# Telehealth in the Delivery of Home Dialysis Care: Catching up With Technology

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**Geographic and socioeconomic barriers may pose a significant difficulty in delivering home dialysis care to remote underserved populations leading to low utilization rates and poor outcomes. Telehealth may serve as a solution to overcome geographic barriers in delivering home dialysis care. Although technologic advances in telehealth have progressed rapidly making it accessible and inexpensive, it has been underused by nephrologists. Components of a regular face-to-face visit that can be successfully accomplished remotely using telehealth techniques include physician-patient communication, physical examination, laboratory and treatment data monitoring, nursing and nutrition education. Regulatory and reimbursement-related policies continue to present barriers that need to be overcome in operationalizing telehealth and widespread adoption of telehealth solutions. Although more quality evidence is needed to study the impact of telehealth on home dialysis outcomes and uptake, telehealth holds the promise of increasing access to care, improving quality of life, and improving quality of care for current and would be home dialysis patients.**



**Key Words:** Telehealth, Home dialysis, Peritoneal dialysis, Quality of life, Modalities education

## INTRODUCTION

Home dialysis is underused in the United States accounting for less than around 11.5% of the total dialysis population.[1] One potential barrier to home dialysis is access to home dialysis care which can be impeded by both geographic and socioeconomic factors.[2,3] Prakash and colleagues[4] recently demonstrated that only 55% of dialysis units are certified to provide home dialysis. In more rural networks such as Network 8 (Alabama, Mississippi, and Tennessee), this percentage can be even lower.[5] Because of the relative paucity of home dialysis units, patients on home dialysis living remotely from their dialysis units can face long commutes for which they must take days off of work, spend time away from family, and suffer financially from lost wages and transportation costs. Although data are lacking, telehealth and remote patient monitoring may provide a means to address geographic barriers to care, thus improving access to home dialysis care, patient quality of life, and outcomes.

Unfortunately, telehealth technologies have been similarly underused by nephrologists largely because of regulatory and reimbursement issues. Early studies using telehealth in remote in-center dialysis care suffered from high costs of implementing secure T1 lines and expensive technology.[6,7] Since these initial studies and conceptualization of telehealth, technology has increased at a very fast pace. Videoconferencing technology has become smaller, easier to use, and more inexpensive making it a mainstay in daily life including applications, such as Face Time and Skype. Technology literacy as well has continued to increase since early 2000. A recent survey among peritoneal dialysis (PD) patients showed that 88% owned a computer and 94% knew how to use a computer.[8] Furthermore, 83% of patients wished to participate in telehealth.[8] It is within this environment that telehealth and remote patient monitoring may begin to transform home dialysis care. Specifically for the purposes of home dialysis, telehealth may be used for 3 main purposes: (1) replacement for the monthly face-to-face visit, (2) remote monitoring of patients vitals, and (3) provision of remote modalities education.

## REPLACING THE MONTHLY FACE-TO-FACE WITH TELEHEALTH

To understand some of the barriers to providing telehealth visits, a basic knowledge of telehealth terminology is needed. Telehealth is a broad term encompassing the use of electronic communication to provide clinical care. This term encompasses interactive videoconferencing, remote monitoring, e-mails, etc. To replace the face-to-face visit, interactive videoconferencing must be used. To do this, the provider (physician or nurse practitioner) is located at what is called the provider site or distant site. The patient must also present to a location which is called the originating site. Criteria to be designated as an appropriate distant or originating site are dictated by third-party payers, and in most cases, meeting these requirements is prerequisite for reimbursement purposes.

