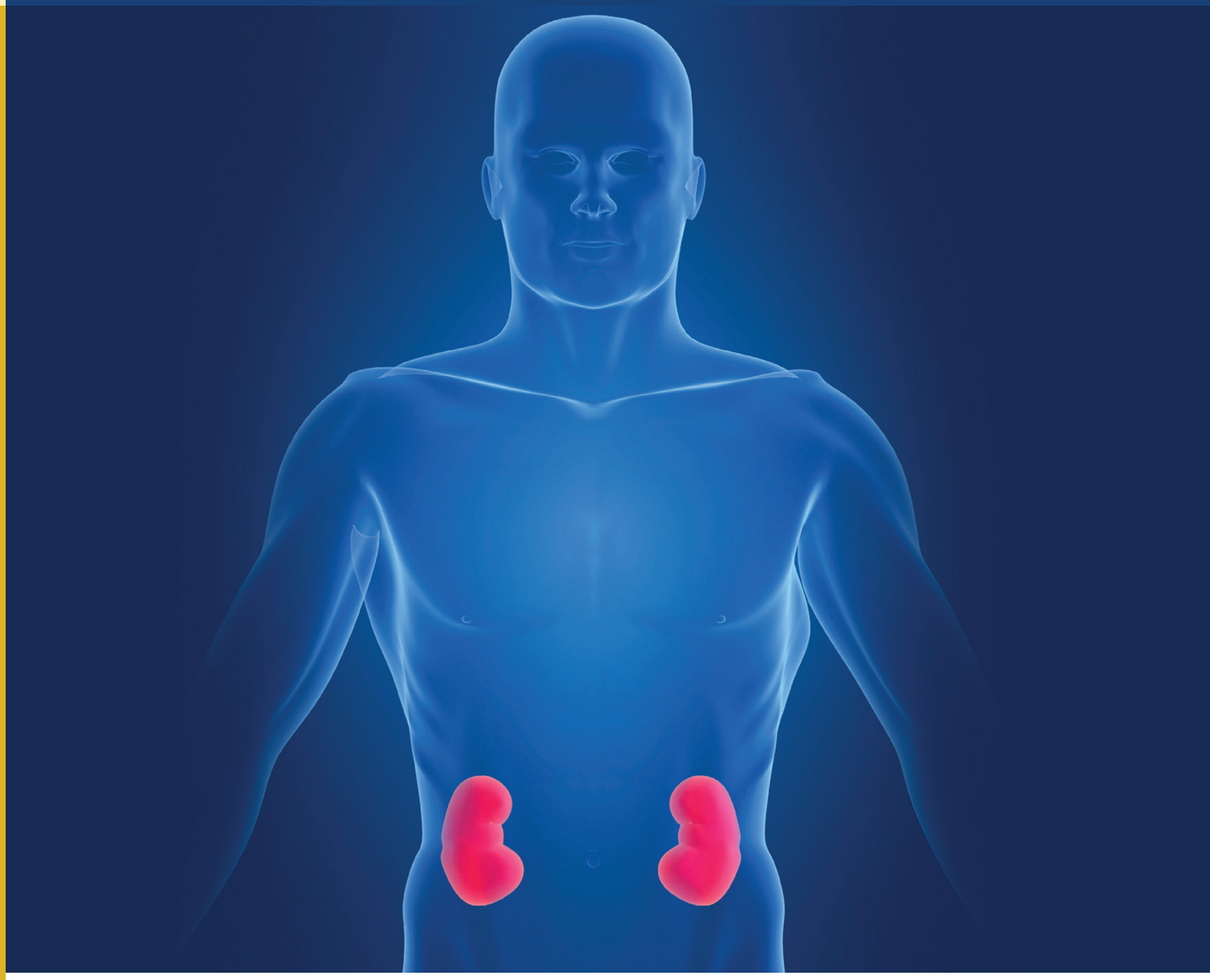
The Royal Australasian College of Physicians

Nephrology

Advanced Training Curriculum

Adult Medicine Division

Paediatrics & Child Health Division



ANZSN

The Royal Australasian College of Physicians

Physician Readiness for Expert Practice (PREP) Training Program

Nephrology Advanced Training Curriculum

TO BE USED IN CONJUNCTION WITH:

Basic Training Curriculum – Adult Internal Medicine

Basic Training Curriculum – Paediatrics & Child Health

Professional Qualities Curriculum

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- Dr Philip Clayton, Advanced Trainee
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- Dr Carmel Hawley, FRACP
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The process was managed by the Curriculum Development Unit within the College's Education Deanery, who designed the document, drafted content material, organised and facilitated writing workshops, developed resource materials, and formatted the final document.

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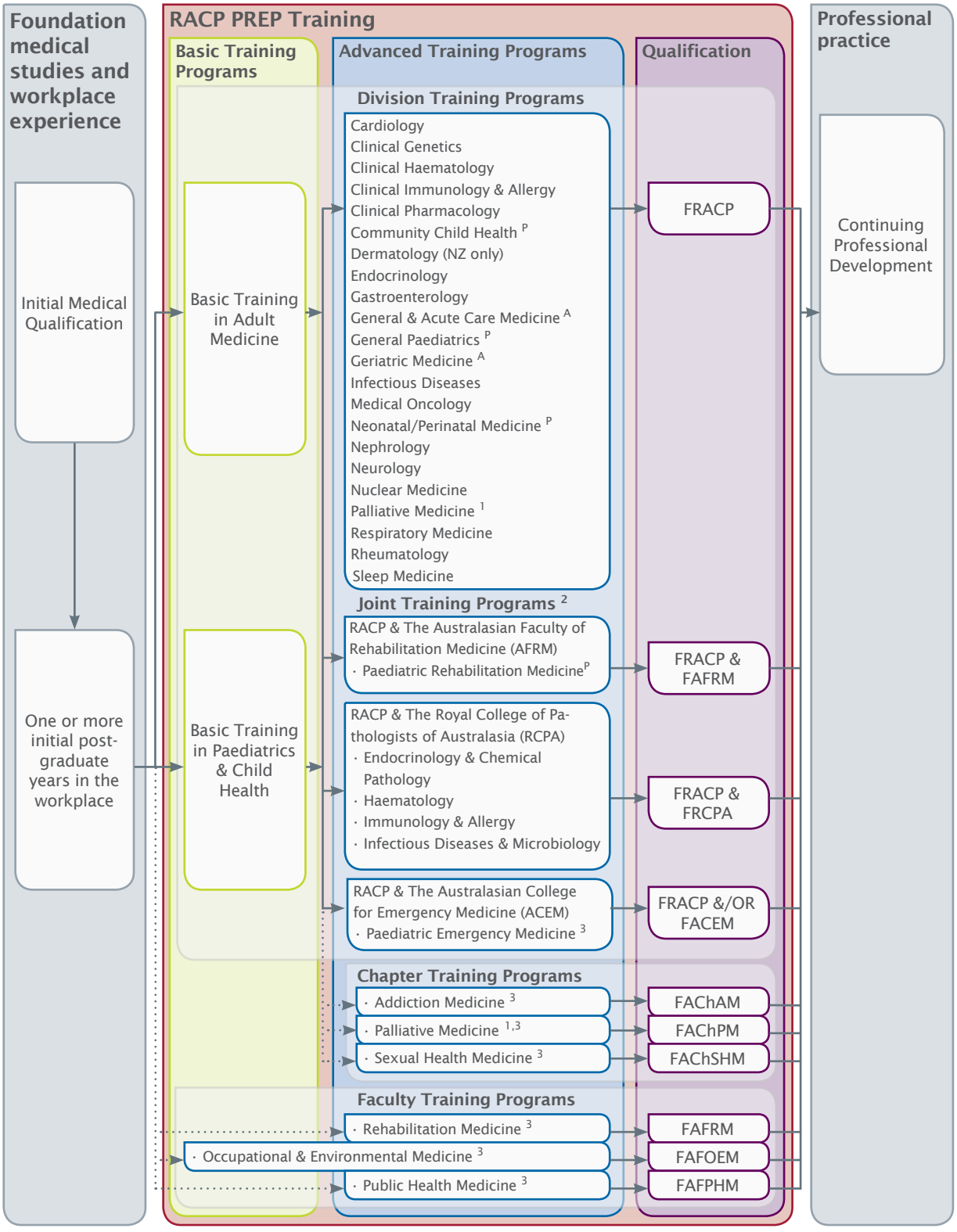
Please note: No Domains, Themes or Learning Objectives have been updated for this edition; design changes ONLY.

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.

CURRICULUM OVERVIEW

The discipline of nephrology is defined by the care of patients with diseases of the kidneys and urinary tract. Nephrology is a specialty with a significant component of general medicine, basic science and clinical research, teaching, as well as clinical areas of transplantation, hypertension, obstetric medicine and more recently an opportunity for procedural work.

