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Managing CKD by Telemedicine: the Zuni Telenephrology Clinic

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Abstract

Telemedicine has significant potential to extend nephrology consultation to rural and isolated communities. We describe a telenephrology clinic which has delivered ongoing consultative care from a nephrologist based at the National Institutes of Health in Bethesda Maryland to the Zuni Comprehensive Health Center in western New Mexico. Over the past nine 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 towards patients with advanced kidney disease ($\text{eGFR} < 30 \text{ ml/min/1.73m}^2$). While there are unique aspects to the Indian Health Service and to the Zuni community which is served by this clinic, it 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.

Keywords

telehealth; telemedicine; kidney disease; indian health service; nephrology consultation

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Managing CKD by telemedicine: the Zuni Telenephrology Clinic

Utilizing telemedicine to provide direct consultation to people with chronic kidney disease (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 interaction could be conducted through a video interaction. Telehealth has the potential to deliver more cost effective care¹ and to improve outcomes². Regardless of cost-effectiveness³, 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 access⁴.

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 which do not involve direct video interaction between nephrologist and patient; Scherpbier-deHaan⁵ developed a system of consultation with family physicians based on review of electronically transmitted data, while Fernandes provided patient evaluation through exchange of digital messages between nephrologist and patient⁶. Mark et al conducted a retrospective review of care provided to 427 patients through a virtual renal clinic in Northern Ireland⁷ 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 eGFR, change in eGFR, and proteinuria. Feasibility and patient satisfaction were assessed at two CKD telemedicine clinics which provided follow-up care through two nurses at remote sites and a nephrologist and nurse practitioner at an Ottawa hospital⁸. (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 < 60 (mean eGFR 37) in the Minneapolis Veterans Affairs (VA) Health Care System and found equivalent outcomes to 150 patients followed in a conventional clinic⁹. The intervention included a home monitoring device for reporting vital signs as well as virtual video visits at home. A retrospective observational study by Rohatgi followed 238 patients enrolled in a telenephrology program at the Bronx VA Hospital, 121 who lived within ten miles of the Medical Center and 117 who lived an average of 64 miles away¹⁰. 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 level¹¹. In 2015 IHS served a population of 2.2 million people from 566 tribes. The 2015 budget appropriation of

\$4.6 million represented a per capita expenditure of \$3099, compared to \$8097 per capita for the to US population¹². 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 injuries¹³. 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 fifteen years in association with widespread implementation of a comprehensive diabetes management effort¹⁴ which includes a focus on diabetic kidney disease¹⁵.

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 otorhinolaryngology¹⁷.

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 due to a nursing shortage. The facility includes 22 outpatient exam 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 15 July 2016 of 132 patients. The IHS medical staff includes 13 physicians and two 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 14000. In 2002 the prevalence of ESRD, adjusted for age and gender, was six times the prevalence for all AI/AN and 21 times higher than the rate for European Americans¹⁹. 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 1989–2006. After this nephrologist relocated to the

National Institutes of Health in Bethesda, Maryland, 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 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 6000 video-conference system with an encrypted ISDN videoconference 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 video connection (384 kbps, H.323, AES encryption) is established to a Polycom VSX 7000 video-conference system at the Zuni Indian Hospital. In 2016, the NIH equipment was upgraded to a Cisco Telepresence EX90 connecting to Zuni over the IP network via H.323/SIP protocol. An exam room at Zuni Hospital was utilized for the clinic. The equipment at the NIH was on a movable cart and used in the nephrologist's office. One wall of the office was painted blue to serve as a backdrop for the video image.

