Guideline

Title: Paediatric Antimicrobial Guideline

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Scope: Paediatric patients aged 1 month and over (for patients less than 1 month old please see neonatal antimicrobial guideline)	**Document for Public Display:** Yes	
To be read in conjunction with the following documents: Infection control manual Sickle cell disease – care of the child or young person		
Required CQC evidence? Yes	**Key CQC Question:** Safe/Effective	

Disclaimer

Since every patient's history is different, and even the most exhaustive sources of information cannot cover every possible eventuality, you should be aware that all information is provided in this document on the basis that the healthcare professionals responsible for patient care will retain full and sole responsibility for decisions relating to patient care; the document is intended to supplement, not substitute for, the expertise and judgment of physicians, pharmacists or other

healthcare professionals and should not be taken as an indication of suitability of a particular treatment for a particular individual.

The ultimate responsibility for the use of the guideline, dosage of drugs and correct following of instructions as well as the interpretation of the published material **lies solely with you** as the medical practitioner.

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Guideline Statement

The guideline was developed in response to the department of health recommendations contained in the documents Healthcare associated infections, in particular infection caused by Clostridium difficile and the code of practice for the Prevention and Control of Healthcare Associated Infections.

The Code of Practice requires NHS bodies to demonstrate compliance with national guidance and good practice in infection prevention and control in order to minimize the risk of infection to

patients and requests urgent action to control the growing problems of Clostridium difficile infections.

Milton Keynes University Hospital NHS Foundation Trust has set working towards the new local targets as a high priority.

This guideline seeks to prevent potential clinical risks associated with the prescribing of antibiotics, in particular with the predisposition of colonisation/infection with organisms such as Clostridium difficile and MRSA and other multi-resistant organisms

Executive Summary

- Antimicrobial Stewardship Programme is seen as a key component in the reduction of HCAI

- **Practice prudent use of antibiotics**

Optimise clinical outcome while minimising unintended consequences of antimicrobial usage -*Clostridium difficile* infection, side effects, drug resistance and harmful changes to body's protective microflora

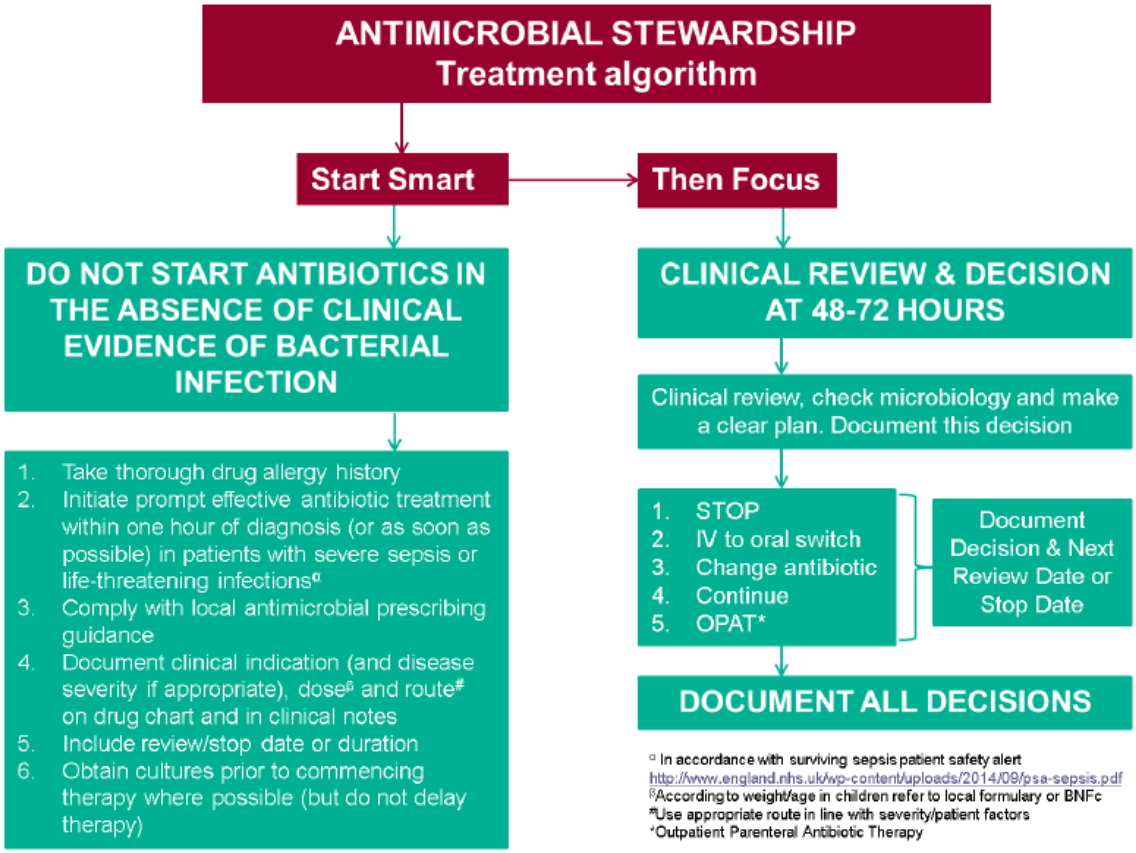
- **Start Smart- then focus**

Start smart
Start only if indicated, use local empirical guidelines, document clearly, and as a general rule obtain cultures
Then focus – review by 48-72 hours and make clear 'Antimicrobial Prescribing Decisions which has the following options:
►stop ►continue and review again at 72 hours ►change ►switch IV to oral ►consider ambulated/outpatient parenteral antibiotic therapy.

- Inappropriate use of broad spectrum antibiotics is associated with selection of resistance in bacteria – MRSA, ESBLs, *Clostridium difficile,* CPE etc.

- Advocating patient safety and auditing of antimicrobial stewardship in hospitals should be based around the principles stated in the AMS algorithm below (Figure 1).

