



The Royal Australasian
College of Physicians

Infectious Diseases

Advanced Training Curriculum

Adult Medicine Division
Paediatrics & Child Health Division





The Royal Australasian
College of Physicians

Physician Readiness for Expert Practice (PREP) Training Program

Infectious Diseases Advanced Training Curriculum

TO BE USED IN CONJUNCTION WITH:

Basic Training Curriculum – Adult Internal Medicine
Basic Training Curriculum – Paediatrics & Child Health
Professional Qualities Curriculum

ACKNOWLEDGEMENTS

The Royal Australasian College of Physicians (RACP) Fellows, trainees and staff have contributed to the development of this document.

The College specifically thanks those Fellows and trainees who have generously contributed to the development of these curriculums, through critical comments drawn from their knowledge, experience and the donation of their time and professional expertise.

The following Fellows and trainees, in particular, deserve specific mention for their contribution:

- Prof Jonathan Carapetis, FRACP, FAFPHM
- A/Prof Damon Eisen, FRACP
- A/ Prof Thomas Gottlieb, FRACP, FRCPA
- Prof Lindsay Grayson, FRACP, FAFPHM
- A/Prof Prof Cheryl Jones, FRACP
- Dr Pamela Konecny, FRACP, FChSHM
- Dr Emma McBryde, FRACP (Supported by a grant from Australasian Society for Infectious Diseases [ASID])
- Dr Brendan McMullan
- Dr David Mitchell, FRACP, FRCPA
- Dr Geoffrey Playford, FRACP, FRCPA
- Dr Kasha Singh, FRACP
- A/Prof Denis Spelman, FRACP
- Dr Alan Street, FRACP
- Dr Ashwin Swaminathan., FRACP

The RACP gratefully acknowledges the contribution of the ASID to the development of this curriculum.

The process was managed by the Curriculum Development Unit within the College's Education Deanery, who designed this document, drafted content material, organised and facilitated writing workshops; developed resource materials, and formatted the final document.

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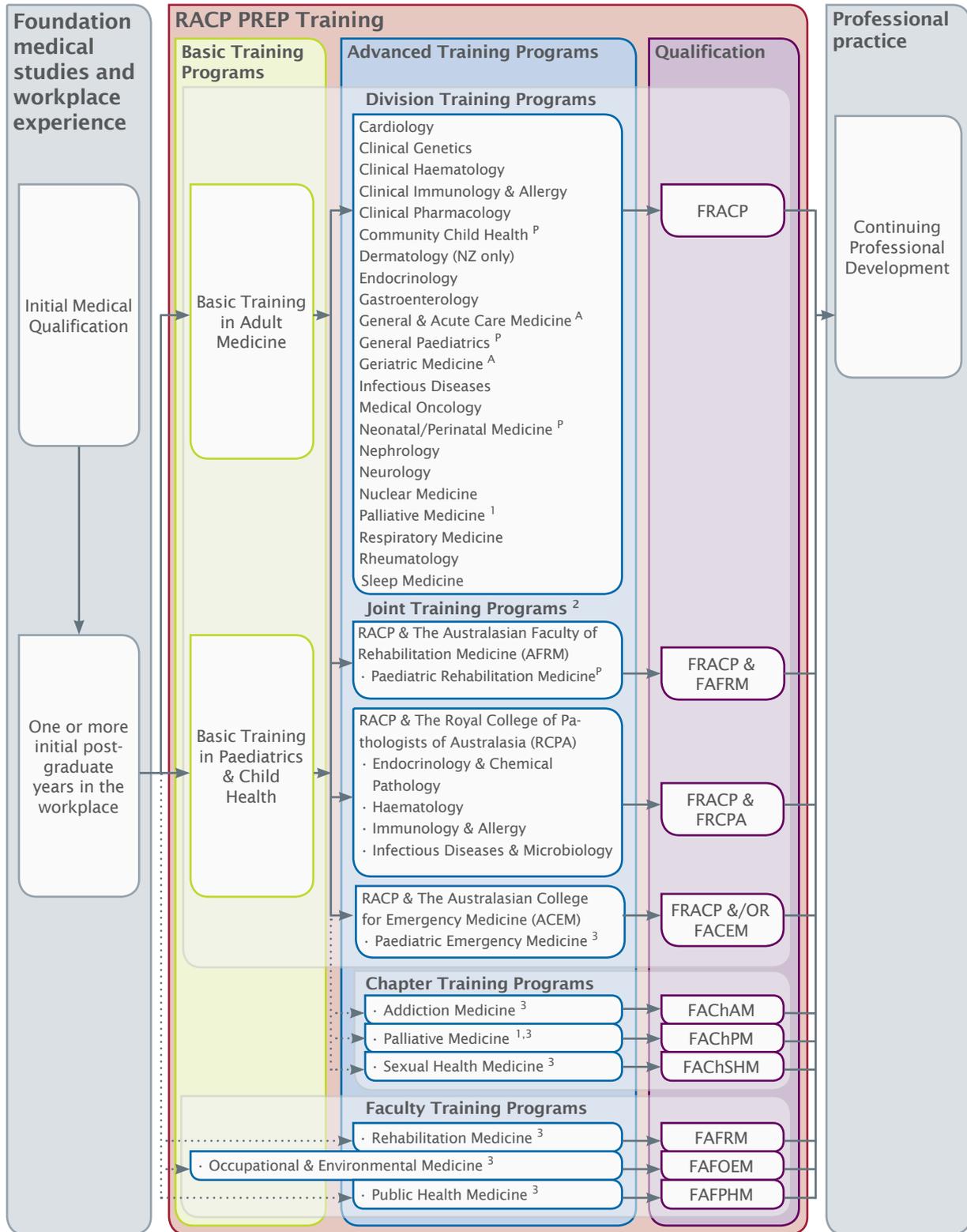
1st edition 2010 (revised 2013).

Please note: No Domains, Themes or Learning Objectives have been updated for this edition; design changes ONLY.

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RACP FELLOWSHIP TRAINING PATHWAYS AND THE CONTINUUM OF LEARNING



^P Trainees must complete Basic Training in Paediatrics & Child Health to enter this program.

^A Trainees must complete Basic Training in Adult Medicine to enter this program.

¹ Trainees who have entered Advanced Training in Palliative Medicine via a RACP Basic Training Program will be awarded FRACP upon completion and may subsequently be awarded FACHPM. Trainees who have NOT entered Advanced Training in Palliative Medicine via a RACP Basic Training Program will only be awarded FACHPM upon completion.

² The Child & Adolescent Psychiatry Joint Training Program with the Royal Australian and New Zealand College of Psychiatrists (RANZCP) is currently under review by the RACP and RANZCP and closed to new entrants at present.

³ Alternative entry requirements exist for these training programs; please see the corresponding PREP Program Requirements Handbook for further information.

NB1: This diagram only depicts training programs that lead to Fellowship. Please see the RACP website for additional RACP training programs.

NB2: For further information on any of the above listed training programs, please see the corresponding PREP Program Requirements Handbook.

OVERVIEW OF THE SPECIALTY

Infectious diseases physicians provide a predominantly hospital-based service, specialising in the various clinical, laboratory and public health aspects of infectious disease medicine and microbiology. They have extensive expertise in the differential diagnosis and management of diseases caused by microbial agents and the management of patients presenting with infections in a number of settings, including perioperative, intensive care, and the immunocompromised host. An infectious diseases physician also has expertise in the assessment of non-infective causes of febrile illnesses and other apparent infections.

Infectious diseases physicians have a key role in the management of acute problems and in long-term chronic care of patients, e.g. those suffering from HIV and chronic hepatitis. In this respect they focus both on the individual patient and the broader community affected by the various infectious agents. Specialists working within this field tend to have a generalist, rather than an organ system specific, focus.

The specialty is currently operating within the context of increased public perceptions of, and the growing importance of, infection control epidemiology and public health. There is also the ever present expectation of having to deal with newly emerging infectious diseases and the re-emergence of 'old' infections.

The specialty of infectious diseases is based on clinical expertise, i.e. the use of cognitive skills, as opposed to the use of more practical procedural or technical skills. Physicians working within this field are required to have, and use, a broad knowledge base across a range of clinical disciplines. They need an extensive knowledge of the role of microbiology and antimicrobials in the diagnosis and management of infectious diseases. A key requirement of their role is the need to ensure that they keep up to date with global developments in infectious diseases and their potential impact within the local community. They play a predominant role in the provision of consulting services and expertise on matters pertaining to infection to other specialist practitioners.

Infectious diseases physicians undertake an important strategic and operational role in the development and implementation of national, state and hospital wide policies related to infection control, immunisation, HIV, hepatitis C virus (HCV), sexual health, tuberculosis (TB) and antibiotic usage. This role also includes making a significant contribution to medical education and research.

Within the broader community, infectious diseases physicians contribute to informed debate and raise political and community awareness through evidence-based advocacy on such issues as: the economic impact of infections and control measures; emerging infectious diseases, e.g. severe acute respiratory syndrome (SARS) and various other 'superbugs' or multi-resistant organisms; antimicrobial resistance, the need for stewardship of antimicrobial use and the costs of newer agents; and the impact of the pharmaceutical industry on clinical practice, the research agenda, and the direction of health advocacy.

The role of physicians practicing within this field is broadening to acknowledge the increasing ambulatory management of acute infections, e.g. short stay visits and hospital-in-the-home programs. This is accompanied by a decentralisation of practice from capital city/tertiary referral centres to regional areas. Related to this is an emergence of an increasing number of opportunities in community-based practice, rural and regional practice, tropical medicine, international health and medical education.

Key technological advancements that are currently impacting upon this field include the use of molecular techniques in the diagnosis of infection, determination of host susceptibility and detection of micro-organisms, virulence factors and resistance genes and the development of computer assisted antibiotic prescribing processes. At the same time the specialty is being affected by developments in other clinical specialties, especially developments in surgical practices, critical care and immunosuppressive therapies and related technical advancements, including transplantation. This is leading to a potential competing/overlapping role with other clinical specialties in organ-based diseases caused by infective agents and an evolving interaction with radiology laparoscopic surgeons and bone marrow and solid organ transplant clinicians.

Along with other physicians, they are also under increasing pressure to lead both quality and cost containment initiatives, which in turn adds complexity to their relationships with administrators and professional colleagues.

Infectious diseases physicians also need to be adept at working within a multidisciplinary team (MDT), including other subspecialties and generalists, as infection is frequently part of a range of other conditions that require active management, and may also masquerade as a non-infective condition and vice versa.

Paediatric vs. adult

Both adult and paediatric infectious diseases trainees should have a good understanding of the topics listed within the learning objectives of this curriculum at the end of training. Topics of particular interest to paediatric trainees have been highlighted by the symbol #, and for adult trainees by the symbol *.

CURRICULUM OVERVIEW

Infectious Diseases – Advanced Training Curriculum

This curriculum outlines the broad concepts, related learning objectives and the associated theoretical knowledge, clinical skills, attitudes and behaviours required and commonly used by infectious diseases physicians within Australia and New Zealand.

The purpose of Advanced Training is for trainees to build on the cognitive and practical skills acquired during Basic Training. At the completion of the Infectious Diseases Advanced Training program, trainees should be able to provide unsupervised comprehensive medical care in infectious diseases at a consultant level.

Attaining competency in all aspects of this curriculum is expected to take three years of training. It is expected that all teaching, learning and assessment associated with the Infectious Diseases Advanced Training Curriculum will be undertaken within the context of the physician's everyday clinical practice and will accommodate discipline-specific contexts and practices as required. As such it will need to be implemented within the reality of current workplace and workforce issues and the needs of health service provision.

There may be learning objectives that overlap with or could easily relate to other domains; however, to avoid repetition, these have been assigned to only one area. In practice it is anticipated that within the teaching/learning environment, the progression of each objective will be explored.

Note: The curricula should always be read in conjunction with the relevant College Training Handbook available on the College website.

Professional Qualities Curriculum

The Professional Qualities Curriculum (PQC) outlines the range of concepts and specific learning objectives required by, and used by, all physicians, regardless of their specialty or area of expertise. It spans both the Basic and Advanced Training Programs and is also used as a key component of the CPD program.

Together with the various Basic and Advanced Training Curricula, the PQC integrates and fully encompasses the diagnostic, clinical, and educative-based aspects of the physician's/paediatrician's daily practice.

Each of the concepts and objectives within the PQC will be taught, learnt, and assessed within the context of everyday clinical practice. Thus, it is important that they be aligned with, and fully integrated into, the learning objectives within this curriculum.

EXPECTED OUTCOMES AT THE COMPLETION OF TRAINING

Graduates from this training program will be equipped to function effectively within the current and emerging professional, medical, and societal contexts. At the completion of the Advanced Training Program in Infectious Diseases as defined by this curriculum, it is expected that a new Fellow will have developed the clinical skills and have acquired the theoretical knowledge for competent infectious diseases practice.

This program does not aim to produce clinical microbiologists, virologists, pharmacologists or public health experts, but infectious diseases physicians with an appropriate understanding of those disciplines and an ability to work with specialists in those areas.

It is expected that a new Fellow will be able to:

- take a relevant history and perform a focussed clinical examination, requesting appropriate diagnostic tests to assess patients at the high standard expected for infectious diseases physicians
- formulate a differential diagnosis of patients presenting with clinical features of infectious diseases
- apply sufficient knowledge and skill in diagnosis and management to ensure safe independent practice in infectious diseases, evaluating and using available evidence to solve difficult diagnostic and management problems
- develop management plans for the 'whole patient' and have a sound knowledge of appropriate treatments, including health promotion, disease prevention, and long-term management plans
- explain the details of diagnosis, natural history and outcome of infectious diseases and the required therapeutic measures to clinical colleagues, patients, and their carers
- manage immunocompromised patients, including those with HIV/AIDS
- recognise and manage hospital acquired infection, including postoperative and intensive care related illness, and institute control systems
- diagnose, investigate and manage imported infection and provide advice in relation to travel medicine
- understand the role of the microbiologist and virologist, and the importance of microbiological techniques and their interpretation in infectious diseases
- understand the process and constraints of the microbiological report
- manage all aspects of antibiotic use
- exhibit appropriate attitudes and communication skills in dealing with colleagues, patients, and their families
- lead and work effectively as part of a team
- apply a MDT approach to the management of infection within the hospital and community and recognise and understand the application of public health management
- apply knowledge of the appropriate basic sciences relevant to infectious diseases
- recognise the limitations of their expertise and refer patients appropriately
- manage time and resources to the benefit of their patients and colleagues
- maintain involvement in a CPD program, using skills of lifelong learning to keep up to date with developments in infectious diseases
- access appropriate resources to maintain knowledge of existing and emerging infectious diseases
- advise patients of patient support organisations and how to access them
- be an effective teacher of infectious diseases
- achieve a firm grasp of basic research methodology, participating in, and initiating research activity
- receive enhanced training in specific areas related to infectious diseases, including clinical virology, clinical pharmacology, public health and epidemiology, sexual health medicine, vaccinology and overseas practice; this part of the curriculum is optional but will be important to some trainees dependent on their intended career pathway.

In addition, this training program will ensure that trainees are:

- knowledgeable and competent in the diagnosis and management of common infectious diseases
- skilled in quality assurance activities, such as clinical audit
- competent in fiscal management of available health care resources
- continuing to learn about new developments in this rapidly expanding field
- able to impart their knowledge to all levels of society
- honest, compassionate, and display the highest standards of personal and interpersonal professional behaviours.

CURRICULUM THEMES AND LEARNING OBJECTIVES

Each of the curriculum documents has been developed using a common format, thereby ensuring a degree of consistency and approach across the spectrum of training.

Domains

The Domains are the broad fields which group common or related areas of learning.

Themes

The Themes identify and link more specific aspects of learning into logical or related groups.

Learning Objectives

The Learning Objectives outline the specific requirements of learning. They provide a focus for identifying and detailing the required knowledge, skills and attitudes. They also provide a context for specifying assessment standards and criteria as well as providing a context for identifying a range of teaching and learning strategies.

Key Principles

The curriculum is based on broad themes representing the breadth of areas in which an infectious diseases physician is expected to have particular knowledge, skills, and attitudes. The themes are not organised by clinical conditions and/or populations.

Within each theme, the learning objectives are applicable to acute and chronic infections presenting in adult and/or paediatric populations, including specific organ infections, e.g. pneumonia, meningitis, and systemic infections.

