American Journal of Transplantation 2015; 15: 2126–2135
Wiley Periodicals Inc.

doi: 10.1111/ajt.13265

Evaluating the Impact of Performance Improvement Initiatives on Transplant Center Reporting Compliance and Patient Follow-Up After Living Kidney Donation

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With the changing demographics of the living donor population and increased regulatory oversight, it is important that transplant centers report outcomes accurately. The aim of our retrospective cohort study of 312 living donors who underwent nephrectomy between 2008 and 2013 was to evaluate the impact of living donor program performance improvement initiatives on: (i) transplant center program reporting compliance; (ii) patient compliance with postdonation follow-up and its associated factors; and (iii) overall financial costs to the transplant center. The effect of the initiatives (donation eras 2008–2010 and 2011–2013) on compliance at key reporting points (6 months, 1 year, 2 years) was analyzed using correlation coefficients, χ^2 and Fisher's exact tests. Multivariable logistic regression models tested the initiatives' effect on the likelihood of patient follow-up. The initiatives were associated with significant improvement in form reporting compliance ($r \geq 0.862$, $p \leq 0.027$; 1 and 2 year Fisher's Exact $p \leq 0.002$) and patient follow-up (χ^2 $p \leq 0.009$) with acceptable transplant center costs. Multivariable analyses demonstrated that donation era was consistently and significantly ($p < 0.001$) associated with increased likelihood of postdonation patient follow-up. Institution of performance improvement initiatives with dedicated program resources is financially feasible and leads to more accurate and complete form reporting and improved patient follow-up after nephrectomy.

Abbreviations: FTE, full-time equivalent; LDF, living donor follow-up; MCR, Medicare Cost Report; OPTN, Organ Procurement and Transplantation Network; PCP, primary care physician; UNOS, United Network for Organ Sharing

Received 14 August 2014, accepted for publication 04 February 2015

Introduction

It is important that accurate and complete follow-up data on living donor health status are collected, as the living donor population evolves toward an older, more medically complex group with increasing acceptance of obese and hypertensive donors (1–5). In addition, there is an increase in nonrelated living donors, living donor exchange programs and public solicitation through social media (6–8). With reports of isolated living donor deaths and significant complications, there has been increased scrutiny of living donor programs with the development of policies to promote donor safety (9). Both the Organ Procurement and Transplantation Network (OPTN) and Centers for Medicare & Medicaid Services, have charged transplant centers with improving their reporting of outcomes of living kidney donors, particularly in the immediate and short-term following donor nephrectomy (9). Failure to do so could result in penalties and exclusion of Medicare funding. Recent policy changes by the OPTN now require living donor programs to report accurate and timely information on Living Donor Follow-up (LDF) forms. As of February 1, 2013, donor status and clinical information must be reported for at least 60% of living donors and follow-up laboratory data, including serum creatinine and urine protein, for at least 50% of living donors at the required reporting periods of 6 months, 1 year and 2 years. Donor data must be collected within 60 days of the required reporting periods to be considered timely (10). It is expected that the requirements for reporting donor status, clinical information and laboratory data will become more rigorous over the next several years.

Over 60% of living kidney donors were lost to follow-up at our center in 2008. This report describes living donor follow-up performance improvement initiatives instituted at our center and aims to evaluate their effect on: (i) program compliance with OPTN living donor reporting requirements; (ii) patient compliance with postdonation follow-up and its associated factors; and (iii) overall financial costs to the transplant center.

Materials and Methods

We evaluated the impact of living donor program performance improvement initiatives implemented between 2008 and 2013 as outlined in Figure 1 on a retrospective cohort of 312 living donors (aged $\geq$ 18 years). Demographic characteristics and clinical variables were abstracted from the electronic medical record and OPTN LDF submitted forms. This study was reviewed and approved by the Institutional Review Board of Vanderbilt University (IRB #130887).

Donation and reporting were classified as: ''early era'' (2008–2010) and ''later era'' (2011–2013). Compliance was evaluated at three OPTN-mandated follow-up time points (6 months, 1 year and 2 years after donation) from two perspectives: (i) center compliance with completeness and timely reporting of required LDF forms; and (ii) donor compliance with required clinical follow-up. Forms were defined as ''complete and timely'' if all clinical and laboratory variables were captured and the form submitted within 60 days of receiving it from UNOS, and ''complete'' if all data were captured but the form was not submitted within 60 days. The specific time windows for evaluating follow-up data were within $\pm$ 60 days of the 6-month (120–240 days), 1-year (302–425 days), and 2-year (670–790 days) anniversary of donation. Patient follow-up compliance was classified as: (i) did not return; (ii) off site; or (iii) return to the transplant center.

Only those forms or donors that were reasonably eligible for a particular follow-up point (i.e. had reached the upper limit of the relevant donation anniversary window at the time of data analysis) were included in the given analysis. Therefore, the number of cases included in analyses of 2-year outcomes was less than the number included in analyses of 6-month and 1-year outcomes. Analyses of the overall effect of calendar year and the effect of donation/performance improvement era on form compliance and patient follow-up rates were performed using correlation coefficients, χ^2 or Fisher's exact tests. Column-wise tests, with a precision of whether the nondirectional α level was less than 0.05, were used to discern which specific condition(s) differed by donation era when overall χ^2 tests of tables having dimensions greater than or equal to three rows (conditions) by two columns (2008–2010 or 2011–2103) were statistically significant. All p-values are two-tailed and analyses were performed using IBM SPSS (versions 21 and 22, International Business Machines Corporation, Armonk, NY).