Nephrology – 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 utilised by nephrology 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 Nephrology Advanced Training Program, trainees should be competent to provide at consultant level, unsupervised comprehensive medical care in nephrology.

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 Nephrology 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, however, it is anticipated that within the teaching/learning environment, the progression of each objective would 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 utilised by, all physicians, regardless of their specialty or area of expertise. It spans both the Basic and Advanced Training Programs and is also utilised as a key component of the Continuing Professional Development (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. It is important, therefore, 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 Nephrology, 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 nephrology practice. It is expected that a new Fellow will be able to:

- deliver health service provision independently and demonstrate a practical understanding of renal diseases/conditions, renal replacement therapies and transplantation
- recognise the impact of chronic kidney disease on individuals, family groups and society
- describe the particular needs of Aboriginal and Torres Strait Islander, Māori and Pacific Islander peoples of Australia and New Zealand
- show an awareness of, and sensitivity to, the special needs of patients from culturally and linguistically diverse backgrounds
- work within and fully utilise multidisciplinary team based approaches to the assessment, management and care of patients
- understand the importance of independent research and ongoing education and training
- be equipped with the skills required to develop independent research projects
- implement future career planning and decision making processes based on a more informed level of knowledge and understanding.

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.

Colour coding in the learning objective tables

The various components within the learning objective tables have been shaded to differentiate between common, adult and paediatric specific material as follows:

DOMAIN 1	FOUNDATIONS OF NEPHROLOGY
Theme	Structure, Function, Epidemiology and Research
Learning Objective	Explain the anatomy of the kidneys and urinary tract
Knowledge	**Skills**
White: Common material	**White: Common material**
Grey: Adult specific material	**Grey: Adult specific material**
Green: Paediatric specific material	**Green: Paediatric specific material**

LEARNING OBJECTIVES TABLES

DOMAIN 1	FOUNDATIONS OF NEPHROLOGY
Theme 1.1	Structure and Function
Learning Objective	
1.1.1	Explain the anatomy of the kidneys and urinary tract
1.1.2	Describe the embryology of the kidneys and urinary tract
1.1.3	Explain the physiology of the kidneys and bladder
1.1.4	Describe the physiology of blood pressure and how the kidneys are involved in its regulation
1.1.5	Evaluate renal endocrine function
1.1.6	Explain the immune system and the role and actions of immunosuppressive agents
Theme 1.2	Growth and Development
Learning Objectives	
1.2.1	Explain the growth and development of the kidneys
1.2.2	Interpret somatic growth and renal disease
1.2.3	Recognise and evaluate developmental issues of children with renal disease
Theme 1.3	Diagnostic Methods
Learning Objectives	
1.3.1	Interpret a biopsy in renal medicine
1.3.2	Use and interpret imaging in renal medicine
1.3.3	Use and interpret pathology tests in renal medicine
Theme 1.4	Therapeutics
Learning Objectives	
1.4.1	Explain the principles of drug prescription in renal medicine
Theme 1.5	Epidemiology and Research
Learning Objectives	
1.5.1	Explain the epidemiology of renal disease
1.5.2	Discuss current science and research in nephrology

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.1	Common Clinical Presentations
Learning Objective	
2.1.1	Assess and manage proteinuria
2.1.2	Assess and manage haematuria
2.1.3	Assess and manage abnormal glomerular filtration rate
2.1.4	Assess and manage chronic kidney disease
2.1.5	Assess and manage nephrotic syndrome
2.1.6	Investigate and manage renal emergencies
2.1.7	Assess and manage patients with acute kidney injury
Theme 2.2	Conditions Affecting the Kidneys
Learning Objectives	
2.2.1	Assess and manage diabetic kidney disease
2.2.2	Assess and manage glomerulonephritis
2.2.3	Assess and manage hereditary and congenital renal diseases
2.2.4	Assess and manage cystic kidney diseases
2.2.5	Describe toxic renal diseases
2.2.6	Assess and manage tubular disorders
2.2.7	Assess and manage haemolytic-uraemic syndrome/thrombotic thrombocytopaenic purpura, haematologic and rare diseases
2.2.8	Assess and manage kidney stone disease
2.2.9	Recognise and manage autoimmune diseases
2.2.10	Assess and manage disorders of water balance and metabolism
2.2.11	Investigate and manage hypertension
2.2.12	Investigate tumours of the kidneys, ureters, bladder and prostate
2.2.13	Assess and manage urinary tract infection
2.2.14	Assess and manage renovascular disease

Theme 2.3	End Stage Kidney Disease
Learning Objectives	
2.3.1	Plan and manage end stage kidney disease
2.3.2	Assess and manage accelerated and premature vascular disease
2.3.3	Insert a temporary venous catheter for dialysis
2.3.4	Describe dialysis in those with limited life expectancy
2.3.5	Explain renal replacement therapies
2.3.6	Plan and manage peritoneal dialysis
2.3.7	Plan and manage haemodialysis
2.3.8	Plan and manage the non-dialysis pathway
2.3.9	Describe haemofiltration and continuous renal replacement therapies
2.3.10	Plan and manage home haemodialysis therapies

DOMAIN 3	TRANSPLANTATION
Theme 3.1	Kidney Transplants
Learning Objectives	
3.1.1	Assess potential transplant recipients
3.1.2	Assess potential live transplant donors
3.1.3	Prescribe immunosuppressants and recognise complications
3.1.4	Acute transplant management
3.1.5	Manage the long term care of a transplant recipient

DOMAIN 1	FOUNDATIONS OF NEPHROLOGY
Theme 1.1	Structure and Function
Learning Objective 1.1.1	Explain the anatomy of the kidneys and urinary tract

Knowledge	Skills

• explain the anatomy of the urinary system, including the bladder and prostate
• recognise the normal size and position of the kidneys, vessels, ureters and bladder
• identify the anatomy of the nephron at an ultrastructural level.
	• assess the common variants of renal vasculature and renal structure
	• localise the lower pole of a kidney for a renal biopsy using ultrasound
	• interpret the normal appearance and common pathological features of kidneys shown by imaging modalities, including:
	  • ultrasound
	  • computed tomography (CT)
	  • plain radiography
	  • magnetic resonance imaging
	  • nuclear medicine scanning
	• describe the strengths and shortcoming of the various imaging modalities
	• interpret renal histopathology.

DOMAIN 1	FOUNDATIONS OF NEPHROLOGY
Theme 1.1	Structure and Function
Learning Objective 1.1.2	Describe the embryology of the kidneys and urinary tract

Knowledge	Skills
• explain the embryology of the urinary tract and system • recognise the relationship between abnormal embryology and clinical syndromes	

• describe the embryological, histological, clinical and radiological features of renal dysplasia and developmental abnormalities of the kidney including:
  • congenital abnormalities of kidney and urinary system (CAKUT)
  • renal dysplasia
  • obstructive uropathy
  • multicystic dysplasic kidneys (MCDK).
	• assess developmental abnormalities on antenatal imaging and provide counselling
	• interpret renal dysplasia on ultrasound and renal biopsy.

DOMAIN 1	FOUNDATIONS OF NEPHROLOGY
Theme 1.1	Structure and Function
Learning Objective 1.1.3	Explain the physiology of the kidneys and bladder

Knowledge	Skills

• describe renal physiology, including:
  • glomerular filtration rate (GFR) including its regulation and measurement
  • tubulointerstitial function
  • regulation of acid base balance, fluid handling, electrolyte balance
• discuss the strengths and limitations of current techniques used to measure renal parameters e.g. GFR by inulin clearance
	• organise appropriate tests to measure renal function
	• interpret results of blood analyses including acid base, electrolytes, and hormone measurements
	• interpret the results of a urine dipstick test, and relate back to physiology and pathophysiology
	• assess patterns of abnormalities in the above tests, including glomerulonephritis, tubulointerstitial disease and renal failure
	• interpret estimated glomerular filtration rate (eGFR) and its limitations
	• discuss mechanism of action of commonly prescribed renal drugs on nephron function e.g. diuretics.

• describe the physiology of the developing nephron
• identify postnatal changes in renal tubular function and GFR
• explain the implications of interpreting GFR measurement techniques, including:
  • ethylenediaminetetraacetic acid (EDTA)
  • diethylene triamine pentaacetic acid (DTPA)
  • mercapto acetyl tri glycine scan (MAG-3)
  • cystatin C.	