As of January 2016, Centers for Medicare and Medicaid Services approved the outpatient monthly capitated payment codes for outpatient PD care (90963-90966) as covered telehealth codes, but many barriers as will be noted below must be overcome to ensure compliance with current Medicare regulations. Home hemodialysis has been excluded from coverage as the vascular access must still be examined

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in person per Medicare regulations. As the majority of dialysis patients are Medicare beneficiaries, the remaining discussion will focus on Medicare regulations. By current Medicare policy, an appropriate originating site cannot be the patient's home or another dialysis facility. An originating site must be another medical facility. Furthermore, the originating site must be located in a rural area defined as being outside a metropolitan statistical area unless it is designated as a health care provider shortage area. Thus, one of the largest barriers to provide telehealth is establishing a network of appropriate originating sites. Because of the likely need for multiple originating sites, the most efficient way to connect with these sites is to become part of a pre-existing telehealth network. Many states have pre-existing telehealth networks that require a monthly subscription fee. This obviates the need to provide telemedicine equipment for each and every patient and limits the time needed to establish and verify multiple originating sites individually. For the PD telemedicine program at the University of Alabama at Birmingham, the Alabama Department of Public Health established a growing telemedicine network within the county health departments. These telemedicine equipped sites are used as the originating sites for PD patients. Because of the difficulties in establishing a network of originating sites, the patient's home, although currently not an accepted telehealth originating site, may have multiple potential advantages over medical facilities.

Once appropriate originating sites are established, all the components of a complete face-to-face visit can be accomplished. This has recently been shown to be feasible as part of a pilot study at University of Alabama at Birmingham where telemedicine is being successfully used as a substitute for 2 of 3 monthly face-to-face visits per quarter, completing all the components of the standard "hands-on" visit remotely as outlined later.

**CLINICAL SUMMARY**

- Telehealth for home dialysis can primarily be used for 3 purposes: (1) replacing the monthly face-to-face visit, (2) remote patient monitoring, and (3) providing remote modalities education.
- Telehealth has the potential to increase access to home dialysis care, thus increasing utilization by overcoming geographic and socioeconomic barriers and improving patient and physician comfort with the home modalities.
- Telehealth technologies have been underused by nephrologists because of multiple barriers largely regulatory and reimbursement related. However, because of the rapidly changing face of telehealth policy, telehealth may soon become a viable and important part of home dialysis care.

### Vital Signs, Weights, and Treatment Data

PD patients are currently responsible for recording sitting and standing blood pressures taken before and after therapy and details of the therapy itself including ultrafiltration, initial drain, tonicity of the dialysate, etc. These are recorded on a flow sheet which the patient then brings to the dialysis unit on a monthly basis. Paper flow sheets are faxed by the originating site to the distant site at the time of the visit. Likewise, electronic data capture of therapy monitoring can be collected on a media card and mailed to the dialysis unit before the telehealth encounter. More recently, real-time data can be collected via Bluetooth-enabled blood pressure cuffs and weight scales. Furthermore, the capability exists to provide real-time therapy monitoring.

### Physician/Patient and Nurse/Patient Communication

Communication is necessary and just as important between the nurse and patient as it is with the physician. Interactive videoconferencing can provide a similar experience for the patient as in-person communication. It is important to note that videoconferencing platforms and the environment of both distant and originating site must comply with HIPAA requirements, thus eliminating the use of platforms such as Face Time and Skype. Furthermore, the telehealth encounter must be provided in a private room with similar privacy requirements as an examination room. There must be appropriate bandwidth to sustain a seamless videoconference which may pose a problem in remote areas most in need of telehealth solutions.

### Remote Physical Examination

Of primary importance in a PD telemedicine visit is a physical examination that includes an assessment of volume status and assessment of the exit site. The auscultatory examination can be performed remotely using Bluetooth-enabled stethoscopes. Standard cardiac and pulmonary examination can be performed using this innovative technology as well. The PD catheter exit site can easily be evaluated using a handheld high-definition camera. Pitting edema can be assessed as well by having the provider on the distant site press on the lower extremities while videoconferencing.

### Laboratory Evaluation

Monthly labs are needed to monitor PD patients. PD patients, many of which do not have permanent vascular access, are not accustomed to auto-phlebotomy. Phlebotomy and centrifugation of samples can be performed at the originating site by trained staff and labs shipped to a central processing laboratory. This may be provided for with the originating site fee which originating sites can bill separately from the clinical visit. In this way, labs are standardized and are maintained within the electronic medical record.