In order to obtain a general assessment of factors associated with donor follow-up of any sort (clinic visit or laboratory data), the time window for patient follow-up was expanded to within $\pm$ 90 days of the relevant donation anniversary for multivariable logistic regression analyses. Three

Era	Phase	Performance Improvement Initiatives
Early Era (2008-2010)	Phase 1	• Transplant center supports financially cost of donor follow-up • Emphasis on in-center donor follow-up • Patient letter/health survey, laboratory form, and billing form are mailed to the patient 60 days prior to the 6 month, 1 year and 2 year anniversary dates • Emphasis on quality of data reported with data manager added
	Phase 2	• Transplant surgery nurse practitioner donor follow-up clinic is established
Later Era (2011-2013)	Phase 3	• Increased efforts to track and measure donor follow-up and data management with patient call 30 days after mailing as a reminder
	Phase 4	• Phone contact by nurse coordinator no earlier than 60 days prior to anniversary dates ▪ Verify and schedule appointment with nurse practitioner ▪ Schedule visit with primary care provider and/or arrange for local follow-up ▪ Complete post-donation questionnaire • If donor misses follow-up, 3 attempts are made via phone and letter at each anniversary date • If no contact is able to be made, donor considered "lost to follow-up" • Patient education class during the pre-donor evaluation process by the nurse coordinator emphasizing the need for and explaining the importance of early follow-up

Figure 1: Performance improvement initiatives as implemented in our living donor program over four phases.

anniversary-specific models tested the effects of relationship (biological/related, spouse/life partner, or nonbiological/unrelated), employment (yes or no), distance from the transplant center (<100 or ≥100 miles), primary care physician (PCP) (yes or no), educational attainment (college degree, some college or technical school, grade or high school education), and donation era (2008–2011 or 2011–2013) on the likelihood of follow-up at 6 months, 1 year and 2 years.

A cost analysis was performed to evaluate costs associated with living donor staffing and patient follow-up including facility and laboratory fees. Current staffing of the living donor program includes: two full-time administrative assistants, two full-time living donor nurse coordinators, two part-time surgery nurse practitioners, and one part-time data manager who are responsible for all aspects of the living donor process from initial contact with the transplant center to longer-term postoperative care. All staff members conducted a 2 week time study to determine how much of their time was directed to the various aspects of care (predonation, immediate postoperative care, later postoperative care). The results were used to calculate total number of full-time equivalents (FTEs) spent on follow-up care. Annual costs for immediate postoperative care and later postoperative care were determined by multiplying the FTEs by living donor position salary including benefits. Facility fees and laboratory costs were generated and patient costs determined for each patient who obtained follow-up at 6 months, 1 year, and 2 years. If patients returned to the center, the cost included both the facility fee and the laboratory costs of both serum creatinine and urinalysis. If the patient obtained follow-up locally, only the laboratory costs were included.

In order to gauge the staff's perception of the relative impact of specific initiatives, the following were ranked in decreasing order of importance (1 = most important, 6 = least important): (i) transplant center supports financially the cost of donor follow-up; (ii) emphasis on in-center donor follow-up with a dedicated nurse practitioner donor follow-up clinic; (iii) mailing of letter, health survey and laboratory forms to patient; (iv) phone contact by nurse coordinator to assist with arranging follow-up; (v) dedicated data manager to track living donor data and submit forms in a timely fashion; and (vi) patient education prior to the living donor surgery on the importance of living donor follow-up. Rankings were averaged for each initiative and the averages were rank-ordered to summarize perceived importance.

Results

The demographic data of our living donor population are described in Table 1. The mean age at donation was 39 years, 63% were female and 82% were white. Most were married (64%), employed (83%) and had some form of education after high school (69%). Sixty-three percent had an identified PCP at the time of donation and 52% resided ≥100 miles from the transplant center where donation occurred. Of the 312 living donors, 159 donated in the 2008–2010 era, while 153 donated in the 2011–2013 era. Only donor identified PCP and time of follow-up differed significantly between donation eras. Persons who donated in the earlier era were more likely to have a PCP ($p = 0.019$) and have longer follow-up ($p < 0.001$).

