012). Treatment of pre-existing health conditions such as diabetes mellitus, stroke and renal insufficiency may prevent other complications, however, patients with these medical problems are shown to be more prone to the development of CAUTI as a complication (King et al., 2012; Mohajer & Darouiche, 2013).

2.5.2 Modifiable risk factors
Prolonged catheterisation is the major risk factor for the development of CAUTI (Gould et al., 2009; Burton et al., 2011; Mohajer & Darouiche, 2013; Lo et al., 2014). Various literature indicate that reducing the unnecessary insertion of indwelling catheters and minimising the duration of catheter use are the primary CAUTI prevention strategies (Gould et al., 2009; Lo et al., 2014).

Other modifiable risk factors that are clinically proven to result in CAUTI include non-compliance to aseptic catheter care, catheter insertion after the sixth day of hospitalisation, catheter insertion outside the operating room (Burton et al., 2011), and disconnection of the drainage system (Gould et al., 2009; King et al., 2012). Non-adherence to aseptic technique during catheter insertion has also been associated with increased risk of bacteriuria (Chenoweth & Saint, 2013). These modifiable risk factors are the focus of the CAUTI prevention strategies presented in the succeeding discussion.

2.6 Strategies to prevent CAUTI
Multiple strategies have been shown to prevent CAUTI and these have been published by the CDC in 1981 and consequently updated in 2009 (Gould et al., 2009) and 2014 (Lo et al., 2014). Other organisations such as the Infectious Diseases Society of America (IDSA) and the Department of Health in Great Britain have also published its CAUTI prevention guidelines between 2001 and 2010 (Lo et al., 2014). The Institute for Health Care Improvement (IHI) has adopted these guidelines and published recommendations on how to prevent CAUTI in 2011.
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In New Zealand, national reporting of CAUTI is yet to be institutionalised. CAUTI requires further work with regard to New Zealand national data availability, research and guideline development (HQSC, 2012).

General strategies for CAUTI prevention include strict adherence to hand hygiene (Boyce & Pittet, 2002) and appropriate use of antimicrobials with reduced use of broad-spectrum antimicrobials to prevent the development of antimicrobial resistance among microorganisms in the urine (Chenoweth & Saint, 2013). Specific individual interventions include: limited use of urinary catheters by ensuring appropriate indications for catheter use (Trautner & Darouiche, 2004; Phipps et al., 2006; Griffiths & Fernandez, 2009; Gould et al., 2009; Rebmann & Greene, 2010; Chenoweth & Saint, 2013; Mohajer & Darouiche, 2013; Murphy, Fader & Prieto, 2013); perioperative management of urinary catheters, including early catheter removal in uncomplicated surgeries; catheter alternatives; aseptic technique on insertion and maintenance of catheters; use of antimicrobial catheters (Chenoweth & Saint, 2013); closed drainage system maintenance; maintenance of unobstructed urine flow; and ensuring only trained persons insert catheters (Gould et al., 2009, Rebmann & Greene, 2010). In 2009, the CDC recommended minimal catheter use and limited duration of use in all patients, especially those of higher CAUTI risk such as women, elderly and immune-compromised (Gould et al., 2009). These strategies and recommendations are summarised into the four components of catheter care to prevent CAUTI as published by IHI in 2011. The four components of care include: avoid unnecessary use of urinary catheters, insert urinary catheters using aseptic technique, maintain urinary catheters based on recommended guidelines, review the necessity of the urinary catheter daily and ensure prompt removal (IHI, 2011).

The succeeding discussion expands the scope of the four components of care as proposed by IHI in 2011 to include other recommendations. The four components of care to prevent CAUTI for the purpose of this study include: reduce inappropriate use of urinary catheters, perform proper techniques for indwelling catheter insertion, implement proper catheter maintenance procedures, and remove catheters in a timely manner.

2.6.1 Reduce inappropriate use of urinary catheters

The presence of a urinary catheter is the primary risk for CAUTI, thus, reducing its inappropriate use is the best way to prevent it (Bernard, Hunter & Moore, 2012; Chenoweth & Saint, 2013). Indwelling urinary catheters facilitate colonisation with urine microorganisms by
providing a surface for the attachment of biofilms. Urinary retention, urinary obstruction, close monitoring of intake and output of critically ill patients, risk of worsening sacral decubitus ulcer due to urinary incontinence and comfort care are some of the indications for short term catheterisation (Gould et al., 2009; Titworth et al., 2012; Mohajer & Darouiche, 2013; Murphy et al., 2013). Other indications for urinary catheter placement include peri-operative use for: selected surgical procedures that last more than three hours, management of acute urologic conditions when straight catheterisation is not possible (Gould et al., 2009; Titworth et al., 2012; Murphy et al., 2013), patients undergoing urologic surgery or other surgery on structures of the genitourinary tract, patients anticipated to receive large-volume infusions or diuretics during surgery, and the need for intraoperative monitoring of urinary output (Gould et al., 2009). Urinary catheterisation may also be indicated for patients requiring prolonged immobilisation (Gould et al., 2009).

Inappropriate use of indwelling catheters include: as substitute for nursing care of incontinent patients or residents; as a means of obtaining urine for culture or other diagnostic tests when the patient is capable of voiding voluntarily and for prolonged postoperative duration without appropriate indications (Gould et al., 2009).

2.6.2 Perform proper techniques for indwelling catheter insertion

Various evidence-based recommendations with regard to the proper insertion of indwelling catheters are discussed below.

Aseptic technique and the use of sterile equipment

Aseptic technique and the use of sterile equipment is recommended when inserting urinary catheters to prevent CAUTI (Gould et al., 2009; Hooton et al., 2010; Lo et al., 2014). This is supported by several prospective studies which indicate that aseptic technique, the use of sterile equipment and even the setting of catheter insertion, i.e., the operating theatre, played a significant role in the lower incidence of catheter-associated bacteriuria (Tambyah et al., 1999; Nagle, Curran, Anez-Bustillo & Poylin, 2014; Barbadoro, et al., 2015). These studies suggest that augmented barrier precautions at the operating room environment during catheter insertion reduce the risk of early catheter-associated-bacteriuria. Other factors independently associated (p<0.05) with a higher risk of catheter-acquired urinary tract infection include: insertion of a catheter after the sixth day of hospitalisation (Shapiro et al., 1984), unsatisfactory catheter care, and prolonged duration (>2 days) of catheterisation (Nagle, et al.,
2014; Barbadoro, et al., 2015). The study further demonstrated that the risk of getting CAUTI is higher among catheters inserted outside the operating room, i.e., the emergency department and the wards due to issues with hand hygiene and proper aseptic insertion techniques (Barbadoro, et al., 2015).

Meatal cleansing immediately before catheter insertion and the avoidance of catheter manipulation

Meatal cleansing immediately before catheter insertion is recommended, however, daily meatal cleaning with an antiseptic may increase bacteriuria rates compared to routine use of soap and water (Gould et al., 2009). This is supported by several randomised controlled trials that evaluated the daily use of antiseptic solution (Burke et al., 1981) and two to three times a day application of antibiotic cream to the urethral meatus to determine its effectiveness in preventing catheter-associated bacteriuria (Classen, Larsen, Burke, Alling & Stevens, 1991; Huth et al., 1992). These studies showed that daily or frequent meatal care has no beneficial effect in preventing catheter-associated bacteriuria. Hazards analysis showed that female gender, lack of antibiotic use and a positive initial meatal culture are associated with an increased risk of bacteriuria (Huth et al., 1992). Possible reasons why meatal care has not been effective in reducing catheter-associated bacteriuria include the negative effect of increased catheter manipulation, inadequate residual antiseptic activity of the topical agent, lack of effect on the intraluminal route of infection, and the possible development of protective biofilms at the catheter-urethra interface (Burke et al., 1981; Classen et al., 1991; Huth et al., 1992). Frequent catheter manipulation with frequent meatal cleaning should therefore be minimised to prevent CAUTI. There is strong recommendation however, that routine hygiene, that is, cleansing the meatal surface during daily bathing or showering with soap and water is appropriate, especially in faecally incontinent patients (Gould et al., 2009).

Other recommendations

Other recommendations include the practice of hand hygiene before and after catheter insertion; and before and after manipulation of the catheter site (Boyce & Pittet, 2002; Gould et al., 2009; Lo et al., 2014) to prevent the introduction of microorganisms into the catheter; and, the use of the smallest bore catheter consistent with good drainage to minimise bladder neck and urethral trauma, unless otherwise clinically indicated (Newman, 2007; Gould et al., 2009; Lo et al., 2014). Clinicians are also encouraged to consider using a portable ultrasound device in assessing urine volume to reduce unnecessary catheter insertions; and to consider
other bladder management methods such as intermittent catheterisation (Gould et al., 2009; Lo et al., 2014).

### 2.6.3 Implement proper urinary catheter maintenance procedures

Proper maintenance of urinary catheters focuses on maintaining a closed system and maintaining an unobstructed urine flow. If breaks in aseptic technique, disconnection or leakage occur, it is recommended that the catheter and collecting bag be replaced using aseptic technique and sterile equipment (Gould et al., 2009). Routine catheter change such as every two to four weeks in patients with functional long-term indwelling urethral or suprapubic catheters is also not recommended due to increased risk of introducing microorganisms into the point where the catheter is inserted (Hooton et al., 2010).

**Maintain a closed system**

Closed urinary drainage systems should remain closed because disconnections at the catheter-collecting tube junctions have been shown to significantly increase the risk of catheter-associated bacteriuria. This is supported by a randomised controlled trial done by Platt, Murdock, Frank Polk & Rosner (1983) which showed that among those patients not taking systemic antibiotics, patients assigned sealed junction catheters had fewer infections and deaths compared to those patients assigned unsealed catheters. This study showed that the relative risk of acquiring CAUTI the day after catheter disconnection is almost double when compared to days without disconnection (RR=1.9, p=0.005, 95% CI 1.2 – 3.0) (Platt et al., 1983).

CAUTI occurs because of intraluminal bacterial spread when the closed system is disrupted (Wille, Van Oud Alblas & Thewessen, 1993). Intraluminal microbial spread could also be facilitated by contamination of the urine in the collection bag through improper emptying (Wenzler-Röttele et al., 2006). In this way, the microorganisms gain access to the drainage system and can ascend to the bladder, particularly if standard hygiene measures are not observed (Wenzler-Röttele et al., 2006). Wille et al. (1993) recommends maintaining a closed drainage system and optimal care which includes: daily meatal cleaning with soap and water, emptying the drainage bag at least twice a day and frequently when full, and using clean gloves and separate collecting container when emptying the urine bag. Gould et al. (2009) further recommends that a closed system should be maintained and the collection of urine
samples should be done aseptically through the needleless sampling port or the drainage bag using a sterile syringe/cannula after the port is cleansed with a disinfectant.

**Maintain an unobstructed urine flow**

Unobstructed urine flow can be achieved through the following measures: keeping the catheter and collecting bag free from coils; keeping the collecting bag below the level of the bladder and off the floor at all times; emptying the collecting bag regularly using a separate, clean collecting jug for each patient; and preventing contact of the drainage spigot with the non-sterile collecting jug (Gould et al., 2009; Hooton et al., 2010; Lo et al., 2014).

Preventing the contamination of the drainage bag should be observed. In an earlier study on the predisposing factors to bacteriuria done in a 570-bed university affiliated community hospital in the USA, it was observed that 23% of the hospitalised patients with temporary closed urinary catheter drainage acquired bacteriuria. The risk was significantly higher in female, elderly or critically ill patients ($p < 0.005$). Breaks in the closed drainage system or improper care of the drainage bag occurred in 30% of the catheters and predisposed the patients to bacteriuria. Bacterial contamination of the drainage bag preceded the onset of bacteriuria in 18% of the cases (Garibaldi, Burke, Dickman & Smith, 1974). Thus, strict adherence to proper care of the closed sterile drainage system is recommended.

Care in keeping the catheter and collecting bag free from coils should also be observed. In a study done by Kubilay, Layon, Kubilay, Archibald and Kirchner in 2013, findings showed that drainage tubing coiling was significantly associated with fever (Kubilay, Layon, Kubilay, Archibald & Kirchner, 2013). One hundred twenty-seven adult ICU patients were evaluated with 91 patient events analysed over 60 days. A high number of catheter associated bacteriuria and temperature of $> 38.1$ among the patients were observed in those with catheter tubing coils. Fever correlated significantly with the presence of catheter tubing coils ($P=.003$). The study recommends the employment of strategies that keep the urine collection bag below the level of the bladder and avoids any coiling in the drainage system. The presence of coils is thought to compromise bladder emptying and possibly increase bladder hydrostatic pressure, thereby causing transient bacteriuria, thus the fevers. Furthermore, coiling facilitates urine stasis at the lower turns of the coils which facilitate the growth of microorganisms within hours. Backflow of this bio-burden facilitate the development of asymptomatic bacteriuria or UTI.
It is recommended that the collection tubing and bag should always remain below the patient’s bladder to allow proper drainage of urine and the drainage tubing should always be above the level of the collection bag. This recommendation is supported by a large prospective study in the USA that showed that improper positioning of the collection tubing and bag and the drainage tubing was associated with a significantly increased risk in CAUTI (RR = 1.9) because of the backflow of contaminated urine from the drainage bag (Maki & Tambyah, 2001). Wenzler-Röttele et al. (2006) explained that microorganisms gain access to the drainage system intraluminally and ascend to the bladder if the collection bag is placed above the level of the bladder.

Apart from proper positioning of the drainage bag, it is also recommended that indwelling catheters be secured to minimise movement and urethral trauma or erosion of the bladder mucosa (Darouiche et al., 2006; Gray, 2008; Hooton et al., 2010; Gould et al., 2009; IHI, 2011). The presence of organic molecules from the damaged mucosa and glycoprotein from the urine facilitate bacterial colonisation, thereby increasing the risk for CAUTI (Trautner & Darouiche, 2004).

2.6.4 Remove urinary catheters in a timely manner
The length of time a urinary catheter is in place is the strongest predictor of CAUTI (Gould et al., 2009). Recommendations indicate that indwelling urinary catheters should be removed as soon as possible postoperatively, preferably within 24 hours unless there are indications for continued use (Stéphan et al., 2006; Gould et al., 2009; Schneider, 2012). It was revealed that for each day that the catheter remains in place, patients develop bacteriuria at a rate of 3-7% per day (Tambyah et al., 1999; Parker et al., 2009; IHI, 2011). This risk increases to 25% when the catheter remains in place for one week and increases to nearly 100% when the catheter stays for up to a month (Tambyah et al., 1999; IHI, 2011). Among those with bacteriuria, 10% will develop CAUTI while 3% will progress to bloodstream infection (Saint & Chenoweth, 2003; IHI, 2011) which may lead to death (Saint & Chenoweth, 2003; Lo et al., 2008; Gould et al., 2009; CDC, 2013).

Effective catheter care involves collaborative effort (Gould et al., 2009; Meddings et al., 2013); however, nurses remain to be largely responsible for indwelling catheter care. Daily assessment of catheter need and the possibility of removal is recommended in various literature (Lo et al., 2008). Staff are also advised to utilise standard precautions during any
type of catheter manipulation, including catheter removal, to prevent cross-transmission of microorganisms thereby preventing CAUTI (Gould et al., 2009).

In summary, the four components of care to prevent CAUTI include: reduction of inappropriate use of urinary catheters, performance of proper indwelling catheter insertion techniques, implementation of proper catheter maintenance procedures, and removal of catheters in a timely manner. While catheter care requires collaborative effort, nurses play a huge role in making each component work (Meddings & Saint, 2011). Proper indwelling catheter care requires education of nurses together with reinforcement prior to and during implementation. Nurse-focused education and the use of other strategies play a significant role in reducing the incidence of CAUTI (Gould et al., 2009; IHI, 2011).

**2.7 Education and other multifaceted implementation strategies to prevent CAUTI**

CAUTI prevention programs implemented all over the world have various components and implementation approaches. A common activity among these approaches is the education of healthcare professionals with regard to evidence-based interventions. While simply disseminating evidence from clinical research through education may not be sufficient for the provision of optimal care or decision making due to challenges such as lack of awareness, lack of agreement with the findings, differences in the decision-making culture (Walshe & Rundall, 2001), user readiness and capacity to take-up the knowledge (Straus, Tetroe & Graham, 2013), and inability to consider context (Bowen, Johnson, Reed, Zhang & Curry, 2011); education will always be a necessary element in various implementation approaches (Straus et al., 2013).

There is growing recognition of a move from knowledge dissemination towards knowledge use. This increasing recognition of the importance of knowledge use has led to attempts to effect behaviour, practice and even policy changes. Changing behaviour is a complex process that requires the evaluation of the entire health system, including system-wide barriers to change such as the lack of integrated health information systems; and including all those involved in decision making such as clinicians, policy makers, and patients (Davis et al., 2003; Straus, Tetroe & Graham, 2011). Effective knowledge use has been shown to improve health outcomes through behaviour change. Multifaceted strategies based on accurate needs assessment and those that actively involve clinicians were identified to be most effective in overcoming barriers to change (Davis, et al., 2003; Straus et al., 2011).
The continued progress in knowledge use and healthcare epidemiology resulted in a better understanding of multifaceted strategies in preventing healthcare associated infections such as CAUTI (Yokoe et al., 2014). With nurses in the forefront of catheter care (Ribby, 2006), nurse education as a primary component of multifaceted interventions have been shown to be effective in preventing CAUTI. Strategies that utilise nurse education and the use of clinician reminders were shown to be effective in reducing inappropriate catheter insertion. This is supported by a pre- and post-intervention study in the emergency department of a large midwestern community teaching hospital in the USA, where an intervention consisting of education and use of an indication sheet attached to each catheter kit for staff to complete prior to use, produced a significant reduction in the total number of catheters used among patients (Gokula, Smith & Hickner, 2007). Both the appropriate use of indwelling catheters and the documentation order for catheter placement significantly increased. There was also a large and sustained decrease in the total number of catheters placed in the emergency department after the intervention. (Gokula et al., 2007). This is further supported by a systematic review done by Murphy et al., (2013) (n= 8 studies, sample size ranging from 182 to 16,959) which showed that education sessions, guideline change and clinician reminders on appropriate catheter use significantly reduced catheter use in acute care. Their findings supported the use of multifaceted interventions and identified the importance of practice change and collaboration and communication between colleagues (Murphy et al., 2013; Leblebicioglu et al., 2013; Hebden, J., 2014; Ghanem, Artine, Moser, Caceres & Basconcillo, 2015).

Multifaceted efforts addressing the catheter maintenance and catheter removal component of catheter care that has significantly reduced CAUTI include the following: competency training of nurses (Knoll et al., 2011; Oman et al., 2012; Marigliano, Barbadoro, Pennacchietti, D’Errico & Prospero, 2012), daily multidisciplinary rounds to assess catheter necessity (Marra et al., 2011), establishment of catheter placement guidelines (Reilly et al., 2006; Bernard et al., 2012; Fakih, Rey, Pena, Szpunar & Saravolatz, 2013; Oman et al., 2012); regular staff feedback (Knoll et al., 2011; Leblebicioglu et al., 2013); standardisation of products (Marra et al., 2011), surveillance (Knoll et al., 2011; Oman et al, 2012; Marigliano et al., 2012; Rosenthal et al., 2012; Leblebicioglu et al., 2013), catheter management posters in strategic areas (Andreessen, Wilde & Herendeen, 2012), catheter removal reminders (Crouzet et al., 2007; Knoll et al., 2011), computerised catheter removal order system (Bernard et al., 2012; Andreessen et al., 2012), decision-making algorithm, daily catheter checklist (Reilly et al., 2006; Fuchs, Sexton, Thornlow & Champagne, 2011), nurse-directed catheter removal
protocol (Oman et al., 2012; Parry, Grant & Sestovic, 2013; Ghanem, et al., 2015) and bladder scanning for urinary retention (Titsworth et al., 2012).

Finally, an expert guidance document on CAUTI prevention published as a result of the collaboration between the Society for Healthcare Epidemiology of America (SHEA), the Infectious Diseases Society of America (IDSA), the American Hospital Association (AHA), and the Association for Professionals in Infection Control and Epidemiology (APIC); recommends assessment of healthcare professional competency in catheter use, catheter care, and maintenance; and education of all healthcare personnel involved in the insertion, care, and maintenance of urinary catheters (Lo et al., 2014). Part of their recommendation was to educate all healthcare personnel on the alternatives to indwelling catheters, and on the procedures for catheter insertion, management, and removal (Lo et al., 2014).

2.8 CAUTI prevention in New Zealand District Health Boards and the need for current research

In New Zealand, a lot of work needs to be done to understand healthcare associated infections (HAI) such as CAUTI. In 2010, District Health Boards (DHB) across New Zealand reported that 2% of the 378 serious or sentinel event recorded from 2009 to 2010 were due to HAIs (Health Quality & Safety Commission [HQSC], 2010). Prior to 2009, data on HAIs were not collected (HQSC, 2012a). Available data were based on voluntary reports and was affected by the quality and existence of surveillance systems, reporting system, and culture of safety (HQSC, 2012b).

The New Zealand government created the Health Quality and Safety Commission in 2010 and the Health and Disability Services – National Reportable Events Policy in 2012 which requires all health providers to institutionalise processes for managing reportable events and to take concrete actions in preventing adverse events (HQSC, 2012b). HAIs are mapped as contributory indicators to a system-level measure of adverse events in the New Zealand Triple Aim Framework (HQSC, 2012c). However, HAIs require further work in terms of availability and understanding of data in New Zealand (HQSC, 2012c). With the policy in place, DHBs have started to implement infection control improvements and HAI surveillance of multi-resistant organisms, central line associated bacteraemia, ventilator associated pneumonia, clostridium difficile and surgical site infections (HQSC, 2012a, 2012b). While CAUTI is not yet included in the HAI national surveillance, various district health boards have started to
look into their own CAUTI incidence rates and have embarked on initiatives to address CAUTI.

In a CAUTI prevention program implemented at Waitemata District Health Board, baseline CAUTI rates were at 26.1/1000 catheter days across the medical, surgical and rehabilitation wards and urinary source of infection accounted for 25-30% of nosocomial bloodstream infections (Bhally et al., 2014). One-third of catheter insertions and dwell time were also found to be inappropriate primarily because of the doctors’ lack of awareness of the urinary catheter’s presence and because of the lack of initiative to remove it (Bhally et al., 2014). CAUTI prevention interventions focused on educating nurses and doctors with regard to certain CAUTI prevention recommendations: ABCDEs (use of aseptic technique during catheter insertion, use of bladder scan to measure the amount of residual urine in the bladder, use of condom catheters or other appropriate alternative catheters, not using indwelling urinary catheters unless necessary and early catheter removal together with the indications for catheter removal) (Bhally et al., 2014). Evaluation of the intervention showed a 55% reduction in CAUTI rate; with an improvement from a baseline 26.1 to 20.2 (immediate post intervention) to 11.5/1000 catheter days (delayed post intervention analysis) (Bhally et al., 2014). Nurses were also shown to prefer daily reminders and ongoing education (Bhally et al., 2014).

In an initial investigation of CAUTI rates in Counties Manukau District Health Board (CMDHB), it was shown that 14 out of the 168 (8%) bloodstream infections documented in 2012 were secondary to CAUTI (unpublished 2012 surveillance data). In 2013, 15 out of the 157 (10%) bloodstream infections were secondary to CAUTI (unpublished 2013 surveillance data). The documented cases of CAUTI in 2012 had a total cost of approximately $50,480.64, whereas those in 2013 had a total cost of approximately $63,267.55. These documented cases represent the tip of the iceberg as CMDHB is yet to start an organisation-wide CAUTI surveillance and CAUTI prevention program.

The clinical consequences and economic burden of CAUTI, and the need to address CAUTI as a threat to patient safety served as an impetus for the conduct of this research. The investigator hypothesised that the implementation of an evidence-based educational package on CAUTI prevention has a positive impact on the nurses’ knowledge and indwelling catheter management practices and prevent the development of CAUTI among patients. With this, the
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study aimed to answer the research question, “What is the impact of a CAUTI education package on the knowledge and indwelling catheter management practices among nurses?”

The specific objectives are:
1. To identify baseline data on staff nurses’ attitude, knowledge and indwelling catheter management practices
2. To develop an educational intervention aimed at addressing knowledge or care management deficits of staff nurses
3. To evaluate the impact of the educational intervention on the staff nurses’ knowledge and indwelling catheter management practices

2.9 Summary

The review of literature presented has identified what CAUTI is, including potential complications, pathophysiology, associated risk factors and how these can be modified through prevention strategies. Prevention strategies from around the world that support the four major components of indwelling catheter care as recommended by the CDC and the IHI was extensively discussed in this chapter. Additionally, evidence that support staff education as part of a multifaceted implementation strategy to prevent CAUTI was also discussed.

The review of the literature also identified a gap in HAI surveillance, reporting and prevention in New Zealand. It is evident in this discussion that there is a need to investigate CAUTI within the New Zealand context especially because CAUTI is not yet part of the list of infections that are included in the national surveillance. Furthermore, there is a need to identify, through research, which prevention strategies work best within the New Zealand context because of the economic and clinical consequences of CAUTI and the threat that it poses to patient safety in general. The need to identify the best prevention strategy served as an impetus for the investigator to look into education as an intervention and to study the impact of an educational intervention on the nurses’ knowledge and indwelling catheter management practices.
Chapter 3. METHODS AND METHODOLOGY

3.1 Introduction
This chapter describes the methods that were utilised to evaluate the impact of a catheter-associated urinary tract infection (CAUTI) education package on staff nurses' knowledge and indwelling catheter management practices. The presentation starts with the research question and research objectives; and proceeds to describe the methods that were used in data collection and the education package as an intervention. This chapter also describes fundamental aspects of study design such as setting, participant recruitment and sampling, data gathering tools, pre-testing of tools, procedure for data gathering, data analysis and study reliability and validity. A discussion of the ethical considerations and summary are provided at the end of this chapter.

The review of literature indicates that multifaceted interventions such as nurse-focused education and guidelines; and, the use of posters, checklists and algorithm for proper catheter use significantly reduce CAUTI risk (Gould et al., 2009; IHI, 2011). Education of nursing staff is vital in implementing these multifaceted interventions. Currently, there are existing procedures on urinary catheter insertion and removal at Counties Manukau District Health Board (CMDHB) that may be further improved by incorporating evidence-based findings. Some of the staff nurses do not have a formal orientation to the use of these procedures, but access these documents when needed in patient care. Catheter care prompts and checklists that guide nurses are also lacking. These concerns are addressed by this study through a CAUTI education package that incorporates evidence-based prevention strategies, with the aim of determining how it impacts on nurses’ knowledge and indwelling catheter management practices.

3.2 Research question
What is the impact of a CAUTI education package on knowledge and indwelling catheter management practices among nurses?

