The Regulation and Quality Improvement Authority

A Regional Retrospective Re-audit of Compliance with Urinary Tract Infection Guidelines in Secondary Care

July 2018

www.rqia.org.uk

Assurance, Challenge and Improvement in Health and Social Care

Contents

Background

Urinary tract infection (UTI) is the second most common clinical indication for empirical antimicrobial treatment in primary and secondary care[1].

UTIs can be classified according to anatomical level of infection, grade of severity of infection, underlying risk factors and microbiological findings[2]. The clinical situation may be classified as cystitis, pyelonephritis or urosepsis. However, conventional definitions of UTI are based on two main categories, complicated and uncomplicated[3].

The European Association of Urology (EAU) undertook a review of the classification of UTI to assist clinicians in diagnosing and classifying UTIs.

Complicated UTIs are defined as an infection associated with a condition such as a structural or functional abnormality of the genitourinary tract, or the presence of an underlying disease[2].

The use of the ORENUC system provides a more detailed differentiation of the underlying risk factors to assist classification of UTI[3]. The system phenotypes the risk factors into six groups[4]:

O – indicates no known risk factors
R – risk of recurrent UTIs but without risk of a more severe outcome
E – extra urogenital risk factors
N – relevant nephropathic disease
U – urological resolvable (transient) risk factors
C – permanent external urinary catheter and unresolved urological risk factors.

Uncomplicated UTIs are seen in otherwise healthy patients without relevant structural and functional abnormalities within the urinary tract, kidney diseases, or comorbidity that could lead to more serious outcomes[2].

The diagnosis and management of a UTI continues to present a challenge. It is particularly difficult in elderly patients, where the prevalence of asymptomatic bacteriuria (ASB) increases with age, and may reach up to 50% in nursing home residents[5]. In addition, the treatment of non-specific indicators for UTI, such as acute

lethargy and weakness, is common due to the patients' inability to articulate their symptoms[6].

Asymptomatic bacteriuria (ASB) is defined as the isolation of cultivatable microorganisms without the presence of signs and symptoms suggestive of a UTI. It is one of the most common causes of antibiotic overprescribing in acute care[7].

ASB is also common in patients with lower urinary tract dysfunction e.g:

- neurogenic bladder patients secondary to multiple sclerosis and spinal cord injury
- incomplete bladder emptying
- neobladder
- ileo-cystoplasty
- catheterisation
- ileal conduits.

These patients frequently become colonised with uropathogens. Studies have shown no benefit in screening and treating in these patient groups[2].

Multiple studies have shown that at least one third of patients with asymptomatic bacteriuria are unnecessarily treated with antibiotics. The treatment of ASB is associated with significantly increased risk of clinical adverse events, adverse drug effects and the development of antibiotic resistant UTIs[8]. Treatment may also eliminate low-virulence strains that suppress the development of uropathogens, thus counterintuitively promoting the development of symptomatic UTIs[7]. Consequently, there is no evidence to support ordering urine cultures in asymptomatic patients[1].

Urine samples constitute the largest single category of specimens examined in most microbiology laboratories[2, 8]. However, the majority of urine cultures do not yield clinically significant results and the unjustified ordering of urine cultures, misinterpretation of urinalysis and positive cultures often leads to clinical adverse events[6]. These issues lead to increased cost, overtreatment of UTI and promotion of multidrug resistant organisms such as methicillin-resistant *staphylococcus aureus* (MRSA*)*, extended-spectrum beta-lactamase (ESBL) and carbapenemase-producing organisms (CPO)[2, 5, 6].

The development of antimicrobial resistance (AMR) is a global problem resulting from the overprescribing of antimicrobials in clinical areas where they are unnecessary. This has resulted in existing antimicrobials becoming less effective, coupled with substantially slowed development of new and novel antibiotics. Prudent use of antibiotics is the only option to delay the development of resistance.Bartoletti[3] described how the cross resistance of *E. Coli* to trimethoprim and fluoroquinolones should prompt a strategy for a treatment plan such as:

- precise indication
- choice of antibiotic
- dose
- route
- duration of treatment.

In May 2015, the World Health Organization (WHO) published a global action plan on AMR[9]. The goal of the action plan is to ensure, for as long as possible, continuity of successful treatment and prevention of infectious diseases with effective and safe medicines that are quality-assured, used in a responsible way, and accessible to all who need them[9].

The action plan sets out five strategic objectives to optimise the use of antimicrobial medicines and to renew investment in research and development of new products. Objectives one to four of the action plan support the provision of antimicrobial stewardship programmes and objective five promotes sustainable economic investment in countering antimicrobial resistance[9]. These programmes monitor and promote the optimisation of antibiotics at national and local level. Antimicrobial stewardship is defined as *'an organisational or healthcare-system-wide approach to promoting and monitoring judicious use of antimicrobials to preserve their future effectiveness'*[10].

The first antimicrobial action plan (AMRAP 2002-2005) in Northern Ireland was launched in 2002. This identified six keys area for targeted action to address the issue of antimicrobial resistance. It recognised the need for a regional strategic approach with a strong focus on antimicrobial stewardship.

Empirical antibiotic guidelines for the treatment of UTI were launched in secondary care in 2009. The Northern Ireland Regional Secondary Care Guidelines for Antimicrobial Prescribing were developed by Antimicrobial Resistance Action Committee (ARAC) and formally launched on European Antibiotic Awareness Day (EAAD) 2010.

The regional strategic action plan 'Changing the Culture 2010' published a five year 'Strategy for Tackling Antimicrobial Resistance (STAR 2012-2017)' in 2012.One of the key objectives of STAR was "to establish and maintain systems to monitor antimicrobial usage and surveillance of resistance". Individual Trust guidelines have been tailored to reflect local resistance patterns as appropriate[11].