Figure 1: Antimicrobial Stewardship (AMS) – treatment algorithm



1.0 Roles and Responsibilities:

All Clinical staff within the paediatric division in the Trust are responsible for ensuring the guideline is adhered to.

1.1 Information to Parents/carers

It is the responsibility of all clinicians to ensure that treatment and care should take into account the child's or young person's individual needs and preferences, as well as those of their parents or carers, where possible. In an emergency, if the person with parental responsibility cannot be contacted, **healthcare professionals may give treatment immediately when it is in the child's or young person's best interests.**

2.0 Implementation and dissemination of document

This document will be widely disseminated via the intranet. The guideline will be a feature of New Doctor Induction training and Non-Medical Prescribers training. This guideline can be accessed via the trust intranet.

Financial implications will be monitored by the Pharmacy Department using Drug Usage Reviews.

3.0 Processes and procedures

3.1 Clinical Guidelines for Antibiotic Therapy:

3.1.1 General Guidelines

1. The major errors of antibiotic therapy are unnecessary use and an unnecessarily extended duration of treatment.

2. Where possible, specimens should be obtained before starting antibiotics.

3. Antibiotics prescribed empirically should be reviewed with culture and sensitivity results.

4. Do not use antibiotics unnecessarily; antibiotic use can predispose to colonisation/infection with organisms such as *Clostridium difficile,* MRSA. and multi-resistant organisms such as Extended Spectrum Beta-lactamase (ESBL) producer and carbapenemase producing enterobacteriacea (CPE)

5. Systemic antibiotics should not be used topically as this will encourage resistance, e.g. Gentamicin or Fusidic acid.

6. IV to oral switch:

   All IV antibiotic prescriptions should be reviewed daily by the Doctors. Antibiotic therapy in meningitis, endocarditis, septic arthritis, osteomyelitis and severe sepsis should also be reviewed regularly but will require prolonged courses of IV antibiotics. If not reviewed, the ward pharmacist will consult a member of the team starting with the Registrar and escalate to the Consultant, if needed, to obtain a review. Consideration should be given to the use of oral antibiotics where appropriate –' IV oral switch' (i.e. there should already be response to therapy with a temperature of less than 38°C for 24 - 48 hours and the patient needs to be able to absorb oral antibiotics) and where a suitable oral alternative is available. All oral antibiotic prescriptions should then be reviewed routinely at 5 days.

7. Oral cephalosporins do not have the same therapeutic cover or indications as IV cephalosporins. **Please discuss IV to oral switch with the Consultant Microbiologist if sensitivity data is not available.**

8. If renal function is impaired, the use of Aminoglycosides (e.g. Gentamicin) or Vancomycin may not be appropriate and an alternative antibiotic may need to be considered. Please contact the Microbiologist/ward Pharmacist for advice.

9. If liver function alters during antibiotic therapy discuss alternative options with the Microbiologist.

10. The dose and frequency of administration will vary according to age, maturity, body weight, renal function and type and severity of infection.

11. When prescribing a dose for children as mg/kg, be aware of maximum doses. Dosing should follow recommendations

12. Monitoring of all antibiotics with a narrow therapeutic range e.g. Aminoglycoside and vancomycin, are required.

13. Antibiotics are colour coded to highlight risk category for *C difficile* infection.
    Red= high risk **Orange** = moderate risk **Black** = low risk

14. Penicillin allergy: Consider individual allergic reactions; 0.5-6.5% of penicillin-sensitive patients will also be allergic to cephalosporins. Patients who have had life threatening reactions to penicillin should **not** be prescribed cephalosporins or carbapenems. A proper history should be taken and should include:

    - If severe reaction (anaphylaxis, bronchospasm or urticaria or less severe form with rash, itching etc.
    - When (age) and why the medication was taken?
    - When symptoms began?
    - Description of symptoms.
    - How long did the symptoms last?
    - Any other concurrent infections?
    - Hospital admission

If unable to take a history, alternative antibiotics should be given and reviewed later.

15. Advice on specimens or prescribing is always available from the Consultant Microbiologist.

16. Documentation: Must document CLEARLY in the patient's notes and drug chart the antibiotic, **indication, IV/oral, duration, review/stop date** for every prescription, at the time of prescribing.

17. If you intend to use an antibiotic for more than 48 hours intravenously or more than 5 days in total the reason(s) should be CLEARLY documented in the patients notes.

18. This guide should be modified according to laboratory results and departmental policies.

19. Any doses stated are paediatric doses (beyond the neonatal stage), assuming no hepatic / renal dysfunction.

20. For further details of individual dosage regimes, a relevant text such as the current Childrens' British National Formulary (CBNF) or specialist text e.g. Renal Drug Database should be consulted.

21. Allergic reaction should be clearly documented and reported.

22. If the patient is under shared care with a tertiary center, please discuss any changes to antimicrobial treatment with the specialist practitioner responsible for the patient

Intravenous Antibiotics should routinely be reviewed daily
Oral Antibiotics should routinely be reviewed after 5 days

3.1.2 Lower Respiratory Tract Infections

For cystic fibrosis patients please refer to Clinical Guidelines: Care of Children with Cystic Fibrosis 2011 - Royal Brompton & Harefield NHS Foundation Trust

****Sputum samples must be taken where possible and antibiotics reviewed with culture results****			
Clinical condition	**Possible Pathogen**	**Treatment choice**	**Notes**
Community Acquired Pneumonia	Streptococcus pneumonia Haemophilus influenza	Mild/Moderate PO amoxicillin 5 days Severe (or not tolerating oral) IV amoxicillin 7 days (review to oral when able) Penicillin allergy > 1 month old PO/IV Clarithromycin 7 days **OR** >6 months old PO azithromycin 3 days	Atypical pathogens use PO clarithromycin 10-14 days **OR** > 6 months old PO azithromycin 3 days Add flucloxacillin if staphylococcal infection suspected 2nd line for deterioration or no improvement after 48 hours IV/PO co-amoxiclav + IV/PO clarihromycin
Hospital Acquired Pneumonia	Streptococcus pneumonia Haemophilus influenza Staphylococcus aureus E.coli Pseudomonas Other multi-resistant organisms	Mild to moderate early onset (less than 5 days): Treat as severe community acquired pneumonia. Severe or late onset (post 5 days of admission): IV Piperacillin & tazobactam (Tazocin) 7 days	
Aspiration Pneumonia	Streptococcus pneumonia Haemophilus influenza Staphylococcus aureus Anaerobes	1st Line PO/IV co-amoxiclav 7-10 days Penicillin allergy PO/IV Metronidazole + PO/IV clarithromycin 7-10 days	