Table 1: Baseline characteristics of living kidney donors included in the study and stratified by donation era

Donor characteristics	All patients (N = 312)	2008–2010 (N = 159)	2011–2013 (N = 153)
Age at donation (years)	39 ± 11	39 ± 11	38 ± 11
Follow-up (months)	33 ± 18	48 ± 11	18 ± 7
Sex			
Men	117 (37)	58 (37)	59 (39)
Women	195 (63)	101 (63)	94 (61)
Race			
White	255 (82)	130 (82)	125 (82)
Black	40 (13)	20 (13)	20 (13)
Other	17 (5)	9 (5)	8 (5)
Body mass index (kg/m^2)			
<30	239 (77)	124 (78)	115 (75)
≥30	73 (23)	35 (22)	38 (25)
Hospital stay (days)	3.4 ± 1.9	3.3 ± 1.4	3.6 ± 2.2
Distance from center (miles)			
<100	150 (48)	80 (50)	70 (46)
≥100	162 (52)	79 (50)	83 (54)
Relationship			
Biological/related	174 (56)	93 (56)	81 (53)
Spouse/partner	40 (13)	21 (13)	19 (12)
Nonbiological/unrelated	98 (31)	45 (28)	53 (35)
Primary care provider			
Yes	196 (63)	110 (69)	86 (56)
No	116 (37)	49 (31)	67 (44)
Marital status			
Single	71 (23)	32 (20)	39 (26)
Married/life partner	200 (64)	101 (64)	99 (65)
Divorced/separated	37 (12)	22 (14)	15 (9)
Unknown	4 (1)	4 (2)	0 (0)
Educational attainment			
Grade school/high school	96 (31)	48 (30)	48 (31)
Attended college/tech school	103 (33)	54 (34)	49 (32)
College/graduate degree	113 (36)	57 (36)	56 (37)
Employed			
Yes	258 (83)	134 (84)	124 (81)
No	54 (17)	25 (16)	29 (19)
Co-morbid conditions (history of)			
Hypertension	4 (1)	2 (1)	2 (1)
Kidney stones	19 (6)	13 (8)	6 (4)
Alcohol or drug abuse	22 (7)	13 (8)	9 (6)
Smoking	77 (25)	42 (26)	35 (23)
Depression/mental illness	71 (23)	37 (23)	34 (22)

Table entries are N (%) or mean (SD).

Form reporting compliance

In the early donation era, less than half of LDF forms were reported as having complete data and very few were submitted in timely fashion. Over the 5-year period, institution of the performance improvement initiatives was associated with a statistically significant improvement in the percentage of forms that were complete ($r = 0.921$, $p = 0.009$) and those that were both timely and complete ($r = 0.862$, $p = 0.027$; Figure 2). Comparison of various measures of form reporting compliance at OPTN-specified follow-up time points during the two donation eras indicated no significant relationship between era and measures of form compliance at the 6-month time period (all $p \geq 0.055$). However, all measures of form compliance were significantly improved in the 2011–2013 era for both year 1 (all $p \leq 0.002$) and year 2 (all $p \leq 0.001$) forms (Figure 3).

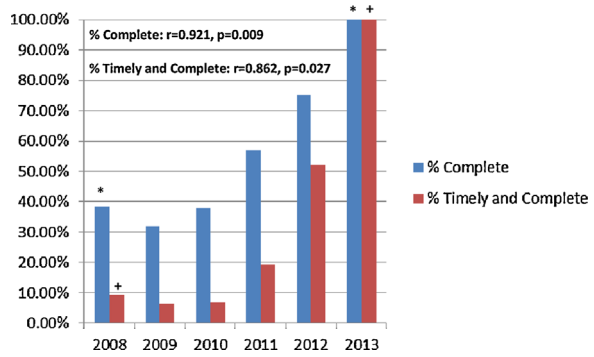


Figure 2: Percentage of living donor follow-up forms by calendar year that were submitted as ''complete'' and as ''timely and complete'' to the OPTN. There was statistically significant temporal improvement on both outcome measures (both $r \geq 0.862$, $p \leq 0.027$).

Patient follow-up compliance

Over the 5-year period studied, 33% of living donors did not return for follow-up at 6 months, 50% were lost to follow-up at 1 year and 63% were lost to follow-up at 2 years (Figure 4). As time after donation increased, patients were less likely to return to the transplant center for their follow-up and a greater proportion were lost to follow-up (Figure 4, overall χ^2 $p < 0.001$). When analyzed by donation era, there was significant improvement at all OPTN-specified follow-up time points with a greater proportion of patients returning to the center for follow-up (Figure 5). At 6 months, the distribution of the three follow-up conditions differed by era (overall χ^2 $p = 0.009$) with the proportion of donors who returned to the center increasing from 28% in the early era to 43% in the later era (column-wise $p < 0.05$). At the 1-year mark (overall χ^2 $p < 0.001$), the percentage returning to the center increased from 13% to 26% (column-wise $p < 0.05$). A similar pattern of improvement was observed at 2 years (overall χ^2 $p < 0.001$), with follow-up at the center increasing from 6% to 31% in the later era (column-wise $p < 0.05$).

