

Research Article

An Assurance of Insurance: Should Living Kidney Donors be Required to have Health Insurance?

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ABSTRACT

Background: The aims of the study were to examine if living donors followed the recommended UNOS medical visits post-surgery examinations and to assess if medical outcomes after donating a kidney were different by insurance status.

Methods: Data was collected from the medical records of 680 consecutive living kidney donors between January 2010 and June 2015.

Results: Significant predictors of having health insurance included higher levels of education (p=0.007) and being married (p=0.031). Post-surgical visits were lower for those without insurance at six months (43% *versus* 77%; p=0.029) and one year (35% *versus* 77%, p<0.001) than those with insurance. A robust trend was observed whereas lack of health insurance was predictive of higher systolic blood pressure (p=0.05). Significant predictors of higher systolic blood pressure included being older (p<0.001), male (p<0.001); and non-Caucasian (p=0.012). Significant predictors of higher diastolic blood pressure were being male (p<0.001) and non-Caucasian (p=0.020); and prior drug use (p=0.003).

Conclusion: Development of interventions to improve post-surgical follow up for kidney donors without insurance is warranted to potentially reduce poor health outcomes such as hypertension post kidney donation.

Keywords: Insurance; Kidney donors; Outcomes; Post-surgical; Retrospective

Abbreviations

ESRD: Endstage Renal Disease; CHD: Coronary Heart Disease; GFR: Glomerular Filtration Rate; UNOS: United Network for Organ Sharing; UPMC, University of Pittsburgh Medical Center

Introduction

Fifteen percent of Americans are without health insurance and over 40,000 deaths per year have been attributed to lack of health insurance [1,2]. The uninsured are less likely to receive preventative care and access to quality care, resulting in poorer health outcomes and increased risk of mortality [2-4]. One explanation of increased risk of mortality is that those without health insurance are more likely to have treatable diseases diagnosed significantly later and have greater complications as a result of the delayed diagnosis [4].

Specific to the proposed study, the uninsured are at an increased risk of a delay in diagnosis of hypertension, which initially presents as asymptomatic [1]. To illustrate the asymptomatic nature of early hypertension, 25% of the general population who have been diagnosed with hypertension did not visit a physician within the last year [5]. Predictors of those who did not visit a physician in the last year included not having health insurance, low income, inadequate education, minority status and lack of access to care [5]. Keng and Sheu [6] found that Taiwanese elders with lower socioeconomic status who did not have health insurance benefitted significantly more from gaining health insurance than those who had higher socioeconomic status. Moreover, the Institute of Medicine [4] found that in areas where much of the population does not have health insurance, the access to medical care is poor for the entire community.

Living kidney donation has been found to result in better outcomes for the recipient when compared to cadaveric donation [7]. Common reasons for declination for living kidney donation have included renal function, hypertension, kidney anatomy and psychosocial reasons, but not for lack of health insurance [8,9]. For the majority of transplant centers in the U.S., living kidney donors are not required to have health insurance [10]. The Organization for Transplant Professionals [10] found that only 4% of transplant centers required donors to have health insurance prior to surgery. Dew et al. [11] found that approximately 18-25% of donors do not have health insurance. Gibney et al. [12] theorized that lack of health insurance may impact the frequency of medical follow-up after surgery and therefore complications associated with donation may be less likely identified early, particularly conditions that are asymptomatic such as hypertension. The United Network for Organ Sharing (UNOS) requires transplant centers to follow living donors for two years [13,14]. However, donors without insurance may not be able to pay for these follow-up visits and as a result some transplant centers offer no-cost follow up exams and laboratory testing for the first two years after donation [1,12-14]. Nonetheless, donors may still have difficulties with the cost of the visit (e.g., gas, parking) even if the follow up testing and exams are of no charge to the donor. With increasing age and possible weight gain, donors are more likely to experience problems with high blood pressure after the two year follow up period [1]. Furthermore, some investigators have reported that living kidney donors may have difficulties obtaining health insurance post-donation despite limited complications

associated with living donation [11,12,15]. As a result, those who chose to donate without insurance may be at risk for high blood pressure and End-Stage Renal Disease (ESRD) later in life without health insurance or the financial ability to treat these, or other medical conditions that are associated with hypertension [11,16,17].