In secondary care the implementation of antimicrobial stewardship programmes has seen a 65% reduction in the use of high-risk antibiotics, a 35% increase in the use of low-risk antibiotics, with a total increase in antibiotic use of 2%. This included a reduction in *C. difficile* cases by 88% from 197 cases in 2008 to 23 in 2010 and a 60% reduction in antibiotic expenditure between 2008 and 2010[11].

The Department of Health England devised a toolkit on antimicrobial resistance and healthcare associated infection ('Start smart then focus' (2015)[12]. The aim of the toolkit is to reduce healthcare associated infections and improve antimicrobial prescribing in the secondary healthcare setting[12].

The Health and Social Care Act 2008 Criterion[9]: Code of Practice on the prevention and control of infections places emphasis on prudent prescribing and antimicrobial stewardship[13].

A 2011 audit of regional guidelines for first line empirical antibiotic therapy in adults with respiratory tract infection (https://www.rqia.org.uk/RQIA/files/76/761f52f4-8399-4a3c-9158-6ec8ec2686da.pdf) found adherence to empirical treatment to be below the target rate of 90%. The audit also found documentation of a review or stop date on the Kardex or in the medical notes was low at 38%[14].

A further audit to determine the adherence to regional guidelines for the treatment of UTIs (https://www.rqia.org.uk/RQIA/files/fb/fb342f0e-38bd-43aa-94bb-b2863d75dd4e.pdf), published in December 2015, demonstrated that overall compliance with empirical guidelines did not meet the required 95% compliance rate[15].

Aim

To assess compliance with empirical guidelines for the treatment of uncomplicated (lower) UTI, complicated (upper) UTI and catheter associated UTI (CAUTI).

Objectives

1. To determine the adherence to the regional guidelines for the treatment of UTIs.
2. To determine an association of demographic, clinical and geographical factors with compliance.
3. To determine site (upper/lower UTI) and severity of the infection.
4. To review the practice and documentation of urinalysis (urine dipstick and midstream urine or catheter sample), including documentation of identified bacteria.
5. To review practices of documenting blood cultures, identifying bacteria and documentation of cultures.

Guidelines and Evidence Base

The following guidelines and evidence bases were used to inform the standards for this audit:

1. Belfast Health and Social Care Trust (BHSCT) empirical antimicrobial guidelines.
2. Northern Health and Social Care Trust (NHSCT) empirical antimicrobial guidelines.
3. Southern Health and Social Care Trust (SHSCT) empirical antimicrobial guidelines.
4. South Eastern Health and Social Care Trust (SEHSCT) empirical antimicrobial guidelines.
5. Western Health and Social Care Trust (WHSCT) empirical antimicrobial guidelines.
6. NICE Urinary tract infection in adults (QS90) 2015.
7. SIGN 88 Management of suspected bacterial urinary tract infection in adults 2012.
8. European Association of Urology guidelines on urological infection 2015.
9. Northern Ireland Management of Infection Guidelines for Primary and Secondary Care 2016.

Standards

Standard	Target	Achieved 2018
Standard 1: Antibiotic, dose, route, duration prescribed are compliant with empirical guidelines	**95%**	**31%**
Standard 2: Clinical symptoms of UTI should be documented in the medical notes	**95%**	**73%**
Standard 3: Urinalysis should be performed and results documented in medical notes	**95%**	**65%**
Standard 3a: Culture results and identified bacteria should be documented in medical notes	**95%**	**44%**
Standard 4. Blood cultures should be requested, were appropriate, and documented in medical notes	**95%**	**33%**
Standard 5: Intended duration or review of antibiotic should be documented on the patient Kardex and in the medical notes	**95%**	**54%**

Methodology

- This retrospective, criterion based re-audit was conducted across the five HSC trusts in Northern Ireland. An initial meeting was set up with antimicrobial pharmacists across the five HSC trusts to discuss the project team, aims and objectives and set the study period, standards and targets.
- A mentor was assigned to assist with the project and a microbiology consultant with a special interest in antimicrobial stewardship nominated to provide expert advice.

- An antimicrobial pharmacist in each trust was nominated to collect data over the defined audit period. The project lead (clinical pharmacist) would collect data for the BHSCT.

- The agreed data collection period was January 2016 to August 2016. A sample size was selected to allow for comparisons with previous RQIA audits on compliance with empirical antimicrobial therapy.

A random sample of 360 patients was selected from all adult medical and surgical inpatients across the five Health & Social Care Trusts from January 2016 to August 2016. Patients diagnosed with an uncomplicated (lower) UTI, complicated (upper) UTI or catheter associated UTI as either primary or secondary diagnosis were included in this audit.

The aim was to audit 360 patients' medical records comprising of 60 patients from the NHSCT, SEHSCT, SHSCT AND WHSCT and 120 patients from the BHSCT. However the total number of medical records audited was 303 (medical records incorrectly coded or without a kardex were excluded from the audit, also limited time of a data collector in one trust only allowed 303 charts to be pulled). Data collected consisted of 120 medical records from the BHSCT (54 from RVH and 66 from BCH), 45 from the NHSCT, 52 from the SEHSCT, 26 from the SHSCT and 60 from the WHSCT.

Inclusion criteria required each adult patient to have had an inpatient stay due to a UTI (uncomplicated (lower) UTI, complicated (upper) UTI or catheter associated UTI).

Patients with a primary or secondary diagnosis of UTI admitted from January 2016 to August 2016 were identified using clinical code N39.0 obtained from each trusts clinical coding department. The patient list was anonymised and electronically randomised by the project lead using an excel spreadsheet. Patients were then selected from the spreadsheet in numerical order. The list of required medical records was forwarded to each trust's audit department to allow for data collection.