Multivariable logistic regression models demonstrated that after adjusting for the donor's relationship to the recipient, employment, distance from the transplant center, PCP and educational attainment, the effect of donation era/implementation of the performance improvement initiatives was associated with significantly increased likelihood (all $p < 0.001$) of patients having any clinical follow-up at the defined follow-up points (Table 2). Specifically, the 6-month model demonstrated that being employed ($p = 0.025$), living closer to the center ($p = 0.011$), having a PCP ($p = 0.023$), and the more recent donation era ($p < 0.001$) were associated with increased likelihood of follow-up, with persons who donated in the more recent era being, on average, 2.6 times more likely to obtain clinical follow-up of some sort. Persons who donated in the more recent era were approximately 3.4 times more likely ($p < 0.001$) than those who donated in the earlier era to have some sort of clinical follow-up at approximately 1 year. The 2-year model demonstrated that persons who were a recipient's spouse or life partner ($p = 0.002$), had some college education ($p = 0.001$), a college or advanced degree ($p = 0.002$), or who donated in the more recent era ($p < 0.001$) were more likely to obtain clinical follow-up, with those in the more recent era being approximately 14.7 times more likely than those in the early era to obtain clinical follow-up.

Cost analysis

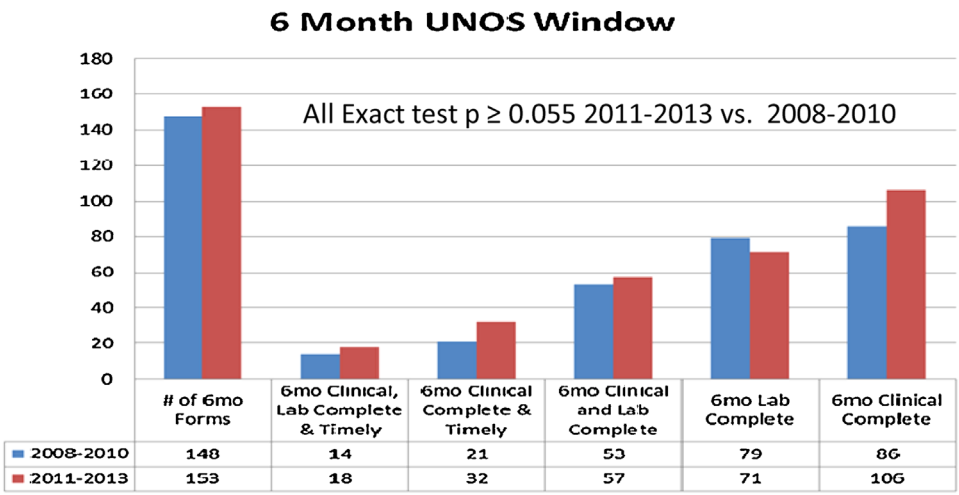
The FTEs and annual salary costs of living donor follow-up are shown in Table 3. The nurse practitioners and administrative assistants spend the majority of their time caring for donors in the immediate postoperative period with a much smaller percentage of their time dedicated to the longer term follow-up. The most time intensive resource of longer term follow-up is phone contact by the nurse coordinators with the patient and arranging for either in-center or local follow-up. Annual staffing costs both in the immediate postoperative and later period of living donor follow-up were $16 695 and $24 910, respectively. Based on the average Medicare Cost Report (MCR) ratio for our kidney transplant program of 82.48%, the majority of annual staffing costs ($13 770 and $20 546, respectively) were reimbursed through the MCR. Table 4 shows the total facility fees and laboratory costs associated with patient follow-up at 6 months, 1 year, and 2 years over the 5-year time period. The facility fees decreased at later time points as fewer patients returned to the center and obtained only local follow-up.

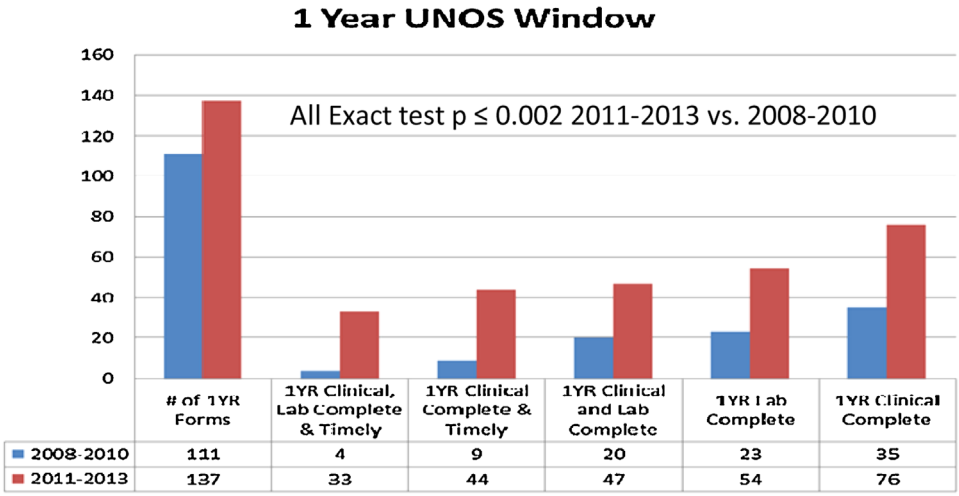
Importance of performance improvement initiatives

Analysis of the staff's ranking of the relative importance of specific initiatives indicated that financial support for costs associated with donor follow-up (average rank = 2.4) and patient education (average rank = 2.7) were perceived as being the most important. Phone contact by the nurse coordinators and having a dedicated data manger were tied with a middle ranking (average rank = 3.4). Emphasis on in-center follow-up with a dedicated nurse practitioner clinic (average rank = 4.0) and mailings to the patients (average rank = 5.0) were perceived as being the least important.