3.3 Research objectives
The specific objectives of the study include:
1. To identify baseline data on staff nurses’ attitude, knowledge and indwelling catheter management practices
2. To develop an educational intervention aimed at addressing knowledge or care management deficits of staff nurses
3. To evaluate the impact of the educational intervention on the staff nurses’ knowledge and indwelling catheter management practices

3.4 Study methodology and design
Methodology refers to underlying principles behind how a research process proceeds (Grant & Giddings, 2002). It guides the formulation of a research question and determines the data gathering method (Grant & Giddings, 2002). Mixed methods as a distinct methodology provides for the integration of theoretical frameworks from the social, behavioural, or biological sciences in all phases of the research (Greene, 2007). It should be remembered that nursing practice draws upon these theoretical frameworks apart from the different sources of data in order to arrive at a sound decision (Moule & Goodman, 2009).

Mixed methods researchers espouse various philosophical positions such as post-positivist and social constructivist worldviews, pragmatic perspectives, and transformative perspectives (Greene, 2007). A post-positivist worldview advocates methodological pluralism and is based on the assumption that research methods are dependent on the research question (Wildemuth, 1993). It aims to formulate context-dependent generalisations and to produce reliably similar results when the research method is repeated (Cooper, 1997). Pragmatic perspective looks into “what works” and values both objective and subjective knowledge (Greene, 2007). A transformative perspective on the other hand, suggests practice-change that aims to improve life and to create a more just and democratic society (Greene, 2007).

This study looked into the impact of a CAUTI education package on various variables such as nurses’ knowledge and indwelling catheter management practices. Data were gathered in multiple phases, namely, the pre-intervention and evaluation phase (see data collection procedure on p. 29). Baseline data on nurses’ knowledge and attitudes about catheter management and CAUTI prevention were gathered in the pre-intervention phase to better understand their existing practices. Knowledge is a measurable variable, whereas, attitude is subjective in nature and requires in-depth understanding, and therefore best analysed as qualitative data. Data on knowledge and practices, on the other hand, were gathered post intervention. Knowledge and practices are variables that could be measured or quantified. The utilisation of both measurable and qualitative data gathered in various phases require the use
of a multi-phased mixed methods approach. Mixed methods use both quantitative and qualitative data to answer the research question (Moule & Goodman, 2009; Burns & Grove, 2011).

Multi-phased mixed methods approach uses rigorous quantitative research to assess the magnitude and frequency of constructs and rigorous qualitative research to explore the meaning and understanding of these constructs (Creswell et al., 2011). It intentionally integrates these two methods to maximise the strength and minimise the weakness of each type of data (Creswell et al., 2011). Mixed methods research enhances the reliability, validity, trustworthiness and overall quality of a research study (Moule & Goodman, 2009). It also provides a more comprehensive view of the research subject (Moule & Goodman, 2009).

The quantitative aspect of this study utilises a pre-test and a post-test to measure and compare the nurses’ level of knowledge on CAUTI prevention, and a self-administered catheter maintenance checklist which include items that measure staff nurses’ catheter management practices. Quantitative data provide the researcher with measurable evidence, generate efficient data collection procedures, enable comparison of groups, and provide insight into the participants’ range of experiences (Creswell et al., 2011).

The qualitative approach utilises focus groups to explore and describe baseline data on nurses’ attitude toward CAUTI prevention. Qualitative data help the researcher understand concepts and processes, provide detailed information about context, and emphasize the perspective of study participants (Creswell et al., 2011).

3.5 Education package

Nurse-focused education and the use of other strategies play a significant role in reducing the incidence of CAUTI (Gould et al., 2009; IHI, 2011). This study implemented an education package that utilised various teaching methods in order to achieve the aim of improving the nurses’ knowledge on indwelling catheter management and CAUTI prevention. The main content of the education package is based on evidence-based indwelling catheter management guidelines published by the Centers for Disease Control and Prevention (CDC). The education package involved the use of a lecture that lasted for 40 minutes and the introduction of a catheter management algorithm and a checklist that contains procedure-specific evidence-based recommendations from the CDC. The checklist served as a procedure prompt and tool in
measuring the nurses’ indwelling catheter management practices, whereas, the algorithm facilitated decision making in terms of catheter insertion and removal. Both the checklist and the algorithm are a novelty in catheter management in CMDHB.

The content of the lecture is divided into four main topics which correspond to the four components of catheter care originally proposed by the Institute for Health Care Improvement (IHI) in 2011. However, the content of the original IHI recommendation was expanded by the researcher to include updated recommendations from CDC. The four components of care to prevent CAUTI for the purpose of this study include: reduce inappropriate use of urinary catheters, perform proper techniques for indwelling catheter insertion, implement proper catheter maintenance procedures, and remove catheters in a timely manner. Indwelling catheter care represents a continuum of care that should be adhered to in order to provide safe quality care and prevent CAUTI. Nurses are expected to comply with all four components. The four main topics of the lecture that correspond to these catheter care components are: CAUTI background knowledge, indwelling catheter insertion, indwelling catheter maintenance and indwelling catheter removal.

This study also utilised various methods of providing information to the nurses such as factsheets and posters to remind them of the recommendations to prevent CAUTI. The factsheets (see Appendix 2) were made available at the staff work-station during the entire length of the study and the posters were placed in strategic areas of the ward and changed every four weeks. A total of four posters were designed for this study (see Appendixes 3, 4, 5 and 6).

3.6 Setting
The study was conducted at two post-operative wards of Manukau Surgery Center (MSC) in CMDHB. MSC provides multi-disciplinary inpatient day-surgery services; and elective and acute planned surgery for patients who do not require intensive care. It has ten operating theatres, two procedure rooms and 78 inpatient beds in two wards and serves residents of South Auckland. MSC patients include those who had orthopaedic surgery such as joint replacement; those who had general surgery; colorectal surgery; breast surgery including breast reconstruction; plastic surgery; ophthalmology and ear, nose and throat surgery; and, those who had gynaecological procedures (CMDHB, 2013b). Majority of these patients continue to have indwelling catheters in the hours following surgery. The CDC recommends
catheter removal within 24 hours for uncomplicated surgeries, unless its indication is documented (Gould et al., 2009; IHI, 2011). This study looked into how indwelling catheters were managed by nurses during the post-operative period.

3.7 Participants and sampling

Sampling is the process of choosing study participants who are representative of the population under study (Burns & Grove, 2011). Sampling method could either be random or non-random (Polit & Beck, 2012) and is designed to improve representativeness of the sample and to decrease bias (Burns & Grove, 2011). This study utilised non-random sampling as the focus was on nurses who were taking care of patients with indwelling catheters in the post-operative setting. Non-random or non-probability sampling includes convenience, quota and purposive sampling (Polit & Beck, 2012). This study gathered information from a convenience sample, that is, from a subset of the population locally available at the time of the study (Polit & Beck, 2012). Data were gathered from a convenience sample of the nurses working at the MSC post-operative wards due to the catheter care tasks that they perform and their availability at the time of research, thereby allowing the formulation of context-dependent generalisations.

Participant recruitment involved approaching MSC Charge Nurse Managers and discussing the importance and methods of the study. The researcher is known to the study participants due to her role as an Infection Prevention and Control Nurse Specialist; thus, to avoid bias and conflict of interest, the Charge Nurse Managers were approached for the purpose of participant recruitment. The Charge Nurse Managers were given a copy of the participant information sheet for managers (see Appendix 7) and were asked to sign the consent form (see Appendix 8). Their participation involved sending out general research invitation e-mails to all staff nurses (n=50) and distributing flyers (see Appendix 9) at MSC wards one and two. The Charge Nurse Managers also distributed separate participant information sheets (see Appendixes 10 and 11) and consent forms (see Appendixes 12 and 13) for the different data-gathering methods utilised in the study. The various data gathering methods include: focus group discussion, pre and post-test, and self-administered catheter maintenance checklist. Nurses were given the option to participate in either one or all of the data-gathering activities. Charge Nurse Managers collected the consent forms, organised the schedule for the focus group and education sessions, facilitated the reservation of rooms for the various research activities and organised nursing care during the actual education sessions and focus-groups.
discussions so as not to compromise patient safety due to the nurses’ participation in the study. The nurse managers’ participation also entailed giving assurance that staff participation or non-participation will not in any way affect their employment status.

All nurses with patient load, regardless of length of nursing experience or experience with indwelling catheter care, were included in the study. The rationale is that New Zealand nurses are expected to promote an environment that allows patient safety, quality of life and health as stated in competency 1.4 of the domain of professional responsibility for registered nurses (Nursing Council of New Zealand [NCNZ], 2012). One of the indicators for this competency is the maintenance of infection control principles (NCNZ, 2012). Nurses who do not have a patient load were excluded in the study because they do not directly assess patients, perform procedures and make referrals and therefore do not contribute to CAUTI development.

3.7.1 Recruitment of participants for focus group discussion
A participant information sheet explaining the study and inviting staff to join the focus group discussion and a copy of the consent form were sent by Charge Nurse Managers to all nursing staff through e-mail. Those willing to participate in the study were asked to sign the consent form. Thirteen (n = 13) nurses accepted the invitation. At most, two focus groups of six or seven nurses were formed to facilitate management of interviews. The focus group discussions were formed by grouping together those who worked on the same day as the schedule of the focus groups. Nurses whose shifts did not coincide with the schedule of focus group discussions came to the hospital solely for the purpose of study participation. Focus group discussions were scheduled at the most common time for those who volunteered to participate. Morning tea was offered and a certificate of attendance was provided as an incentive for the nurses’ professional development.

3.7.2 Recruitment of participants for pre-test and post-test
A participant information sheet for the pre-test and post-test, together with the consent form was e-mailed to all staff by the Charge Nurse Manager. This method was preferred to avoid bias and conflict of interest because the researcher is known to the nurses due to her role as an Infection Prevention and Control Nurse Specialist. All nurses who were willing to participate in the study were invited to attend a forty-minute education session where they, as a group, completed the pre-test prior to the lecture and post-test afterwards. Each of the pre-test and the post-test took approximately 20 minutes to complete. Nurses were also taught how to
complete the catheter maintenance checklist in the education session. Completion of the education session counted towards staff in-service education hours. Certificates of attendance were given to the nurses as an incentive (see Appendix 14). Nurses were also given a copy of the pre and post-test and the answers with rationale as a learning resource one month after the post-test (see Appendix 15).

3.8 Data gathering instruments
Research instruments are devices used in data collection (Polit & Beck, 2012). Below are descriptions of the instruments that were used in this study

3.8.1 Focus group
Focus groups are in-depth open-ended discussions designed to obtain the participants’ perceptions about a certain topic (Grove, Burns & Gray, 2013). It is a method used in qualitative research that concentrates on gathering data on a clearly defined topic from a specific group of people who possess characteristics that are of interest to the researcher (Reed & Payton, 1997). The advantages of utilising focus groups as a method include cost-effectiveness, participant tendencies to provide more candid responses, the participants build on one another’s responses and it is not time consuming compared to individual interviews. (Leung & Savithiri, 2009). Focus group disadvantages include: the tendency of outspoken individuals to dominate the discussion, dependence of its quality on the skill of the moderator, difficulty in analysing large volumes of data and tendency of participants to self-select thereby making generalisability difficult (Leung & Savithiri, 2009).

Focus group discussions were utilised in this study to determine and describe nurses’ attitudes about catheter care and potential barriers to CAUTI prevention. Thirteen (n = 13) nurses participated in the focus groups. Two focus groups were formed to facilitate the management of interviews. Seven nurses participated in the first focus group, whereas six participated in the second. The focus group discussions were organised on different dates to accommodate as many participants as possible without compromising patient care or safety. The focus group took approximately 45 minutes and centred on the nurses’ attitude towards urinary catheter insertion, maintenance and removal and the prevention of CAUTI as a whole. It was moderated by the researcher’s supervisor who is experienced in the conduct of focus group discussions, to avoid bias and conflict of interest as the researcher is known to the nurses as a Clinical Nurse Specialist. An interview prompt sheet (see Appendix 16) was utilised to guide
the focused group discussions and the questions were pre-tested among six nurses in other wards to improve its reliability. Prior to the actual conduct of the focus groups, the nurses were reminded that they have the right to choose not to answer any questions that they were unhappy with or to leave the focus group at any time. The proceedings were audio-recorded, transcribed by the researcher and made accessible only to the researcher and supervisors. The focus group discussions were held in a meeting room at the Manukau Surgery Centre as approved by the CMDHB Research office.

3.8.2 Pre-test and post-test
A pre-test and a post-test was administered to evaluate the nurses’ knowledge about catheter management and CAUTI prevention. The test consists of 25 multiple-choice questions that were adapted from CAUTI tests published by Schneider in 2012 and, Dumont and Wakeman in 2010 (see Appendix 17). Adaptation of the test questions from pre-tested tools was done to improve test reliability. Additional questions that were relevant to the research setting were also incorporated and answers were referenced to complete the tool. The final tool was piloted through staff nurses in another clinical area and changes with regard to sentence construction was done to improve reliability and validity.

The tests were administered immediately before and after the lecture in the education session to make the conclusion of knowledge change valid. According to Polit and Beck (2012), it is plausible to conclude that knowledge gain is caused by the intervention if the intervention is a brief teaching and the baseline knowledge is measured immediately before and after the intervention. This study did not have a control group and randomisation was not done; thus, extraneous factors cannot be controlled if the outcome, which is knowledge, is measured after a long period of time (Polit & Beck, 2012). Each of the pre-test and post-test took 20 minutes to complete.

3.8.3 Catheter maintenance checklist
A checklist is a two-dimensional arrangement of statements and responses (Polit & Beck, 2012). Evidence suggests that education and use of checklists, algorithms and guidelines for appropriate catheter use significantly decreased unspecified UTI and bacteriuria (Gould et al., 2009).
Chapter 3 – Methods and Methodology

The advantages of using checklists include efficiency, easy to understand, absence of interviewer bias and they serve as prompts for respondents to follow (Fuchs et al., 2011; Polit & Beck, 2012). Based on the review of literature, majority of respondents find CAUTI checklists relevant and easy to use (Fuchs et al., 2011). These are the reasons why this tool was chosen for this study.

The Daily Urinary Catheter Maintenance Checklist (see Appendix 18) is a self-administered indwelling catheter maintenance checklist introduced to nurses following education sessions to identify nurses’ management of indwelling catheters. The checklist contains procedure-specific evidence-based recommendations from the Centers for Disease Control. Appropriate catheter indications, hand hygiene, catheter insertion technique, catheter maintenance and catheter removal are among the sub-headings found in the checklist that required completion by the nurse. The checklist contains tick boxes next to evidence-based statements on catheter care to facilitate documentation of care. A CAUTI prevention flowchart is also found at the back of the checklist for the nurses’ use.

The checklists were strategically placed at the staff workstation and were replenished by the Charge Nurse Managers as needed. The checklists were collected weekly from the two wards by the researcher.

In summary, this study utilised three tools – focus group, pre-test and post-test, and catheter maintenance checklist – to answer the research question. Care was taken to ensure that these tools were pre-tested to improve reliability and validity. These tools were utilised in collecting and validating data on nurses’ knowledge, attitude, and indwelling catheter management practices. How these tools were used in data collection is discussed in the succeeding section.

3.9 Data collection procedure

Data collection was done in 32 weeks and had three phases; namely, the pre-intervention, intervention and evaluation phase. The pre-intervention phase involved the gathering of baseline data to determine nurses’ knowledge and attitudes about catheter management and CAUTI prevention. The intervention phase involved the implementation of education sessions. The evaluation phase involved post-test administration, utilisation of an evidence-based checklist that nurses taking care of patients with indwelling urinary catheters completed,
utilisation of posters as reminders for nurses, feedback of test results and the evaluation of the impact of the education session on nurses’ knowledge and catheter management practices.

3.9.1 Pre-intervention phase
The pre-intervention phase lasted for eight weeks. Pre-intervention activities include: information dissemination, participant recruitment, organising the education programme, signing of informed consent and administration of pre-test immediately before the education sessions.

Information dissemination was performed with the assistance of the MSC Charge Managers who also consented to helping with the participant recruitment. The dissemination of information regarding the research itself involved the use of flyers which were placed in the ward workstation for nurses to see. The Charge Nurse Managers also sent out general research invitation e-mails to all staff nurses and distributed separate participant information sheets for the different data-gathering methods utilised in the study. The participant information sheets discussed what it means to participate in the study; ethical considerations such as confidentiality of information; the costs, risks and benefits of participation; research participants’ rights and what happens to results after the study. The information sheets also contain the researcher’s mobile phone and e-mail address should the nurses have queries with regard to the research.

The Charge Nurse Managers also helped distribute and collect signed consent forms. The consent forms contained statements confirming the nurses’ understanding of the conduct of the study, and statements that reaffirm confidentiality of information and the nurses’ right to withdraw from the study at any time.

The education session was also organised in the pre-intervention phase. This involved preparation of the lecture and posters that highlight evidence-based catheter care guidelines; preparation of pre and post-tests and catheter maintenance checklists; and, administration of the pre-test to the nurses.

3.9.2 Intervention phase
The intervention phase lasted for eight weeks. This phase involved the actual conduct of the education sessions wherein lectures were held and educational materials such as CAUTI
factsheet, daily catheter maintenance checklist and CAUTI prevention flowchart were given to the nurses. Posters that highlight evidence-based catheter care guidelines were also placed in strategic areas of the ward to prompt nurses of proper catheter care.

3.9.3 Evaluation phase
The evaluation phase lasted for 15 weeks. The activities in this phase are: post-test administration, nurses’ completion of catheter maintenance checklist and the weekly collection of these checklists. The post-tests were marked and feedback was provided to the nurses apart from being given a copy of the answers and rationale for their use as a learning resource. Copies of the test questions with the answers and rationale were also made available to other nurses as a learning resource. Certificates of attendance in the focus group and certificates of attendance in the educations sessions were given to the nurses as an incentive. The checklists were strategically placed at the ward work station and were replenished by the Charge Nurse Managers as needed. The checklists were collected weekly from the two wards by the researcher until the end of the 15th week when data collation and analysis was done.

3.10 Data analysis
Descriptive statistics describe and synthesise data (Polit & Beck, 2012). Univariate descriptive statistics describe one variable at a time without relating these to one another (Polit & Beck, 2012). Examples include measures of central tendency and percentages (Polit & Beck, 2012) which were used to describe the nurses’ demographic data; and pre-test and post-test scores. Variability of data was also measured using standard deviation. Standard deviation indicates the degree to which a value veers away from the mean (Polit & Beck, 2012). Tables and graphs were also utilised to present data.

3.10.1 Qualitative data analysis
A general inductive approach was utilised in analysing qualitative data from this study. Inductive approach allows research findings to emerge from the frequent, dominant, or significant themes inherent in raw data (Thomas, 2006). Transcribed data from the focus group discussion was initially grouped together into small units and then into categories, so that the content of each discussion group could be summarised (Doody, Slevin & Taggart, 2012). Focus group data were analysed one focus group at a time and the themes that emerge from one group were compared to the other group to achieve data saturation.
Chapter 3 – Methods and Methodology

3.10.2 Quantitative data analysis

Inferential statistics provide a framework for formulating conclusions about a population and involves hypothesis testing (Polit & Beck, 2012). Hypothesis testing provides objective parameters in deciding whether a hypothesis is supported by empirical data (Polit & Beck, 2012). The independent variable in this study, which is the education package, is at the nominal level of measurement whereas the dependent variable – pre-test and post-test scores - are at the ratio level. With the independent and dependent variables at different levels of measurement, this study utilised t-test in hypothesis testing. A t-test is a parametric procedure of testing the difference in group means (Polit & Beck, 2012). Specifically, the study utilised a paired t-test because the pre test scores and the post-test scores came from the same sample, and therefore, can be paired together. For non-parametric data, the Wilcoxon signed-rank test is used. The Wilcoxon signed-rank test does not assume normality of the data and is used to compare two sets of scores from the same sample (Polit & Beck, 2012). Hypothesis testing commonly use a significance level of $P < 0.05$ (Polit & Beck, 2012). Significance level of $P < 0.05$ indicates a five in 100 chance of rejecting a true null hypothesis (Burns & Grove, 2011; Polit & Beck, 2012). Microsoft Excel Software and SPSS (Statistical Package for the Social Sciences) was utilised in quantitative data collation and encoding.

3.10.3 Reliability and validity

Measures were done to improve the reliability and validity of the findings of this study. Reliability refers to the consistency in measuring variables (Polit & Beck, 2012). Stability and internal consistency are aspects of reliability (Polit & Beck, 2012). To ensure stability and internal consistency of self-report questionnaires and tests, questions were adapted from tests previously published by Dumont and Wakeman (2010) and Schneider (2012). Pre-testing of the instruments was also done (Polit & Beck, 2012) by asking six nurses from another ward to answer the test and provide feedback with regard to the ease in understanding the test questions. Changes to sentence construction were made based on feedback from the pre-testing.

Internal validity refers to the degree to which one can infer that the independent variable truly influences the dependent variable (Burns & Grove, 2011; Polit & Beck, 2012). Threats to validity include history and instrumentation (Polit & Beck, 2012). Threat of history refers to external events that occur concurrently with the independent variable, thereby affecting the dependent variable (Polit & Beck, 2012). To minimise the threat of history in this study,
nurses’ knowledge was measured immediately after the education session. The threat of instrumentation refers to changes in measuring tools or methods of measurement between two data gathering points (Polit & Beck, 2012). To avoid threat of instrumentation in this study, the same test and interview prompt sheet was used before and after the education sessions.

External validity refers to the applicability of findings to other settings or samples (Burns & Grove, 2011; Polit & Beck, 2012). Ideally, a sample should be representative of the population for it to be generalisable (Polit & Beck, 2012). This study, however, utilised non-random sampling because it focused on nurses who were taking care of patients with indwelling catheters in the post-operative setting. Specifically, convenience sampling, i.e., the subset of the population who were locally available at the time of the study was utilised; thus, the study result is only generalisable to the study population.

The qualitative aspect of this study utilised a relatively small sample size to facilitate data gathering. The utilisation of a small sample size and the subjectivity of the data gathered are intrinsic characteristic of qualitative data, making it generalisable only to a population similar to the study population.

3.10.4 Ethical considerations
Prior to the conduct of the study, ethics approval was sought from the CMDHB Research Committee and the Director of Hospital Services as per CMDHB policy (CMDHB, 2010). The CMDHB Research Committee advised that the study did not require review by the CMDHB Maori Research Review Committee (MMRC) because it does not need a full pathway ethical review through the Health and Disability Ethics Committee. The CMDHB Research Committee approval was obtained on 28th February 2014 with research registration number: 1577. Ethical approval was also sought from the University of Auckland Human Participants Ethics Committee (UAHPEC). Ethical approval was obtained on 25th February 2014 with reference number 011046. The approval was valid for three years. The pre-intervention phase of the data collection procedure commenced after approval was obtained from both CMDHB and UAHPEC.

Ethical considerations are concerned with protecting the rights of human research subjects (Burns & Grove, 2011; Polit & Beck, 2012). This study adhered to the following ethical principles: principle of beneficence, by ensuring that participants benefit from the research and
are free from harm; principle of respect for human dignity, by protecting the participants’ right to make voluntary decisions and give informed consent; principle of veracity, by fully disclosing the nature of the study; and the principle of justice, through fair treatment of study participants, maintaining anonymity and by protecting confidentiality of information.

Participant information sheets fully disclosing the nature of the study and the various data gathering methods, i.e., focus group and pre and post-tests, were distributed and made available for eight weeks so that the nurses have enough time to make an informed decision. The information sheet emphasised voluntary participation and reiterated that the nurses’ participation or non-participation in the study will not in any way affect their relationship and employment with the organisation. The information sheets also contained the researcher’s contact details should the nurses have queries. Those who expressed their interest to participate in the study were given a consent form to sign. The consent form emphasised full disclosure of information related to the study; and, reiterated confidentiality of information and the nurses’ right to ask questions, refuse to answer questions and withdraw from the study at any given time. Nurses who wished to withdraw their pre and post-test information were given up to one month after the post-test. The nurses were made aware, however, that the information from focus group discussions cannot be withdrawn because of the nature of the data-gathering method. The consent form and all other data were only made accessible to the researcher and the research supervisors to protect confidentiality of information.

All audio-recorded focus group interviews were transcribed by the researcher and the transcriptions were only made accessible to the researcher and the research supervisors for the purpose of protecting confidentiality of information. All audio-recorded focus group interviews were eventually deleted after data analysis was completed.

All pre and post-tests were coded and the nurses were assigned a code to link them with the pre and post questionnaire. Names were not required in the pre and post-test to avoid bias during the marking process. All data, including the coding list, were only made accessible to the researcher and research supervisors. All electronic data were stored in password protected computers and the hard copy data were stored in a locked cabinet. There is a plan to securely delete all electronic data with the use of software and dispose hardcopies of data, including the pre and post-tests and checklists in the confidentiality bin after six years so as protect confidentiality of information. Following completion of the research write-up, the study
findings will be made available to the nurses in the form of an executive summary. Nurses were also informed that anonymity will be maintained in reporting and publication in academic journals.

### 3.11 Summary

Chapter three presented the research question, objectives and the methods used in data collection. Chapter three also described the fundamental aspects of study design such as setting; participant recruitment and sampling; data gathering tools; pre-testing of tools; procedure for data gathering; data analysis; study reliability and validity; and, the ethical considerations in the conduct of this study.
Chapter 4. FOCUS GROUP DISCUSSION FINDINGS

4.1 Introduction

Focus group discussions are qualitative research techniques that collect data through group interaction on a topic identified and moderated by the researcher (Doody, Slevin & Taggart, 2012). Focus group discussions were conducted in this study to gain insight into the nurses’ attitude towards urinary catheter insertion, maintenance and removal; and, the prevention of catheter-associated urinary tract infection (CAUTI).

Chapter four presents the qualitative findings of the study and is divided into three sections: section 4.1 presents the introduction to the chapter, section 4.2 provides the socio-demographic profile of the focus group discussion participants and section 4.3 provides a textual description of the key themes from the focused group discussions.

4.2 Socio-demographic profile of focus group participants

The participants’ socio-demographic profile centre on factors that affect the experience of nurses, thereby shaping their attitude toward indwelling catheter management and CAUTI prevention. Focus group participants were all staff nurses who worked at MSC wards one and two. Of the 13 participants, seven came from ward two, and six came from ward one. The majority (n=12) of the participants were females and only one participant was male.

Age

Table 1 presents the ages of the focus group participants. The participants come from various age groups, with the biggest group falling between the ages of 20-25 years.

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Number</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-25 years</td>
<td>5</td>
<td>38</td>
</tr>
<tr>
<td>26-30 years</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>31-35 years</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>36-40 years</td>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>41-45 years</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>46-50 years</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>&gt; 51 years</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>13</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
Chapter 4 – Focus Group Discussion Findings

Length of Clinical Experience
Table 2 shows the years of clinical experience for each participant whether gained in New Zealand or outside New Zealand. More than half of the nurses had less than five years of clinical experience, four had five to ten years clinical experience, and, two had more than ten years clinical experience. The clinical experience described in the table also refer to clinical experience other than that gained in the surgical or perioperative area.