3.1.3 Upper Respiratory Tract Infections

Clinical Condition	Possible pathogen	Treatment choice	Notes
Eppiglottitis	H. Influenza	IV Cefotaxime 10 days	
Pharyngitis/tonsilitis	Staphylococcus aureus Group A streptococcus	Mild to moderate PO Penicillin V (IV benzylpenicillin if not tolerating orally) 10 days Penicillin Allergy PO Clarithromycin 10 days	Majority are viral. Consider no antibacterial treatment for 24-48 hours, only treat with antibiotics if streptococcal
		Severe IV ceftriaxone + refer to ENT Penicillin allergy (anaphylaxis) Contact microbiology for advice	
Otitis media	Streptococcus pneumonia Streptococcus pugenes (Group A streptococci)	PO Amoxicillin 5 days Penicillin Allergy PO Clarithromycin 5 days	Majority are viral. Consider no antibacterial treatment for 24-48 hours
Lymphadenitis		Mild to moderate PO co-amoxiclav Penicillin allergy PO clarithromycin 7 days Severe IV Ceftriaxone + IV/PO metronidazole 7 days Refer to ENT Penicillin allergy (anaphylaxis) Contact microbiology for advice	

3.1.4 Gastro-intestinal System

Clostridium difficile infection

C difficile infection (CDI) causes serious illness and outbreaks among hospital in-patients.

Who is most at risk?

C.difficile is present asymptomatically in the gut flora of approximately 30% of infants between 1 and 6 months of age, which gradually decreases to a similar rate of carriage to a non-hospitalised adult (approximately 3%) by 3 years of age. This rises to over 40% in hospitalized patients, due to nosocomial transmission. *C.difficile* spores can survive for several months or even years on environmental surfaces on wards. Patients most at risk are:

- Antimicrobial use (multiple/long courses of broad spectrum and high risk antimicrobials)
- Multiple comorbidities
- Hospital admission (recent admission/increased length of stay/multiple admissions)
- ITU patients
- Presence of nasogastric tube/feeding tubes
- Patients receiving concomitant treatment with PPIs.
- Receiving chemotherapy/immunosuppression
- Use of laxatives/surgery/non-surgical gastro-intestinal procedures (e.g. endoscopy)

Clinical teams should review antibiotic prescribing regularly, adhere to the Trust Antimicrobial Guidelines. All unnecessary antibiotic prescriptions should be stopped and change those that do not comply with guidelines. Where guidelines have not been adhered to please ensure this has been documented in the patient's medical notes including reasons for deviation. Prudent use of antibiotics should be practiced by all concerned – 'Start Smart then Focus'.

Early diagnosis and treatment is crucial in managing cases of CDI. Apply the following mnemonic (SIGHT) protocol when managing suspected potentially infectious diarrhoea:

Suspect that a case may be infective where there is no clear alternative cause of diarrhoea.
Isolate the patient
Gloves and aprons must be used for all contacts with patient and their environment
Hand washing with soap and water before and after patient and patient's environment.
Test the stool for toxin by sending a specimen immediately

What is the role of antibiotics in *C.difficile* associated disease?

There are sufficient reports in the literature to merit discontinuation of widespread use of quinolones, and cephalosporins, clindamycin and co-amoxiclav. **Wherever possible use low risk antibiotics.**

High Risk	Moderate Risk	Low Risk
Quinolones	Macrolides	Benzylpenicillin
Cephlasporins	Amoxicillin	Pivmecillinam
	Piperacillin/tazobactam (Tazocin)	Flucloxacillin
Clindamycin	Carbapenems	Trimethoprim
Co-amoxiclav		Nitrofurantoin
		Aminoglycosides
		Tetracyclines
		Aztreonam
		Glycopepetides
		Metronidazole

Assessment of Severity of CDI Disease AND Treatment of *First* Episodes, Recurrence and High risk patients

Mild
- Not associated with raised WCC
- Associated with <3 stools of type 5-7 on **Bristol Stool chart per day

Moderate
- Associated with raised WCC that is <15x10^9/L
- Associated with 3-5 stools type 5-7 on **Bristol stool chart per day

Severe
- Associated with a WCC > 15x10^9/L (although low WCC also seen)
- Or an acute rising serum creatinine (>50% increase above baseline)
- Or a temperature of > 38.5°C
- Or evidence of severe colitis (abdominal or radiological signs)
- The number of stools may be less reliable indicator of severity

Life threatening
- As above plus hypotension, partial or complete ileus
- Or toxic megacolon
- Or CT evidence of severe disease

Antimicrobial Recommendations		
Clinical Condition	**Recommended Empirical Treatment**	**Duration/Comments**
MILD	If treatment required: Metronidazole PO	Duration: 10-14 days May not require specific *C. difficile* antibiotic treatment
MODERATE	Metronidazole PO	Duration 10-14 days
SEVERE	Vancomycin PO	Duration 10-14 days If no response, discuss with a Consultant Microbiologist.
	Following discussion with Consultant Microbiologist: Vancomycin PO +/- Metronidazole IV	Determined by response
LIFE THREATENING	Vancomycin via NG tube or rectal instillation PLUS Metronidazole IV	10-14 days Patients should be closely monitored with surgical input. • Measure blood lactate. • Colectomy considered if caecal dilatation is >10cm • Colectomy is best performed before blood lactate rises >5 mmmo/L, when survival is extremely poor

PERSISTENT DIARRHOEA

There may be persistent diarrhoea due to post-infective irritable bowel syndrome.
The patient may be treated with an anti-motility agent such as loperamide PRN.