The aims and objectives were discussed and agreed upon by the steering/project team.

The data collection form (appendix 1) was developed based on the previous RQIA audit.

Case notes were reviewed and the information was entered into the data collection form. Data were collected confidentially by the project lead in BHSCT and by the antimicrobial pharmacists in their own trust.

Data collection

Data were collected retrospectively from patients' medical records on the data collection form (Appendix 1).

Data collected were validated by an antimicrobial pharmacist in the BHSCT.

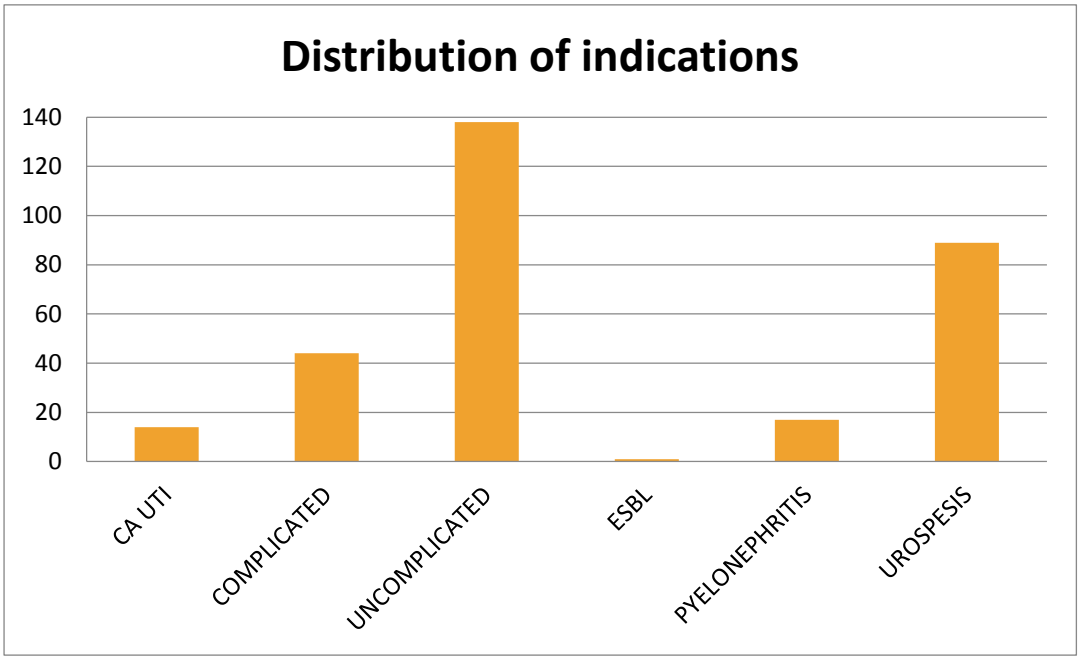
Data analysis

Each piece of Trust anonymised data was given a unique ID number and populated into an Excel spreadsheet which was sent to the project lead. In order to validate the data, a draft set of findings was produced and checked by a second facilitator (member of project team) for accuracy. The report was then produced by the project lead

Findings

In this audit the medical records of 303 patients diagnosed with a UTI were reviewed to assess compliance with Regional Urinary Tract Infection Guidelines. Results were generated to evaluate compliance with the standards set by the audit team.

Graph 1: Distribution of indications for treatment audited



Standard 1 - Antibiotic, dose, route, duration prescribed are compliant with empirical guidelines

Table 1: Compliance of prescribed antibiotic and corresponding dose with regional antibiotic guidelines for each trust

Trust	Antibiotic	Dose
A	67 (56%)	63(94%)
B	20(44%)	20(100%)
C	30(60%)	29(97%)
D	18(69%)	16(89%)
E	38(63%)	35(92%)

Compliance - Prescribed antibiotic is compliant with empirical guidelines

Fifty seven percent (173 of 303) of patients reviewed were prescribed an antibiotic according to the empirical guidelines. This is below the target rate of 95%. None of the individual trusts met the target.

Compliance - **Prescribed dose of empirical antibiotic is compliant with empirical guidelines**

Ninety four percent (163 of 173) of patients reviewed with correctly prescribed empirical antimicrobial therapy were prescribed the correct dose of the empirical antibiotic. This is below the target of 95%. Two trusts met the target and three trusts did not meet the target.

Exceptions - Gentamicin dose was not reviewed, as dose is weight dependent, and not all patient weights were readily available.

Table 2: **Compliance of antibiotic duration and route with regional antibiotic guidelines n=303**

Trust	Duration	Route
A	60(50%)	98(81%)
B	23(51%)	38(84%)
C	26(52%)	44(88%)
D	18(69%)	21(81%)
E	36(60%)	56(93%)

Compliance - Antibiotic duration is compliant with empirical guidelines

Fifty four percent (163 of 303) of patients reviewed were prescribed the correct duration of antibiotic, according to the empirical guidelines. Duration of antibiotic relates to the recommended length of administration time to treat the corresponding UTI. This is below the target of 95%. None of the trusts meet the target for compliance of duration according to empirical guidelines.

Compliance - Route is compliant with empirical guidelines

Eighty-five percent (257 of 303) of patients reviewed were prescribed the correct route for the antibiotic. Route relates to oral administration or intravenous administration of the antibiotic. This is below the target of 95%. None of the trusts meet the target for correct route administered.