Discussion

Although most centers are in agreement that living donor follow-up is a high priority and all would agree that improved data regarding living donors are needed, there are significant barriers to obtaining meaningful living donor follow-up (11). In a survey of 147 programs performing living donor kidney transplants, the majority agreed that donors should be followed for at least 2 years. Despite this, 40% of programs lost contact with more than 75% of their donors by 2 years after donation with similar results noted by our center in 2008. Cited barriers to donor follow-up included donor inconvenience and lack of desire to follow-up at the transplant center, inability to contact donors, and lack of program and donor reimbursement for follow-up costs.





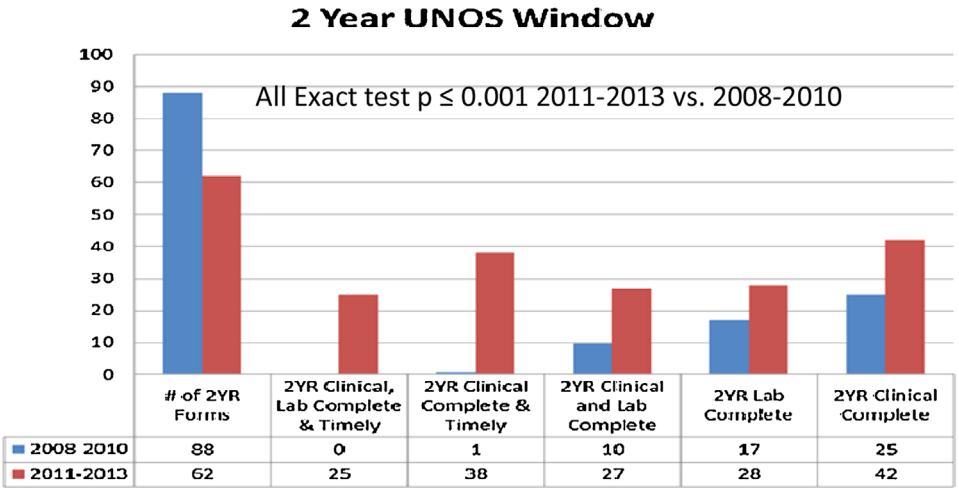


Figure 3: Form compliance with UNOS submission requirements by donation era and follow-up point. All 1- and 2-year form compliance metrics were significantly improved after implementing the performance improvement initiatives.

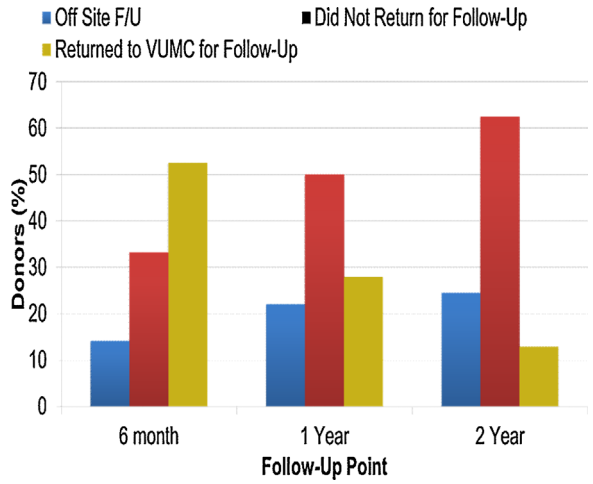


Figure 4: Overall percentage of living donors who completed follow-up at 6 months, 1 year, and 2 years between 2008 and 2013. Over the full study period, as time after donation increased from 6 months to 2 years, a smaller proportion of patients returned to the transplant center for follow-up and a greater proportion were lost to follow-up (χ^2 $p < 0.001$).

Based on our overall poor donor follow-up and the recognition by the transplant center that improvements were required both for patient safety and OPTN compliance, performance improvement initiatives were implemented beginning in 2008. We identified patient- and transplant center–specific factors that were associated with poor donor follow-up. It was noted that there was a lack of patient education regarding the importance of follow-up with many donors not wanting to return for postdonation care, in particular those that lived far from the center. To encourage compliance with the follow-up schedule, we provided counseling in an education class conducted by the nurse coordinator during the predonor evaluation process emphasizing the importance of early follow-up and although not required, preference for the donor to follow-up at the transplant center for the first 2 years. Our rank order analysis would suggest that education by the nurse coordinators is perceived as one of the most important performance improvement initiatives implemented that has led to an increase in living donor follow-up rates. We have also developed a specific living donor follow-up clinic that is staffed by two posttransplant nurse practitioners and try to align follow-up visits with that of the living donor recipient. Although distance from the transplant center was significantly related to the likelihood of follow-up at 6 months, 43% of donors returned to the center for their 6-month postdonation visit in the 2011–2013 era. This decreased to 26% and 31% at 1 and 2 years, respectively, but there was an increase in off-site follow-up and as such, distance no longer played a role in likelihood of follow-up at these time points. These data suggest that even minor efforts to better educate donors perioperatively on the importance of overall medical follow-up can lead to significant improvements in postdonation care and medical surveillance requirements as specified by the OPTN.