Boudville et al. [16] found in a meta-analysis that kidney living kidney donors had a five-mm Hg average increase in blood pressure five years after surgery when compared to healthy controls. This average increase was defined as a six-mm Hg increase in systolic blood pressure *versus* a four-mm Hg increase in diastolic blood pressure for living kidney donors over five years [16]. Increases in blood pressure have been linked to an increased risk of mortality from coronary heart disease (CHD;18). Van den Hoogen et al. [18] found that for every ten-mm Hg increment of increased systolic blood pressure or five-mm Hg increment of diastolic blood pressure, a 1.28 relative risk in mortality from CHD was observed. The SPRINT study team [19] found that maintaining a systolic blood pressure of 120 mmHg greatly reduced risk of cardiovascular disease when compared to maintaining a systolic pressure of 140 mmHg. Yet kidney donors without health insurance may be less likely to engage in annual preventive exams or be aggressively treated for high blood pressure [20]. Mehrotra and Kessler [21] found that for every 10% increase in health insurance coverage is linked with a 1.8% lower incidence of ESRD. With regard to donors, antihypertensive medicines were found to be the most prescribed medications to living kidney donors post-donation and more likely to occur if the donor had insurance [22].

The aims of the study were to examine sociodemographic differences between patients with and without health insurance. Then, we investigated the reasons for donor candidates to be excluded from surgery. Finally, we examined differences by insurance status on blood pressure, urine creatinine, urine protein, urine albumin, urine-albumin ratios, serum creatinine, and glomerular filtration rate (GFR) pre- and post-surgery. Finally, we examined the rate of return to the transplant center of primary care physician for follow up after donor surgery by insurance status.

Methods and Materials

Design

The study is a retrospective medical chart review of longitudinal data concerning living kidney donors pre- and post-surgery.

Participants

A total of 680 consecutive living kidney donors from January 2010 to June 2015 who were evaluated at the University of Pittsburgh Medical Center (UPMC)'s Transplant Center were included in this study. Patients who were evaluated at a different transplant center and did not pursue surgery at UPMC were excluded.

Assessment

Sociodemographic status and insurance data: We collected data on participants' age at time of the evaluation, gender, race, education, marital status, job status and number of children from the patients' medical chart. Insurance data was verified by a combination of scanned insurance cards on file, reported by social work or the medical team. Only insurance status (yes/no) was included for the purposes of this study.

Mental health and medical conditions: Both psychiatric diagnoses and medical conditions before and after surgery were collected from medical charts including the surgical, nephrology, social work, and psychiatric evaluations to account for potential reasons for declination from surgery.

Donor candidacy: The final documentation from the multidisciplinary selection committee decision was used to determine if the individual was approved for living kidney donor nephrectomy. Patients were approved for surgery or declined for surgery. Specific reasons for declining the candidate from surgery were recorded. Three patients who did not have a decision, for reasons such as nonadherence to evaluation procedures and were excluded.

Blood pressure

Both systolic and diastolic blood pressures in millimeters of mercury (mmHg) were obtained from the patients' medical chart prior to surgery, operationally defined as the highest pressure during the evaluation process. Post-surgical values were obtained from follow-up reports at 6 months, 1 year and 2 years after surgery.

Laboratory tests

Urine creatinine, urine protein, urine albumin, urine-albumin ration, serum creatinine, and GFR were obtained from the patients' medical chart prior to surgery. Post-surgical values were obtained from follow-up laboratory reports at 6 months, 1 year and 2 years after surgery.

Procedure

This study was approved by the University of Pittsburgh's Institutional review board. This study involved a retrospective review of patient charts and all identifying information was removed prior to analyses.