The learning objectives also seek to acknowledge regional differences in the epidemiology and clinical profile of infectious diseases within Australia/New Zealand and different patient populations, including Māori and Pacific Islander (NZ) and Aboriginal/Torres Strait Islander (Australia) populations.

The curriculum does not set out to provide a catalogue of infectious diseases. However, it is acknowledged that certain topics need to be emphasised because of their clinical significance and importance to the practice of the infectious diseases physician.

LEARNING OBJECTIVES TABLES

DOMAIN 1	PRINCIPLES OF INFECTIOUS DISEASES
Theme 1.1	Principles of Infectious Diseases
Learning Objectives	
1.1.1	Apply epidemiology, clinical spectrum of disease, diagnostic methods, and antimicrobial therapy for specific pathogenic micro-organisms to patient management
1.1.2	Discuss general principles of pathogenesis, microbiology and immunology in the assessment and management of patients with infectious diseases
DOMAIN 2	INFECTIOUS DISEASES
Theme 2.1	General Infectious Diseases
Learning Objectives	
2.1.1	Recognise, diagnose, and manage clinical presentations associated with infection
Theme 2.2	Chronic Infectious Diseases of Clinical Importance
Learning Objectives	
2.2.1	Assess and manage patients with HIV
2.2.2	Assess and manage patients with TB
2.2.3	Assess and manage patients with hepatitis B
2.2.4	Assess and manage patients with hepatitis C
Theme 2.3	Organ System Infections
Learning Objectives	
2.3.1	Assess and manage patients with organ system infections
Theme 2.4	Rare Yet Serious Infections
Learning Objectives	
2.4.1	Assess and manage patients with rare yet serious infections
Theme 2.5	Special Hosts
Learning Objectives	
2.5.1	Recognise, diagnose, and manage infections in special hosts

DOMAIN 3	DIAGNOSTIC SERVICES
Theme 3.1	Diagnostic Services in the Management of Infections
Learning Objectives	
3.1.1	Select and interpret appropriate microbiological diagnostic tests
3.1.2	Interpret diagnostic test results considering accuracy, validity, reproducibility, and cost effectiveness
DOMAIN 4	INFECTION PREVENTION AND TREATMENT
Theme 4.1	Infection Prevention and Treatment
Learning Objectives	
4.1.1	Select antimicrobial and other relevant drugs, considering their pharmacological characteristics
4.1.2	Use preventative and therapeutic modalities, recognising the relevant evidence of clinical efficacy and cost effectiveness
4.1.3	Undertake and advocate immunisation with an understanding of the immunological, epidemiological, and public health basis of immunisation strategies
4.1.4	Discuss the principles of antimicrobial prophylaxis procedures
4.1.5	Discuss the principles of antimicrobial stewardship and select appropriate antimicrobial drugs to control antimicrobial resistance
DOMAIN 5	HOSPITAL EPIDEMIOLOGY AND CONTROL OF INFECTION
Theme 5.1	Hospital Epidemiology and Control of Infection
Learning Objectives	
5.1.1	Outline the principles of epidemiology and the use of epidemiological tools in the surveillance and control of infections in health care settings
5.1.2	Recognise, diagnose, and manage healthcare associated infections
5.1.3	Use preventative strategies to control health care associated infections, recognising the relevant evidence of clinical efficacy and cost effectiveness

DOMAIN 6	PUBLIC HEALTH ASPECTS OF INFECTIOUS DISEASES
Theme 6.1	Public Health Aspects of Infectious Diseases
Learning Objectives	
6.1.1	Recognise the public health consequences of infections and initiate measures to minimise disease burden and prevent transmission through advice and notification
6.1.2	Collaborate with public health services to plan for, and respond to, communicable disease incidents and threats
6.1.3	Discuss public health issues in northern and central Australia, Māori and Pacific Islander, Aboriginal and Torres Strait Islander peoples and other indigenous populations
6.1.4	Discuss the global epidemiology of infections and their impact outside Australia and New Zealand

DOMAIN 1	PRINCIPLES OF INFECTIOUS DISEASES
Theme 1.1	Principles of Infectious Diseases
Learning Objective 1.1.1	Apply epidemiology, clinical spectrum of disease, diagnostic methods, and antimicrobial therapy for specific pathogenic micro-organisms to patient management

Knowledge

Describe:

- organism characteristics
- typical disease patterns
- diagnostic tools and approach
- effective antimicrobial and adjunctive therapy and expected resistance patterns
- epidemiologic factors
- characteristics of predisposed host
- incubation and infectivity periods; and
- expected morbidity and mortality for the following pathogens:

Gram positive bacteria:

- *Staphylococcus aureus*, including methicillin-resistant *S. aureus* (MRSA) * #
- coagulase-negative staphylococcus * #
- group A streptococcus * #
- group B streptococcus #
- *Streptococcus pneumoniae* * #
- *Enterococcus*, including vancomycin resistant enterococcus (VRE) *
- alpha-haem/*Streptococcus anginosus* group
- listeria/clostridia (including *Clostridium botulinum*)/bacillus, including *Bacillus anthracis*/corynebacteria
- nocardia/actinomycosis

Gram negative bacteria:

- *Escherichia coli* * #
- *Salmonella* * #
- *Campylobacter* * #
- *Shigella/Yersinia/Vibrio*
- *Klebsiella*
- *Acinetobacter*
- *Enterobacter*
- *Serratia*
- *Proteus*, including those with multidrug resistance, such as extended spectrum beta lactamases producers and ESCAPPM organisms * #

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Gram negative bacteria:

- *Pseudomonas aeruginosa* * #
- *Neisseria meningitidis*/*Haemophilus influenzae*/*Neisseria gonorrhoeae* * #
- *Bacteroides fragilis* group/*Fusobacterium*
- *Stenotrophomonas maltophilia* and *Burkholderia pseudomallei*
- *Brucella*
- *Legionella pneumophila* *

Spirochaetes:

- *Treponema pallidum* * #
- *Leptospira* spp.
- *Borrelia*

Mycobacteria:

- *Mycobacterium tuberculosis* (MTB) * #
- atypical mycobacteria
- *Mycobacterium avium* complex * #
- *Mycobacterium ulcerans*
- *Mycobacterium leprae*

Cell wall deficient bacteria:

- *Chlamydia pneumoniae* # + *Chlamydia psittaci*, *Chlamydia trachomatis*/*Mycoplasma pneumoniae* #
- *Rickettsia* spp.: spotted fever/typhus gp/*Coxiella burnetii*/*Ehrlichia*

Fungi:

- *Candida* spp. * #
- *Cryptococcus neoformans* * #
- *Aspergillus* spp. * #
- mucorales
- *Fusarium*, *Scedosporium* and *Sporothrix*
 - *Cryptosporidium parvum* #
 - microsporidia and *Cyclospora cayatanensis*
 - *Leishmania* spp.
 - *Trypanosoma* spp.

DOMAIN 1	PRINCIPLES OF INFECTIOUS DISEASES
Theme 1.1	Principles of Infectious Diseases
Learning Objective 1.1.1	Apply epidemiology, clinical spectrum of disease, diagnostic methods, and antimicrobial therapy for specific pathogenic micro-organisms to patient management

Parasites:

- protozoa:
 - *Plasmodium spp.* * #
 - *Toxoplasma gondii* #
 - *Pneumocystis jiroveci* * #
 - *Giardia lamblia* #
 - *Entamoeba histolytica* *
- helminths
- round worms:
 - *Strongyloides stercoralis* * #
 - *Enterobius* #, *Trichuris* #, *Ascaris*, hookworm #
- tape worms:
 - *Taenia solium cysticercosis* * #
 - *Echinococcus granulosus* *
- flukes:
 - *Schistosoma spp.*
 - lung and liver flukes
- filariae:
 - lymphatic filariasis – *Wuchereria bancrofti* and *Brugia malayi*
 - *Onchocerca volvulus*
 - *Loa loa*
- others:
 - *Angiostrongylus cantonensis*
 - agents of cutaneous larva migrans

Viruses:

- DNA viruses:
 - *Herpesviridae* * #
 - herpes simplex virus (HSV), varicella zoster virus (VZV), cytomegalovirus, Epstein-Barr virus, human herpes virus -6, 7, and human herpes virus -8
 - adenovirus #
 - papillomaviruses
 - JC, BK and other polyomaviruses
 - hepatitis B virus (HBV) * # and hepatitis delta virus
 - parvovirus #
 - poxviruses
- RNA Viruses:
 - rotaviruses #
 - rubella virus #
 - flaviviruses – dengue virus *, Ross River virus and Murray Valley encephalitis virus * #
 - Bunyah forest virus

DOMAIN 1	PRINCIPLES OF INFECTIOUS DISEASES
Theme 1.1	Principles of Infectious Diseases
Learning Objective 1.1.1	Apply epidemiology, clinical spectrum of disease, diagnostic methods, and antimicrobial therapy for specific pathogenic micro-organisms to patient management

- RNA Viruses:
 - HCV * #
 - coronaviruses, including SARS #
 - parainfluenza #
 - mumps
 - human respiratory syncytial virus and metapneumovirus #
 - measles * #
 - Marburg and Ebola virus hemorrhagic fevers
 - influenza – human and avian * #
 -
 - human T-lymphotropic virus I/II
 - HIV * #
- *Picornaviridae*:
 - polio #
 - coxsackievirus, echoviruses and enteroviruses #
 - hepatitis A virus *
- norovirus and other calicivirus

Prions.

Skills

- for each pathogen:
 - recognise, or suspect, the condition from presenting signs or symptoms
 - discern further relevant features from clinical history
 - conduct thorough, specific, and directed clinical examination
 - synthesise information to construct a differential diagnosis
 - select relevant diagnostic investigations
 - interpret laboratory data in context of clinical information, including clinical presentation, specific exposures, and host characteristics
 - formulate treatment plan for specific infections
 - monitor condition
- identify and manage treatment failure and complications of infections
- anticipate/monitor for and manage adverse drug reactions
- communicate clearly with carers, relatives, and other members of a MDT.

*Organisms for which in depth knowledge is required is indicated by * for adult infectious diseases trainees, and # for paediatric infectious diseases trainees, see appendix for example of detail required.*

DOMAIN 1	PRINCIPLES OF INFECTIOUS DISEASES
Theme 1.1	Principles of Infectious Diseases
Learning Objective 1.1.2	Discuss general principles of pathogenesis, microbiology and immunology in the assessment and management of patients with infectious diseases
Links	Learning Objective 1.1.1 lists the pathogens for which this knowledge is required
Knowledge	
<ul style="list-style-type: none"> • describe genetic, structural and biological characteristics of micro-organisms that determine virulence, e.g. toxins, adherence/attachment cell entry receptors, microbial growth characteristics, and mechanisms of organism reproduction • list regional flora at various anatomical sites in outpatients and inpatients • list host determinants of susceptibility to infection in general and for specific pathogens listed in learning objective 1.1.1, including: <ul style="list-style-type: none"> • age • underlying immunodeficiency - congenital/acquired • immunogenetics • pregnancy • high risk behaviours - intravenous drug use, tattoos and blood product receipt • country of birth • occupation • animal/pet exposure • travel to endemic country • describe host immunological response to micro-organisms and how it is altered by physiological states, e.g. extremes of age and pregnancy, or pathological states - burns, congenital or acquired immunodeficiencies and co-infection with other micro-organisms. 	
Skills	
<ul style="list-style-type: none"> • apply basic principles of microbiology to the clinical diagnosis, treatment, and monitoring of infectious diseases • evaluate infection in terms of host susceptibility and adjust clinical response accordingly • identify high risk hosts, guided by fundamental principles of defence against disease. 	

DOMAIN 2	INFECTIOUS DISEASES
Theme 2.1	General Infectious Diseases
Learning Objective 2.1.1	Recognise, diagnose, and manage clinical presentations associated with infection

Knowledge

- describe approach to the following clinical syndromes, including characteristic features of history, examination and investigations, differential diagnosis, characteristics of specific aetiologies, identification of critically ill patient/urgent conditions, and management:
 - fever of short duration
 - prolonged fever - pyrexia of unknown origin (PUO)
 - fatigue following infection
 - septic patient
 - lymphadenopathy - generalised, localised and especially cervical
 - failure to thrive/weight loss
 - febrile child without localising features
 - fever plus signs or symptoms
 - fever plus rash
 - fever plus headache, altered consciousness, or neurological signs
 - fever plus cough or shortness of breath
 - fever and jaundice
 - fever and urinary symptoms
 - fever and musculoskeletal symptoms
 - fever/infection in specific hosts or epidemiological
- describe approach to the following common infectious diseases consultations, including characteristic features of history, examination and investigations, differential diagnosis, characteristics of specific aetiologies, identification of critically ill patient/urgent conditions and management:
 - congenital infections
 - sexually transmitted infections (STIs) and genital discharge/lesion
 - difficult PUO – after negative outpatient work up by a general physician or inpatient work up on a medical ward
 - difficult fever (not necessarily meeting PUO criteria) – after work up by parent unit and frequent institution of empiric antibiotics in #:
 - ICU patients
 - neurosurgical patients
 - burns patients
 - post-operative patients
 - immunocompromised patients – especially neutropenia and HIV
 - neonates and infants
 - other illnesses, with or without fever, in returned travellers and immigrants, such as:
 - pulmonary infiltrates
 - meningitis
 - encephalitis skin lesion or skin rash
 - eosinophilia
 - chronic diarrhoea
 - the swollen leg

DOMAIN 2	INFECTIOUS DISEASES
Theme 2.1	General Infectious Diseases
Learning Objective 2.1.1	Recognise, diagnose, and manage clinical presentations associated with infection
<ul style="list-style-type: none"> • difficult pneumonia – ongoing fever and infiltrates despite broad-spectrum antibiotics: <ul style="list-style-type: none"> • community-acquired pneumonia • immunocompromised patients – HIV, leukaemia/lymphoma and bone marrow transplant patients • nosocomial pneumonia • non-resolving cellulitis • undiagnosed chronic headache with pleocytosis. 	
Skills	
<ul style="list-style-type: none"> • take a directed history and perform physical examination and investigation to differentiate amongst the aetiologies of these clinical presentations • manage infective causes of these syndromes, judging necessity of antimicrobial therapy, choice of empiric or directed therapy, and use of non-antimicrobial modalities • anticipate and manage complications of infections • anticipate, monitor for, and manage adverse drug reactions • communicate with patients, families, and carers • consider diagnostic issues in relation to patient fears and recognise need for patient and family understanding of procedures, investigation results, and disease management • communicate with referring doctors and other health care providers, including non-clinicians involved in the patient's care • for each syndrome: <ul style="list-style-type: none"> • define from presenting signs or symptoms • identify and manage clinical emergencies • discern further relevant features from clinical history and examination findings to narrow the differential diagnosis and assess the likelihood of each • select relevant diagnostic investigations relating to specific micro-organisms • interpret laboratory data in context of clinical information, including clinical presentation, specific exposures, and host characteristics • formulate prompt management plan, including: <ul style="list-style-type: none"> • necessity for empiric treatment based on urgency or severity • need for further investigations • modify patient management considering new findings, e.g. narrowing antimicrobial spectrum in the event of identification of a specific infectious agent. 	
<p><i># Syndromes for which in depth knowledge is required by paediatric infectious diseases trainees, see appendix for example of detail required.</i></p>	