Another identified barrier is that living donor contact information becomes outdated with many donors unable to be tracked to obtain follow-up information. In an effort to ensure contact with the donors postoperatively, demographic information for the donor and multiple family members is obtained and verified repeatedly during the pre- and post-operative clinical visits. Donors are contacted within several days of their surgery and at routine intervals through multiple methods postoperatively as described in the performance improvement initiatives. Although resource intensive, we have significantly decreased the number of patients who are lost to follow-up.

Lack of financial reimbursement for living donor follow-up expenses has been cited as a major concern by most programs (11). Kher and coworkers have suggested that with appropriate billing processes in place, most bills for follow-up visits of living donors were paid by insurance companies and that inadequate reimbursement should not be a barrier to providing follow-up care (12). At our center, the early postoperative donor follow-up care is included in the Medicare 90-day global payment for the surgery. After that period, later follow-up services are billed using the recipient's Medicare health insurance claim number. If not covered by Medicare, a claim is submitted under the recipient's commercial payer, and if no reimbursement for living donor follow-up care is paid by a third party payer, the transplant center will financially cover the costs of donor follow-up. It is estimated that the transplant center assumes costs 3–5% of the time. Although travel costs for donor follow-up are not supported by the transplant center, a substantial percentage of our donors have qualified for financial assistance from the National Living Donor Assistance Center and have used funds to cover the cost of travel to and from the center both for living donor evaluation and postdonation follow-up.

In addition to the identified need for the transplant center to financially support donor follow-up, it was also recognized that staffing resources needed to be put into place to assist with data collection and allow for improvements in the quality and timeliness of data collected. Previously, all that was required for LDF form data to be adequate was a statement that the donor was ''lost to follow-up.'' With new OPTN guidelines this is no longer considered acceptable (10). Donor status, clinical information, and laboratory variables including serum creatinine and urine protein results must be reported on the majority of donors and must be reported in a timely fashion (60 days of the required reporting periods of 6 months, 1 year, and 2 years). It was recognized by our program that we would require dedicated and adequate staff to ensure quality and complete postdonation data as outlined in the performance improvement initiatives. Currently, two nurse coordinators and one data manager are responsible for ensuring complete and accurate data collection of the above mentioned variables.