From 2007 through May 2016, clinics were generally conducted two 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 1870 telenephrology patient visits documented during the nine 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 five months of 2016 reflects the level of illness managed through the clinic. From Jan 1 through May 31 2016, there were 95 patient encounters with 64 patients. Thirty-nine (60.9%) of the patients were women. Patients ranged from 18 to 85 years old, mean age 63.1 years. There were ten (10.5%) new evaluations and 85 (89.5%) follow-up visits. Etiology of kidney disease was attributed to diabetes in 51 of the 64 patients (79.6%). eGFR was > 60 ml/1.73m² for 15 patient visits (15.7%), 45–59 ml/1.73m² for 11 visits (11.6%), 30–44 ml/1.73m² for 11 visits (11.6%), 15–29 ml/1.73m² for 40 visits (42.1%) and <15 ml/1.73m² for 18 visits (18.9%). Most clinic visits (60%) were for management of CKD in patients with eGFR less than 30 ml/min/1.73m². During the nine year history of the clinic, 44 patients were referred for initiation of dialysis and two died. Zuni IHS billed third parties for 1026 of the 1746 visits; the amount billed was \$193,604 and the amount received from payers was \$149,719²⁰.

The clinic is organized and managed by an RN case manager from the Zuni Public Health Nursing Department. Initially, this was the nurse who worked in the onsite clinic conducted between 1989 and 2006. She mentored her replacement, who has managed the clinic since 2009. In addition to the case manager, diabetes educators, dietitians, and primary clinicians are easily available for consultation, during the clinic, if necessary (i.e., curbside consults are available even during a telemedicine clinic). Most clinics include the active participation of a PharmD student in the last year of training on a two-month rotation at Zuni.

Zuni Hospital strives to provide continuity of care for patients by assigning each patient to a primary clinician and a team. Any clinician may refer a patient for a telenephrology consultation based on the patient's status and the clinician's comfort in managing the patient. There is no eGFR threshold which must be met or at which a patient must be referred. Referring clinicians are strongly urged to complete a one-page referral developed

by the National Kidney Disease Education Program²¹ and incorporated within the Zuni electronic health record (EHR). The referral form includes basic information on presence of diabetes, eGFR trends, albuminuria, patient knowledge, screening labs and medications. Much of the form is pre-filled by the EHR. New referrals are screened by the nurse manager and screening labs which have not been completed are ordered. If there is a question about the referral the nurse manager will discuss with the referring provider. Follow-up appointments can be scheduled by nephrologist, referring provider, or case manager. Return visits are pre-screened and follow-up labs and imaging studies are ordered and obtained prior to the visit. The nephrologist reviews all labs and other studies which he orders.

On clinic day, patients are screened by outpatient staff and medicine reconciliation is performed by the pharmacy student prior to entering the exam room. The nurse manager is in the room with the patient during the entire visit, allowing her to raise issues that may have become apparent “off-screen” or which require clarification by the nephrologist. The nurse manager also provides translation for those patients who prefer to communicate in Zuni. Visits generally last 15–45 minutes. Following the visit, the nurse manager assures a follow-up appointment is scheduled and may recheck the patient or provide additional education at the patients home or through an appointment in the Public Health Nursing office at Zuni Hospital.

Patients with progressive disease who require vascular or peritoneal access placement are referred to a facility in Gallup, NM, approximately forty miles north of Zuni. Vascular evaluation, access placement, and initiation of dialysis are available from the same group of physicians who manage the Zuni dialysis unit. Patients who are interested in transplant are referred to one of two transplant centers in Albuquerque for evaluation. Timely completion of transplant evaluation is a challenge due to the distance, 150 miles, from the transplant center.

Lessons learned

The referring Zuni medical staff, the nurse manager, and the nephrologist have identified key elements to the success of this collaborative approach to delivering specialty consultation by telemedicine:

Nurse case manager. Telenephrology is collaborative management between the referring provider, the RN nurse manager and the nephrologist. The nurse manager is the most critical factor in successfully conducting a referral clinic by telemedicine. A detailed list of responsibilities are included in Figure 2. In addition, a strong ancillary staff (e.g., program assistants and nurses) are important to mail out patient appointment letters, enter patients name into the EHR system when patients arrive for appointment, and assist with appointment reminders via phone calls.

Access to EHR. Although multiple firewalls and confidentiality protections can make access to the EHR difficult, access makes faxing or mailing of records unnecessary and allows the nephrologist to view, order and document in real time. Messaging and sharing clinical notes with collaborating health professionals is facilitated.