DOMAIN 2	INFECTIOUS DISEASES
Theme 2.2	Chronic Infectious Diseases of Clinical Importance
Learning Objective 2.2.1	Assess and manage patients with HIV
Knowledge	
<ul style="list-style-type: none"> • recognise need for a comprehensive long-term management plan for patients with HIV • discuss general epidemiology and therapeutic options for HIV, including the role of complementary therapies • describe pathophysiology and clinical signs and symptoms of infection • discuss current diagnostic tests and procedures • describe treatment of HIV in pregnancy and the implications for the unborn child • describe progression of HIV to AIDS • discuss health maintenance strategies for patients with HIV/AIDS • describe reporting procedures for patients with HIV/AIDS • identify and evaluate role of patient support groups • describe hepatitis B co-infection with HIV and its implications for the management of hepatitis B and HIV • describe hepatitis C co-infection with HIV and its implications for the management of hepatitis C and HIV • diagnose HIV infection when present in patients presenting various manifestations of HIV and AIDS, including: <ul style="list-style-type: none"> • seroconversion illness, e.g. an unexplained febrile illness • an illness consistent with mild immunosuppression • non-infectious conditions found more frequently in HIV positive people, e.g. thrombocytopenia • weight loss • clinical immunodeficiency states • take history for risk factors in patients with a possible diagnosis of HIV • counsel, manage and monitor subjects with potential exposure to HIV infection, including advice on post-exposure prophylaxis • perform and interpret diagnostic tests for HIV infection, including testing high risk patients and during suspected seroconversion illness • manage a patient newly diagnosed with HIV: <ul style="list-style-type: none"> • screen for STIs • perform baseline tests for opportunistic infections • perform Pap smear • provide education on risk minimisation • provide counselling and assess psychological impact • notify necessary parties • perform contact tracing • design a long-term management plan for patients with HIV • counsel women with HIV regarding its female-specific manifestations • perform and interpret tests for the monitoring of patients infected with HIV • interpret CD4 viral load and resistance assays, modifying management accordingly • commence and stop opportunistic infection prophylaxis in patients with improving CD4 counts • assess patient suitability for adherence to antiretroviral therapy (ART) 	

DOMAIN 2	INFECTIOUS DISEASES
Theme 2.2	Chronic Infectious Diseases of Clinical Importance
Learning Objective 2.2.1	Assess and manage patients with HIV
Skills	
<ul style="list-style-type: none"> • counsel patients regarding positives and negatives of ART prior to its introduction commence, monitor, and alter ART. • provide ongoing support aimed at maintaining adherence • diagnose, manage, and prevent complications of advanced HIV disease/AIDS, including: <ul style="list-style-type: none"> • determine whether an individual meets indications for treatment • select appropriate antiretroviral drug combination • counsel to maximise adherence, including anticipate adverse reactions of minor nature and intercurrent illness • determine the need for prophylaxis against opportunistic infection • monitor for adverse drug reactions, antiretroviral failure and immune reconstitution syndromes • recognise and manage adverse drug reactions • recognise and manage failed ART and determine cause of failure • diagnose and manage the following syndromes in HIV/AIDS patients: <ul style="list-style-type: none"> • undifferentiated fever • fever and respiratory symptoms • neurological syndromes • oral/cutaneous lesions • persistent diarrhoea/hyperbilirubinaemia/gastrointestinal (GI) blood loss/GI disease • weight loss • cytopaenias • visual disturbance • renal disease • cardiac abnormalities • diagnose and manage malignancies in HIV/AIDS patients • monitor and treat pregnant women with HIV • test and provide perinatal management to children born to these women • manage hepatitis B co-infection with HIV • manage hepatitis C co-infection with HIV • recognise and provide support for the social and psychological aspects of patients with HIV infection • counsel regarding maintenance of general health • diagnose and manage children with HIV/AIDS #: <ul style="list-style-type: none"> • identify at-risk infants • recognise clinical manifestations in children • perform and interpret diagnostic tests for at-risk infants • diagnose and manage children with perinatal exposure to HIV through mother to child transmission • provide pregnancy counselling • follow-up at-risk infants • prescribe antiretroviral prophylaxis • prescribe opportunistic infection prophylaxis • counsel regarding differences in management prognoses and clinical syndromes in this age group 	

DOMAIN 2	INFECTIOUS DISEASES
Theme 2.2	Chronic Infectious Diseases of Clinical Importance
Learning Objective 2.2.1	Assess and manage patients with HIV
<ul style="list-style-type: none"> perform and interpret tests monitoring CD4 count follow paediatric guidelines for initiation, selection, and monitoring of ART and prophylaxis against opportunistic infections counsel parents regarding routine immunisation recommendations. 	
<p># In depth knowledge is required by paediatric infectious diseases trainees, see appendix for example of detail required.</p>	

DOMAIN 2	INFECTIOUS DISEASES
Theme 2.2	Chronic Infectious Diseases of Clinical Importance
Learning Objective 2.2.2	Assess and manage patients with TB
Knowledge	
<ul style="list-style-type: none"> describe pathophysiology and clinical signs and symptoms of TB describe progression from latent TB to active TB describe clinical manifestations of active TB: <ul style="list-style-type: none"> primary infection pulmonary disease extra-pulmonary disease discuss current diagnostic tests and procedures recognise need for a comprehensive long-term management plan for patients with TB discuss general epidemiology and therapeutic options for TB, including the role of complementary therapies discuss implications of treatment interruption and premature treatment cessation describe treatment of latent and active TB in pregnancy and the implications for the unborn child outline reporting procedures for patients with TB identify and evaluate role of patient support groups discuss implications of a diagnosis of multi-drug-resistant TB (MDRTB) or extensively drug-resistant TB (XDRTB). 	
Skills	
<ul style="list-style-type: none"> provide empiric therapy when TB is suspected diagnose latent TB, including interpretation of tuberculin reaction or interferon gamma release assay results in context of likelihood of false positives and false negatives, and risk of disease manage latent TB infection based on risk of disease and risk of drug reactions identify patients at risk of TB, MDRTB and XDRTB 	

DOMAIN 2	INFECTIOUS DISEASES
Theme 2.2	Chronic Infectious Diseases of Clinical Importance
Learning Objective 2.2.2	Assess and manage patients with TB
Skills	
<ul style="list-style-type: none"> • recognise clinical manifestations of active TB: <ul style="list-style-type: none"> • primary infection • pulmonary disease • extrapulmonary disease • order appropriate investigations • manage TB: <ul style="list-style-type: none"> • employ standard regimen to manage TB • evaluate and manage extrapulmonary TB • evaluate and manage drug resistant TB • recognise and manage culture negative TB • identify TB resistant to anti-TB therapy and differentiate from MDRTB • evaluate and treat MDRTB and XDRTB • assess and manage patients intolerant to therapy or with renal/hepatic impairment • recognise treatment failure and plan alternate action • prescribe corticosteroids appropriately • anticipate and manage side effects of therapy • monitor the effects of therapy • recognise indications for cessation of treatment • employ treatment re-introduction regimens • trace patient contact to determine disease spread and notify and counsel appropriately • conduct routine monitoring for usual response of disease and for acquired drug resistance • manage TB during pregnancy: <ul style="list-style-type: none"> • screen for TB in pregnancy • manage latent and active TB during pregnancy and breastfeeding • manage neonate born to mother with TB • treat side effects of chemotherapy. 	

DOMAIN 2	INFECTIOUS DISEASES
Theme 2.2	Chronic Infectious Diseases of Clinical Importance
Learning Objective 2.2.3	Assess and manage patients with hepatitis B

Knowledge

- recognise need for a comprehensive long-term management plan for patients with hepatitis B
- discuss general epidemiology and therapeutic options for hepatitis B, including the role of complementary therapies
- describe pathophysiology and clinical symptoms and signs of infection
- discuss current diagnostic tests and procedures
- describe treatment of hepatitis B in pregnancy and the implications for the unborn child
- outline reporting procedures for patients with hepatitis B
- identify and evaluate the role of patient support groups.

Skills

- manage chronic and acute hepatitis B
- interpret hepatitis B serology
- counsel patients regarding:
 - natural history of infection
 - reducing transmission
 - efficacy and adverse effects of treatment
- select appropriate patients for therapy
- select treatment strategy for patients with chronic hepatitis B based on serology, HBV DNA and alanine transaminase
- monitor patients
- select patients and treatment regimens for retreatment
- manage hepatitis B/HIV co-infection
- diagnose and manage children with perinatal exposure to hepatitis B through perinatal transmission. #

In depth knowledge is required by paediatric infectious diseases trainees, see appendix for example of detail required.

DOMAIN 2	INFECTIOUS DISEASES
Theme 2.2	Chronic Infectious Diseases of Clinical Importance
Learning Objective 2.2.4	Assess and manage patients with hepatitis C

Knowledge

- recognise need for a comprehensive long-term management plan for patients with hepatitis C
- discuss general epidemiology and therapeutic options for hepatitis C, including the role of complementary therapies
- describe pathophysiology and clinical symptoms and signs of infection
- discuss current diagnostic tests and procedures
- describe treatment of hepatitis C in pregnancy and the implications for the unborn child
- outline reporting procedures for patients with hepatitis C
- identify and evaluate role of patient support groups.

Skills

- perform a pretreatment evaluation
- request and interpret baseline investigations
- order the following tests appropriately:
 - serology
 - HCV RNA
 - genotype
 - liver enzymes
 - liver biopsy
- manage chronic and acute hepatitis C
- counsel patients regarding:
 - natural history of infection
 - reducing transmission
 - efficacy and adverse effects of treatment
- select appropriate patients for therapy
- select appropriate treatment strategy
- monitor patients for indicators of response and for ADR
- select patients and treatment regimens for retreatment
- manage hepatitis C/HIV co-infection
- diagnose and manage children with perinatal exposure to hepatitis C through perinatal transmission. #

In depth knowledge is required by paediatric infectious diseases trainees, see appendix for example of detail required.

DOMAIN 2	INFECTIOUS DISEASES
Theme 2.3	Organ System Infections
Learning Objective 2.3.1	Assess and manage patients with organ system infections
Knowledge	
<ul style="list-style-type: none"> for each organ system infection below, describe: <ul style="list-style-type: none"> predisposing factors to infection epidemiology microbiology, including normal flora associated with organ system differential diagnosis pathophysiology/pathogenesis clinical presentation expected course investigations and issues in diagnosis – specimens/tests to order and role for biopsy management, including differences between paediatric and adult management, e.g. for bone and joint infections, and therapeutic options reporting procedures where appropriate: <ul style="list-style-type: none"> suppressive therapy prevention and screening <p>Bone and joint infections:</p> <ul style="list-style-type: none"> osteomyelitis – acute and chronic acute bacterial arthritis viral arthritis vs. reactive arthritis chronic arthritis septic bursitis infections with prostheses in bones and joints <p>Skin and soft tissue infections:</p> <ul style="list-style-type: none"> cellulitis cutaneous involvement in systemic bacterial and mycotic infections orbital cellulitis wound infection skin implantation injuries – vegetation, soil and water impetigo folliculitis furuncle and carbuncle bites – human, clenched-fist, and animal diabetic foot infection subcutaneous tissue infections and abscess necrotising fasciitis gangrene, including Fournier’s and clostridial myonecrosis 	

DOMAIN 2	INFECTIOUS DISEASES
Theme 2.3	Organ System Infections
Learning Objective 2.3.1	Assess and manage patients with organ system infections

Nervous system:

- meningitis – aseptic, viral, purulent, chronic and other
- encephalitis – acute and chronic
- epidural abscess
- cerebral abscess
- Guillian-Barre syndrome
- transmissible spongiform encephalopathies
- infections in hydrocephalus shunts
- infectious causes of neuropathy, myopathy and neurotropic viruses

Cardiovascular system:

- infective endocarditis
- rheumatic fever
- myocarditis
- pericarditis
- vasculitis – infection associated/endarteritis
- vascular foreign bodies – vascular graft infection, arteriovenous shunt infections and pacemaker infections

Head and neck:

- eye and orbit:
 - conjunctivitis and keratitis
 - endophthalmitis, retinitis, and uveitis
 - peri-orbital infections
- mouth:
 - odontogenic infections
 - Vincent’s angina
 - osteomyelitis of the jaw
- ear:
 - otitis media
 - otitis externa – including malignant
 - mastoiditis
- pharynx and peripharyngeal spaces:
 - pharyngitis
 - tonsillitis
 - peritonsillar abscess
 - Ludwig’s angina
 - Lemmiere’s syndrome
 - retropharyngeal abscess
 - subacute and suppurative thyroiditis

DOMAIN 2	INFECTIOUS DISEASES
Theme 2.3	Organ System Infections
Learning Objective 2.3.1	Assess and manage patients with organ system infections

- pharynx and peripharyngeal spaces:
 - cervical lymphadenitis – suppurative, mycobacterial, granulomatous and lymphotropic virus

Respiratory system:

- upper respiratory:
 - sinusitis and otitis media
 - pharyngitis and tonsillitis
 - epiglottitis
 - pertussis
 - laryngotracheobronchitis and laryngitis
 - common cold
- lower respiratory:
 - bronchitis, exacerbation of chronic obstructive pulmonary disease, or acute
 - bronchiolitis
 - pneumonia, community vs. hospital acquired, aspiration, immune compromised and all levels of severity
- mycobacteria, including mycobacteria other than TB
- bronchiectasis
- cystic fibrosis
- lung abscesses
- pleurisy, pleural effusion and empyema

Intra-abdominal/GI system:

- infectious diarrhoea – enteritis and enterocolitis
- parasite infestations
- surgical abdomen/peritonitis/pancreatitis/intra-abdominal abscess/cholangitis
- spontaneous bacterial peritonitis
- peritonitis associated with peritoneal dialysis
- liver abscess – pyogenic and amoebic
- splenic abscess
- peptic ulceration secondary to *Helicobacter pylori*
- Whipple's disease
- parasitic infections of the GI tract
- surgical abdomen/peritonitis/pancreatitis/intra-abdominal abscess/cholangitis
- spontaneous bacterial peritonitis
- peritonitis associated with peritoneal dialysis
- liver abscess – pyogenic and amoebic
- splenic abscess
- peptic ulceration secondary to *Helicobacter pylori*

DOMAIN 2	INFECTIOUS DISEASES
Theme 2.3	Organ System Infections
Learning Objective 2.3.1	Assess and manage patients with organ system infections

Intra-abdominal/GI system:

- Whipple’s disease
- parasitic infections of the GI tract

Urinary:

- cystitis and urethral syndromes
- pyelonephritis
- renal abscess
- asymptomatic bacteriuria
- recurrent urinary tract infection (UTI) – with and without a catheter
- UTI in children – investigation and prophylaxis #
- prostatitis
- epididymitis
- orchitis

Genital:

- genital lesions, ulcer, warts, and vulvitis
- urethritis (male)
- proctitis
- vaginal discharge, vaginitis and vaginosis
- cervicitis
- infestations – lice and scabies
- infections of the female pelvis:
 - pelvic inflammatory disease
 - postpartum fever
 - endometritis
 - post-caesarean infection
 - episiotomy infections
 - post-abortion sepsis
 - postoperative gynaecological infections.

Skills

- diagnose listed infections, construct a relevant treatment plan, and manage appropriately
- prescribe suitable medication
- monitor for, and manage, potential complications.

In depth knowledge is required by paediatric infectious diseases trainees, see appendix for example of detail required.

DOMAIN 2	INFECTIOUS DISEASES
Theme 2.4	Rare Yet Serious Infections
Learning Objective 2.4.1	Assess and manage patients with rare yet serious infections
Knowledge	
<ul style="list-style-type: none"> • describe pathophysiology, differential diagnosis, features on history, examination, and investigations that rapidly rule in/out diagnosis, and hence management, of the following conditions, including, where relevant, the public health implications: <ul style="list-style-type: none"> • diphtheria • tetanus • anthrax • smallpox • botulism • chronic fatigue • polio • leprosy • rheumatic fever • Creutzfeldt–Jakob disease • infections from animals – pets and non-domestic • outline reporting procedures for these conditions • describe approach to the following questions frequently put to the infectious diseases consultant, regarding the possibility of rare but serious conditions: <ul style="list-style-type: none"> • “could this be diphtheria?” upon presentation of fever and sore throat • “could this be tetanus?” upon presentation of muscle stiffness/trismus • “could this be anthrax?” upon presentation of necrotic skin lesion • “could this be smallpox, chicken pox, or HSV?” upon presentation of vesicular skin rash • “could this be botulism?” upon presentation of cranial mononeuritis multiplex • “could this be polio?” upon presentation of fever and lower motor neurone weakness • “does this patient have leprosy?” • “could this be rheumatic fever?” upon presentation of fever and arthritis • “could this be Creutzfeldt–Jakob disease?” upon presentation of rapidly progressive decline in cognitive state. 	
Skills	
<ul style="list-style-type: none"> • diagnose listed infections, construct a relevant treatment plan, and manage appropriately • perform contact tracing for presented condition • monitor for, and manage, potential complications • notify relevant agencies in the case of positive diagnosis • address patient’s concerns rationally and allay fears in the case of negative diagnosis. 	