ALL of the following apply:

- diarrhoea persists despite 20 days' treatment
- the patient is stable
- the daily number of type 5–7** motions has decreased
- the WCC is normal
- there is no abdominal pain or distension

The patient should be closely observed for evidence of a therapeutic response and to ensure there is no evidence of colonic dilatation. **NOTE: Anti-motility agents should not be prescribed in acute CDI**

**** Bristol Stool Scale available at:**
https://www.nice.org.uk/guidance/cg99/evidence/cg99-constipation-in-children-and-young-people-full-guidance3, Page 32

Stool sample should be taken and antibiotic reviewed with culture results			
Clinical Condition	**Possible pathogen**	**Treatment choice**	**Notes**
Gastroenteritis		Usually self-limiting and may not be bacterial. Antibiotics not indicated	
Campylobacter enteritis Notify all cases of bloody diarrhoea to CCDC, contactable through hospital switchboard		Usually self-limiting. Antibiotics not indicated Immunocompromised or severe infection: PO/IV Clarithromycin 5 days	Route of administration dependent on severity of symptoms
Typhoid	Salmonalla typhi Salmonella paratyphi	IV ceftriaxone	**Ensure that stool samples are taken**
Antibiotic associated colitis **See algorithm above**	Clostridium difficile	First episode mild to moderate infection: PO Metronidazole 10-14 days Severe infection: PO Vancomycin 10-14 days Severe infection not responding to vancomycin or life threatening infection: PO vancomycin + IV metronidazole 10-14 days	**DO NOT** use IV vancomycin as it is not systemically available in the colon Stop all other antibacterials if possible. If antibiotic treatment is required, please prescribe a low risk antibiotic and contact microbiology for further advice Review PPIs and laxatives
Appendicitis		If bridging therapy to theatre required or septic **AND** surgery expected >8 hours later: IV co-amoxiclav + IV metronidazole At induction to surgery (if not received in last 8 hours): IV co-amoxiclav + IV metronidazole Penicillin allergy: IV ceftriaxone + IV metronidazole Penicillin allergy	No post-operative doses required unless: • Inflamed - continue for 24 hours post-op then review • Perforated/gangrenous/ complicated surgery -continue for 72 hours post-op then review

		anaphylaxis: Discuss with microbiology	

3.1.5 Urinary tract infections

****Urine sample must be taken and antibiotics reviewed with culture results****			
Clinical Condition	**Possible Pathogen**	**Treatment Choice**	**Notes**
Acute Pyelonephritis/Upper UTI	E coli Klebsiella spp Proteus spp Enterococcus spp P. aeroginosa Multiresistant organisms	< 3 months of age IV Cefotaxime + IV amoxicillin 7-10 days	Consider changing to IV ceftriaxone to enable ambulatory administration if ongoing IV antibiotics are required
		>3 months of age IV ceftriaxone Penicillin Allergy (anaphylaxis) IV gentamicin + IV teicoplanin 7-10 days	
Cystitis/lower UTI	E coli Klebsiella spp Proteus spp Staphylococci spp (coagulase negative)	PO Cefalexin Penicillin allergy (anaphylaxis) PO nitrofurantoin	Give for 3 days if >3 month old with uncomplicated lower UTI

3.1.6 Skin and Soft Tissue Infections

Swabs at infection site must be taken and antibiotics reviewed with culture results			
Clinical condition	**Possible Pathogen**	**Treatment choice**	**Notes**
Impetigo/ infected eczema	Staphlococcus Aureus Streptococcus Pyogenes	Mild/moderate PO Flucloxacillin 10 days Penicillin Allergy PO clarithromycin 10 days Severe IV Flucloxacillin +/- IV Benzylpenicillin 10 days Penicillin allergy IV Teicoplanin 10 days	If not responding or Group A Streptococcus suspected add PO penicillin V Add PO/IV acyclovir if eczema herpeticum suspected
Cellulitis, erysipelas	Group A strep S. aureus	IV Flucloxacillin + IV Benzylpenicillin 10 days Penicillin allergy IV/PO Clarithromycin 10 days	Switch to PO flucloxacillin + PO penicillin V when able
Peri-orbital cellulitis	H Influenzae S. aureus Streptococci	IV Co-amoxiclav If intracranial extension suspected IV ceftriaxone + IV metronidazole Penicillin allergy (anaphylaxis) IV clarithromycin + IV metronidazole	Patients should receive IV antibiotics for a minimum of 48 hours, with conversion to oral depending on clinical response. Total course 10 days (may need longer with intracranial extension)
Orbital cellulitis	Group A strep S. aureus H. Influenzae M. catarrhalis Anaerobes	IV ceftriaxone + IV metronidazole Penicillin allergy (anaphylaxis) IV clarithromycin + IV metronidazole	Review and stop metronidazole after 24-48 hours Review daily and change to PO co-amoxiclav when able Total course 7 days

Bites- Human/Animal	Pasteurella S. Aureus Anaerobes	Mild/ Moderate PO Co-amoxiclav Severe IV co-amoxiclav Penicillin allergy (non-anaphylaxis) IV cefuroxime + IV/PO metronidazole Penicillin allergy (anaphylaxis) IV/PO Ciprofloxacin + IV/PO metronidazole 5-7 days	

3.1.7 Eye infections

****Take eye swabs and review choice with culture results****			
Clinical condition	**Possible Pathogen**	**Treatment choice**	**Notes**
Conjunctivitis	S. aureus S. pneumoniae H. Influenzae	Chloramphenicol eye drops 1 drop 2 hourly then reduce frequency as infection is controlled Chloramphenicol eye ointment – apply either at night (if eye drops used during the day) or 3-4 times daily (if eye ointment used alone) Continue for 48 hours after healing	
	Pseudomonas	Gentamicin eye drops 1 drop 2 hourly then reduce frequency as infection is controlled and continue for 48 hours after healing	

