

Nephrology Curriculum
Internal Medicine Residency Training Program
(Adapted from the University of Michigan Curriculum)
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This paragraph only applies if you are rotating at the University of Colorado Hospital. Please review the rest of the curriculum below.

Specialty Residents must complete the Web-based Training for Touchworks for this rotation. To complete the training, please follow the instructions below and then notify the Ambulatory Training team via email at UCH-AmbulatoryServicesTraining@uch.edu that the training is complete. They will send you a login via email.

1. Type www.uch.edu in the address field of your web browser.
2. Click the **For Employees** option in the upper-right corner of the page.
3. Under the **Other Helpful Links** section, select the [Ambulatory Services Training](#) link.
4. Under the **Web Based Training** section, select to complete each section: [Lesson1](#), [Lesson 2](#), [Lesson 3](#) links under title **TouchWorks for Specialty Residents**.

Rotation Goals and Educational Purpose

The kidneys play a key role in fluid, electrolyte and acid-base regulation and are affected by a wide range of systemic disorders, drugs, and toxins. The general internist should be competent to detect and evaluate intrinsic renal disorders, asymptomatic urine abnormalities, renal vascular disease, nephrolithiasis, urinary tract infections, and neoplasms of the urinary system. S/he should also be able to manage simple fluid, electrolyte, and acid –base disorders; understand the ways in which systemic diseases may affect the kidneys; and recognize the potential nephrotoxicity of various therapeutic and diagnostic agents. The general internist must also be familiar with guidelines for pre-dialysis management of patients with renal failure, and be able to recognize indications for dialysis and referral to a nephrologist.

This rotation is an elective for residents at the R1, R2 and R3 levels.

Rotation Competency Objectives

In supplement to the University of Colorado longitudinal learning objectives, the following provides an overview of the knowledge, skills, and behaviors promoted in this rotation.

- I. Patient Care
 - a. History and Physical Examination
 - i. By completion of the rotation, R1 residents should be able to elicit

1. A complete nephrologic history, distinguishing risk factors for and temporal duration of kidney disease;
 2. A genitourinary systems review
 3. Palpable renal abnormalities (ballotable kidneys)
 4. Symptoms and signs of diseases associated with renal involvement (enlarged urinary bladder, vasculitides, SLE, artheroembolic disease.
 5. Symptoms and signs of complications related to kidney failure (uremia, accelerated atherosclerosis, hypertension, anemia, salt and water retention, mineral and bone disease, malnutrition, sexual dysfunction, neuropathy, electrolyte and acid-base disturbance.
 6. A complete medication history (prescribed and over-the-counter) to explore potential risks for adverse drug effects.
- ii. By the conclusion of the rotation, R2 and R3 residents will additionally perform nephrologic history and physical examinations with appropriate efficiency and increasing autonomy.
- b. Laboratory and radiologic testing. By completion of the rotation, residents will:
- i. Interpret urinalysis and microscopy of urine sediment, including RBCs, WBCs, tubular, transitional and squamous epithelial cells, bacteria and hyaline/granular/cellular casts.
 - ii. Interpret quantitative estimates of proteinuria (dipstick, spot protein to creatinine ratio, 24 hour collection).
 - iii. Interpret measurements of serum electrolytes and osmolality, urine electrolytes and osmolality, and arterial blood gas parameters.
 - iv. In the context of the pretest probabilities for specific renal diseases, interpret common serologic tests for intrinsic renal disease (e.g., ANCA, anti-GBM, ANA).
 - v. Describe the indications for, and information gained from, diagnostic imaging studies including ultrasound, CT, excretory urography, conventional and MR angiography, antegrade and retrograde urography, cystoscopy, and radioisotope studies.
- c. Diagnostic decision making. By completion of the rotation, residents will
- i. Integrate history, physical exam, and diagnostic studies to formulate a differential diagnosis for common nephrologic syndromes:
 1. Acute kidney injury
 2. Chronic kidney disease
 3. Disorders of salt and water metabolism
 4. Disorders of major electrolytes (Na^+ , K^+ , Ca^{2+} , Mg^{2+} , Phos^{3-})
 5. Clinical acid-base disorders
 - ii. Recognize indications for renal biopsy
- d. Management of common nephrologic conditions
- i. By the completion of the rotation, R2 residents should demonstrate knowledge of the etiology, risk factors, preventive interventions, pathophysiology, natural history, initial management strategies, interventional indications, potential surgical interventions, and chronic care management for the following common nephrologic conditions:
 1. Pre-renal kidney failure
 2. Diabetic nephropathy
 3. Hypertensive nephrosclerosis
 4. Atheroembolic kidney disease

