

Nephrology Pharmacy: Historical Reflections and Future Challenges

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Nephrology pharmacy commenced in the 1970s, which was the second decade of the clinical pharmacy era. The “original” nephrology clinical pharmacists, such as John Gambertoglio, characterized the influence of hemodialysis and chronic kidney disease (CKD) on drug disposition by using emerging pharmacokinetic methodologies.¹⁻³ These original investigations were used to develop individualized dosage adjustments for medications primarily cleared through the kidneys. In fact, Vasilios A Skoutakis⁴ was the first to describe the role of the clinical pharmacist in the treatment of ambulatory hemodialysis patients. Larry Hak, Shiv Seth, and JV Anandan, who were trained in the epicenters of the clinical pharmacy movement, passionately established some of the first nephrology education modules in academic medical centers at the University of North Carolina, The Ohio State University, and Wayne State University. Over the next several years, these early clinical nephrology pharmacy practitioners and several of the PharmD students whom they mentored began to make significant contributions to the literature regarding the safety and optimal utilization of drugs in transplant and dialysis patients.

In the 1980s, several nephrology pharmacy centers of excellence emerged in academic medical centers in Minneapolis, Chicago, Madison, Richmond, and Albany under the direction of Gary Matzke and Charles Halstenson, Alan Lau, Curtis Johnson, Tom Comstock, and George Bailie. The sophistication of the original clinical services and research programs was enhanced, the breadth and depth of the professional educational offerings were expanded, and many of the first nephrology residency and fellowship programs were established at these institutions during this time.^{5,6}

In the late 1980s, a new generation of clinicians, including Cynthia Norwood, Steven Pahre, Wendy St. Peter, Bruce Mueller, and Nancy Mason, ushered in a focus on pharmacotherapy optimization to improve clinical outcomes associated with conditions such as hypertension, anemia, and hyperparathyroidism, which were now commonly encountered in the ever-expanding population of patients requiring peritoneal dialysis and hemodialysis.^{7,8} It was during this time that many of the initial evaluations of the contribution of pharmaceutical care to patient outcomes were initiated. The introduction of several new drug therapies, such as erythropoietin alfa, and the emergence of peritonitis as a major clinical problem expanded the need for pharmacist involvement in the care of dialysis patients. In response to the need for more clinically trained individuals, the American Society of Health-System Pharmacists, with the support of Amgen Inc., partnered with Gary Matzke, Charles Halstenson, Curtis Johnson, and George Bailie to establish a dialysis traineeship program to educate and train pharmacy practitioners.⁹

In 1993, the American College of Clinical Pharmacy (ACCP) Nephrology Practice and Research Network (PRN) was founded, with 79 members under the leadership of Gary Matzke, as a forum for clinicians, researchers, and educators to share their experiences and move the discipline forward. The clinical metamorphosis has continued into the 21st century and the focuses have now expanded to include the provision of a broad array of clinical services to outpatients with predialysis CKD (Melanie Joy and Maria Pruchnicki),^{10,11} the identification and management of drug-related problems in chronic dialysis patients (Harold Manley),¹² continuation of the evaluation of removal of drugs by dialysis (Darrin Grabe),¹³ and pharmacotherapy outcomes in the US dialysis population (Wendy St. Peter).¹⁴ On the research frontier, several of the discipline’s investigators (Melanie Joy, Donald Brophy, Thomas Dowling, Amy Pai) have received National Institutes of Health (NIH) funding or institutional translational research

Ann Pharmacother 2007;41:1884-6.
Published Online, 9 Oct 2007, www.theannals.com
DOI 10.1345/aph.1K402
Author information provided at the end of the text.

grants for the conduct of basic and translational research in pharmacogenomics, pharmacokinetics, individualized therapy, drug transport and metabolism, thrombosis, and inflammation.

What is the Future of Research in Nephrology Pharmacy?

Although the future of nephrology pharmacy is difficult to predict, the solid foundation of more than 30 years of research productivity and the recent funding of less senior nephrology pharmacy researchers by the NIH, institutional grants, and various foundations, suggest that at least there are pathways for a resurgence of the discipline's contribution of highly trained clinical and translational researchers to society and the pharmacy profession. The critical elements in the expansion of this emergence are continued funding resources and the stimulation of professional students' interest in the discipline via the development of novel and engaging educational offerings in the curricula of schools of pharmacy. The Nephrology PRN group of the ACCP is currently working on a curriculum survey and recommendations. This information should be available in the near future. Certainly, the aspect of research introduction and training needs to be an available educational pathway for students early in their training. It will be necessary to identify and nurture the budding interest of those who step forward with an interest in nephrology and its research component and to develop engaging mentorship opportunities and relationships. This may require the investment of time and energy as well as the identification of undergraduate and graduate funding opportunities. The revitalization of the specialty residency and fellowship programs of the last century along with the development of new graduate programs will ultimately be required to provide the education and training that the clinicians and investigators of the future will need to be valued contributors to nephrology research. The ACCP listing of specialty fellowships identifies only one fellowship that is currently in existence: at the University of Michigan.¹⁵ The mentoring of students and availability of research funding mechanisms will enhance the expansion of our understanding of the mechanisms of kidney disease and the therapies with which to mitigate their consequences. Additionally, researchers will be needed to reevaluate hemodialysis clearance data for old drugs due to the marked improvements in dialysis technology, as well as to devise and conduct investigations of new drugs in the dialysis and CKD populations.

What is the Future of Clinical Nephrology Pharmacy?

The future of nephrology pharmacy clinical practice is at a critical juncture in its history. Residency programs

need to be enhanced in both number and quality to provide the experiences and skills that nephrology practitioners will need to contribute to the care of 20 million plus patients in the US who have CKD. The current ACCP listing of residencies cites 3 residency programs (The Ohio State University Medical Center, Rutgers University, and State University of New York at Buffalo).¹⁵ Many obstacles to provision of residency training exist, including lack of funding and lack of motivated students. The funding aspect may be alleviated by partnering with centers or industries that have high stakes in the provision of high level care. Furthermore, as the Centers for Medicare and Medicaid Services (CMS) begin to link payment with clinical outcomes, negotiations with medical centers, dialysis providers, or practices for funding may be enhanced. Negotiations will need to include solid documentation of the enhancement of services and outcomes provided by pharmacists as well as improved resource utilization. Approximately a year ago, CMS held a period of open comment regarding provision of medication management of dialysis patients. The results of the future ruling may be a catalyst to enhance the number of practitioners in nephrology to provide medication management services to over 4000 dialysis units.

Pharmacy students will need to be exposed to the wide array of clinical practice opportunities afforded by nephrology training through clinical rotations, didactic lectures, and/or informal roundtable types of discussions. More highly trained clinicians will be needed for the onslaught of future CKD cases secondary to the aging population and rising incidence of type 2 diabetes mellitus. The current nephrology pharmacy community lacks the critical mass to respond to all of the patients in our society who have CKD and to their needs. A recent opinion paper by the ambulatory care and nephrology PRN groups outlined many of the opportunities available for practitioners in the area of nephrology.¹⁶ Additionally, an editorial by the former groups identified the clinical pharmacist as an integral member of the multidisciplinary renal team.¹⁷ Interventions are needed to identify current practitioners who are able and willing to undergo additional training to enhance their education and skills in the discipline of nephrology. Clinicians who are actively involved will need to diligently engage our future students and trainees so that discipline can grow to optimally care for the expanding population of patients with CKD. The advent of medication therapy management programs and their reimbursement potential also provides an excellent clinical and financial opportunity for practitioners today and in the future.

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