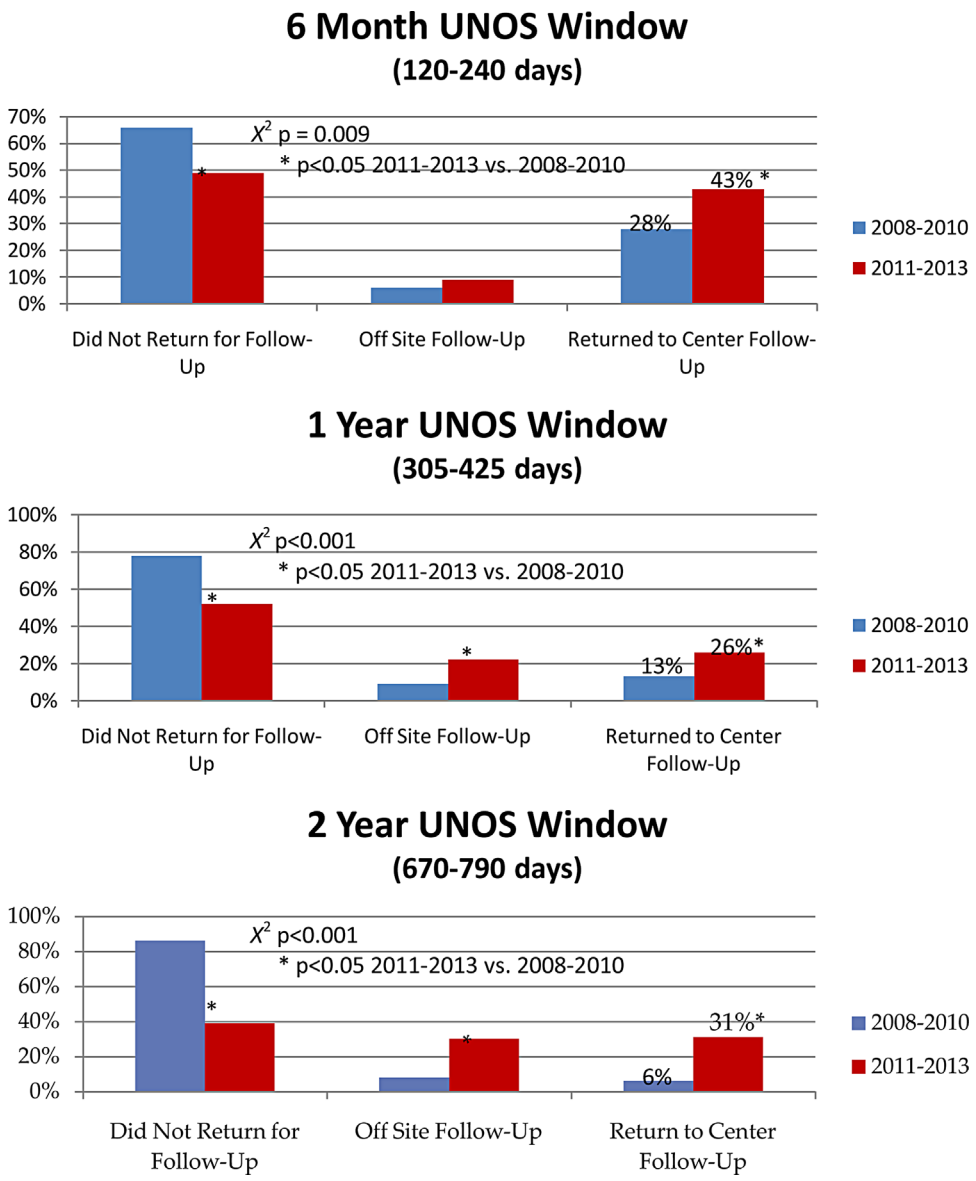


Figure 5: Patient follow-up by donation era at UNOS-specified time points. There were statistically significant reductions in the proportion of patients who were lost to follow-up and significant improvement in the proportion who returned to the transplant center for follow-up at all three monitoring points. Off-site follow-up also improved significantly at the 1- and 2-year points.

With institution of appropriate staffing, our LDF form completeness and timeliness of data submission has improved significantly at the 1- and 2-year reporting periods. There was no significant difference in the LDF form reporting compliance at the 6-month time period and may have been due to the fact that in the early era (2008–2010), patients were routinely seen at 3–4 months postdonation in the surgery clinic with clinical and laboratory values obtained and reported as the 6-month time point. Over time, the data have become more accurate with the average days to 6-month follow-up now being 170 days compared to 130 days in the early era.

Although appropriate living donor program staffing resources are essential for successful longer-term patient follow-up, it is important to recognize that most of the staffing time is spent on the evaluation/predonation phase of living donors. As mentioned in the results, only a small percentage of total effort and salary support is required to ensure live donor follow-up in the later postoperative period. Phone contact of living donors by the nurse coordinators with review of the variables in the postdonation questionnaire and arrangement of transplant center or local follow-up was the most time-intensive role, requiring on average 7–8 h per

Table 2: Multivariable logistic regression models of the likelihood of clinical follow-up after living kidney donation

Model	Covariates	B	p-value	Odds ratio	95% confidence interval of B
6-month follow-up (90–270 days), N = 312, model, p < 0.001	Employed (ref: not employed)	0.740	0.025	2.095	1.096–4.006
	Distance from transplant center <100 miles (ref: ≥100 miles)	0.656	0.011	1.927	1.164–3.193
	Has PCP (ref: no PCP)	0.597	0.023	1.817	1.084–3.046
	Educational attainment	–	0.352	–	–
	Some college/technical (ref: ≤high school)	−0.095	0.761	0.909	0.493–1.677
	College degree (ref: ≤high school)	0.328	0.300	1.388	0.746–2.583
	Relationship to recipient	–	0.236	–	–
	Biological (ref: nonbiological, other)	−0.372	0.192	0.689	0.394–1.206
	Spouse/partner (ref: nonbiological, other)	0.193	0.661	1.231	0.511–2.879
	Donation era 2011–2013 (ref: 2008–2010)	0.974	<0.001	2.649	1.588–4.421
	Constant	−0.974	0.046	0.377	–
1-year follow-up (275–455 days), N = 269, model, p < 0.001	Employed (ref: not employed)	−0.428	0.213	0.652	0.332–1.278
	Distance from transplant center <100 miles (ref: ≥100 miles)	0.239	0.368	1.270	0.755–2.136
	Has PCP (ref: no PCP)	−0.032	0.909	0.969	0.563–1.666
	Educational attainment	–	0.106	–	–
	Some college/technical (ref: ≤high school)	−0.101	0.761	0.904	0.472–1.731
	College degree (ref: ≤high school)	0.517	0.110	1.677	0.890–3.160
	Relationship to recipient	–	0.978	–	–
	Biological (ref: nonbiological, other)	0.047	0.873	1.048	0.590–1.862
	Spouse/partner (ref: nonbiological, other)	−0.024	0.956	0.976	0.417–2.285
	Donation era 2011–2013 (ref: 2008–2010)	1.219	<0.001	3.384	2.014–5.686
	Constant	−0.624	0.203	0.536	–
2-year follow-up (640–820 days), N = 195, model, p < 0.001	Employed (ref: not employed)	−0.222	0.633	0.801	0.323–1.988
	Distance from transplant center <100 miles (ref: ≥100 miles)	0.399	0.296	1.490	0.705–3.151
	Has PCP (ref: no PCP)	0.300	0.476	1.350	0.592–3.082
	Educational attainment	–	0.003	–	–
	Some college/technical (ref: ≤high school)	1.792	0.001	5.999	2.044–17.608
	College degree (ref ≤high school)	1.676	0.002	5.343	1.838–15.535
	Relationship to recipient	–	0.008	–	–
	Biological (ref: nonbiological, other)	0.874	0.064	2.397	0.950–6.049
	Spouse/partner (ref: nonbiological, other)	1.926	0.002	6.859	2.040–23.069
	Donation era 2011–2013 (ref: 2008–2010)	2.689	<0.001	14.719	5.516–39.279
	Constant	−3.888	<0.001	0.020	–