DOMAIN 1	FOUNDATIONS OF NEPHROLOGY
Theme 1.1	Structure and Function
Learning Objective 1.1.4	Describe the physiology of blood pressure and how the kidneys are involved in its regulation
Links	Learning Objective 2.2.11

Knowledge	Skills

• describe the kidneys' contribution to blood pressure (BP) regulation, including:
  • volume homeostasis
  • pressure natriuresis
  • tubuloglomerular feedback (TGF)
  • renin angiotensin aldosterone system
• describe other main regulators of BP, including:
  • sympathetic nervous system
  • endothelial function
  • adrenal glands.
	• measure BP according to 'best practice'
	• interpret the diurnal variations of BP regulation and how to adjust medications to optimise BP control
	• interpret BP measurements in different age groups using reference data e.g. American College of Paediatrics for paediatric normal values
	• discuss current methods of investigation described in the relevant regulatory systems
	• interpret above tests.

DOMAIN 1	FOUNDATIONS OF NEPHROLOGY
Theme 1.1	Structure and Function
Learning Objective 1.1.5	Evaluate renal endocrine function

Knowledge	Skills

• explain the main renal endocrine functions, including:
  • renin, angiotensin, aldosterone axis
  • vitamin D, calcium, phosphate and parathyroid hormone homeostasis (PTH)
  • erythropoiesis
• explain how systemic hormones (ACTH, cortisol, noradrenaline/adrenaline, serotonin) may impact on renal endocrine function and BP control.
	• evaluate renal endocrine systems in a clinicopathological context
	• interpret results of investigations, including:
	  • aldosterone: renin ratio
	  • Ca/PO4/PTH/vitamin D levels
	  • measures of erythropoeisis
	• evaluate the influence of systemic hormones on renal function and BP control.

DOMAIN 1	FOUNDATIONS OF NEPHROLOGY
Theme 1.1	Structure and Function
Learning Objective 1.1.6	Explain the immune system and the role and actions of immunosuppressive agents

Knowledge	Skills
• describe normal immune function and how perturbations of the immune system may give rise to kidney specific or systemic disease that effect the kidneys • describe the rationale/clinical trial outcome studies for the use of immunosuppressive treatments for these conditions • discuss the rationale/clinical trial outcome studies using the various immunosuppressive regimens in renal transplant medicine • compare the benefits and disadvantages of therapy including malignancy and infection; conventional and opportunistic • explain how immunosuppressives can contribute to a desired therapeutic outcome and also to complications including infection and malignancy.	• prescribe immunosuppressive medication with an understanding of risks, side effects and expected outcomes • assess aspects of immune function • evaluate the potential risks of immunosuppressive therapy • assess and manage the complications of immunosuppressive therapy, including appropriate referral to other specialist services.

DOMAIN 1	FOUNDATIONS OF NEPHROLOGY
Theme 1.2	Growth and Development
Learning Objective 1.2.1	Explain the growth and development of the kidneys

Knowledge	Skills
• describe antenatal and postnatal assessment of kidney morphology and function, including physiological changes that occur during childhood.	• interpret renal growth patterns and their clinical implications, including hypoplasia.

DOMAIN 1	FOUNDATIONS OF NEPHROLOGY
Theme 1.2	Growth and Development
Learning Objective 1.2.2	Interpret somatic growth and renal disease

Knowledge	Skills
• describe factors that contribute to impaired body growth in children with renal disorders and chronic kidney disease (CKD) • recognise the relationship between body growth and renal function • describe normal pubertal growth and how this may be influenced by kidney disease • describe approaches to the management of pubertal delay • describe the indications, use, risks and expected outcomes of recombinant human growth hormone (rhGH) for children with CKD.	• interpret growth patterns in children with kidney disease.

DOMAIN 1	FOUNDATIONS OF NEPHROLOGY
Theme 1.2	Growth and Development
Learning Objective 1.2.3	Recognise and evaluate developmental issues of children with renal disease

Knowledge	Skills
• describe the factors influencing neurodevelopment in children with kidney disease • identify normal development patterns and recognise developmental delay • discuss strategies used to assess and minimise developmental delay • describe the psychological impacts of CKD on children and their families.	• evaluate developmental delay.

DOMAIN 1	FOUNDATIONS OF NEPHROLOGY
Theme 1.3	Diagnostic Methods
Learning Objective 1.3.1	Interpret a biopsy in renal medicine

Knowledge	Skills
• outline the technique of renal biopsy using the appropriate radiological imaging method e.g. ultrasound, CT • describe indications for biopsy of native and transplant kidneys • explain the anatomy of the native and transplant kidney • recognise potential complications, incidence and risk minimisation techniques.	• assess when a biopsy is required • interpret significant abnormalities on renal biopsies • obtain informed consent for the procedure • interpret and manage complications • interpret the pathology of common glomerular diseases • develop a management plan based on biopsy findings • explain results to patients, their families and other health professionals involved
Minimum practical performance requirements	• *An adequate number of native kidney and transplant renal biopsies under clinical supervision to achieve safe and independent procedural competence. 20 to 50 biopsies are suggested.* • *Paediatric trainees can perform adult biopsies.*

DOMAIN 1	FOUNDATIONS OF NEPHROLOGY
Theme 1.3	Diagnostic Methods
Learning Objective 1.3.2	Use and interpret imaging in renal medicine

Knowledge	Skills

• describe the variety of imaging modalities including their strengths limitations, indications and complications
• explain risks of imaging including ionising radiation, contrast and gadolinium toxicity in patients with CKD
• describe the modalities of antenatal imaging
• recognise the impact of radiation exposure and choose imaging modality for at risk groups including children and pregnant women
	• use imaging for patient management including:
	  • plain radiological imaging (interventional and non-interventional)
	  • ultrasound
	  • nuclear medicine scans
	  • computed tomography
	  • angiography and fluoroscopy
	  • antegrade and retrograde pyelography
	  • magnetic resonance imaging
	• assess the risk of imaging modalities against their utility.

• describe local imaging recommendations for conditions such as urinary tract infection (UTI), antenatal hydronephrosis.	

DOMAIN 1	FOUNDATIONS OF NEPHROLOGY
Theme 1.3	Diagnostic Methods
Learning Objective 1.3.3	Use and interpret pathology tests in renal medicine

Knowledge	Skills
• explain normal and age appropriate ranges • recognise the range and application of the biochemical, haematological, microbiological and immunological laboratory tests involved in the clinical practice of nephrology.	• use and interpret pathology tests • formulate a management plan based on investigation results • plan timing of future tests • explain results and follow up where required • perform urine microscopy and interpret urine sediment.

DOMAIN 1	FOUNDATIONS OF NEPHROLOGY
Theme 1.4	Therapeutics
Learning Objective 1.4.1	Explain the principles of drug prescription in renal medicine

Knowledge	Skills

• describe the interrelationship between drug dosing to GFR and age using Cockcroft–Gault equation (CG) or eGFR equation
• describe the principles of therapeutic drug monitoring with reference to various dialysis modalities and/or clinical states of altered volume of distribution e.g. nephrotic syndrome
• identify the toxicity of certain agents in CKD
• discuss important drug interactions
• identify principles of pain management in patients with CKD/end stage kidney disease (ESKD)
• describe the role of therapeutic drug level monitoring in renal medicine.
	• use electronic databases to determine drug dosing including:
	  • Monthly Index of Medical Specialties (MIMs)
	  • paediatric drug pharmacopeia
	• prescribe common medications to CKD patients safely
	• adjust drug doses according drug levels.

DOMAIN 1	FOUNDATIONS OF NEPHROLOGY
Theme 1.5	Epidemiology and Research
Learning Objective 1.5.1	Explain the epidemiology of renal disease

Knowledge	Skills
• outline the impact of renal disease on local and global environments • recognise the prevalence and aetiology of renal disease that is endemic in Aboriginal and Torres Strait Islander, Māori and Pacific Islander peoples • recognise the affliction of renal disease across different age groups • identify local and international strategies to improve diagnosis and prognosis by opportunistic and at risk screening and early intervention • describe the role, mechanisms and use of Australia and New Zealand Dialysis and Transplant Registry (ANZDATA) and international data registries • discuss the risk factors for kidney disease.	• identify at risk individuals or groups • apply the epidemiology of renal disease to clinical practice • assess when to screen for renal disease, including the use of urine microscopy and dipstick analysis • describe the collection process and interpretation of urine microscopy.

