Guidelines for preventing healthcare-associated infections in primary and community care

Section 3 of 5 sections; each section is in an individual file
Section 3

Guidelines for preventing healthcare-associated infections during long-term urinary catheterisation in primary and community care

Introduction

In the community and primary healthcare settings, long-term (>28 days) catheterisation (LTC) of the bladder is most commonly used in the management of the elderly and patients with neurological conditions. The prevalence of LTC in the United Kingdom (UK) has been estimated as 0.5 percent in those over 75 years old\(^1\) and 4 percent in people undergoing domiciliary care.\(^2\) Some patients may require continuous bladder drainage using urethral or suprapubic catheters. Alternatively, patients or carers may insert and remove urethral catheters at regular intervals (intermittent catheterisation).

Catheter care in the community is time consuming and expensive.\(^1\)-\(^3\) LTC should be regarded as a ‘method of last resort’ in the management of urinary problems as the burden both to the health service and to individual patients is high.\(^4\) However, there will remain a group of patients for whom LTC is the best option.

The method of catheterisation will depend on each patient’s individual requirements, available clinical expertise and services. Infection is a major problem in LTC although there are other non-infectious complications associated with LTC, including physiological/structural damage,\(^5\) urological cancer\(^6\) and psycho-social problems.\(^7\) In selecting particular strategies to manage urinary problems, healthcare practitioners must take account of all of these complications. These guidelines focus on preventing infection. However, since infection has a complex inter-relationship with encrustation and blockage, these aspects of catheter management are also addressed.

These guidelines apply to adults and children and should be read in conjunction with the guidance on Standard Principles. These recommendations are broad principles of best practice and are not detailed procedural protocols. They need to be adapted and incorporated into local practice guidelines. The recommendations are divided into five distinct interventions:

1. Education of patients, their carers and healthcare personnel;
2. Assessing the need for catheterisation;
3. Selection of catheter type and system;
4. Catheter insertion;
5. Catheter maintenance.

References
Systematic review process

Two sets of guidelines were identified as a result of the search for national and international guidelines. These were retrieved and appraised using the AGREE instrument. The appraisal for the epic phase 1 guidelines was undertaken by two external independent appraisers. These were regarded as sufficiently robust to be used as a basis for these guidelines with additional searches for outstanding questions (Appendix UC1).

After appraisal, search questions were developed from advice received from focus groups, stakeholders and our specialist advisers (Appendix UC2). The following systematic review questions were used:

1. If it is necessary to catheterise, which approach – indwelling urethral/suprapubic/intermittent results in the lowest rates of infection?
2. Is the management or type of drainage system a factor in colonisation/infection?
3. Is the frequency or method of changing catheters (indwelling, suprapubic) a factor in colonisation/infection?
4. Does monitoring urinary pH assist in the prevention of encrustation and blockage of long term indwelling catheters?
5. Which catheters materials cause least irritation/encrustation/blockage?
6. Does the use of bladder irrigation/instillation/washout prevent/reduce encrustation and symptomatic urinary tract infection?
7. Does the use of antibiotic prophylaxis at the time of changing catheters reduce symptomatic infection?
8. Which method of cleaning and storing intermittent catheters result in the lowest rates of colonisation/infection?
9. Is there any cost effectiveness evidence relating to the above?
10. What are the training and education implications for staff and patients?

In setting up the search the following MeSH terms were used: infection control; cross infection; community-acquired infections; disease transmission; urinary tract infections; urinary catheterization; indwelling catheters; antibiotic prophylaxis; irrigation; biofilms; hydrogen ion concentration; urease; proteus; proteus infections; providencia; morganella. In addition the following thesaurus and free text terms were used: intermittent catheterisation; urethral catheterisation; suprapubic catheterisation; bacteriuria; pyuria; encrustation; blockage; non blocker; bladder irrigation; bladder washout; bladder instillation.

These databases were searched from 1985 onwards: Medline, Cumulated Index of Nursing and Allied Health Literature (CINAHL), Embase, The Cochrane Library, National Electronic Library for Health, The NHS Centre for Reviews and Dissemination (CRD), The National Research Register, The Web of Science, The Institute of Health Technology, Health CD Database, Health Management Information, Consortium Database.

Search Results: 7387 articles were identified. These articles were initially sifted to determine if they related to infections associated with long term urinary catheters, were...
written in English, were primary research or were a systematic review or a meta-analysis, and appeared to inform one or more of the review questions. Following this first sift, 978 full text articles were retrieved. Using the same criteria as in the first sift, retrieved full-text articles were then re-sifted to select those for critical appraisal. A total of 72 full text articles were independently critically appraised by two appraisers. Consensus and grading was achieved through discussion. Following critical appraisal, 34 were accepted into the study (38 were rejected).

Evidence tables for accepted and rejected studies were generated and used to create summary reports, including evidence grades (Appendix UC3). The summary reports were used as the basis for guideline writing.

Following our reviews, guidelines were drafted which described 28 recommendations within the below 5 intervention categories:

1. Education of patients, their carers and healthcare personnel;
2. Assessing the need for catheterisation;
3. Selection of catheter drainage system;
4. Catheter insertion;
5. Catheter maintenance.

References
Intervention 1  |  Education of patients, carers and healthcare personnel

Given the prevalence of LTC and the associated risk of clinical urinary tract infection, it is important that everyone involved in catheter management is educated about infection prevention. As many people, including children, will manage their own catheters, they must be confident and proficient in the procedure, aware of the signs and symptoms of clinical infection and how to access expert help when difficulties arise.\(^{(1-4)}\)

Recommendations

**UC1.** Patients and carers should be educated about and trained in techniques of hand decontamination, insertion of intermittent catheters where applicable and catheter management before discharge from hospital.

**UC2.** Community and primary healthcare personnel must be trained in catheter insertion, including suprapubic catheter replacement and catheter maintenance.

**UC3.** Follow-up training and on-going support of patients and carers should be available for the duration of LTC.

References

**Intervention 2 Assessing the need for catheterisation**

Catheterising patients increases the risk of acquiring a urinary tract infection. The longer a catheter is in place, the greater the danger.

The highest incidence of healthcare-associated infection is associated with indwelling urethral catheterisation.\(^{(1)}\) Many of these infections are serious and lead to significant morbidity. In acute care facilities, 20-30% of catheterised patients develop bacteriuria, of whom 2-6 percent develop symptoms of urinary tract infection (UTI).\(^{(1)}\) The risk of acquiring bacteriuria is approximately 5 percent for each day of catheterisation,\(^{(2,3)}\) and therefore most patients with LTC are bacteriuric after 30 days of catheterisation.\(^{(4)}\)

A study of patients in long-term care facilities demonstrated significantly higher morbidity and mortality in catheterised patients than in matched non-catheterised controls.\(^{(5)}\) Duration of catheterisation is strongly associated with risk of infection, i.e., the longer the catheter is in place, the higher the incidence of UTI.\(^{(1)}\)

Best practice emphasises that all procedures involving the catheter or drainage system and the related batch codes of these devices are recorded in the patient's records.\(^{(6)}\) Patients should be provided with adequate information in relation to the need, insertion, maintenance and removal of their catheter by the person planning their care.\(^{(6)}\)

**Recommendations**

- **UC4.** Indwelling urinary catheters should be used only after alternative methods of management have been considered.
- **UC5.** The patient's clinical need for catheterisation should be reviewed regularly and the urinary catheter removed as soon as possible.
- **UC6.** Catheter insertion, changes and care should be documented.

**References**

**Intervention 3  Catheter drainage options**

**How to select the right system**
Choosing the right system for any given patient will depend on a comprehensive individual patient assessment.

Our search identified one systematic review\(^1\) concerning the approaches to catheterisation. This reported a higher rate of infection associated with indwelling rather than intermittent catheterisation. This finding is reflected in a recent position paper\(^2\) on urinary tract infections in long-term care facilities by the Society for Healthcare Epidemiology of America (SHEA) who recommended that “where clinically appropriate, intermittent catheterisation should be used for urinary drainage rather than a chronic indwelling catheter.”

Two studies were identified in our search which compared catheter options\(^3,4\). The first focussed on the risk of Methicillin-resistant *Staphylococcus aureus* (MRSA) colonisation and infection in nursing home patients.\(^3\) This study concluded that indwelling catheters posed a greater risk of infection than intermittent catheters. The second studied men with prostatomegaly and reported a significantly lower rate of infection in those with suprapubic rather than urethral catheters, despite the former being used for two weeks longer.\(^4\) A non-comparative study of patients with neuropathic bladder demonstrated a low rate of infection (6 percent) associated with the use of long-term suprapubic catheters.\(^5\) However, 30% of patients in this study reported other catheter-related complaints. Economic opinion suggests that if staff and resource use are the same, suprapubic catheterisation is more cost effective.\(^5,6\)

Eight studies were identified which focussed exclusively on the use of intermittent catheterisation. The study populations encompassed a wide range of patient groups and ages.\(^7-14\) One theme emerging from these studies was that the prevalence of bacteriuria is equal between men and women\(^8,9\) though the incidence of clinical UTI appears to be higher in women.\(^8,10\) There is also some evidence that bacteriuria rates are similar between adults and children.\(^15\)

Generally, large studies indicated that the rates of infection associated with intermittent catheterisation were low\(^11,12\), 1 per 87 months,\(^11\) and that hydrophilic catheters were associated with a further reduction in infection risk.\(^7,10\)

A possible alternative to indwelling and intermittent catheterisation is the penile sheath (condom catheter). Whilst our systematic review did not include a specific question related to the use of penile sheath catheters, there is evidence that this type of device may be preferable in men who are able to empty their bladder and are unlikely to manipulate the system.\(^6,15\) To date there are no controlled studies comparing penile sheaths with indwelling devices.
Recommendations

UC7. Following assessment, the best approach to catheterisation that takes account of clinical need, anticipated duration of catheterisation, patient preference and risk of infection should be selected.

UC8. Intermittent catheterisation should be used in preference to an indwelling catheter if it is clinically appropriate and a practical option for the patient.

References

Is one catheter better than another?