DOMAIN 2	INFECTIOUS DISEASES
Theme 2.5	Special Hosts
Learning Objective 2.5.1	Recognise, diagnose, and manage infections in special hosts
Knowledge	
<ul style="list-style-type: none"> • recognise that states of decreased and increased immune response can contribute to a hosts clinical response to infection • describe immune defect, specific pathogen susceptibility and management, including prophylaxis, immunisation, immunotherapy, vaccine responses, pre-emptive and empiric therapy, where appropriate, of special hosts with defective immune systems for the following: <ul style="list-style-type: none"> • primary immunodeficiency syndromes: <ul style="list-style-type: none"> • T-cell • B-cell • combined T-cell and B-cell – severe combined immunodeficiency (SCID) • phagocyte abnormalities • solid organ transplantation • bone marrow transplantation • haematological malignancy • splenectomy and hyposplenism • HIV • drugs: <ul style="list-style-type: none"> • types of drugs responsible and types of immune suppression, e.g. T-cell and neutrophil • neutropaenic patients: <ul style="list-style-type: none"> • pathogens • empiric therapy – varies according to institution and susceptibility patterns • describe immune defect, specific pathogen susceptibility and management of hosts with less profound immune suppression but higher risk of specific infections: <ul style="list-style-type: none"> • diabetes mellitus • alcoholism • chronic renal failure • chronic liver disease • elderly • neonates # • infants # • pregnancy • describe likely pathogens, investigations, and management groups concerned with particular exposures in: <ul style="list-style-type: none"> • immigrants and refugees • returned travellers • people living in tropical climates • people living in extreme poverty • remote Māori and Pacific Islander/Aboriginal and Torres Strait Islander communities • people working with/exposed to animals • injecting drug users • groups exposed to biowarfare agents – military and paramedical • people in closed communities, e.g. prisons, cruise ships, child care centres and long-term care facilities 	

DOMAIN 2	INFECTIOUS DISEASES
Theme 2.5	Special Hosts
Learning Objective 2.5.1	Recognise, diagnose, and manage infections in special hosts
<ul style="list-style-type: none"> • describe diagnosis and management of infections in pregnant women, the fetus and newborns – congenital and perinatal infections # • describe epidemiology, routes of transmission, risk factors, antenatal and perinatal screening, interpretation of serology and management of infectious disease or contact for the following vertically transmitted infections: # <ul style="list-style-type: none"> • rubella • cytomegalovirus • VZV • toxoplasma • parvovirus • <i>Treponema pallidum</i> • HBV • HCV • HIV • HSV • streptococcus group B • enterovirus • listeria • list infections for which pregnant women are at higher risk and those infections which are more severe in pregnancy • list common causes of infection and fever in pregnancy, e.g. UTI, premature rupture of membranes and chorioamnionitis • access information resources on the use and safety of antimicrobial agents during pregnancy and breastfeeding, particularly those high risk D or X • discuss management issues relating to treatment of children and adolescents. # 	
Skills	
<ul style="list-style-type: none"> • assess a patient for evidence of immune compromise, including features on history, examination, first line investigation, and more specific immunological tests • manage antimicrobial prophylaxis and pre-emptive and empiric therapy in immune deficiency states according to evidence-based guidelines • for the following conditions: <ul style="list-style-type: none"> • recognise or suspect the condition from presenting signs or symptoms • discern further relevant features from clinical history, including timing of onset of syndrome with respect to degree of immune suppression • perform thorough, specific, and directed clinical examination • synthesise information to construct a differential diagnosis • select diagnostic investigations referring to specific micro-organisms • interpret laboratory data in context of clinical information, including clinical presentation, specific exposures and host characteristics • formulate treatment plan for specific infections 	

DOMAIN 2	INFECTIOUS DISEASES
Theme 2.5	Special Hosts
Learning Objective 2.5.1	Recognise, diagnose, and manage infections in special hosts

Skills

- monitor, identify, and manage treatment failure, complications of infections and anticipate/monitor for and manage adverse drug reactions:
 - haematological malignancy/basal metabolic temperature (BMT) and new lung infiltrate
 - bacterial, viral, and fungal infections in haematological and solid organ transplant patients
 - neutropaenic fevers
 - oropharyngeal infections
 - otitis
 - sinusitis
 - infections of the central nervous system (CNS)
 - infections of the GI tract
 - skin infections
 - intravenous drug use
 - skin, soft-tissue, bone and joint, infective endocarditis, endovascular, pulmonary infections, hepatitis, splenic abscess, CNS, ophthalmic, blood borne viruses (BBVs) and STIs
 - solid organ transplant patient with fever
 - BMT patient with fever, haemorrhagic cystitis, veno-occlusive diseases, graft-vs.-host disease, hepatitis, pneumonia, diarrhoea, rash and osteomyelitis
- direct empiric therapy at expected pathogens and local sensitivity patterns
- follow appropriate management algorithm
- give screening advice
- advise on infection risk reduction during pregnancy.

In depth knowledge is required by paediatric infectious diseases trainees, see appendix for example of detail required.

Domain 3

These learning objectives relate to all laboratory and other services employed in the investigation of patients with suspected or proven infections. These include but are not limited to:

- clinical microbiology
- other laboratory services including histopathology, clinical chemistry and immunopathology
- imaging services, including radiology, nuclear medicine and ECHO.

DOMAIN 3	DIAGNOSTIC SERVICES
Theme 3.1	Diagnostic Services in the Management of Infections
Learning Objective 3.1.1	Select and interpret appropriate microbiological diagnostic tests
Knowledge	
<ul style="list-style-type: none">• describe basic laboratory procedures, including:<ul style="list-style-type: none">• lab safety• hygiene and asepsis, principles of sterilisation• use of microscope• preparation and quality control of solid and broth media• essential contents of important, common media, and how to access information for more complex selective media• use of biohazard cabinets• use of centrifuges• specimen collection and transport• list and describe common microbiological tests• recognise importance of removing pathogenic organisms in the prevention of infection in:<ul style="list-style-type: none">• aseptic technique• decontamination of environmental sources• pre-operative sterilisation• describe common methods used in laboratory identification for general schema, including:<ul style="list-style-type: none">• gross examination• microscopy:<ul style="list-style-type: none">• identifying good and bad specimens• Gram stain• other stains• wet prep• motility test• acid-fast strain• describe colony morphology, colony physiology, and growth requirements that differentiate bacteria• describe standard media used for inoculation, based on site and clinical information, and their limitations• define types of commonly used media:<ul style="list-style-type: none">• broth• solid• identify selective, differential, enriched and specialised media to identify fastidious bacteria and differentiate among likely causative organisms	

DOMAIN 3	DIAGNOSTIC SERVICES
Theme 3.1	Diagnostic Services in the Management of Infections
Learning Objective 3.1.1	Select and interpret appropriate microbiological diagnostic tests
<ul style="list-style-type: none"> • describe culture conditions: <ul style="list-style-type: none"> • aerobic • anaerobic • CO² • special atmosphere • interpret common biochemical tests used for bacterial identification, such as: <ul style="list-style-type: none"> • catalase • coagulase • oxidase • indole • bacitracin disk • bile solubility test • X and V factor • optochin sensitivity • L-pyrrolidonyl-b-naphthylamide hydrolysis • give examples of automated systems for identifying bacteria and describe the principles of identification • describe basic methodology, advantages, and limitations of polymerase chain reaction (PCR) tests • describe methods used in laboratory identification of the following specific specimens: <p>Urine:</p> <ul style="list-style-type: none"> • describe how cell counts are determined • describe how to identify good and bad samples • describe how red cell morphology is determined <p>Sputum:</p> <ul style="list-style-type: none"> • describe limitations of sputum microscopy • define contaminated specimen <p>Faeces:</p> <ul style="list-style-type: none"> • describe basic principles of screening agars • describe differential selectivity of different solid media: MacConkey, xylose lysine deoxycholate, CAMP/CCDA, CCFA, selenite enrichment • list biochemical tests used to identify <i>Campylobacter spp.</i> and <i>Clostridium difficile</i> • list tests used to examine faeces for parasites <p>Wounds</p> <p>Urogenital</p> <p>Cerebrospinal fluid (CSF)</p> <p>Throat swabs</p> 	

DOMAIN 3	DIAGNOSTIC SERVICES
Theme 3.1	Diagnostic Services in the Management of Infections
Learning Objective 3.1.1	Select and interpret appropriate microbiological diagnostic tests
<p>Blood:</p> <ul style="list-style-type: none"> • describe principles of semi-automated blood culture systems • list different blood culture systems and volume of blood required • describe composition of blood culture bottles • describe limitations of blood culture media <p>Mycobacteria:</p> <ul style="list-style-type: none"> • describe principles of Ziehl–Neelsen stains and modified Ziehl–Neelsen stains • describe media used to detect <i>Mycobacterium tuberculosis</i> and other mycobacteria • describe how local reference laboratory performs susceptibility tests • describe different methods of antimicrobial susceptibility testing, including: <ul style="list-style-type: none"> • disk diffusion • minimum inhibitory concentration using microdilution • E-test, broth dilution with appropriate quality control • automated methods • molecular methods • describe principles of antigen detection methods, including: <ul style="list-style-type: none"> • enzyme immunoassay (EIA) • particle and latex agglutination • immunofluorescence • describe principles of antibody detection methods, including: <ul style="list-style-type: none"> • EIA • immunofluorescence • compliment fixation test • radioimmunoassay • latex agglutination • Western blotting • describe tests performed in the viral PCR laboratory at local hospital and state reference laboratory • describe basic principles and interpretations of: <ul style="list-style-type: none"> • pulsed-field gel electrophoresis testing • ribotyping • describe recognition scheme for commonly encountered groups of pathogens based on Gram stain, colony characteristics, growth requirements, motility, and biochemical tests: <ul style="list-style-type: none"> • Gram-positive cocci – aerobic and facultatively anaerobic • Gram-positive bacilli • Gram-negative cocci • Gram-negative bacilli • glucose fermenting • non-fermentative 	

DOMAIN 3	DIAGNOSTIC SERVICES
Theme 3.1	Diagnostic Services in the Management of Infections
Learning Objective 3.1.1	Select and interpret appropriate microbiological diagnostic tests
<ul style="list-style-type: none"> • non-pigmented colonies • yellow pigmented colonies • fastidious organisms – poor growth on blood agar • HACEK organisms • anaerobes • mycobacteria • aerobic actinomycetes • fungi • describe the common methods used in laboratory identification of viruses, including specimen collection requirements, culture, antigen and antibody detection, nucleic acid amplification commercial kits vs. in-house, and role of the reference laboratory. 	
Skills	
<p><u>Basic laboratory skills</u></p> <p>General:</p> <ul style="list-style-type: none"> • prepare media • inoculate specimens onto appropriate media • choose appropriate incubation of plates • set up and use a microscope • prepare a smear and perform a Gram stain • examine the smear and describe the quantity, morphology, and staining qualities of bacteria • identify epithelial cells and polymorphs • assess quality of specimens, identifying contamination • report findings using convention and interpret in the clinical context • prepare a motility test • prepare a wet prep • prepare an acid-fast stain • identify colony morphology of common bacteria on different media • identify contaminated specimens on microscopy and interpret culture growth of normal flora/colonising organisms vs. likely pathogens • perform and interpret basic biochemical tests • perform full identification studies • perform antimicrobial susceptibility studies 	

DOMAIN 3	DIAGNOSTIC SERVICES
Theme 3.1	Diagnostic Services in the Management of Infections
Learning Objective 3.1.1	Select and interpret appropriate microbiological diagnostic tests
<p>For urine:</p> <ul style="list-style-type: none"> perform cell counts by urine microscopy identify red and white cells, bacteria, yeast, and casts, e.g. granular and hyaline identify red cell morphology identify common uropathogens interpret and report findings as per standard guidelines <p>For respiratory tract specimens:</p> <ul style="list-style-type: none"> set up upper respiratory tract specimens, e.g. throat swabs, and lower respiratory tract specimens, e.g. bronchoalveolar lavage and sputum interpret contaminated specimens identify common respiratory tract pathogens process specimens for legionella, mycobacteria, and opportunistic pathogens <p>For faeces:</p> <ul style="list-style-type: none"> process specimens for routine bacterial pathogens – salmonella, shigella and campylobacter differentiate <i>Salmonella</i> typhi and paratyphi from other salmonella process specimens for <i>C. difficile</i> recognise when specimens should be processed for less common pathogens of clinical and public health importance, e.g. vibrios recognise common parasites on microscopy, e.g. <i>Trichuris</i>, <i>Giardia</i>, <i>Strongyloides</i>, <i>Taenia</i>, microsporidia and <i>Cryptosporidium</i> <p>For wounds, fluids and tissues:</p> <ul style="list-style-type: none"> recognise when enrichment media and/or anaerobic culture should be used recognise when specimens should be cultured for opportunistic and fastidious organisms, e.g. fungi and mycobacteria recognise common wound pathogens Gram-negative bacilli, e.g. <i>E. coli</i>, <i>Klebsiella</i>, <i>Proteus</i> and <i>Pseudomonas</i>, and Gram-positive cocci, e.g. <i>Staphylococcus</i> and <i>Enterococci</i>, and perform appropriate tests to identify these, e.g. coagulase, indole, catalase and oxidase <p>For urogenital specimens:</p> <ul style="list-style-type: none"> recognise <i>N. gonorrhoeae</i> and group B streptococcus perform wet preparation for yeasts and <i>Trichomonas</i> examine vaginal smears for bacterial vaginosis perform appropriate tests to identify <i>Neisseria spp.</i>: oxidase carbohydrate fermentation and group B streptococcus <p>For CSF:</p> <ul style="list-style-type: none"> perform cell count and Gram stain 	

DOMAIN 3	DIAGNOSTIC SERVICES
Theme 3.1	Diagnostic Services in the Management of Infections
Learning Objective 3.1.1	Select and interpret appropriate microbiological diagnostic tests

For CSF:

- interpret findings along with glucose, protein levels and clinical context so that appropriate empiric therapy can be given
- process for appropriate bacterial pathogens depending on clinical context
- order N-acetylaspartic acid tests
- order studies for less common pathogens, e.g. MTB, cryptococcus and syphilis

For blood:

- process blood culture bottles in an automated system
- perform microscopy and subculture of signalled bottles
- recognise when methods for enhanced detection of fastidious organisms, e.g. mycobacteria and fungi should be used
- interpret significance of growth from blood cultures in the clinical context

Advanced laboratory skills

Identification tests:

- set up and interpret kit biochemical tests, e.g. analytical profile index
- identify isolates using an automated system, e.g. VITEK
- recognise limitations of these methods
- provide clinical advice based on interpretation of susceptibility testing
- recognise limitations of the antibiogram for outbreak investigation and control

Serology:

- interpret serology test results with regard to test limitations, including false negatives and false positives/cross reactions, and communicate this to clinicians
- recognise when more advanced serology tests, e.g. affinity studies, should be performed

Antigen tests:

- perform point of care tests, e.g. influenza, recognising their limitations
- interpret results of antigen tests and communicate this interpretation to clinicians

Nucleic acid/molecular tests:

- interpret PCR tests
- interpret other nucleic acid based tests
- interpret results of molecular tests for pathogen detection, pathogen quantitation, e.g. viral load, virulence, e.g. toxin detection, antimicrobial resistance, and epidemiological typing
- request and interpret microbiological investigations to differentiate the aetiology for the following conditions, taking into account clinical presentation:
 - arthritis

DOMAIN 3	DIAGNOSTIC SERVICES
Theme 3.1	Diagnostic Services in the Management of Infections
Learning Objective 3.1.1	Select and interpret appropriate microbiological diagnostic tests

- CNS infection
- diarrhoea
- eye infection
- febrile illness in the returned traveller
- PUO
- gastritis/duodenal ulcer
- genital discharge/ulcer
- hepatitis
- HIV – diagnosis and early work up if positive
- prenatal vertically transmitted infection screen
- lymphadenopathy
- upper respiratory tract infection
- lower respiratory tract infection
- pharyngitis and tonsillitis
- UTI
- wound infection/ulcer
- rash – vesicular, nonvesicular and fungal.