Excellent communication with referring clinicians, including easy availability of consultant to referring clinicians by phone and email between clinics. Referring clinicians also must be easily accessible to the consultant to clarify questions that arise during clinic and to provide urgent evaluation of problems that cannot be assessed by telemedicine. Periodic “in person visits” by the consultant on site enhances patient rapport, trust with referring clinicians and patients.

Challenges

Although telemedicine provides access to consultation for patients, there are clear limitations:

- Generally, **telenephrology is not feasible for acutely ill patients** that require immediate attention. Access to video equipment may be difficult. Scheduling of other patients may preclude interruption of clinic.
- **Certain nonverbal cues may not be picked up** on camera for the provider to notice and address.
- **Technical difficulties** causing loss of audio, video or both or loss of access to EHR occur and can delay or cancel patient care. Lack of bandwidth can freeze or interrupt interaction. Excellent technology support reduces the delays and shortens them when they occur.

In addition, challenges to conducting a virtual clinic may require development of specific clinical skills:

- **Provider presence.** If the provider and patient are in the same room and the provider looks away from the patient or moves a short distance away, the patient still has a sense that the provider is “present.” When the clinician is only visible on the monitor and he or she looks away or moves slightly away, the patient may feel like the provider is no longer “present.” Thus, it is particularly important to review the chart prior to the encounter rather than while onscreen.
- **Maintaining “eye contact.”** It takes practice to look at the camera, rather than the screen image of the patient, to provide the patient with the sense that the clinician is “looking them in the eyes”.
- **Conveying emotional support.** Nephrology consultation often involves delivering difficult information. Sitting silently for a few moments with a patient can be helpful if the clinician is sitting in the same room. Silence on the video monitor may not convey emotional support as well. Similarly, there is no way to comfort the patient through touch through telemedicine.
- **Patient discomfort.** “Seeing the doctor” by video may seem bizarre or make some patients uncomfortable, especially people from some cultural traditions. As in many clinical settings, a sense of humor may be useful in putting the patient “at ease”.

While the IHS is a unique organization, its' approach to many of the challenges of addressing the health needs of rural, medically underserved populations conforms to the widely accepted principles of managing chronic conditions (e.g., Chronic Care Model) and may be widely applicable. The model of telemedicine described in this report is based on an interdisciplinary approach to collaborative care that is not inconsistent with the approach of many integrated health care systems (e.g., Veterans Administration). While this model was implemented as a way to provide care which otherwise was not easily accessible, not as a clinical research trial, it does demonstrate that telemedicine can be a durable approach to deliver nephrology consultation to a high risk rural population, including people with advanced kidney disease, over an extended period of time.

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Clinical Summary

- This paper describes a model of telenephrology care which has been sustained over nine 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 which are critical include access to the electronic health record and excellent communications between the distant consultant and the onsite primary clinicians.

Figure 1.

- Chart reviews- order and send copies of reports (stress test, colonoscopy reports, biopsy reports etc.) to MD.
- Perform chart reviews prior to clinic:
 - review and ordering of labs
 - confirm reports of out of facility care and evaluation are entered into EHR
 - prepare handouts specific for patients needs (e.g., blood pressure control, exercise handouts, motivational cards, low phosphorus foods, etc.)
- Call patients morning of clinic to inquire and remind patients of appointment
- Ensure equipment and room is ready for use. Have dark colored cloth (blue) for background. Have video equipment properly functioning. Contact IT staff to ensure connection between facilities is present. Have BP, weight scale, etc. within reach to reassess.
- Recheck BPs, glucose checks, assess access sites, assess for edema, and overall health status.
- Enter nursing interventions, education, assessment in electronic health record.
- Provide patient copy of lab results and reiterate nephrologist's message of adherence to medications, reasons for new orders
- Case management duties- scheduling, cancellations, overbooking of appointments. Coordinate patient's appointments with other scheduled appointments to ensure adherence.
- Provide parenteral meds if patients are on anemia management program.
- Provide immunizations as needed under standing orders.
- Provide telephone report to a RN if sending a patient to Urgent Care/Walk-in for further evaluation.
- Send/fax patient record of renal visit to another facility if referring clinician is at another facility to ensure continuity of care.
- Perform home visits to recheck lab work, blood pressure and follow up as needed.

Figure 2.
Role of RN Case Manager