A systematic review identified three experimental studies that compared the use of coated latex with silicone catheters.\(^1\) No significant difference in the incidence of bacteriuria was found. Our systematic review identified one laboratory study which indicated that bacteria were less likely to adhere to hydrophilic coated catheters than silicone coated catheters.\(^2\) However, many practitioners have strong preferences for one type of catheter over another. This preference is often based on clinical experience, patient assessment and which materials induce the least allergic response. There is also some evidence that the balloon material on all silicone Foley catheters has a greater tendency to “cuff” on deflation than latex catheters, particularly when used suprapublically. Cuffing can cause distress and injury to patients when the catheter is removed.\(^3\) Our systematic review showed that smaller gauge catheters (12-14 Ch) with a 10 ml balloon minimise urethral trauma, mucosal irritation and residual urine in the bladder, are all factors that predispose to catheter-associated infection.\(^4,5\) A non-systematic review of the literature confirmed this.\(^6\) For suprapubic catheterisation, a 16 Ch gauge catheter is usually preferable to avoid blockage.\(^7\) Where there is no difference in the quality of the catheter, the least expensive option should be used.\(^8\)

One study\(^9\) identified by our systematic review compared the use of catheter valves with a standard drainage system and found no significant difference in urinary tract infection but a patient preference for the catheter valve. The Medical Device Agency suggests patients need to be assessed for their mental acuity, manual dexterity, clothing preferences and use of night bags when considering using catheter valves.\(^10\)

Recommendations

**UC9.** For urethral and suprapubic catheters, the choice of catheter material and gauge will depend on the patient’s characteristics and predisposition to blockage. In general, the catheter balloon should be inflated with 10 ml of sterile water in adults and 3-5 ml in children.

**UC10.** In patients for whom it is appropriate, a catheter valve can be used as an alternative to a drainage bag.

References

**Intervention 4  Catheter Insertion**

**Catheterisation is a skilled procedure**
Principles of good practice, clinical guidance\(^1,2\) and expert opinion\(^3-7\) agree that urinary catheters must be inserted using sterile equipment and an aseptic technique. Expert opinion indicates that there is no advantage in using antiseptic preparations for cleansing the urethral meatus prior to catheter insertion.\(^8\) Urethral trauma and discomfort will be minimised by using an appropriate sterile, single-use lubricant or anaesthetic gel. The insertion of urinary catheters by healthcare personnel who are competent in the procedure will minimise trauma, discomfort and the potential for catheter-associated infection.\(^1,3,7,9\)

Our systematic review found that in a study examining the safety of clean versus sterile intermittent catheterisation in male adults aged 36-96 years, no significant differences were found in infection rates, time to first infection or number of episodes.\(^10\) A systematic review identified three controlled trials regarding the benefits of sterile or “non-touch techniques” for intermittent catheterisation vs. conventional clean intermittent catheterisation.\(^11\) Data “neither supports nor refutes the need to utilize sterile, as opposed to clean, intermittent catheterisation.” Economic analysis suggests that clean intermittent catheterisation is unlikely to lead to additional infections and the additional cost of sterile catheterisation is unlikely to be justified.\(^10,12\)

**Recommendations**

- **UC11.** All catheterisations carried out by healthcare personnel should be aseptic procedures. After training, healthcare personnel should be assessed for their competence to carry out these types of procedures.

- **UC12.** Intermittent self-catheterisation is a clean procedure. A lubricant for single patient use is required for non-lubricated catheters.

- **UC13.** For urethral catheterisation, the meatus should be cleaned before insertion of the catheter, in accordance with local guidelines/policy.

- **UC14.** An appropriate lubricant from a single-use container should be used during catheter insertion to minimise urethral trauma and infection.

**References**
Intervention 5  Catheter Maintenance

Leave the closed system alone!
Maintaining a sterile, continuously closed urinary drainage system is central to the prevention of catheter-associated infection.\(^{(1-6)}\) The risk of infection reduced from 97% with an open system to 8-15% when a sterile closed system was employed as standard practice.\(^{(7-9)}\) However, breaches in the closed system such as unnecessary emptying of the urinary drainage bag or taking a urine sample increase the risk of catheter-related infection and should be avoided.\(^{(4,9,10)}\) Hands must be decontaminated and healthcare personnel should wear clean, non-sterile gloves before manipulation.

Reflux of urine is associated with infection and, consequently, best practice suggests catheters are secured to avoid trauma and drainage bags should be positioned in a way that prevents back-flow of urine.\(^{(4,5)}\) Expert opinion also recommends that urinary drainage bags should be supported in such a way that prevents contact with the floor.\(^{(9)}\) For night drainage, a link system should be used to maintain the original closed system, i.e., a bag attached to the end of the day system.\(^{(11)}\)

Drainable urinary drainage bags should be changed when clinically indicated and/or in line with the manufacturer’s recommendations, generally every 5-7 days. Bags that are non-drainable should be used once, e.g., overnight, and emptied before disposal.

Recommendations

UC15. Indwelling catheters should be connected to a sterile closed urinary drainage system or catheter valve.

UC16. Healthcare personnel should ensure that the connection between the catheter and the urinary drainage system is not broken except for good clinical reasons, e.g., changing the bag in line with manufacturer’s recommendation.

UC17. Healthcare personnel must decontaminate their hands and wear a new pair of clean, non-sterile gloves before manipulating a patient’s catheter and must decontaminate their hands after removing gloves.

UC18. Carers and patients managing their own catheters must wash their hands before and after manipulation of the catheter, according to the recommendations in the Standard Principles Section.

UC19. Urine samples must be obtained from a sampling port using an aseptic technique.

UC20. Urinary drainage bags should be positioned below the level of the bladder and should not be in contact with the floor.

UC21. A link system should be used to facilitate overnight drainage to keep the original system intact.
UC22. The urinary drainage bag should be emptied frequently enough to maintain urine flow and prevent reflux and changed when clinically indicated.

References

Appropriate maintenance minimises infections

**Meatal cleansing with antiseptic solutions is unnecessary**
One systematic review considered six acceptable studies that compared meatal cleansing with a variety of antiseptic/antimicrobial agents or soap and water.\(^{(1)}\) No reduction in bacteriuria was demonstrated when using any of these preparations for meatal care compared with routine bathing or showering. Expert opinion\(^{(2-4)}\) and another systematic review\(^{(5)}\) support the view that vigorous meatal cleansing is not necessary and may increase the risk of infection and that daily routine bathing or showering is all that is needed to maintain meatal hygiene.

**Recommendation**

UC23. The meatus should be washed daily with soap and water.
Instillation and washouts do not prevent infection

Our systematic review suggests that more than 50% of patients with long-term catheters will experience catheter encrustation and blockage. A tendency to encrustation is multifactorial and includes patient factors, catheter materials and bacterial organisms. Several studies identified an association between high urinary pH (alkaline) and encrustation and blocking but there is no evidence that monitoring urinary pH can be used to predict blocking.

Systematic review evidence and further evidence from one controlled trial failed to demonstrate any beneficial effect of bladder instillation or washout with a variety of antiseptic or antimicrobial agents in preventing catheter-associated infection. A laboratory study demonstrated that any effect was only temporary. Study investigators commented that these agents may prove detrimental to patients with dehydration or low urine output. A study using a model bladder identified that whilst saline had no effect on encrustation, Suby G and mandelic acid washouts both made it more difficult for *P. Mirabilis* to adhere to catheters.

Evidence from best practice supports the above and indicates that the introduction of such agents may have local toxic effects and contribute to the development of resistant microorganisms.

Recommendations

**UC24.** Each patient should have an individual care regimen, aimed to minimise the problems of blockage and encrustation. The tendency for catheter blockage should be assessed in each newly catheterised patient.

**UC25.** Bladder instillations or washouts must not be used to prevent catheter-associated infection.

References

Changing catheters

There is no definitive evidence as to the optimal interval for changing catheters in patients undergoing long-term urinary drainage via either the urethral or suprapubic route. Our search identified a study which suggested that a higher rate of infection was associated with frequent catheter changes, though evidence is not definitive. (1) Expert opinion suggests changing the catheter according to the clinical needs of the patient or as recommended by the catheter manufacturer (usually every 12 weeks). (2,3) Our systematic review identified a study that showed if catheter blockage occurs within a shorter interval, catheters should be changed more frequently to avert a future clinical crisis. (4) An economic analysis suggested that there may be a cost saving in changing a catheter at six weeks when there is an increased likelihood of blockage (>50%). (5)

Our systematic review suggests that antibiotic prophylaxis to prevent bacteraemia at primary catheter insertion for acute retention is of proven value. (6) In the community setting however, a prospective survey of 120 catheter changes found zero incidence of clinical complications, despite a 5.6 percent incidence of sub clinical bacteraemia detected by blood culture. (7) This descriptive finding is matched by the result of an experimental study of residents in a geriatric care centre. (8) Antibiotic prophylaxis was of no benefit in preventing or delaying bacteriuria following long-term catheter placement. A systematic review (9) and expert opinion (10,11) suggest antibiotic prophylaxis at catheter change should be reserved for those with a history of symptomatic UTI following catheter change for patients catheterised between 3-14 days or to prevent endocarditis in patients with heart valve lesion, septal defect, patent ductus or prosthetic valve.

Recommendations

**UC26.** Catheters should be changed only when clinically necessary or according to the manufacturer's current recommendations.

**UC27.** Antibiotic prophylaxis when changing catheters should be used only for patients with a history of catheter-associated urinary tract infection following catheter change or who have a serious cardiac condition.

References


### Re-use of intermittent catheters

Many people use disposable single-use catheters for intermittent catheterisation. Reusable single patient use catheters need to be cleaned after use. Our systematic review identified two crossover studies of young people with neurogenic bladders indicated that cleaning catheters with soap and water results in acceptably low rates of bacteriuria when compared with the use of sterile catheters. However, manufacturer’s recommendations advise against using soap as soap residues may cause urethral irritation. Catheters should be stored in a clean and dry condition, which is least likely to promote the growth of contaminating microorganisms.

**Recommendation**

**UC28.** Reusable intermittent catheters should be cleaned with water and stored dry in accordance with the manufacturer's instructions.