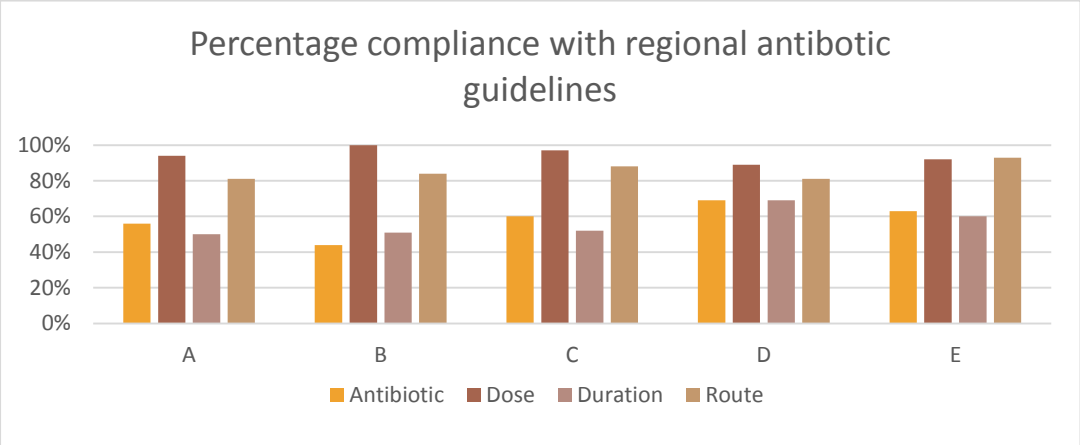
Table 3: Overall compliance with regional antibiotic guidelines for the four parameters of antibiotic, dose, duration and route

Trust	Overall
A	36 (30%)
B	12 (27%)
C	13 (26%)
D	11(42%)
E	23 (38%)

Compliance with four components: correct antibiotic, at the correct dose, via the correct route for the correct duration

Thirty-one percent (95 of 303) of patients reviewed were treated according to the regional antibiotic guidelines for UTI. None of the five HSC trusts met the set target of 95% for compliance with regional antibiotic guidelines

Graph 2: Percentage compliance with regional antibiotic guidelines for the four parameters of antibiotic, dose, duration and route



Standard 2: Clinical symptoms of UTI should be documented in the medical notes

Table 4: Number of medical notes in each trust with documented clinical symptoms of UTI

Trust	n per trust	%
A	81	68%
B	38	84%
C	43	86%
D	21	81%
E	38	63%

Compliance: Of the patients reviewed, 73% (221 of 303) of patients had clinical symptoms of UTI documented in their medical notes. None of the Trusts met the set target of 95%.

Standard 3: Urinalysis should be performed and results documented in medical notes. Culture results and identified bacteria should be documented in medical notes

Table 5: Medical notes with documented urinalysis, using urine multistix or urine culture, in each trust

Trust	Urine multistix n per trust	MSU/CSU n per trust
A	56 (47%)	92(77%)
B	34(76%)	39(87%)
C	35(70%)	46(92%)
D	21(81%)	20(86%)
E	51(85%)	53(88%)

Compliance: Of the patients reviewed, 65% (197 of 303) of patients had urinalysis results documented in their medical notes taken using a urine multistix, and 83% (250 of 303) had midstream urine cultures or catheter cultures taken. This falls below the target of 95%

Exceptions: Urinalysis should not be performed in asymptomatic patients. Urinalysis should only be performed in patients with a confirmed diagnosis of a UTI. SIGN 88[1] denotes that urinalysis is not required in female patients with uncomplicated UTI. This can result in the treatment of asymptomatic bacteria based uropathogens, which in patients such as the elderly or those with lower urinary tract dysfunction may be inappropriate.

Standard 3a: Culture results and identified bacteria should be documented in medical notes

Table 6: Medical notes with documented culture results including identified bacteria in each trust

Trust	n per trust
A	59 (49%)
B	18 (40%)
C	23 (46%)
D	8 (31%)
E	26 (43%)

Compliance: Of the patients reviewed, 44% (134 of 303) of patients had culture results or identified bacteria recorded in their medical notes. This falls below the target of 95%

Standard 4: Blood cultures should be requested, were appropriate, and documented in medical notes

Table 7: Medical notes in each trust with documented blood cultures requested

Trust	n per trust
A	49 (41%)
B	9 (20%)
C	11(22%)
D	6 (23%)
E	21 (35%)

Compliance: Of the patients reviewed, 32% (96 of 303) of patients had documentation of requested blood cultures. None of the trusts met the set target of 95%.

Table 8: Documentation of blood cultures requested for urosepsis, complicated UTI including pyelonephritis

Not all UTIs require blood cultures. Complicated UTI and urosepsis only require blood culture. Other patients may have had blood cultures performed however this was not documented in their medical notes.

Trust	Documented blood culture for complicated UTI
A	39 (54%)
B	8 (40%)
C	7 (42%)
D	4 (57%)
E	14 (58%)

Table 9: Documentation of requested blood cultures in urosepsis

Trust	Sepsis criteria met. Blood culture documented	Sepsis criteria met Blood culture not documented
A	14	9
B	3	5
C	6	7
D	5	1
E	10	6