Knowledge

- describe risks of diagnostic procedures, including:
 - interventional radiology
 - surgery
 - other specimen acquisition
- describe approximate costs of diagnostic procedures
- define:
 - sensitivity
 - specificity
 - positive and negative predictive values
 - likelihood ratios
- describe limitations of the following investigations, including reasons for false positive and false negative results and expected rates of inconclusive or inaccurate diagnostic results:
 - antibody detection
 - antigen detection
 - microscopy and culture
 - antimicrobial resistance testing
 - molecular tests
 - in-house assays vs. commercial assays, and discuss validation
 - chest x-ray, other x-ray, CT scans and MRI bone scan etc.

DOMAIN 3	DIAGNOSTIC SERVICES
Theme 3.1	Diagnostic Services in the Management of Infections
Learning Objective 3.1.2	Interpret diagnostic test results considering accuracy, validity, reproducibility, and cost effectiveness
Skills	
<ul style="list-style-type: none"> • collaborate with diagnostic service providers, providing expert elicitation of clinical conditions, and information that assists test interpretation • request diagnostic procedures considering patient history and examination • adapt approach to investigations, recognising patient factors, and comorbidities • weigh patient risks, benefits, and cost of investigations in each clinical situation and counsel patients regarding these • apply diagnostic reasoning to minimise the number of investigations used and potential harm from false positives • recognise situations where it is appropriate not to investigate at all • collect specimens • interpret test results considering their limitations, including false negatives and false positives pertaining to organisms listed in Domain 1 • interpret clinical signs in: <ul style="list-style-type: none"> • chest x-rays • head CTs • chest, abdomen, and bone scans • microbiology and other laboratory tests • incorporate possibility of false positives and false negatives into clinical decision making • interpret laboratory resistance testing based on knowledge of resistance mechanisms/cross-resistance and inducible resistance • choose most cost effective investigative path • select appropriate tests and interpret results, e.g. serology, in the context of timing after onset of illness. 	

Domain 4

These learning objectives relate to all modalities used in the prevention and treatment of infections. These include but are not limited to:

- antimicrobial agents, including chemoprophylaxis
- biologically active agents including immunomodulators, immune-replacement therapy, and vaccines
- surgery.

DOMAIN 4	INFECTION PREVENTION AND TREATMENT
Theme 4.1	Infection Prevention and Treatment
Learning Objective 4.1.1	Select antimicrobial and other relevant drugs, considering their pharmacological characteristics

Knowledge

- describe the pharmacological principles of the below listed antimicrobials with respect to:
 - pharmacokinetics:
 - oral bioavailability
 - metabolism
 - dose
 - changes in renal function
 - liver impairment
 - site of action/levels in various target organs, CNS, bone, joint, blood, and bile
 - mechanism of action:
 - site of action within microbe
 - pharmacodynamics
 - type of killing – time above minimum inhibitory concentration vs. peak dose or area-under-the-concentration-vs.-time-curve
 - post-antibiotic effect
 - bacteriostatic vs. bactericidal
 - adverse drug reaction:
 - class related and drug specific
 - type 1 hypersensitivity
 - dose related vs. idiosyncratic drug interactions
 - synergy, additive, antagonistic and pharmacokinetic interactions
 - contraindications
 - approval for use in neonates, infants and children #
 - use in pregnancy and breastfeeding #
 - resistance and cross-resistance:
 - class resistance
 - cross resistance
 - different mechanisms of resistance
 - inducible and constitutive resistance
 - plasmid, transposon and chromosomal
 - spectrum of activity

DOMAIN 4	INFECTION PREVENTION AND TREATMENT
Theme 4.1	Infection Prevention and Treatment
Learning Objective 4.1.1	Select antimicrobial and other relevant drugs, considering their pharmacological characteristics

- paediatric dosing: #
 - differences in adverse effects between paediatric and adult patients
 - specific practical issues with antibiotic choice in paediatric patients, e.g. compliance, formulations and dosing frequency
- differences in pharmacokinetics and prescribing by age, weight, and surface area
- formulations – tablet, capsule and syrup
- recognise above characteristics as broad class effects and identify the differences within classes, particularly regarding spectrum of activity, half-life, dose intervals, cross-resistance, and hypersensitivity

Detailed knowledge is expected for each class of antimicrobial agent. Specific agents that are not commonly used would require less detailed knowledge.

Beta-lactams:

- penicillins:
 - benzylpenicillin (penicillin G), phenoxymethylpenicillin (penicillin V), procaine penicillin and benzathine penicillin
 - moderate spectrum penicillin:
 - amoxicillin and ampicillin
 - antistaphylococcal penicillins:
 - flucloxacillin and dicloxacillin
 - broad spectrum antipseudomonal penicillins:
 - piperacillin, ticarcillin
 - combination penicillin and beta-lactamase inhibitor:
 - amoxicillin, clavulanic acid, piperacillin, tazobactam, ticarcillin and clavulanic acid
- cephalosporins:
 - first generation:
 - cephalexin, cephalothin and cephazolin
 - second generation:
 - cefaclor, cefuroxime, cefoxitin and cefotetan
 - third generation:
 - ceftriaxone, cefotaxime and ceftazidime
 - fourth generation:
 - cefepime and ceftiprome
- carbapenems:
 - meropenem, imipenem and ertapenem
- monobactams:
 - aztreonam
- glycopeptides:
 - vancomycin and teicoplanin
- fluoroquinolones:
 - norfloxacin, ciprofloxacin, moxifloxacin and gatifloxacin

DOMAIN 4	INFECTION PREVENTION AND TREATMENT
Theme 4.1	Infection Prevention and Treatment
Learning Objective 4.1.1	Select antimicrobial and other relevant drugs, considering their pharmacological characteristics

- aminoglycosides:
 - gentamicin, tobramycin, amikacin and streptomycin
- macrolides:
 - erythromycin, roxithromycin, clarithromycin and azithromycin
- tetracyclines:
 - tetracycline and doxycycline
- antifolate:
 - trimethoprim, trimethoprim and sulfamethoxazole
- rifamycins:
 - rifampicin and rifabutin
- nitroimidazoles:
 - metronidazole and tinidazole
- other:
 - linezolid, fusidic acid, clindamycin, quinupristin/dalfopristin, pristinamycin, colistin, chloramphenicol and nitrofurantoin

Anti-TB agents:

- in addition to general principles for antimicrobial agents, describe:
 - activity (bacteriostatic vs. bactericidal, site of action, intracellular vs. extra-cellular) and use first vs. second line for each agent
 - duration of therapy
 - rationale for choice of agents
 - changes to therapy and management of MDRTB
- first line:
 - isoniazid, rifampicin, pyrazinamide and ethambutol
- second line – discuss these and their indications and rationale for use:
 - para-aminosalicylic acid, prothionamide, aminoglycosides, fluoroquinolones, clarithromycin, cycloserine and capreomycin

Antiretroviral agents:

- in addition to general principles (above), describe the class effects, individual adverse effects and dosing regimens, approval in infants and children #, paediatric dosing #, for the following:
 - nucleoside/nucleotide reverse transcriptase inhibitors:
 - abacavir
 - bacavir + lamivudine
 - abacavir + lamivudine + zidovudine
 - didanosine
 - emtricitabine (FTC)
 - emtricitabine + tenofovir
 - lamivudine (3TC)
 - lamivudine+zidovudine

DOMAIN 4	INFECTION PREVENTION AND TREATMENT
Theme 4.1	Infection Prevention and Treatment
Learning Objective 4.1.1	Select antimicrobial and other relevant drugs, considering their pharmacological characteristics
<ul style="list-style-type: none"> • stavudine (d4T) • tenofovir • zidovudine • non-nucleoside reverse transcriptase inhibitors • efavirenz • nevirapine • delavirdine • etravirine • protease inhibitors: <ul style="list-style-type: none"> • atazanavir • fosamprenavir • indinavir • lopinavir + ritonavir • nelfinavir • saquinavir • darunavir • tipranavir • ritonavir • integrase inhibitors: <ul style="list-style-type: none"> • raltegravir • HIV-entry inhibitors: <ul style="list-style-type: none"> • enfuvirtide (T20) • maraviroc • combination agents: <ul style="list-style-type: none"> • lamivudine and zidovudine • abacavir and lamivudine • abacavir, lamivudine and zidovudine • tenofovir and emtricitabine • lopinavir and ritonavir • define the principles of management of failed ART • describe the principles of antiretroviral selection regarding: <ul style="list-style-type: none"> • minimising resistance • maximising efficacy • long-term considerations individualised in respect to side effects and adherence • antifungal agents: <ul style="list-style-type: none"> • amphotericin B deoxycholate • liposomal amphotericin B • azoles – systemic: <ul style="list-style-type: none"> • fluconazole, itraconazole, voriconazole and posaconazole 	

DOMAIN 4	INFECTION PREVENTION AND TREATMENT
Theme 4.1	Infection Prevention and Treatment
Learning Objective 4.1.1	Select antimicrobial and other relevant drugs, considering their pharmacological characteristics

- azoles – topical:
 - caspofungin, clotrimazole, bifonazole, econazole, ketoconazole, miconazole, nystatin and flucytosine
 - pentamidine (*P. jiroveci*)

Antiviral agents:

- herpes group:
 - acyclovir, ganciclovir, valacyclovir, famciclovir, valganciclovir, foscarnet, cidofovir and topical agents
- hepatitis:
 - interferon-alpha 2a /2b, pegylated-interferon-alpha 2b, ribavirin, adefovir, lamivudine and entecavir
- influenza:
 - amantadine, oseltamivir and zanamivir

Antiparasitic agents:

- antimalarials:
 - artesunate
 - lumefantrine
 - atovaquone
 - proguanil
 - chloroquine
 - mefloquine
 - primaquine
 - quinine (doxycycline/clindamycin)
- other antiparasitics:
 - paramomycin
 - metronidazole
 - tinidazole
 - ivermectin
 - diethylcarbamazine
 - permethrin
 - benzimidazoles:
 - albendazole and mebendazole
 - praziquantel
 - nitazoxanide
 - diloxanide furoate
 - pyrimethamine and sulfadiazine
 - pyrantel

Topical antibiotics:

- mupirocin
- polymixin B
- colistin.

DOMAIN 4	INFECTION PREVENTION AND TREATMENT
Theme 4.1	Infection Prevention and Treatment
Learning Objective 4.1.1	Select antimicrobial and other relevant drugs, considering their pharmacological characteristics
Skills	
<ul style="list-style-type: none"> • take a complete drug history including history of use of complementary therapies and over-the-counter medicines • adjust dose with reference to specific patient factors, such as liver and renal function, weight, and age • choose antibiotic to achieve therapeutic levels of antimicrobial agent at the intended site of action and minimise the probability of adverse effects, including excessive exposure to antimicrobial agent and unintended drug interactions (with other antimicrobials and other medication) • choose effective drugs with least potential for teratogenic effects in pregnant patients • demonstrate rational use of multiple antimicrobial agents • demonstrate appropriate dosing interval based on half-life of agent and kill dynamics, including post-antibiotic effect and clinical evidence where available • consult pharmacist, MIMS, Australian antibiotic guidelines and other databases to obtain prescribing information • provide clinic letters and accurate medication list on discharge, along with a plan for cessation or review • antiretroviral agents: <ul style="list-style-type: none"> • devise combination ART regimens giving consideration to: <ul style="list-style-type: none"> • previous antiretroviral experience • viral load and CD4 count • risk profile for adverse events • pill burden • adherence as per guidelines • recognise and manage failed ART. 	
<p><i># In depth knowledge is required by paediatric infectious diseases trainees, see appendix for example of detail required.</i></p>	

DOMAIN 4	INFECTION PREVENTION AND TREATMENT
Theme 4.1	Infection Prevention and Treatment
Learning Objective 4.1.2	Use preventative and therapeutic modalities, recognising the relevant evidence of clinical efficacy and cost effectiveness
Links	Theme 1.1: Principles of Infectious Diseases
	Theme 2.1: General Infectious Diseases

Knowledge

- describe principles of initiating antimicrobial therapy with reference to:
 - choice of empiric therapy for syndromes given in learning objective 2.1.1, discussing rationale for choice
 - commencement of empiric therapy vs. waiting for a microbiological diagnosis
 - importance of completing investigations prior to initiating antimicrobial therapy
- describe dose and duration of antimicrobial agents for conditions listed in learning objectives 1.1.1 and 2.1.1, giving examples of evidence base or lack of available evidence
- give reasons for antimicrobial failure

Trainee is expected to apply basic science principles to the reasons and think broadly, e.g. consider pharmacokinetics, pharmacodynamics, patient adherence, pathogen resistance and revising diagnosis.

- give rationale for use of multi-agent therapy, giving examples of each:
 - empiric
 - avoid resistance
 - synergy
- list antimicrobial agents that require monitoring and describe the monitoring process, including baseline assessment
- describe principles of home therapy with antibiotics, in particular:
 - infections and circumstances amenable to hospital in the home and contraindications – social and medical
 - outpatient parenteral antibiotic therapy
 - choice of antibiotic – appropriate stability
 - dosing
 - monitoring
 - vascular access and pumps
 - patient selection issues
- describe mechanisms of antibiotic resistance in general and for antibiotic class, organism combinations and how this impacts on antibiotic choice, giving historical or observed examples of antibiotic misuse and its consequences

Trainee should cover different mechanisms of resistance, e.g. antibiotic inactivation, alteration of target sites, reduced influx, increased efflux; and different types of genetic changes that lead to resistance, including point mutations that arise de novo, plasmid, transposon and chromosomal resistance, inducible resistance and the consequent difficulties with interpretation. The trainee would be expected to relate this to class resistance and resistance across classes (or otherwise) of antibiotics.

- describe role of surgery in management of infectious diseases and list the conditions for which urgent surgery, or surgical review, is required
- describe role of other therapeutic modalities in management of infectious diseases, including immune-modulating therapeutic agents:
 - normal immunoglobulin: *Streptococcus pyogenes* toxic shock syndrome and necrotising fasciitis

DOMAIN 4	INFECTION PREVENTION AND TREATMENT
Theme 4.1	Infection Prevention and Treatment
Learning Objective 4.1.2	Use preventative and therapeutic modalities, recognising the relevant evidence of clinical efficacy and cost effectiveness

- granulocyte-colony stimulating factor
- macrophage-colony stimulating factor
- granulocyte macrophage-colony stimulating factor
- activated protein C: shock with multiple organ dysfunction syndrome
- interferons alpha and gamma
- thalidomide
- glucocorticoids for TB (pericarditis, meningitis), bacterial meningitis, croup, and *P. jiroveci*
- hyperbaric oxygen.

Skills

- use antimicrobial agents only when the benefits are demonstrable and substantial
- use narrowest spectrum for effective antimicrobial therapy to treat known or suspected pathogens and exercise judgment with regard to timing of antibiotic commencement
- prescribe optimal dose known to be efficacious, minimising adverse drug reactions, and considering local resistance patterns
- treat for a duration based on evidence and in accordance with guidelines
- direct therapy to common pathogens underlying a condition when target pathogens are not known and therapy cannot wait for conclusive microbiological evidence
- modify antimicrobial regimen to narrow spectrum as microbial data becomes available and to broaden spectrum if evidence of deterioration exists
- anticipate likely break-through organisms based on spectrum of antimicrobial coverage
- detect, interpret, and manage antimicrobial failure
- consider cost-effectiveness of therapeutic methods when planning and executing treatment plan
- demonstrate evidence-based practice for combined antifungal use
- follow evidence-based practice for fungal prophylaxis in haematology patients
- implement strategies to enhance patient adherence
- regularly review antimicrobial treatment for patients on long-term therapy and evaluate antimicrobial effect and requirement for dose adjustment while monitoring for adverse effects
- identify and evaluate common adverse drug reactions and select appropriate investigations, e.g. monitoring renal or hepatic function
- engage patient in decision making, explain drug therapy and follow-up verbal with written information where appropriate.