Data analysis

All data was entered and verified on SPSS Version 22 (IBM Corp, Armonk, NY). Chi-square and Mann-Whitney U tests were performed to test between group differences by insurance status. Fisher's Exact Test was performed in cases when the number of patients in one subgroup was less than ten. Significant factors in the univariate analyses were then entered into a linear regression model to determine predictors of insurance status. Next, Mann-Whitney U tests were performed to examine the reasons for declination from surgery such as physical or psychosocial reasons as well as the laboratory values by insurance status. Lastly, systolic and diastolic blood pressure, urine and serum creatinine, urine protein, urine albumin, urine-albumin ratios, and GFR values were compared between donors with and without insurance before surgery and 6 months, 1 year and 2 years after surgery. Mann-Whitney U tests were used to examine factors were predictive of blood pressure and all laboratory tests. Bonferroni corrections were used on all analyses to address the multiple comparisons. Using the results

from univariate analyses, significant factors were entered into a mixed model linear regression to determine if the changes in blood pressure were significantly different between those with and without insurance after adjusting for significant predictors of systolic and diastolic pressure.

Results

Demographic characteristics of potential living kidney donors and health insurance

Of the 680 participants evaluated for living kidney donation, a total of 263 of the potential living kidney donors were male (39%) and 419 (61%) were female. The majority of participants were Caucasian (89%) and African American (7%). Of all the living donors evaluated, 306 were approved for donation (45%), and 143 (21%) were approved but did not have surgery at the time of the analyses for reasons including but not limited to the recipient received a deceased organ or passed away, the surgery had not yet been scheduled, or donors was unable to identify a suitable caregiver. A total of 231 (34%) were declined for surgery. Three patients did not have a decision regarding if they should proceed with surgery and were not included in the analyses. Sample characteristics are presented in Table 1.

There were 592 (87%) potential donors evaluated who had health insurance at the time of the evaluation and 88 (13%) who did not have health insurance. The participants' mean age was 42.9 (SD=12.2) with an average BMI of 27.5 (SD=4.6). Rates of substance usage for the potential donors included 473 currently consumed alcohol (70%), 139 currently used tobacco (20%) and 31 currently reported drug use (5%). The majority

Table 1: Sociodemographic characteristics of the sample.

Variable	Evaluated Patients (n=680)	Patients who underwent surgery (n=306)
Insurance (n, %)		
Yes	592 (87%)	270 (88%)
No	88 (13%)	36 (12%)
Gender		
Male	263 (39%)	119 (39%)
Female	417 (61%)	187 (61%)
Race		
Caucasian	602 (89%)	278 (91%)
Non-Caucasian	69 (10%)	28 (9%)
Age at Time of Evaluation		
Mean (S.D)	42.9 (12.2)	42.3 (11.1)
BMI		
Mean (S.D.)	27.5 (4.6)	26.8 (4.5)
Initial SBP		
Median (IQR)	126.0 (17.0)	123.0 (16.0)
Initial DBP		
Median (IQR)	74.5 (14.0)	74.0 (14.0)
Alcohol Usage (n, %)		
Current	473 (70%)	226 (74%)
None	207 (30%)	80 (26%)
Tobacco Usage (n, %)		
Current	139 (20%)	49 (16%)
None	541 (80%)	257 (84%)
Drug Usage (n, %)		
Current	31 (4.6%)	13 (4.2%)
None	649 (95%)	293 (96%)
Education (n, %)		
High school or below	192 (28%)	89 (29%)
Some college and above	488 (72%)	212 (69%)
Children (n, %)		
Have children	268 (39%)	120 (39%)
No children	401 (59%)	183 (60%)
Job status (n, %)		
Employed	549 (81%)	261 (85%)
Not employed	120 (18%)	44 (14%)
Marital status (n, %)		
Married	404 (59%)	119 (39%)
Single	274 (40%)	187 (61%)

of the potential donors reported some college (72%), were employed (81%), were married (59%) and did not have children (59%). The majority of candidates were donating to family members (77%), friends (20%), and 3% of donors were non-directed donations. Potential donors had a median systolic blood pressure of 126 mmHg (IQR=17) and diastolic blood pressure of 74.5 mmHg (IQR=14) prior to surgery.