Table 10: Documentation of requested blood cultures in uncomplicated UTI

Trust	Documented blood culture	Sepsis criteria met
A	7	2
B	1	0
C	3	0
D	1	1
E	4	1

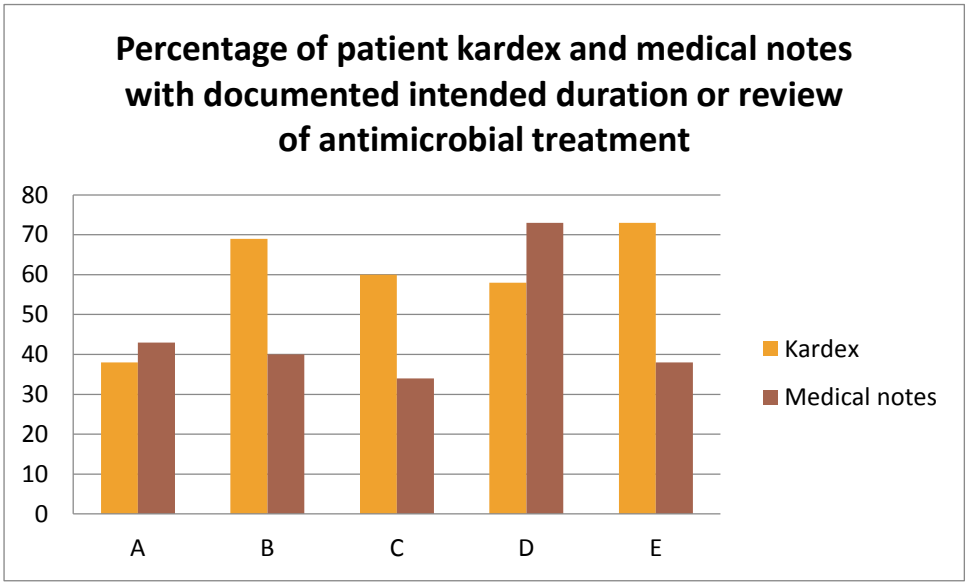
Standard 5: Intended duration or review of antibiotic should be documented on the patient Kardex and in the medical notes (n=303)

Table 11 Kardex and medical notes in each trust with documented intended duration or review of antibiotic

Trust	Kardex	Medical notes	Overall compliance
A	45(38%)	51(43%)	26 (22%)
B	31(69%)	18(40%)	12 (27%)
C	30(60%)	17(34%)	14 (27%)
D	15(58%)	19(73%)	9 (35%)
E	44(73%)	23(38%)	14(23%)

Compliance: Of the patients reviewed, 25% (75 of 303) had a documented intended duration of antibiotic treatment or documented review date in their medical notes and drug kardex.

Graph 3: Percentage of patient kardex and medical notes with documented intended duration or review of antimicrobial treatment



Compliance: Of the patients reviewed, 54% (165 of 303) of Kardexes had a documented review date or intended duration for antibiotic therapy. Forty-two percent (128 of 303) had a documented review date or intended duration of antibiotic treatment in their medical records. None of the trusts met the set target of 95%

Observations

Results for standard one in relation to the dose of the selected empirical antibiotic showed that only two trusts reached the target of 95% compliance for patients correctly prescribed an antibiotic according to empirical guidelines. The audit found that the appropriate route of antibiotic delivery was selected in 85% (257 of 303) of kardexes. On reviewing the data, failure to select an appropriate route often corresponded with difficulty in classifying the type of UTI. Uncomplicated UTIs were treated as complicated UTIs across all trusts and subsequently prescribed intravenous antibiotics instead of oral antibiotics set out in the regional guidelines.

Results show that the correct antibiotic, as set out in the guidelines was prescribed in only 57% of cases (173 of 303) compared to the required standard of 95%; this is independent of the other components such as dose etc.

Several factors impacted on the non-selection of the guideline antibiotic. These included difficulty in diagnosing UTI due to the non-specificity of its symptoms, e.g. difficultly distinguishing UTI from respiratory tract infection, delirium, pneumonia, and gastroenteritis, especially in elderly patients. The audit found patients presenting with non-specific symptoms were prescribed additional antimicrobial therapy or a broader spectrum antibiotic cover in the presence of only a differential diagnosis.

To ensure compliance with empirical guidelines it is important to correctly diagnose and classify UTIs. Abbo[8] states that the classification of UTI according to the individual host (ORENUC) and the severity of location have therapeutic implications in antimicrobial stewardship

Poor documentation of performing urine and blood cultures, with poor documentation of appropriate sensitivities, results in the inability to effectively de-escalate antimicrobial therapy; as a result a non-guideline antibiotic is often prescribed.

Current guidelines do not provide explicit recommendations on de-escalating antibiotics in UTI, however, knowing the antibiotic susceptibility can help clinicians prescribe the most appropriate therapy and stop antibiotics when an infection is unlikely[12].

Fifty percent of patients (152 of 303) treated for complicated UTI or urosepsis had culture results and identified bacteria documented in their medical records (graph one). Of the remaining 50% (151 of 303) of patients with no documented sensitivities, 55% (83 of 151) of them were not treated in line with the regional antibiotic guidelines. Tailoring the antibiotic therapy based on regional guidelines and culture results, along with reporting susceptibility for uropathogens are important antimicrobial stewardship practices to improve the appropriate use of antibiotics[8].

The duration of therapy failed to comply with guidelines in all five HSC trusts. Of the 6% (17 of 303) cases of pyelonephritis documented, only three were treated for the correct duration. In relation to duration of treatment for pyelonephritis in the audit this was often treated as a complicated UTI (seven to ten days).

The duration of treatment complied with guidelines in only 41% (123 of 303) of patients diagnosed with uncomplicated UTI, 32% (40 of 124) for females and 67% (83 of 124) for males. This is in keeping with the RQIA (2015) audit finding of 32.9% compliance for females and 73.7% compliance in males.

Of the data reviewed, in 90% (273 of 303) of all prescribed antibiotics, duration was too long for uncomplicated UTI. 96% (262 of 273) of females were prescribed a longer duration of antibiotic than recommended by empirical guidelines. In the remaining 10% (30 of 303) of cases of non-compliance with duration the period of prescription was too short, with mostly males being prescribed a shorter duration of antibiotic than recommended by empirical guidelines.