**References**


Areas for Further Research

In developing the recommendations we identified several areas that were inadequately addressed in the literature. The following recommendations for research are therefore made.

**Intervention 1: Assessing the need for catheterisation**

Epidemiological studies of the prevalence and incidence of bacteriuria/clinical urinary tract infection during long-term catheterisation in different populations and different care settings. These should at least encompass the predominant populations; older people and those with neurological deficits in both institutional and domiciliary settings. There needs to be clear definition of the ‘cases’ and the populations from which they are drawn.

**Intervention 2: Catheter drainage options**

Randomised controlled trials of different approaches to urinary drainage. These should compare urethral indwelling catheterisation with and without a drainage bag (i.e., a valve); urethral intermittent catheterisation; suprapubic catheterisation; penile sheath drainage and incontinence pads in appropriate populations. Outcome measures need to include rates of bacteriuria/clinical UTI; tissue damage; patient/carer satisfaction; and cost-benefit.

Randomised controlled trials of the efficacy of antimicrobial impregnated urethral catheters for long-term use.

**Intervention 4: Catheter maintenance**

Randomised controlled trials of strategies to reduce/prevent/manage encrustation and blockage. These need to determine whether catheter maintenance solutions (washouts/installations) are effective in reducing encrustation; blockage; urethral trauma; frequency of catheter replacement; and interventions/visits by healthcare practitioners. The rates of these complications when catheter valves are used in place of drainage bags also needs to be compared.

Cohort studies to determine whether monitoring of urinary pH can be used to predict time to blockage. These need to be undertaken in defined and representative groups.

Randomised controlled trials to establish the optimum time interval between changing equipment. There is a particular need to determine whether the frequency of changing leg bags or catheter valves influences the rates of bacteriuria/clinical UTI.
## Key Audit Criteria

<table>
<thead>
<tr>
<th>Aim</th>
<th>Criteria</th>
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| Identify all patients with LTC, their clinical need for catheterisation, assessed and documented. | All patients should have a patient record that documents the reason for catheterisation, type of catheter, catheter insertion, changes and care.  
Standard 100%  
Data collection: Review of patient notes |
| Ensure that all healthcare personnel are trained and competent in urinary catheterisation. | Evidence of healthcare personnel training and annual assessment of competence.  
Standard 100%  
Data collection: Review of staff education records |
| To prevent catheter-related urinary tract infections (CR-UTI) associated with LTC | All healthcare personnel must decontaminate their hands and wear a new pair of non-sterile gloves before manipulation of the system.  
Standard 100%  
Data collection: Observation/ self audit |
| To reduce the incidence of CR-UTI by maintaining a closed system. | All LTC must be connected to a sterile closed drainage system or valve  
Standard 100%  
Data collection: Observation |
| To reduce the incidence of CR-UTI caused by blocking. | All newly catheterised patients should have a patient record that documents the integrity of the catheter at first change and adjustments made to their change schedule accordingly.  
Standard 100%  
Data collection: Review of patient notes |
| To ensure patients and carers are informed and educated about catheter management | All patients and carers are aware of the need to:  
- Decontaminate their hands;  
- Keep the system closed;  
- Seek professional help when they suspect clinical infection.  
Standard 100%  
Data collection: direct patient questioning |
## Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Aseptic procedure (technique)</strong></td>
<td>Method used to prevent microbial contamination of the catheter insertion site. This means that sterile equipment is used and that healthcare personnel wear sterile gloves during this procedure.</td>
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<tr>
<td><strong>Bacteraemia</strong></td>
<td>Bacteria in the bloodstream.</td>
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<td><strong>Bacteriuria</strong></td>
<td>The presence of bacteria in the urine with or without associated symptoms of infection. In the absence of symptoms this is referred to as asymptomatic bacteriuria or (in the case of a patient with an indwelling catheter) catheter colonisation.</td>
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<tr>
<td><strong>Bladder instillation</strong></td>
<td>Introducing a therapeutic liquid into the bladder and leaving it there for a variable 'holding' time to dissolve particulates/encrustation, altering pH, or suppressing bacterial growth.</td>
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<tr>
<td><strong>Bladder washout</strong></td>
<td>The introduction into the bladder of a sterile fluid which is allowed to drain more or less immediately, for the purpose of diluting the bladder contents / unblocking an obstruction to restore free catheter drainage.</td>
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<tr>
<td><strong>Carer</strong></td>
<td>A family member or person who regularly looks after a sick, disabled or elderly person.</td>
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| **Catheter-associated Urinary Tract Infection** | The occurrence of local or distant clinical symptoms or signs attributable to bacteria present either within the urinary tract, or in the bloodstream (with the urinary tract as the source).  

Infection may arise:  
- either at the time of, or immediately following catheter insertion;  
- or subsequently, because the colonising flora within the catheterised urinary tract becomes invasive (this may occur spontaneously, or follow catheter manipulation). |
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<thead>
<tr>
<th>Term</th>
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<tr>
<td>NB</td>
<td>The presence of pus cells in the urine (pyuria) of a patient with an indwelling catheter does not, by itself, signify infection.</td>
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<tr>
<td>Clean procedure (technique)</td>
<td>Hands are decontaminated before and after procedure and clean gloves are used.</td>
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<td>Healthcare personnel</td>
<td>Any person employed by the health service, social service, local authority or agency to provide care for sick, disabled or elderly people.</td>
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<tr>
<td>Hydrophilic catheter</td>
<td>100% silicone intermittent catheter that, with the addition of water, allows virtually friction-free insertion and removal, without lubricating gel.</td>
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<td>Indwelling urethral catheter</td>
<td>A catheter that is inserted into the bladder via the urinary urethra and remains in place for a period of time.</td>
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<td>Long-term catheter</td>
<td>A catheter left in place for 28 days or more.</td>
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<td>Link system</td>
<td>An extension from the drainage system used during the day for overnight drainage, e.g., Uriplan bed bag™</td>
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<td>Sterile</td>
<td>Free from any living microorganisms, e.g., sterile gloves, sterile catheter.</td>
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<td>Suprapubic catheterisation</td>
<td>Suprapubic catheterisation creates a tunnel from the abdominal wall to the bladder. Urine can then be drained directly from the bladder into a bag through this tunnel.</td>
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<tr>
<td>Urethra</td>
<td>The tube that conveys urine from the bladder to the external urethral orifice.</td>
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APPENDIX UC1 – AGREE Scores

AGREE Monitoring Appraisal Form (PHLS Ward Urinary Catheters Guidelines)

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**Domain Scores**

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<td>(36/48) x 100 = 75%</td>
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<td>(82/84) x 100 = 98%</td>
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<td>(17/24) x 100 = 71%</td>
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APPENDIX UC2 – Long Term Indwelling Urinary Catheters - Systematic Review Process

Systematic Review Questions

1. If it is necessary to catheterise, which approach – indwelling urethral/ suprapubic /intermittent results in the lowest rates of infection?
2. Is the management or type of drainage system a factor in colonisation/infection?
3. Is the frequency or method of changing catheters (indwelling, suprapubic) a factor in colonisation/infection?
4. Does monitoring urinary pH assist in the prevention of encrustation and blockage of long term indwelling catheters?
5. Which catheters materials cause least irritation / encrustation / blockage
6. Does the use of bladder irrigation / instillation / washout, prevent / reduce encrustation & symptomatic urinary tract infection?
7. Does the use of antibiotic prophylaxis at the time of changing catheters reduce symptomatic infection?
8. Which method of cleaning and storing intermittent catheters result in the lowest rates of colonisation/infection?
9. Is there any cost effectiveness evidence relating to the above?
10. What are the training and education implications for staff and patients?

Databases and Search Terms Used

DATABASES

MESH TERMS
infection control; cross infection; community-acquired infections; disease transmission; urinary tract infections; urinary catheterization; indwelling catheters; antibiotic prophylaxis; irrigation; biofilms; hydrogen ion concentration; urease; proteus; proteus infections; providencia; morganella.

THESAURUS AND FREE TEXT TERMS
intermittent catheterisation; urethral catheterisation; suprapubic catheterisation; bacteriuria; pyuria; encrustation; blockage; non blocker; bladder irrigation; bladder washout; bladder instillation.
Search Results
Total number of articles located =

Sift 1 Criteria
Abstract indicates that the article: relates to infections associated with urinary catheters, is written in English, is primary research or a systematic review or a meta-analysis, and appears to inform one or more of the review questions.

Articles Retrieved
Total number of articles retrieved from sift 1 =

Sift 2 Criteria
Full Text confirms that the article relates to infections associated with urinary catheters, is written in English, is primary research or a systematic review or a meta-analysis, and informs one or more of the review questions.

Articles Selected for Appraisal
Total number of articles selected for appraisal during sift 2 =
Critical Appraisal
All articles which described primary research, a systematic review or, a meta-analysis and met the sift 2 criteria were independently critically appraised by two appraisers. Consensus and grading was achieved through discussion.