### Anemia Management

Administration of erythropoietin and intravenous iron usually occurs in the home dialysis unit. Patient's occasionally present multiple times a month for administration of erythropoietin. This can be accomplished remotely by training patients to self-administer erythropoietin. Iron administration is more difficult to achieve. Oral iron

remains an option although poorly tolerated. A newer method of repleting iron may be with the phosphate binder ferric citrate that has been shown to increase iron stores in dialysis patients.[9]

Data analyses are ongoing in determining the effect of the telemedicine intervention on decreased travel time, decreased patient costs, and improved quality of lives for the patients in this pilot study. Unfortunately, there are no data evaluating efficacy of telehealth as a replacement of the face-to-face visit in the PD population in regard to hard outcomes, such as peritonitis, hospitalization, technique failure, or modality utilization.

Much of the above discussion could also pertain to the home hemodialysis population. However, technology to remotely monitor a patient's vascular access reliably and preferably with better accuracy than an in-person examination will need to be developed.

## REMOTE PATIENT MONITORING

Remote patient management is the ability to monitor real-time or store-and-forward patient data. Many remote monitoring platforms now exist whereby patients take their vital signs including heart rate, blood pressures, weights, and more recently therapy monitoring data on Bluetooth-enabled devices. These devices then send data directly to the dialysis unit for real-time monitoring. The primary advantages of remote monitoring programs are earlier detection of problems, leading to early intervention and improved outcomes. Furthermore, remote monitoring may improve patient quality of life by eliminating cumbersome paper records kept on a daily basis. Finally, improved accuracy of data can be achieved using remote monitoring. However, remote monitoring is not currently covered by Centers for Medicare and Medicaid Services in the ESRD population.

Data on the efficacy of remote monitoring in the home dialysis population are lacking, and no randomized controlled trials have been conducted on remote monitoring in home dialysis. However, in high-risk hemodialysis patients, remote monitoring has been shown to reduce hospitalizations[10] and costs.[7,11] Sicotte and colleagues[12] suggested that there is no single prescriptive model for the delivery of tele-expertise after they observed no differences in health condition or care utilization when using different tele-hemodialysis models such as virtual patient rounds and tele-case reviews with multidisciplinary teams. Studies on remote monitoring in other disease states have shown mixed results. The Better Effectiveness After Transition-Heart Failure trial was a well-designed randomized controlled trial which showed no difference in hospital readmission rates in patients on telemonitoring vs control for heart failure.[13] As such, it is clear that a remote monitor without an appropriate clinical algorithm to intervene on the data will not prevent hospitalizations nor improve outcomes. Clinical studies are needed to determine appropriate standards of remote monitoring including establishing appropriate actionable values as well as intervention algorithms to make full use of this technology.

## MODALITIES EDUCATION

Yet another potential use of telehealth in the provision of home dialysis care is that of modalities education. A survey of dialysis patients showed that appropriate access to modalities education is lacking, in that 66% of respondents had not been educated on PD and 88% had not been educated on home hemodialysis.[14] Dedicated personnel to provide modalities education to the end-stage kidney disease patient may not be available in smaller nephrology practices. Telehealth could provide a means by which nephrologists who do not have access to their own dedicated modalities educator could use the services of a modalities educator remotely. Studies such as ones being conducted on this matter at the University of Arkansas for Medical Sciences may help guide this effort.[15,16]

## OTHER POTENTIAL USES OF TELEHEALTH IN HOME DIALYSIS

### The Home Visit

Other potential uses of telehealth in home dialysis may be in the home evaluation. Home visits take nursing time and may not be feasible in the day of urgent start PD. Telehealth can provide a means to examine home environment without having the nurse to be physically present.