There was poor documentation of the intended duration or review of antimicrobial therapy. Fifty four percent (165 of 303) of patients' Kardexes audited had a documented review or intended duration of treatment. Forty two percent (128 of 303) of patient medical records had documentation of review or intended duration of treatment. This is an improvement on 2015 audit with 37% compliance with intended duration in patients' medical records. Documentation of intended duration of therapy should be recorded in all patients' medical notes and kardexes at initiation of the therapy. Overall compliance to documentation of review date or intended duration of treatment in both medical notes and kardex was 25%.

Vercheval[16] established that the reasons for poor documentation include a reluctance to discontinue antibiotics initiated by another healthcare professional, resulting in prolonged courses of antibiotic therapy. This promotes resistance and increases risk of adverse effects such as c. difficile. Start smart then focus[12] stipulates that it is essential to review the continuing need for antibiotics and the subsequent decision be clearly documented in the clinical notes and kardex.

Pulcini[17] reported that stickers were moderately useful as a method for improving documentation. As the current regional kardex does not have a prompt for documentation of intended duration, a sticker is one possibility that could improve this practice.

Reassessment of antibiotic therapy around day three has been proven to trigger use of empirical therapy and improve antibiotic use. The focus on day three is due to 'clinical evolution and the availability of culture results' which allow for reassessment, antibiotic planning and review of diagnosis[17]. Of 199 patients reviewed that were prescribed intravenous antibiotics, 32% (64 of 199) of patients were maintained on intravenous antibiotics without justification. Start smart then focus[12] developed the five 'antimicrobial prescribing decision' options, which are Stop, Switch, Change, Continue and Outpatient Parenteral Antimicrobial Therapy (OPAT). This advocates:

- Stopping antibiotics if there is no infection
- Switch from IV to oral
- Change antibiotics
- Continue and document next review or stop date for IV and oral antibiotics
- Using OPAT team when appropriate to continue treatment in community

The regional kardex does have a prompt to review therapy at Day 3; however the audit showed that this prompt is not effective. Consideration should be given to reviewing the regional kardex to include the use of a sticker for review or duration or a dedicated section to record review or duration of treatment.

For standard two, clinical symptoms of UTI are documented in 73% (221 of 303) of medical records. One reason for non-compliance with the documentation of signs and symptoms of UTI is the failure of patients to articulate symptoms due to dementia, cognitive impairment or learning disabilities. This was the case in 33% (27

of 83) of patients. Of the 83 medical records without fully documented signs and symptoms, in 81 cases there was insufficient evidence to conclude a diagnosis of a UTI. Of these patients, 38% (32 of 83) had documented dementia, learning difficulty or a neurogenic bladder and 25% (21 of 83) patients were diabetic. Diabetes mellitus, correlates with a higher frequency of ASB in women[2]. Treating ASB in diabetic patients has not been shown to reduce the risk of symptomatic UTI. Therefore, screening and treatment is not recommended[2].

Sixty five percent (197 of 303) of patients had a recorded urinalysis using dipstick multistix and 83% (250 of 303) had a urine culture taken**.** Over interpretation of urinalysis has placed an undue emphasis on pyuria and nitrite positivity driving inappropriate prescribing of antibiotics for ASB.

This audit also identified that 30% (92 of 303) patients had only one documented symptom of UTI. These included, acute confusion (35), fever/malaise (19), frequency/urgency (8), difficulty urinating (8), pain (20) haematuria (2). The presentation of atypical or non-specific symptoms presents a difficulty for diagnosis. Therefore, several differential diagnoses are considered resulting in the prescribing of a broad spectrum antibiotic.

The presence of non-specific signs and symptoms can be misleading. Flokas[7] suggests there is no association between these non-urinary indications and the presence or absence of bacteriuria. As such there is no evidence to suggest treating bacteriuria in this context[7]. Studies have identified barriers to the appropriate management of ASB such as knowledge gaps regarding recognition and management, poor familiarity with guidelines, difficultly evaluating non-specific indicators for UTI and prescriber anxiety regarding complications of ASB[5, 8].

SIGN 88[1]guidelines stipulate that the diagnosis of UTI is primarily based on signs and symptoms. Urinalysis and urine cultures may inform the management of UTI but should not have important implications for diagnosis. The urine culture should be used to identify bacteria and sensitivity. Dipstick testing should not be used to diagnose UTI in catheterised patients.

SIGN 88[1] recommends that women with uncomplicated UTI should receive empirical therapy and do not require urinalysis. Abbo[8] reiterates that cultures are not recommended for most women with acute uncomplicated cystitis, as a short course therapy is effective. Urinalysis should be used to guide treatment decisions in women with suspected uncomplicated UTI presenting with two or more symptoms of UTI.

Of the 138 patients diagnosed as uncomplicated UTI, 92% (127 of 138) did not have sepsis or meet the sepsis criteria and 8 % (11) had signs of sepsis. Of the 127 patients who did not have sepsis or meet the sepsis criteria 76% (96 of 127) had a urine culture requested. The unnecessary use of tests and subsequent antibiotic treatment may be minimised by developing simple decision rules, diagnostic guidelines or other educational interventions[19].

The Start Smart then focus[12] antimicrobial stewardship algorithm also advocates review of clinical condition and only starting antibiotics when there is clear evidence of infection.

A recommendation was issued by the Society of Healthcare Epidemiologists of America and the American Board of internal Medicines under the Choosing Wisely Campaign ‘don’t perform urinalysis or urine culture unless the patients have signs and symptoms of infection’ as tests can be falsely positive leading to over diagnosis and overtreatment.

Flokas[7] demonstrated that didactic session, audit and feedback initiatives restricting inappropriate ordering of urine cultures, are effective sustainable training methods in reducing prescribing and treatment of ASB.

