

Managing CKD by Telemedicine: The Zuni Telenephrology Clinic



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Telemedicine has significant potential to extend nephrology consultation to rural and isolated communities. We describe a telenephrology clinic that has delivered ongoing consultative care from a nephrologist based at the National Institutes of Health in Bethesda, MD, to the Zuni Comprehensive Health Center in western New Mexico. Over the past 9 years, the clinic has conducted 1870 patient visits managing patients using a collaborative approach engaging a nurse case manager, nephrologist, primary clinicians, pharmacists, and community health nurses. A significant proportion of the care provided is directed toward patients with advanced kidney disease (estimated glomerular filtration rate <30 mL/min/1.73 m²). Although there are unique aspects to the Indian Health Service and to the Zuni community which is served by this clinic, this telemedicine clinic does serve as a demonstration that nephrologic consultative care can be delivered effectively and efficiently to rural high-risk communities using a collaborative and integrated model of care.

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Utilizing telemedicine to provide direct consultation to people with CKD would seem to be an obvious way to deliver care to patients with decreased access to specialty care, particularly rural underserved populations. Nephrologic consultation often is based largely on laboratory assessment, and the patient interaction is often centered around disease education and explanation of treatment choices. Thus, much of what transpires in an in-person consultation could be conducted through a video interaction. Telehealth has the potential to deliver more cost-effective care¹ and to improve outcomes.² Regardless of cost-effectiveness,³ in many settings, the alternative to telemedicine may be no care. Lack of nephrology consultation has been recognized as a barrier to improved outcomes even for patients without a geographic barrier to access.⁴

CKD AND TELEHEALTH

Published descriptions of direct consultative care of CKD patients are few and generally describe small numbers of patients with early disease managed over a relatively short period of time. Two reports describe approaches to consultation that do not involve direct video interaction between nephrologist and patient; Scherpbier-deHaan and others⁵ developed a system of consultation with family physicians

based on review of electronically transmitted data, whereas Fernandes and colleagues⁶ provided patient evaluation through exchange of digital messages between nephrologist and patient. Mark and colleagues⁷ conducted a retrospective review of care provided to 427 patients through a virtual renal clinic in Northern Ireland and calculated savings of £111.6 per visit. However, the focus of the virtual clinic was on patients considered less likely to progress based on estimated glomerular filtration rate (eGFR), change in eGFR, and proteinuria. Feasibility and patient satisfaction were assessed at 2 CKD telemedicine clinics that provided follow-up care through 2 nurses at remote sites and a nephrologist and nurse practitioner at an Ottawa hospital.⁸ (Initial consults were all done in person.) Patient, nurse, and nephrologist satisfaction was high. Seventy-seven percent of the patients agreed with the statement "I feel as confident about the doctor's assessment as I would with an in-person assessment." Ishani and an interdisciplinary team followed 451 veterans with eGFR less than 60 mL/1.73 m² (mean eGFR 37 mL/1.73 m²) in the Minneapolis Veterans Affairs Health Care System and found equivalent outcomes to 150 patients followed in a conventional clinic.⁹ The intervention included a home monitoring device for reporting vital signs and virtual video visits at home. A retrospective observational study by Rohatgi followed 238 patients enrolled in a telenephrology program at the Bronx Veterans Affairs Hospital, 121 who lived within 10 miles of the Medical Center, and 117 who lived an average of 64 miles away.¹⁰ Providing care through telemedicine improved attendance at appointments for the patients living at distance to the hospital.

TELEHEALTH IN THE INDIAN HEALTH SERVICE

Indian Health Service (IHS) is an agency of the Department of Health and Human Services that provides comprehensive health care to American Indians and Alaska Natives (AI/AN) with the mission to raise their health status to the highest possible level.¹¹ In 2015, IHS served a population of 2.2 million people from 566 tribes. The 2015 budget appropriation of \$4.6 million

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represented a per capita expenditure of \$3099, compared with \$8097 per capita for the US population.¹² Care is delivered through both federal and tribal facilities including 46 hospitals, 344 health centers, 150 Alaska Village Clinics, and 105 health stations. During fiscal year 2013 (October 2012 through September 2013), this system experienced 70,000 admissions and provided 14 million outpatient visits. In addition, the Community Health Representative Program provides significant support for chronic disease management to patients at home and in the community. Disparities in health status persist among AI/AN people resulting in a life expectancy that is 4.4 years less than the US population resulting from higher death rates due to diabetes, liver disease, and unintentional injuries.¹³ Diabetes affects 15.9% of the adult population, and prevalence of associated complications among AI/AN is high. However, incidence rates of ESRD among AI/AN people with diabetes have decreased significantly over the past 15 years in association with widespread implementation of a comprehensive diabetes management effort¹⁴ that includes a focus on diabetic kidney disease.¹⁵