Characteristics of donors based on health insurance status

The Bonferroni correct p-value for this set of analyses was 0.005. Potential living kidney donors who did not have health insurance were significantly younger (Mann-Whitney U=34,405.5, $p<0.001$); more likely to be from a minority background ($\chi^2=6.849$, $p=0.009$); less likely to complete college ($\chi^2=30.417$, $p<0.001$); and less likely to be married ($\chi^2=31.124$, $p<0.001$). With the p-value adjusted, no significant differences with regard to insurance status based on alcohol use ($\chi^2=1.674$, $p=0.196$); drug use ($\chi^2=0.293$, $p=0.588$); tobacco use ($\chi^2=6.518$, $p=0.011$); BMI (Mann-Whitney U=26,766, $p=0.676$); employment status ($\chi^2=5.434$, $p=0.020$); or gender ($\chi^2=4.423$, $p=0.035$). The descriptive data are presented in Table 2.

Table 2: Univariate analysis of potential predictors of insurance status.

Variable	Has Insurance	No Insurance	Total
	n=592 (87%)	n=88 (13%)	n = 680
Approved for Surgery (n, %)			
Approved	421 (71%)	58 (66%)	479 (70%)
Declined	171 (29%)	30 (34%)	201 (30%)
Gender (n, %)			
Male	220 (37%)	43 (49%)	263 (39%)
Female	372 (63%)	45 (51%)	417 (61%)
Race (n, %)*			
Non-Caucasian	53 (9%)	16 (18%)	69 (10%)
Caucasian	530 (90%)	72 (82%)	602 (89%)
Age at Time of Donation*			
Mean (S.D.)	43.8 (12.1)	37.2 (11.8)	43.0 (12.2)
BMI			
Mean (S.D.)	27.5 (4.6)	27.3 (4.7)	27.5 (4.6)
Initial SBP			
Median (IQR)	126.0 (17.0)	127.0 (19.0)	126.0 (17.0)
Initial DBP			
Median (IQR)	75.0 (14.0)	74.0 (13.3)	74.5 (14.0)
Alcohol Usage (n, %)			
Current	417 (70%)	56 (64%)	473 (70%)
None	175 (30%)	32 (36%)	207 (30%)
Tobacco Usage (n, %)			
Current	113 (19%)	27 (31%)	140 (21%)
None	479 (81%)	61 (69%)	540 (79%)
Drug Usage (n, %)			
Current	26 (4.3%)	5 (5.7%)	31 (4.6%)
None	566 (96%)	83 (94%)	649 (95%)
Education (n, %)*			
High school degree and below	145 (25%)	49 (56%)	192 (28%)
Some college and above	422 (71%)	39 (44%)	461 (68%)
Children (n, %)			
Have children	240 (41%)	28 (32%)	268 (39%)
Some college and above	343 (58%)	58 (66%)	401 (59%)
Job Status (n, %)			
Employed	486 (82%)	63 (72%)	531 (78%)
Not Employed	99 (17%)	22 (25%)	121(18%)
Marital Status (n, %)*			
Not married	215 (36%)	59 (67%)	274 (40%)
Married	376 (64%)	28 (32%)	404 (59%)

Indicates FET was performed.
*Adjust p-value with Bonferroni correction =0.005.

Predictors of health insurance status

The Bonferroni correct p-value for these analyses was 0.006. Univariate analyses of significant group differences were performed and those without health insurance were younger in age (Mann-Whitney U=34,405.5, p<0.001), non-Caucasian (χ^2=6.849, p=0.009), had a lower educational attainment (χ^2=30.417, p<0.001), and were not married (χ^2=31.124, p<0.001). After adjusting for all the significant predictors in a mixed model linear regression only higher levels of education (β=1.100; 95% CI, 1.358 to 6.640; p=0.007) and being married (β= 0.913; 95% CI, 1.087 to 5.712; p=0.031) were significant predictor of health insurance. These data are presented in Table 3.