Abbo[8] identified a decrease in antibiotic treatment of ASB by adopting a ‘wait and see’ approach of observation with delayed empiric antimicrobials.

Trautner[20] developed an evidence-based (‘*fast and frugal*’) algorithm to encourage a wait and see approach to ASB. This is a step up from their *“kicking CAUTI”* intervention which successfully decreased inappropriate screening for ASB and successfully decreased ASB overtreatment with antibiotics[21].

The audit identified that blood cultures were requested for 12% (16 of 138) patients diagnosed as uncomplicated UTI. Twenty five percent (4 of 16) of patients met the sepsis criteria. Blood cultures should only be requested for patients diagnosed with complicated UTI and urosepsis. Fifty one percent (150 of 303) of patients diagnosed with complicated UTI, pyelonephritis or urosepsis had documentation that a blood culture was requested. Blood cultures should be requested, and the request documented for all patients with complicated UTI, pyelonephritis and urosepsis.

To allow for comparison with the 2015 audit, the following areas, documented diagnosis of urosepsis, sepsis criteria and allergy status have been identified.

The audit identified that 89 patients had a documented diagnosis of urosepsis and of these 71% (63 of 89) of patients met the sepsis criteria and 29% (26 of 89) did not. This is an improvement on the 2015 audit finding of 40%.

Of the 105 patients who met the sepsis criteria 60% (63) had urosepsis documented as their diagnosis. Uncomplicated UTI was documented as diagnosis in 11 patients (11%) who met the sepsis criteria. This was similar to the 2015 audit finding of 10% of patients diagnosed as uncomplicated UTI meeting sepsis criteria.

Allergy status was not documented on the patient kardex in 3 out of 303 patients while 99% of patient kardexes had a documented allergy status. This is a decrease from the 2015 audit which had 100% of allergy status documented on the patient kardex.

Areas of good practice

- Ninety-four percent (154 of 163) of patients were prescribed the correct dose of empirical antibiotic in accordance with empirical guidelines

Areas for improvement

- Fifty seven percent (173 of 303) of inpatients diagnosed with UTI were prescribed an antibiotic recommended by empirical guidelines - a decrease of 29% from the 2015 audit.

- Fifty four percent (163 of 303) of patients diagnosed with a UTI were treated for the duration recommended by empirical guidelines.

- Fifty-four percent (165 of 303) of patients had a documented review date or intended duration of treatment on their kardex with 42% (128 of 303) having a documented review date or intended duration in their medical notes. This is in keeping with previous audits of 2015 and 2012 in which 37% and 38% respectively had intended duration of treatment documented.

- Seventy-three percent (221 of 303) of patients treated with UTI had clinical symptoms of UTI documented in their medical notes.

- Eighty-three percent (250 of 303) of patients had mid-stream urine cultures taken and 32% (96 of 303) of patients had blood cultures taken. The target set by the regional antimicrobial team was 95%. However this target may not always be appropriate, e.g. uncomplicated (lower) urine tract infection and asymptomatic bacteriuria do not require cultures to be taken. When to perform urine and blood cultures should be clarified in the empirical guidelines to reduce unnecessary testing.

- Forty-four percent of (134 of 303) of patients, who had blood and urine cultures taken, had culture results documented in their medical notes. This is necessary to guide treatment and allow de-escalation to narrow spectrum antibiotic.

Recommendations

1. Promote regional empirical antibiotic guidelines to all grades of medical staff.

2. Promoting the importance of documenting treatment plan, including review and intended duration of antibiotic. Consideration should be given to revising the regional kardex to include a more effective prompt for review and a dedicated section to document intended duration of therapy.

3. Promoting diagnosis of UTI by clinical signs and symptoms. Use of regional evidence based algorithm to aid diagnosis and classification of UTI. Target Accident and Emergencies.

4. Education and protocol in the management of asymptomatic bacteria. Development of algorithm and wait and see approach for treating ASB.

5. Education or protocol for when it is appropriate to take cultures and urinalysis, how to interpret cultures, using cultures to guide treatment and importance of documenting cultures in medical records.

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Appendix 1: Data collection proforma

Adherence to Trust Urinary Tract Infection Guideline Audit Form

Date completed: _____ Completed by: _____ Time Taken: _____

Patient Details

Patient Initials	**Hospital Number**
Patient Age	**Patient Gender** M ❑ F ❑
Trust	**Hospital**
Ward	**Speciality**

Allergies

Allergy status completed on drug chart?	Yes ❑ No ❑ Details _____

Admission and onset details

Indication for antibiotics
❑ uncomplicated (lower) UTI ❑ complicated (upper) UTI
❑ catheter associated UTI ❑ urinary sepsis ❑ proven ESBL

Other _____

Antimicrobial **indication** documented in **medical notes?** Yes ❑ No ❑
(Documented as_____)

Antimicrobia**l indication** written on **drug chart?** Yes ❑ No ❑

Antimicrobial **duration or review date** written on **drug chart?** Yes ❑ No ❑

Antimicrobial **duration or review date** written in **medical notes?** Yes ❑ No ❑

*PLEASE LIST ALL **ANTIMICROBRIAL(s)** that have been used to treat this INFECTION:*

Date initiated					
Antimicrobial					
Dose					
Route					
If iv therapy >48 hours is therapy justified? Y/N/NA					
Total duration					
Antibiotic therapy:					

1. Non-compliant with guidelines					
2. As per guidelines					
3. **As per sensitivities**					
4. **As per microbiology**					
5. **Other** *please comment* **Eg: clinical decision**					
Is gentamicin recommended by Trust guideline for this indication but not prescribed: Y/N/n/a					
If gentamicin indicated but not prescribed, please state reason: **1, 2 or 3 (see below)**					
1: renal impairment 2:need for gentamicin TDM 3:clinical decision 4: not documented					