3.1.8 Cardiovascular System

**** Collect blood cultures (3 sets) without delay PRIOR to antibiotic therapy and review antibiotic choice with culture results****			
Clinical condition	**Possible Pathogen**	**Treatment choice**	**Notes**
Endocarditis: initial blind therapy	Staphylococci Streptococci Enterococci 'HACEK' mico-organisms	IV Flucloxacillin (or Benzylpenicillin if symptoms less severe) + IV Gentamicin (TDS dosing) Penicillin allergy/ MRSA/ cardiac prostheses present: IV Vancomycin + PO Rifampicin + IV Gentamicin (TDS dosing) 4-6 weeks	Discuss with consultant microbiologist

3.1.9 Central Nervous System

****Notify all cases of meningitis to CCDC, contactable through hospital switchboard****			
Clinical condition	**Possible Pathogen**	**Treatment choice**	**Notes**
Meningitis: Initial blind therapy <3 months of age:	Group B haemolytic streptococci E. coli N. Meningitidis Gram negative entero -bacteria Listeria	IV Cefotaxime + IV Amoxicillin + IV Aciclovir Penicillin Allergy IV Cefotaxime + IV Aciclovir and contact Microbiology 14 days	Discuss with consultant microbiologist Consider changing to IV ceftriaxone to enable ambulatory administration
Meningitis: Initial blind therapy >3 months of age:	Meningococci Pneumococci H. Influenza N. meningitidis Consider TB	IV Ceftriaxone Penicillin allergy IV Chloramphenicol 10 days	Discuss with consultant microbiologist Consider adjunct treatment with dexamethasone, preferably within 4 hours of starting antibiotic, (but not more than 12 hours

			after the first antibiotic dose). Avoid in septic shock, meningococcal septicaemia, immunocompromised, or meningitis following surgery.

3.1.10 Musculoskeletal system

Clinical condition	Possible Pathogen	Treatment choice	Notes
Osteomyelitis	S. aureus Group A strep H. Influenzae S. pneumoniae N. meningitidis	IV Flucloxacillin + PO Rifampicin Penicillin allergy or MRSA: IV Vancomycin 6 weeks	Discuss choice of antibiotics and duration with microbiology
Septic arthritis		IV Flucloxacillin Penicillin allergy or MRSA: IV Vancomycin 4-6 weeks	Discuss choice of antibiotics and duration with microbiology

3.1.11 Sepsis and blood infections

For sickle cell patients refer to MKH Guideline Sickle Cell Disease - Care of the Child or Young Person

Blood cultures must be taken and review antibiotics with culture results			
Clinical condition	**Possible Pathogen**	**Treatment choice**	**Notes**
Sepsis: < 3 months of age	Group B strep E. coli Listeria	IV Cefotaxime + amoxicillin Penicillin allergy IV Cefotaxime + contact microbiology 7 days	
Sepsis: > 3 months of age	N. Meningitidis S. pneumoniae S. aureus	IV Ceftriaxone Penicillin allergy (anaphylaxis) IV chloramphenicol + IV gentamicin (single dose)	

		7 days	
Febrile Neutropenia	Coliforms Pseudomonas Staphylococci Streptococci	IV Piperacillin and tazobactam (Tazocin) Penicillin allergy IV Ciprofloxacin + IV Vancomycin Review daily	Please refer to Oxford Febrile Neutropenia Guideline
Meningococcal disease	N. Meningitidis	IV ceftriaxone 7 days	
Pyrexia of unknown origin (PUO)		IV Ceftriaxone Review daily	

4.0 Statement of evidence/references

Jangi, S., Lamont, T. (2010) Asymptomatic colonization by clostridium difficile in infants: Implications for disease in later life. Journal of Pediatric Gastroenterology and Nutrition; Vol 51 (1) 2-7

Bacterial meningitis and meningococcal septicaemia: management of bacterial meningitis and meningococcal septicaemia in children and young people younger than 16 years in primary and secondary care. NICE Clinical Guidance 102, issued June 2010. www.nice.org.uk/guidance/cg102

Diarrhoea and vomiting in children: diarrhoea and vomiting caused by gastroenteritis: diagnosis assessment and management in children younger than 5 years. NICE Clinical Guidance 84, issued April 2009. www.nice.org.uk/guidance/cg84

Feverish illness in children: assessment and initial management in children younger than 5 years. NICE Clinical Guidance 160, issued may 2013. www.nice.org.uk/guidance/cg160

Northampton General Hospital NHS Trust (Reviewed 2014) Guideline for the prescribing of antibiotics for paediatric patients

Nottingham Children's Hospital (Reviewed 2013) Periorbital cellulitis

Oxford university Hospital NHS Trust (updated 2014) Antimicrobial guidelines for paediatrics

Paediatric Formulary Committee. *BNF for Children* [2014-2015]. London: BMJ Group, Pharmaceutical Press, and RCPCH Publications; [2014]

Public Health England (2013). Revised: May 2013. *Updated guidance on the management and treatment of Clostridium difficile infection.* London: Public Health England.
Urinary tract infection in children: diagnosis, management and long-term treatment. NICE Clinical Guidance 54, issued August 2007. www.nice.org.uk/guidance/cg54

5.0 Governance

5.1 Record of changes to document

Version number: 4		**Date:** July 2015		
Section Number	**Amendment**	**Deletion**	**Addition**	**Reason**
	Treatment of typhoid from mild: no treatment severe: Ceftrixatone, to treat with Ceftriaxone			

5.2 Consultation History

Stakeholders Name/Board	**Area of Expertise**	**Date Sent**	**Date Received**	**Comments**	**Endorsed Yes/No**
Matthew Burnett and Suraiya Chandratillake	Antimicrobial Pharmacist	September 2014		Reviewed	Yes
Stephanie Brown	Paediatric Pharmacist	April 2015 October 2015	April 2015 October 2015	Comments made	Yes
Dr Ragunathan and Dr Anguvaa	Consultant Microbiologist and Paediatric Consultant	April 2015	April 2015	Comments made	Yes
Paediatric Patient Information Group	Multi-disciplinary	June 2015	June 2015	Comments made	Yes
Antimicrobial Stewardship Group	Multi-disciplinary	June 2015	June 2015	No comments Approved	
Paediatric Clinical Improvement Group	Multi-disciplinary	July 2015	July 2015	No comments Approved	
Pharmacy Clinical Improvement Group	Multi-disciplinary	July 2015	July 2015	No comments Approved	
Clinical Board	Multi-disciplinary	August 2015	August 2015	No comments Approved	

5.3 Audit and monitoring

This Guideline outlines the process for document development will be monitored on an ongoing basis. The centralisation of the process for development of documents will enable the Trust to audit more effectively. The centralisation in recording documents onto a Quality Management database will ensure the process is robust.