Table 2. Focus group participants’ length of clinical experience

<table>
<thead>
<tr>
<th>Participants’ Length of Clinical Experience (Years)</th>
<th>Number</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5 years</td>
<td>7</td>
<td>54</td>
</tr>
<tr>
<td>5 - 10 years</td>
<td>4</td>
<td>31</td>
</tr>
<tr>
<td>&gt; 10 years</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>13</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Ethnicity
The ethnic backgrounds identified by the focus group participants highlight the ethnic diversity of the group. Table 3 presents the different ethnic backgrounds the participants identify with.

Table 3. Focus group participants’ ethnic background

<table>
<thead>
<tr>
<th>Ethnic Background</th>
<th>Number</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Zealand European</td>
<td>4</td>
<td>31</td>
</tr>
<tr>
<td>Pacific Island</td>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>Indian</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>African</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>Romanian</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Filipino</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>13</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Primary Spoken Language
Majority of the participants identified English as their first language despite coming from diverse ethnic backgrounds. Table 4 highlights the primary spoken language of the participants.
Table 4. Focus group participants’ primary spoken language

<table>
<thead>
<tr>
<th>Primary Spoken Language</th>
<th>Number</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>8</td>
<td>61</td>
</tr>
<tr>
<td>Pacific</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Punjabi</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>African</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Filipino</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Romanian</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>13</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

**Nursing School Attended**

The nurses who participated in the focus group discussion attended various schools of nursing in New Zealand and overseas. Majority of the participants graduated from Manukau Institute of Technology (MIT). Three graduated from other schools of nursing in the Auckland area; one graduated from Greenlane, which is a hospital-based training facility; and, three participants completed their training overseas. The breakdown of the different training institutions attended by the participants is presented in Table 5.

Table 5. Nursing school attended by focus group participants

<table>
<thead>
<tr>
<th>Nursing School Attended by Participants</th>
<th>Number</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manukau Institute of Technology</td>
<td>7</td>
<td>53</td>
</tr>
<tr>
<td>Unitec</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>University of Auckland</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Greenlane</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Overseas</td>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>13</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

The socio-demographic profile of the participants presented above demonstrates a diversity of backgrounds that is reflective of the nursing participants employed at MSC wards one and two.

4.3 Focus group results

The transcribed data from the two focus group discussions were analysed using the constant comparison analysis technique. This technique was first used in grounded theory research and can be used in various types of data analysis (Doody, Slevin & Taggart, 2012). The process involved three stages. In the first stage, the data were grouped together into small units and a code was attached to each unit. The codes were then grouped into categories in the second
stage. Themes were then developed from the categories in the third stage to summarise the content of each discussion group (Doody, Slevin & Taggart, 2012). Focus group data were analysed one focus group at a time and the themes that emerge from one group were compared to the other group to achieve data saturation.

The results of the two focus groups discussions were combined and the following four key themes were established:

- Preparation for catheter management
- Nursing skills and knowledge
- Current clinical practice
- Catheter management resources

4.3.1 Preparation for catheter management

The focus group participants highlighted two subthemes related to the preparation for catheter management in the clinical practice setting: diversity in undergraduate training experience and diversity in training while on the job. These sub-themes, may be attributed to the diversity in their demographic background.

4.3.1.1 Diversity in undergraduate training experience

The undergraduate training experience of the participants are diverse. It is diverse in the following ways: focus of the teaching session, time allotted and frequency of teaching the topic, and teaching strategy used. Some participants felt that catheter care was briefly discussed in a lecture in their undergraduate years, and that the focus was mainly on catheter insertion. A few had an opportunity to watch a demonstration and participate in a return demonstration of catheter insertion. Other participants reported that they attended a lecture on urinary elimination which briefly touched on the use of indwelling catheters.

“I’ve had a school session (on catheter care), brief. It was so quick.”

“It’s more about how to insert indwelling catheters for ladies, but after that nothing much about maintenance.”

“It was 16 years back. Back home. They demonstrate (catheter insertion), the nursing school tutor ... and then 4 or 5 of the students demonstrate too.”
Chapter 4 – Focus Group Discussion Findings

“In the lectures they mention it. But, they only go over the kidney function, the risk of infection, but not discuss it straight away so that the information is ready”

None of the participants recall attending teaching sessions that discussed the various phases of catheter care, i.e., catheter insertion, maintenance and removal, and how each phase is considered an integral part of the entire catheter management package. Lecture was the main teaching strategy used for topics that belong to the psychomotor domain of learning, i.e., catheter insertion and removal.

4.3.1.2 Diversity in training while on the job

On the job training was also varied among the participants. Participants who are new on the job reported getting an orientation on catheter insertion by watching a demonstration.

“When I started, the preceptor, helped me through. She demonstrated. So when I came to do one, she talked me through it.”

“When I was on orientation, I got to see and watch. But I didn’t have an opportunity to actually insert one.”

For those who started working in the MSC wards more than five years ago, they reported that they did not have an orientation and that they relied on familiarising themselves with the hospital policies. The participants reported that accessing the policy took the place of an on-the-job training.

“I don’t remember specifically an orientation. That was nine years ago for me.”

“No (orientation), just as per the hospital policies, you just print out the form. The policy and procedure, online ...”

On the job training reportedly focused on catheter insertion, and very little on catheter maintenance and removal.

“I got talked through it (catheter removal). Not so much formal information.”
The focus group participants recommended the training of nurses on the use of the bladder scanner. The training is vital because an accurate measurement of residual urine is important in making a decision whether to perform in and out catheterisation or not. Nurses use the bladder scanner for patients who have not passed urine or has a distended abdomen. In such instances, nurses discuss their assessment findings with the medical staff to get an affirmation if they think the patient needs an in and out catheter. Below is a direct quote from the nurses when asked about other topics they want to discuss with regard to catheter management.

“Probably for a lot of us too, the bladder scanning. We know that it’s indirectly related, but we’ll just all use the bladder scanner, and give a go for it. And that’s when you often have to make a decision as to when the catheter goes in.”

The nurses also recommended that the use of the bladder scanner be included in the orientation book for new graduate nurses to standardise training for all participants.

“... we have that orientation book, but it’s actually not included (referring to the use of the bladder scanner). It should be, so everyone will be on the same page with everyone and they can assess each other.”

In summary, diversity in undergraduate training experience and diversity in training on the job relates to the nurses’ catheter management skills and knowledge which will be discussed in the succeeding theme.

4.3.2 Nursing skills and knowledge

The discussion on nursing skills and knowledge related to catheter management highlighted two sub-themes: task-oriented catheter care and the misconceptions associated with catheter care practises.

4.3.2.1 Task-oriented catheter care

When asked about their responsibility with regard to catheter care and its impact on their workload, the nurses started to enumerate activities that they do in relation to catheter care. This discussion highlighted nursing responsibilities across the different phases of catheter care.
In the catheter insertion phase, the decision to insert or re-insert a catheter relies heavily on the doctors’ orders. The nurses, however, want to be informed of the rationale behind the doctor’s order and how it relates to the patient’s health condition.

“I should know why the surgeon wants the IDC (indwelling catheter) inserted, first of all. And what’s the problem with the patient. And then we have to do it and ask for consent like, ‘Is it alright for you if we do this?’, and provide education around it, and we do it.”

The nurses also expressed that they know the importance of explaining the procedure to the patient. They also reported that they inform the patient of what to report to nurses.

“When we insert, it’s our responsibility to educate what it is for and what signs to look out for. If it’s painful, they need to let us know, and if they feel that they are not passing urine, or there’s blood.”

The nurses expressed that they often revisit online organisational policies before inserting a catheter to review the procedure. Prior to catheter insertion, patients were informed of the procedure and verbal consent was obtained. This was followed by preparation of equipment and documentation of the type of catheter, the catheter size, date and time of insertion, amount of fluid in the catheter balloon, colour and amount of urine and other urine characteristics.

“You should always document what sort of catheter you put in, what size, what time, the colour of the urine, the amount that you actually get. I mean if you put it in, and it sort of have a pus, then you’re gonna take a specimen as well ... also if it’s cloudy.”

It also emerged from the discussion that each nurse view documentation as important although each had different documentation practices, i.e., what to document and where to document the information. Some of the nurses verbalised that catheter insertion should be documented in the clinical notes, whereas others mentioned that it should be documented in the daily care plan.

“We document in the notes or daily care plan - IDC was inserted ... catheter size and ... how much fluid you put in the balloon.
“(We document) on the clinical notes. That’s what we do. That’s what I do.”

Overall, the process of catheter insertion was viewed as task-oriented and guided by policies.

The catheter maintenance phase is reported to highlight various aspects of the nursing process such as assessment and monitoring of the patient’s urinary function. The nurses emphasised the necessity of collaborating with patients, educating patients on what to report to nurses and documenting assessment findings. Documentation however, centred on the assessment of urine output volume, characteristics and fluid balance.

“When we check the obs (observations) and we check the patient ... if they got any problems, like low urine output. You always check and then you document in the fluid balance chart the amount you emptied because you want to keep track of that.”

“And then ... you assess ... the patient. You check if the patient is febrile, are they comfortable? You still ask, ‘Are you alright with it?’ Some will say yes, others will say ‘Oh, I don’t like it. It’s burning and it’s stinging’

“(You check) if it’s draining or not ... if it’s leaking, (if the) balloon (is) inflated, (the) amount of urine and how much the patient is drinking. (You check) the intake and output.”

Nurses see the catheter maintenance phase as routine although occasionally challenging in terms of monitoring intake and output, making the patient comfortable and keeping the catheter in place.

“We just maintain it like how we do it every time. It’s just there.”

“I don’t think it will be difficult to manage them (catheters). Unless they have a low urine output. That’s when you have to go there frequently and encourage them to drink.”

“Just make sure that they are comfortable with it. And also maintain the output. You need to encourage them to drink more. And on some you’d find that it’s very
The nurses expressed that the decision to remove catheters is dependent on the decision of the medical staff and is guided by post-operative protocols. The doctor’s order to remove the catheter, on the other hand, is guided by the nurse’s recommendation after assessing the patient.

“In my ward, we have the protocol for the knee and hip joint replacements. So on day one, they have to have it out, if they have no problems. If their output is low and you’re concerned about it, then you check with the doctor if they want to keep it another day and ensure proper fluid intake and output and how much they are drinking.”

Nurses expressed that with the existing post-operative protocol for hip and knee surgery, they remove the catheter based on the guidelines and do not wait on the doctor to order catheter removal.

“... the enhanced recovery after surgery (protocol) … is very prescribed ... everything has to happen at exactly the right time ... And you don’t wait for the doctor to tell you to remove the IDC. You do it as per the guidelines.”

However, some nurses find the protocol too prescriptive and not suitable for all patient conditions. Some of the nurses expressed that they still need to make important nursing decisions around patient care and when to remove the catheter. Overall, the nurses expressed that catheter removal as a process is “quick and easy”.

The prevention of urinary tract infection was reported to be associated with several tasks across the various phases of catheter management. The nurses highlighted that they perform the following tasks to prevent infection: effective cleaning of perineal area on catheter insertion, use of sterile technique on catheter insertion, ensuring patient comfort and proper hygiene even with the catheter in place, using one jug per person when emptying the urine bag, ensuring that the patient has adequate fluid intake and removing the catheter as soon as possible.
4.3.2.2 Misconceptions associated with catheter care practices

The participants highlighted a few practices that need to be addressed to improve patient safety. These practices include: the use of saline solution in inflating the indwelling catheter balloon and putting the catheter bag on an incontinence pad that lines the floor when nurses have difficulty in hanging the bags at the bed rails. These practices are inconsistent with best practice literature and guidelines.

“... you have to get some gloves, sterile gloves. Also you have to put some saline, so you can actually balloon it so it won’t come out. And also some saline for you to wash the area.”

“But the other one (referring to another type of indwelling catheter bag), the tube is just a narrow one. It’s just a standard long drainage bag. And sometimes they don’t drain very well if they’re pinned to the side of the bed. So we put a bluey sheet (incontinence pad) on the floor and put the bag on it.”

It was also highlighted that different nurses have different ways of securing the catheter and that some of these practises put patients at risk of impaired skin integrity.

“Because they used to just put a tegaderm on top, and the tube cuts into the skin and you can see that mark.”

Thus, the nurses recommended that safe practises be standardised within the organisation. The nurses further recommended the procurement of urine bags with hooks for hanging drainage bags on the side rails, together with dressings that adhere to the skin without causing cuts or red marks.

Additional input on the rationale behind hourly urine output measurement is also required for nurses to know the importance of performing this accurately.

“We get told to do hourly urines ... And we get that more often than not. (We do it) in an hour and a half, one hour, fifty minutes, just depending on when you get there.”
To summarise, the discussion about the catheter management skills and knowledge of nurses highlighted two sub-themes: the task-oriented nature of the current catheter care practice and the misconceptions associated with the nurses’ catheter care practices.

4.3.3 Current clinical practice
The focus group participants highlighted four subthemes related to the quality of current catheter care practice: collaborative practice, impact of patient’s gender on practice, decision-making in practice and issues in practice.

4.3.3.1 Collaborative practice
The focus group participants expressed that effective catheter care involves the collaboration of medical participants, nurses and patients. Each one was perceived to have a role in its care; either in insertion, maintenance or removal. Nurses were viewed to be responsible for aseptic insertion, maintenance and removal of the catheter, whereas cognitively able patients were seen to have a role in catheter maintenance together with the nurse. Below is a direct quote from the nurses when asked about who is responsible for catheter maintenance.

“Us and the patient ... if the patient is able ... cognitively ... and she is able to tell you, it’s sore or I don’t think it’s draining or any problem they might have.”

Nurses also viewed themselves as responsible for educating patients and empowering them to actively participate in their care.

“When we insert, it’s our responsibility to educate (the patient) what it is for and what signs to look out for. If it’s painful, they need to let us know. And if they feel that they are not passing urine, or there’s blood.”

Catheter removal decision is based on either the protocol or the doctors’ decision. However, nurses make recommendations to keep the catheter in place based on their assessment of the patient. Below is a direct quote from the nurses when asked about a patient who may not fit the criteria for catheter removal based on the protocol.

“If I’m not having any success getting them out of bed, I’ll definitely say to the house surgeon that I’m not taking this (catheter) out ...”
“If we are concerned, we just leave it for later, for the next nurse to monitor and assess.”

“Because for some patients they would have no urine output, like at night. So if you take it at 6 (am), sometimes it would be hard for you to know if they are improving or worsening so leave it in and maybe it could be taken at midday.”

The nurses also emphasised the importance of handover of current decisions for patients who may not fit the criteria for catheter removal. Below is a direct quote from nurses when asked whether they make important decisions around actual patients and catheter removal.

“If you leave it in and you didn’t handover, someone may just leave it in too. So you have to handover that it has to be taken out.”

Overall, the participants expressed that they perceive the nurses to be mainly responsible in the implementation of the three phases of care.

4.3.3.2 Impact of patient’s gender on practice

Another sub-theme that emerged from the focus group discussion was that catheter insertion practice was affected by the patient’s gender. Though unwritten in any organisational policy, nurses can insert indwelling catheters primarily on female patients alone, whereas doctors insert indwelling catheters on male patients. Below is a direct quote from nurses when asked about who inserts catheters among patients.

“Nurses do females; for males, the doctors.”

“When I came back ... they said nurses don’t do male catheters.”

The question was rephrased when another group was interviewed. Below is their simultaneous reply when asked if nurses insert catheters on male patients.

“We don’t. We’re not allowed.”

Catheter insertion opportunities among nurses were also reportedly affected by the nurses’ gender. A male nurse has been refused the opportunity to insert an indwelling catheter several
times because patients, regardless of gender, prefer a female nurse. Gender, however, was not reported as a factor that affects catheter maintenance and catheter removal practices.

4.3.3.3 Decision-making in practice
The participants highlighted that decision-making in practice is dependent on the nurses’ application of the nursing process. Nurses recognise that patient assessment plays a major role in collaborative care and that it is an essential step to making decisions. Nursing assessment was also viewed as a complement to protocol compliance and justifies referrals and nursing recommendations. Below is a direct quote from participants when asked if they assess the patient and compare it against the protocol or pathway to make a decision.

“You check the pathway and you check if the patient is mobile and they’re able to go to the toilet. And then you take it out.”

Documentation of assessment findings that led to certain decisions and handover to the next shift was also seen as essential in the quality and continuity of care.

“It’s a variance at the end of the pathway where you just write the reason why you haven’t taken it out and who you discussed it with and what’s the problem. You just document in the variance why it is not followed according to the pathway.”

4.3.3.4 Issues in practice
Catheter care challenges as a sub-theme emerged from discussions of current clinical practice. The participants highlighted various issues namely: nurse’s gender as a barrier in catheter insertion practice and nurses’ ethical dilemma.

Nurse’s gender as a barrier in catheter insertion practice
While the patient’s gender determines who may insert an indwelling catheter on them, it was not categorically identified as a barrier in catheter care. Nurse’s gender on the other hand, was identified by a male nurse as a barrier, not only in catheter care, but also in his learning and nursing care experience. According to this participant, he has been refused the opportunity to insert an indwelling catheter several times because patients, regardless of gender, have stated that they prefer a female nurse to perform catheter insertion and care.
Chapter 4 – Focus Group Discussion Findings

“For me as a male nurse, it’s a challenge … asking permission (to insert a catheter) is like it has always has been - ‘I prefer a female nurse’... I never got the opportunity to actually put one in because of that barrier.”

The nurse thinks that it is not good for his learning and hopes that he would be given an opportunity to be able to insert a catheter someday.

**Nurses’ ethical dilemma**

Nurses face a dilemma when the patients refuse to have an indwelling catheter inserted. For patients who refuse, nurses need to work out between refusal as a patient right and their responsibility to perform the procedure.

“If they refuse, that’s their right ... You need to work with that.”

The nurses also highlighted that it is a challenge to provide instructions to older people with dementia thus making catheter management tricky. There is also a risk for these patients to pull their catheters out even when the balloon is still inflated, thereby causing trauma. This was reported to be particularly more common among male patients.

“It is difficult to explain to the demented patient about the catheter.”

“They might pull out the catheter. Sometimes, they do pull them out.”

Nurses also expressed that they had to strike a balance between securing the catheter in place and maintaining the patient’s skin integrity or even removing the catheter if it is not necessary.

“I think in theatre they’ve got this new little dressing, which is very fancy ... It’s quite nice, but we know that most of them will end up with a red mark the following day, so we remove it.”

“But most of them are very comfortable. They may not be complaining but its pulling ... then we secure them.”
This dilemma results in various ways of securing the urinary catheter. It was reported that the type of dressings used cause red marks or cuts on patients with fragile skin. In some cases, the patient’s skin reacts to the dressing.

“I found a new thing ... especially if you’ve got somebody with fragile skin. If you put a piece of tegaderm on their leg and then stick the plaster to this tegaderm, it sticks really well.

“But you would put that green piece of gauze, underneath, wouldn’t you? Some usually do.”

“Some just puts tegaderm on top.”

The nurses concern for their patient’s safety led them to the recommendation that the organisation should procure dressings that would not cause allergies nor cuts on the patient’s skin. This is in addition to a previous recommendation for the organisation to look into other products that would make catheter management safe such as urine bags that are easy to secure to the side rails and a bladder scanner.

In summary, the following sub-themes emerged from the discussion of the quality of current catheter care practice: catheter management requires a collaborative approach, gender impacts on catheter care, decision-making in practice and issues in practice. A huge part of the quality of the current catheter care practice is dependent on the nursing process. The nursing process, on the other hand was viewed as a complement to existing organisational protocols and catheter management resources.

4.3.4 Catheter management resources
Catheter management resources as a theme emerged from discussions of the impact of working with patients who have indwelling catheters. Catheter management resources such as policies and protocols were viewed to have helped compensate for the variability in training of the staff. The subthemes that developed out of this discussion include: nurses’ awareness of and access to catheter management resources; and the quality of available catheter management resources.
4.3.4.1 Nurses’ awareness of and access to catheter management resources

Most of the participants were aware of the existing organisational policy on catheter insertion and removal, but were not sure about maintenance. All of the nurses were aware that it is available intranet, however, some were not aware of its exact location. Lack of awareness of the specific location of the organisational policy relates to issues of access.

“I think there is a protocol and guidelines on how to insert it. But it’s not always easy to find and you just do what you are told.”

For those who do not know where to locate the policy, they rely on their colleagues or ward resource nurse to support them in recalling the procedure.

“The first one I’ve inserted, I went to someone and said that I can’t find the guidelines, I didn’t have it and no one has showed me which one to look at yet.”

“I was quite new and I went to the resource nurse and said that I can’t find it online, can you talk me through the process. So we went step by step and that was not with the policy printed out. But I still went step by step.”

While the organisational policy is the primary go-to guide when recalling information; in its absence, colleagues were seen as very valuable in readily accessing information and guidance at work.

4.3.4.2 Quality of available catheter management resources

For some post-surgical patients, indwelling catheter removal schedule was reported to be integrated in the enhanced recovery after surgery (ERAS) guidelines. In several ways, these organisational policies were viewed to have standardised the process and guided nurses in deciding whether to remove the catheter or not.

“For our ERAS patients, we go by the ERAS guidelines... ERAS is the enhanced recovery after surgery and it’s very very prescribed ... you don’t wait for the doctor to tell you to remove the IDC. You do it as per the guidelines.”
Chapter 4 – Focus Group Discussion Findings

“... we follow the surgeon’s plan because some of them will say 48 or 24 hours and some will say next morning. On the whole, we tend to remove them at about 6 o’clock in the morning.”

“We’ve got general surgery, we’ve got vascular, we’ve got breast… And some of them have clear pathways and some of them we know the catheter’s gonna come out the next morning … So mostly, they come out early morning, 6 am.”

Some nurses find the existing protocol too prescriptive and not suitable for various types of patients. In circumstances wherein patient conditions do not conform to what was described in the guidelines, nurses rely on the nursing process and collaborative care in making important decisions and interventions.

“If their output is low and you’re concerned about it, then you check with the doctor if they want to keep it another day, and ensure proper fluid intake and output and how much they are drinking.”

The discussion of catheter management resources as a theme dealt mostly with nurses’ compliance with existing catheter management policies that is accessible intranet.

4.4 Conclusion

This chapter has provided the qualitative findings from the focus group discussions. It has highlighted themes and subthemes that emerged from focus group discussions and offers insight into nurses’ experiences which shaped their attitude toward catheter management. The emerging themes also provided insight into the nurses’ knowledge and practices in relation to catheter management.
Chapter 5. PRE and POST-TEST FINDINGS

5.1 Introduction
Chapter five highlights the quantitative pre and post-test findings from the education session on evidence-based catheter management practices. The chapter is divided into six sections: section 5.1 presents the introduction or the overview of the chapter; section 5.2 provides a tabular and textual presentation of the pre-test and post-test participants’ demographic data; section 5.3 provides a graphical and textual comparison of the pre-test and post-test results; section 5.4 presents the results of hypothesis testing and statistical analysis and section 5.5 presents the conclusion derived from the hypothesis testing.

Staff nurses working at Manukau Super Clinic wards one and two were invited to attend the forty-minute education session on evidence-based catheter management practices where they, as a group, completed the pre-test prior to the lecture and post-test afterwards. Fourteen (n=14) nurses participated in the education session. A description of the education session participants is provided in the next section.

The education session was offered on two different dates to accommodate as many staff as possible without compromising patient care. The education session was divided into three parts: pre-test administration, lecture and post-test administration. For the pre-test, the participants were given a 25-item multiple choice quiz that took them approximately 20 minutes to complete. This was followed by a lecture on catheter-associated urinary tract infection (CAUTI) that lasted for 45-minutes. After which, a post-test similar to the pre-test was also given to the nurses. The participants took around 10-15 minutes to complete the post-test.

5.2 Demographic data
All of the participants in the education session were females (n=6), with six (n=6, 43%) of them from MSC ward one and eight of them (n=8, 57%) from MSC ward two.

Age
The participants come from various age groups, with the biggest group falling between the age range of 36-40 years of age. Table 6 presents the ages of the pre-and post-test participants.
Chapter 5 – Pre and Post-test Findings

Table 6. Pre and post-test participants’ age

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Number</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
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<td>20-25 years</td>
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<td>26-30 years</td>
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<td>0</td>
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<td>&gt; 51 years</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Length of Clinical Experience

The participants also demonstrated diversity in relation to length of clinical experience. Majority of the participants (n=8) had five to ten years of experience whereas one participant did not answer the question on length of clinical experience. Clinical experience refer to clinical practise in the surgical area or outside; and those gained either in New Zealand or outside of New Zealand. Table 7 presents data on the participants’ number of years of clinical experience.

Table 7. Pre and post-test participants’ length of clinical experience

<table>
<thead>
<tr>
<th>Participants’ Length of Clinical Experience (Years)</th>
<th>Number</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3 years</td>
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<tr>
<td>3-5 years</td>
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<tr>
<td>5-10 years</td>
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<td>57</td>
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<tr>
<td>&gt; 10 years</td>
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<tr>
<td><strong>Total</strong></td>
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<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Ethnicity

The pre and post-test participants come from various ethnic backgrounds. Majority (n=5) of the nurses or 36% had a New Zealand European background. Other participants identify as Pacific islanders, Indians, Maori, African and Filipino. Table 8 presents the different ethnic backgrounds the participants identify with.
Table 8. Pre and post-test participants’ ethnic background

<table>
<thead>
<tr>
<th>Ethnic Background</th>
<th>Number</th>
<th>Percentage (%)</th>
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<tr>
<td>New Zealand European</td>
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<tr>
<td>Pacific Island</td>
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<td>Indian</td>
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<td>Filipino</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>14</strong></td>
<td><strong>99</strong></td>
</tr>
</tbody>
</table>

Primary Spoken Language

Given the participants’ diversity in ethnic background, it was not surprising that eight (57%) of the participants had English as their first language. The other participants had Punjabi, Hindi and African as their primary language. One participant identified Pacific island language as her primary language without specifying which one it was. Table 9 highlights the primary spoken language of the participants.

Table 9. Pre and post-test participants’ primary spoken language

<table>
<thead>
<tr>
<th>Primary Spoken Language</th>
<th>Number</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>8</td>
<td>57</td>
</tr>
<tr>
<td>Punjabi</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>Hindi</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>African</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Pacific island language</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14</strong></td>
<td><strong>99</strong></td>
</tr>
</tbody>
</table>

The demographic data collected show that although all of the participants were females, a range of demographic characteristics such as age, length of clinical experience and ethnic background provided diversity in the participants’ group.

5.3 Pre-test and post-test results

The main quantitative findings of this study are presented in this section. The section starts with a presentation of the number of nurses with correct and incorrect answers to each test question in the pre and post-test. The questions were then grouped together into four main topics, namely: CAUTI background knowledge, indwelling catheter insertion, indwelling catheter maintenance and indwelling catheter removal, to facilitate hypothesis testing. These main topics correspond with the four components of catheter care discussed in the review of
Chapter 5 – Pre and Post-test Findings

literature and incorporated in the education package. The four components of catheter care are: reduce inappropriate use of urinary catheters, perform proper techniques for indwelling catheter insertion, implement proper catheter maintenance procedures, and remove catheters in a timely manner. A graphical presentation of the number of nurses with correct and incorrect answers in the various questions under each main topic is also presented in this section. The section then proceeds with a graphical presentation of each nurse’s pre and post-test scores.