Comments Box

Evidence of Infection: Investigations and Severity

<table>
<tr><td colspan="2">INVESTIGATION DOCUMENTED (AT START OF ANTIMICROBIAL TREATMENT)</td><td>Result</td></tr>
<tr><td colspan="2">Elevated White Cell Count: > 12x10^9/L?
Yes ❑/No ❑/Unknown ❑</td><td>White cell count documented (state if known:)
Yes ❑/No ❑</td></tr>
<tr><td colspan="2">Pyrexia: >38^{o}C or < 36^{o}C</td><td>Yes ❑/No ❑/Unknown ❑</td></tr>
<tr><td colspan="2">CRP : 10.0-50.0mg/L ❑ CRP: >50.0mg/L ❑ (state actual figure:)</td><td>Yes ❑/No ❑/Unknown ❑</td></tr>
<tr><td colspan="2">Sepsis: SEPSIS Criteria: Clinical impression of infection + 2; Temp >38°C or < 36°C , pulse > 90bpm, resp rate > 20/min, WCC >12 or <4 x 10^9/l.</td><td>Yes ❑/No ❑/Unknown ❑</td></tr>
<tr><td colspan="3">Symptoms of UTI: Pain or burning during urination❑ Pain in the bladder region❑ Difficulty urinating or urinary incontinence❑ Dysuria or loin pain over the affected kidney❑ Acute confusion❑ Fever, chills &/or general malaise❑ Frequency/urgency ❑
Haematuria ❑ Other ❑ (please specify_____)</td></tr>
<tr><td colspan="2">Renal impairment: eGFR <30ml/min
(if yes, please state Creatinine:)</td><td>Yes ❑/No ❑/Unknown ❑</td></tr>
</table>

<table>
<tr><td colspan="4">Urinalysis documented</td></tr>
<tr><td colspan="2">MSSU Yes ❑ No ❑ CSU Yes ❑ No❑ Incontinent ❑</td><td>Before antibiotics started?</td><td>Yes ❑ No ❑ Unknown ❑ N/A ❑</td></tr>
<tr><td>Urinalysis dipstick performed:</td><td>Yes ❑ No ❑</td><td>Urinalysis dipstick documented:</td><td>Yes ❑ No ❑ Unknown ❑ N/A ❑</td></tr>
<tr><td>Urinalysis (if performed) positive for:</td><td>Leucocytes ❑</td><td>Nitrites ❑</td><td>Blood ❑</td></tr>
<tr><td>Blood cultures requested</td><td>Yes ❑ No ❑ N/A ❑</td><td>Before antibiotics started:</td><td>Yes ❑ No ❑ Unknown ❑ N/A ❑</td></tr>
<tr><td>Any Culture results recorded in Medical notes?</td><td colspan="3">Yes ❑ No ❑ N/A ❑ (n/a if no samples sent)</td></tr>
<tr><td>Catheter insitu Yes ❑/No ❑

Is it long-term Yes ❑ No ❑

unknown ❑</td><td colspan="2">Co-morbidity Yes ❑/No ❑</td><td>Diabetic Yes ❑/No ❑</td></tr>
<tr><td colspan="4">Is there evidence of a Urinary Tract Infection? Yes ❑ No ❑ Unsure ❑</td></tr>
</table>

Please answer the following question(s) for any patient with samples sent for culturing– a Yes or No response may render subsequent questions ‘Not applicable’ (If no cultures sent, all answers will be N/A)

Culture results (Date of culture:)	**Yes**	**No**	**N/A**	
1: a: Was there a positive culture of a clinically relevant organism?				*SPECIFY SAMPLE TYPE & ORGANISM*
b: If positive, were sensitivities performed?				
c: If positive, was the organism sensitive to the empirical antibiotic regimen prescribed?				
d: If it was not sensitive, was the empirical antibiotic regimen changed?				
e: If not changed, was a reason documented for not changing the antibiotic *(e.g. clinical improvement)*				*SPECIFY REASON IF ANY RECORDED*
2: a: Was there an opportunity to change to a narrower spectrum antibiotic such as amoxicillin, Trimethoprim, nitrofurantoin? *(i.e. de-escalation)*				*SPECIFY WHAT NARROWER SPECTRUM ANTIBIOTICS, THE ORGANISM WAS SENSITIVE TO*
b: If Yes, was a change made to a narrower spectrum antibiotic?				
c: If No, was a reason for not de-escalating recorded				*SPECIFY REASON IF ANY RECORDED*

This form is now: Complete ❑ Needs to be reviewed further (please detail in comments box) ❑

Comments Box

Appendix 2: Project team

Name	Job Title	Trust Area	Role in Project
Loren Hagan	Clinical pharmacist	BHSCT	Project lead Data collection/ analysis and report writing
Caroline Mallon	Antimicrobial pharmacist	BHSCT	Supervisor/ internal reviewer
Grace Ong	Consultant microbiologist	BHSCT	Advisor
Ann McCorry	Antimicrobial pharmacist	SHSCT	Data collection
Fidelma Magee	Antimicrobial pharmacist	NHSCT	Data collection
Fiona Gilmore	Antimicrobial pharmacist	NHSCT	Data collection
Bernadette McCullagh	Antimicrobial pharmacist	SEHSCT	Data collection
Edel Leonard	Antimicrobial pharmacist	WHSCT	Data collection
Cairine Gormley	Antimicrobial pharmacist	WHSCT	Data collection
Aaron Brady	Antimicrobial pharmacist	BHSCT	Data validation

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