DOMAIN 4	INFECTION PREVENTION AND TREATMENT
Theme 4.1	Infection Prevention and Treatment
Learning Objective 4.1.3	Undertake and advocate immunisation with an understanding of the immunological, epidemiological, and public health basis of immunisation strategies
Links	Theme 6.1: Public Health Aspects of Infectious Diseases

Knowledge

- explain rationale for the standard vaccine schedule and catch up schedules in terms of:
 - development of immunity
 - concepts of herd immunity #
- describe different types of immunity and vaccines, and their implications in terms of adverse events, age at vaccination, spacing of vaccines, contraindications and passive and active immunity: #
 - killed organisms
 - component
 - toxoid
 - live attenuated
 - protein conjugate
- describe special vaccination requirements for the following groups: #
 - Māori and Pacific Islander peoples (NZ) and Aboriginal/Torres Strait Islander peoples (Australia)
 - pregnant women
 - premature babies
 - neonates
 - children under two years of age
 - travellers
 - those taking corticosteroids and other immunosuppressive therapy
 - oncology and transplant patients
 - bone marrow transplant patients
 - HIV/AIDS patients
 - asplenic individuals
 - dialysis patients
- discuss the response to an individual or parent concerned about immunisation, or an anti-immunisation group
- describe the composition, adverse effects, contraindications, efficacy, route of administration, spacing and schedule of the following immunisations: #
 - hepatitis B
 - diphtheria-tetanus-acellular pertussis
 - *H. influenzae* type B
 - inactivated polio vaccine
 - conjugate pneumococcal vaccine
 - 7-valent pneumococcal conjugated vaccine
 - measles, mumps and rubella
 - conjugated meningococcal C vaccine
 - VZV
 - rotavirus
 - influenza
- describe how to manage a patient presenting with a possible vaccine adverse event, mild or serious, and implications for subsequent immunisations

DOMAIN 4	INFECTION PREVENTION AND TREATMENT
Theme 4.1	Infection Prevention and Treatment
Learning Objective 4.1.3	Undertake and advocate immunisation with an understanding of the immunological, epidemiological, and public health basis of immunisation strategies
<ul style="list-style-type: none"> • recognise the process of licensure, recommendation and funding of new vaccines in Australia/New Zealand • remain current with new vaccine development and release • describe composition, adverse effects, contraindications, efficacy, route of administration, spacing and schedule of the following immunisations for travellers and special groups (in addition to above) and in what situations they should be administered: <ul style="list-style-type: none"> • 23 valent pneumococcal polysaccharide vaccine • polysaccharide meningococcal vaccine – A, C, W135 and Y • cholera • hepatitis A • Japanese encephalitis • rabies • typhoid • yellow fever • bacillus Calmette-Guerin. 	
Skills	
<ul style="list-style-type: none"> • follow standard vaccination procedures • implement appropriate immunisation, including routine childhood immunisation, adult with or without adequate childhood immunisation, travellers, and those with special requirements • counsel regarding efficacy, potential adverse events and their management and true and false contraindications to immunisation • respond to concerns about immunisation, explaining risks, and benefits • respond to anti-immunisation groups addressing: <ul style="list-style-type: none"> • true and false contraindications for vaccination • misconceptions regarding immunisation • impact of immunisation on public health • advocate in favour of immunisation as a public health strategy where appropriate. 	
<p><i># In depth knowledge is required by paediatric infectious diseases trainees, see appendix for example of detail required.</i></p>	

DOMAIN 4	INFECTION PREVENTION AND TREATMENT
Theme 4.1	Infection Prevention and Treatment
Learning Objective 4.1.4	Discuss the principles of antimicrobial prophylaxis procedures
Links	Domain 5: Hospital Epidemiology and Control of Infection

Knowledge

- describe the following principles of prevention of surgical site infection:
 - asepsis
 - non-antibiotic related methods – laminar flow, avoidance of hair removal, normoglycaemia and normothermia
 - timing of antibiotics in surgical procedures
 - normal flora of sites associated with procedure
 - local resistance patterns
 - evidence base for antimicrobial prophylaxis for different surgical procedures
- describe principles of infection prevention associated with the following conditions:
 - recurrent rheumatic fever
 - endocarditis – across varying risks, cardiac conditions, and varying risk procedures
 - joint prosthesis
 - post-splenectomy
 - cirrhotic patients with GI bleeding
- describe principles of infection prevention following contact with potentially contagious individuals:
 - meningitis – invasive Hib disease and invasive meningococcal disease
 - chickenpox
 - following sexual activity with a person known to have HIV, hepatitis B or other STI, or if status unknown, including following sexual assault
 - post-occupational exposure to BBVs, e.g. sharps injuries and mucosal exposures
- discuss principles of community control of scabies and impetigo in Māori and Pacific Islander and Aboriginal and Torres Strait Islander communities
- describe principles of epidemic acute post-streptococcal glomerulonephritis management in remote Māori and Pacific Islander and Aboriginal and Torres Strait Islander communities.

Skills

- select antibiotics appropriate to organisms associated with procedure, following guidelines for antibiotic prophylaxis
- implement local and national antimicrobial prophylaxis guidelines through consultation with relevant discipline
- use antibiotics for the minimal effective duration for prophylaxis – advise use of a single dose unless otherwise stated in guidelines
- implement and advise on other principles of surgical site infection prevention – hand hygiene, normoglycaemia and normothermia
- counsel individuals and determine need for prophylaxis following HIV, HBV, HCV exposure or potential exposure.

DOMAIN 4	INFECTION PREVENTION AND TREATMENT	
Theme 4.1	Infection Prevention and Treatment	
Learning Objective 4.1.5	Discuss the principles of antimicrobial stewardship and select appropriate antimicrobial drugs to control antimicrobial resistance	
Knowledge		
<ul style="list-style-type: none"> review evidence for antimicrobial drug resistance, cross-resistance and in the setting of antibiotic misuse, its consequences locally and globally describe constituents of antibiotic control programs locally, nationally, and internationally, including: <ul style="list-style-type: none"> antibiotic use restriction formulary selection computer based systems guidelines education programs. 		
Skills		
<ul style="list-style-type: none"> use antimicrobials with judicious restraint select narrowest spectrum effective antibiotic regimen communicate the need to narrow spectrum to other clinicians modify antibiotics appropriately following results of cultures educate hospital staff in the principles of antimicrobial stewardship. 		
Teaching and learning methods	Assessment methods	
<ul style="list-style-type: none"> attendance at infection control meetings with discussion with supervisor text and journal reading clinical experience and reflective analysis relevant online resources, including Australian Commission on Safety and Quality in Healthcare for antimicrobial stewardship resources: www.safetyandquality.gov.au; and www.agargroup.org for antimicrobial resistance surveillance in Australasia 	<ul style="list-style-type: none"> Case-based Discussion case note review direct observation by supervisor in ward simulated communication scenarios 	

DOMAIN 5	HOSPITAL EPIDEMIOLOGY AND CONTROL OF INFECTION
Theme 5.1	Hospital Epidemiology and Control of Infection
Learning Objective 5.1.1	Outline the principles of epidemiology and the use of epidemiological tools in the surveillance and control of infections in health care settings
Links	Theme 6.1: Public Health Aspects of Infectious Diseases

Knowledge

- describe general principles of epidemiology
- describe, define and where appropriate compare and contrast the following:
 - experimental vs. quasi-experimental studies
 - randomisation and blinding
 - case series, case-control, cohort, control, and randomised control trial
 - prevalence, point prevalence, and incidence
 - relative risk and odds ratio
 - measures of central tendency
 - measures of spread
 - sources of error – lack of precision, bias and confounding
 - principles of causal inference – temporality, biological gradient, and strength of association
 - study generalisability
 - predictor and outcome variable sensitivity and specificity
 - positive and negative predictive values and likelihood ratio
 - discrete and continuous variables
 - meta-analysis
 - principles of multivariable analysis
 - principles of economic analysis, including cost-benefit and cost-effectiveness
- recognise different methods of analysis depending on outcome variable, continuous vs. discrete, predictor variable, continuous vs. discrete, and one or greater than one predictor variable
- list important questions to ask when reviewing a clinical trial publication
- describe epidemiology of common and emerging hospital-acquired infections, referring to sites of colonisation, routes of transmission, patterns of disease and reservoirs
- list the principles of hospital acquired infection surveillance:
 - standardisation
 - communication
 - timely collection and feedback of results
 - risk factors
 - changes in rates
 - careful data collection
 - planned interventions with pre- and post-intervention surveillance
- list steps for outbreak investigation as they relate to hospital epidemics.

DOMAIN 5	HOSPITAL EPIDEMIOLOGY AND CONTROL OF INFECTION
Theme 5.1	Hospital Epidemiology and Control of Infection
Learning Objective 5.1.1	Outline the principles of epidemiology and the use of epidemiological tools in the surveillance and control of infections in health care settings
Skills	
<ul style="list-style-type: none"> • review a clinical trial for peers, e.g. journal club, interpreting findings in reference to general epidemiological principles • design and conduct or assist in a small study, recognise its limitations, adjust for or acknowledge potential sources of error, analyse data, and interpret findings • interpret a cost-effectiveness analysis • evaluate studies to determine cost-benefit of new interventions • appraise and apply new knowledge to modify clinical practice. 	

DOMAIN 5	HOSPITAL EPIDEMIOLOGY AND CONTROL OF INFECTION
Theme 5.1	Hospital Epidemiology and Control of Infection
Learning Objective 5.1.2	Recognise, diagnose, and manage healthcare associated infections
Knowledge	
<ul style="list-style-type: none"> • define healthcare acquired infection • list risk factors for surgical site infection (SSI) • list common types of healthcare acquired infection, their relative frequency, common pathogens, pathophysiology, and clinical manifestations of each • describe local resistance patterns of local hospital's microbes and how they compare to national and international figures • describe changes in patient flora following hospitalisation • describe changes in host susceptibility in hospitalised patients, including first line defences, innate, and adaptive immunity • for the following health acquired infections, describe epidemiology, risk factors, pathogenesis, aetiology (common pathogens, resistance patterns generally and locally), diagnosis, management and prevention: <ul style="list-style-type: none"> • intravascular line infections • SSIs • UTIs • respiratory infections, e.g. post-op, ventilator-associated pneumonia and viral • blood-borne infections 	

DOMAIN 5	HOSPITAL EPIDEMIOLOGY AND CONTROL OF INFECTION
Theme 5.1	Hospital Epidemiology and Control of Infection
Learning Objective 5.1.2	Recognise, diagnose, and manage healthcare associated infections
<ul style="list-style-type: none"> describe host risk factors, local prevalence and incidence rates, typical sites of colonisation, relationship between colonisation and infection and resistance mechanisms, clinical disease, attributable mortality and morbidity for the following pathogens: <ul style="list-style-type: none"> MRSA VRE multi-resistant Gram negative bacteria, including carbapenem-resistant acinetobacter, extended spectrum beta lactamase and ESCAPPM <i>C. difficile</i> invasive candidiasis list situations that give rise to antibiotic resistance. 	
Skills	
<ul style="list-style-type: none"> identify and manage patients with infection or colonisation with multi-resistant organisms comply with local/national infection control guidelines limit spread of multi-resistant organisms according to available evidence and clinical practice guidelines, e.g. isolation, contact precautions, antibiotic restriction and hand hygiene collaborate with other health care providers and non-clinicians, including administrative services to control health care associated infections advise on need for prophylaxis following HIV, HBV and HCV exposure or potential exposure identify and manage diagnosis, isolation, contact tracing notification for patients with the following infections: <ul style="list-style-type: none"> MRSA VRE VZV enteric infections, including viral diarrhoea RTIs BBVs extended spectrum beta lactamase-producing organisms multiply-resistant acinetobacter baumannii <i>C. difficile</i> – associated diarrhoea ectoparasites, such as lice and scabies. 	

DOMAIN 5	HOSPITAL EPIDEMIOLOGY AND CONTROL OF INFECTION
Theme 5.1	Hospital Epidemiology and Control of Infection
Learning Objective 5.1.3	Use preventative strategies to control health care associated infections, recognising the relevant evidence of clinical efficacy and cost effectiveness
Links	Domain 4: Infection Prevention and Treatment

Knowledge

- discuss use, efficacy, and cost-effectiveness of the following infection control initiatives:
 - hand hygiene
 - environmental/equipment hygiene
 - sterilisation/disinfection
 - antimicrobial prophylaxis
 - antimicrobial stewardship
 - sharps disposal
 - hospital infection control teams
 - isolation
 - infection control bundles
- describe epidemiology, prevention, and management of percutaneous injuries involving exposure or potential exposure to HIV, hepatitis C and hepatitis B – local or state-wide protocols
- describe role of the hospital infection control team, with reference to:
 - surveillance and outbreak investigation
 - education
 - staff health
 - antimicrobial stewardship
 - hygiene
 - staff immunisation
- define and describe methods of:
 - asepsis
 - antisepsis
 - sterilisation
 - disinfection
- describe requirements for the following types of isolation and the pathogens/circumstances for which these are required:
 - standard precautions
 - contact precautions
 - airborne precautions
 - droplet precautions
 - special guidelines for emerging contagions, e.g. SARS, H5N1 influenza and suspected bioterrorism
- list priorities in hospital infection control and describe the approach to their implementation, including evidence for the following interventions:
 - hand hygiene
 - minimisation of device use

DOMAIN 5	HOSPITAL EPIDEMIOLOGY AND CONTROL OF INFECTION
Theme 5.1	Hospital Epidemiology and Control of Infection
Learning Objective 5.1.3	Use preventative strategies to control health care associated infections, recognising the relevant evidence of clinical efficacy and cost effectiveness

- asepsis
- antimicrobial stewardship
- infection control team involved in pre- and post-intervention surveillance and feedback of results.

Skills

- practice and teach the principles of infection control, i.e. hand hygiene, aseptic technique, sharps disposal, select investigations and interventions, that will minimise the number of invasive procedures a patient requires and use antimicrobials with judicious restraint
- counsel staff in post exposure prophylaxis, prevention of sharps injury, and safe workplace practices, e.g. safe hours
- contribute to local infection control practices, by:
 - devising infection control guidelines
 - attending meetings
 - conducting surveillance
 - conducting outbreak investigations and interventions
 - training junior staff
 - formulating and reviewing evidence-based guidelines
 - providing education and feedback
 - reviewing surveillance data
- enlist cooperation from hospital staff to ensure adherence to infection control interventions.

DOMAIN 6	PUBLIC HEALTH ASPECTS OF INFECTIOUS DISEASES
Theme 6.1	Public Health Aspects of Infectious Diseases
Learning Objective 6.1.1	Recognise the public health consequences of infections and initiate measures to minimise disease burden and prevent transmission through advice and notification
Links	Theme 1.1: Principles of Infectious Diseases

Knowledge

- discuss need for efficient and equitable distribution of health care resources according to need and the principles of social justice
- for important and common communicable infectious diseases, describe:
 - clinical presentation
 - identification
 - incidence – worldwide distribution

DOMAIN 6	PUBLIC HEALTH ASPECTS OF INFECTIOUS DISEASES
Theme 6.1	Public Health Aspects of Infectious Diseases
Learning Objective 6.1.1	Recognise the public health consequences of infections and initiate measures to minimise disease burden and prevent transmission through advice and notification
<ul style="list-style-type: none"> • reservoir • mode of transmission • incubation periods • period of communicability • definition of contact • susceptibility, immunity and preventative and control measures • contact tracing • isolation precautions • clinical management • prophylaxis • disaster implications • consequences for pregnant women and neonates • describe how to access information on the above for less common communicable diseases • list the factors considered in resource allocation for public health interventions • describe the process of planning and implementing a public health intervention • discuss strategies on how to assess and increase public awareness of infectious diseases • describe strategies for health promotion and media communication of public health issues • describe the key processes in public health surveillance • discuss key aspects of state and national policies, including gaps and limitations, with respect to: <ul style="list-style-type: none"> • epidemic and pandemic preparedness and management • immunisation • healthcare associated infections • prevention of antimicrobial resistance. 	
Skills	
<ul style="list-style-type: none"> • cooperate with competing health sectors, such as public health and community services • communicate with other agencies to identify new disease cases locally • recognise a local or nearby disease outbreak • use statistics to analyse health data and make relevant inferences • provide advice and consultation on common communicable infectious diseases • recognise when urgent epidemiological action is required • communicate with epidemiological control team – hospital and community • undertake notification, counselling of patient, and initiation of contact tracing for STIs. 	