All participants (n=14) took both the pre-test and a post-test. The test involved questions that dealt with background knowledge and included topics such as CAUTI definition, risk factors, pathophysiology, signs and symptoms, and complications. There were also several test questions related to the three components of catheter care to prevent CAUTI - indwelling catheter insertion, maintenance and removal. The test questionnaire with answers and rationale could be found in Appendix 15.

Data gathered for each of the questions in the pre and post-tests are presented below to provide a comparison between the two data collection points.

**Question Number One**

Question one focused on the effects of CAUTI on the patient’s length of hospital stay. In the pre-test, eight nurses (57%) gave the correct answer while six nurses (43%) gave an incorrect answer. In contrast to this, all the participants answered the question correctly after the education session. Figure 1 presents the participants’ responses to question one and shows that all of the participants answered the question correctly in the post test.

**Figure 1. Number of nurses with correct and incorrect answers to pre-test and post-test question number one**

![Figure 1](image)
Chapter 5 – Pre and Post-test Findings

**Question Number Two**
Question two focused on the most common type of healthcare-associated infection which is CAUTI. Majority or 12 nurses (86%) gave the correct answer in the pre-test. Two nurses (14%), however, gave an incorrect answer. Figure two presents the findings for this question. Figure 2 shows that after the education session, all of the participants answered the question correctly.

**Figure 2. Number of nurses with correct and incorrect answers to pre-test and post-test question number two**

![Bar chart showing the number of nurses with correct and incorrect answers to question number two](chart1)

**Question Number Three**
Question number three asked the participants to identify the true statement from choices that described the risk of getting CAUTI from an indwelling catheter. Ten nurses (72%) gave the correct answer while four nurses (28%) gave an incorrect answer in the pre-test. All of the nurses gave the correct answer in the post-test. Figure 3 presents the findings to this question.

**Figure 3. Number of nurses with correct and incorrect answers to pre-test and post-test question number three**

![Bar chart showing the number of nurses with correct and incorrect answers to question number three](chart2)
Chapter 5 – Pre and Post-test Findings

**Question Number Four**

Question number four asked about the nurses’ concept of biofilms. The nurses provided varying answers to question number 4 in the pre-test, with half of them (n=7, 50%) giving the correct answer and the other half (n=7, 50%) giving various incorrect answers. All of the nurses, however, gave the correct answer in the post-test. Figure 4 presents the findings to this question.

**Figure 4. Number of nurses with correct and incorrect answers to pre-test and post-test question number four**

![Figure 4](image)

**Question Number Five**

Question number five asked about the diagnostic criteria for the diagnosis of CAUTI, including the signs and symptoms associated with it. In the pre-test, 12 nurses (86%) answered it correctly, while two nurses (14%) provided incorrect answers. All of the nurses gave the correct answer in the post-test. Figure 5 presents the findings to this question.

**Figure 5. Number of nurses with correct and incorrect answers to pre-test and post-test question number five**

![Figure 5](image)
Chapter 5 – Pre and Post-test Findings

**Question Number Six**
Question number six focused on evidence-based interventions that reduce the incidence rate of CAUTI. In the pre-test, ten nurses (71%) gave the correct answer, while four nurses (29%) gave an incorrect answer. In the post-test, two of the nurses (14%) gave the same incorrect answer that they provided in the pre-test. Figure 6 presents the findings to this question.

**Figure 6. Number of nurses with correct and incorrect answers to pre-test and post-test question number six**

<table>
<thead>
<tr>
<th></th>
<th>Pre-test</th>
<th></th>
<th>Post-test</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>RNs with Incorrect Answer</td>
<td>4</td>
<td>2</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>RNs with Correct Answer</td>
<td>10</td>
<td>12</td>
<td>71%</td>
<td>29%</td>
</tr>
</tbody>
</table>

**Question Number Seven**
Question number seven asked about the signs and symptoms that need to be monitored when CAUTI is suspected. Thirteen nurses (93%) identified the correct signs and symptoms; however, one nurse (7%) did not provide any answer to the question in the pre-test. All of the nurses gave the correct answer in the post-test. Figure 7 presents the findings to this question.

**Figure 7. Number of nurses with correct and incorrect answers to pre-test and post-test question number seven**

<table>
<thead>
<tr>
<th></th>
<th>Pre-test</th>
<th></th>
<th>Post-test</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>RN with No Answer</td>
<td>1</td>
<td>13</td>
<td>7%</td>
<td>14</td>
</tr>
<tr>
<td>RNs with Correct Answer</td>
<td>14</td>
<td>13</td>
<td>93%</td>
<td>29%</td>
</tr>
</tbody>
</table>
Chapter 5 – Pre and Post-test Findings

**Question Number Eight**

Question number eight focused on the components of a good CAUTI prevention programme. Ten nurses (71%) gave the correct answer while four nurses (29%) gave an incorrect answer in the pre-test. All of the nurses gave the correct answer in the post-test. Figure 8 presents the findings to this question.

**Figure 8. Number of nurses with correct and incorrect answers to pre-test and post-test question number eight**

![Bar chart showing the number of nurses with correct and incorrect answers to question number eight.](image)

**Question Number Nine**

Question number nine asked the nurses to identify from a list, a statement that is not considered an acceptable indication for catheter insertion. All (n=14, 100%) of the participants gave the correct answer in the pre-test and this was consistent in the post-test.

**Question Number Ten**

Question number ten focused on sterile insertion technique as a way of preventing CAUTI. Eight nurses (57%) gave correct answers, while six nurses (43%) gave incorrect answers in the pre-test. All of the nurses gave the correct answer in the post-test. Figure 9 presents the findings to this question.
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Figure 9. Number of nurses with correct and incorrect answers to pre-test and post-test question number ten

![Bar chart showing the number of nurses with correct and incorrect answers to question number ten.](chart)

Question Number 11

Question number 11 asked the nurses if they think that the use of smaller-diameter catheters and catheter-stabilisation devices improves patient comfort. This is a true statement and ten nurses (72%) answered the question correctly while four nurses (28%) did not provide the correct answer in the pre-test. All of the nurses gave the correct answer in the post-test. Figure 10 presents the findings to question number 11.

Figure 10. Number of nurses with correct and incorrect answers to pre-test and post-test question number 11

![Bar chart showing the number of nurses with correct and incorrect answers to question number eleven.](chart)
Question Number 12
Question number 12 focused on the strongest predictor of CAUTI. Twelve nurses (86%) answered the question correctly, while two nurses (14%) gave incorrect answers in the pre-test. All of the nurses gave the correct answer in the post-test. Figure 11 presents the findings to this question.

Figure 11. Number of nurses with correct and incorrect answers to pre-test and post-test question number 12

Question Number 13
Question number 13 focused on evidence-based measures to prevent CAUTI in the hospital setting. Nurses were given a list and were asked to identify which practice does not prevent CAUTI. Six nurses (43%) provided the correct answer while eight nurses (57%) provided variable incorrect answers in the pre-test.

In the post-test, twelve nurses (86%) provided the correct answer while two nurses (14%) remained to provide wrong answers. One nurse gave the same incorrect answer in the post-test. Another nurse gave the correct answer in the pre-test, and subsequently made an error in the post-test. There is, however, a 43% (n=6) increase in the number of nurses with correct answers after the education session. Figure 12 presents the findings to this question.
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Figure 12. Number of nurses with correct and incorrect answers to pre-test and post-test question number 13

Question Number 14
Question number 14 focused on the complications associated with CAUTI and the nurses were asked to identify which one is not considered a complication from a list of four health problems. Eight nurses (57%) identified the correct answer, while six nurses (43%) gave various incorrect answers in the pre-test. All of the nurses gave the correct answer in the post-test. Figure 13 presents the findings to question number 14.

Figure 13. Number of nurses with correct and incorrect answers to pre-test and post-test question number 14

Question Number 15
Question number 15 focused on the use of systemic antimicrobial agents as a prophylaxis against CAUTI. Six nurses (43%) identified the correct answer, while eight nurses (57%) gave various incorrect answers in the pre-test.
Chapter 5 – Pre and Post-test Findings

In the post-test, 13 nurses (93%) provided the correct answer, while one nurse (7%) gave an incorrect answer. The nurse who gave an incorrect answer in the post-test gave the same incorrect answer in the pre-test. Figure 14 presents the findings to this question.

**Figure 14. Number of nurses with correct and incorrect answers to pre-test and post-test question number 15**

![Bar chart showing the number of nurses with correct and incorrect answers between pre-test and post-test for question 15.](chart_image)

**Question Number 16**

Question number 16 focused on when to perform hand hygiene while doing urinary catheter cares. All of the nurses (n=14, 100%) provided the correct answer to this question in both the pre-test and the post-test.

**Question Number 17**

Question number 17 asked the nurses to identify an appropriate use of indwelling catheters from a list of inappropriate uses of indwelling catheters. Six nurses (43%) gave the correct answer while the remaining eight nurses (57%) gave various incorrect answers in the pre-test.

For the post-test, eight nurses (57%) provided the correct answer, while six nurses (43%) gave variable incorrect answers. The nurses who gave an incorrect answer in the post-test were the same nurses who gave an incorrect answer in the pre-test. Figure 15 presents the findings to this question.
Chapter 5 – Pre and Post-test Findings

Figure 15. Number of nurses with correct and incorrect answers to pre-test and post-test question number 17

Question Number 18
Question number 18 asked about the proper time for removing indwelling urinary catheters among patients with uncomplicated surgeries. Eleven nurses (79%) gave correct answers while three nurses (21%) gave an incorrect answer in the pre-test. All of the nurses gave the correct answer in the post-test. Figure 16 presents the findings to question number 18.

Figure 16. Number of nurses with correct and incorrect answers to pre-test and post-test question number 18

Question Number 19
Question number 19, which focused on hand hygiene, is a reiteration of question 16. All of the nurses (n=14, 100%) provided the correct answer in both the pre-test and the post-test.
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**Question Number 20**

Question number 20 focused on the routine use of antiseptic lubricants. Eight nurses (57%) gave incorrect answers in the pre-test while six nurses (43%) gave the correct answer. Note that in the pre-test, those with incorrect answers outnumber those with correct answers. In the post-test, two nurses (14%) gave incorrect answers, whereas, twelve nurses (86%) gave the correct answer. The nurses who gave an incorrect answer in the post-test were the same nurses who gave a similar incorrect answer in the pre-test. Figure 17 presents the findings to this question.

**Figure 17. Number of nurses with correct and incorrect answers to pre-test and post-test question number 20**

![Bar chart showing the number of nurses with correct and incorrect answers in pre-test and post-test](chart)

**Question Number 21**

Question number 21 focused on securing the indwelling catheter to prevent urethral traction and unnecessary trauma. All of the nurses (n=14, 100%) provided the correct answer to this question in both the pre-test and the post-test.

**Question Number 22**

Question number 22 focused on the proper indications for changing the urinary catheter and the collecting system. Thirteen nurses (93%) gave correct answers while one nurse (7%) gave an incorrect answer in the pre-test. All of the nurses gave the correct answer in the post-test. Figure 18 presents the findings to this question.
Chapter 5 – Pre and Post-test Findings

Figure 18. Number of nurses with correct and incorrect answers to pre-test and post-test question number 22

Question Number 23

Question number 23 focused on the proper indications for changing the urinary catheter and the collecting system. Ten nurses (71%) gave incorrect answers in the pre-test, whereas, only four nurses (29%) gave the correct answer. Note that in the pre-test, those with incorrect answers outnumber those with correct answers.

In the post-test, only one nurse gave an incorrect answer, whereas, thirteen nurses (93%) gave the correct answer. The nurse with an incorrect answer in the post-test also provided an incorrect answer in the pre-test. Figure 19 presents the findings to question number 23.

Figure 19. Number of nurses with correct and incorrect answers to pre-test and post-test question number 23
Question Number 24

Question number 24 focused on the practise of regularly cleaning the peri-urethral area with antiseptics while the catheter is in place. Eight nurses (58%) gave incorrect answers in the pre-test, whereas, six nurses (42%) gave the correct answer. Note that those with incorrect answers outnumber those with correct answers in the pre-test.

A nurse gave an incorrect answer in the post-test, whereas, thirteen nurses (93%) gave the correct answer. The nurse with an incorrect answer in the post-test had a correct answer in the pre-test. Figure 20 presents the findings to question number 24.

![Figure 20. Number of nurses with correct and incorrect answers to pre-test and post-test question number 24](image)

Question Number 25

Question number 25 focused on where to collect urine samples for culture. Eleven nurses (79%) gave various incorrect answers in the pre-test, whereas, only three nurses (21%) gave the correct answer. Note that those with incorrect answers outnumber those with correct answers in the pre-test.

In the post-test, four nurses (29%) gave an incorrect answer, whereas ten nurses (71%) gave the correct answer. The nurses who gave an incorrect answer in the post-test were the same nurses who gave variable incorrect answers in the pre-test. Figure 21 presents the findings to this question.

![Figure 21](image)
Overall, the pre-test results showed that the nurses had some knowledge about catheter management and CAUTI prevention. The nurses had similar concepts on the following topics as evidenced by at least twelve of them (86%) providing the correct answer: signs and symptoms of CAUTI (question 5 and 7), indications of urethral catheterisation (question 9), CAUTI risk factors (question 12 and 21), hand hygiene (question 16 and 19), and proper indications for changing the urinary catheter (question 22).

On the other hand, the nurses’ concept of the following topics vary greatly as evidenced by their varying answers: effects of CAUTI on the patient’s length of hospital stay (question 1), biofilm (question 4), evidence-based interventions that reduce the incidence rate of CAUTI (question 6, 10, 11, 13, 15), components of a CAUTI prevention programme (question 8), complications associated with CAUTI (question 14), appropriate and inappropriate use of indwelling catheters (question 17), proper time for removing indwelling urinary catheters (question 18), use of antiseptic lubricants (question 20), proper indications for changing the urinary catheter and the collecting system (question 23), peri-urethral area cleaning (question 24), urine sample collection (question 25). All of the nurses did well, however, in identifying an inappropriate indication for indwelling catheter use (question 9). These findings helped the researcher identify areas that need emphasis when feedback was given to the nurses.

The post-test result showed a significant change in the nurses’ overall knowledge level although some of the nurses’ earlier concept of catheter management and CAUTI prevention remained the same. The questions where a few nurses remained to have incorrect answers were: evidence-based interventions that reduce the incidence rate of CAUTI (question 6, 13,
Chapter 5 – Pre and Post-test Findings

15), appropriate and inappropriate use of indwelling catheters (question 17), use of antiseptic lubricants (question 20), proper indications for changing the urinary catheter (question 23), peri-urethral area cleaning (question 24), urine sample collection (question 25). These findings helped the researcher identify areas that require reinforcement when feedback was given to nurses.

The pre-test and post-test result when compared to each other, showed an overall improvement in the number of nurses who provided correct answers to each of the 25 questions. While not all of the questions were answered correctly in the post-test, 17 or 68% of the questions were answered correctly by all of the nurses after the education session.

Nurses with correct and incorrect answers in the four components of catheter care

The pre and post-test questions were developed in consideration of four main topics that correspond with the four components of catheter care. These four main topics are: CAUTI background knowledge, indwelling catheter insertion, indwelling catheter maintenance and indwelling catheter removal. The four components of catheter care are: reduce inappropriate use of urinary catheters, perform proper techniques for indwelling catheter insertion, implement proper catheter maintenance procedures, and remove catheters in a timely manner. Grouping of the test questions into the four main topics was done to facilitate hypothesis testing. A graphical presentation of the number of nurses with correct and incorrect answers in the various questions under each main topic is presented in the succeeding graphs.

For the purpose of this study, background knowledge includes risk factors, pathophysiology, signs and symptoms and CAUTI complications. Question numbers 1, 2, 3, 4, 5, 7, 8, 12 and 14 focused on CAUTI background knowledge. Figure 22 presents the number of nurses with correct and incorrect answers in each of the test questions under the CAUTI background knowledge. The graph shows that all of the nurses gave a correct answer for all of the background knowledge questions in the post-test.
Chapter 5 – Pre and Post-test Findings

**Figure 22. Number of nurses with correct and incorrect answers in the CAUTI background knowledge questions**

Question numbers 6, 9, 10, 11, 17 and 20 focused on indwelling catheter insertion. Figure 23 presents the number of nurses with correct and incorrect answers in each of the test questions pertaining to catheter insertion. All of the nurses gave correct answers in three out of five questions in the post-test.

**Figure 23. Number of nurses with correct and incorrect answers in questions pertaining to indwelling catheter insertion**

Question numbers 13, 15, 16, 19, 21, 22, 24 and 25 focused on indwelling catheter maintenance. Figure 24 presents the number of nurses with correct and incorrect answers in each of the test questions pertaining to indwelling catheter maintenance. All of the nurses gave the correct answers in four out of eight questions in the post-test.
Chapter 5 – Pre and Post-test Findings

**Figure 24. Number of nurses with correct and incorrect answers in questions pertaining to indwelling catheter maintenance**

Question numbers 18 and 23 focused on indwelling catheter removal. Figure 25 presents the number of nurses with correct and incorrect answers in each of the test questions pertaining to indwelling catheter removal. All of the nurses gave the correct answer in one out of two questions in the post-test.

**Figure 25. Number of nurses with correct and incorrect answers in questions pertaining to indwelling catheter removal**

**Nurses’ pre and post-test scores**

The nurses manifested improvement in their test scores after the education session. Figure 26 presents the nurses’ pre-test score side by side with their post-test scores to facilitate comparison between the scores. The pre-test and post-test scores of each nurse when
compared to each other, showed an overall improvement. While only five nurses received a perfect score in the post-test, there were four more nurses who received a near-perfect score.

**Figure 26. Nurses’ pre-test and post-test scores**

In summary, the pre-test results showed that the nurses had some knowledge about catheter management and CAUTI prevention. The pre-test and post-test result when compared to each other, showed an overall improvement in the number of nurses who provided correct answers to each of the 25 questions. The test questions when grouped together, relate to four main topics, namely: CAUTI background knowledge, indwelling catheter insertion, indwelling catheter maintenance and indwelling catheter removal. Grouping of the test questions was done to facilitate hypothesis testing. The four main topics correspond with the four components of catheter care which are: reduce inappropriate use of urinary catheters, perform proper techniques for indwelling catheter insertion, implement proper catheter maintenance procedures, and remove catheters in a timely manner. The nurses as a group, manifested improvements in their test scores in the four main topics of the education package. Each nurse manifested overall improvement in their test scores after the education session.

**5.4 Hypothesis testing and statistical analysis**

This study aims to measure and compare the pre and post-test scores of the nurses to ascertain the impact of the CAUTI education package on the nurses’ knowledge on indwelling catheter care and CAUTI prevention knowledge.
Chapter 5 – Pre and Post-test Findings

The test questions were grouped together into four main topics to facilitate hypothesis testing. The four main topics correspond with the four components of catheter care, which include: reduce inappropriate use of urinary catheters, perform proper techniques for indwelling catheter insertion, implement proper catheter maintenance procedures, and remove catheters in a timely manner. The four main topics with the relevant questions are:

- Background knowledge – questions 1, 2, 3, 4, 5, 7, 8, 12, 14
- Indwelling catheter insertion – questions 6, 9, 10, 11, 17, 20
- Indwelling catheter maintenance – questions 13, 15, 16, 19, 21, 22, 24, 25
- Indwelling catheter removal – questions 18, 23

Data for each main topic were found to be not normally distributed. Thus, a non-parametric test, i.e., Wilcoxon Signed-Rank test was used to determine if there was a significant difference between the pre and the post-test. The Wilcoxon signed-rank test is used to compare two sets of scores from the same sample (Polit & Beck, 2012). Table 10 provides a summary of the statistical testing that was done on the combined pre and post-test scores of the nurses on the four main topics presented. As shown in the last column, there is a significant difference ($P < 0.05$) between the pre and post-test scores of the nurses on the four main topics discussed in the lecture.

Table 10. Descriptive summary of statistical testing on the four main topics in the pre and post-test

<table>
<thead>
<tr>
<th>Components</th>
<th>Test</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Median</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background Knowledge</td>
<td>Pre</td>
<td>6.6</td>
<td>1.02</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>9</td>
<td>0</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Difference (Post-Pre)</td>
<td>2.4</td>
<td>1.02</td>
<td>2.5</td>
<td>0.0001</td>
</tr>
<tr>
<td>Catheter Insertion</td>
<td>Pre</td>
<td>3.9</td>
<td>1.6</td>
<td>4</td>
<td></td>
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<tr>
<td></td>
<td>Post</td>
<td>5.2</td>
<td>0.97</td>
<td>5.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Difference (Post-Pre)</td>
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<td>1.7</td>
<td>0.5</td>
<td>0.0234</td>
</tr>
<tr>
<td>Catheter Maintenance</td>
<td>Pre</td>
<td>5.4</td>
<td>0.94</td>
<td>5</td>
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<tr>
<td></td>
<td>Post</td>
<td>7.4</td>
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<td>7.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Difference (Post-Pre)</td>
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<td>1.2</td>
<td>2</td>
<td>0.0005</td>
</tr>
<tr>
<td>Catheter Removal</td>
<td>Pre</td>
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</tr>
<tr>
<td></td>
<td>Post</td>
<td>1.9</td>
<td>0.27</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Difference (Post-Pre)</td>
<td>0.9</td>
<td>0.66</td>
<td>1</td>
<td>0.002</td>
</tr>
</tbody>
</table>
Chapter 5 – Pre and Post-test Findings

Paired t-test was carried out in order to test for a significant difference in the overall score between the pre and the post-test. A t-test is a parametric procedure of testing the difference in group means (Polit & Beck, 2012). Table 11 provides a summary of the statistical testing done on the overall pre and post-test scores of the nurses.

Table 11. Descriptive summary of statistical testing of overall pre and post-test scores

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Difference (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-test</td>
<td>23.6</td>
<td>1.70</td>
<td>6.64 (4.96, 8.33)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Pre-test</td>
<td>16.9</td>
<td>2.56</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The last column shows that there is a significant difference (p < 0.0001) in the overall pre and post-test scores of the nurses, with a mean difference of 6.64 and 95% CI of (4.96, 8.33). These descriptive statistical analyses provide an opportunity to draw a conclusion from the quantitative data of this study.

5.5 Conclusion

The CAUTI education package had a significant impact on the nurse’s overall knowledge on indwelling catheter care and CAUTI prevention. Specifically, the CAUTI education package had a significant impact on the four components of indwelling catheter care and CAUTI prevention, namely: reduce inappropriate use of urinary catheters, perform proper techniques for indwelling catheter insertion, implement proper catheter maintenance procedures, and remove catheters in a timely manner. These components are inter-related and represent the entirety of proper indwelling catheter management to prevent CAUTI. Education on CAUTI prevention should not only focus on one aspect of care, but should be spread across all four components of care.
Chapter 6. DOCUMENT ANALYSIS FINDINGS

6.1 Introduction
Knowledge gained should be integrated within practice for it to be truly effective. After the education sessions, data on the nurses’ indwelling catheter management practices were gathered utilising a self-administered indwelling catheter maintenance checklist. This chapter presents the document analysis of the Daily Urinary Catheter Maintenance Checklist which was introduced to identify nurses’ indwelling catheter management practices that relate to the prevention of catheter-associated urinary tract infection (CAUTI). The chapter is divided into five sections: section 6.1 presents the introduction to the chapter; section 6.2 provides an insight into the nurses’ documentation of indwelling catheter care using the checklist provided; section 6.3 presents the results of the documentation analysis; section 6.4 summarises the findings to present a bigger picture of document analysis; and, section 6.5 concludes the presentation of the findings.

6.2 Documentation of indwelling catheter care practices
Data gathering for the checklists lasted for 15 weeks. Checklists were provided to the nurses from 16th of June until 26th of September in 2014. The checklists were strategically placed at the ward work station and were replenished by the Charge Nurse Managers as needed. The checklists were collected weekly from the two wards by the researcher. In the first four weeks, the researcher collected around 12 to 16 checklists per week. The number declined in the succeeding three weeks until the researcher was only able to collect eight checklists on the last week of data collection.

The checklist contained procedure-specific evidence-based recommendations from the Centres for Disease Control (CDC) and also served as procedure prompt for nurses and tool for measuring the nurses’ indwelling catheter management practices. The checklist contained tick boxes that were placed alongside evidence-based statements on catheter care that nurses could record their practice against. Nurses were also free to add any note that they deem relevant to catheter care management. These notes, along with the documented recordings on the checklist were analysed by the researcher to see if these aligned with best practice.
6.3 Results of document analysis

In total, 175 Daily Urinary Catheter Maintenance Checklists were collected during the 15-week evaluation phase or data gathering period. The checklist was divided into three main parts, namely: catheter insertion technique, catheter maintenance technique and catheter removal. Sub-parts such as appropriate catheter indications and hand hygiene were also identified to emphasise their importance in indwelling catheter management. The parts of the checklist completed by the nurses were dependent on what was relevant during a particular nurse-patient interaction. These are described in detail below.

6.3.1 Catheter insertion, maintenance and removal part were completed

Ninety-two out of 175 (53%) checklists had the catheter insertion, maintenance and removal part completed. Fifty-four (59%) of these checklists had a written note which indicated that the indwelling catheter had been inserted in the operating theatre; had all the items ticked, including appropriate catheter indications and hand hygiene; and were signed and dated. On examination, all of the indwelling catheters were removed within 24 hours of surgery. Documentation also showed that the patients’ need for the catheter was assessed daily and that standard precautions was utilised when the catheter was removed. Ten of these checklists indicated that the catheter has been inserted at the theatre; had all the items ticked, including appropriate catheter indications and hand hygiene; but, were not signed and dated. Fourteen of these checklists had no indication as to where the catheter has been inserted, had all the items ticked, and were signed and dated.

Eleven checklists indicated that the indwelling catheter had been inserted by nurses on the ward. These checklists had the appropriate catheter indications and hand hygiene before and after indwelling catheter manipulation ticked. All the items in the catheter insertion, maintenance and removal part have also been ticked. However, only eight of these checklists were signed and dated, leaving three without a signature and date. On examination, the indwelling catheters were removed within 24 hours of surgery for the eight checklists that indicate date of removal.

Two checklists indicated through a nurses’ note that the patients arrived at the ward with an indwelling catheter, with no mention of where it was inserted and who inserted it. One checklist had a note stating “IDC (indwelling catheter) inserted by house officer”. All three checklists had the appropriate catheter indications and hand hygiene before and after
indwelling catheter manipulation ticked. All the items in the catheter insertion, maintenance and removal part have also been ticked; and the checklists were signed and dated.

