



## Postoperative Telemonitoring Following Kidney Transplantation: Effects on Early Hospital Readmissions and Graft Outcomes

Elfadawy N<sup>1</sup>, Sanchez EQ<sup>2</sup>, Ngendahimana D<sup>3</sup>, Love TE<sup>3</sup>, Augustine JJ<sup>4</sup>, Woodside KJ<sup>5</sup>, Humphreville VR<sup>2</sup>, Abdalla M<sup>1</sup>, Hricik DE<sup>1</sup> and Sarabu N<sup>1</sup>\*

<sup>1</sup>Department of Medicine, University Hospitals Cleveland Medical Center, Cleveland, Ohio, USA

<sup>2</sup>Department of Surgery, University Hospitals Cleveland Medical Center, Cleveland, Ohio, USA

<sup>3</sup>Department of Population and Quantitative Health Sciences, Case Western Reserve University, Cleveland, Ohio, USA

<sup>4</sup>Division of Nephrology, Cleveland Clinic, Cleveland, Ohio, USA

<sup>5</sup>Department of Surgery, University of Michigan, Ann Arbor, Michigan, USA

### Abstract

**Background:** Telemonitoring has been recently shown to improve outcomes and reduce hospital admission rate in cardiac patients. Effect of telemonitoring s:0ission 66e (admission )-0.9s angrafect(outcome[ikidney bstnspvelte TJ0 Tw 0 -1.2 Td(po

**\*Corresponding author:** Nagaraju Sarabu, MD, MPH, Department of Medicine, University Hospitals Cleveland Medical Center, 11100 Euclid Avenue, Cleveland, Ohio, USA, Tel: +1 216-844-8509; E-mail: [Nagaraju.Sarabu@Uhhospitals.org](mailto:Nagaraju.Sarabu@Uhhospitals.org)

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care delivery across distance. According to the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services, it includes activities involving telecommunications and electronic information to support and promote long-distance clinical health care, patient and professional health-related education, public health, and health administration. Telehealth services can be diverse and include telecheck-ups (e.g., phone calls to ensure that the patient is doing well), telemonitoring by recording physiological data, teleconsultation, and teletreatment [11]. Remote patient monitoring, also sometimes referred to as telemonitoring or telehomecare, has been recently shown to improve outcomes and reduce readmission, mainly in congestive heart failure (CHF) patients. In a meta-analysis that included thousands of patients with CHF, telemonitoring has reduced all-cause mortality by 34%, all-cause hospitalizations by 9% [12]. In our own health system, telemonitoring has been effective in reducing 30-day hospitalization by 50% among patients with CHF (unpublished data). Studies are lacking on the influence of telemonitoring on outcomes following kidney transplantation. In this study, we explored our experience with telemonitoring in the early post-operative period after kidney transplant surgery, and studied its impact on readmission, rejection rates, and one-year graft and patient survival.

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1-2 weeks. Routine laboratory testing includes renal function panel, complete blood count, and tacrolimus level. This is done twice weekly for the first three months after transplant.

### **Outcomes**

Primary exposure was assignment of telemonitoring at discharge. Primary outcome was readmission within 30 days of discharge. Patients with multiple readmissions within 30 days were counted as having one. There were four different transplant nephrologists during the study period, and criteria for determining admission were based on the judgment of transplant nephrologist actively involved. Secondary outcomes were ED visits, acute rejection episodes that were identified by for cause biopsies and according to contemporary BANFF criteria, patient survival, and graft survival through 1-year of follow-up. All demographic data, hospital admission and discharge dates, immunosuppression, and outcomes data were abstracted from the