Minimum practical performance requirements	• 20 urine microscopies* ** NOTE: highly desirable skill - in a unit where this not routinely performed/ equipment not available trainees encouraged to visit the pathology laboratory to gain knowledge of this technique.*

DOMAIN 1	FOUNDATIONS OF NEPHROLOGY
Theme 1.5	Epidemiology and Research
Learning Objective 1.5.2	Discuss current science and research in nephrology

Knowledge	Skills
• describe research methodology • recognise various groups coordinating and performing research in Australia and New Zealand e.g. Australian and New Zealand Society of Nephrology (ANZSN) and Transplantation Society of Australia and New Zealand (TSANZ) • describe the functioning of national and international renal databases such as ANZDATA • explain the roles of the Dialysis Nephrology and Transplantation (DNT) subcommittee and Caring for Australasians with Renal Impairment (CARI) guidelines in promoting evidence-based practice • recognise the main bodies involved in communicating research and public health campaigns to the community, e.g. Kidney Health Australia and Department of Health and Ageing • recognise the Australasian Kidney Trials Network (AKTN) proposed and current studies and the rationale of these studies.	• critically appraise a journal article • formulate, design and complete a research project that is peer reviewed and presented as a poster or oral presentation at a national or international scientific meeting • organise research program for non-core Advanced Training period • use current national and international guidelines (e.g. CARI) recognising their strengths and limitations.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.1	Common Clinical Presentations
Learning Objective 2.1.1	Assess and manage proteinuria

Knowledge	Skills
• explain quantitation, classification and risk stratification of proteinuria and albuminuria • explain the aetiology of proteinuria • describe the relationship between proteinuria and other renal presentations • explain when to perform a renal biopsy for proteinuria • differentiate between pathological and postural proteinuria • identify the prognostic associations of albuminuria and proteinuria (i.e. cardiovascular disease and risk of progression of renal impairment) • describe the advantages and disadvantages of spot urine and timed urine in the assessment of proteinuria.	• perform a clinical assessment in a patient presenting with proteinuria • assess the histological changes on a renal biopsy specimen • formulate and discuss a management plan including pharmacologic and nonpharmacologic antiproteinuric measures.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.1	Common Clinical Presentations
Learning Objective 2.1.2	Assess and manage haematuria

Knowledge	Skills
• recognise the interrelationship between haematuria and other renal presentations • identify causes of microscopic and macroscopic haematuria • recognise the role and limitations of urine microscopy • describe the pathologic and clinical features of thin basement membrane disease.	• assess and investigate a patient presenting with haematuria • perform urine microscopy and distinguish between non-glomerular and glomerular haematuria, including recognising red cell casts • assess when a patient requires urological evaluation • assess a patient for a renal biopsy • formulate a management plan and follow up • explain the likely outcome and requirements for patients, families and other health professionals.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.1	Common Clinical Presentations
Learning Objective 2.1.3	Assess and manage abnormal glomerular filtration rate

Knowledge	Skills
• discuss the use and limitations of GFR measurements and eGFR corrected for body surface area • assess a patient with an abnormal GFR • explain the ageing process in relation to reduction in eGFR • recognise that the rate of decline in GFR is not universal and may depend upon the aetiology of the renal disease and comorbidities.	• distinguish between acute and chronic renal injury • formulate a rational plan to investigate a patient with an abnormal eGFR/GFR • assess the rate of change of eGFR/GFR in a patient with reducing renal function (+/- associated abnormalities of urinalysis) and plan their care.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.1	Common Clinical Presentations
Learning Objective 2.1.4	Assess and manage chronic kidney disease

Knowledge	Skills

• describe chronic kidney disease (CKD), including:
  • definition and staging according to GFR and urinary/anatomical abnormalities
  • aetiologies
  • manifestations, risk stratification and complications according to stage
  • available treatment options
• identify strategies for preservation of renal function.
	• assess and investigate a patient with CKD for causes and complications
	• manage and educate a patient with CKD including:
	  • lifestyle and diet
	  • anaemia management, including use of erythropoietin
	  • CKD-mineral bone disorder (MBD) including calcium/phosphate/PTH and vitamin D control
	  • fluid and electrolyte abnormalities
	  • hypertension
	  • minimisation of risk factors for vascular disease
	  • planning for endstage renal disease management.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.1	Common Clinical Presentations
Learning Objective 2.1.5	Assess and manage nephrotic syndrome

Knowledge	Skills

• recognise and identify the causes of nephrotic syndrome, including the complications and prognosis
• explain treatment options for nephrotic syndrome, including:
  • diuretic therapy
  • fluid restriction
  • angiotensin converting enzyme inhibitors/ angiotensin receptor lockers (ACEI/ARB)
  • anticoagulation
  • lipid lowering therapy
  • immunosuppression
• describe the causes and natural history of nephrotic syndrome considering:
  • histology
  • genetics
  • differential diagnosis in different age groups
  • nephrotic syndrome as part of systemic disease
• identify nephrotic syndrome, including indications for renal biopsy and genetic studies
• explain evidence based treatment options for nephrotic syndrome
• explain the implications for transplantation, including recurrence risks
• identify complications of immunosuppressive therapy
	• investigate a patient presenting with nephrotic syndrome
	• institute a management plan
	• organise a plan for investigation and management
	• interpret a renal biopsy for the common lesions causing nephrotic syndrome in children, including:
	  • minimal change disease
	  • focal segmental glomerulosclerosis (FSGS)
	  • membranoproliferative
	  • glomerulonephritis (GN)
	  • diffuse mesangial sclerosis
	  • systemic lupus erythematosus (SLE)
	• assess and manage complications
	• manage immunosuppression, diuretics, ACEI/ARB, statins.

• describe the causes of nephrotic syndrome considering renal histology and differential diagnosis in different age groups
• describe indications for referral for genetic studies
	• interpret a renal biopsy for the common lesions causing nephrotic syndrome including:
	  • membranous nephropathy
	  • diabetes
	  • focal glomerulosclerosis
	  • minimal change disease
	  • systemic lupus erythematosus (SLE)
	  • light chain disease
	  • amyloidosis.

• describe growth and childhood complications of therapies.	

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.1	Common Clinical Presentations
Learning Objective 2.1.6	Investigate and manage renal emergencies

Knowledge	Skills

• describe the potential presentations of renal emergencies, including:
  • acute kidney injury (AKI) and rapidly progressive glomerulonephritis
  • acidosis
  • sodium, potassium and calcium disturbances
  • hypertensive emergency
  • fluid overload
  • access problems.
	• formulate an investigation and management plan for the renal emergencies listed opposite
	• initiate prescription of acute dialysis, including for management of certain drug overdoses or toxicities such as:
	  • lithium
	  • digoxin
	  • salicyclic acid
	  • theophylline.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.1	Common Clinical Presentations
Learning Objective 2.1.7	Assess and manage patients with acute kidney injury

Knowledge	Skills
• describe acute kidney injury (AKI) and its staging • describe the causes and clinicopathological presentations of AKI • explain the potential long term impact of AKI on kidney function • identify indications for acute dialysis and the role of different renal replacement therapies • describe the implications of drug dosing in AKI • identify the implications of AKI on the management of other comorbidities	• assess and investigate a patient presenting with AKI, including identifying the role of kidney biopsy • evaluate and manage fluid status in a patient with AKI • assess and manage patients with all degrees of severity of AKI and its aetiologies • manage acute electrolyte abnormalities • prescribe acute renal replacement therapy • prescribe plasmapheresis or plasma exchange • manage the recovery phase of AKI including the management of a post obstructive diuresis
• recognise the definitions and staging of AKI in children and neonates • describe the epidemiology and pathophysiology of AKI in neonates and children • discuss the considerations for conservative and renal support therapy, including choice of modality in children with AKI.	• evaluate fluid status • manage paediatric patients with AKI.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.2	Conditions Affecting the Kidney
Learning Objective 2.2.1	Assess and manage diabetic kidney disease

Knowledge	Skills
• recognise diabetic kidney disease as the most common cause of ESKD • describe the pathophysiology of diabetic kidney disease and its relationship to the spectrum of clinical presentations • describe the evidence for retarding diabetic CKD progression • explain the impact of micro and macrovasculature abnormalities in patients with diabetes and CKD • explain the advances and outcomes in pancreas, kidney and islet cell transplantation • explain risk factors and preventative strategies metabolic syndrome.	• assess a patient with diabetes and CKD, including consideration of other causes of CKD • screen for diabetic complications • assess and manage albuminuria and proteinuria • assess and manage hypertension (HT) in a patient with diabetic nephropathy • assess and manage cardiovascular risk in patients with diabetic kidney disease • assess impact of micro and macrovascular abnormalities.
	• institute a comprehensive management plan for a patient with diabetes and CKD.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.2	Conditions Affecting the Kidney
Learning Objective 2.2.2	Assess and manage glomerulonephritis

Knowledge	Skills

• identify the forms of glomerulonephritis (GN) considering the:
  • pathogenesis
  • clinical presentation
  • investigation
  • histological features
  • evidence based treatment options
  • prognosis
• describe the associations between types of GN and systemic diseases e.g. membranous and malignancy, anti-neutrophil cytoplasmic autoantibodies (ANCA) and hepatitis B
	• assess and investigate a patient presenting with suspected GN
	• prescribe different therapeutic options using evidence based criteria
	• assess the risks of therapy.