### 6.3.2 Only catheter maintenance and removal part were completed

There were 52 (30%) checklists that had the catheter maintenance and removal part completed. All of these checklists were signed and dated by the nurses who completed them. All of the indwelling catheters were removed within 24 hours of surgery – with three explicitly stating “removed within 24 hours”. Documentation also showed that the patients’ need for the catheter was assessed daily and that standard precautions was utilised during catheter removal. The routine hygiene items found in the catheter maintenance part were not ticked in ten checklists. The said item identified cleansing of the peri-urethral area during daily bathing or showering as an example of routine hygiene for the patients. Five of the checklists had the hand hygiene before and after indwelling catheter manipulation ticked, whereas, only three of the checklists had the appropriate catheter indications ticked.

### 6.3.3 Only the catheter insertion part was completed

There were two (1%) checklists that had only the catheter insertion part completed. Nurses who completed these checklists wrote notes stating that the indwelling catheter has been “inserted in theatre”. Both checklists were not signed and dated by the nurses who completed them.

### 6.3.4 Only the catheter maintenance part was completed

Sixteen (9%) checklists had only the catheter maintenance part completed. Twelve of the checklists were not signed and dated whereas four of the checklists were signed and dated by the nurses who completed them. Of those checklists that were not signed and dated, two nurses noted that the patients had been “discharged with IDC”; seven did not tick “routine hygiene, i.e., cleansing of peri-urethral area done during bathing or showering”; while four nurses ticked all the items in the catheter maintenance part.

### 6.3.5 Only the catheter removal part was completed

There were thirteen (7%) checklists that had only the catheter removal part completed. Documentation showed that the patients’ need for the catheter was assessed daily and that standard precautions was utilised during catheter removal. All of these checklists were signed
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and dated by the nurses who completed them. On examination, all indwelling catheters were removed within 24 hours post-operatively.

6.3.6 Appropriate catheter indications and hand hygiene

Of the 175 checklists collected by the researcher, only 95 (54%) had the appropriate catheter indications completed whereas 97 (55%) had the hand hygiene completed. These items were ticked in all the completely filled up checklist, whereas only three of the appropriate catheter indications and five of the hand hygiene statement were ticked in the partially completed checklists.

6.4 Summary of findings

In summary, of the 175 checklists collected by the researcher, two (1%) had the catheter insertion part completed; 16 (9%) had the catheter maintenance part completed; 52 (30%) had the catheter maintenance and removal part completed; 13 (7%) had only the catheter removal part completed; 13 (7%) had all parts including appropriate catheter indications and hand hygiene completed, but was not signed and dated; and 79 (45%) had all parts competed, including the date and signature. Figure 27 shows the nurses’ documentation of indwelling catheter care practices in the Daily Urinary Catheter Maintenance Checklist.

Figure 27. Nurses’ documentation of indwelling catheter care practices in the Daily Urinary Catheter Maintenance Checklist
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Documentation showed that for those checklist parts that were completed, almost all of the evidence-based recommendations were ticked. This indicates that during catheter insertion; nurses observed aseptic technique, utilised sterile equipment, utilised a single-use packet of lubricant for catheter insertion and secured the catheter to prevent movement immediately after catheter insertion. This also indicates that during catheter maintenance, the nurses ensured that: the catheter bag is below the bladder and off the floor at all times, there is no kinking of the catheter tubing, the collecting bag is emptied regularly, a closed-drainage system is maintained at all times, and a clean urine collecting jug is used for each patient at all times. Not everyone who completed the catheter maintenance part however, indicated that routine hygiene was performed as evidenced by the 17 checklists with this part left unanswered. This also indicates that during catheter removal, nurses assessed the need for the catheter to be removed and that standard precautions was used.

Documentation showed that there were a total of 157 out of 175 (90%) documented indwelling catheter removals during the period of data gathering. Of these, 144 had the appropriate date of removal and nurses’ signature. On examination, all 144 patients had their indwelling catheters removed within 24 hours of surgery. While two patients were documented to have been discharged home with indwelling catheters, whatever happened to the other 16 indwelling catheters was not known because documentation was not found.

Documentation also revealed that of the 175 checklists collected by the researcher, only 95 (54%) had the appropriate catheter indications completed whereas only 97 (55%) had the hand hygiene completed. Whether this is just an indication of poor documentation or a true indicator of poor hand hygiene during catheter care is not known.

6.5 Conclusion

This chapter has provided the findings from the document analysis of the Daily Urinary Catheter Maintenance Checklists. The 175 checklists collected by the researcher were shown to be in various stages of completion. This could be attributed to the patients’ coming into the postoperative ward in various conditions themselves. However, this could also be an indication of incomplete documentation. Incomplete documentation of catheter care may further be improved by completing the parts of the checklist. It was also observed that for those checklist parts that were completed, all of the evidence-based recommendations were ticked except for routine peri-urethral hygiene done during daily bathing or showering. This
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indicates that nurses adhere to evidence-based guidelines when reminded to do so. On the other hand, there are a few possible reasons for the unanswered routine peri-urethral hygiene: the patient did not shower, the patient was discharged early, the nurse missed this part or that it was actually not performed.

Checklist documentation also showed that house officers also insert catheters among patients. This has an implication in the development of policies on indwelling catheter management and strategies to prevent CAUTI. The dwindling of numbers of the completed checklists as the study period reached its fourth month is also noteworthy. This indicates that further improvement may be done with regard to sustaining the use of catheter care checklists over time.
Chapter 7. DISCUSSION, CONCLUSION AND RECOMMENDATIONS

7.1 Introduction
Chapter seven presents an analysis of data gathered, the conclusion and the recommendations of this study. This study aims to determine if the introduction of a catheter-associated urinary tract infection (CAUTI) education package improved the staff nurses’ knowledge and indwelling catheter management practices. To attain this, the study utilised both quantitative and qualitative research methods to provide a more comprehensive view of the research subject (Moule & Goodman, 2009). The study looked into the current knowledge, attitudes and indwelling catheter management practices of nurses and determined the impact of the introduction of a CAUTI education package on the nurses' knowledge and indwelling catheter management practices. Key findings from the focus group discussion, the pre-test and the post-test; and the self-administered catheter maintenance checklist were analysed and compared with literature so as to present the underlying context behind the nurses’ knowledge, attitude and indwelling catheter management practices. This is followed by a discussion of the strengths and weaknesses of the study thereby paving the way for the study conclusion and recommendations.

7.2 Nurses’ existing knowledge, attitudes and indwelling catheter management practices
One of the objectives of this study was to explore the nurses’ existing knowledge, attitude and practices relating to indwelling catheter management. To address this objective, focus groups were organised to explore and describe the nurses’ experience and attitude toward catheter insertion, maintenance and removal; and CAUTI prevention.

7.2.1 Preparation for catheter management
The nurses’ did not always feel confident towards indwelling catheter management due to their lack of preparation or catheter care training. There was evidence of diversity in training and feelings of not being prepared properly during their undergraduate training due to the teaching method utilised, the time allotted for the training, the focus of the training itself and the lack of opportunity to practice catheter management skills to prevent CAUTI. These relate to feelings of insufficiency with regard to catheter care knowledge and lack of confidence with regard to catheter management skills. This is supported by the findings of a study done in a university north of England which suggest that undergraduate students’ knowledge about the
theoretical and practical aspect of infection prevention in general is diverse, deficient, brief and infrequent (Ward, 2011). In a study done in Taiwan by Wu, Gardner and Chang (2009a), it was reported that nursing students have low levels of knowledge of infection prevention and are having issues with applying their knowledge to practice. Wu, Gardner & Chang (2009b) recommended that an educational programme that integrates concepts on infection prevention, the learning theory and teaching strategies is necessary in order to improve nursing students’ capability to prevent and respond to infections. Diversity and deficiency in undergraduate education can be one of the reasons why nurses’ practices vary thereby affecting the quality of patient care. While this may be remedied by a standard education programme for nurses upon employment and by standard organisational policies and procedures, integration of the principles and methods of infection prevention in the undergraduate programme is vital so that nurses can apply these in their practice. Undergraduate nursing education needs to be revisited and assessed in terms of content and methods of teaching infection prevention among students. Infection prevention and control is a joint responsibility between the educational institution and practise placement, thereby bringing together theory and practice so that the concepts can be retained and applied in real-world settings (Mody, Saint, Galecki, Chen & Krein, 2010; Ward, 2011).

Diversity in training and feelings of inadequacy related to catheter care knowledge and catheter management skills also emerged from discussions related to the nurses’ on the job training. This is consistent with the findings from various studies which indicate that nurses’ in-service trainings on catheter care vary in content and methods (Mody et al., 2010; Dailly, 2012). The diversity in content and in-service training methods impact on the quality of care delivered to patients. Nurses’ who did not have training on the other hand, relied on familiarising themselves with hospital policies or ask colleagues for support. When faced with the task of inserting or caring for patients with indwelling catheters, nurses manifest resourcefulness in finding information and learning the proper procedure. Resourcefulness help compensate for the challenges of an inadequate in-service training.

In summary, the nurses’ diversity in training, feelings of inadequacy related to catheter care knowledge and lack of confidence related to catheter management skills are the challenges that relate to the nurses’ preparation for catheter management. These attitudes impact on the quality of indwelling catheter care nurses provide to patients. Despite these challenges, nurses cope with the task by being resourceful and by asking colleagues for support. There are also
recommendations to standardise in-service training programmes and organisational policies and procedures; and, to revisit undergraduate nursing programmes to emphasise infection prevention and control.

7.2.2 Nursing skills and knowledge
The discussion on nursing skills and knowledge related to catheter management highlighted the nurses’ task-oriented perception of catheter care.

The findings suggest that nurses perceive catheter management as task-oriented, with the decision to insert, re-insert and remove a catheter being heavily reliant on doctors. This is consistent with the findings in the literature which indicate that nurses rely heavily on doctors’ orders for catheter insertion and removal. In this study, nurses expressed that they want to be informed of the rationale behind the order to catheterise and how it relates to the patient’s condition. In addition, nurses also want to advocate for their patients’ safety. Nurses should be empowered to assert evidence-based practices that would minimise risks and improve their patients’ conditions. Nurses should be aware of their patients’ condition, the contextual situation and the risks and benefits of the use of indwelling catheters for them to be able to make the best possible decision for the patient (Kiyoshi-Teo, Krein & Saint, 2013) and assert this when needed.

Nurses also expressed that the decision to remove catheters is dependent on the doctor’s decision and is guided by protocols. The existence of post-operative protocols on the other hand, make the nurses feel empowered to remove catheters and not wait on the doctor’s order. This is consistent with recommendations that suggest that nurses should be empowered to remove catheters through catheter removal protocols (Meddings & Saint, 2011). Some nurses in this study expressed that they remove urinary catheters based on a specific post-operative protocol. While some expressed that they find the protocol prescriptive and not suitable for all patient conditions, they also expressed that they still need to make important nursing decisions around patient care and when to remove the catheter. This is supported by studies that indicate that nurses make important decisions around catheter removal and should therefore be empowered (Meddings & Saint, 2011; Knoll, et al., 2011; Parry, Grant & Sestovic, 2013). Nurses may be empowered through the use of nurse-directed catheter removal protocols and its success in reducing catheter days and catheter-related infections has been widely
documented (Keenan, 2012; Oman et al., 2012; Meddings, 2013; Parry et al., 2013; Glasofer, 2014; Hebden, 2014; Meddings, Budelmann & Reichert, 2014a; Ghanem, 2015).

The utilisation of online organisational policies is very much a part of nursing care. Nurses in this study expressed that they often revisit online organisational policies to review the procedure before inserting a catheter to feel more confident. This is supported by the findings of Manias, Aitken and Dunning (2005), which showed that organisational policies provide nurses with added security when checking if their practices are acceptable. Organisational guidelines assist nurses in integrating knowledge with practice and promoting effective decision-making, apart from providing standards to be followed when using devices (Manias, Aitken & Dunning, 2005). Use of online policies was viewed to improve patient safety by preventing complications and minimising use of harmful interventions (Hovde, Jensen, Alexander, & Fossum, 2015).

Nurses expressed awareness of the importance of catheter care documentation. However, the documentation practices reported by the nurses were variable. It is apparent that the nurses record catheter care in different places and the contents of the documentation vary. Documentation was reported to focus mainly on the assessment of urine characteristics and not the assessment of the patient. This is a concern because quality care is dependent on the assessment of patients. The findings showed that nurses failed to relate assessment of the urine characteristics with the patient’s health status. This seems to show a lack of understanding of the purpose of the nursing process itself, thereby making documentation and assessment task-oriented. These results were consistent with the findings of the study done by Daskein, Moyle and Creedy (2009) which revealed that while the nurses showed a sound knowledge of the importance of documentation, the concern is that nurses seem to lack an understanding of the documentation required in nursing care. Nurses also seem not to appreciate the purpose of patient assessment and how it relates to the entire nursing process (Daskein, Moyle & Creedy, 2009). There is also a growing concern related to the quality of documentation of urinary catheter care (Williams, Voytas, Lewis-Hengy & Eves, 2008; Daskein et al., 2009; Cowey, Smith, Booth & Weir, 2012; Fink, et al., 2012; Dailly, 2012; Malki, Mckenna, & Mcilhenny, 2014; Meddings, Reichert & Mcmahon, 2014b). Standardised documentation of patient assessment and catheter status has been recommended in various studies (Gould et al., 2009; IHI, 2011; Dailly, 2012; Meddings, et al., 2014a). The use of reminder systems containing urinary care variables to improve the quality of nurses’ documentation has been recommended.
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(Williams, et al., 2008; Daskein et al., 2009; Malki, et al., 2014). Specific recommendations on the use of stickers (Malki, et al., 2014), protocols (Daskein et al., 2009) and electronic health information (Williams, et al., 2008; Daskein et al., 2009; Wald, Bandle, Richard, Min & Capezuti, 2014) to improve the quality of documentation have also been advocated.

In summary, catheter care skills and knowledge of nurses still has room for improvement. While nurses expressed that catheter care is task-oriented and the decisions around it are doctor dependent, there is a growing recognition among nurses that they also make important patient care decisions. The existence of organisational protocols such as those related to catheter removal empowers nurses to make important nursing decisions. Revisiting organisational protocols also help nurses feel more confident in performing procedures. Nurses want to advocate for their patients’ safety, thus increased confidence and empowerment facilitates nurses’ assertion of evidence-based practices to minimise risks and improve their patient’s condition. Finally, nurses also expressed awareness of the importance of catheter care documentation. However, there is an apparent discrepancy in what the nurses expressed as recognition of the importance of documentation and actual documentation of patient care as evidenced by variability in actual documentation and failure to relate assessment findings with the patient’s health status. Standardised documentation of patient assessment and catheter status is recommended to improve the quality of documentation in relation to nursing assessment.

7.2.3 Current clinical practice

The focus group discussion participants highlighted four subthemes related to the quality of current catheter care practice: collaborative practice, impact of patient’s gender on practice, decision-making in practice and issues in practice. Catheter care decision and some issues in practice have already been described in an earlier discussion. The succeeding discussion focuses on catheter care as a collaborative practice, the impact of patient’s gender on practice and other issues not mentioned earlier.

Effective catheter care involves collaborative effort (Gould et al., 2009; Meddings & Saint, 2011). The nurses in this study identified the role the doctor, nurse and the patient plays in catheter care. The interplay of roles and responsibilities associated with catheter care is embodied in an interesting conceptual model -‘the lifecycle of the urinary catheter’- introduced by Meddings and Saint (2011). This conceptual model did not see the patient as part of the team involved in catheter care. The lifecycle of a catheter begins with catheter
placement that is dependent on the doctor’s decision. The catheter is then inserted and kept in place by the nurse who is also tasked to assess it and make the doctor aware of its presence. Made aware of catheter existence, the doctor is then tasked to recognise that the catheter is not necessary and order its removal. The last step involves the nurse who responds to the doctor’s order by removing the catheter (Meddings & Saint, 2011). These roles and responsibilities coincide with those identified by the nurses in the focus group discussion. Nurses were perceived to be mainly responsible for the insertion, maintenance and removal of catheters. This is supported by Meddings and Saint (2011) who recognise the nurses’ role in each step of the lifecycle of a urinary catheter. However, the nurses also identified another team member that was not identified in CAUTI literature, the patient. This makes patient care in Counties Manukau District Health Board (CMDHB) setting unique because of patient involvement. The nurses in the focus groups expressed that cognitively able patients have a role in catheter maintenance, together with the nurse. Nurses also expressed that they are responsible for educating and empowering patients to actively participate in their care.

Catheter insertion practice was reported to be affected by a patient’s gender. Though unwritten in any organisational policy, nurses can insert indwelling catheters on female patients alone, whereas doctors insert indwelling catheters on both male and female patients. This practice is supported by literature. Cowey et al. (2012) identified unwritten, agreed rules of behaviour that relate to catheterisation which is similar to those expressed by the nurses in this study. Gender, however, was not reported as a factor that affects catheter maintenance and catheter removal practices.

While the patient’s gender determines who may insert an indwelling catheter on them, it was not categorically identified as a barrier in catheter care. Nurse’s gender on the other hand, was identified as a barrier to catheter care. Cowey et al. (2012) described the unwritten, agreed rules of behaviour that guide clinical practice as “limiting, annoying, time-consuming and never helpful” according to nurses. These findings highlight the importance of having a standardised organisational policy on catheterisation (Cowey et al., 2012) which could potentially remove the nurses’ gender as a barrier in catheter care, without compromising patient preference.

Nurses expressed a few other concerns related to catheter care that require ethical decision-making. This involves a patient’s refusal to have an indwelling catheter versus the nurse’s responsibility to perform the procedure. Nurses can feel vulnerable during these times and the
fear of going against the patient’s preference can be a concern (Young & Conway, 2011). Patient preferences cannot be separated from their moral, cultural and religious values (Rady & Verheijde, 2010). In patient-centred care, these factors need to be considered. A patient must have the capacity to understand the information being given to him, evaluate the impact of the options, deliberate on these options according to his values, express this choice and remain consistent over time (Soriano & Lagman, 2012). Health workers are encouraged to have a truthful conversation with the patient when trying to balance the patient’s choice with their best-interest (Spike, 2015). Health workers have the responsibility to help a patient with his decision, and it takes trust, persuasion and persistence to fulfil this complex duty (Spike, 2015). The nurses in this study expressed feelings of concern in such circumstances, but are able to overcome this by maintaining an open communication with the patient.

The findings of this study also highlighted some clinical practises that were of concern with regard to patient safety and indicated poor knowledge and hence clinical practice. These practices include: the use of saline solution to inflate the catheter balloon, erratic monitoring of hourly urines, and putting the catheter bag on the floor. It was also highlighted that some practices related to securing the catheter in place are putting patients at risk of impaired skin integrity. These practices are inconsistent with best practice literature and guidelines. However, these findings are consistent with findings in literature which indicate that there remains to be a wide discrepancy between evidence-based recommendations and catheter-care practices among nurses (Drekonja, Kuskowski & Johnson, 2010; Mody et al., 2010; Dailly, 2012). To improve healthcare personnel knowledge and practice, a multi-pronged approach in educating and addressing practice discrepancies has been recommended. Recommendations include structured in-service education, informal discussions with staff, identifying effective links and infection control champions, coaching support for staff, and regular performance feedback (Gould, et al., 2009; Mody, et al., 2010; IHI, 2011; Fakih, et al., 2014).

The nurses also expressed concern related to maintaining the patient’s skin integrity especially for those with fragile skin. There were also issues on the type of dressing that the organisation currently uses, with some patients manifesting skin reactions and the available equipment used in securing the catheter in place. Patient experiences with catheterisation vary. Some patients develop allergies to the material used in the products whereas others do not. For this reason, nurses should ask patients if they have latex or rubber allergy prior to catheterisation (Wilson, 2012). Nurses should also ensure that a suitable catheter, gloves, dressings and other
catheterisation products are used (Wilson, 2012). Daily assessment of catheter status and symptoms is recommended (Meddings, et al., 2014a). It is the nurse’s responsibility to ensure that the patient is comfortable and symptom-free. Thus, it is wise for the organisation to look into products that would minimise additional risks such as appropriate dressing, urine bags that are easy to secure to the side rails and a bladder scanner. Overall, there is growing evidence for the need to standardise catheter care processes concerning catheter indications, documentation, products and organisational protocols (Gould et al., 2009; Titsworth et al., 2012; Lo, et al., 2014).

In summary, catheter care requires collaborative effort. While nurses were perceived to be mainly responsible for catheter insertion, maintenance and removal, doctors also need support in terms of recognising the unnecessary presence of a patient’s catheter. Nurses in this study expressed that cognitively able patients play a role in catheter care. This makes patient care in CMDHB setting unique because of patient involvement. Nurses perceive that they are responsible for educating and empowering patients to actively participate in their care. Catheter care also involves advocating for the patient’s interests. Nurses feel vulnerable and fear going against their patient’s preference when faced with circumstances that require ethical decision-making. Nurses are aware that in patient centred care, the patient’s moral, cultural and religious values need to be considered. Thus, nurses overcome this feeling of concern by maintaining an open communication with the patient. Nurses also identified their gender as a barrier to catheter care due to unwritten, agreed rules of behaviour that guide clinical practice. To remove this barrier without compromising patient preference, a standardised organisational policy on catheterisation has been recommended. Nurses also reported clinical practises that were of concern with regard to patient safety and indicated poor knowledge and hence clinical practice. A multi-pronged approach in educating and addressing practice discrepancies has been recommended to improve nurses’ knowledge and practise. Overall, clinical practice related to catheter care requires nursing skills, decision-making, critical thinking and a complete grasp of ethical principles.

### 7.2.4 Catheter management resources

Discussions of the impact of caring for patients who have indwelling catheters brought out catheter management resources as a theme. Two subthemes emerged from this discussion and these are: nurses’ awareness of and access to catheter management resources; and the quality of available catheter management resources.
Nurses were aware that organisational policies are the primary go-to guide when recalling information at work. Policies have the potential to enhance patient care by promoting interventions that have been proven to be effective through research (Mody et al., 2010). Nurses in the study are also aware that clinical policies are available intranet although some could not identify its exact location. Lack of awareness of specific location of policies deters nurses from accessing policies. This is consistent with the findings of an integrative research review done by Hovde et al. (2015) which identified ease of access as one of the factors that affect utilisation of computerised policies. Gurses et al. (2008) identified access to computerised policies as a factor that affect nurses’ compliance to guidelines. Ease of access to policies and consistency with day to day workflow were also identified by Hyde and Murphy (2012) as factors that would enhance nursing care. Thomas, Dhanani, Irwin and Doherty (2010) described the importance of installing shortcuts to the policies on the desktop computers to facilitate uptake. Hovde et al. (2015) further identified time and bedside proximity of computers as other factors that affect utilisation of computerised policies. Thus, introducing policies into routine clinical practice requires dissemination and implementation strategies that are thoughtful, effective, and efficient (Mody et al., 2010).

Nurses expressed that for those who have concerns with locating computerised policies, colleagues prove to be valuable in accessing information and guidance at work. Thomas et al. (2010) acknowledged that bedside coaching of staff and the presence of experienced nurses who correct deviations from the guidelines were helpful. Gurses et al. (2008) further recommend that infection control practitioners should be available to provide consultation and support to the staff when needed.

The nurses also reported that for some post-surgical patients, the recommended schedule for indwelling catheter removal has been integrated in the enhanced recovery after surgery (ERAS) guidelines. In several ways, these organisational policies were viewed to have standardised the process and guided nurses in deciding whether to remove the catheter or not. This is consistent with the recommendations in various literature for standardised, evidence-based guidelines that facilitate patient safety and quality-improvement (Gurses et al., 2008; Silow-Carroll, Edwards & Rodin, 2012; Hovde et al., 2015). Literature indicates that care providers are more likely to adhere to guidelines if they are aware of the norms and
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expectations and they believe in the feasibility of complying with the guidelines despite their workload and responsibilities (Gurses et al., 2008).

Some nurses find the existing guideline too prescriptive and not suitable for various types of patients. Guideline exception ambiguity such as this has been documented in various literature (Gurses et al., 2008). In circumstances wherein patient conditions do not conform to what was described in the guidelines, nurses rely on the nursing process and collaborative care in making important decisions and interventions. Gurses et al. (2008), further recommends that decision-support tools should be developed to facilitate decisions regarding deviations from specific organisational guidelines.

In summary, nurses are aware that organisational policies on catheter management are available intranet, although some have concerns with locating it. Ease of access to policies and consistency with day to day workflow can potentially enhance nursing care. Support from colleagues also proves to be valuable when nurses cannot access policies. The nurses also reported that the existence of policies on catheter removal helped standardise the process itself and guided nurses in their decisions. For those who found the organisational policy not suitable for various types of patients, their expertise in the use of the nursing process and collaborative care helped them arrive at important decisions and interventions. Decision-support tools were recommended to be utilised as these facilitate decisions regarding deviations from specific organisational guidelines. While organisational policies facilitate decisions and nursing care, these do not replace nurses’ knowledge and skills in providing quality patient care.

7.3 Nurses’ knowledge of indwelling catheter management

One of the aims of this study is to determine the impact of the introduction of a CAUTI education package on the nurses’ knowledge of indwelling catheter management. It was hypothesised that the implementation of a CAUTI education package would improve the nurses’ knowledge of indwelling catheter management. Nurses’ knowledge was measured using pre- and post-test scores and these were compared after the introduction of the CAUTI education package. The results of the pre-test and post-test findings indicate a significant difference ($p < 0.0001$) in the overall score between the pre and post-test with a mean difference of 6.64 and 95% confidence interval (CI) of (4.96, 8.33). This suggests a significant improvement in the knowledge of the nurses on indwelling catheter management. Indwelling
catheter management represents a continuum of care with four components. The four components of indwelling catheter care are: reduce inappropriate use of urinary catheters, perform proper techniques for indwelling catheter insertion, implement proper catheter maintenance procedures, and remove catheters in a timely manner. These components are inter-related and represent the entirety of proper catheter management to prevent CAUTI. The four components of indwelling catheter care are reflected in the four main topics of the CAUTI education package. The four main topics of the CAUTI education package are: background knowledge on CAUTI and appropriate use of urinary catheters, catheter insertion techniques, catheter maintenance procedures, and catheter removal. Education on CAUTI prevention should not only focus on one aspect of care, but should be spread across all four components of care. The result of statistical testing of the main topics show a significant difference in the pre and post-test scores, thereby suggesting a significant improvement in the knowledge of the nurses not only on each of the four components of indwelling catheter management, but also on the nurses’ overall knowledge of indwelling catheter management and CAUTI prevention.

These findings are consistent with current evidence which suggest that active education of health professionals significantly improve their knowledge and catheter management practices (Lo et al., 2014). A study conducted by Marigliano et al. in 2012 showed that active education and implementation of a surveillance system significantly reduced the catheterisation rate and positively influenced health care workers’ choices about catheter use, motivations for insertion and management of catheters. The study assessed the nurses’ and physicians’ knowledge through pre- and post-tests after the implementation of an educational intervention on urinary catheter use to reduce CAUTI rate. The educational intervention in the study utilised the Centers for Disease and Prevention/National Healthcare Safety Network’s CAUTI definition, catheterisation rate, and CAUTI guidelines.