Accepted and Rejected Evidence
Total number of articles accepted after critical appraisal = Total number of articles rejected after critical appraisal =

Evidence Tables
Evidence tables for accepted and rejected studies were generated and used to create evidence summary reports. The summary reports were, in turn, used as the basis for guideline writing.
## APPENDIX UC3 – Long Term Indwelling Urinary Catheters Evidence Tables

**UC Accepted Tables**

<table>
<thead>
<tr>
<th>ID</th>
<th>Quest.</th>
<th>Author, Date, Country of Origin and Objective</th>
<th>Design, Setting, Sample Size and Population</th>
<th>Outcomes</th>
<th>Strengths and Limitations</th>
</tr>
</thead>
</table>
| UC6 | 1      | Bakke A, Vollset SE. 1993. Norway. To study factors that may predict the occurrence of bacteriuria and clinical urinary tract infection in patients using clean intermittent catheterisation. | **Design:** Descriptive Study – 1 year follow-up study  
**Setting:** Not stated  
**Sample:** 302 (149M, 153F)  
**Pop**: Residents in Norway carrying out CIC | Bacteriuria equal amongst men and women. The incidence of clinical UTI over twofold higher in women during the 1 year observational period. 25% of patients had no infection at all, while only 1 or 2 lower urinary infections episodes were noted in 23%.  
More serious infection problems, including upper urinary tract infection, were noted in 17%.  
In the total male population determinants of high urinary tract infection were: Age of 45 years or less; diseases or injuries of the spinal cord above the conus; affection of the conus and peripheral nerves; high frequency of cleansing the meatus; and catheterisation not performed by patient himself.  
Determinants of high urinary tract infection in the women were, age and mean catheterisation volume p<0.05. Younger women more at risk than older women. | Complicated descriptive study possibly compromised by the fact that infection rates and severity relied on self reporting. Large sample size.  
Many of the patients were using prophylactic antibiotics and anti-infective agents which may have had a direct effect on the results. Same cohort as UC35. |
### UC14 6

Getliffe KA, Hughes SC, Le Claire M. 2000. UK

To identify the optimum volume of acidic bladder washout solution (Suby G) to dissolve catheter encrustation and to compare the effectiveness of different bladder washout delivery devices.

| Design: | Experimental |
| Setting: | Laboratory |
| Sample: | 24 |
| Pop*: | Pooled urine from 4 volunteers. |

Under controlled laboratory conditions, smaller (50 ml) volumes of acidic bladder washout solution are as effective as the 100 ml commonly used, but two sequential washouts with 50 ml are more effective than a single washout. Optiflow as effective as the other devices. Has not been tried in clinical practice but clinical implications considered. A well conducted study, each experiment repeated 5 times. Washout followed standard procedure.

### UC32 1


Three year follow-up of patients who presented to the accident and emergency department with acute urinary retention due to prostatomegaly required catheterisation and were managed either by suprapubic catheters or catheterised urethrally.

| Design: | Descriptive Study – Prospective Follow-up |
| Setting: | Urban Hospital Accident and Emergency Unit |
| Sample: | 86 (Males) |
| Pop*: | Men with acute retention due to prostatomegaly. |

30 urethral catheter – mean period 3 weeks. 56 suprapubic – mean period 5 weeks. 12 (40%) urethral group had infections. 10 (18%) suprapubic p < 0.05. 5 (17%) urethral catheters developed urethral stricture compared with none in suprapubic p < 0.001. 13 (23%) suprapubic catheters become discharged.

Makes recommendation that suprapubic catheters be used rather than urethral for the treatment of acute urinary retention. A well conducted study.
<table>
<thead>
<tr>
<th>UC34</th>
<th>6</th>
<th>Kennedy AP, Brocklehurst JC, Robinson JM. et al. 1992. UK. To compare the use of acidic washout solutions with neutral saline in a group of elderly catheterized females.</th>
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<tr>
<td><strong>Design:</strong></td>
<td>Randomised Controlled Trial</td>
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<td><strong>Setting:</strong></td>
<td>3 urban hospitals</td>
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<td><strong>Sample:</strong></td>
<td>25 (Females)</td>
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<tr>
<td><strong>Pop:</strong></td>
<td>All female patients with long-term catheters.</td>
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Administration of bladder irrigation using: 100 mls sodium chloride 0.9%, Suby G or Solution R for 20-30 minutes, twice weekly over a 3 week period, followed by a rest week with saline. Catheters changed at the end of each period.

- More crystals observed during saline washouts (p<0.0001). Struvite appeared significant in saline and rarely seen in Suby G and Solution R (p<0.001).
- Uric acid identified in Suby G and Solution R. Overall Solution R produced the best results and Suby G the worst.
- Suggests catheterised patients are potential blockers as they tend to become crystal formers. Acidic washouts do not appear to reduce crystals and may actually damage endothelium.
- Acidic washouts may be contra-indicated for patients with dehydration or low urine output.

The study addresses an appropriate and clearly focused question. Small study but the fact that it includes total population and crossover trial strengthens its validity. Only 14 completed full trial.
To characterize and quantify the complications related to clean intermittent catheterisation. | **Design:** Descriptive prospective study  
**Setting:** Out-patients  
**Sample:** 302 (149M, 153F)  
**Pop:** Residents in Norway carrying out CIC. | Women had higher infection scores than men 2.5 Vs 1.8 (p<0.01) over 3 month period. Tendency for lower infection scores in men with increasing age (p<0.01). Lower infection score for patients using low friction catheters compared to those using PVC catheters 2.1 Vs 3.7 (p<0.05).  
Results indicate that rates of symptomatic UT infection is lower in those using only low friction catheters compared to those using plain PVC catheters, however only 41 of the patients used plain PVC catheters. | Lack of comparison group makes it difficult to judge if there are any differences in complications with similar groups using other forms of urinary drainage.  
Same cohort as UC6. |
| UC36 | 5 | Roberts J, Kaak B, Fussell E. 1993. USA  
To evaluate bacterial adherence of 8 microorganisms to 5 urethral catheters: red rubber polytetrafluoroethylene-coated latex (Teflon), silicone elastomer-coated latex, and hydrophilic-coated latex (Lubricath). | **Design:** Descriptive Study  
**Setting:** Laboratory  
**Sample:** 120 samples  
**Pop:** Urine specimen taken from patient with catheter in situ. | No bacteria adhered to the inside or outside of the hydrophilic catheter surfaces regardless of preparation. Infrequent adherence to the outside of catheters except silicone. Adherence variable to the inside of Teflon and elastomer catheters but less than silicone. | No details of origin of specimen. |
| UC38 | 4 | Kunin CM, Chin QF, Chambers S. 1987. USA.  
To describe the factors associated with the formation of encrustations and blockage of flow of urine, and the microbial flora in the catheter and bladder urine of 50 patients aged 60+years who required a long term catheter. | **Design:** Descriptive Study  
**Setting:** Urban 250-bed skilled nursing home  
**Sample:** 50 (9M, 41F)  
**Pop:** Nursing home patients | Blockers tended to tolerate catheter for 7-10 days and excreted more alkaline urine, containing more calcium, protein and mucin than non-blockers.  
There were significant differences in the composition of 24 hour urine samples between blocked and non-blocked catheters. | The study addresses an appropriate and clearly focused question. All relevant outcomes are measured in standard, valid and reliable way. |
To examine the effectiveness of bladder washouts of Suby G, mandelic acid 1% and saline 0.9% in reducing catheter encrustation, in a model bladder. | **Design:** Experimental  
**Setting:** Laboratory  
**Sample:** 15 samples  
**Pop:** Not relevant as synthetic urine. | Saline washout has no effect.  
Suggests both Suby G and mandelic acid make it difficult for P mirabilis to adhere to sides and therefore reduce encrustation. | Laboratory study – well controlled and thorough. |
| UC43 | 1 | Webb RJ, Lawson AL, Neal DE. 1990. UK.  
Follow up of 172 patients using Clean Intermittent Self-Catheterisation. | **Design:** Descriptive study – Retrospective Follow-up  
**Setting:** Hospital out-patients at one urban hospital  
**Sample:** 170 (gender not stated)  
**Pop:** Out-patients using CIC. | 145 patient were successfully using CISC at time of writing/ Seven patients were either "unable or unwilling to master the techniques"  
Symptomatic infection rates were available in 153 patients; 70 (48%) had never had a symptomatic infection (1 total of 1187 infection free patient months) and 22 (14%). Reported only 1 infection (mean time on treatment = 32 months); 32 patients (21%) reported infection rates of less than 1 per year, p(6%) recorded 2 infections per year, 12 (8%) had 4 infections per year and 8 (5%) complained of 6 or more infections per year. The mean infection rate was 1 per 87 patient months. | General study of CIC that contributes to the evidence. |
| UC52 | 1,2,6,7 | Saint S and Lipsky BS. 1999. USA.  
To provide ‘an evidence based synthesis of the literature on preventing catheter-associated urinary tract infections to develop recommendations for clinicians’.

**Design:** Systematic synthesis of literature

**Setting:** Various (mainly hospital)

**Sample:** N/A

**Pop:** Adults

---

Catheterisation should be avoided when not required and when needed and terminated as soon as possible. Use of suprapubics and condom catheters may be associated with a lower risk of UTI and terminated as soon as possible. Aseptic catheter insertion and a properly maintained closed drainage system are critical to reducing risk of bacteriuria. Instillation of antimicrobial agents into the bladder and urinary drainage bags are crucial to reducing the risk of bacteriuria. Instillation of antimicrobial agents into the bladder or urinary drainage bag and rigorous meatal cleaning seem to be of little benefit.

Systemic antibiotic drug therapy seems to prevent UTIs but primarily in patients catheterised for 3-14 days.

---

To determine the incidence and clinical relevance of bacteraemia induced by urinary catheter replacements.

**Design:** Descriptive

**Setting:** 2 Long-term care hospital facilities

**Sample:** 39 (26M, 13F). 120 routine catheter replacements.

**Pop:** Geriatric patients in long-term care facilities.

---

Minimal increase in bacteraemia (27/480, 5.6%) and bacteriuria (5/120, 4.2%). 0/120 had clinical symptoms or signs of infection.

Catheter replacement does not necessarily increase the chance of colonisation.

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Only 1 database (Medline used).

Other references identified by expert consideration and review of references in retrieved articles.

Preference given to RCT, data on prevention summarised qualitatively. Therefore no formal metaanalysis.

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Study carried out within routine clinical practice. All subjects included underwent the same treatment. Criteria for inclusion and exclusion clearly stated. Study was restricted to elderly (over 65yrs).