• describe the pathogenesis, clinical considerations, management and prognosis of children with:
  • post infectious GN
  • Henoch-Schönlein purpura
  • rapidly progressive GN.	

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.2	Conditions Affecting the Kidney
Learning Objective 2.2.3	Assess and manage hereditary and congenital renal diseases

Knowledge	Skills

• explain the inheritability of kidney disease, including cystic, ultrastructural and metabolic diseases
• identify developmental disorders of the urinary tract including reflux nephropathy
• describe the histological, clinical and radiological features of congenital renal kidney disease including:
  • CAKUT, including agenesis, dysplasia, multicystic dysplastic kidney, obstructive uropathies and reflux nephropathy
  • cystic kidney disease, including autosomal recessive polycystic kidney disease (ARPCKD), autosomal dominant polycystic kidney disease (ADPCKD)/ glomerulocystic kidney disease, juvenile nephronopthisis and syndrome associated cystic kidney disease
  • glomerular/tubular disease, including congenital nephrotic syndrome and other podocyte/ glomerular basement membrane (GBM)/structural abnormalties; tubulopathies, including cystinosis, Fanconi, and related syndromes
• develop a strategy of investigation and management of vesico-ureteric reflux and associated nephropathy
• describe the clinical and radiological features of renal dysplasia and obstructive uropathy
	• include families in screening and counselling
	• manage obstructive uropathy, including antenatal diagnosis and post natal imaging
	• manage patient with hereditary and congenital renal diseases, including cyst complications, urinary tract infections, stones, hypertension, renal failure
	• manage complications and recognise the extra renal pathologic manifestations associated with hereditary and congenital renal diseases

• describe the antenatal and postnatal features and management of hydronephrosis.	• organise antenatal counselling, postnatal investigation and management of congenital renal disease • use genetic testing.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.2	Conditions Affecting the Kidney
Learning Objective 2.2.4	Assess and manage cystic kidney diseases

Knowledge	Skills
• describe hereditary and acquired cystic diseases of the kidney • identify complications and management options	• manage patients who present with cystic disease of the kidneys

• describe the histological, clinical and radiological features of renal cystic kidney disease, including:
  • polycystic ARPCKD, ADPCKD
  • glomerulocystic kidney disease
  • hereditary malformation syndrome
  • juvenile nephronopthisis
  • multicystic dysplastic.
	• organise antenatal counselling, postnatal investigation and management of congenital renal disease.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.2	Conditions Affecting the Kidney
Learning Objective 2.2.5	Describe toxic renal diseases

Knowledge	Skills

• describe the common nephrotoxins causing:
  • AKI – drugs, contrast
  • CKD – environmental, drugs, herbs, e.g. Balkan nephropathy
  • allergic/interstitial renal disease
• describe the use of renal replacement therapy to remove toxic agents.
	• formulate a careful history to establish nephrotoxin exposure including occupational exposure and smoking
	• use pathology tests, imaging and/or renal biopsy to assess for toxicities
	• use screening for features of toxicity complications e.g. transitional cell carcinoma in analgesic nephropathy.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.2	Conditions Affecting the Kidney
Learning Objective 2.2.6	Assess and manage tubular disorders

Knowledge	Skills

• describe the metabolic causes of renal tubular acidosis (RTA)
• identify tubular disorders of electrolyte regulation
• recognise the presentation of tubular disorders in adulthood
• outline the mechanisms by which the body regulates acid-base balance, including:
  • bicarbonate buffer system
  • bicarbonate recycling
  • distal ammonium excretion
• identify the acid base disturbances commonly observed in renal medicine, including:
  • metabolic and respiratory acidosis
  • RTA
  • alkalosis
• explain common electrolyte disturbances and management strategies, including sodium, potassium and calcium
	• investigate RTA
	• manage recognised clinical syndromes, including:
	  • cystinosis
	  • primary hyperoxaluria
	  • Bartter syndrome
	  • Gitelman syndrome
	• interpret the following:
	  • metabolic acidosis and alkalosis
	  • respiratory acidosis and alkalosis
	  • the anion gap
	• institute a management plan for a patient with acidosis
	• manage common electrolyte disturbances, including treatment options and rate of correction of abnormality.

• explain the inheritability of tubular disorders.	

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.2	Conditions Affecting the Kidney
Learning Objective 2.2.7	Assess and manage haemolytic-uraemic syndrome/thrombotic thrombocytopaenic purpura, haematological and rare diseases

Knowledge	Skills

• explain the pathogenesis of the genetic and acquired forms of hemolytic-uremic syndrome/ thrombotic thrombocytopenic purpura (HUS/TTP)
• describe public health implications of HUS
	• coordinate and implement a management plan
	• interpret immune system tests and recognise their role in disease diagnosis and monitoring, including:
	  • serum and urine immunoelectropheresis
	  • serum free light chain assay
	  • paraprotein-related renal diseases (e.g. multiple myeloma, amyloidosis)
	• recognise and manage a patient presenting with a thrombotic microangiopathy and renal involvement

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.2	Conditions Affecting the Kidney
Learning Objective 2.2.7	Assess and manage haemolytic-uraemic syndrome/thrombotic thrombocytopaenic purpura, haematological and rare diseases

Knowledge	Skills
• recognise the secondary forms of renal disease related to haematologic disorders, including amyloidosis, myeloma and other paraprotein diseases • explain the use of 'high cut-off dialysis' and plasma exchange in the treatment of AKI from cast nephropathy in patients with myeloma • identify rare forms of diseases affecting the kidneys including Fabry's disease, mixed cryoglobulinemia and sarcoidosis	• investigate and manage a patient with unexplained renal failure; examine for common and uncommon diseases • manage various paraprotein diseases.
• distinguish between typical and atypical HUS and perform appropriate investigations.	

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.2	Conditions Affecting the Kidney
Learning Objective 2.2.8	Assess and manage kidney stone disease

Knowledge	Skills

• describe the normal excretion of solute and the protective mechanisms against stone formation
• identify the various metabolic, dietary and environmental factors predisposing to stone formation
• apply an evidence-based approach to the pharmacologic management of stone disease
• discuss a urological approach to kidney stones.
	• evaluate a patient with a predisposition to renal stones calculi using diagnostic tests, including:
	  • assess renal anatomy by imaging
	  • urine solute excretion analysis
	  • relevant blood tests
	  • stone analysis
	• initiate a management plan and preventative plan for renal stone disease, including:
	  • optimising hydration
	  • dietetic assessment
	  • urine alkalinisation
	  • thiazide diuretics
	  • allopurinol
	  • citrate therapy.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.2	Conditions Affecting the Kidney
Learning Objective 2.2.9	Recognise and manage autoimmune diseases

Knowledge	Skills

• describe the main diseases nephrologists are often involved in diagnosing and managing
• NOTE: refer to list opposite.
	• interpret immune system tests and recognise their role in disease diagnosis and monitoring including:
	  • anti-nuclear antibody test (ANA)
	  • extractable nuclear antigens (ENA)
	  • double stranded DNA (dsDNA)
	  • ANCA
	  • GBM
	  • rheumatoid factor (RhF)
	  • complement levels
	  • cryoglobulins
	• recognise and manage immune and connective tissue diseases including:
	  • SLE
	  • Wegener's granulomatosis
	  • microscopic polyangiitis
	  • Churg-Strauss disease
	  • scleroderma
	  • Sjögren's syndrome
	  • polyarteritis nodosa
	  • anti-GBM disease and Goodpasture's syndrome
	  • Henoch-Schönlein purpura
	• identify the role, benefits and side effects of immunosuppression
	• explain the role of plasmaphaeresis and plasma exchange.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.2	Conditions Affecting the Kidney
Learning Objective 2.2.10	Assess and manage disorders of water balance and metabolism

Knowledge	Skills

• discuss water homeostasis
• describe common conditions associated with abnormalities of water and sodium, including:
  • volume overload
  • dehydration
  • hypo- and hypernatraemia
  • syndrome of inappropriate antidiuretic hormone (SIADH)
  • diabetes insipidus.
	• assess a patient's fluid status
	• evaluate and manage a patient with alteration in volume status and/or sodium balance
	• manage fluid balance including the use of fluid replacement, volume restriction, diuretics and desmopressin.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.2	Conditions Affecting the Kidney
Learning Objective 2.2.11	Investigate and manage patients with hypertension