IHS has a long history of using health information technology to improve access and quality of care for the rural communities that it serves.¹⁶ There is no nationally coordinated telehealth program, but extensive programs have developed in several areas, particularly behavioral health, cardiology, ophthalmology, and otorhinolaryngology.¹⁷

ZUNI TELENEPHROLOGY CLINIC ORGANIZATION AND INFRASTRUCTURE

Zuni Pueblo is a rural community located in western New Mexico 150 miles west of Albuquerque with a population of approximately 10,000 people. In 2010, per capita income was \$10,792 (2010-2014).¹⁸ The IHS Zuni-Ramah Service Unit includes the Pueblo of Zuni and nearby Navajo Communities with a total service population of approximately 14,000. The Zuni IHS is within a Rural Health Professional Shortage Area. The Zuni Comprehensive Health Center is licensed for 37 beds but is able to maintain 18 beds because of a nursing shortage. The facility includes 22 outpatient examination rooms, a high complexity laboratory, and radiology including ultrasound and CT. Adjacent to the hospital is a privately owned and operated dialysis unit with 31 stations and a census on July 15, 2016, of 132 patients. The IHS medical staff includes 13 physicians and 2 nurse practitioners. The "user population," individuals who received care at the Zuni Hospital, included 11,261 individuals during 2012-2015. During fiscal year 2015, the Zuni facility experienced 107,042 outpatient visits

and had 330 discharges including 64 newborn discharges. Average length of stay was 4.1 days.

Burden of DM and CKD

As with other native communities in the United States, Zuni Pueblo has high rates of diabetes and diabetic kidney disease. The Diabetes Registry of Zuni Hospital includes approximately 1600 individuals of the total service population of 14,000. In 2002, the prevalence of ESRD, adjusted for age and gender, was 6 times the prevalence for all AI/AN and 21 times higher than the rate for European Americans.¹⁹ In response to the high burden of kidney disease in Zuni, an IHS nephrologist conducted a weekly interdisciplinary CKD Clinic at the Zuni Hospital from 1989 to 2006. In 2006 when the nephrologist relocated to the National Institutes of Health in Bethesda, MD, an effort was made to continue providing care for patients via telemedicine. The NIH Center for Information Technology, working with the IHS's Office of Information Technology, established a telehealth link (Figure 1) allowing the nephrologist at the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) to consult with

patients beginning in 2007. NIDDK used a Tandberg Codec 6000 as the principal component of a custom videoconference system, with a secure ISDN broadband connection (384 kbps, H.320, AES encryption) to a Polycom MGC100 video bridge at the IHS Video Technology Support Center in Sioux Falls, SD. From there, a secure IP-based connection (384 kbps, H.323, AES encryption) was established, over the IHS IP Network, to a Polycom VSX 7000 videoconfer-

ence system at the Zuni Indian Hospital. An exam room at Zuni Hospital was utilized for the clinic. The equipment at the NIH end was assembled on a movable cart, which was located in the nephrologist's office. One wall of the office was painted blue to serve as a backdrop for the video image. In April 2016, the nephrologist relocated to a new NIH office and the custom videoconference system was upgraded to a Cisco TelePresence System EX90, which provides an encrypted connection to Zuni over the Internet and the Secure IHS IP Network, via the H.323 protocol.

From 2007 through May 2016, clinics were generally conducted 2 days each month. Most of the patients came from the immediate community of Zuni pueblo. Additional patients came from the Navajo communities nearby. Yearly clinic visits were about 200 per year, with a total of 1870 telenephrology patient visits documented during the 9-year period. Clinical data on all the patients seen in the telemedicine clinic are not easily retrievable, but review of all patients seen in the first 5 months of 2016 reflects the level of illness managed through the

CLINICAL SUMMARY

- This article describes a model of telenephrology care that has been sustained over 9 years and provided 1870 visits.
- Over half the care provided is to patients with advanced kidney disease.
- The on-site nurse case manager is the single most important factor in the success of a telenephrology clinic.
- Other factors that are critical include access to the electronic health record and excellent communication between the distant consultant and the on-site primary clinicians.

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