However there was no comparison group to test this.
### UC61

<table>
<thead>
<tr>
<th>1</th>
<th>Bakke A Digranes A. 1991, Norway.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>To assess the occurrence of bacteriuria in all patients using CIC in a defined population over a period of one year.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Design:</strong> Descriptive Study - Prospective.</td>
<td></td>
</tr>
<tr>
<td><strong>Setting:</strong> Hospital Out Patients</td>
<td></td>
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<tr>
<td><strong>Sample:</strong> 407 (206M, 201F)</td>
<td></td>
</tr>
<tr>
<td><strong>Pop:</strong> Adult out-patients using CIC Feb-Aug 1988.</td>
<td></td>
</tr>
<tr>
<td><strong>1413 urine samples cultured. Bacteriuria in 51% of samples, no difference between male and female. Frequency of bacteriuria significantly lower in patients using antibiotics and methenamine hippurate cpw those not using anti-infectives (p&lt;0.05). Gram –ve species higher (p&lt;0.001) among patients using antibiotics or methenamine hippurate compared with those not using anti-infectives. Majority of patients with bacteriuria were asymptomatic.</strong></td>
<td></td>
</tr>
</tbody>
</table>

### UC66

<table>
<thead>
<tr>
<th>2</th>
<th>Hardyck C, Petrinovich L. 1998. USA.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>To compare the effectiveness of two drainage systems in controlling urinary tract infections and the total costs of drainable bags (DB) versus non-drainable bags (NDB).</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Design:</strong> Descriptive Study</td>
<td></td>
</tr>
<tr>
<td><strong>Setting:</strong> Patient’s Homes</td>
<td></td>
</tr>
<tr>
<td><strong>Sample:</strong> 82 (36M, 27F)</td>
<td></td>
</tr>
<tr>
<td><strong>Pop:</strong> Home care patients</td>
<td></td>
</tr>
<tr>
<td><strong>UTI rate in the DB group was 1395 with 27 admissions. The NDB rate was 71 with 2 admissions. The reduction in UTIs resulted in cost savings that outweighed the higher cost of the NDB units.</strong></td>
<td></td>
</tr>
</tbody>
</table>

### UC72

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>To test the efficacy of povidone iodine 2%w/v, phenoxyethanol 2.4v/v, chlorhexidine 200ug/ml +/- Tris and EDTA against E. coli, P. mirabilis, K. pneumoniae, P. aeruginosa and S. faecalis</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Design:</strong> Experimental</td>
<td></td>
</tr>
<tr>
<td><strong>Setting:</strong> Laboratory</td>
<td></td>
</tr>
<tr>
<td><strong>Sample:</strong> 48 samples</td>
<td></td>
</tr>
<tr>
<td><strong>Pop:</strong> Sterile pooled urine.</td>
<td></td>
</tr>
<tr>
<td><strong>With the exception of phenoxyethanol against P. Staurtii and possibly P. aeruginosa, all washouts only temporarily reduced bacterial growth. Phenoxyethanol is the only effective antiseptic against P. Staurtii and, if given twice against P. aeruginosa, daily washouts of other antiseptics merely reduce microorganisms that recover within 24 hours. It is the cells in the biofilm that are the most difficult to treat.</strong></td>
<td></td>
</tr>
</tbody>
</table>

1 year follow-up of a total CIC population. Epidemiological study.

Selection of sample unclear. Data collection based on retrospective reports from multiple informants.

A well reported laboratory study.
### UC74 4 & 5

**Getliffe KA. 1994 (b). UK.**

A prospective long-term study of 47 community patients with long-term catheters, identifying them as blockers and non-blockers.

<table>
<thead>
<tr>
<th>Design:</th>
<th>Descriptive Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting:</td>
<td>Community</td>
</tr>
<tr>
<td>Sample:</td>
<td>42 (18M, 24F).</td>
</tr>
<tr>
<td>Pop*:</td>
<td>Community patients living at home or in warden controlled community settings across three health authorities.</td>
</tr>
</tbody>
</table>

Q4: Blocker status was significantly associated with high urinary pH and high urinary ammonia.

Q5: At least 76% of all patients experienced one or more recurrent problems associated with catheterisation, with almost half (47%) complaining of urinary leakage, and nearly a third (37%) suffering from retention. A prevailing tendency towards 'crisis care' existed for patients classed as blockers. Blockers had a significantly shorter time between recatheterisations than non blockers. P<0.0001. Blocker status associated with females, poor mobility and with high urinary pH and ammonium, and catheters needed replacing <6 weeks.

Q5: Blockers were significantly less mobile than non-blockers.

Q5: There was no relationship between blocking and fluid intake.

The study addresses an appropriate and clearly focused question. All relevant outcomes are measured in standard, valid and reliable way.

### UC75 5

**Roe BH, Brocklehurst J. 1987. UK.**

A preliminary investigation of patients’ understanding and knowledge of their catheter’s location and function, its acceptance, problems associated with its use, social implications and its subsequent management.

<table>
<thead>
<tr>
<th>Design:</th>
<th>Qualitative Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting:</td>
<td>A community study in one health authority</td>
</tr>
<tr>
<td>Sample:</td>
<td>36 (20M, 16F)</td>
</tr>
<tr>
<td>Pop*:</td>
<td>Patients over 50 years with long-term catheter.</td>
</tr>
</tbody>
</table>

Patients with a catheter of at least 18 Charriere were more likely to experience pain 32 (89%) experienced leakage at least once a week. 23 (64%) blocked with a median occurrence of between 1 and 3 months.

Data collected from medical/nursing records and carers as well as patients though results not clearly linked to source.
| UC87 | 1 | Duffy LM, Cleary J, Ahern SA et al. 1995. USA.  
To compare the safety and cost of clean versus sterile intermittent bladder catheterization in male nursing home patients. | Design: Randomised Controlled Trial  
Setting: 3 long term facilities  
Sample: 80 (Males)  
Pop*: Veterans aged 36-96 years. | No significant differences found between clean and sterile groups with regard to:  
treatment episodes, time to first infection,  
types of organism cultured or cost of antibiotic treatment.  
Randomised by research site.  
Previous history of UTI identified by authors as possible confounding factor.  
No significant differences found between clean and sterile groups with regard to:  
treatment episodes, time to first infection,  
types of organism cultured or cost of antibiotic treatment. |  |
To evaluate the bacteriological and clinical efficacy of aztreonam in the prevention of UTI in elderly hospitalised patients who needed indwelling urethral catheterisation. | Design: Randomised controlled trial  
Setting: Hospital medical ward  
Sample: 162 (96M, 66F)  
Pop*: Elderly hospitalised patients needing urethral catheterisation. Age range: 60-91 years. | A single dose 2g im. of aztreonam is effective in preventing UTI in elderly patients needing indwelling urethral catheters.  
89% of the aztreonam group had negative urine cultures compared with 46% of the placebo p<0.001. For the diabetics, 29 received aztreonam and 30 placebo 14% and 63% respectively had UTI p<0.001.  
All patients were followed up for 7 days.  
Randomised by research site.  
Previous history of UTI identified by authors as possible confounding factor. | Not double blind.  
Well matched experimental group and controls.  
Prophylactic use of antibiotic was before first catheterisation.  
Prophylactic use of antibiotic was before first catheterisation. |  |
| UC91 | 5 | Getliffe K. 1990. UK.  
To examine a number of issues related to catheter blockage in patients at home. | Design: Descriptive Study  
Setting: Community settings (patients homes in one district authority).  
Sample: 81 (47M, 34F)  
Pop*: Patients with indwelling urinary catheters for more than four weeks. | Despite all catheters being susceptible to encrustation and blockage, the length of time a catheter remains functional can vary and requires individual care regimens.  
Over 50% of patients suffer from recurrent encrustation and blockage.  
All relevant outcomes are measured in a standard, valid and reliable way.  
However it relies on the nurses completing the questionnaire accurately and fully. |  |
| UC96 | 2 | Wilson C, Sandhu SS, Kaisary AV. 1997. UK. To compare the use of a catheter-valve with the standard drainage system in terms of morbidity and patient preference. | Design: Randomised Controlled Trial  
Setting: Hospital (one follow up at home)  
Sample: 100 (84M, 16F)  
Pop*: Patients undergoing long term catheterisation. | 17 involved in crossover study, all preferred valve system. No significance in UTI rate between groups. Patient satisfaction significantly higher in valve group, 92% compared with those in the standard drainage group. Use of valve was more cost effective. | Lacking detail as to underlying conditions or how patient preference collected. |
| UC99 | 4 | Burr RG, Nuseibeh I. 1995. UK. To relate blockage of the urinary catheter to urine chemistry. | Design: Descriptive Study  
Setting: Spinal Injuries Unit  
Sample: 44 (46M, 18F)  
Pop*: Patients with spinal cord lesions with indwelling urinary catheters. | Catheter blockage was significantly related to the duration of cord lesion, patient age, urinary pH and calcium concentration. The only significant prediction of catheter blockage were urine pH and calcium concentration. Patients troubled by frequent blockage (n=21) and those who experienced no blockage (n=23) were compared. Maximum pH and calcium concentrations correctly discriminated between 91% of the patients (95% CI 78-97%). Urinary pH and calcium levels were higher in patients who had a more recent spinal injury. | Convenience sample. |
| UC100  | 1  | Charbonneau-Smith R. 1993. Canada. 
To assess the effectiveness of the O’Neil Sterile Field TM urinary catheter in reducing number and length of infections in a group of spinal cord injured patients (requiring intermittent catheterisation). | Design: Descriptive Study  
Setting: Long-term care facility  
Sample: 110 (gender not stated)  
Pop*: Traumatic spinal cord injuries. | The use of the O’Neil catheter (UK equivalent Instant Cath Protect) results in a reduction in number of infections (from 3 to 1 per person – medians) and reduction in length of infection (from 39.5 to 12.5 days – medians). Comparison was between retrospective control data and prospective experimental data. | No discussion of other changes that may have taken place in the unit between the control-experimental times that could potentially reduce number and length of infections was recorded. |
| UC113  | 1  | Terpenning MS; Bradley SF; Wan JY et al. 1994. USA. 
To assess colonization and infection with methicillin-resistant Staphylococcus aureus (MRSA), high-level gentamicin-resistant enterococci (R-ENT) and gentamicin and/or ceftriaxone-resistant Gram-negative bacilli (R-GNB) and the factors that are associated with colonization and infection with these organisms. | Design: Descriptive Study – Prospective Before and After  
Setting: Nursing home care unit  
Sample: 551 (542M, 9F)  
Pop*: Patients admitted to unit June 1989 – May 1991. | Catheterisation is a significant risk factor. Infection rates tend to be lower with intermittent catheterisation that with indwelling. Statistically significant catheterisation associated with recurrent UTI (p=0.007) indwelling catheters (p=0.001). | Catheterisation only one of many risk factors studied. No details given regarding the number of patients within this sample who were catheterised. |
To compare the effectiveness of 2 solutions for cleaning plastic urethral catheters used for clear intermittent catheterisation: sunlight liquid detergent and cetrimide 1:30 (Savlon). | Design: Cross over study  
Setting: Home  
Sample: 30 (16M, 14F)  
Pop*: Patients aged 1-18 years with neurogenic bladder using CIC for 2 months. | 60 catheterised patients examined from each group. No difference between the two groups in terms of the contaminated catheters or type of organisms cultured 4/8 hours after cleaning. Very low colony count on contaminated catheters. | Plastic catheters were used only once, when normally they are re-used for 1-3 weeks. Therefore limited generalisability. |
### UC122
8

To determine whether microwaves were an effective means of sterilising polyethylene catheters and to provide a simple sterilisation protocol which patients using this technique could follow.

| Design: | Experimental |
| Setting: | Laboratory |
| Sample: | 2 groups of catheters in batches of 6 tested at 5 different times periodically. Total number not specified. |
| Pop*: | Not stated. |

Colony count reducing with increased duration of microwaving. After 6 mins, complete sterilisation was achieved. Suggests that this is a reliable cost-effective method for sterilising polyethylene catheters for ISC that could be carried out easily by patients. Suggests infection may be as low as 1 in 8 patient months using this technique.