Knowledge	Skills
• describe the pathophysiology of HT and the cardio-renal axis • define the physiological BP changes and definition of HT across age groups • recognise the importance of HT and its interaction with renal disease and cardiovascular disease progression • describe the impact and risk factors of HT on the progression of renal impairment • identify the advantages of different treatment modalities for renal artery stenosis (RAS) • explain the primary and secondary causes of HT • describe the concepts of whitecoat (office) and masked HT • describe the mechanisms of action, benefits and potential side effects of antihypertensive drug classes • describe the mechanisms of action, specific benefits and potential side effects of the various antihypertensive drug classes • define resistant, accelerated and malignant HT	• educate a patient on the benefits of lifestyle modification, pharmacotherapy, and the importance of compliance in the management of HT • assess a patient for primary and secondary causes • assess and manage patients with RAS • apply evidence from recent HT trials when prescribing antihypertensive medication • investigate a patient with possible office/white coat HT • use and interpret ambulatory BP monitoring • identify and manage hypertensive urgencies and emergencies • prescribe antihypertensive medication with an understanding of indications, side effects and precautions

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.2	Conditions Affecting the Kidney
Learning Objective 2.2.11	Investigate and manage patients with hypertension
• manage HT and renal disease in pregnancy	
• identify paediatric specifics within various antihypertensive data • describe age, gender and height related standards for BP • describe age-specific dosing and delivery of antihypertensives in paediatric patients.	• monitor and interpret ambulatory BP in children • assess and manage neonates, infants and children with systemic HT.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.2	Conditions Affecting the Kidney
Learning Objective 2.2.12	Investigate tumours of the kidneys, ureters, bladder and prostate
Knowledge	**Skills**
• describe the epidemiology and aetiology of renal tract cancer, in particular the impacts of age, urbanisation and smoking on incidence • identify common benign and malignant tumours of the kidney and the significance of the histological grading and staging used • apply a multidisciplinary approach to the management and support of a patient with renal cell carcinoma	• investigate a patient with a possible renal mass • refer to other specialist groups • undertake the pre and peri-operative management and support of a patient undergoing a nephrectomy, including preparation for dialysis
• identify Wilms' tumour	
• recognise that transitional cell carcinomas (TCC) and squamous cell carcinomas (SCC) in the bladder, renal pelvis and ureters are a cause of haematuria • recognise that TCC and SCC are the most common urothelial malignancies • explain the multifocal nature of TCC and need for ongoing surveillance once urothelial tumours have been diagnosed or risk factors identified	• investigate a patient with haematuria; this may include cystoscopy, urine cytology, assessment of renal function and imaging • investigate patients presenting with a renal mass • identify early urological referral and the need for a multidisciplinary approach in the care of patients with urothelial tumours

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.2	Conditions Affecting the Kidney
Learning Objective 2.2.12	Investigate tumours of the kidneys, ureters, bladder and prostate

- describe emerging evidence for a relationship between urothelial tumours and toxins, including:
  - smoking
  - phenacetin containing analgesics
  - aristolochic acid (in Chinese herbs)
  - aristolochic acid in Balkan nephropathy chemical carcinogens e.g. dyes, cyclophosphamide
  - infection with schistosoma haematobium.

- explain when surveillance is required for TCC in patients at high risk:
  - exposure to cyclophosphamide
  - analgesic nephropathy
  - referral to urology for further investigation
- explain the advantages and disadvantages of screening for prostate cancer in males.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.2	Conditions Affecting the Kidney
Learning Objective 2.2.13	Assess and manage urinary tract infections
Links	Learning Objective 2.2.10

Knowledge	Skills

• explain the basis behind the definitions including:
  • bacteriuria
  • simple urinary tract infections (UTIs)
  • complicated UTIs
  • recurrent infection (relapse vs. reinfection)
• recognise the host defence mechanisms usually preventing infection such as structure, flow and urine composition, including excretion of blood group antigens and uromodulin
• identify structural abnormalities predisposing to UTI, including incomplete bladder emptying or retention due to outflow obstruction, vesico-ureteric reflux and neurological disorders
• recognise prostatitis and urethritis as diagnoses that can mimic UTI but require additional diagnostic and management considerations
• understand the rationale for prophylactic and suppressive antimicrobial therapy, potential benefits and complications
	• interpret mid-stream urine (MSU) microscopy and culture
	• investigate and manage a patient with suspected UTI according to best practice guidelines/evidence
	• manage patients with difficult to control infection, including:
	  • complicated UTI
	  • pregnant patients
	  • neonate and young child
	  • postmenopausal women
	  • structural abnormalities of the urinary tract
	• identify and manage upper and lower UTIs in different age groups

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.2	Conditions Affecting the Kidney
Learning Objective 2.2.13	Assess and manage urinary tract infections

• identify urine collection methods
• describe antibiotic therapy for UTI prophylaxis
• describe recurrent UTIs in childhood including:
  • assessment of bladder function
  • upper tract involvement and
  • indications for surgical intervention
• identify imaging strategies for UTI in childhood
• recognise familial risks.
	• interpret radiological studies including:
	  • micturating cystourethrogram (MCU)
	  • ultrasound scan (USS)
	  • dimercaptosuccinic acid (DMSA).

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.2	Conditions Affecting the Kidney
Learning Objective 2.2.14	Assess and manage renovascular disease

Knowledge	Skills
• describe the causes, physiologic implications and natural history of renal artery stenosis • describe the causes and clinical manifestations of acute renal infarction • describe the causes and clinical manifestations of renal vein thrombosis • understand the rational for medical vs. interventional strategies for renal vascular disease	• assess and manage a patient with unilateral or bilateral renal artery stenosis • assess and manage a patient with transplant renal artery stenosis • assess and manage acute renal infarction • assess and manage renal vein thrombosis
• identify the clinical manifestations of cholesterol embolisation.	• diagnose and manage acute renal failure caused by cholesterol embolisation.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.3	End Stage Kidney Disease
Learning Objective 2.3.1	Plan and manage end stage kidney disease

Knowledge	Skills

• describe the causes of ESKD
• explain the pathophysiology of disturbances, including:
  • acid base balance
  • fluid balance
  • electrolyte abnormalities
  • HT
  • CKD MBD
  • anaemia
• recognise the association of accelerated vascular disease in ESKD patients and its impact on mortality
• describe the role of nutrition and dietetics in ESKD
• explain the treatment options for ESKD patients, including renal replacement therapy (RRT) (dialysis and transplantation) and conservative management
• describe specific challenges and considerations in managing adolescents and young adults with ESKD
	• apply differential diagnosis of ESKD
	• manage common ESKD problems, with reference to evidence based guidelines including CARI
	• manage vascular risk factors according to evidence based guidelines/CARI
	• plan and manage patients, with ESKD for all treatment options, consider:
	  • adolescents and young adults
	  • education
	  • dietetic review
	  • timely dialysis access (AVF and PD catheter)
	  • preparation for pre-emptive living-donor transplant
	  • implementation of a conservative care pathway
	• use and contribute to the ANZDATA registry

• describe funding issues, including home vs. hospital dialysis	

• identify the causes and natural history of ESKD in children
• describe general strategies for ESKD including management of:
  • anaemia
  • CKD MBD
  • nutrition
  • growth
  • drug prescription
• explain the specific requirements for diseases such as cystinosis and hyperoxaluria
• discuss options for RRT transplant or dialysis
• recognise the neurodevelopmental and psychosocial impact on children and families.
	• manage children with ESKD
	• manage a child and family during preparation for dialysis/transplant and their long term care.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.3	End Stage Kidney Disease
Learning Objective 2.3.2	Assess and manage accelerated and premature vascular disease

Knowledge	Skills

• describe the impact of cardiovascular disease in adults and adolescents who developed ESKD at an early age
• identify and describe traditional and non-traditional risk factors contributing to cardiovascular disease in patients with renal disease (e.g. inflammation, calcification disorders)
• identify strategies available to treat cardiovascular disease in patients with renal disease
• identify importance of BP lowering
• describe controversies in lipid management
• explain calcium and phosphate homeostasis and associations with vascular calcification as an active process
• recognise the importance of glycaemic control.
	• use evidence based management strategies accepting limitations in literature
	• evaluate and investigate a patient with ESKD for vascular disease using imaging including stress testing, dopplers and nuclear scans for:
	  • peripheral vascular disease
	  • coronary artery disease
	  • aneurysmal disease
	  • other occlusive disease (bruits)
	  • assessment of vascular calcification.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.3	End Stage Kidney Disease
Learning Objective 2.3.3	Insert a temporary venous catheter for dialysis

Knowledge	Skills

• explain surface and structural anatomy of the subclavian, jugular and inguinal regions
• describe the management options available to treat complications after access insertion or removal, including:
  • infection
  • haemorrhage
  • arterial puncture
  • pneumothorax
  • air embolism
• describe the procedure of vascatheter placement and the types of registered devices available
• describe common sites used for insertion of dialysis central venous catheters (CVCs) and understand how the risk of different complications is affected by the site chosen for use
• identify options and potential complications of different catheter locking solutions
• understand the difference between cuffed/ tunnelled and non tunnelled CVCs and the different indications for their use.
	• screen patients to ensure there are no contraindications to vascatheter insertion
	• obtain informed consent for the procedure
	• explain the procedure of vascatheter placement to a patient, including the associated complications and incidence
	• safely perform the procedure using ultrasound guidance
	• confirm subclavian and jugular vein vascatheter positioning using x-rays.