The utilisation of various teaching strategies in educating nurses was also shown to significantly increase the knowledge of nurses in CAUTI prevention. The current study utilised various methods of providing information to the nurses. Among the education strategies utilised were lectures, factsheets, posters and checklists to remind nurses of the measures to prevent CAUTI and to assist them in making decisions for catheter removal. These methods have been shown to have significantly improved the nurses’ knowledge and to have influenced their catheter management practices. This result is supported by a prospective
pre-test and post-test study by Schneider in 2012, where a significant increase in the knowledge of nurses was noted after they were educated on CAUTI-prevention catheter protocols. Various teaching strategies such as slide presentations, demonstrations and return-demonstration, e-mails, posters, flipcharts and handouts were utilised (Schneider, 2012). Information given to nurses include basic care of indwelling catheters, aseptic insertion technique, catheter insertion and removal protocols and proper documentation (Schneider, 2012). After the intervention, none of the patients developed CAUTI compared to 14 who developed CAUTI prior to the education intervention (Schneider, 2012).

The findings of this study also emphasise the need to continuously educate nurses on CAUTI prevention. The results show that the mean for the pre-test scores for the four components of the CAUTI education package are: background knowledge on CAUTI and appropriate use of urinary catheters (mean score of 6.6 out of a total score of 9), catheter insertion techniques (mean score of 3.9 out of a total score of 6), catheter maintenance procedures (mean score of 5.4 out of a total score of 8), and catheter removal (mean score of 1.1 out of a total score of 2). The low pre-test score means indicate that there is a gap in the knowledge of the staff that needs to be addressed. It has been proven from previous studies that the implementation of a comprehensive education program has significantly reduced CAUTI rate (Welch & Brown, 2013). Lectures, demonstrations on catheter insertion and management and the proper use of a bladder scanner, daily multidisciplinary rounds to discuss continued need for the catheter and alternative interventions, daily audits and real-time teaching were shown to significantly reduce CAUTI rate (Welch & Brown, 2013). Thus, these methods would also be helpful when aiming for a continuous education of nurses on CAUTI prevention. Furthermore, courses should be tailored to the audience’s needs, job duties and educational level. In this way, courses can improve the likelihood of successful integration of new recommendations into clinical practice (Bloom, 2005; Welch & Brown, 2013).

In summary, the CAUTI education package significantly improved the nurses’ knowledge of indwelling catheter management. This significant improvement is manifested across all four components of indwelling catheter care and CAUTI prevention. Education on CAUTI prevention should not only focus on one aspect of care, but should be spread across all four components of care, i.e., reduction of inappropriate urinary catheter use, utilisation of proper techniques for indwelling catheter insertion, implementation of proper catheter maintenance procedures, and timely removal of urinary catheters, for it to be truly effective. Active,
continuous education of nurses utilising various teaching strategies significantly improve nurses’ knowledge of indwelling catheter care and CAUTI prevention. Knowledge gained is best integrated with practice to ensure quality patient care.

7.4 Nurses’ indwelling catheter management practices
This study also aims to determine the impact of the introduction of a CAUTI education package on staff nurses’ indwelling catheter management practices. After the education sessions, data on the nurses’ catheter management practices were gathered using the Daily Urinary Catheter Maintenance Checklist, a self-administered indwelling catheter management checklist which contained procedure-specific evidence-based recommendations from the Centres for Disease Control.

Document analysis of the checklists indicates that the 175 checklists collected by the researcher were shown to be in various stages of completion. This could be attributed to the patients’ coming into the postoperative ward in various conditions themselves or an indication of incomplete documentation. Documentation is a necessary aspect of patient care. Nursing documentation facilitates communication of health information, assists research, demonstrates nurses’ accountability and facilitates funding and quality assurance (Berman, Snyder, Kozier, & Erb, 2008). Proper documentation of catheter care for quality improvement purposes is part of the guidelines on CAUTI prevention (Gould et al., 2009; Hooton et al., 2010; IHI, 2011; Lo et al., 2014). A comprehensive written documentation demonstrates planning, delivery, assessment and evaluation of patient care (Daskein, et al., 2009).

Findings show that 92 (53%) of the checklist had all parts - catheter insertion, maintenance and removal; and appropriate catheter indications and hand hygiene completed. Some of these, however, were not signed and dated. Complete documentation of care should include the caregiver’s name, time and date of entry (Berman et al., 2008). Checklists that were not signed and dated indicate non-adherence to standards of documentation which is a concern expressed in various literature (Williams, et al., 2008; Daskein et al., 2009; Cowey, et al., 2012; Fink, et al., 2012; Dailly, 2012; Malki, et al., 2014; Meddings, 2014b). Lack of or poor quality of documentation makes monitoring of catheter care very resource intensive (Meddings, et al., 2013). Documentation of appropriate catheter indications supports literature which recommends that avoidance of unnecessary urinary catheter use is the most important strategy in preventing CAUTI (Meddings, et al., 2013). Hand hygiene, on the other hand, is
the single most important measure that would prevent cross transmission of infections in the hospital setting (Pittet, et al., 2000; Grayson, et al., 2008). Evidence suggests that a substantial proportion of hospital acquired infections can be effectively and efficiently prevented by improving hand hygiene practice among healthcare workers (Pittet, et al., 2000; Grayson, et al., 2008). Adherence to hand hygiene indicates best practice. Complete documentation of catheter insertion indicates that sterile equipment was used, sterile technique was observed and the catheter was secured to minimise movement and urethral traction after insertion. Adherence to these recommendations indicate best practice in catheter insertion (Gould et al., 2009; Hooton et al., 2010; IHI, 2011; Lo et al., 2014). Complete documentation of catheter maintenance indicate that the catheter bag was below the bladder and off the floor at all times, there was no kinking of the catheter tubing, the collecting bag was emptied regularly, a closed-drainage system was maintained at all times, and a clean urine collecting jug was used for each patient at all times. Adherence to these recommendations indicate best practice in catheter maintenance (Gould et al., 2009; Hooton et al., 2010; IHI, 2011; Lo et al., 2014). This also showed an improvement in the nurses’ practice of putting the catheter bag on the floor which they have reported in the focus group discussion. Prior to the education session, the nurses were not aware that this practise exposes the patients to the risk of entry of microorganisms from the floor into the catheter system through the drainage spigot. This was corrected through the education session, thus the improvement in the nurses’ practice.

Documentation also revealed that 157 (90%) indwelling catheters were removed from patients during the period of data gathering. Of these, 92% had their indwelling catheters removed within 24 hours of surgery and the checklists had the appropriate date of removal and signature. Documentation showed that the patients’ need for the catheter was assessed daily and that standard precautions was utilised each time a catheter was removed. These are consistent with recommendations from various literature which indicate documentation of appropriate catheter indications, daily assessment of catheter need and prompt catheter removal using standard precautions, preferably within 24 hours after an uncomplicated surgery (Gould et al., 2009; Hooton et al., 2010; IHI, 2011; Lo et al., 2014). Prompt catheter removal is recommended because the catheter potentially becomes colonised with disease-causing microorganisms within three days of catheter introduction (Rebmann & Greene, 2010). The longer the catheter stays, the higher the risk of infection (Gould et al., 2009; Burton et al., 2011; Mohajer & Darouiche, 2013; Lo et al., 2014). The presence of the catheter itself and the duration of catheterisation are also major risk factors for CAUTI, thus, proper indications for
catheterisation and its documentation is advised (Gould et al., 2009; Hooton et al., 2010; IHI, 2011; Lo et al., 2014).

A substantial number (59%) of the complete checklists had a written documentation that indicates catheter insertion in the theatre. This implies that for quality improvement to occur, education and training of all those involved in catheter care, including those from the theatre, should be involved (Gould et al., 2009; Hooton et al., 2010; IHI, 2011; Meddings & Saint, 2011; Meddings et al., 2013; Lo et al., 2014). Majority of the catheters were also inserted by nurses, with one checklist specifying that the catheter was inserted by a doctor. This indicates that doctors also take part in the various phases of catheter care. Various literature recommend involving doctors in quality improvement measures related to catheter care (Gould et al., 2009; Hooton et al., 2010; IHI, 2011; Meddings & Saint, 2011; Meddings et al., 2013; Lo et al., 2014). These recommendations support the collaborative nature of catheter management.

Two of the checklists indicate that the patients have been discharged with an indwelling catheter. It was not documented why the catheter was not removed and if the catheter was for long term use. Best practice recommends early catheter removal; however for long-term indwelling catheters, further research is needed with regard to the use of optimal catheter materials and catheter irrigation because long-term catheters are prone to frequent obstructions (Gould, et al., 2009; Lo et al., 2014). Further research is also recommended for alternative methods of urinary drainage, including intermittent catheterisation, external catheters, and suprapubic catheters (Gould, et al., 2009; Lo et al., 2014).

Findings also indicate that the number of checklists completed by the nurses dwindled as the study period reached its fourth month. In the first four weeks of data collection, the researcher collected around 12 to 16 checklists per week. The number declined in the succeeding weeks until the researcher was only able to collect eight checklists on the last week of data collection. This is consistent with literature that recommends interventions to sustain compliance with the use of catheter care checklists (Gurses et al., 2008).

Feedback with the use of the checklist indicates that the checklist reminded nurses of the evidence-based guidelines related to catheter care. Feedback also indicate that its design could be improved further by making it concise and by enabling the nurses to document on the
checklist everyday using the same sheet, instead of getting a different sheet to complete each day.

In summary, the CAUTI education package resulted in an improvement in the nurses’ indwelling catheter management practices. Practises reported by nurses that were not optimal such as putting the catheter bag on the floor improved when the nurses were made aware that this practise exposes the patients to the risk of entry of microorganisms into the catheter system. Nurses also adhered to evidence-based guidelines on indwelling catheter insertion, catheter maintenance and catheter removal as evidenced by their documentation of care. While there were some lapses in documentation such as the lack of date and signature and incomplete entries, this could be improved further through reminders and education. Documentation also revealed that doctors insert indwelling catheters and that a substantial number of catheters were also inserted in the theatre. This implies that for quality improvement to occur, education and training of all those involved in catheter care, including doctors and those from the theatre should occur. Some patients were documented to be discharged home with indwelling catheters; thus, organisational policies pertaining to long-term catheters should be revisited so that alternative methods could be recommended. Finally, the dwindling numbers of completed checklists over time indicates that intervention is required to sustain compliance with the use of checklists and catheter care documentation.

7.5 Strengths of the Study

There are a number of strengths in this study. First, this study is the first to investigate the nurses’ awareness of CAUTI as a health problem in CMDHB and their readiness to address it in terms of nursing skills, knowledge and attitude. This creates a new body of knowledge within the district health board and adds to the existing body of knowledge in New Zealand and worldwide. This study provides vital insight into the complex nature of CAUTI development and how this process could be stopped by making the nurses aware of their role in CAUTI prevention. This study also shed light on the level of knowledge and practices of nurses and the current status of organisational variables such as policies and resources that may in several ways help curb CAUTI development among patients.

Secondly, the use of multi-phased mixed methods approach in data collection enabled richer collection of data. This approach allowed further exploration of nurses’ perceptions, attitudes and experience in catheter care which may not be gathered through the pre-test and post-test
and the checklist alone. The utilisation of multiple data sources allowed validation of data thereby ensuring the credibility of the study findings.

The pilot testing of the pre-test/post-test to ensure content and language validity apart from adapting a few test items from previously utilised tests published in literature, adds to the validity and reliability of the study instrument itself. This test may potentially be used again should future researchers want to replicate or conduct a similar study in other New Zealand healthcare settings.

### 7.6 Limitations of the Study

There are a number of limitations in this study. The small sample size for the pre-test and post-test (n=14) limit the generalisability of the study conclusion. Additionally, the study was only conducted in two post-operative wards, thus its limited generalisability. The small sample size makes it difficult to ascertain if the conclusions drawn from the quantitative findings are true representations of the nurses’ level of knowledge on catheter care. Future studies should be done in other clinical areas so as to ascertain nurses’ knowledge on catheter care and to explore catheter care experiences of nurses in other health care services.

Another limitation is that the actual number of patients with catheters during the study period was not obtained because this is not the focus of the study. It would benefit future research if the actual number of patients with catheters during the entire study period was obtained as this information can be used to compute for the checklist completion rate. Feedback from the nurses also indicate that the checklist design could be improved further by making it concise and compact so as to save paper when using the checklist on patients whose catheter need to stay longer.

Finally, subjective interpretation, like any qualitative investigation, is a potential limitation of the focus group discussion particularly when developing thematic categories wherein some data may have been miscategorised because of the fluidity of its content.

### 7.7 Conclusion

This study had three research objectives and each of these objectives were reviewed. The first objective of the study was to identify baseline data on staff nurses’ knowledge, attitudes and indwelling catheter management practices. This objective was attained through various data
gathering methods. Quantitative data on the nurses’ knowledge showed the need to improve the nurses’ knowledge on the four components of indwelling catheter management and CAUTI prevention. Qualitative data gathered through focus groups showed that nurses feel responsible for catheter care and have expressed the need for empowerment to make decisions regarding catheter care. Further data on the nurses’ indwelling catheter management practices also showed the potential to improve practices related to indwelling catheter maintenance, catheter removal and proper documentation of catheter care.

The second objective of the study was to develop an educational intervention aimed at addressing knowledge or care management deficits of staff nurses. This objective was attained through the development of an education package derived from evidence-based indwelling catheter management guidelines published by the Centers for Disease Control and Prevention (CDC). This education package was implemented utilising various teaching methods such as lectures and the distribution of various educational materials such as CAUTI factsheet, best-practice catheter insertion instructions, catheter management algorithm, daily catheter maintenance checklists, posters and catheter removal flowchart. The checklist served as a procedure prompt and tool in measuring the nurses’ catheter management practices, whereas, the algorithm facilitated decision making in terms of catheter insertion and removal. Both the checklist and the algorithm are a novelty in catheter management in CMDHB.

The third objective of the study was to evaluate the impact of the educational intervention on the nurses’ knowledge and indwelling catheter management practices. This objective was attained as shown by the significant difference (p < 0.0001) in the overall score and along the four components of catheter care between the pre and post-test. Catheter care practices that were rooted on lack of information were also addressed through the education package. Practices that were not optimal across the various components of indwelling catheter care were changed after the educational intervention.

Knowledge gained should be applied in practice for it to be truly effective. This study introduced a multi-faceted educational intervention on CAUTI prevention that focused on educating nurses on evidence-based indwelling catheter management guidelines through methods that are a novelty in catheter management in the current research setting. The study has shown that multi-faceted, evidence-based strategies that continuously and actively involve nurses improve knowledge and practice, thereby ensuring quality patient care.
In conclusion, the introduction of a CAUTI education package had a significant impact on the nurse’s knowledge and indwelling catheter management practices. While various factors affect catheter management practices, enhanced training will not only improve nurses’ knowledge, but their practice as well. Education on CAUTI prevention should not only focus on one aspect of care, but should be spread across all four components of catheter care for it to be effective. Catheter care also involves collaborative care. Thus, continuous education of nurses and everyone involved in catheter care utilising various teaching strategies is essential in CAUTI prevention. Catheter maintenance checklists serve as procedure prompts for evidence-based interventions apart from improving documentation of care. Finally, quality improvement initiatives on CAUTI prevention would help improve CAUTI rates and nurses’ knowledge, skills and attitude toward catheter management.

7.8 Recommendations
The findings of this study have implications to various areas of practice. In view of this, the following discussion presents the research recommendations.

CAUTI Surveillance
Prolonged urinary catheter use has been associated with negative outcomes such as catheter-associated urinary tract infection. This study was conducted in CMDHB where CAUTI surveillance is not yet in place. However, unpublished data from CMBHB showed that CAUTI and CAUTI complications such as bloodstream infections are a growing concern among patients. For the purpose of enhanced patient safety, CAUTI surveillance should be initiated in CMDHB. Consensus should be made with regard to CAUTI surveillance definition, keeping track of indwelling catheter use and statistical measures for CAUTI prevalence. An appropriate case-finding method should be identified based on the surveillance definition. Medical and nursing ward rounds should also incorporate the review of all patients with catheters to identify who among the patients need their catheters and whose catheters need to be removed. Nurse-directed removal of unnecessary urinary catheters is also recommended.

Evidence-based policies and procedures
Findings show that there are various catheter care procedures that exist and that was authored by different hospital services in CMDHB. Consolidation of similar policies and alignment of these with evidence-based guidelines is recommended. Policies and procedures on catheter
insertion, maintenance and removal need to be standardised to avoid confusion among its end-users. Nurses should be empowered through nurse-directed catheter removal policies for unnecessary catheters. The availability of the policies should also be made known to the staff apart from making it accessible. The protocol on urinary retention management and the use of bladder scanner also requires updating.

**Workflow Reminders**

Findings of this study indicate that procedure prompts such as checklists and posters prove to be helpful for nurses. Thus, this study recommends the use of checklists not only to remind nurses of evidence-based procedures but also to improve catheter care documentation. Checklists may contain CAUTI prevention algorithms to facilitate decision making. The checklist utilised in this study may be further improved by making it concise and by enabling nurses to complete it every day utilising the same sheet. Audits of catheter care, including its proper documentation to imbibe staff accountability and enhance patient safety, should also be conducted.

The use of visual reminders such as posters placed in strategic areas, standardised catheter reminders and automatic stop orders for other patient conditions are also recommended based on the findings from this study.

**Standardised catheter care products**

Findings of the study also indicate that there is a need for the procurement of products that would stabilise the urinary catheter to prevent urethral traction; products that would secure the catheter onto the bed when the patient is not mobilising; products that would not impair the patient’s skin integrity when the catheter is secured onto the patient’s skin and additional bladder scanners that would help staff make decisions based on assessment data. Standardisation of these products is also recommended for the entire organisation.

**Staff Training and Education**

Findings of this study indicate the need to update staff regarding evidence-based techniques and procedures for urinary catheter insertion, maintenance, and removal. Regular in-service education about CAUTI, other complications of urinary catheterisation, alternatives to indwelling catheters, intermittent catheterisation and use of bladder ultrasound scanners are also recommended. Development of competencies on catheter management and other
educational materials are necessary to make regular training and education of staff feasible. Providing performance feedback to staff related to catheter care and maintenance may also be needed for ongoing improvement of patient care.

**Collaborative care**

Findings of this study support literature that suggests the collaborative nature of catheter care. This entails involving doctors in regular education and training, apart from addressing them as stakeholders in the development of catheter care policies and procedures, together with nurses. Measures to enhance communication and teamwork among all those involved in catheter care should also be implemented. Culture change where doctors are more mindful of appropriate catheter indications and catheter removal orders is necessary. Visual reminders suitable for doctors may also be necessary to remind them of proper catheter indications and timely catheter removal.

**Comprehensive Quality Improvement Programme**

Findings reveal that various areas of practice could be improved further to enhance the use of indwelling catheters and to prevent CAUTI. Thus, the development and implementation of a multi-faceted quality improvement programme that will improve catheter care and reduce CAUTI risks is recommended organisation-wide. A proposed CAUTI bundle (see Appendix 19) with the four components of catheter care utilised in this research was developed by the researcher for CMDHB. The details of the procedure under each component require approval from the organisation based on the current situational analysis. The implementation of the CAUTI bundle is tied to the analysis of the various organisational drivers that is envisioned to facilitate organisational uptake. The proposed CAUTI prevention project driver diagram in Appendix 20 details the primary and secondary drivers that facilitate the implementation of this program. Primary CAUTI prevention drivers include leadership support, continuous nursing and medical staff training and education, CAUTI surveillance, standardised catheter care products and workflow reminders and culture change. Secondary drivers for CAUTI prevention include management and staff accountability, evidence-based policies and procedures, consistent drumbeating of CAUTI prevention programme, development of staff catheter care competencies and other educational materials, development of and strategic placement of workflow reminders, consensus with regard to surveillance definition of CAUTI, identification of areas for surveillance, and engaging other stakeholders in CAUTI prevention through enhanced communication and teamwork.
Chapter 7 – Discussion, Conclusion and Recommendations

**Future Research**

Future research could further improve this study by utilising a bigger sample size. Additionally, to further improve generalisability, this study should be conducted in other clinical areas to ascertain nurses’ knowledge on catheter care and to explore catheter care experiences of nurses in other health care services.

There is also a need to explore the perceptions of doctors with regard to catheter indications and to implement education interventions addressing concerns when necessary. Future studies on the impact of a CAUTI prevention education package on the doctors’ knowledge, attitudes and practices is also recommended because of the collaborative nature of catheter care. A survey research on the prevalence of indwelling catheter use among patients and which among these catheters have an appropriate indication is also necessary. The impact of nurse-directed catheter removal protocols on the number of catheters that are removed in a timely manner should also be evaluated so as to identify its impact in the prevention of CAUTI. Future research endeavours may also look into the various drivers of a comprehensive quality improvement programme on CAUTI prevention to make it useful for the organisation.

In summary, the CAUTI education package had a significant impact on the nurse’s knowledge and indwelling catheter management practices. Catheter care and CAUTI prevention within the organisation could be improved further through research and interventions that would address the various drivers of a comprehensive quality improvement programme on CAUTI prevention.
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Impact of a CAUTI Education Package on Nurses’ Knowledge and Indwelling Catheter Management Practices

CATHETER-ASSOCIATED URINARY TRACT INFECTION (CAUTI) PREVENTION Factsheet

Key Points: Catheter Removal

- Assess catheter need and possibility of removal daily.

- For operative patients who have an indication for an indwelling urinary catheter, remove the catheter as soon as possible postoperatively, preferably within 24 hours unless there are indications for continued use.

- Catheters should not be changed as part of a fever work-up.

- Use standard precautions during any manipulation, including removal of the catheter.

Key Points: Appropriate Indications for Catheter Insertion

- Acute urinary retention or bladder outlet obstruction

- Accurate measurement of urine output in critically ill patients for a finite time period

- Perioperative use for selected surgical procedures, e.g. for urologic surgery or surgery of adjoining genitourinary tract structures, surgical procedure > 3 hours, when intra-operative monitoring of urine output is needed, and when large-volume infusions or diuretics during surgery are anticipated

- Patient requires prolonged immobilisation (unstable spine and pelvic fractures)

- To assist in healing of open sacral or perineal wounds in incontinent patients

- End of life care

Catheters should NOT be used for urinary incontinence or staff convenience.

Key Points: Catheter Removal

- Assess catheter need and possibility of removal daily.

- For operative patients who have an indication for an indwelling urinary catheter, remove the catheter as soon as possible postoperatively, preferably within 24 hours unless there are indications for continued use.

- Catheters should not be changed as part of a fever work-up.

- Use standard precautions during any manipulation, including removal of the catheter.

Four components of care to prevent or reduce CAUTI:

- Avoid unnecessary urinary catheters

- Insert urinary catheters using aseptic technique

- Maintain urinary catheters based on recommended guidelines

- Review urinary catheter necessity daily and remove promptly

References:


CAUTIs are the most common cause of healthcare-associated infections (HAI) worldwide.

- About 40% of HAIs are due to indwelling catheters, with prolonged catheter use as the major CAUTI risk factor

- With the catheter in place, the daily bacteriuria risk is about 3 to 7%. If the catheter stays in place for a week, the risk increases to 25%.

- Among those with bacteriuria, 10% will develop CAUTI symptoms while 3% will progress to bacteremia.
Key Points: Catheter Maintenance

- Assess need for on-going catheter daily.

- Following aseptic insertion of the urinary catheter, maintain a closed drainage system
  - If breaks in aseptic technique, disconnection or leakage occur, replace the catheter and collecting bag using aseptic technique and sterile equipment.

- Maintain unobstructed urine flow
  - Keep the catheter and collecting bag free from kinks.
  - Keep the collecting bag below the level of the bladder and off the floor at all times.
  - Empty the collecting bag regularly using a separate, clean collecting jug for each patient.
  - When draining collecting bag, avoid splashing urine, and prevent contact of the drainage spigot with the non-sterile collecting jug.

- Change catheters and collecting bag based on clinical indications such as infection, obstruction or when the closed system is compromised. Changing indwelling catheters or collecting bags at routine, fixed intervals is not recommended.

- Unless indicated, do not use systemic antimicrobials routinely to prevent CAUTI in patients requiring either short or long-term catheterisation.

- Do not clean peri-urethral area with antiseptics to prevent CAUTI while the catheter is in place. Routine hygiene, i.e., cleansing of the area during daily bathing is appropriate.

- Obtain urine samples aseptically by cleaning sampling port with an alcohol swab and allow to air dry. Label sample as catheter obtained.

Proper Techniques for Catheter Insertion

- Perform hand hygiene immediately before and after insertion or manipulation of the catheter device or site.

- Insert urinary catheters using aseptic technique and sterile equipment only
  - Use sterile gloves, drape, sponges, an appropriate antiseptic or sterile solution for peri-urethral cleaning and a single-use packet of lubricant jelly for insertion.
  - Routine use of antiseptic lubricants is not necessary.

- Secure indwelling catheters after insertion to prevent movement and urethral traction.

- Use the smallest bore catheter possible, consistent with good drainage, to minimise bladder neck and urethral trauma, unless otherwise clinically indicated.

- Consider using a portable ultrasound device to assess urine volume to reduce unnecessary catheter insertions.
Does your patient REALLY need a urinary catheter?

Indications for Urinary Catheter Use

- Acute urinary retention or bladder outlet obstruction
- Accurate measurement of urine output in critically ill patients for a finite time period
- Perioperative use for selected surgical procedures, e.g. for urologic surgery or surgery of adjoining genitourinary tract structures, surgical procedure > 3 hours, when intra-operative monitoring of urine output is needed, and when large-volume infusions or diuretics during surgery are anticipated
- Patient requires prolonged immobilisation (unstable spine and pelvic fractures)
- To assist in healing of open sacral or perineal wounds in incontinent patients
- End of life care

If NOT, then DO NOT PLACE a urinary catheter!
Impact of CAUTI Education Package on Nurses’ Knowledge and Practices

APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN PARTICIPANT ETHICS COMMITTEE ON 25/02/2014 for 3 years, Reference number 011046.

Appendix 4

Proper Techniques for Indwelling Catheter Insertion

- Perform hand hygiene immediately before and after catheter insertion/manipulation
- Insert catheters using aseptic technique and sterile equipment
  - Use sterile equipment, antiseptic for peri-urethral cleaning and a single-use packet of lubricant jelly
  - Routine use of antiseptic lubricants is not necessary
- Secure catheters after insertion to prevent movement and urethral traction
- Use smallest bore catheter possible, consistent with good drainage, to minimise bladder neck and urethral trauma
- Consider using a portable ultrasound device in assessing urine volume to reduce unnecessary catheter insertions

Some images were obtained from https://www.google.co.nz/search?q=catheter+bag&rlz=1C1CHWA_enNZ644NZ644&espv=2&biw=1366&bih=667&source=lnms&tbm=isch&sa=X&ved=0CAYQ_AUoWCHMIoe6I2qS6yQIV4:=mCh3oA4
Appendix 5

Key Points: Catheter Maintenance

- Assess need for on-going catheter daily
- If breaks in aseptic technique/disconnection/leakage occur, replace the catheter using aseptic technique and sterile equipment
- Maintain unobstructed urine flow
  - Keep the catheter free from kinks
  - Keep the collecting bag below the level of the bladder & off the floor at all times
  - Empty the collecting bag regularly using a separate, clean collecting jug for each patient
  - When draining the bag, prevent contact of the drainage spigot with the non-sterile collecting jug
- Change catheters based on clinical indications such as infection, obstruction or when the closed system is compromised
- Do not clean peri-urethral area with antiseptics while the catheter is in place. Routine hygiene is more appropriate.
- Obtain urine samples aseptically by cleaning the sampling port with an alcohol swab and allow to air dry. Label sample as catheter obtained.