### Nursing Home and Rehabilitation Units

It is estimated that 3 billion dollars a year are spent in the ambulance transfer of patients with end-stage kidney disease to and from dialysis units.[17] Many of these patients are traveling from nursing facilities and rehabilitation units. Furthermore, many of these facilities will not allow for a patient on PD to continue this therapy in the nursing home. As such, PD and home hemodialysis patients are converted to in-center hemodialysis with the additional cost of ambulance transport. Telehealth and remote patient management would provide a mechanism to improve the care of patients on home dialysis in nursing home facilities while providing interactive support to nurses in those facilities caring for home dialysis patients, thus improving their comfort with accepting home dialysis patients.

## BARRIERS TO THE USE OF TELEHEALTH IN HOME DIALYSIS

Although there are many potential benefits to the implementation of telehealth in the dialysis population, significant barriers must be overcome before widespread implementation (Table 1). Regulatory and reimbursement issues are among the largest barriers. Currently, physicians must have a license to practice in any state where a patient presents. Thus, telehealth can only provide care across state lines with the added time and investment of getting licenses in every state the physician will practice. Contractual agreements may be necessary between physician, dialysis provider, and presenting sites to ensure that all parties agree on their respective roles, and this can increase

**Table 1. Potential Benefits and Barriers of Telehealth in ESRD**

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| Potential yet unproven benefits |
| Decreased burden of disease and increased quality of life |
| Increased uptake to home dialysis |
| Improved outcomes |
| Decreased hospitalizations and re-hospitalizations |
| Improved peritonitis and exit site infection rates |
| Decreased technique failure rates |
| Improved comfort level with therapy |
| Better access to standardized education modules |
| Decreased costs from reduction in nonemergent transportation |
| Improvement in patient throughput |
| Barriers |
| Regulatory and reimbursement |
| Access to high speed Internet |
| Obtaining access to appropriate originating sites |
| Liability |
| Cost associated with technology |
| Physician acceptance of telehealth as a mode of health care delivery |
| Patient acceptance of telehealth as a mode of health care delivery |
| Limited data on efficacy and cost effectiveness in the dialysis population |

the time and effort needed to establish appropriate originating sites. Another barrier is that every third-party payor has differing requirements regarding telehealth. As an example, Medicaid in numerous states requires the health care provider to enroll as a telehealth provider and a telehealth consent form. Medicare does not have such requirements but does require that patients be in an area designated as rural which can be analyzed using the Medicare Telehealth Payment Eligibility Analyzer (http://datawarehouse.hrsa.gov/telehealthadvisor/telehealtheligibility.aspx). Uniform telemedicine regulations would go a long way to alleviate this barrier.

Remote monitoring also poses unique problems. These primarily stem from the amount of data which will now be available to dialysis units. Data can be triaged using parameters that trigger alarms. However, addressing every alarm requires significant nursing time which at present is not reimbursed. Should data overwhelm the ability to address all the alarms, and there may be increased liability on the part of the dialysis unit. Studies establishing a standard of care with regard to how to remote monitor, what to remote monitor, and algorithms related to interventions to remote monitor may guide physicians and nurses and mitigate liability.

Other barriers exist to widespread implementation of telehealth. One such barrier is that access to technology and broadband Internet capabilities required to support interactive videoconferencing may be lacking in areas which need telehealth most. Improving access for these patients may require a significant investment in infrastructure. Alternatively, satellite Internet may be a solution. Cost of both technology and monthly Internet subscription may also prove to be barriers for home access to telehealth. Although data would suggest patient acceptance of telehealth is high, telehealth solutions may also be viewed negatively or as intrusive to patients. Finally, nephrologist's acceptance of telehealth is unknown and will be hampered as there is limited data with respect to outcomes in the ESRD population.

## CONCLUSIONS

Telehealth holds great promise in the care of patients with end-stage kidney disease, but nephrologists are continuing to try to catch up with the technology. Benefits of telehealth in the home dialysis population may be realized through improved outcomes, improved quality of life, and increased uptake to home modalities. Furthermore, telehealth can ensure that access to home dialysis care is equitable by eliminating geographic barriers. However, widespread adoption of telehealth for home dialysis faces significant barriers which will need to be overcome. Quality evidence on the impact of these interventions is lacking and will be necessary moving forward to better inform telehealth practices as they relate to home dialysis.

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