DOMAIN 6	PUBLIC HEALTH ASPECTS OF INFECTIOUS DISEASES
Theme 6.1	Public Health Aspects of Infectious Diseases
Learning Objective 6.1.2	Collaborate with public health services to plan for, and respond to, communicable disease incidents and threats
Knowledge	
<ul style="list-style-type: none"> • recognise the security sensitive biological agents regulatory scheme and associated legislations • describe principles of the notifiable diseases system, process for reporting a notifiable infectious disease and expectations on the public health practitioner and clinician • list steps in a public health outbreak management plan, e.g. pandemic influenza and SARS • describe potential use for the following agents in bioterrorism and their clinical presentation, identification, mode of transmission, incubation period, period of communicability, definition of contact, susceptibility/immunity and preventive and control measures: <ul style="list-style-type: none"> • <i>Bacillus anthracis</i> • <i>Francisella tularensis</i> • <i>Clostridium botulinum</i> toxin • <i>Variola major</i> – a more serious form of smallpox than <i>Variola minor</i> • <i>Yersinia pestis</i> • filo and arena viruses. 	
Skills	
<ul style="list-style-type: none"> • recognise presentation of reactions to common agents that could be used in bioterrorism and contact appropriate public health officials for advice and notification • practice with due regard to legislation and process pertaining to public health measures • identify notifiable infectious diseases, recognise the need for notification and contact appropriate public health officers • manage an incident of notifiable disease containment, including contact tracing and counselling of patients in collaboration with public health • assess risk in a potential bioterrorism incident • manage patients exposed or potentially exposed to an agent of bioterrorism and contribute to a coordinated public health response. 	

DOMAIN 6	PUBLIC HEALTH ASPECTS OF INFECTIOUS DISEASES
Theme 6.1	Public Health Aspects of Infectious Diseases
Learning Objective 6.1.3	Discuss public health issues in northern and central Australia, Māori and Pacific Islander, Aboriginal and Torres Strait Islander peoples and other indigenous populations
Knowledge	
<ul style="list-style-type: none"> describe differences in health outcomes between Māori and Pacific Islander/Aboriginal/Torres Strait Islander peoples and non-indigenous New Zealanders and Australians in relation to infectious diseases, and the heterogeneity of these outcomes within these populations list infectious diseases found more frequently in Māori and Pacific Islander and Aboriginal/Torres Strait Islander peoples than in non-indigenous populations, describing their social determinants give examples of current Māori and Pacific Islander and Aboriginal/Torres Strait Islander peoples public health programs relevant to infectious diseases describe infectious diseases more frequently encountered in tropical Australia describe emerging infectious diseases in Australia/New Zealand, including: <ul style="list-style-type: none"> Japanese encephalitis Australian bat lyssavirus Hendra virus Nipah virus community-acquired MRSA. 	
Skills	
<ul style="list-style-type: none"> advocate for universal access to high quality healthcare contribute to coordinated local public health interventions participate in effective health promotion and media communication of public health issues plan, implement, and measure the effects of public health interventions apply basic health economic concepts to health promotion, including the rational use of resources and setting priorities to improve health equity. 	

DOMAIN 6	PUBLIC HEALTH ASPECTS OF INFECTIOUS DISEASES
Theme 6.1	Public Health Aspects of Infectious Diseases
Learning Objective 6.1.4	Discuss the global epidemiology of infections and their impact outside Australia and New Zealand

Knowledge

- describe global burden and distribution of disease, including:
 - epidemiology of infectious diseases in special populations
 - dynamics of communicable diseases in populations – pathogen, host and environment
 - determinants of different disease burdens in different populations, e.g. in Māori and Pacific Islander/ Aboriginal/Torres Strait Islander populations, people in low income countries, prior exposure, genetic differences and social determinants of disease
- identify and describe prevalence of potential infections in immigrants
- recognise Australian and New Zealand immigrant population – countries of origin, conditions prior to immigration, access to medical facilities
- recognise common pathogens of each region, particularly those that are persistent and may present more than six months following immigration
- assess vaccine status and facilitate catch up vaccination program
- potential infections:
 - MTB
 - malaria
 - HIV
 - *S. typhi*
 - hepatitis B, C and delta
 - herpes viruses
 - *Echinococcus granulosus*
 - *Strongyloides stercoralis*
 - *Taenia solium*
 - *Schistosoma spp.*
 - *Treponema pallidum*
- describe geographical distribution, latent period, clinical presentation, diagnosis, and management of the following tropical infections:

Parasitic:

- amoebiasis
- malaria
- trypanosomiasis
- leishmaniasis
- schistosomiasis
- cestodes and trematodes
- hydatid disease
- migrating worms
- ectoparasites
- filariasis

Viral and bacterial:

- viral haemorrhagic fevers
- dengue fever
- bacterial rickettsial and spirochetes

DOMAIN 6	PUBLIC HEALTH ASPECTS OF INFECTIOUS DISEASES
Theme 6.1	Public Health Aspects of Infectious Diseases
Learning Objective 6.1.4	Discuss the global epidemiology of infections and their impact outside Australia and New Zealand
<ul style="list-style-type: none"> • epidemic bacterial meningitis • bacterial diarrhoea: <ul style="list-style-type: none"> • secretory, dysenteric and tropical sprue • typhoid fever • melioidosis • brucellosis • leptospirosis • leprosy • staphylococcal and streptococcal skin and soft tissue infections • recognise sociologic differences between urban Australia/New Zealand and Pacific Islands • identify infections with higher prevalence in the pacific region • identify emerging infectious diseases in the pacific region • describe priorities in advising and managing a person prior to travelling to a developing country • list measures that will minimise the likelihood of common travel infections • list indications, contraindications, adverse effects, composition, dose schedule and efficacy of travel vaccines • describe differential diagnosis, history examination, investigation, and management for the following syndromes in returned travellers: <ul style="list-style-type: none"> • fever • diarrhoea and food borne illness • confusion and coma • cough and respiratory infections • jaundice – a classic symptom of hepatitis • skin ulcers and rashes • eosinophilia • lymphadenopathy • splenomegaly and anaemia • ectoparasites • animal bites – rabies • list incubation periods of common imported infections • describe epidemiology, clinical presentation, diagnosis, preventive control measures of emerging and re-emerging infectious disease threats throughout the world, including: <ul style="list-style-type: none"> • SARS • H5N1 influenza • Australian bat lyssavirus • Hendra and Nipah viruses • human metapneumovirus • chikungunya • Rift Valley fever • identify and appraise resources used to keep up to date on current disease outbreaks, new syndromes and new diseases • list key infections that an individual could be exposed to following unprotected sexual intercourse abroad, including their incubation periods, prevention, prophylaxis, treatment, and contact tracing. 	

DOMAIN 6	PUBLIC HEALTH ASPECTS OF INFECTIOUS DISEASES
Theme 6.1	Public Health Aspects of Infectious Diseases
Learning Objective 6.1.4	Discuss the global epidemiology of infections and their impact outside Australia and New Zealand

Skills

- use resources to remain current on emerging infectious diseases and infectious disease outbreaks worldwide
- incorporate new knowledge into current understanding of infectious diseases
- counsel travellers to minimise risks of infection, including:
 - food and water hygiene
 - mosquito avoidance
 - STI risk behaviour
 - appropriate use of medication for diarrheal illness
 - immunisation, including standard and travel and region specific
 - global distribution of disease, including resistance patterns, e.g. malaria
- use reference material to assist in decision making
- take a relevant travel history, including:
 - exact chronology of exposures and symptom onset
 - itinerary
 - type of exposure
 - adherence to prophylaxis, e.g. immunisation, malaria chemoprophylaxis, self-medication, management abroad, including over-the-counter medications
- formulate differential diagnosis, prioritising treatment for infections that are transmissible, urgent and treatable over those more common but less urgent
- interpret clinical presentation in the context of host history, e.g. returned (malaria naïve) traveller with brief exposure vs. immigrant with long-term exposure
- identify behaviour that affects risk, such as:
 - sexual activity
 - drug use
 - traditional remedies
 - occupation
 - contact with animals, fresh water, insects, and food
 - water hygiene
- regularly review resources on global infectious disease epidemiology
- incorporate new material rapidly into clinical response to, and assessment of, returned travellers and pre-travel advice
- follow current guidelines for assessment and management of returned travellers from transmission regions, e.g. during SARS or H5N1 transmission.

Reference list

Australian Antibiotic guidelines

RACP Advanced Training curriculum Immunology

RACP Basic Training curriculum

Curriculum of the Joint Committee of Higher Medical Training (UK) for Infectious Diseases

Curriculum of the Joint Committee of Higher Medical Training (UK) for Infectious Diseases and Tropical Medicine

Infectious Diseases: A clinical approach, Yung, A, McDonald, M, Spelman, D et al.

Recommended reading list/learning resources

Manson's Tropical Medicine GC Cook, WB Saunders Company Ltd 1996. 20 ed.: WB Saunders Company Ltd, 1996 (Cook G, ed.)

Hospital Epidemiology and Infection Control. 2 ed.: Lippincott Williams & Wilkins, 1999 (Mayhall C, ed.)

HIV Management in Australasia: a guide for clinical care. Australasian Society for HIV Medicine Inc, 2004 (Hoy J, Lewin S, eds.) www.ashm.org.au/uploads/File/hiv-management-mono.pdf

Mandell, Douglas and Bennett's Principles and Practice of Infectious Diseases. 6 ed.: Elsevier Churchill Livingstone, 2005 (Mandell G, Bennett J and Dolin R, eds.)

Therapeutic Guidelines: Antibiotic. 13 ed. Melbourne: Therapeutic Guidelines Limited, 2006 (Group AE, ed.)

Oxford Handbook of Public Health Practice. 2 ed. Oxford: Oxford University Press, 2006 (Pecheon D, Guest C, Melzer D and Muir Gray J, eds.)

Fields BN, Knipe DM and Howley PM. Fields' Virology. 5th ed. Philadelphia: Wolters Kluwer Health / Lippincott Williams & Wilkins, 2007

Gordis L. Epidemiology. WB Saunders Company, 1996

Heymann DL, American Public Health Association. Control of Communicable Diseases Manual. 18th ed. Washington, DC: American Public Health Association, 2004

Kucers A, Crowe S, Grayson M and Hoy J. The Use of Antibiotics. 5 ed., 1997 (Heinemann B, ed.)

Murray P, EJ B, Pfaller M, Tenover F and Tenover R. Manual of Clinical Microbiology. 7 ed.: ASM Press, 1999

Roitt IM. Roitt's Essential Immunology. 11th ed. Oxford: Blackwell Science, 2006

Yung A, Ruff T, Torresi J, Leder K and O'Brien D. Manual of Travel Medicine. 2 ed. Melbourne: IP Communications, 2004

Yung A, McDonald M, Spelman D, et al. Infectious Diseases: A Clinical Approach. 2 ed. Melbourne: IP Communications, 2005

Peters and Pasvol Atlas of Tropical Medicine and Parasitology, 6th edition

Journals

Good reviews in clinical infectious diseases can be found in the following journals:

New England Journal of Medicine
www.nejm.org

Journal of Infectious Diseases
Clinical Infectious Diseases
www.journals.uchicago.edu/CID/home.html

Lancet Infectious Diseases
www.elsevier.com/locate/j.lancetid

Emerging Infectious Diseases

www.cdc.gov/ncidod/EID/

Infection Control and Hospital Epidemiology

AIDS

Pediatric Infectious Diseases Journal

Useful online resources

Australian Immunisation handbook

www9.health.gov.au/immhandbook

Australasian Society of Infectious Diseases

www.racp.edu.au/ASID

ozbug Australian infectious diseases email discussion group contact

asid-ozbug@burnet.edu.au

RACP homepage

www.racp.edu.au

Australian Society of HIV Medicine homepage

www.ashm.org.au

Promedmail

www.promedmail.org

CDC website

www.cdc.gov

MMWR

www.cdc.gov/mmwr

WHO

www.who.int/en

Travellers' health

www.cdc.gov/travel

Up To Date

www.uptodate.com

APPENDIX

EXAMPLE OF AN ORGANISM FOR WHICH DETAILED KNOWLEDGE IS REQUIRED AND ONE FOR WHICH BASIC KNOWLEDGE REQUIRED

DETAILED

Cryptococcus neoformans (C. neoformans)

C. neoformans is a dimorphic fungus that can cause disease in the apparently immunocompetent host without an underlying disease and those severely immunocompromised.

There are 4 serotypes (A-D) and three varieties:

- Serotype A = var *grubii* (previously var *neoformans*)
- Serotype B, C = var *gattii*
- Serotype D = var *neoformans*

Immunocompromised hosts are particularly susceptible to serotypes A (var *grubii*) and D (var *neoformans*), whereas serotypes B and C (var *gattii*) often occur in immune competent individuals.

Pathogenesis

Pathogenesis is determined by:

- status of the host defences
- virulence of the strain of *C. neoformans*
- size of the inoculum.

The susceptible host comes into contact with cryptococci from the environment through inhalation of infectious propagules. In the alveoli, the yeasts contact the alveolar macrophages, which recruit other inflammatory cells through cytokines or chemokines, and a proper Th1 response and granulomatous inflammation is elicited.

The infection can then take one of three pathways:

- In an immunosuppressed host, the yeast continues to proliferate and disseminate, causing clinical disease.
- The effective immune response completely eliminates the yeast from the host.
- The yeasts produce a small lung/lymph-node complex and remain dormant in tissues but are not dead.

Cryptococci can then be reactivated at times of immune suppression and disseminate to other organs in much the same way as TB. Exposure is common but disease is rare.

The histological changes range from virtual absence of an inflammatory reaction to intense granulomatous inflammation with caseous necrosis. The immune reaction appears to be primarily a function of the host status, but the yeast can participate in the inflammatory response.

Host response

Cellular immune response

A primary effector cell against *C. neoformans* is the macrophage, which produces anticryptococcal activity when it is 'activated' as do other professional phagocytes. Natural killer cells, and lymphocytes (CD4, CD8) have been shown to possess direct anticryptococcal effects.

Granulomatous inflammation is essential for containment of infection. Because granuloma formation is a result of a helper T cell 1 (Th1)-polarised response, cytokines such as tumour necrosis factor, interferon-gamma, and interleukin (IL)-2 are required.

Humoral immune response

Antibodies provide for efficient phagocytosis, enhanced natural killer cell function, and improvement in clearing capsular polysaccharide.

Innate immune system

Virulence factors

- capsule:
 - immune evasion: acts as antiphagocytosis barrier, depletes complement, causes antibody unresponsiveness, cytokine dysregulation, selectin, and tumour necrosis factor receptor loss
 - toxicity: produces brain oedema, intracellular toxicity, enhanced HIV replication
- melanin:
 - immune evasion: T cell evasion and reduced antibody opsonisation
 - antioxidant
 - cell wall changes, protecting from temperature changes and antifungals
 - growth at 37°C

Specifics of laboratory diagnosis including differentiation from related organisms

Microbiology

Three direct tests that predict that a yeast may be *C. neoformans*:

1. India ink preparation may reveal the encapsulated yeast 5-10 microns. The capsule is generally better seen in direct clinical specimens and may not be apparent in wet mounts made from cultures.

Approximately 50% of non-AIDS patients with cryptococcal meningitis and over 80% of patients with AIDS have a positive India ink examination of the CSF. The number of cryptococci may be so low that several millilitres of CSF must be cultured for a positive culture to be obtained especially in the immunocompetent host.

Lymphocytes can be mistaken for yeasts. India ink smears of urine, sputum, and bronchoalveolar lavage specimens are almost impossible to interpret.

2. 2A rapid urease test is positive in most *Cryptococcus* species: distinguishing it from *Candida* sp.
3. Laccase activity, an enzyme that allows the conversion of diphenolic compounds into melanin. Detection of this unique biologic characteristic is possible with special media. Does not distinguish from non-pathogenic cryptococci.

On agar: white colonies on agar within one to two days, later mucoid (polysaccharide capsule)

Serotypes

To distinguish serotypes, the following can be used:

- commercial antibodies
- PCR
- special agar: uses ability of serotype B and C isolates to assimilate glycine as a sole carbon source, which leads to a colour change on agar

Histology

C. neoformans appear as spherical, narrow-based, budding, encapsulated yeast cells. With routine histopathologic stains, such as hematoxylin and eosin, the yeasts are surrounded by empty spaces, which reflect the capsule. The polysaccharide capsule can be identified with specific stains, and its ability to produce melanin allows it to be stained with a specific stain. Silver fungal stain identifies the narrow-based budding yeast in tissue, and a Gram stain usually reveals a poorly stained Gram-positive yeast.

Cryptococcal antigen

Serum cryptococcal antigen is generally negative in normal host with disease confine to lungs.

