



An Interactive Ambulatory Nephrology Curriculum for Internal Medicine Interns: Design, Implementation, and Participant Feedback

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While diminishing nephrology fellow recruitment is a known issue, more work is needed to evaluate possible interventions to reverse this trend. We designed and implemented a curriculum to increase exposure to ambulatory nephrology among internal medicine interns. The curriculum focused on key aspects of outpatient nephrology practice, including supervised clinic visits, formal themed didactic content, and an online interactive forum with assigned evidence-based readings and small-group responses to relevant cases. We obtained postcourse surveys from all participating interns. Of the 43 interns who took part in the first year of the ambulatory nephrology curriculum, 100% reported a positive didactic experience and 91% reported a positive interactive online experience. 77% reported an improvement in their familiarity with clinical nephrology practice (median 2-point increase in familiarity score on a 7-point scale, $P < 0.001$ by signed rank testing). Qualitative feedback included praise for the high-yield topics covered by the lectures and energizing teachers. In conclusion, we successfully implemented an ambulatory nephrology curriculum using a framework that integrated formal didactics, interactive online learning, and key clinical components of outpatient nephrology care. Future investigation will evaluate whether early implementation of this curriculum is associated with increased pursuit of nephrology as a career.

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There has been declining interest in nephrology among US medical graduates since 2002.¹⁻³ More than half of fellowship programs and more than one-third of the total positions were unfilled in the academic year beginning in 2016.² Simultaneously, the total number of nephrology programs has remained relatively stable during the past 5 academic years.^{2,4} This waning appeal of nephrology as a career choice may be particularly problematic because data suggest that the demand for nephrologists will increase in coming decades³ due to a growing prevalence of chronic kidney disease (CKD),^{5,6} a larger number of patients requiring dialysis,⁵ and a concomitant decline in the mortality rate of dialysis patients.⁵ Further work is needed in the academic nephrology community to engage students and residents early in their clinical rotations and, in particular, to improve internal medicine residents' perceptions of clinical nephrology.

Dissatisfaction with nephrology teaching among medical students and residents likely plays an important role in waning interest in nephrology as a career. Medical students surveyed about preclinical renal pathophysiology courses often indicate that they perceive the material to be uninteresting, irrelevant, or overly complicated.^{7,8} Specifically, medical students criticize that courses are often taught by non-clinicians, using overly confusing approaches to the

subject area in the absence of clear clinical correlations.⁹ This perception of an exceptional level of complexity continues into residency. When asked about reasons for choosing alternative fields, graduating residents cited anxiety related to electrolyte management, as well as negative perceptions surrounding dialysis.¹⁰ Among fellows in other specialties, almost one-third stated that nephrology was the most difficult physiology course in medical

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school, and almost a quarter stated that they would have considered nephrology fellowship if they had been better taught during either medical school or residency.¹⁰

Additionally, resident exposure to nephrology is typically skewed toward inpatient care, for which the majority of teaching takes place at the bedside by non-nephrologist internists. Most residents primarily care for highly morbid patients with acute kidney injury and patients on dialysis who become acutely ill.¹¹ Thus, residents' clinical nephrology experience tends to represent a subset of patients with greater medical and social complexity who endure graver outcomes than the broader scope of patients under nephrologists' care. Residents have limited exposure to more common issues such as evaluation of proteinuria, management of diseases of bone and mineral metabolism, and management of complex hypertension.¹¹ Typically, internal medicine residents' exposure to ambulatory nephrologic issues takes place in their primary care clinics, in the absence of formal teaching by a nephrologist. As a result, the perceived complexity of nephrology persists not only into, but throughout residency.

Because a significant part of the perceived difficulty of nephrology seems to be due to excessively complex or irrelevant didactics and skewed clinical experiences, we aimed to design and implement a required nephrology experience for interns early during their residency that would more directly address these issues. We implemented a multifaceted ambulatory nephrology module that aimed to provide residents with exposure to ambulatory topics in nephrology often under-represented in inpatient

medicine and to increase overall comfort with nephrology through organized exposure to these topics. Additionally, we systematically evaluated intern feedback to assess the impact of the module on perceived familiarity with nephrology and satisfaction with the quality and relevance of the didactics and to facilitate ongoing improvements to the curriculum. Our overarching goal was to create a reproducible nephrology curriculum that would help elucidate the utility, approachability, and appeal of ambulatory nephrology to internal medicine interns and ultimately attenuate the nationwide trend of declining nephrology fellow recruitment.

Nephrology Curriculum Design

The module took place over an 8-week period, consisting of 4 consecutive 2-week blocks. The curriculum consisted of 3 major components, including: (1) in-person themed didactic content, (2) subspecialty clinic experiences, and (3) an interactive online forum (Fig 1). The didactic content was composed of a series of core lectures on topics relevant to ambulatory nephrology. These topics included CKD management in the primary care setting, introduction to long-term dialysis patient care, case-based approach to electrolyte and acid-base disorders, management of difficult-to-control hypertension, initial evaluation of nephrotic and nephritic syndromes, and fundamentals of posttransplantation care. Each of the lectures was provided by nephrologists in the Renal-Electrolyte and Hypertension Division at the University of Pennsylvania, with a focus on recruiting lecturers who had previously received

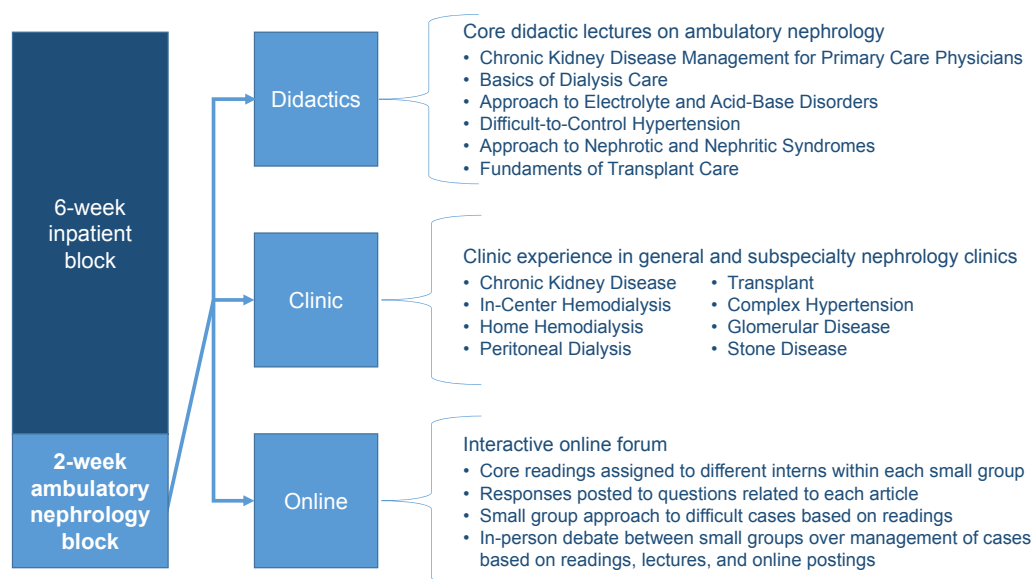


Figure 1. Intern ambulatory nephrology curriculum: detailed components of the curriculum design.

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