Proteus sp bacteria were used and the authors report that their sensitivity to microwaves is similar to other species eg. E coli, Klebsiella, Pseudomonas and Enterobacter but these were not tested in this study.

### UC124
4
Kunin C. 1989. USA.

To study the blocker/non blocker 'phenomenon':
1. How consistently do patients remain as blockers or non blockers?
2. Do blockers have more febrile episodes?
3. Is there a relationship between formation of encrustations and: urinary microbial sp.; production of urease; pH and constituents of urine?
4. Do some organisms protect against encrustations?
5. Does antimicrobial therapy alter formation of encrustations?

| Design: | Descriptive Study |
| Setting: | 260 bed nursing home. |
| Sample: | 65 (Females) |
| Pop*: | Nursing home patients with indwelling catheters. |

Urine of blockers was significantly more alkaline and contained less Mg PO$_4$ and urea than non blockers.

No comment on the advisability of monitoring urinary pH.
To investigate whether prophylactic antibiotics given during catheter replacement can prevent or delay the development of subsequent bacteriuria | **Design:** Randomised Controlled Trial  
**Setting:** Geriatric Centre  
**Sample:** 70 (21M, 49F)  
**Pop:** Residents with long-term urinary catheters. | **Treatment group 1gm of IV meropenem 30 minutes before catheterisation.**  
Use of prophylactic antibiotic did not prevent or delay development of bacteriuria after long term urinary catheter replacement.  
No significant difference in urine cultures between treatment and control groups at 3, 7, 14 or 28 days. | Patients recruited had no antibiotics for previous 2 weeks.  
Random allocation to treatment.  
Treatment and control groups similar.  
Regular follow-up over 28 days. |
To determine the relationship between urinary pH, UTI and encrustation in patients with long term catheters. | **Design:** Descriptive Study  
**Setting:** Setting not stated  
**Sample:** 64 (gender not stated)  
**Pop:** Patients with long-term indwelling urinary catheters. | Non-blockers had a significantly more acidic voided urine pH (6.26) with a wide safety margin between voided and crystallization pH (7.66) and no infection. | No patient details included. Not clear how many specimens taken or over what time frame. |
1. To evaluate the overall rate of complications of CIC.  
2. To record reasons for acceptance of CIC, frequency of UTI and rates of urethral strictures. | **Design:** Retrospective period prevalence survey  
**Setting:** Rehabilitation hospital  
**Sample:** Aim 1: 159 (113M, 46F)  
Aim 2: 21  
**Pop:** Spinal cord injury patients. | **Aim 1:** 60% had asymptomatic cytobacteriological infection (39.7% females; 66% males) ; 28% symptomatic infection (17.3 females; 32.7% males) P<0.05 in both groups.  
Aim 2: Symptomatic infections <1 every 2 yrs in 11pts; <1 a year in 1 pt; 1-2 episodes in 5; 2-4 times a year in 4pts.  
Asymptomatic cytobacteriological infections: <1 infection every 2 yrs in 15; <1 per year in 2; 1-2 times per yr in 2; 2 pts had permanent antimicrobial prophylaxis. | Non-random sample from total population.  
Outcomes well defined.  
Authors suggest a comparative study should be undertaken. |
| UC138 | 1 & 8 | Moore KN, Kelm M, Sinclair O et al. 1993. Canada. To test the hypothesis that bacteriuria would be reduced in subjects who used single-use rather than clean reused catheters for intermittent self catheterisation. | **Design:** | Crossover Study (Randomised Controlled Trial) | **Q1:** 6 months crossover using sterile single-use catheters or clean reused. A comparable group used sterile catheters only. 38% +ve cultures in crossover groups regardless of whether sterile single use or clean reused catheters were employed. Compared with 36% +ve cultures in the group using only sterile catheters. No differences between males and females, those performing self or parental catheterisation. **Q8:** Soapy water and rinsing can be used as method of cleaning a catheter for re-use. | Crossover design adds to internal validity. Only conducted amongst subjects with spinabifida and therefore generalisability may be limited. |
| UC140 | 1 | Sheriff MK, Foley S, Mc Farlane J et al. 1998. UK. To identify the current place of long-term suprapubic catheterisation in the management of neuropathic bladder, how should these be best managed and what do patients think about this form of bladder management. | **Design:** | Descriptive Study | **Q8:** Soapy water and rinsing can be used as method of cleaning a catheter for re-use. | Well designed study conducted in a standard, valid and reliable way. |
|       |     | **Setting:** Neurological unit | **Sample:** 157 (80M, 77F) | 9 (6%) developed recurrent UTI. 28 (18%) experienced blockages. 12 (8%) leakage. Overall 30% of patients complained about catheter related complaints. Suggests suprapubic catheterisation is an effective and well tolerated method for patients with neuropathic bladder for whom surgery is the only option. | | |
|       |     | **Pop:** Patients referred to neurological unit. | | | | |
|       |     | | | | | |
UC143

3

White MC, Ragland KE. 1995. USA. 

To determine in home care patients on long term urinary catheterisation: 
1. the urinary catheter infection rate, 
2. the characteristics of patients who get UTI’s compared with those who do not, 
3. the influence of catheter change interval on the length of time patients remain infection free.

Design: Historical Cohort Study
Setting: Patient’s Home
Sample: 106 (gender not stated)
Pop*: Home care patients

Only patients who were free of infection at the start of home care period were included in analysis: n=81. Incidence = 20.9 infections/10,000 catheter days. Of those whose catheters were changed at intervals of 2 weeks or less – 15.4% remained free of infection after 4 weeks. Those whose catheters were changed at 4 to 6 week intervals – 80% remained free of infection after 6 weeks. The number of different nurses changing the catheter was also significant, with a relative hazard of 1.38 (CI 1.22 – 1.55). Relative hazard rate for infection = 11.94 (CI 5.46-26.22) for catheter change </= 4 weeks versus catheter change >4 weeks. This analysis controlled for age, sex, severity of illness and number of nurses changing catheter.

Limitations: retrospective chart review; data on other risk factors for infection e.g. co-morbidities not collected/not available.

UC145

4

Burr RG, Nuseibeh IM. 1997. UK

To study the relationship between urine pH and calcium to catheter blockage and suggest how to reduce encrustation.

Design: Descriptive Study
Setting: Spinal Injuries Centre
Sample: 60 (42M, 18F)
Pop*: Spinal injuries patients

Mean and maximum circadian pH and Ca was higher in blockers than non-blockers. pH and calcium urine measurement in laboratory correctly diagnosed 56-58 (96.6%) as blockers or non-blockers.

Included newly injured patients whose calcium levels may have been higher than normal.

No information on patient selection.
<table>
<thead>
<tr>
<th>ID</th>
<th>Study</th>
<th>Design</th>
<th>Setting</th>
<th>Sample</th>
<th>Population</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>UC149</td>
<td>Shekelle PG, Morton SC, Clark KA, Pathak M, Vickrey BG. 1999. USA.</td>
<td>Systematic Review</td>
<td>Not reported</td>
<td>Multiple studies</td>
<td>Adults and adolescents over the age of 13 years with neurogenic bladder due to spinal cord dysfunction.</td>
<td>Eight studies were reviewed using different populations and were consistent in their findings; persons using intermittent catheterisation had fewer infections than those with indwelling catheters and those voiding without catheters.</td>
</tr>
<tr>
<td>UC193</td>
<td>Pratt RJ, Pellowe C, Loveday HP et al. 2001. UK.</td>
<td>Systematic Review</td>
<td>Acute care settings</td>
<td>Stud Designs: Mainly controlled trials, some experimental and descriptive.</td>
<td>N/A</td>
<td>Comprehensive description included in technical report. All databases included, 7 in total. No hand searching. All articles subjected to clinical review and critical appraisal.</td>
</tr>
</tbody>
</table>
## UC Rejected Studies