	Telemonitoring	No Telemonitoring	p value
Total number	167	191	
Median Age (IQR)	53.0 (40.5, 62.0)	51.0 (43.0, 61.0)	0.98
Males (%)	107 (64.1)	107 (56.0)	0.15
Black Race (%)	66 (51.5)	67 (35.1)	<0.01
Etiology (%)			0.09
Other	23 (13.8)	27 (14.1)	
Diabetes	35 (21.0)	47 (24.6)	
Glomerulonephritis	34 (20.4)	32 (16.8)	
HTN	65 (38.9)	59 (30.9)	
PKD	10 (6.0)	26 (13.6)	
Median BMI (IQR)	28.4 (24.8, 33.0)	28.81 (24.8, 33.3)	0.7
Living Donor (%)	34 (20.4)	50 (26.2)	0.2
Heart Disease (%)	34 (20.4)	25 (13.1)	0.1
Hypertension (%)	134 (80.2)	117 (61.3)	<0.001
Mean Dialysis Vintage (years)	5.0 (2.2, 7.0)	3.7 (1.8, 5.4)	<0.01
Retransplant (%)	22 (13.2)	36 (18.8)	0.19
Delayed Graft Function (%)	40 (24.0)	36 (18.8)	0.29
Induction (%)			0.1
None	3 (1.8)	1 (0.5)	
Basiliximab	8 (4.8)	19 (9.9)	
ATG	156 (93.4)	171 (89.5)	
Tacrolimus (%)	163 (97.6)	190 (99.5)	0.29
HCV (%)	13 (7.8)	4 (2.1)	0.02
Mean Class I PRA (SD)	17.1 (28.7)	19.9 (31.9)	0.39
Mean Class II PRA (SD)	14.6 (29.8)	17.1 (29.7)	0.43
Mean HLA mismatch (SD)	4.2 (1.4)	4.1 (1.5)	0.57
Mean Length of Stay (SD)	8.0 (4.6)	8.1 (7.2)	0.91
Steroid Use	87 (52.1)	100 (52.4)	1

**Table 1:** Baseline characteristics of the kidney transplant recipients, stratified by assignment to telehealth.

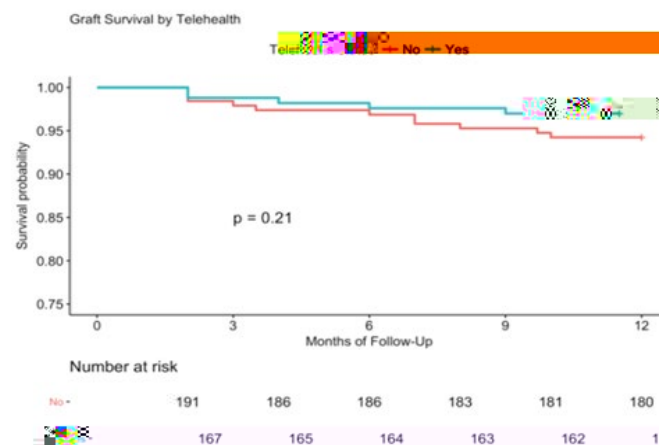
Telemonitoring group included kidney transplant recipients who were transplanted between November 2013 and December 2015 while controls were transplanted between January 2012 and October 2013. Heart Disease was defined as having history of coronary artery disease, or congestive heart failure or valvular disease or valvular surgeries. Hypertension was defined as either history of hypertension or being on anti-hypertensives. Four patients who underwent HLA identical kidney transplants didn't receive any induction. Stent refers to the use of stent in transplant ureter. Continuous variables are described using mean and SD (standard deviation), and median and IQR (interquartile range) for normal and non-normally distributed variables respectively. Categorical variables are described using frequency. Comparisons between two groups are made using the Wilcoxon rank-sum test, t-test for continuous variables and Chi-Square test for categorical variables.

at one year, with a patient survival of 95.7%, compared to 4 out of 243 who didn't have readmission, with a patient survival of 98.4% (HR: 2.70; 95 CI: 0.72-10.05; p = 0.14) (Table 2).

Outcome	Unadjusted		Adjusted <sup>1</sup>	
	Effect Size	95 % CI	Effect Size	95 % CI
Early Readmission	1.13	0.72-1.76	0.97	0.60-1.58
Early ED Visits	1.32	0.77-2.24	1.09	0.61-1.96
BPAR	0.73	0.38-1.44	0.68	0.33-1.40
Graft Survival	0.51	0.18-1.48	0.46	0.15-1.46
Patient Survival	0.32	0.07-1.55	0.29	0.05-1.66

**Table 2:** Impact of telemonitoring on outcomes.

<sup>1</sup>Adjusted for baseline variables with p-values less than 0.2 between telemonitoring and control groups. These were race, hypertension, dialysis duration in years, transplant ureter placement during operation, hepatitis C Virus antibody, and number of clinic visits in the first 30 days after discharge. For early readmission, ED (emergency department) visits, and BPAR (biopsy proven acute rejection), the effect sizes are odds ratios from logistic regression modeling. For graft and patient survivals, the effect sizes are hazard ratios from Cox modeling.



**Figure 2:** Kaplan-Meier estimates of graft survival through 12 months with accompanying risk table, stratified by telemonitoring Telemonitored patients



of Telemonitoring studies [29-31].

In conclusion, early hospital readmission rates are high in kidney