Early, asymptomatic spread to the CNS may be manifested only by a positive CSF fungal culture, with otherwise normal CSF and a negative antigen test.

A positive antigen test should prompt examination of CSF.

Culture

C. neoformans can grow on most bacterial and fungal media. Ordinary blood culture methods are effective in detecting cryptococcaemia, and the finding of positive blood cultures has been more common during the AIDS epidemic. Most *C. neoformans* isolates from untreated patients can be detected in culture three to seven days after the specimen is collected and placed into or on culture media.

The identification of the varieties for *C. neoformans* can be made by several distinguishing varieties:

- a colour reaction on concanavaline-glycine-thymol agar, which distinguishes serotypes A, D, and AD from B and C
- an antibody kit for serotyping
- fingerprinting with DNA-based methods
- serology
- EIA/latex agglutination tests for detection of cryptococcal polysaccharide antigen are extremely accurate (>90% sens and spec) for the diagnosis of invasive disease when used on serum or CSF, but not urine, bronchoalveolar lavage

False positives:

- extremely rare if CSF titers are 1:4 or greater
- may occur with microorganisms such as *Trichosporon asahii* (*beigelii*) or other infections

False negative tests:

- early asymptomatic meningitis
- chronic, indolent meningitis

Other important points:

- in patients with cryptococcal infection of the lung who have a positive serum polysaccharide antigen test, there is heightened concern that the infection has become extrapulmonary
- in cases of serum cryptococcal polysaccharidaemia in HIV-infected patients with negative fungal cultures from CSF and urine, it is probably wise to start empiric therapy because many of them will eventually develop cryptococcosis
- it is advisable to confirm a positive latex agglutination with an enzyme immunoassay, and vice versa, before beginning prolonged therapy with fluconazole. False positives in one test are not usually accompanied by false positives in the other.

Radiology

Chest

The chest radiograph of pulmonary cryptococcosis can localise or diffuse infiltrates, nodules, hilar lymphadenopathy, cavitation and pleural effusions.

- DDx in AIDS patients - *Pneumocystis* infection.

Brain

- approximately half of CT scans are normal in CNS infection
- hydrocephalus
- gyral enhancement
- single or multiple nodules: those with var. gattii infection cryptococcomas occur in up to 25% of non-AIDS and apparently immunocompetent patients
- AIDS patients have the same CT findings with the addition of atrophy in a third of cases
- MRI is more sensitive than CT
- clustered foci in the basal ganglia or midbrain
- hyperintense on T2-weighted images nonenhancing
- rarely, there may also be multiple miliary enhancing parenchymal and leptomeningeal nodules.

DDx of cryptococcoma in AIDS patients

- lymphoma
- toxoplasmosis
- nocardiosis
- other secondary infection

NOTE: follow-up scans may show worsening of lesions, with enlargement, new lesions, or persistence of cryptococcomas. This finding is not necessarily a sign of treatment failure. It simply represents enhancement by inflammation as microscopic yeast foci are being eliminated or immune reconstitution.

Detail of common and rarer disease manifestations

Clinical manifestations can vary from asymptomatic colonisation of the respiratory airways to dissemination of infection into any part of the human body. *C. neoformans* enters the host primarily through the lungs but has a special predilection for invading the CNS of the susceptible host.

HIV-infected patients present with more CNS and extrapulmonary infections, higher rates of positive India ink examinations, higher polysaccharide antigen titers, more frequent positive blood cultures, and fewer CSF inflammatory cells.

Lung

The respiratory tract is the most common portal of entry for this yeast, and symptoms there range from asymptomatic colonisation of the airway to life-threatening pneumonia with evidence of an acute respiratory distress syndrome.

Normal hosts

In at least a third of normal hosts, the infection is asymptomatic on presentation and is detected by an abnormal chest radiograph. Often it presents as an incidental finding of well-defined, noncalcified nodule(s), as DDx of a coin lesion. Other radiographic characteristics include indistinct masslike infiltrates, hilar lymphadenopathy, lobar infiltrates, pleural effusions, and lung cavitation.

In immune compromised hosts

More likely to present with constitutional symptoms, such as fever, malaise, chest pain, shortness of breath, and weight loss. In these patients, pneumonia can progress to features of acute respiratory compromise even without evidence of CNS involvement. Chest radiographs in these immunocompromised hosts are similar in their range of presentations to those of immunocompetent hosts. However, alveolar and interstitial infiltrates are particularly common and thus might be confused with *Pneumocystis* infection. There may also be a miliary pattern.

Immunocompromised patients frequently present with a meningeal rather than a pulmonary syndrome.

In AIDS patients, cryptococcal pneumonia may not be symptomatic, and over 90% may present with concomitant CNS infection at the initial diagnosis. Also consider concomitant infection with other opportunists such as:

- typical and atypical mycobacterium
- cytomegalovirus
- *Nocardia* and *Pneumocystis*
- endobronchial masses
- endobronchial colonisation
- acute respiratory distress syndrome
- mediastinal adenopathy
- hilar adenopathy
- pleural effusions and empyema
- miliary pattern.

Patients with prior chronic lung disease but no immunosuppression

C. neoformans may be isolated from the sputum repeatedly over months and years with no evidence of active pulmonary parenchymal disease, negative serum cryptococcal antigen, and negative fungal cultures from urine and CSF. These patients are considered to have chronic endobronchial colonisation. A pulmonary nodule in such a patient may be considered to be cryptococcal in origin but may represent a malignancy.

CNS

Most patients with cryptococcosis of the CNS, present with signs and symptoms of subacute meningitis or meningoencephalitis, such as headache, fever, cranial nerve palsies, lethargy, coma, or memory loss over several weeks. Symptoms may not be typical, and patients may present with acute symptoms (several days) of severe headaches, with intermittent headaches, or even with no headache but with altered mental status.

This syndrome is similar for immune competent and immunocompromised patients, with some differences:

HIV-infected patients

- the burden of yeast is generally higher, and this may be reflected in higher polysaccharide antigen titers, slower conversion of CSF to sterilisation during treatment, and a tendency toward a higher incidence of increased intracranial pressure.
- extracranial disease sites more likely to be found during the initial workup.
- second CNS event may occur, such as infection with *Toxoplasma gondii* or development of a lymphoma.

Immune reconstitution syndrome

After starting highly active antiretroviral therapy (HAART), some patients develop acute symptoms of cryptococcal meningitis or pain and swelling in peripheral, hilar, or mediastinal lymph nodes. This syndrome may also occur during treatment of cryptococcal meningitis in the first few months after HAART is introduced. It appears to correlate with a significant drop in HIV load, but there may be only a modest rise in the number of CD4 cells.

It is hypothesised that as immunity improves with HAART, silent or latent cryptococcal infections are made clinically apparent as inflammation is mobilised to interact with the yeasts or polysaccharide antigen. During treatment for cryptococcal meningitis, this immune reconstitution syndrome may be marked by increasing headaches, new neurologic signs, appearance of more inflammatory cells in the CSF, and possibly increased intracranial pressure. Distinction between immune reconstitution and progressive infection can be difficult, but cultures from the CSF and lymph node aspirates are negative in immune reconstitution syndromes, even though cryptococci may be present on a smear.

Less common sites

Eye:	Papilledema, extraocular muscle paresis, keratitis, chorioretinitis, optic nerve atrophy and endophthalmitis
GI tract:	Oesophageal nodule, nodular or ulcerated lesions in stomach or intestines (may resemble Crohn's), hepatitis, peritonitis and pancreatic mass
Genitourinary:	Prostatitis, renal cortical abscess, positive urine culture and genital lesions
Bone and joints:	osteolytic lesion(s) and arthritis
Skin:	multiple manifestations including papules and maculopapules, subcutaneous abscess, vesicles, plaques and cellulitis etc.
CVS:	cryptococcaemia, endocarditis (native and prosthetic), mycotic aneurysm, myocarditis, infected vascular graft and pericarditis
Endocrine:	adrenal insufficiency, adrenal mass, thyroiditis, and thyroid mass
Other:	breast abscess, gingivitis, myositis and sinusitis

Detailed knowledge of antimicrobial therapeutics

- local and global resistance patterns and mechanisms
- alternative agents in patients with altered pharmacokinetics and severe hypersensitivity
- dosage according to disease site
- the site of infection will determine the treatment recommendation
- CNS or disseminated cryptococcosis:
 - AIDS meningitis: 0.7-1mg/kg/day ampho+5FC 25mg/kg qid for two weeks then fluconazole 400mg orally daily then fluconazole 200mg daily suppressive therapy indefinitely consider stopping if CD4 is more than 200 for more than six months
 - induction course leads to more rapid sterilisation of CSF
 - adjust flucytosine in renal impaired and watch for bone marrow toxicity
 - some evidence that combination with flucytosine reduces relapse
 - non-AIDS meningitis: can start with fluconazole 400mg daily 8-10 weeks if mild in severity, if the non-Aids meningitis is severe start ampho 0.5-0.8 mg/kg/day IV+5FC 37.5 mg/kg qid until afebrile and culture negative then switch to fluconazole 200mg daily:
 - in patients without AIDS combination therapy with ampho /5FC reliably sterilises CSF after two weeks of therapy

Control of increased intracranial pressures with external drainage, such as by repeated lumbar punctures with large-bore needles and ventricular or lumbar drains, may be necessary during the early treatment phase. Persistent, symptomatic, high CSF pressures may warrant placement of a permanent CSF shunt. Corticosteroid treatment was not found to be generally useful. Blindness, permanent dementia, or death may result from persistent raised intracranial pressure.

Cryptococcosis confined to the lung in previously healthy persons responds very well to fluconazole at 200–400mg/day for three to six months. Non-immunosuppressed patients with endobronchial colonisation but without radiologic evidence of pulmonary parenchymal disease do not require antifungal treatment. However, if the patient becomes immunocompromised, treatment should be considered. CNS cryptococcomas tend to be treated for longer periods with fluconazole.

Epidemiology of disease transmission, reservoirs and vectors, carrier state and environmental niches, incubation and infectivity periods

Most cryptococcal infections are acquired primarily by inhalation of infectious propagules following exposure to environmental source. There are occasional cases of other modes of transmission, such as direct traumatic inoculation through contaminated environmental projectiles and transplanted organs.

Intense bird exposure has been reported as predisposing factor in a number of cases. Otherwise, there is little evidence of zoonotic transmission, although *C. neoformans* can be found in many animal species.

In the pre-AIDS era, cryptococcosis was extremely rare, reached a peak in the early 90s in developed countries and is now declining with HAART and fluconazole therapy for oral candidiasis.

In many developing nations with high HIV prevalence, it is the most common cause of culture positive meningitis and culture positive blood stream infection; some reports indicate that 15%–45% of those with advanced HIV infection succumb to cryptococcosis.

C. neoformans var *grubii* and var *neoformans*

Associated with birds, especially pigeons and chickens, and rotting vegetation

C. neoformans var *gattii*

Associated with river red gums, *Eucalyptus camaldulensis*, and forest red gums, *Eucalyptus tereticornis*

Characteristics of multiple different predisposed hosts

- var grubii and var neoformans are associated with immune compromise whereas var gattii is not
- predisposing factors for var grubii and var neoformans:
 - AIDS especially as CD4 drops below 100 (80% var grubii)
 - idiopathic CD4 lymphopenia
 - corticosteroid therapy
 - transplantation
 - malignancy, especially lymphoproliferative
 - sarcoidosis
 - hyper IgM, hyper IgE syndrome
 - monoclonal antibodies such as infliximab
 - systemic lupus erythematosus, dialysis, cirrhosis and possibly diabetes mellitus

BASIC

Vibrio cholerae

Serotypes O1 and O139 are responsible for epidemic cholera in humans. Serotype O139 was discovered in the early 1990s as the aetiological agent responsible for the outbreaks of cholera in South Asia and continues to cause epidemics in Bangladesh.

Organism characteristics

- Gram-negative rod

Pathogenesis

Following attachment and colonisation of the small intestinal epithelium *Vibrio cholerae* produces its major virulence factor, cholera toxin, composed of A and B subunits. The A1 fragment is the active enzyme; A1 catalyses the ADP-ribosylation of a guanosine-5'-triphosphate-binding protein, leading to persistent activation of adenylate cyclase. The increase of cyclic adenosine monophosphate in the intestinal mucosa leads to increased chloride secretion and decreased sodium absorption, producing the massive fluid and electrolyte loss characteristic of the disease.

Typical disease patterns

- can be asymptomatic or mild
- severe cases profuse watery diarrhoea (rice water stools)
- no blood in stool
- fever rare
- rapid death due to dehydration
- high mortality rate if untreated

Diagnostic tools and approach

- mostly a clinical diagnosis
- gram-negative rod on Gram stain of stool – high organism load in stool
- culture using selective media

Effective management and expected resistance patterns

- rehydration, not antibiotics, mainstay of treatment
- low osmolarity oral rehydration or IV rehydration if rapid or severe (>10%) dehydration, severe vomiting, change in mental state
- antibiotics only an adjunct (decrease organism burden and shorten duration of illness by one day)
 - tetracycline resistance exists
 - ciprofloxacin/norfloxacin treatment of choice
 - erythromycin/azithromycin for children and pregnant women

Epidemiologic factors

- Food and/or water spread
- Endemic in Asia and Africa
- Epidemics South and Central America

Characteristics of predisposed host if any

- high gastric pH

Incubation and infectivity periods

- Hours to five days incubation

Vaccine

- DUKORAL: oral killed V cholerae01 and non-toxic B subunit, 85% efficacy against all cholera, including El Tor PLUS ETEC, but short lived (three years)
- Oral live vaccine exists but unavailable in Australia
- Parenteral vaccine lacks efficacy and no longer indicated

GLOSSARY OF ACRONYMS

ADR	acquired drug resistance
AIDS	acquired immune deficiency syndrome
ALT	alanine transaminase
API	analytical profile index
AUC	area-under-the-concentration-vs.-time-curve
BAL	bronchoalveolar lavage
BBV	blood borne virus
BCG	bacillus Calmette-Guerin
BMT	basal metabolic temperature
CEA	cost-effective analysis
CFT	compliment fixation test
CJD	Creutzfeldt-Jakob disease
CMV	cytomegalovirus
DEC	diethylcarbamazine
EBV	Epstein-Barr virus
EIA	enzyme immunoassay
ESBL	extended spectrum beta lactamase
G-CSF	granulocyte colony stimulating factor
GI	gastrointestinal
GM-CSF	granulocyte macrophage colony stimulating factor
GVHD	graft vs. host disease
HAI	healthcare acquired infection
HAV	hepatitis A virus
HBV	hepatitis B virus
HCV	hepatitis C virus
HDV	hepatitis delta virus
HHV	human herpes virus
HIV	human immunodeficiency virus

HSV	herpes simplex virus
HTLV	human T-lymphotropic virus
IPV	inactivated polio vaccine
IVDU	intravenous drug use
LRTI	lower respiratory tract infection
MAC	Mycobacterium avium complex
M-CSF	macrophage colony stimulating factor
MDRTB	multidrug resistant tuberculosis
MIC	minimum inhibitory concentration
MODS	multiple organ dysfunction syndrome
MRO	multiresistant organism
MRSA	methicillin-resistant Staphylococcus aureus
MTB	Mycobacterium tuberculosis
MTCT	mother to child transmission
NAA	N-acetylaspartic acid
NNRTI	non-nucleoside respiratory tract infection
NRTI	nucleotide reverse transcriptase inhibitor
PAS	para-aminosalicylic acid
PCR	polymerase chain reaction
PEP	post exposure prophylaxis
PFGE	pulsed-field gel electrophoresis
PID	pelvic inflammatory disease
PUO	pyrexia of unknown origin
PYR	L-pyrrolidonyl-b-naphthlyamide
RIA	radioimmunoassay
RSV	respiratory syncytial virus
RT	respiratory tract
SCID	severe combined immunodeficiency
SSI	surgical site infection

STI	sexually transmitted infection
TB	tuberculosis
URTI	upper respiratory tract infection
UTI	urinary tract infection
VAP	ventilator associated pneumonia
VRE	vancomycin-resistant enterococci
VZV	varicella zoster virus
XDRTB	extensively drug resistant tuberculosis
XLD	xylose lysine deoxycholate
ZDV	zidovudine