|-----|---------------|-----------------------------------|-----------|---------------------------------------------|------------------------|
Setting: Spinal Injuries Unit  
Sample: 18 (15M, 3F)  
Pop*: Spinal cord injury patients. | The sample size is not appropriate. |
| UC9 | 1             | Eika B, Frkiper J. 1989. Denmark. | The aim of this study was to analyse a group of women using CISC. | Design: Descriptive Study - Retrospective Review  
Setting: Not reported  
Sample: 80 (Females)  
Pop*: Women with neurogenic and non neurogenic voiding problems. | Unreliable data source. |
| UC10 | 6 | King JB, Stickler DJ, 1992. UK. | To examine the activity of repeated installations of chlorhexidine 0.02%w/v, chlorhexidine/EDTA/TRIS and mandelic acid 1.0%w/v against established infections of Pseudomonas aeruginosa, Proteus mirabilis, Providencia stuartii and Escherica coli. | Design: Experimental  
Setting: Laboratory  
Sample: Not available.  
Pop*: Not available. | Laboratory study using bladder model. |
| UC12 | 4 | Mobley HLT, Warren JW. 1987. USA. | To observe the incidence of urease production and blockage in women ≥ 65 years with silicone-latex coated catheters in place for ≥100 days. | Design: Descriptive Study  
Setting: Setting not stated  
Sample: 32F ≥ 65 years  
Pop*: Long-term catheterised | Study question unclear. No details of recruitment or sample. |
|------|----|---------------------------------|------------------------------------------------------------------|----------------------------------------------------------------------|---------------------------------------------------------------------|
| UC23 | 6 | Robertson MH, Norton MS, 1990, UK. | To test the effect of 1% mandelic acid bladder washouts on 40 patients with indwelling urethral catheters. | Design: Experimental Study  
Setting: Hospital In-Patients (assumed as no detail).  
Sample: 40  
Pop*: Patients with indwelling catheters harbouring Proteus or Pseudomonas sp. but asymptomatic. | Too many items missing, e.g., setting, characteristics of study population. |
| UC24 | 6 | Muncie HL, Hoopes JM, Damron DJ et al. 1989. USA. | To ascertain whether once daily irrigations of long-term catheters with normal saline has an effect on the formation of encrustation and blockage and the development of infection. | Design: Randomised Controlled Trial  
Setting: Urban hospital  
Sample: 44 (gender not stated)  
Pop*: Patients with long-term indwelling catheters. | High dropout rate (21/41). |
| UC27  
(now UC147) | 6 | Maizels M, Schaeffer AJ. 1980. USA. | To determine whether the incidence of bacteriuria can be reduced in catheterised patients by instilling hydrogen peroxide into the drainage bag. | Design: Randomised Controlled Trial  
Setting: Spinal cord injury unit.  
Sample: 31 (24M, 7F)  
Pop*: Acute spinal injuries. | Sample too small for study design. |
| UC28 | 4 | Hedelin H, Larsson L, Eddeland A et al. 1985. Sweden. | To observe which factors affected the frequency of catheter blockage and change within a 6-week schedule. | Design: Descriptive Study  
Setting: Department of long-term care and rehabilitation  
Sample: 19 (5M, 14F)  
Pop*: No information | Sample underpowered. |
|---|---|---|---|---|---|
| UC30 | 1 | Mitsui T, Minami K, Furuno T et al. 2000. Japan. | Long-term outcome of spinal cord injury (SCI) patients was compared between those managed by suprapubic cystomy (SPC) and clean intermittent catheterisation (CIC). | Design: Descriptive Study - Long term Follow-up  
Setting: Outpatients  
Sample: 61 (57M, 4F)  
Pop*: Spinal cord injury patients. | Method and criteria for determining infection and other complications not stated.  
Methodology not clear.  
Follow-up time different.  
Groups comparable in terms of age, sex and sample number but Group A were high cervical lesions and Group B low cervical lesions preventing meaningful comparison. |
| UC44 | 1 | Hellstrom P, Tammela, T, Lukkarinen O et al. 1991. Finland. | To investigate the efficacy, safety and complications of clean intermittent catheterisation | Design: Descriptive Study  
Setting: Hospital Outpatients  
Sample: 41 (26M, 15F)  
Pop*: Patients attending urology department | Sample too small given variables such as: age range, the wide range of underlying / pre-existing aetiologies, different frequency of CIC, and no monitoring of catheterisation techniques, e.g., hand washing.  
No stats given. |
| UC45 | 4 | Hedelin H, Bratt CG,    
|      |    | Eckerdal G et al., 1991,  
|      |    | Sweden.       | Design: | Descriptive Study                          | Sample underpowered.  
|      |    | To correlate urinary pH  
|      |    | with the precipitation of  
|      |    | catheter encrustation and  
|      |    | detect any unusual urea-  
|      |    | splitting bacteria in  
|      |    | catheter urine samples  
|      |    | with a raised pH but  
|      |    | without growth of urease-  
|      |    | producing bacteria.        | Setting: | Hospital with 500 beds for long-term care  
|      |    |                             
|      |    | and rehabilitation          | Sample: | 11 (8M, 3F)                                 | No baseline measures.  
|      |    | Pop*: No information        |        |                                           |                       |
| UC47 | 6 | Elliott TSJ, Reid L,  
|      |    | Gopal Rao G et al. 1989. UK. | Design: | Randomised Controlled Trial       | Small study – only females in  
|      |    | To test the effect of  
|      |    | bladder washouts on the  
|      |    | urothelium.                  | Setting: | Not stated                           | intervention group.  
|      |    |                             | Sample: | 50 (30M, 20F)                          |                       |
|      |    | Pop*: Control – normal adult men. Women had  
|      |    | long-term indwelling urinary catheters. |        |                                           |                       |
| UC54 | 4 | Kohler-Ockmore J. 1991. UK. | Design: | Descriptive Study                          | No information on gender, confounding  
|      |    | To identify factors which  
|      |    | may cause catheter  
|      |    | blockage and how they  
|      |    | may be overcome.          | Setting: | Community; own home and nursing homes | conditions or catheter types.  
|      |    |                             | Sample: | 54                                      | Analysis poor and incomplete. |
|      |    | Pop*: 3 health districts residents with catheters  
|      |    | for >3 months.                |        |                                           |                       |
### UC58 7

Wiseman O. 1997. UK.

**To determine the management of long-term urinary catheter in asymptomatic patient in the Accident and Emergency department.**

<table>
<thead>
<tr>
<th><strong>Design:</strong></th>
<th>Descriptive Study (Retrospective)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Setting:</strong></td>
<td>Accident and Emergency department</td>
</tr>
<tr>
<td><strong>Sample:</strong></td>
<td>40 patients with 80 presentations (68M, 12F)</td>
</tr>
<tr>
<td><strong>Pop:</strong></td>
<td>A&amp;E</td>
</tr>
</tbody>
</table>

Audit though described as research. Flawed urine collection method.

### UC71 8

Kurtz MJ, Van Zandt K, Burns JL. 1995. USA.

**To identify a single effective and inexpensive cleaning method that could be recommended to clients using intermittent catheterisation.**

<table>
<thead>
<tr>
<th><strong>Design:</strong></th>
<th>Experimental</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Setting:</strong></td>
<td>Laboratory</td>
</tr>
<tr>
<td><strong>Sample:</strong></td>
<td>16</td>
</tr>
<tr>
<td><strong>Pop:</strong></td>
<td>Children re-using non-latex catheters for IC.</td>
</tr>
</tbody>
</table>

Small sample.

### UC73 2

Roe BH. 1990. UK.

**To test the effects of an education programme (including an information booklet and demonstration) on the management of urine drainage systems by patients and carers.**

<table>
<thead>
<tr>
<th><strong>Design:</strong></th>
<th>Randomised Controlled Trial</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Setting:</strong></td>
<td>Community (Home and Home Care)</td>
</tr>
<tr>
<td><strong>Sample:</strong></td>
<td>45 (gender not stated)</td>
</tr>
<tr>
<td><strong>Pop:</strong></td>
<td>2 district health authority, patients &gt;18 years of age.</td>
</tr>
</tbody>
</table>