5. Renovascular disease
 6. Nephritic syndrome
 7. Nephrotic syndrome
 8. Acute tubular necrosis
 9. Tubulo/interstitial renal diseases
 10. Cystic kidney diseases
 11. Iatrogenic renal toxins (e.g., NSAIDs, contrast dye, etc.)
 12. Nephrolithiasis
 13. Post-renal kidney failure
 14. Electrolyte, fluid, and acid/base disorders.
- ii. R3 residents should additionally be able to independently develop initial management plans based on medical evidence for patient across the full spectrum of nephrologic diseases.
- e. Procedures
- i. Residents are encouraged to perform bladder catheterization when necessary, under supervision unless independently credentialed.
 - ii. Residents may, under supervision and with faculty permission, obtain central intravascular access.

II. Core Knowledge

Upon completion of this rotation residents will have the knowledge to:

- i. Recognize risk factors for acute renal failure and chronic kidney disease.
- ii. Use serum creatinine concentration to estimate Glomerular Filtration Rate (GFR); explain the assumption of steady-state concentration; and discuss shortcomings of creatinine-based methods of estimating GFR. Discuss the physiological concept of clearance; apply this to GFR, principles governing solute clearance by dialysis, and handling of medications by the kidney.
- iii. Interpret spot protein-to-creatinine ratio and spot albumin-to-creatinine ratio of a random urine sample as a marker of kidney damage and a quantitative measure of proteinuria. Relate spot testing to 24-hour urine results, recognizing that 24 hour urine collections are not generally superior to spot tests for GFR estimation or proteinuria evaluation.
- iv. Identify the fundamental renal mechanisms underlying regulation of Na^+ , K^+ , H^+ , and H_2O .
- v. Identify the role of the kidney in blood pressure regulation, and identify the relationships between hypertension and renovascular disease.
- vi. Discuss the pathophysiology underlying normal and abnormal proteinuria. Define nephrotic-range proteinuria, glomerular proteinuria, tubular proteinuria, and Bence-Jones proteins.
- vii. Categorize- based on both frequency and on dominant pathological site(s) of injury (pre-renal, intra-renal and post-renal)- the causes of acute renal failure and chronic kidney disease.
- viii. Define and list the most common causes of nephritic syndrome and rapidly progressive glomerulonephritis.
- ix. Define and list the most common causes of isolated hematuria and isolated proteinuria.
- x. Describe the basic metabolic, homeostatic regulatory functions and endocrine functions of the kidneys.

- xi. Identify chronic kidney disease as an indication for aggressive cardiovascular risk factor reduction.
- xii. Identify indications for dialysis, relative advantages/disadvantages of intermittent hemodialysis vs. continuous renal replacement therapy in acute kidney injury and of hemodialysis vs. peritoneal dialysis for end-stage renal disease, and preferred vascular access for maintenance hemodialysis.

III. Practice-Based Learning and Improvement

- a. R1 residents are expected to
 - i. Demonstrate self-initiative in the use of information technology to access and retrieve materials for self-education. Utilize National Kidney Foundation Clinical practice guidelines and current literature to generate appropriate diagnostic and therapeutic plans.
 - ii. Constructively respond to and internalize feedback from faculty, nursing, and allied healthcare providers. Demonstrate willingness to change identified behaviors and ability to learn from errors.
- b. R2 residents are additionally expected to critically review clinical trial data.
- c. R3 residents are additionally expected to demonstrate personally investigated knowledge of the evidence base for national guidelines on diagnosis and management of common acute and chronic kidney diseases.

IV. Interpersonal and Communication Skills

- a. By completion of the rotation R1 residents will
 - i. Under supervision, communicate with primary care and/or subspecialty physicians about the patient's course, the results of specific tests, long-term follow-up plans, and issues regarding risk-factor modification.
 - ii. Develop an organized approach to communication surrounding transitions of care, including post-discharge treatment.
 - iii. (Throughout the rotation), present oral and written communication that develops a constructive relationship with colleagues on referring services.
- b. Additionally R2 residents will
 - i. Effectively communicate with patients and other professionals regarding the indications, risks and benefits of renal biopsy. Under supervision, engage patients in informed consent for renal biopsy, respecting patient autonomy and promoting patient participation in health care decisions.
 - ii. Under supervision, effectively engage patients in counseling regarding indications for dialysis, mechanics of dialysis, and common potential dialysis-associated symptoms.
 - iii. Engage in patient-centered counseling regarding kidney disease risk factors, ESRD management, renal replacement modality selection, and vascular access preparation.
- c. Additional, R3 residents will
 - i. Provide counseling, with increased autonomy, regarding initiation of dialysis.
 - ii. Under supervision, effectively communicate with patients regarding kidney transplant evaluation.