Minimum practical performance requirements	• An adequate number of tunnelled or untunnelled vascular catheters under clinical supervision to achieve safe and independent procedural competence. 10 to 20 vascular catheters are suggested.* **NOTE: highly desirable.*

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.3	End Stage Kidney Disease
Learning Objective 2.3.4	Describe dialysis in those with limited life expectancy

Knowledge	Skills
• recognise different cultural approaches to palliation and death	• organise and manage family meetings with allied health staff • organise palliative care teams to assist with symptom control and in end of life care • use a 'trial of dialysis' for patients where the benefits of dialysis may not be clear
• describe current data suggesting potential poorer outcomes of renal replacement therapy (RRT) in older patients with comorbidities • identify relevance of either dialysis or non-dialysis pathway in certain circumstances • describe ethical issues about dialysis in terminally ill patients and older people • recognise the potential ethical issues of a non-dialysis approach to ESKD • describe the CARI guidelines on dialysis relevant to appropriateness of dialysis	• counsel patients developing ESKD where RRT may not be a treatment offering improved quality of, or prolonged, life
• recognise the difficulties of dialysing a child with significant comorbidities • describe outcomes of renal failure in infants and children diagnosed at an early age • explain principles of bioethics and ethics support available • identify the principles of bereavement management.	• counsel and inform families of children with, or approaching ESKD where RRT may not be a treatment offering improved quality of, or prolonged, life • describe the medical, nursing, practical and psychosocial needs of the child and their family in this situation.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.3	End Stage Kidney Disease
Learning Objective 2.3.5	Explain renal replacement therapies

Knowledge	Skills

• identify the fundamentals of RRT, focusing on principles of dialysis, ultrafiltration and permeability dialysis (PD)
• identify the general principles of chronic peritoneal dialysis (PD) - automated PD (APD) and continuous ambulatory PD (CAPD) - and haemodialysis (HD) (standard and extended), and advantages and disadvantages of each modality
• describe the principles of measuring dialysis adequacy and limitations of these measurements
• explain the complications of each type of dialysis including:
  • access failure
  • infection
  • mechanical complications
  • ultrafiltration failure
  • long-term problems, e.g. dialysis amyloid, sclerosing peritonitis.
	• counsel and prepare a patient for RRT, including targeted screening for cardiovascular disease and assessment of:
	  • bone disease
	  • coronary and other vascular disease
	  • diabetes mellitus
	  • workup for transplantation
	• interpret measurements of dialysis and access adequacy including urea reduction ratio, Kt/V and recirculation tests
	• manage chronic ambulatory PD patients on dialysis
	• evaluate the advantages and disadvantages of each dialysis modality
	• educate patients to allow informed choices.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.3	End Stage Kidney Disease
Learning Objective 2.3.6	Plan and manage peritoneal dialysis

Knowledge	Skills

• describe the science of PD
• explain factors involved in choice of dialysis modality
• describe the physiology of PD
• describe the principles and methods of APD and CAPD
• describe the methods to assess dialysis adequacy, and optimising prescription with respect to CARI and other clinical guidelines
• prescribe PD considering the following aspects:
  • interpret PET tests
  • different fluids available and their use
  • benefits, limitations and complications
  • potential infections and their management.
	• describe the concepts of dialysis, ultrafiltration and membrane characteristics
	• manage ESKD patients beginning PD
	• manage access for PD
	• plan and initiate treatment of a patient on PD, including:
	  • education
	  • surgical assessment
	  • prescription
	  • medications
	  • PET (peritoneal equilibration test)
	  • nutritional assessment e.g. normalised protein nitrogen appearance (nPNA), dietary protein intake
	  • dialysis adequacy
	• manage complications noting guidelines including:
	  • membrane failure
	  • exit site infection
	  • peritonitis
	  • catheter malfunctions
	  • leaks and hernias
	  • ultra-filtration failure
	  • hyperglycemia
	  • weight gain
	• recognise when a change of prescription may be required
	• alter the prescription of peritoneal dialysis for a patient with fluid overload or poor clearances
	• recognise when change of RRT modality may be required.

Minimum practical performance requirements	• Management of an adequate number of peritoneal dialysis patients under clinical supervision, in inpatient and outpatient settings, to ensure safe and independent practice. A suggested number of patients is 50.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.3	End Stage Kidney Disease
Learning Objective 2.3.7	Plan and manage haemodialysis

Knowledge	Skills

• describe the principles of the various forms of blood filtration
• manage patients undergoing HD therapy
• manage patients requiring RRT due to acute renal failure (ARF)
• explain the different methods of vascular access and their care
• explain the principles of HD
• describe benefits, limitations and complications
• identify methods of assessing HD adequacy and CARI guidelines regarding these
• describe different line sizes membranes, dialysers and options for dialysate composition
• recognise different profiling programmes and online monitoring of adequacy and blood volume monitoring
• understand principles of monitoring water quality for haemodialysis.
	• apply principles of HD
	• use and assess limitations of temporary access permcatheters
	• plan and manage patients for HD including:
	  • education
	  • vascular access planning
	  • pharmacotherapy
	  • nutrition
	  • psychosocial review
	  • adequacy
	• manage complications of HD including:
	  • access failure
	  • intradialytic hypotension
	  • infection
	• manage patients with ARF requiring RRT recognising the different forms of RRT including:
	  • continuous veno-venous hemofiltration (CVVH)
	  • continuous venous to venous hemodialysis (CVVHD)
	  • continuous veno-venous hemodiafiltration (CVVHDF)

	• assess suitability of children for HD and suitable access creation • prescribe dialysis for children of all ages and to adjust a prescription as needed.

Minimum practical performance requirements	• Management of an adequate number of haemodialysis patients under clinical supervision, in inpatient and outpatient settings, to ensure safe, independent practice. A suggested number of patients is 50.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.3	End Stage Kidney Disease
Learning Objective 2.3.8	Plan and manage the non-dialysis pathway

Knowledge	Skills

• identify the components relevant to the patient and their family in supporting a non-dialysis patient:
  • symptom control
  • continuity of care
  • multidisciplinary management with allied health staff particularly social work and dietetics
  • relevant pharmacology and drug interactions in ESKD patients
• recognise the value of joint care in this circumstance with palliative services when these are available.
	• manage common ESKD problems – pruritus, fatigue, xerostomia, depression, constipation, insomnia, nausea, vomiting, dyspnoea and pain
	• adjust drug doses according to reduced GFR
	• liaise with allied health staff
	• describe reduced life expectancy to a patient with respect, empathy and dignity.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.3	End Stage Kidney Disease
Learning Objective 2.3.9	Describe haemofiltration and continuous renal replacement therapies
Links	Learning Objective 2.1.7

Knowledge	Skills
• describe the principles and different forms of haemofiltration • recognise timing and requirement of switching patients on continuous therapy to intermittent HD or PD • describe the water quality principles for haemofiltration.	• use principles of prescription of therapy • manage access including permcaths and vascath • manage complications including access failure and infection • manage fluids and prescribe haemofiltration • manage drug prescription on continuous RRT.

DOMAIN 2	DISEASES OF THE KIDNEYS AND URINARY TRACT
Theme 2.3	End Stage Kidney Disease
Learning Objective 2.3.10	Plan and manage home haemodialysis therapies

Knowledge	Skills

• recognise the benefits of home HD, including:
  • autonomy
  • survival benefits
  • flexibility
  • growth
  • management of CKD MBD cardiac improvements: better BP control, reduction in left ventricular hypertrophy (LVH)
  • reduced sleep apnoea
  • cost-economic benefits
• describe methods of home HD
• describe nocturnal dialysis
• explain short daily dialysis
• recognise impact on family/caregivers.
	• organise counselling for patients and their family/ caregivers
	• manage the prescription of home dialysis in all its modalities.

Minimum practical performance requirements	• Management of an adequate number of home haemodialysis patients under clinical supervision to ensure safe, independent practice. A suggested number of patients is 10.