Small sample inadequate for statistical tests. Method of randomisation not stated. Drop out rate unacceptable.
| UC78 | 8 | Mervine J, Temple R. 1997. USA. | To determine the effect on:  
1. the concentration of bacteria of washing (with soap and water) red rubber and clear plastic intermittent-use catheters,  
2. the amount of time in a microwave oven required to eliminate stock bacteria from red rubber and clear plastic catheters,  
3. the effect of repeated use of a microwave oven on the patency and pliability of red rubber and clear plastic catheters. | Design: Experimental  
Setting: Laboratory  
Sample: Urine from patients was used but it is not stated how many specimens were obtained.  
Pop*: Patients in urban hospital giving urine for routine culture or on CIC. | No detail on sample size or patient details.  
No statistical analysis. |
| UC79 | 1 & 7 | Prieto-Fingerhut T, Banovac K, Lynne CM. 1997. USA. | To determine the effect of sterile and nonsterile intermittent catheterisation on the incidence of urinary tract infection (UTI) in patients after spinal cord injury. | Design: Randomised Controlled Trial  
Setting: Medical Rehabilitation Centre  
Sample: 29 (16M, 13F)  
Pop*: Spinal cord injury patients | Numbers are small. Method of randomisation not stated.  
No details of reliability of catheterisation techniques.  
No baseline measurements. |
| UC80 | 1 | Terpenning MS, Allada R, Kauffman CA. 1989. USA. | A prospective study of elderly patients receiving IC for development of bacteriuria and/or urinary tract infection. | **Design:** Descriptive Study (Prospective Follow-up study)  
**Setting:** Veteran Administration Hospital and nursing home  
**Sample:** 35 (34M, 1F)  
**Pop**: Patients aged 60 years and over with long-term catheter. | Total population not given and no idea of refusals/drop outs. Sample size too small given two sites. No standardisation of catheter used. Descriptive statistics only. |
| UC81 | 1 | Ouslander JG, Greengold B, Chen S. 1987. USA. | To examine the relative frequency of urinary tract infection (UTI) and bacteriuria among male nursing home patients managed with and without catheters. | **Design:** Descriptive Study – Comparative Follow-up  
**Setting:** Nursing Home  
**Sample:** 92 (Males)  
**Pop**: Male nursing home residents. | Comparison group preferentially included patients with a past history of a GU diagnosis. Significant differences among the groups that could have affected their susceptibility to infection. Observation uncontrolled but long follow up period. No baseline measurements of UTI. Many confounding variables. Small sample, two groups which do not meet power requirements. |
| UC83 | 1 | Johnson DE, Muncie HL, O’Reilly JL et al. 1990. USA. | To assess the safety and efficacy of a new external urine collection system for women. | **Design:** Descriptive Study - Observational  
**Setting:** Hospital and a medical centre  
**Sample:** 26 (Females)  
**Pop**: All women over 65 years old not receiving antibiotics. | Insufficient description of methodology. |
<p>| UC86 | 1 | Quigley PA, Riggin OZ. 1993. USA. | To determine whether there was a difference in the incidence of urinary tract infection that occurred following use of two types of catheterization (intermittent) techniques: open catheterization and closed catheterisation. | Design: Randomised Controlled Trial | Setting: Hospital rehabilitation | Sample: 30 (gender not stated) | Pop*: Rehabilitation patients, spinal cord injuries and stroke patients. | Small sample - 14 in the control group and 16 experimental groups. Groups not treated equally. No stats. Multiple factors affecting reliability of data collection. |
| UC92 | 1 | Wyndale JJ, Maes D. 1990. Belgium. | To study the long term effects and complications resulting in patients using intermittent self catheterisation. | Design: Descriptive Study - Retrospective Follow-up | Setting: Hospital Outpatients/rehabilitation | Sample: 75 (33M, 42F) | Pop*: Patients using CISC. | Method used to select patients or source of patients unclear. Insufficient information on demographics of sample. No baseline measures. Patients monitored over varying lengths of time. |</p>
<table>
<thead>
<tr>
<th>UC94</th>
<th>8</th>
<th>Silbar EC, Ciechanec JF, Burke BM et al. 1989. USA.</th>
<th>To see whether microwaving would make aseptic intermittent self-catheterisation a practical possibility.</th>
<th>Design: Experimental</th>
<th>No details are given about the population and sample.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Setting: Laboratory</td>
<td>Greater concentration of bacteriuria used than would have been found on a patient.</td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td>Sample: No details given about patients.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pop*: Patients with UTI</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UC95</th>
<th>1</th>
<th>Taylor CED, Hunt GM, Matthews IG. 1986. UK.</th>
<th>A comparison was made between two groups of children using CIC.</th>
<th>Design: Descriptive Study</th>
<th>Small sample. No attempt to control acknowledged extraneous variables.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Setting: Assume hospital outpatients at Addenbrookes, Cambridge</td>
<td>No baseline measurements.</td>
</tr>
<tr>
<td></td>
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<td>Sample: 24 (1M, 23F)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pop*: Myelomeningocele and spina bifida patients.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UC97</th>
<th>2</th>
<th>Bennett CJ; Young MN; Razi SS et al. 1997. USA.</th>
<th>To determine whether an introducer tip catheter reduces urinary tract infection in spinal cord injured patients on intermittent catheterisation.</th>
<th>Design: Descriptive Study</th>
<th>Small sample. Variability in number of catheterisations was high. Sampling method unclear.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>Setting: Hospital</td>
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<td></td>
<td>Sample: 19 (gender not stated)</td>
<td>No baseline measurements.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pop*: Spinal cord injuries unit.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UC98</th>
<th>1</th>
<th>Perkash I, Giroux J. 1993. USA.</th>
<th>To evaluate long-term clean intermittent catheterisation for genito-urinary complications in non-hospitalised spinal cord injury patients and to institute and evaluate prompt management.</th>
<th>Design: Descriptive Study – Observational/follow-up</th>
<th>Small sample. 66% discontinued.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td>Setting: Community setting/Outpatients</td>
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<tr>
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<td></td>
<td>Sample: 50 (Males)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pop*: Spinal cord injuries.</td>
<td></td>
</tr>
<tr>
<td>Study ID</td>
<td>Patients</td>
<td>Authors</td>
<td>Study Design</td>
<td>Setting</td>
<td>Sample</td>
</tr>
<tr>
<td>----------</td>
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</tr>
<tr>
<td>UC109</td>
<td>2</td>
<td>Joseph C, Jacobsen C, Strausbaugh L et al. 1991. USA.</td>
<td>A pilot study of intermittent urinary catheterisation in elderly nursing home patients utilizing a new modification of clean technique and conventional sterile technique.</td>
<td>Randomised Controlled Trial</td>
<td>Elderly Nursing Home Care Unit.</td>
</tr>
<tr>
<td>UC114 1 &amp; 2</td>
<td>1 &amp; 2</td>
<td>Oie S, Kamiya A, Seto T et al. 2000. Japan.</td>
<td>To evaluate the microbial contamination of a widely used in-use lubricant for non-touch urethral catheters.</td>
<td>Descriptive Study</td>
<td>Out patients department</td>
</tr>
<tr>
<td>UC117 1</td>
<td>1</td>
<td>Maynard FM and Glass J. 1987. USA.</td>
<td>To report on 5 year urological outcomes in a population of new spinal cord injury patients who were all managed initially by clean technique of intermittent catheterisation.</td>
<td>Descriptive Study – Observational</td>
<td>Outpatients</td>
</tr>
</tbody>
</table>
### UC118

**7**  

**Presumed objective to identify the prevalence and incidence of bacteriuria developing in chronically catheterised out-patients who have been prescribed prophylactically systematic antibiotic therapy at each out-patients clinic visit.**

| **Design:** | Descriptive Study |
| **Setting:** | Hospital outpatient clinic |
| **Sample:** | 120 (119M, 1F) |
| **Pop**: | Urology out-patients |

**States this is a RCT but methodology unclear, no control group. No statistics provided. Timing of microbiological assessment unclear. Also unclear whether the results of this study are directly applicable to the patient group targeted by the study.**

### UC121

**6**  
Nesbit SA, Katz LE, McClain BW et al. 1999. USA.

**To compare the efficacy of amphotericin B 10mg vs. 50mg per litre of sterile water as a continuous irrigation for 72 hours to eradicate funguria.**

| **Design:** | Randomised Controlled Trial |
| **Setting:** | Urban hospital, medical floor or intensive care |
| **Sample:** | 28 (8M, 20F) |
| **Pop**: | All hospitalised patients whose physicians ordered amphotericin B continuous bladder irrigation. |

**Small study that failed to recruit adequate numbers.**

### UC127

**6**  
Linsenmeyer TA, Jain A, Thompson BW. 1999. USA

**To determine the effectiveness of neomycin/polymyxin bladder irrigations in asymptomatic spinal cord injury patients with resistant organisms.**

| **Design:** | Descriptive study |
| **Setting:** | Rehabilitation Unit |
| **Sample:** | 10 (7M, 3F) |
| **Pop**: | Spinal cord injury patients who had undergone bladder irrigation. |

**Small study, two people had two sets of irrigation. Use of statistics inappropriate in this sample.**
To review the records of spinal cord injured subjects and compare two CIC catheter cleaning and storage procedures (wet and dry).

**Design:** Descriptive Study (Retrospective)

**Setting:** Neurological rehabilitation unit

**Sample:** 48 (37M, 11F)

**Pop**: Spinal cord injury patients.

The findings may have been influenced by the between group differences in length of time of catheterisation intervals. Potential lack of sensitivity in detecting a type 2 error. Generalisability limited due to convenience sampling. Sampling bias due to unequal distribution of subjects and small sub groups. Limited reliability of retrospective data collection.

To quantify the micro-organisms present in blood at urinary catheter removal and reinsertion. To identify whether:

Q3: there was an increased risk of bacteriuria during UC removal and insertion,

Q7: prophylactic antibiotics would be useful before this manipulation.

**Design:** Descriptive Study

**Setting:** Geriatric Medical Centre

**Sample:** 33 (15M, 18F)

**Pop**: Patient’s chronic indwelling catheter positive urine cultures.

Lack of clarity on sampling technique, e.g. 33 patients specified – 46 cases in group 2.
### UC133

**1**  
**Presumed aim** is to record long term outcomes (bacteriological ‘evolution’, acceptance, continence and complications) of IUSC.  
**Design:** Descriptive Study  
**Setting:** Paraplegic centre  
**Sample:** 46 (27M, 19F)  
**Pop:** Patients using ISC.  

The study does not address an appropriate and clearly focused question. The selection of subjects to the study may have induced bias.

### UC134

**1**  
**To evaluate intermittent self catheterisation with intermittent catheterisation performed by a catheter team.**  
**Design:** Descriptive Study  
**Setting:** Spinal injury unit  
**Sample:** 25 (22M, 3F)  
**Pop:** Paraplegics  

Outcomes difficult to measure given that some patients (unspecified) had pre-existing UTI. Unspecified number of patients received antibiotics during the study.

### UC135

**1**  
**Presumed aim was to record the frequency of infective episodes’ in two groups of patients with neuropathic bladders who used clean intermittent catheterisation.**  
**Design:** Descriptive Study  
**Setting:** Spinal injury unit  
**Sample:** 48 (gender not stated)  
**Pop:** Patients with neuropathic bladders.  

The study does not address an appropriate and clearly focused question. The selection of subjects to the study has induced bias. Measurements not standardised.

### UC139

**1**  
Sadowski A, Duffy L, 1988, USA.  
**To investigate the current usage, procedural differences, incidence of documented urinary tract infections and staff satisfaction with CIC in a long term care setting.**  
**Design:** Descriptive Study (Survey)  
**Setting:** Long term care facilities  
**Sample:** 103 facilities  
**Pop:** Patients in long term care using urinary catheters.  

Questionnaire study with poor response (48%) and reporting bias.
| UC141 | 2 | Giannantoni A, Du Stasi SM, Scivoletto G et al. 2001. Italy. | To compare patients’ acceptance and safety related to the use of the conventional Nelaton catheter and the prelubricated nonhydrophilic catheter in spinal cord injured patients on intermittent catheterization. | **Design:** Randomised Controlled Trial  
**Setting:** Hospital in-patients  
**Sample:** 18 (16M, 2F)  
**Pop:** Spinal cord injury patients. | Sample too small for RCT. |
APPENDIX UC4 - Full Reference List


(8) Beattie TK, Anderton A. Microbiological evaluation of four enteral feeding systems which have been deliberately subjected to faulty handling procedures. J Hosp Infect 1999; 42:11-20.


(11) Boyce JM, Kelliher S, Vallande N. Skin irritation and dryness associated with two hand-hygiene regimens: Soap-and-water hand washing versus hand antisepsis with an alcoholic hand gel. Infection Control and Hospital Epidemiology 2000; 21(7):442-448.


(146) Seymour VM, Dhallu TS, Moss HA, Tebbs SE, Elliot TSJ. A prospective clinical study to investigate the microbial contamination of a needleless connector. J Hosp Infect 2000; 45:165-168.


NOTE: SECTIONS 1, 2, 4 and 5 ARE AVAILABLE AS SEPARATE FILES