V. Professionalism

- a. Throughout the rotation, R1 residents are expected to

- i. Respond in a timely manner to consultative requests and patient care needs. Complete all dictations and letters in a timely manner.
 - ii. Recognize and compassionately respond to factors affecting treatment plans, including personal economic factors, complexities of family care at home, and other factors affecting adherence with medical therapy.
 - iii. Recognize and compassionately respond to patients' emotional and social stressors related to chronic kidney disease.
- b. R2 Residents additionally are expected to reflect understanding of appropriate indications to discuss end-of-life decision making in ESRD (including withdrawal from dialysis) with patients and families and to sensitively respond to patient and family decisions regarding palliative care.

VI. Systems-Based Practice

- a. Effectively coordinate multidisciplinary team care (primary service, consult services, social work, nursing, pharmacy, nutrition, and other allied health professionals) in patient care.
- b. Apply evidence-based, cost-conscious strategies to prevention, diagnosis, and management of common kidney diseases.
- c. Reflect awareness of societal costs for the epidemic growth in end-stage renal disease within the greater healthcare system. Acknowledge the extent of undiagnosed and inadequately treated chronic kidney disease and necessity of a systematic scope for prevention of ESRD.

The principal teaching methods employed for this rotation are:

- I. Supervised Direct Patient Care:
 - a. In-patient Services
 - i. Residents encounter patients admitted to any of the inpatient services at their assigned hospital (DHMC, DVAMC, or UCH). The population is obtained from the outpatient clinics, the emergency department, and in transfer from other facilities or other hospitals. Faculty supervises admission histories, physical exams, daily management, and discharge plans.
 - ii. Management and teaching rounds are conducted daily for several hours. Discussions of differential diagnosis, pathophysiology, and treatment may be incorporated into these rounds or may, at the discretion of the Attending physician, occur separately. The exact timing for teaching rounds and other didactic sessions varies by hospital, intensity of service etc. This generally occupies 30- 50% of the total rotation time.
 - iii. The management team includes one attending physician, one PGY4 or higher resident (the renal fellow) and 1 or 2 PGY1- PGY3 residents, with participating medical students. Bedside rounds emphasize fundamental skills for management of hospitalized patients while incorporating issues such as resource utilization. This mandatory session involves critical critique and discussion assimilating basic science knowledge, clinical data, pathophysiology, and evidence based principles. The bedside component includes confirmation of residents' history and physical examination skills by the teaching attending physician. The teaching attending assesses and models communication skills.

b. Outpatient Clinics

Residents participate in three half-day outpatient nephrology clinics weekly:

- i. VAMC Thursday afternoon and Friday morning for those at VA or DHMC (one of them for those at UCH)
- ii. Other clinics vary by hospital assignment:
 - Tuesday and Wednesday afternoons for residents at UCH
 - Tuesday afternoon for residents at DHMC
- iii. Residents also maintain their regular schedule of Internal Medicine continuity clinics (1 or 2 weekly).

II. Educational Conferences

Residents participate in the Division's daily educational conferences (0800-0900). The schedule

is:	Monday	Journal Club (Pathology in first week of the month)
	Tuesday	Physiology
	Wednesday	Research
	Thursday	Case Discussions
	Friday	Grand Rounds

In addition, residents continue to attend the regularly scheduled noon housestaff conferences.

Methods of evaluation utilized in this rotation are:

I. Ongoing "feedback"

- a. Patient records are reviewed by the Attending who provides specific feedback to the resident on data-gathering and documentation skills.
- b. At approximately mid-month, the Attending physician meets informally with the resident so that each may provide the other with his/her perceptions of the rotation and the other's performance to date.

II. Resident Performance

Upon completion of the rotation faculty complete computerized resident evaluation forms. The evaluation is competency-based. The evaluation is shared with the resident, who receives a copy, and is internally reviewed by the residency office. The evaluation is part of the resident file and is incorporated into the semiannual performance review for directed resident feedback.

III. Faculty Performance

Upon completion of the rotation, residents complete a computerized faculty evaluation form. Faculty evaluations are reviewed by the program director and attending faculty physicians receive anonymous copies of completed evaluations. Collective evaluations serve as a tool to assess faculty development needs.

IV. Rotation Experience

Upon completion of the rotation, residents complete a computerized service evaluation form. Service evaluations are reviewed by the program director and the residency rotation director. Collective evaluations serve as a tool to assess program development needs.

The Textbooks suggested for this rotation (and provided on loan to the residents) are:

“Manual of Nephrology” 7th Edition, edited by Robert W. Schrier

“The Fluid, Electrolyte and Acid-Base Companion” by Sarah Faubel and Joel Topf