DOMAIN 3	TRANSPLANTATION
Theme 3.1	Kidney Transplants
Learning Objective 3.1.1	Assess potential transplant recipients

Knowledge	Skills
• recognise the importance of thorough evaluation of a potential recipient with understanding of relative and absolute contraindications to transplantation • identify the advantages and disadvantages of deceased donor versus live donor • describe the transplant limitations imposed due to the relative lack of deceased donor kidneys in Australia and NZ • identify graft and patient survival data and review outcomes from standard and extended criteria donors.	• evaluate a potential recipient including screening and management of comorbidities • assess diseases precluding transplantation including cancer, severe cardiac disease, metabolic disease and severe respiratory disease • assess viral status and planning of prophylaxis including cytomegalovirus (CMV), HIV, hepatitis B and C • assess and manage bone status • assess blood group, human leukocyte antigen (HLA) testing and sensitisation and how this impacts on graft waiting times and outcomes • plan immunosupression • carefully and thoroughly work through a unit protocol and report findings to transplant team members • evaluate urinary tract and bladder function in patients with congenital urological disease • discuss the benefits and disadvantages of different options for a patient with an incompatible live donor including Paired Kidney Exchange Scheme (PKES), ABO incompatible and desensitisation • assess whether to accept a donor organ offered to a patient.

DOMAIN 3	TRANSPLANTATION
Theme 3.1	Kidney Transplants
Learning Objective 3.1.2	Assess potential live transplant donors

Knowledge	Skills
• explain that rigorous screening of a potential live donor must be completed to proceed to donation • describe principles and results of tissue typing • identify contraindications to live donation • recognise the impact of donating a kidney on the donor • describe donor outcome studies • recognise the importance of clinical separation of responsibility for the donor and recipient • outline current data recorded by ANZDATA living kidney donor registry.	• assess a potential donor using local transplant unit criteria • counsel a potential donor using data from outcome studies • assess when a potential donor requires specialist referral e.g. psychiatric, cardiac, and anaesthetic assessment • follow up a transplant donor.

DOMAIN 3	TRANSPLANTATION
Theme 3.1	Kidney Transplants
Learning Objective 3.1.3	Prescribe immunosuppressants and recognise complications
Links	Learning Objective 1.1.7

Knowledge	Skills
• describe the major histocompatibility complex (MHC) • describe the process of tissue typing and crossmatching • describe techniques of crossmatching e.g. luminex testing • explain the different types of immunosuppressives used in transplantation including their short and long-term side effects • describe determinants of adherence	• interpret tissue typing reports • prescribe and monitor effects of immunosuppressives, including therapeutic drug monitoring • safely modify immunosuppressive regimen according to patient profile • monitor for long term side effects of immunosuppression in patients • counsel to ensure adherence.
• recognise particular effects of immunosuppression in children.	

DOMAIN 3	TRANSPLANTATION
Theme 3.1	Kidney Transplants
Learning Objective 3.1.4	Acute transplant management

Knowledge	Skills

• describe the structure and function of the organ donor service program and its strengths and limitations
• organise an acute transplant and manage chronic stable transplant patients
• describe the histology of acute rejection, including the Banff classification and the changes of humoral (antibody mediated) rejection
• assess offer of a particular diseased donor offered to their patient for transplantation.
	• organise and manage an acute transplant, including:
	  • preparation of a patient
	  • perioperative management
	  • planning and use of immunosuppression, particularly understanding side effects of commonly used drugs (calcineurin inhibitors (CNI), glucocorticoids, mammalian target of rapamycin (mTOR) inhibitors, antimetabolites and monoclonal antibodies)
	• manage early surgical problems
	• manage a suspected rejection
	• identify and manage post-transplant diabetes in the early post-transplant period
	• identify potential side effects of drugs
	• screen and manage patients with BK nephropathy
	• manage age and disease-specific peri operative risks, including:
	  • graft thrombosis
	  • fluid management
	  • disease recurrence e.g. focal segmental glomerulosclerosis (FSGS).

Minimum practical performance requirements	• Acute transplant: participation in 12 acute renal transplants over two years of core training. Acute renal transplantation is defined as participation in the peri-operative and early outpatient (first three months) care of transplant recipients. • Chronic transplantation: 48 episodes of contact with a minimum of 24 different chronic (more than three months post transplantation) renal transplant recipients.

DOMAIN 3	TRANSPLANTATION
Theme 3.1	Kidney Transplants
Learning Objective 3.1.5	Manage the long term care of a transplant recipient

Knowledge	Skills

• explain the principles of maintaining health in a transplant recipient, including:
  • regular outpatient review
  • counselling regarding healthy lifestyle
  • use of pharmacotherapy for treatment of cardiovascular risk factors
  • coordinate multidisciplinary care of renal transplant recipients
• discuss the rationale and limitations of protocol biopsies in renal transplantation
• describe the Banff histological classification of acute rejection
• describe the histological changes seen in transplant glomerulopathy, calcineurin inhibitor toxicity and BK nephropathy
• discuss the limitations of renal transplantation, graft failure and timing of dialysis recommencement.
	• manage ambulatory transplant patients, including:
	  • therapeutic drug monitoring
	  • cardiovascular risk
	  • skin diseases
	  • malignancy surveillance
	  • infection e.g. Epstein-Barr virus (EBV), cytomegalovirus (CMV), BK
	  • vaccination
	  • growth in children
	  • post-transplant bone disease
	• identify and manage post-transplant diabetes in the early post-transplant period
	• manage acute rejection
	• manage a failing graft, including timing of withdrawal of immunosuppression
	• manage fertility issues in transplant recipients.

Glossary of Acronyms and Initialisms

ACEI/ARB	Angiotensin converting enzyme inhibitors/angiotensin receptor blockers
ADPCKD	Autosomal dominant polycystic kidney disease
AKI	Acute kidney injury
ANA	Anti-nuclear antibody test
ANCA	Anti-neutrophil cytoplasmic autoantibodies
anti-GBM	Anti–glomerular basement membrane autoimmune disease
AN	Adriamycin nephrosis
ANZDATA	Australia and New Zealand Dialysis and Transplant Registry
ANZOD	Australia New Zealand Organ Donor Registry
APD	Automated Peritoneal Dialysis
ARF	Acute renal failure
ARPCKD	Autosomal recessive polycystic kidney disease
AVF	Arteriovenous fistula
BP	Blood pressure
CARI	Caring for Australians with Renal Impairment guidelines
CAKUT	Congenital abnormalities of kidney and urinary system
CAPD	Continuous Ambulatory Peritoneal Dialysis
CG	Cockcroft–Gault equation
CKD	Chronic kidney disease
CMV	Cytomegalovirus
CNI	Calcineurin inhibitors
CVC	Central Venous Catheter
CVVH	Continuous veno-venous hemofiltration
CVVHD	Continuous veno-venous dialysis
CVVHDF	Continuous veno-venous hemodiafiltration
DMSA	Dimercaptosuccinic acid
dsDNA	Double Stranded DNA
DTPA	Diethylene triamine pentaacetic acid

Glossary of Acronyms and Initialisms

EBV	Epstein-Barr virus
EDTA	Ethylene diamine tetraacetic acid
eGFR	Estimated glomerular filtration rate
ENA	Extractable nuclear antigens
ESKD	End stage kidney disease
FSGS	Focal segmental glomerulosclerosis
GBM	Glomerular Basement Membrane
GFR	Glomerular filtration rate
GN	Glomerulonephritis
HD	Haemodialysis
HLA	Human leukocyte antigen testing
HUS/TTP	Haemolytic-uraemic syndrome/thrombotic thrombocytopaenic purpura
HT	Hypertension
IF	Immunofluorescence
LM	Light-microscopy
LVH	Left ventricular hypertrophy
MAG-3	Mercapto acetyl tri glycine scan
MBD	Mineral bone disorder
MCDK	Multicystic dysplasic kidneys
MHC	Major histocompatibility complex
MCU	Micturating cystourethrogram
MIMS	Monthly Index of Medical Specialties
MSU	Mid-stream urine
mTOR Inhibitors	Mammalian target of rapamycin inhibitors
nPNA	Normalised protein nitrogen appearance
PAN	polyarteritis nodosa
PD	Peritoneal dialysis
PET	Positron emission tomography

Glossary of Acronyms and Initialisms

PKE	Paired Kidney Exchange Scheme
PSA	Prostate specific antigen
PTH	Parathyroid hormone
RAS	Renal artery stenosis
RhF	Rheumatoid Factor
rhGH	Recombinant human growth hormone
RRT	Renal replacement therapy
RTA	Renal tubular acidosis
SCC	Squamous cell carcinomas
SIADH	Syndrome of inappropriate antidiuretic hormone secretion
SLE	Systemic lupus erythematosus
TCC	Transitional cell carcinomas
U/A	Urinalysis
USS	Ultrasound scan
UTI	Urinary tract infection