Some images were obtained from [https://www.google.co.nz/search?q=catheter+bag&rlz=1C1CHWA_enNZ644NZ644&espv=2&biw=1366&bih=667&source=lnms&tbm=isch&sa=X&ved=0CAYQ_AUoAWoVChMIob6i2qSGyQIV4-mCh3osAC4](https://www.google.co.nz/search?q=catheter+bag&rlz=1C1CHWA_enNZ644NZ644&espv=2&biw=1366&bih=667&source=lnms&tbm=isch&sa=X&ved=0CAYQ_AUoAWoVChMIob6i2qSGyQIV4-mCh3osAC4)
Does your patient STILL need a urinary catheter?

Key Points: Catheter Removal

- Assess indwelling urinary catheter need and possibility of removal daily.
- For operative patients, remove the catheter as soon as possible postoperatively, preferably within 24 hours unless there are indications for continued use.
- Catheters should not be changed as part of a fever work-up.
- Use standard precautions during any manipulation, including removal of the catheter.
RESEARCH PARTICIPANT INFORMATION SHEET FOR CHARGE NURSE MANAGERS

Title: Impact of catheter-associated urinary tract infection (CAUTI) education package on nurses’ knowledge and indwelling catheter management practices

Researcher
Monina Gesmundo who is studying for a Master of Nursing Degree at The University of Auckland.

An Invitation
You are invited to participate in a study that aims to determine if the introduction of a catheter-associated urinary tract infection (CAUTI) education package will improve staff nurses’ knowledge and indwelling catheter management practices. The information will help us identify ways on how to further assist nurses improve their urinary catheter care practices so as to ultimately prevent CAUTI. The study will be utilised in the completion of the degree of Master of Nursing and will be conducted from March, 2014 to the 30th of November, 2015.

Is it my choice?
Yes, you have a choice if you wish to participate in this study. If you do agree to participate, you may withdraw CMDHB participation from the study at any time, without having to give a reason. However, you will not be able to withdraw any data provided by individual staff nurses. To help you decide, please take time to read this information sheet. Feel free to ask questions or discuss your concerns with us.

Who is invited to participate in this study?
You and your staff nurses are invited to participate because you take care of patients who recently underwent less complicated surgeries and who have indwelling catheters. Your valuable input will contribute to the development of an education package on indwelling catheter management for nurses and organisational procedures and policies that will support this.

What is involved if I decide to participate in this study?
Your participation involves sending out e-mails to staff inviting them to participate in the study and distributing flyers in the ward, taking approximately 20 minutes of your time. This entails your assurance that staff participation or non-participation will not affect their relationship and employment with the organisation. Your participation further necessitates allowing staff who volunteered to attend activities relevant to the study such as: focus groups, completion of pre-test and post-test, education sessions, and completion of catheter maintenance checklists. Your participation also entails allowing the researchers to access institutional resources such as office space and staff time as approved by the CMDHB Research office.

Staff nurses will be invited to participate in a 40-minute education session on improving knowledge and indwelling catheter management practices. They will also receive an input on how to complete an evidence-based catheter maintenance checklist. The study will also involve a focus group session of 5-6 staff participants and will take approximately 50 minutes. It will be moderated by the researcher’s supervisor who is experienced in conducting focus groups. The focus group will be audio-recorded, but participants have the right to choose not to answer any questions that they are unhappy with or leave the focus group at any time. The focus group will be held in a meeting room in Manukau Surgery Centre as approved by the CMDHB Research office.

The study also involves a pre-test and a post-test that will be administered during the education session, i.e., before and after the lecture and demonstration, and will count towards in-service education hours. The test will be a 25-item multiple-choice quiz and it may take 15-20 minutes to complete. Participants will be given a copy of the answers and rationale one month after the post-
test for learning purposes. Overall, staff nurses who participate in all the activities will commit two hours of their work time during the entire study period.

**Will information be kept confidential?**

Yes, all information given to us will remain strictly confidential and no material that could identify the participants, the wards and the DHB will be used in any report. All data will only be accessible to the researcher and research supervisors. All electronic data will be stored on password protected computers and hard copies will be stored in a locked unit at the University of Auckland for 6 years after the completion of the study. After this time all data will be securely deleted with the use of software and hardcopies will be disposed of in the confidentiality bin.

**What are the costs, risks or benefits to participation?**

There are no anticipated risks or costs associated with participating. Your staff, however, will benefit from attending the education session by receiving an update on evidence-based CAUTI prevention and additional in-service education hours for their professional development. Increased knowledge and improved practice will ultimately lead to better patient care.

**What provisions will be in place should there be risks and inconveniences?**

If any topics arise that staff feel are sensitive and would like to discuss with someone, they are advised to contact Counties Manukau District Health Board Employee Assistance Programme (CMDHB EAP) at 0800-327-669 for confidential professional assistance.

**What will happen with the results of this study?**

The findings will be utilised for the completion of a Master of Nursing degree and for quality improvement purposes within CMDHB. The study may also be published via an academic journal. The findings from the study will be made available to the ward in the form of an executive summary.

**What are my rights?**

For any concerns regarding ethical issues you may contact the Chair, The University of Auckland Human Participants Ethics Committee, The University of Auckland, Research Office, Private Bag 92019, Auckland 1142. Telephone 09 373-7599 extn. 87830/83761 Email: humanethics@auckland.ac.nz.

**Has this study been approved?**

Yes, this study has been approved by the University of Auckland Human Participants Ethics Committee, by the CMDHB Director of Hospital Services and by the CMDHB Research Committee.

**If you require further information, please contact** the researcher Monina Gesmundo at 021-414298 or mges194@aucklanduni.ac.nz or the supervisor Lisa Stewart at 09-9235346 or lisa.stewart@auckland.ac.nz

**Should you decide to participate, please complete and sign the CONSENT FORM.**

**Researcher:** **Monina Gesmundo**  
Mobile Phone: 021-414298  
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09 923 5346  
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09 923 1537  
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School of Nursing  
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APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN PARTICIPANTS ETHICS COMMITTEE ON 25/02/2014 for 3 years, Reference number 011046.
CONSENT FORM FOR CHARGE NURSE MANAGERS

RE: Impact of Catheter-associated Urinary Tract Infection (CAUTI) Education Package on Nurses’ Knowledge and Indwelling Catheter Management Practices

Researcher name: Monina Gesmundo

- I have read and understood the information sheet and consent to facilitating participation of my staff in the study.
- I understand that taking part in this study is voluntary or my choice, and I may withdraw CMDHB participation from the study at any time without having to give a reason. I will not be able to withdraw any data provided by individual staff nurses.
- I have had the opportunity to ask questions about this study and I am satisfied with the answers that I have received.
- I understand that my participation in this study involves sending out e-mails to staff inviting them to participate in the study and distributing flyers in the ward, taking approximately 20 minutes of my time.
- I give assurance that staff participation or non-participation will not affect the participant’s relationship and employment with the organisation.
- I understand that my participation in this study further entails allowing staff who volunteered to participate to attend activities relevant to the study such as: focus groups, completion of pre-test and post-test, education sessions, and completion of catheter maintenance checklists.
- I further understand that staff participation involves attending a 40-minute lecture demonstration on improving knowledge and practices on indwelling catheter management, completion of a pre-test and post-test which may take 15-20 minutes, and attending focus groups which may take around 50 minutes. Overall, I understand that staff who volunteer to participate will commit two hours of their work time during the entire study period.
- I understand that the focus group will be held in a meeting room in Manukau Surgery Centre as approved by the CMDHB Research office.
- I understand that the findings from the study will be made available to the ward in the form of an executive summary.
- I understand that no material that could identify the participants, the wards or the DHB will be used in any report.
- I understand that all electronic data will be stored on password protected computers and hard copies will be stored in a locked unit at the University of Auckland for 6 years after the completion of the study. I further understand that after 6 years, all data will be securely deleted and hardcopies will be disposed of in the confidentiality bin.
- I have had enough time to consider whether to participate or not in this study.
- I know who to contact if I have queries about the study.

I, ___________________________ (full name in PRINT), hereby consent to participate in this study.

Charge Nurse Manager’s Signature _____________________________ Date ______________________

APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN PARTICIPANTS ETHICS COMMITTEE ON 25/02/2014 for 3 years, Reference number 011046.
INVITATION TO TAKE PART IN A STUDY

Title: Impact of catheter-associated urinary tract infection (CAUTI) education package on nurses’ knowledge and indwelling catheter management practices

About the study

You are invited to participate in a study that aims to determine if the introduction of a catheter-associated urinary tract infection (CAUTI) education package will improve staff nurses’ knowledge and indwelling catheter management practices. The information will help us identify ways on how to further assist nurses improve urinary catheter care practices so as to ultimately prevent CAUTI. The study is part of my requirements in the completion of the degree of Master of Nursing.

Who may participate in this study?

All staff nurses working at Manukau Surgery Centre Wards 1 and 2 who have a patient load may participate. Your valuable input will contribute to the development of an education package on indwelling catheter management for nurses and relevant organisational procedures and policies.

What is involved if I decide to participate in this study?

By giving consent to be a part of this study, you will be invited to a focus group and a pre-test and post-test prior to and after a CAUTI prevention education session.

The study involves attending a 40-minute lecture-demonstration on improving knowledge and indwelling catheter management practices; including an input on how to complete an evidence-based catheter maintenance checklist. During the education session, a pre-test and a post-test, will be administered, i.e., before and after the lecture and demonstration. Attendance in the education session will count towards your in-service education hours. The questionnaire will be a 25-item multiple-choice quiz and may take 15-20 minutes to complete. You will be given a copy of the answers and rationale one month after the post-test for learning purposes.

The study will also involve a focus group with 5-6 participants and will take 50 minutes. It will focus on your attitude towards urinary catheter insertion, maintenance and removal and the prevention of CAUTI as a whole. The focus group will be moderated by the researcher’s supervisor who is experienced in its conduct and will be held in a meeting room in Manukau Surgery Centre as approved by the CMDHB Research office. The focus group will be audio-recorded, but you may choose not to answer questions that you are unhappy with or leave at any time. Audiotapes will be transcribed by the researcher and will be accessible only to the researcher and supervisors.

You will receive an e-mail of the information sheets, one for the pre-test and post-test, and another for the focus group; and, a consent form for your perusal. If you are interested to participate in the study, please complete the consent form and e-mail it back to the researcher.

Participation is voluntary and your manager has assured that your decision to participate or not participate will not affect your relationship and employment with the organisation. If you do agree to participate, you may withdraw from the study at any time without having to give a reason.

If you require further information, please contact the researcher Monina Gesmundo at 021-414298 or mges194@aucklanduni.ac.nz or the supervisor Lisa Stewart at 09-9235346 or lisa.stewart@auckland.ac.nz

APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN PARTICIPANTS ETHICS COMMITTEE ON 25/02/2014 for 3 years, Reference number 011046.
RESEARCH PARTICIPANT INFORMATION SHEET FOR FOCUS GROUP

Title: Impact of catheter-associated urinary tract infection (CAUTI) education package on nurses’ knowledge and indwelling catheter management practices

Researcher
Monina Gesmundo who is studying for a Master of Nursing Degree at The University of Auckland.

An Invitation
You are invited to participate in a study that aims to determine if the introduction of a catheter-associated urinary tract infection (CAUTI) education package will improve staff nurses’ knowledge and indwelling catheter management practices. The information will help us identify ways on how to further assist nurses improve their urinary catheter care practices so as to ultimately prevent CAUTI. The study is part of my requirements in the completion of the degree of Master of Nursing and will be conducted from March, 2014 to the 30th of November, 2015.

Who is invited to participate in this study?
Staff nurses working at Manukau Surgery Centre Wards 1 and 2 because you take care of patients who recently underwent less complicated surgeries and who have indwelling catheters. Your valuable input will contribute to the development of an education package on indwelling catheter management for nurses and organisational procedures and policies related to this.

Is it my choice?
Yes, you have a choice if you wish to participate in this study. If you do agree to participate, you may withdraw from the study at any time. Audio-taped information from focus-group, however, cannot be withdrawn because of the nature of this data gathering method. To help you make a decision, please take time to read this information sheet. Feel free to ask us questions or discuss your concerns with us. Your manager has given assurance that your decision to participate or not participate in this study will not in any way affect your relationship and employment with the organisation.

What is involved if I decide to participate in this study?
The study will involve a focus group that will have 5-6 participants and will take approximately 50 minutes. It will centre on your attitude towards urinary catheter insertion, maintenance and removal and the prevention of CAUTI as a whole. The focus group will be moderated by the researcher’s supervisor who is experienced in its conduct and will be held in a meeting room in Manukau Surgery Centre as approved by the CMDHB Research office.

The focus group will be audio-recorded, but you have the right to choose not to answer any questions that you are unhappy with or leave the focus group at any time. The audiotapes will be transcribed by the researcher and will be made accessible only to the researcher and supervisors.

Will my information be kept confidential?
Yes, all information that you provide will remain strictly confidential and no material that could identify you will be used in any study report. All data will only be accessible to the researcher and research supervisors. All audio-recorded focus group interviews will be deleted after data analysis is completed, up to one year. All electronic data will be stored on password protected computers and hard copy data will be stored in a locked unit at the University of Auckland for 6 years after
Appendix 10

the completion of the study. After this time all data will be securely deleted with the use of software and hardcopies will be disposed of in the confidentiality bin. Given the nature of focus groups, all participants are also expected to respect the confidentiality of all other participants.

What are the costs, risks or benefits to participation?
There are no anticipated risks or costs associated with participating. Individual benefits for participation include additional in-service education hours that could be counted towards your professional development and improved catheter management knowledge and skills.

What provisions will be in place should there be risks and inconveniences?
If any topics arise that you feel are sensitive and would like to discuss, please contact Counties Manukau District Health Board Employee Assistance Programme (CMDHB EAP) at 0800-327-669 for confidential professional assistance.

What will happen with the results of this study?
The findings will be utilised for the completion of a Master of Nursing degree and for quality improvement purposes within CMDHB. The study may also be published via an academic journal. The findings from the study will be made available to the ward in the form of an executive summary.

What are my rights?
For any concerns regarding ethical issues you may contact the Chair, The University of Auckland Human Participants Ethics Committee, The University of Auckland, Research Office, Private Bag 92019, Auckland 1142. Telephone 09 373-7599 extn. 87830/83761. Email: humanethics@auckland.ac.nz.

Has this study been approved?
Yes, this study had been approved by the University of Auckland Human Participants Ethics Committee and by the Counties Manukau District Health Board Research Committee.

If you require further information, please contact the researcher Monina Gesmundo at 021-414298 or mges194@aucklanduni.ac.nz or the supervisor Lisa Stewart at 09 923 5346 or lisa.stewart@auckland.ac.nz

Should you decide to participate, please complete and sign the CONSENT FORM.

Researcher: Monina Gesmundo
Mobile Phone: 021-414298
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Head of School: Judy Kilpatrick
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Phone: 09 9232897
E-mail: j.kilpatrick@auckland.ac.nz

APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN PARTICIPANTS ETHICS COMMITTEE ON 25/02/2014 for 3 years, Reference number 011046.
Title: Impact of catheter-associated urinary tract infection (CAUTI) education package on nurses’ knowledge and indwelling catheter management practices

Researcher
Monina Gesmundo who is studying for a Master of Nursing Degree at The University of Auckland.

An Invitation
You are invited to participate in a study that aims to determine if the introduction of a catheter-associated urinary tract infection (CAUTI) education package will improve staff nurses’ knowledge and indwelling catheter management practices. The information will help us identify ways on how to further assist nurses improve their urinary catheter care practices so as to ultimately prevent CAUTI. The study is part of my requirements in the completion of the degree of Master of Nursing and will be conducted from March, 2014 to the 30th of November, 2015.

Who is invited to participate in this study?
Staff nurses working at Manukau Surgery Centre Wards 1 and 2 because you take care of patients who recently underwent less complicated surgeries and who have indwelling catheters. Your valuable input will contribute to the development of an education package on indwelling catheter management for nurses and organisational procedures and policies related to this.

Is it my choice?
Yes, you have a choice if you wish to participate in this study. If you do agree to participate, you may withdraw from the study at any time, without having to give a reason. You may withdraw your test information up to one month after the post-test. To help you make a decision, please take time to read this information sheet. Feel free to ask us questions or discuss your concerns with us. Your manager has given assurance that your decision to participate or not participate in this study will not in any way affect your relationship and employment with the organisation.

What is involved if I decide to participate in this study?
The study involves attending a 40-minute lecture-demonstration on improving knowledge and indwelling catheter management practices; including an input on how to complete an evidence-based catheter maintenance checklist. The study also involves a pre-test and a post-test that will be administered during the education session, i.e., before and after the lecture and demonstration, and will count towards your in-service education hours. The questionnaire will be a 25-item multiple-choice quiz and may take 15-20 minutes to complete. You will be given a copy of the answers and rationale one month after the post-test for learning purposes.

Will my information be kept confidential?
Yes, all information that you provide will remain strictly confidential and no material that could identify you will be used in any study report. All participants will be assigned a questionnaire number and a coding list will be maintained to link participants with the pre and post questionnaire. No names shall appear in the pre and post-test to avoid bias during the marking process. All data (including the coding list) will only be accessible to the researcher and research supervisors. All electronic data will be stored on password protected computers and hard copy data will be stored in a locked unit in the University of Auckland for 6 years after completion of the study. After this time, all data will be securely deleted with the use of software and hardcopies will be disposed of in the confidentiality bin.
Appendix 11

What are the costs, risks or benefits to participation?
There are no anticipated risks or costs associated with participating. Benefits of attending the education session include receiving an update on evidence-based CAUTI prevention recommendations, additional in-service education hours that could be counted towards your professional development and improved catheter management knowledge and skills.

What provisions will be in place should there be risks and inconveniences?
If any topics arise that you feel are sensitive and would like to discuss with someone, please contact Counties Manukau District Health Board Employee Assistance Programme (CMDHB EAP) at 0800-327-669 for confidential professional assistance.

What will happen with the results of this study?
The findings will be utilised for the completion of a Master of Nursing degree and for quality improvement purposes within CMDHB. The study may also be published via an academic journal. The findings from the study will be made available to the ward in the form of an executive summary.

What are my rights?
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If you require further information, please contact the researcher Monina Gesmundo at 021-414298 or mges194@aucklanduni.ac.nz or the supervisor Lisa Stewart at 09 923 5346 or lisa.stewart@auckland.ac.nz

Should you decide to participate, please complete and sign the CONSENT FORM.

Researcher: Monina Gesmundo  
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Head of School: Judy Kilpatrick  
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Phone: 09 9232897  
E-mail: j.kilpatrick@auckland.ac.nz

APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN PARTICIPANTS ETHICS COMMITTEE ON 25/02/2014 for 3 years, Reference number 011046.
CONSENT FORM FOR FOCUS GROUP PARTICIPANTS

RE: Impact of Catheter-associated Urinary Tract Infection (CAUTI) Education Package on Nurses’ Knowledge and Indwelling Catheter Management Practices

Researcher name: Monina Gesmundo

- I have read and understood the information sheet and consent to participating in the study.
- I understand that taking part in this study is voluntary or my choice.
- I have had the opportunity to ask questions about this study and I am satisfied with the answers that I have received.
- I understand that the study will involve a focus group that will have 5-6 participants and will take approximately 50 minutes.
- I understand that the focus group will be audio-recorded and that I have the right to choose not to answer any questions that I am unhappy with or leave the focus group at any time. I further understand that audio-taped information cannot be withdrawn because of the nature of focus group.
- I understand that my participation or non-participation in the study will not in any way affect my relationship and employment with the organisation.
- I understand that my participation in this study is confidential and that no material that could identify me will be used in any study reports.
- I understand that data will be password protected, made accessible only to the researchers and stored in a secure computer at the University of Auckland for 6 years; after which time, it will be securely deleted.
- I understand that given the nature of focus group discussions, I am expected to respect confidentiality of all other participants.
- I understand the findings from the study will be made available to the ward in the form of an executive summary.
- I understand the findings will be utilised for the completion of a Master of Nursing degree and for quality improvement purposes within CMDHB. The study may also be published via an academic journal.
- I understand that there are no anticipated risks or costs associated with participating and benefits include additional in-service education hours that could be counted towards my professional development and improved catheter management knowledge and skills.
- I have had enough to time to consider whether to participate or not in this study.
- I know who to contact if I have queries about the study.

I, ____________________ (full name in PRINT), hereby consent to participate in this study.

Participant’s Signature____________________________________________________________________ Date __________________

APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN PARTICIPANTS ETHICS COMMITTEE ON 25/02/2014 for 3 years, Reference number 011046.
CONSENT FORM FOR PRE-TEST and POST-TEST PARTICIPANTS

RE: Impact of Catheter-associated Urinary Tract Infection (CAUTI) Education Package on Nurses’ Knowledge and Indwelling Catheter Management Practices

Researcher name: Monina Gesmundo

- I confirm that I have read and understood the information sheet and consent to participating in the study.

- I understand that taking part in this study is voluntary or my choice.

- I have had the opportunity to ask questions about this study and I am satisfied with the answers that I have received.

- I understand that the study involves attending a 40-minute lecture-demonstration on improving knowledge and practices on indwelling catheter management. The study further involves a pre-test and a post-test that will be administered during the education session and may take 15-20 minutes to complete.

- I understand that I may withdraw from the study at any time. I may withdraw my test information for up to one month after the post-test.

- I understand that my participation or non-participation in the study will not in any way affect my relationship and employment with the organisation.

- I understand that my participation in this study is strictly confidential and that no material that could identify me will be used in any study reports.

- I understand that confidential data will be password protected, made accessible only to the researchers and stored in a secure computer at the University of Auckland for 6 years; after which time, it will be securely deleted.

- I understand the findings from the study will be made available to the ward in the form of an executive summary.

- I understand the findings will be utilised for the completion of a Master of Nursing degree and for quality improvement purposes within CMDHB. The study may also be published via an academic journal.

- I understand that there are no anticipated risks or costs associated with participating and benefits include additional in-service education hours that could be counted towards my professional development.

- I have had enough to time to consider whether to participate or not in this study.

- I know who to contact if I have queries about the study.

I, ________________ (full name in PRINT), hereby consent to participate in this study.

Participant’s Signature_________________________________ Date ___________________

APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN PARTICIPANTS ETHICS COMMITTEE ON 25/02/2014 for 3 years, Reference number 011046.
Attendance Record
for
Type name here

at the Education Session
on Catheter-associated Urinary Tract Infection Prevention
03 April 2014 1300 - 1500
1 HOUR

Signed
Monina Gesmundo
Clinical Nurse Specialist
Infection Prevention and Control, Laboratory Services

28th July 2014
Appendix 15

Impact of a Catheter-associated Urinary Tract Infection (CAUTI) Education Package on Nurses’ Knowledge and Indwelling Catheter Management Practices

PRE-TEST/POST-TEST ANSWER KEY

1. Research indicates that catheter-associated urinary tract infection (CAUTI) increases a patient’s length of stay on average by:
   A. 2 days
   B. 10 days
   C. 1 month
   D. None of the above

   ANSWER: A. The best answer is 2 days; however, this is just an average and the impact of CAUTI is extremely variable and dependent on many factors. Urinary tract infections are not benign. They are potentially fatal and have been estimated to cost the US, $131 million in excess expenditures annually (Gould, et al, 2009; Dumont & Wakeman, 2010; Burton et al, 2011).

2. The most common type of healthcare-associated infection (HAI) is
   A. Ventilator-associated Pneumonia
   B. Catheter-associated urinary tract infection (CAUTI)
   C. Central catheter-associated bloodstream infection (CLABSI)
   D. Surgical-site infection (SSI)

   ANSWER: B. CAUTI represents 36 to 40% of all HAIs. The National Healthcare Safety Network reported that the average rate of CAUTI is between 3.1 and 7.5 per 1,000 patient days (calculated as number of CAUTI ÷ number of patient days X 1,000) (Gould, et al, 2009).

3. Which among the following is a true statement?
   A. CAUTI risk increases from 3% to 7% daily in the acute care setting with the use of indwelling urinary catheters.
   B. CAUTI comprise about 40% of healthcare-associated infections (HAIs).
   C. CAUTIs can lead to bloodstream infections.
   D. All of the above

   ANSWER: D. CAUTI represents 36 to 40% of HAIs and can lead to serious complications such as bloodstream infections (Gould, et al, 2009). The risk of CAUTI increases from 3% to 7% with each day of catheterisation. When an indwelling catheter remains in place for a week, the risk of bacteriuria increases to 25%; and, at 1 month, the risk increases to 100% (Institute for Healthcare Improvement [IHI], 2011). Although bacteriuria may be asymptomatic, it may lead to CAUTI. Ten per cent to 24% of patients with bacteriuria will develop CAUTI symptoms such as fever, dysuria, urgency, frequency and suprapubic tenderness; and up to 3% will progress to bacteremia (Saint, 2000). Approximately 17% of hospital-acquired bacteremias have been found to have a urinary source and carry an associated mortality rate of 10% (Gould, et al, 2009).

4. Which among the following is true about biofilm?
   A. It develops only on the external side of urinary catheters.
   B. It provides shelter for bacterial growth.
   C. It is a diagnostic criterion for CAUTI.
   D. It enhances bactericidal activity.
Appendix 15

ANSWER: B. A biofilm is a coating of polysaccharides and microorganisms that develops on every indwelling medical device. Within the biofilm, microorganisms are highly resistant to antimicrobial treatment and bind tenaciously to the surface. The microorganisms living in the biofilm are virtually impossible to eradicate without removing the catheter (Gould, et al, 2009).

5. According to the Centers for Disease Control (CDC), CAUTI is diagnosed when
   A. the patient develops fever.
   B. the patient has an indwelling catheter at the time of or within 48 hours before specimen collection
   C. the patient develops one of the following signs and symptoms: urgency, frequency, dysuria, suprapubic tenderness or costovertebral angle pain; bacteriuria and leukocyturia
   D. All of the above

ANSWER: D. The Centers for Disease Control issued specific criteria that must be met before CAUTI diagnosis is made. These include the following:

- Patient had an indwelling catheter at the time of or within 48 hours before specimen collection
- Patient has at least one of the following signs and symptoms: fever (> 38°C), urgency, frequency, dysuria, suprapubic tenderness or costovertebral angle pain; with no other recognised infection somewhere else
- A positive urine culture of > 10^5 CFU/ml with no more than 2 species of microorganisms (Gould et al., 2009; CDC, 2013), which would suggest contamination of specimen (Dumont & Wakeman, 2010).