Audit/Monitoring Criteria	Tool	Audit Lead	Frequency of Audit	Responsible Committee/Board
Compliance with the policy- Documenting indication, appropriate drug for indication, documenting review dates/stop dates in notes and drug chart, restricted antibiotic use	Audit on policy adherence – Divisional level	Antimicrobial Pharmacists / Consultant Microbiologist	Annual presentation at Trust wide Audit Plenary Sessions. Reports to Committees as requested/appropriate.	Antimicrobial Stewardship Group (AMSG)
Drug usage & Financial Expenditure	Statistical reports from the Pharmacy department showing drug usage and financial expenditure (drug usage review).	Antimicrobial Pharmacists / Consultant Microbiologist	Every 4 months	Antimicrobial Stewardship Group

5.4 Equality Impact Assessment

This document has been assessed using the Trust's Equality Impact Assessment Screening Tool. No detailed action plan is required. Any ad-hoc incident which highlights a potential problem will be addressed by the monitoring committee.

Impact	Age	Disability	Race	Gender	Religion or Belief	Sexual Orientation
Do different groups have different needs, experiences, issues and priorities in relation to the proposed Guideline?	No	No	No	No	No	No
Is there potential for or evidence that the proposed Guideline will not promote equality of opportunity for all and promote good relations between different groups?	No	No	No	No	No	No
Is there potential for or evidence that the proposed Guideline will affect different population groups differently (including possibly discriminating against certain groups)?	No	No	No	No	No	No
Is there public concern (including media, academic, voluntary or sector specific interest) in potential discrimination against a particular population group or groups?	No	No	No	No	No	No

Appendix 1: Oral antibiotic doses

Please refer to BNFc for latest dosing guidance

Drug	Age	Dose	Comments
Amoxicillin	1 month – 1 year	125mg TDS	Increase if necessary up to 30mg/kg (max 1g) TDS
	1 year – 5 years	250mg TDS	
	5 years – 12 years	500mg TDS	
	12 years – 18 years	500mg TDS	Can increase to 1g TDS in severe infections
Azithromycin >6 months	Body weight <15kg	10mg/kg OD	To be used in patients >6 months old only
	Body weight 15-25kg	200mg OD	
	Body-weight 26-35kg	300mg OD	
	Body-weight 36-45kg	400mg OD	
	Body-weight over 45kg	500mg OD	
Cefalexin	1 month – 1 year	125mg BD	
	1 year – 5 years	125mg TDS	
	5 years – 12 years	250mg TDS	
	12 years – 18 years	500mg BD-TDS	Can increase to 1-1.5g 3-4 times daily for severe infections
Ciprofloxacin	1 month – 18 years	20mg/kg (max 750mg) BD	
Clarithromycin 1month -12 years	Body weight under 8kg	7.5mg/kg BD	
	Body-weight 8-11kg	62.5mg BD	
	Body weight 12-19kg	125mg BD	
	Body-weight 20-29kg	187.5mg BD	
	Body-weight 30-40mg	250mg BD	
Clarithromycin	12 years – 18 years	250mg BD	Can increase to 500mg BD in severe infections
Co-amoxiclav	<1 year	0.25mL/kg of 125/31 suspension TDS	Dose doubled in severe infections
	1 year – 6 years	5mL of 125/31 suspension TDS	
	6 years – 12 years	5mL of 250/62 suspension TDS	
	12 years – 18 years	375mg TDS	Increase to 625mg TDS in severe infections
Doxycycline	12 years – 18 years	200mg first day, then 100mg daily	Can increase to 200mg daily in severe infections
Metronidazole	1 month – 2 months	7.5mg/kg BD	
	2 months – 12 years	7.5mg/kg (max 400mg) TDS	
	12 years – 18 years	400mg TDS	
Nitrofurantoin	3 months – 12 years	750 micrograms/kg	

		QDS	
	12 years – 18 years	50mg QDS	Can increase up to 100mg QDS in severe chronic recurrent infections
Phenoxymethylpenicillin	1 month – 1 year	62.5mg QDS	Increase up to 12.5mg/kg QDS if necessary
	1 year – 6 years	125mg QDS	
	6 years – 12 years	250mg QDS	
	12 years – 18 years	500mg QDS	Can increase up to 1g QDS
Rifampicin	1 month – 1 year	5-10mg/kg BD	
	1 year – 18 years	10mg/kg (max 600mg) BD	
Trimethoprim	1 month – 6 weeks	4mg/kg (max 200mg) BD	
	6 weeks – 6 months	25mg BD	
	6 months – 6 years	50mg BD	
	6 years – 12 years	100mg BD	
	12 years – 18 years	200mg BD	
Vancomycin (c diff)	1 month – 5 years	5mg/kg QDS	Can increase up to 10mg/kg QDS with microbiology advice
	5 years – 12 years	62.5mg QDS	Can increase up to 250mg QDS with microbiology advice
	12 year – 18 years	125mg QDS	Can increase up to 500mg QDS with microbiology advice

References

Paediatric Formulary Committee. *BNF for Children* [2014-2015]. London: BMJ Group, Pharmaceutical Press, and RCPCH Publications; [2014]

Appendix 2: IV antibiotic doses

Please refer to BNFc for latest dosing guidance. Please consult product literature for displacement values when preparing IV antibiotics.