Table 3: Full time equivalents (FTEs) and annual staff salary support of living donor follow-up care

Position	Total FTE for early postoperative care	Total FTE for later follow-up care	% of FTE dedicated to early postoperative care	% of FTE dedicated to later follow-up care	Annual cost of early postoperative care ($)	Annual cost of later follow-up care ($)
Nurse practitioner (N = 2)	0.12	0.03	12	3	12 333	2608
Nurse coordinator (N = 2)	0.00	0.19	0	19	0	17 569
Data manager (N = 1)	0.03	0.09	3	9	1238	3591
Administrative assistant (N = 2)	0.07	0.03	7	3	3123	1143
Total annual costs	–	–	–	–	16 695	24 910
Average Medicare cost Report ratio for center 82.48%	–	–	–	–	13 770	20 546
Total costs to the transplant center	–	–	–	–	2925	4364

Early postoperative care (within 3 months of operation); later follow-up care (6 months, 1 year, and 2 years after donation).

Table 4: Facility fees and laboratory costs associated with living donor follow-up care over the 5-year period

Follow-up visit	Facility fees ($)	Lab costs ($)	Total cost ($)	Average cost per patient ($)
6 months (N = 211)	19 038	23 843	42 881	203
12 months (N = 133)	8436	15 029	23 465	176
24 months (N = 72)	2850	8136	10 986	153
Total (N = 416)	30 324	47 008	77 332	186

The facility fees decrease at later time points as fewer patients return to the center and obtain only local laboratory follow-up.

week. Additionally, our data manager spent on average 3–4 h per week ensuring LDF forms were completed and submitted to the OPTN.

It has been identified that there is a lag time between the implementation of process changes and the ability to evaluate results. We noted a 2-year period after quality-assurance processes were put into place before significant changes to our LDF form and patient follow-up compliance were obvious. Although our interventions have led to improvement over this time period, we recognize that our absolute completion rates of LDF forms remain below targets set by the OPTN with overall patients lost to follow-up numbers high. Significant improvements have been noted in the later era with over 50% of LDF forms submitted as ''timely and complete'' in 2012 and 100% in the first part of 2013. Fifty to sixty percent of our living donors presented for follow-up in the 2011–2013 era. Ongoing efforts and review of our compliance and follow-up rates are needed to further define the optimal processes for living donor follow-up.

One of the limitations of this study is that it was designed to assess compliance with governmental reporting requirements and not the impact on clinical outcomes. Fortunately, our overall rates of living donor complications in the postoperative period is quite low, with most being wound complications and incisional hernias. We had one donor death by suicide at 20 months postdonation and no donors with development of end-stage renal disease. No patients developed diabetes, 4 (1.3%) patients required anti-hypertensive medications and 22 (7.0%) patients had positive protein reported on urinalysis. These initial data would suggest that the number of postoperative complications in living donors within the first 2 years of donation is quite low but obviously requires ongoing study and begs the questions: Are 6 months, 1 year, and 2 years appropriate follow-up points? Should consideration be placed on screening only medically high-risk donors during this follow-up period or extending the follow-up out to 5, 10 or 20 years? Obviously, this would be very challenging to the individual transplant center both from a staffing and financial resource standpoint.

In addition to determining the appropriate timing of screening, it may be useful to determine if other clinical variables play a role in overall donor follow-up or lack thereof, such a participation in paired donor exchange programs or recipient outcomes/graft failures should be evaluated in future studies. Also, it remains to be determined if medically complex donors or high-risk populations require additional initiatives for living donor follow-up. We do not have programs in place specifically for high-risk or medically complex donors outside of the performance improvement initiatives as the number of high-risk donors that our center accepts for donation is small. The average age of donation is 39 years with only 13% African-American and 23% obese. We do not accept living donors with hypertension, glucose intolerance or creatinine clearance <80 mL/min.

In summary, most transplant centers recognize that living donor follow-up is not being performed as well as it should be. Our data would suggest that the institution of performance improvement initiatives with dedicated resources to the living donor program and an emphasis on patient education leads to improved LDF form and patient follow-up compliance with acceptable costs to the transplant center. Based on current data trends, we hope that with additional longitudinal follow-up, we will achieve and surpass targets as defined by the OPTN. Future efforts at our center will be aimed at exploring electronic tools to educate donors and their PCPs and to aid in the collection of postdonation demographic, clinical and laboratory variables. Hopefully, with more reliable and complete donor follow-up data submitted by living donor programs, the immediate and short-term safety of living kidney donation will be confirmed.

Acknowledgments

This research was supported by the Vanderbilt O'Brien Mouse Kidney Physiology and Disease Center NIH Grant 3 P30 DK079341-05S1. We would like to thank Nancy Lightsey and Mark deCasestecker, MD, PhD for their work in organizing the Student Research Training Program (SRTP) in Kidney Disease.

Disclosure

The authors of this manuscript have no conflicts of interest to disclose as described by the *American Journal of Transplantation*.

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