This definition does not include asymptomatic bacteriuria which was removed from the definition in January, 2009 (Press & Metlay, 2013).

6. Which of the following reduces the incidence of CAUTI?
   A. Routine catheter irrigation with 0.9% sodium chloride solution
   B. Catheterisation only when indicated and prompt catheter removal
   C. Antibacterial ointment application to urethral meatus
   D. All of the above

ANSWER: B. Reducing catheter days decreases the incidence of CAUTI. Catheter irrigation, instillation of antimicrobial solutions into the catheter or drainage bag, and antimicrobial ointments applied to the urinary meatus have not been shown to decrease CAUTI. Some evidence indicate that routine meatal care with soap and water (good hygienic care) may reduce the incidence of CAUTI, especially in faecal incontinent patients (Gould et al., 2009).

7. Signs and symptoms of CAUTI include:
   A. Fever of 38°C or more
   B. New onset flank or suprapubic tenderness
   C. Change in urine characteristics
   D. All of the above

ANSWER: D. Signs and symptoms of CAUTI can develop early on, before the patient becomes seriously ill. Paediatric patients younger than 1 year may experience hypothermia (<36 °C). CAUTI should be immediately suspected if a patient with any of these signs and symptoms has an indwelling urinary catheter or has had one removed in the past 48 hours (CDC, 2013).
Appendix 15

8. Components of the CAUTI prevention programme include
   A. Staff education about catheter management
   B. Regular monitoring of CAUTI incidence
   C. Frequent changing of the urinary drainage bag
   D. All of the above
   E. A and B only

ANSWER: E. Changing drainage bags at a routine basis or fixed intervals is not recommended. Change drainage bags and catheters based on clinical indicators such as infection, obstruction or compromise of the closed system (Gould et al., 2009).

9. All of the following are accepted indications for urethral catheterisation EXCEPT
   A. Acute urinary retention or obstruction
   B. To accurately measure urinary output in critically ill patients
   C. Patient comfort after administration of a diuretic
   D. To assist healing of open perineal wounds in incontinent patients

ANSWER: C. According to the CDC, appropriate indications for indwelling urinary catheterisation are:
   • Acute urinary retention or bladder outlet obstruction
   • Accurate measurement of urine output in critically ill patients
   • Selected perioperative situations; for example for urologic surgery, when intraoperative monitoring of urine output is needed, and when large-volume infusions or diuretics during surgery are anticipated
   • Patient requires prolonged immobilisation (unstable spine and pelvic fractures)
   • To assist in healing of open sacral or perineal wounds in incontinent patients
   • End of life care.
   Patient comfort (except during end-of-life care) and convenience are not appropriate uses for indwelling urinary catheters (Gould et al., 2009; Schneider, 2012).

10. Sterile insertion technique is the only effective measure in preventing CAUTI.
    A. True
    B. False
    C. Not sure
    D. Don’t know

ANSWER: B. Sterile technique is required for insertion of an indwelling urinary catheter in the hospital setting, but clean technique can be used for intermittent catheterisation in non-acute settings. By itself, sterile technique on insertion does not prevent CAUTI. Prevention of CAUTI depends on several factors such as nurses’ knowledge of causes, proper maintenance techniques, and early catheter removal (HICPAC, 2010).

11. The use of smaller-diameter catheters and catheter-stabilisation devices improves patient comfort.
    A. True
    B. False
    C. Not sure
    D. Don’t know

ANSWER: A. Using the smallest-bore catheter that will adequately drain the bladder is recommended to prevent bladder neck and urethral trauma. Indwelling urinary catheters should be secured after insertion to prevent urethral traction and movement that could damage the urethral lining (Gould et al., 2009).
Appendix 15

12. The strongest predictor of CAUTI is
   A. Patient age
   B. Latex urinary catheter use
   C. Length of catheter dwell time
   D. Failure to use an antiseptic solution during catheter care

**ANSWER: C.** The length of time a urinary catheter is in place is the strongest predictor that CAUTI is likely to develop. No evidence had shown that the use of antiseptic solutions or catheter material has any effect on CAUTI (Gould et al., 2009).

13. At the hospital level, ALL of the following are evidence-based ways of preventing CAUTI, EXCEPT:
   A. Appropriate urinary catheter use
   B. Proper urine sample collection
   C. Proper catheter insertion and maintenance
   D. Proper catheter removal

**ANSWER: B.** Three key steps for hospitals to focus on to prevent CAUTI based on clinical evidence are – appropriate urinary catheter use, proper catheter insertion and maintenance and prompt catheter removal. Integration of these steps into daily practice entails the commitment of the entire healthcare team (Health Research & Educational Trust [HRET], 2013).

14. ALL of the following are common outcomes associated with CAUTI, EXCEPT:
   A. Bacteraemia
   B. Urethral strictures
   C. Mechanical trauma of the urinary tract
   D. Genital infections

**ANSWER: D.** Morbidity associated to a single episode of catheterisation may be limited, however, the cumulative burden of frequent use of catheters in the hospital is a legitimate concern. Bacteremia and sepsis occur in a small proportion of patients with CAUTI. Other negative outcomes include nonbacterial urethral inflammation, urethral strictures and mechanical trauma (Lo et al, 2008).

15. Systemic antimicrobial agents are best used routinely as prophylaxis against CAUTI.
   A. True
   B. False
   C. Not sure
   D. Don’t know

**ANSWER: B.** Routine use of systemic antimicrobial agents against CAUTI is not recommended based on evidence from either a well-designed clinical trial without randomisation, from a cohort or case control analytic study, or from a multiple time series study (Lo et al, 2008).

16. Proper hand hygiene should be performed
   A. immediately before insertion of the catheter
   B. before manipulating the catheter site
   C. before manipulating the catheter itself
   D. all of the above
Appendix 15

ANSWER: D. Proper hand hygiene should be performed immediately before and after the insertion of a urinary catheter; before and after manipulating the catheter site and before and after manipulating the catheter itself (Lo et al., 2008).

17. The following are examples of inappropriate use of indwelling catheters, EXCEPT
   A. As a substitute for nursing care of a patient with incontinence
   B. As a means of obtaining urine for culture or other diagnostic tests when the patient can voluntarily void
   C. To assist in healing of open sacral or perineal wounds in incontinent patients
   D. Perioperative use for all types of surgery

ANSWER: C. Evidence based on expert consensus suggest that A, B, and D are examples of inappropriate uses of indwelling catheters. Examples of appropriate indications for indwelling urethral catheter use include the following:
   • Patient has acute urinary retention or bladder outlet obstruction
   • Need for accurate measurements of urinary output in critically ill patients
   • Perioperative use for selected surgical procedures such as:
     - urologic surgery or other surgery on contiguous structures of the genitourinary tract
     - anticipated prolonged duration of surgery (catheters inserted for this reason should be removed in PACU)
     - patients anticipated to receive large-volume infusions or diuretics in surgery
     - need for intraoperative monitoring of urinary output
   • To assist in healing of open sacral or perineal wounds in incontinent patients
   • Patient requires prolonged immobilisation, e.g., potentially unstable thoracic or lumbar spine, multiple traumatic injuries such as pelvic fractures, and,
   • To improve comfort for end of life care if needed (Gould et al., 2009).

18. Indwelling urinary catheters in patients with uncomplicated surgeries should be removed within
   A. 12 to 24 hours
   B. 24 to 48 hours
   C. 48 to 72 hours
   D. 72 to 96 hours

ANSWER: A. Strong recommendations based on evidence suggest that indwelling urinary catheters should be removed as soon as possible postoperatively, preferably within 24 hours unless there are indications for continued use (Gould et al., 2009; Schneider, 2012). It was revealed that for each day that the catheter remains in place, patients develop bacteriuria at a rate of 3-10% per day (Parker et al., 2009).

19. Hand hygiene should be performed immediately before and after manipulation of the catheter device or site.
   A. True
   B. False
   C. Not sure
   D. Don’t know

ANSWER: A. Hand hygiene should be performed immediately before and after insertion or any manipulation of the catheter device or site (Gould et al., 2009).
Appendix 15

20. Routine use of antiseptic lubricants is not necessary when inserting the urinary catheter aseptically.
   A. True
   B. False
   C. Not sure
   D. Don’t know
   **ANSWER: A.** Evidence suggests that routine use of antiseptic lubricants is not necessary when inserting the urinary catheter using aseptic technique and with the use of sterile equipment (Gould et al., 2009).

21. Properly securing the indwelling catheter after insertion will prevent urethral traction and unnecessary trauma.
   A. True
   B. False
   C. Not sure
   D. Don’t know
   **ANSWER: A.** A strong recommendation supported by low quality evidence suggests that properly securing the indwelling catheter after insertion will prevent movement, urethral traction and unnecessary trauma (Gould et al., 2009).

22. When disconnection or urine leakage occurs, the urinary catheter and collecting system should be replaced using aseptic technique and sterile equipment.
   A. True
   B. False
   C. Not sure
   D. Don’t know
   **ANSWER: A.** A strong recommendation supported by low quality evidence suggests that if breaks in aseptic technique, disconnection, or leakage occur, the urinary catheter and collecting system should be replaced using aseptic technique and sterile equipment (Gould et al., 2009).

23. Changing indwelling catheters or drainage bags at routine, fixed intervals is highly recommended.
   A. True
   B. False
   C. Not sure
   D. Don’t know
   **ANSWER: B.** Changing indwelling catheters or drainage bags at routine, fixed intervals is not recommended. It is suggested that the decision to change catheters and drainage bags be based on clinical indications such as infection, obstruction, or when the closed system in compromised (Gould et al., 2009).

24. Cleaning of the peri-urethral area with antiseptics should be done regularly while the catheter is in place to prevent CAUTI.
   A. True
   B. False
   C. Not sure
   D. Don’t know
Appendix 15

**ANSWER:** B. Cleaning of the peri-urethral area with antiseptics to prevent CAUTI is not recommended while the catheter is in place. There is strong recommendation supported by low quality evidence that routine hygiene, that is, cleansing the meatal surface during daily bathing or showering is more appropriate (Gould et al., 2009).

25. Urine samples for culture could be collected from the port of the drainage bag using a sterile urine container.
   A. True
   B. False
   C. Not sure
   D. Don’t know

**ANSWER:** B. A strong recommendation supported by evidence suggests that if a fresh urine sample is needed for either urinalysis or culture, urine should be aspirated from the needleless sampling port with a sterile syringe/cannula after the port is cleansed with a disinfectant (Gould et al., 2009).

References


Appendix 15


Appendix 16

Impact of Catheter-associated Urinary Tract Infection (CAUTI) Education Package on Nurses’ Knowledge and Indwelling Catheter Management Practices

Prompts for focus group discussions

Introduction: Interviewer to introduce self, ask participants to introduce themselves, and thank participants for their participation and availability

Explanation: Interviewer will explain the study and remind participants that they are free to withdraw from the discussion at any time without any consequences and that the focus group discussions will be audio taped. This information is also outlined in the participant consent form.

Themes/prompts that the interviewer may use to stimulate discussion

- How would you describe your training in regard to indwelling catheters?
  Additional prompt for facilitator to explore if not included in the discussion:
  a. inserting an indwelling catheter
  b. maintaining a urinary catheter
  c. urinary catheter removal

- Who do you think is responsible for indwelling catheters?
  Additional prompt for facilitator to explore if not included in the discussion:
  a. inserting an indwelling catheter
  b. maintaining a urinary catheter
  c. urinary catheter removal

- Given that a house officer ordered insertion of a urinary catheter on one of your patients, what do you think should your responsibilities be? What about in regard to catheter maintenance and removal?

- Tell me how confident and skilled you feel working with clients who have a need for or have indwelling catheters
  Additional prompt for facilitator to explore if not included in the discussion:
  a. inserting an indwelling catheter
  b. maintaining a urinary catheter
  c. urinary catheter removal

- What do you see as a nursing role in preventing catheter-associated urinary tract infections

- How does working with clients who have indwelling catheters impact on your workload
  Additional prompt for facilitator to explore if not included in the discussion:
  a. inserting an indwelling catheter
  b. urinary catheter removal

- Is there anything else you would like to add or anything related to indwelling catheters that you think is significant that has not been addressed in the discussion today

Thank you for your time.

APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN PARTICIPANTS ETHICS COMMITTEE ON 25/02/2014 for 3 years, Reference number 011046.
Appendix 17

Impact of a Catheter-associated Urinary Tract Infection (CAUTI) Education Package on Nurses’ Knowledge and Indwelling Catheter Management Practices

PRE-TEST/POST-TEST

Test Number: _________  Age: _________  Sex: _________  Date: ________________

Ward: _______  Position: ________________________  Number of years in clinical area: _________

Ethnicity: __________________________  First Language: ________________________________

Instruction: Please read each question carefully and circle the best answer. Please choose only ONE answer. All participants are assured that your answers to this pre-test will be treated with strictest confidentiality and you will not be identified in any way.

Thank you very much for your participation.

-----------------------------------------------------------------------------------------------------------------------------

1. Research indicates that catheter-associated urinary tract infection (CAUTI) increases a patient’s length of stay on average by:
   A. 2 days
   B. 10 days
   C. 1 month
   D. None of the above

2. The most common type of healthcare-associated infection (HAI) is
   A. Ventilator-associated Pneumonia
   B. Catheter-associated urinary tract infection (CAUTI)
   C. Central catheter-associated bloodstream infection (CLABSI)
   D. Surgical-site infection (SSI)

3. Which among the following is a true statement?
   A. CAUTI risk increases from 3% to 7% daily in the acute care setting with the use of indwelling urinary catheters.
   B. CAUTI comprise about 40% of healthcare-associated infections (HAIs).
   C. CAUTIs can lead to bloodstream infections.
   D. All of the above

4. Which among the following is true about biofilm?
   A. It develops only on the external side of urinary catheters.
   B. It provides shelter for bacterial growth.
   C. It is a diagnostic criterion for CAUTI.
   D. It enhances bactericidal activity.

5. According to the Centers for Disease Control (CDC), CAUTI is diagnosed when
   A. the patient develops fever.
   B. the patient has an indwelling catheter at the time of or within 48 hours before specimen collection
   C. the patient develops one of the following signs and symptoms: urgency, frequency, dysuria, suprapubic tenderness or costovertebral angle pain; bacteriuria and leukocyturia
   D. All of the above
Appendix 17

6. Which of the following reduces the incidence of CAUTI?
   A. Routine catheter irrigation with 0.9% sodium chloride solution
   B. Catheterisation only when indicated and prompt catheter removal
   C. Antibacterial ointment application to urethral meatus
   D. All of the above

7. Signs and symptoms of CAUTI include:
   A. Fever of 38°C or more
   B. New onset flank or suprapubic tenderness
   C. Change in urine characteristics
   D. All of the above

8. Components of the CAUTI prevention programme include
   A. Staff education about catheter management
   B. Regular monitoring of CAUTI incidence
   C. Frequent changing of the urinary drainage bag
   D. All of the above
   E. A and B only

9. All of the following are accepted indications for urethral catheterisation EXCEPT
   A. Acute urinary retention or obstruction
   B. To accurately measure urinary output in critically ill patients
   C. Patient comfort after administration of a diuretic
   D. To assist healing of open perineal wounds in incontinent patients

10. Sterile insertion technique is the only effective measure in preventing CAUTI.
    A. True
    B. False
    C. Not sure
    D. Don’t know

11. The use of smaller-diameter catheters and catheter-stabilisation devices improves patient comfort.
    A. True
    B. False
    C. Not sure
    D. Don’t know

12. The strongest predictor of CAUTI is
    A. Patient age
    B. Latex urinary catheter use
    C. Length of catheter dwell time
    D. Failure to use an antiseptic solution during catheter care

13. At the hospital level, ALL of the following are evidence-based ways of preventing CAUTI, EXCEPT:
    A. Appropriate urinary catheter use
    B. Proper urine sample collection
    C. Proper catheter insertion and maintenance
    D. Proper catheter removal
Appendix 17

14. ALL of the following are common outcomes associated with CAUTI, EXCEPT:
   A. Bacteraemia
   B. Urethral strictures
   C. Mechanical trauma of the urinary tract
   D. Genital infections

15. Systemic antimicrobial agents are best used routinely as prophylaxis against CAUTI.
   A. True
   B. False
   C. Not sure
   D. Don’t know

16. Proper hand hygiene should be performed
   A. immediately before insertion of the catheter
   B. before manipulating the catheter site
   C. before manipulating the catheter itself
   D. all of the above

17. The following are examples of inappropriate use of indwelling catheters, EXCEPT
   A. As a substitute for nursing care of a patient with incontinence
   B. As a means of obtaining urine for culture or other diagnostic tests when the patient can voluntarily void
   C. To assist in healing of open sacral or perineal wounds in incontinent patients
   D. Perioperative use for all types of surgery

18. Indwelling urinary catheters in patients with uncomplicated surgeries should be removed within
   A. 12 to 24 hours
   B. 24 to 48 hours
   C. 48 to 72 hours
   D. 72 to 96 hours

19. Hand hygiene should be performed immediately before and after manipulation of the catheter device or site.
   A. True
   B. False
   C. Not sure
   D. Don’t know

20. Routine use of antiseptic lubricants is not necessary when inserting the urinary catheter aseptically.
   A. True
   B. False
   C. Not sure
   D. Don’t know

21. Properly securing the indwelling catheter after insertion will prevent urethral traction and unnecessary trauma.
   A. True
   B. False
   C. Not sure
   D. Don’t know
Appendix 17

22. When disconnection or urine leakage occurs, the urinary catheter and collecting system should be replaced using aseptic technique and sterile equipment.

A. True
B. False
C. Not sure
D. Don’t know

23. Changing indwelling catheters or drainage bags at routine, fixed intervals is highly recommended.

A. True
B. False
C. Not sure
D. Don’t know

24. Cleaning of the peri-urethral area with antiseptics should be done regularly while the catheter is in place to prevent CAUTI.

A. True
B. False
C. Not sure
D. Don’t know

25. Urine samples for culture could be collected from the port of the drainage bag using a sterile urine container.

A. True
B. False
C. Not sure
D. Don’t know

-------- End of Quiz -------
Appendix 18

Impact of a CAUTI Education Package on Nurses’ Knowledge Indwelling Catheter Management Practices among Post-operative Patients

Daily Urinary Catheter Maintenance Checklist

**Instruction:** Please read each statement carefully and tick the appropriate answer. **All participants are assured that your answers to this checklist will be treated with strictest confidentiality and you will not be identified in any way.**

Thank you very much for your participation.

<table>
<thead>
<tr>
<th>Components of Care to Prevent Catheter-associated Urinary Tract Infection (CAUTI)</th>
<th>YES</th>
<th>NO</th>
<th>Not Applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Appropriate Catheter Indications</strong></td>
<td></td>
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<tr>
<td>• Patient meets at least one of appropriate catheter indications*</td>
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<tr>
<td><strong>Hand Hygiene</strong></td>
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<tr>
<td>• Hand hygiene before catheter insertion</td>
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<td>• Hand hygiene after catheter insertion</td>
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<tr>
<td>• Hand hygiene after catheter manipulation</td>
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<tr>
<td><strong>Insertion Technique</strong></td>
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<tr>
<td>• Use sterile equipment including sterile gloves, drape, sponges and antiseptic solution</td>
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<tr>
<td>• Use aseptic technique to insert catheter. If aseptic technique is broken, replace catheter and collecting bag with sterile equipment</td>
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<tr>
<td>• Use single-use packet of lubricant jelly for insertion</td>
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<tr>
<td>• Secure catheter to prevent movement and urethral traction</td>
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<tr>
<td><strong>Catheter Maintenance</strong></td>
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<tr>
<td>• Collecting bag below level of bladder at all times</td>
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<td>• Tubing checked frequently for kinking</td>
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<td>• Urine collecting bag off the floor at all times</td>
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<tr>
<td>• Closed-drainage system maintained</td>
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<tr>
<td>• Urine collecting bag emptied regularly</td>
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<tr>
<td>• Used separate clean urine collecting jug for each patient</td>
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<tr>
<td>• Contact of drainage spigot with collecting jug is avoided when collecting urine</td>
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<td>• Routine hygiene, i.e., cleansing of peri-urethral area done during daily bathing or showering</td>
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<tr>
<td><strong>Catheter Removal</strong></td>
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<tr>
<td>• Catheter need assessed daily</td>
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<tr>
<td>• Standard precaution used during catheter removal</td>
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<tr>
<td>• Catheter removed</td>
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<td>Date removed: __________ Removed by: _______________ Signature</td>
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</table>

* **Appropriate catheter indications:** acute urinary retention or urinary obstruction, accurate urine output measurement in critically ill patients, prolonged immobilisation required, to assist in healing of open sacral or perineal wounds, end of life care, perioperative use for selected surgical procedures, e.g. for urologic surgery or surgery of adjoining structures, surgical procedure > 3 hours, intra-operative monitoring of urine output, and intra-operative administration of large-volume infusions or diuretics
Appendix 18

CAUTI Prevention Flowchart

Patient admitted to Unit

YES

Does patient have a standing order for the indwelling urinary catheter?

NO

Continue to assess patient at least 2 hourly for the following and refer as necessary:
- incontinence/toileting
- skin breakdown
- bladder distention
- if unable to void, consider the use of bladder scanner

Notify physician to discuss discontinuation of catheter order or order for intermittent catheter PRN

Does patient meet at least one of the insertion criteria?
- Acute urinary retention or urinary obstruction
- Accurate measurement of urine output in critically ill patients
- Perioperative use for selected surgical procedures, e.g. for urologic surgery or surgery of adjoining structures, surgical procedure > 3 hours, intra-operative monitoring of urine output needed, and for intra-operative administration of large-volume infusions or diuretics
- Prolonged immobilisation (unstable spine and pelvic fractures)
- To assist in healing of open sacral or perineal wounds in incontinent patients
- End of life care

NO

Maintain catheter based on recommended guidelines:
- Maintain a closed drainage system
- Maintain unobstructed urine flow
  - Keep the catheter free from kinks
  - Keep collecting bag below the level of the bladder and off the floor at all times
  - Empty the collecting bag regularly using a separate, clean collecting jug for each patient
  - When draining collecting bag, prevent contact of drainage spigot with the non-sterile collecting jug
- Change catheters based on clinical indications such as infection, obstruction or compromised closed system.
- Unless indicated, do not use systemic antimicrobials routinely to prevent CAUTI in patients.
- Do not clean peri-urethral area with antiseptics while the catheter is in place. Routine hygiene, i.e., cleansing of the area during daily bathing is appropriate
- Obtain urine samples aseptically
- Assess need for on-going catheter daily

YES

Insert urinary catheter using sterile technique, reassess catheter need and possibility of removal daily

Patient with ongoing need for catheter?

YES

NO

Remove catheter promptly

References:
CATHETER CARE COMPONENTS

Appropriate Catheter Indications

- Patient meets at least one of appropriate catheter indications: acute urinary retention or urinary obstruction, accurate urine output measurement in critically ill patients, prolonged immobilisation required, to assist in healing of open sacral or perineal wounds, end of life care, perioperative use for selected surgical procedures, e.g. for urologic surgery or surgery of adjoining structures, surgical procedure > 3 hours, intra-operative monitoring of urine output, and intra-operative administration of large-volume infusions or diuretics

Insertion Technique

- Use sterile equipment including sterile gloves, drape, sponges and antiseptic solution
- Use aseptic technique to insert catheter. If aseptic technique is broken, replace catheter and collecting bag with sterile equipment
- Use single-use packet of lubricant jelly for insertion
- Secure catheter to prevent movement and urethral traction

Catheter Maintenance

- Collecting bag below level of bladder at all times
- Tubing checked frequently for kinking
- Urine collecting bag off the floor at all times
- Closed-drainage system maintained
- Urine collecting bag emptied regularly
- Use separate clean urine collecting jug for each patient
- Contact of drainage spigot with collecting jug is avoided when collecting urine
- Routine hygiene, i.e., cleansing of peri-urethral area done during daily bathing or showering

Catheter Removal

- Catheter need assessed daily
- Standard precautions used during catheter removal
Aim: To reduce CAUTI Rate

Primary Drivers

Leadership
- Management Support for CAUTI prevention
- Consistent drumbeating of CAUTI prevention programme
- Evidence-based policies and protocols on CAUTI prevention
- Development of competencies/curriculum re IDC management

Education and Training
- Development of educational materials
- Training/competency upgrade for staff responsible for IDC orders, insertion, maintenance, removal
- Regular updates for nursing personnel
- Availability of educational resources

Facilities and workflow reminders
- Availability of supplies needed for aseptic-technique insertion
- Visual reminders in strategic places
- Availability of CAUTI prevention algorithms
- Identification of area where surveillance will be conducted

Surveillance
- Standardised CAUTI definition
- Obtain rate of IDC usage in CMDHB
- Calculate CAUTI rates

Culture change
- Engagement of senior leaders, doctors, nurses, allied health, non-clinical support and patients

Secondary Drivers

Management Support for CAUTI prevention

Consistent drumbeating of CAUTI prevention programme

Evidence-based policies and protocols on CAUTI prevention

Development of competencies/curriculum re IDC management

Development of educational materials

Training/competency upgrade for staff responsible for IDC orders, insertion, maintenance, removal

Regular updates for nursing personnel

Availability of educational resources

Availability of supplies needed for aseptic-technique insertion

Visual reminders in strategic places

Availability of CAUTI prevention algorithms

Identification of area where surveillance will be conducted

Standardised CAUTI definition

Obtain rate of IDC usage in CMDHB

Calculate CAUTI rates

Engagement of senior leaders, doctors, nurses, allied health, non-clinical support and patients

Senior management accountability for ensuring adequate number of trained personnel

Unit/service leaders to ensure accountability of their personnel

Ensure healthcare provider’s compliance to evidence-based PPGs

IP and C team to ensure programme implementation, to conduct surveillance and to feedback surveillance data regularly

Ward rounds to incorporate review of all patients with IDCs

Development of evidence-based policies on catheter insertion, maintenance and removal

Enforcement of institutional policy requiring review of patient need for IDC

Development of evidence-based protocol for management of urinary retention

Development of standardised catheter stop orders

Alignment/consolidation of existing initiatives

Development of factsheets, posters and other visual reminders

Standardisation of products

Procurement of standardised products

Utilisation of CAUTI checklist

Education of staff on how to use the algorithm

Area identification

IP and C to develop CAUTI definition for CMDHB

Use appropriate case-finding methods

Measure IDC use in surveillance areas

Develop cooperative relationship with stakeholders

Enhance teamwork and cooperation
PERFORMANCE MEASURES

• PROCESS MEASURES
  - Compliance with documentation of catheter insertion and removal dates
  - Compliance with documentation of indication for catheter placement

• OUTCOME MEASURE
  - Rates of symptomatic CAUTI
    • Numerator: number of symptomatic CAUTI
    • Denominator: total number of urinary catheter-days
  - Rates of bacteraemia attributable to CAUTI
    • Numerator: number of episodes of BSI attributed to CAUTI
    • Denominator: total number of urinary catheter-days