Drug	Age	Dose	Comments
Amikacin	See appendix 3		
Amoxicillin	1 month – 18 years	20-30mg/kg (max 500mg) TDS	Double in severe infections (max 4g daily)
		Meningitis: 50mg/kg every 4-6 hours (max 2g every 4 hours)	
Aztreonam	1 month – 2 years	30mg/kg every 6-8 hours	
	2 years – 12 years	30mg/kg every 6-8 hours	Can be increased to 50mg/kg (max 2g) in severe infection
Benzylpenicillin	1 month – 18 years	25mg/kg QDS	Can increase up to 50mg/kg every 4-6 hours (max 2.4g every 4 hours) in severe infections
Cefotaxime	1 month – 18 years	50mg/kg BD-TDS	Increase to QDS in very severe infections (max 12g daily).
		Meningitis 50mg/kg QDS (max 12g daily)	
Ceftriaxone	1 month – 12 years Body weight under 50kg	50mg/kg OD	Can increase up to 80mg/kg in severe infections. IV doses over 50mg/kg via infusion only
		Meningitis 80mg/kg OD	
	1 month – 12 years Body weight over 50kg and 12 years – 18 years	1g daily	Can be increased to 2-4g in severe infections. IV doses above 1g via infusion only
		Meningitis 2-4g OD	Via infusion only
Cefuroxime	1 month – 18 years	20mg.kg (max 750mg) TDS	Can increase to 50-60mg/kg (max 1.5g) every 6-8 hours in severe infection
Chloramphenicol	1 month – 18 years	12.5mg/kg QDS	Doses may be doubled in severe

			infections such as septicaemia, meningitis. Plasma concentrations must be measured and doses reduced as soon as indicated
Clarithromycin	1 month – 12 years	7.5mg/kg (max 500mg) BD	
	12 years – 18 years	500mg BD	
Co-amoxiclav	1 month – 3 months	30mg/kg BD	
	3 months-18 years	30mg/kg (max 1.2g) TDS	
Flucloxacillin	1 month – 18 years	12.5-25mg/kg (max 1g) QDS	Double in severe infections
		Osteomyelitis 50mg/kg (max 2g) QDS	
Gentamicin	See appendix 3		
Meropenem	1 month – 12 years Body weight under 50kg	10-20mg/kg TDS	
	1 month – 12 years Body weight over 50kg and 12 years – 18 years	0.5-1g TDS	
Metronidazole	Child 1-2 months	15mg/kg as a single loading dose, followed after 8 hours by 7.5mg/kg TDS	
	2 months- 18 years	7.5mg/kg (max 500mg) TDS	
Piperacillin & tazobactam (Tazocin)	1 month – 12 years	90mg/kg (max 4.5g) TDS	Neutropenia: 90mg/kg (max 4.5g) every 6 hours
	12 years – 18 years	4.5g TDS	
Teicoplanin	See appendix 4		
Tobramycin	See appendix 3		
Vancomycin	See appendix 4		

References

Paediatric Formulary Committee. *BNF for Children* [2014-2015]. London: BMJ Group, Pharmaceutical Press, and RCPCH Publications; [2014]

Appendix 3: Treatment Protocol for Aminoglycosides in Paediatric Patients

For use in (clinical areas):	Paediatrics
For use by (staff groups):	All Medical, Nursing and Pharmacy Staff
For use for (patients):	Paediatric Patients (NB. See Exclusion Criteria below)
Document owner:	Pharmacy Department
Status:	Approved

Aminoglycoside Once Daily Dosing Regimen

To be used in patients >1 month old with normal renal function. This protocol DOES NOT apply to patients with the following exclusion criteria:

Endocarditis — Prophylaxis
Ascites — Burns patients
Pregnancy

Aminoglycosides distribute poorly into adipose tissue. Patients who are obese (>20% above lean body weight) should receive a relatively lower dose. In overweight children, lean body weight can be estimated by the 50th centile on the weight-for-age chart.

DOSES: Children > 1 month and normal renal function *(over 44 weeks corrected gestational age)*		**TROUGH LEVELS:** 18-24 hours after dose given	
Gentamicin	7mg/kg OD	Max: 420mg*	Gentamicin < 1mg/l
Tobramycin	7mg/kg OD *(10mg/kg for CF)*	Max: 420mg* *(Max: 660mg*)*	Tobramycin < 1mg/l
Amikacin	20mg/kg OD *(30mg/kg for CF)*	Max: 1200mg* *(Max: 1500mg)*	Amikacin < 5mg/l *(<3mg/l for CF)*
**Maximum for a child > 60kg. If child is obese: base dose on lean body weight.*		*If trough level is above this range, delay dose for 12 hours and re-check trough. If acceptable then continue. Involve a pharmacist if trough remains high.*	

If patient is being treated for cystic fibrosis please refer to Clinical Guidelines: Care of Children with Cystic Fibrosis 2011 - Royal Brompton & Harefield NHS Foundation Trust for monitoring advice and dose adjustments

Administration

Gentamicin: Add the desired dose to 20-50mL of Sodium chloride 0.9% or dextrose 5% and administer via IV infusion over 60 minutes

Tobramycin: Add the desired dose in 50-100mL of sodium chloride 0.9% and administer via IV infusion over 30 minutes

Amikacin: Add the required dose to 100mL of sodium chloride 0.9% and administer via IV infusion over 30 minutes

First Level

- Take the first level 1-6 hours before the second dose is due (trough level)
- Gentamicin and tobramycin: DO NOT give the next dose until a level is known
- Amikacin: Continue treatment and review as soon as levels are received (assays are not performed on site)

Subsequent Monitoring

- Normal renal function: monitor levels weekly (i.e. next level day 8). Doses can be administered before results are known. If child is <2 years old, recheck levels on day 3.
- Renal impairment: monitor levels daily and DO NOT administer the next dose until a level is known
- Renal function must be checked at least three times a week
- If renal function deteriorates, daily monitoring will be required

If further advice is needed on any of these issues contact a clinical pharmacist or microbiologist without delay.

