

Telemedicine and Hemodialysis: An Analysis of Clinical Outcomes

Betty A. Levine¹, Alan Neustadt², James Grigsby³, James Winchester⁴, Seong K. Mun¹

¹Department of Radiology, Imaging Science and Information Systems Research Center, Georgetown University Medical Center, ²Department of Sociology, University of Maryland, College Park, ³Division of Geriatric Medicine, Department of Medicine, University of Colorado Health Sciences Center, ⁴Division of Nephrology, Department of Medicine, Georgetown University Medical Center
levineb@georgetown.edu

Project Phoenix was established to assess the relationship of clinical outcomes and one mode of telemedicine on patients receiving hemodialysis. Two hemodialysis centers were chosen: one at Georgetown University Medical Center (GUMC) and one in downtown Washington, DC.

Telemedicine was offered at the downtown center but not at the GUMC dialysis center. Patients at the downtown center received standard care plus a weekly telemedicine session with the nephrologist. The telemedicine session consisted of a two-way videoconference between patient and physician where social and medical concerns were discussed, the physician could view the access site and physical condition of the patient, and clinical records could be reviewed. The differences in Kt/V measurements, quality of life, and patient satisfaction were evaluated across these two patient groups.

Data collection for Project Phoenix began in January 1997 and ended in January 1999. During this period, approximately 73 patients with end-stage renal disease (ESRD) participated in 1,134 monthly Kt/V measurements, the primary endogenous measure of the study, which were calculated for study participants. Kt/V represents a measurement of the dialysis dose, taking into account the efficiency of the dialyzer, treatment time, and total volume of urea in the patient's body.

The most important exogenous measure used was the type of treatment each patient received—standard care versus standard care supplemented with telemedicine. Patients were not randomly

assigned to these groups, a weakness of this study due to the high cost of installing the telemedicine application at both centers and logistical constraints associated with giving some patients—and not others—access to telemedicine. Instead, patients selected where they were treated, which then determined the type of treatment they received (standard care or telemedicine).

Other exogenous measures used to provide statistical control for our analyses included sex, number of dialysis treatments, race, education, income, average number of days spent in the hospital, average number of medications while a study participant, and total number of comorbidities. On average, the patients in our study undergoing treatment for ESRD using telemedicine were more likely to be a minority, have a lower income and a lower level of education, be taking a greater number of medications, have a greater number of comorbidities, and have spent less time in a hospital.

Different survey instruments were used to evaluate patients' satisfaction with their care, their lives, and their telemedicine experiences. Quality of life (QOL) was measured using the subscales of the Short Form-36 physical and mental health index and the scaled items from the Kidney Dialysis Quality of Life form.

Measures were aggregated to the level of the patient, resulting in between 34 and 71 cases. Then, using simple *t*-tests, correlation coefficients, or ordinary least squares regression, comparisons of outcomes (Kt/V, satisfaction, and QOL)

were made of patients utilizing telemedicine versus patients receiving standard treatment.

SUMMARY OF RESULTS

The results of our study are mixed, with results obtained sometimes as hypothesized, but often not. The following sections summarize the results of the clinical evaluation by the major endogenous measures—Kt/V, patient satisfaction, and patient QOL.

Analysis of Kt/V

Results favoring telemedicine should show Kt/V measurements that are greater on average for telemedicine patients than for standard care patients.

In a bivariate analysis, there is a slight difference in the average Kt/V levels, with patients receiving standard dialysis treatments exhibiting higher levels of Kt/V (1.55 versus 1.44). However, this

difference is neither statistically nor substantially significant.

We also employed multiple analysis of variance (MANOVA) to try to explain the difference in average Kt/V across the treatment groups. In general, the overall model is statistically significant and explains 22 percent of the variance in the Kt/V measurement. However, only one variable is statistically significant—the number of dialysis treatments a patient received. Therefore:

- The average Kt/V levels for the telemedicine patients are not significantly different from those for the standard dialysis patients.
- MANOVA shows that the number of dialysis treatments is statistically significant and associated with higher Kt/V levels.

Analysis of Patient QOL

In general, QOL should correlate with physical factors such as the Kt/V levels of the patients—in particular, higher Kt/V

values should be associated with higher values on the QOL scales. Examining the bivariate correlation coefficients between the major independent measures, we found that:

- The correlations are mixed with little consistency but are often in the expected direction.
- The correlations between Kt/V and QOL measures are low and not statistically significant, but almost all of the coefficients are in the anticipated direction (positive).
- Comorbidity behaves as one would expect, with most of the coefficients in the appropriate direction (negative), and some are statistically significant.
- Some statistically significant correlations show that the telemedicine patients report better health and physical functioning than the standard treatment patients.
- Men report lower values of sexual and social functions compared to women.
- Being a minority is associated with lower values of the burden of kidney disease, work status, pain, and general health, where lower values indicate worse health or functioning.
- Patients with high income are more likely to report greater work function.

Analysis of Patient Satisfaction

Research subjects were surveyed about their satisfaction with their care and treatment as well as the use of telemedicine in treating ESRD. Across each survey instrument, we found that

- Patients tended to be very satisfied with their medical treatment.
- Telemedicine participants did not express concern about their treatment, telemedicine, or the use of technology in general.
- There were no significant differences in satisfaction between telemedicine and standard ESRD treatment on survey items asked of both groups.

MAJOR FINDINGS

Satisfaction With Care

- Nearly 70 percent of the patients responded that the doctors and staff members were friendly and interested in the participant as a person.
- Approximately 74 percent of respondents felt that it was at least mostly true that the staff encouraged them to be independent.
- Approximately 83 percent reported that the staff supported them in coping with their kidney disease.
- Satisfaction levels were high on these items across the treatment sites, so that there is no statistically significant difference between the telemedicine and standard treatment groups.

Satisfaction With Life

- Nearly 20 percent of the patients were “neutral” when asked if their lives were close to ideal; the remainder were roughly split between agreeing and disagreeing with this statement.
- Sixty-two percent of respondents slightly disagreed that “the conditions of my life are excellent.”
- Similarly, approximately 65 percent of respondents slightly disagreed with the statement, “If I could live my life over, I would change almost nothing.”
- There were no statistically significant differences in overall satisfaction with life across treatment sites except for the final statement, “If I could live my life over, I would change almost nothing.” The telemedicine participants were less likely to agree with this statement than the standard treatment group.

Satisfaction With Telemedicine

- In general, there was little variance in participants’ responses—most people were satisfied with their telemedicine treatment.

- Study participants using telemedicine were not concerned about privacy, using the technology, and not being physically present with their doctor.
- Study participants using telemedicine felt that they had more control over their disease.

ACKNOWLEDGMENT

This project was funded in whole with Federal funds from the National Library of Medicine under Contract No. N01-LM-6-3544.