Treatment Review

- Empirical treatment should be reviewed after 48 hours
- All patients should be reviewed after 7 days
- Gentamicin should be stopped in all patients after 14 days unless discussed with microbiology

Gentamicin multiple daily dosing regimen

To be used for patients >1 month old with normal renal function.

Aminoglycosides distribute poorly into adipose tissue. Patients who are obese (>20% above ideal body weight) should receive a relatively lower dose. In overweight children, lean body weight can be estimated by the 50th centile on the weight-for-age chart.

Doses		**Peak level**	**Trough level**
1 month – 12 years	2.5mg/kg TDS	5-10mg/L (3-5mg/L for endocarditis)	Less than 2mg/L (less than 1mg/L for endocarditis)
12years – 18 years	2mg/kg TDS		

Administration

Ready diluted, although can be further diluted to a convenient volume with sodium chloride 0.9% or dextrose 5% if required. Administer via IV bolus over 3 to 5 minutes

Initial monitoring

Levels should be taken after the 3rd dose

- Peak levels - 1 hour post dose
- Trough levels - immediately before the next dose.

Involve a Pharmacist if levels are high

- Renal function must be checked at least three times a week

Subsequent monitoring
Re-check levels every 3 days, or sooner if deterioration in renal function or other risk factors

References

Alder Hey Children's NHS Foundation Trust (2013) Aminoglycoside monitoring pathway for gentamicin, tobramycin and amikacin; Version 6.

Paediatric Formulary Committee. *BNF for Children* [2014-2015]. London: BMJ Group, Pharmaceutical Press, and RCPCH Publications; [2014]

Royal Brompton & Harefield NHS Foundation Trust (updated 2014) Clinical guidelines: care of children with cystic fibrosis. http://www.rbht.nhs.uk/healthprofessionals/clinical-departments/paediatrics/childrencf/

University College London Hospitals NHS foundation Trust (2010). *Injectable medicines administration guide, Third edition*. Blackwell Publishing

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Appendix 4: Treatment Protocol for Vancomycin and Teicoplanin in Paediatric Patients

For use in (clinical areas):	Paediatrics
For use by (staff groups):	All Medical, Nursing and Pharmacy Staff
For use for (patients):	Paediatric Patients
Document owner:	Pharmacy Department
Status:	Approved

Vancomycin

Monitoring of vancomycin levels is necessary to prevent nephrotoxicity and ototoxicity. Both side effects relate to serum drug concentration and duration of therapy.

Dose:

- Patients <50mg: 15mg/kg every 8 hours (max. daily dose = 2g)
- Patients 50kg or greater : 1g every 12 hours
- Renal impairment: starting dose should be same as in normal renal function

Administration

1. Add 10mL of water for injection to a 500mg vial **or** 20mL of water for injection to a 1g vial
2. Further dilute in sodium chloride 0.9% or dextrose 5% so the final concentration is no more than 5mg/L

Dose	Suggested diluent volume
Up to 250mg	Add to 50mL bag or make up to 50mL in a syringe
251-500mg	Add to 100mL bag
501-1250mg	Add to 250mL bag
1251-1500mg	Add to 500mL bag

3. Administer via Intravenous infusion over at least 60 minutes (infusion rate must not exceed 10mg/minute). **NOT** to be given via intravenous bolus injection

Initial monitoring

Normal renal function: Take the first sample before the morning dose 48 hours after starting vancomycin. DO NOT withhold treatment whilst awaiting results

Renal impairment: Take the first sample before the morning dose 24 hours after starting vancomycin. Do not give the next dose until the level is known

Trough level	Dosage adjustment
Below 10mg/L	Increase dose by approximately 20-25%
10-20mg/L	Desirable concentration – no adjustment needed
Over 20-25mg/L	Reduce dose by approximately 20-25%
Over 25mg/L	In patients with normal renal function, check timing of sample Vs. drug administration. If sampling does not account for high concentration: 1. Omit further doses

	2. Monitor concentrations at 24 hour intervals until 20mg/L or below 3. Restart vancomycin with approximately 25% dose reduction

Subsequent monitoring
If renal function remains stable: measure levels once weekly thereafter.
If renal function is fluctuating: measure trough levels daily

Teicoplanin

Dose:

- Standard dose: Initially 10mg/kg (max 400mg) every 12 hours for 3 doses, then 6mg/kg (max 400mg) once daily
- Severe infections: Initially 10mg/kg (max 600mg) every 12 hours for 3 doses, then 10mg/kg (max 600mg) once daily

Administration

- Reconstitute the vial with the diluent provided (water for injection). Slowly inject the water down the vial wall, swirl gently or roll to ensure powder fully dissolves. If a froth forms, leave for 15 minutes to settle.
- Administer over 3-5 minutes

Monitoring
Therapeutic monitoring is only usually required for patients requiring teicoplanin for more than 7 days. Therapeutic drug monitoring is not routinely required because the relationship between teicoplanin levels and toxicity have not been established.

Pre-dose trough levels can be taken after 7 days of therapy (i.e. before the 8th dose). However, patients being treated for more serious infections may be monitored more frequently to determine therapeutic level are reached and maintained.

Repeat the level after 7 days if the result is outside of therapeutic range

DO NOT withhold further doses whilst waiting for results (assays are not performed on site)

Trough level	**Interpretation**
Below 10mg/L	Sub-optimal for all infections
10-20mg/L	Sufficient for cellulitis and soft tissue infections
20-60mg/L	Required for severe infections

Seek advice from microbiology/Pharmacy if dose adjustment is required

References

Oxford University Hospital NHS Trust (2012) Use of intravenous teicoplanin and vancomycin in paediatrics. Accessed via: http://ouh.oxnet.nhs.uk/PaedHaemOnc/Pages/HaematologyOncologyGuidelines.aspx

Paediatric Formulary Committee. *BNF for Children* [2014-2015]. London: BMJ Group, Pharmaceutical Press, and RCPCH Publications; [2014]

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