Reasons for being declined for surgery

Those without insurance were more likely to be declined for psychosocial reasons (33%) than those with insurance (11%), χ^2=11.773, p<0.001. Table 4 shows the physical and psychosocial reasons for being declined for living kidney donation. The majority of donors who were declined for physical reasons (85%) including hypertension (16%), obesity and weight issues (16%), risk of kidney stones (10%), cardiac issues (7.4%), structural kidney issues (6.9%), low GFR (6.1%), and risk/ current diabetes (6.1%). The most common psychosocial reasons for being declined were substance abuse disorders (6.9%), unmanaged psychiatric disorders (2.6%) and concerns about nonadherence (2.2%).

Factors influencing pre-surgical blood pressure

The Bonferroni correct p-value for these analyses was 0.0125. Univariate analyses were performed and significant predictors of systolic blood pressure included male gender (Mann-Whitney U=7,545.50, p<0.001) and being older (r=0.166, p<0.001); and race (Mann-Whitney=5,008.0, p=0.011). Past drug use was not significant with the adjusted p-value (Mann-Whitney U=1,201.5, p=0.025) Significant predictors of diastolic blood pressures included male gender (Mann-Whitney U=7,035.0, p<0.001). Race (Mann-Whitney=4,751.5, p=0.049) and past drug use (Mann-Whitney U=1,243.5, p=0.035) were not significant with the Bonferroni correction.

Table 3: Logistic regression analyses examining the predictors of health insurance.

Parameters	Beta	Standard error	P-Value	Odds Ratio	C.I. (95%)
Age	0.015	0.016	0.347	1.015	0.984-1.048
Gender	0.299	0.397	0.451	1.349	0.620-2.938
Race	0.773	0.562	0.159	2.167	0.720-6.518
Education	1.100	0.405	0.007	3.003	1.358-6.640
Marital Status	0.913	0.423	0.031	2.492	1.087-5.712
Job Status	0.382	0.432	0.377	1.465	0.628-3.416
Current Tobacco	0.088	0.426	0.837	1.092	0.474-2.516

Table 4: Reasons for donors being declined from surgery.

Variable	Has Insurance n=195 (84%)	No Insurance n=36 (16%)	Total n=231
Physical Reasons (n, %)*	**173 (89%)**	**24 (67%)**	**197 (85%)**
Current/ undiagnosed HTN	34 (17%)	4 (11%)	38 (16%)
Obesity/ weight issues	34 (17%)	2 (5.6%)	36 (16%)
Risk of/ current kidney stones	16 (8.2%)	7 (19%)	23 (10%)
Cardiac Issues	15 (7.7%)	2 (5.6%)	17 (7.4%)
Kidney Structural Related Issues	15 (7.7%)	1 (2.8%)	16 (6.9%)
Low GFR	13 (6.7%)	1 (2.8%)	14 (6.1%)
Risk of/ current Diabetes	11 (5.6%)	3 (8.3%)	14 (6.1%)
Non-Kidney GI/GU issues	8 (4.1%)	1 (2.8%)	9 (3.9%)
Risk of/ Current Kidney Disease	7 (3.6%)	1 (2.8%)	8 (3.5%)
COPD/ Respiratory	6 (3.1%)	1 (2.8%)	6 (2.6%)
New onset/ current Cancer	5 (2.6%)	1 (2.8%)	6 (2.6%)
Other medical reasons	9 (4.6%)	1 (2.8%)	10 (4.3%)
Psychosocial Reasons (n, %)*	**22 (11%)**	**12 (33%)**	**34 (15%)**
Substance abuse	10 (5.1%)	6 (17%)	16 (6.9%)
Unstable Psychiatric disorder	3 (1.5%)	3 (8.3%)	6 (2.6%)
Nonadherence	4 (2.0%)	1 (2.8%)	5 (2.2%)
Other non-medical reasons	5 (2.6%)	2 (5.6%)	7 (3.0%)

*p < 0.05; **p < 0.001 level

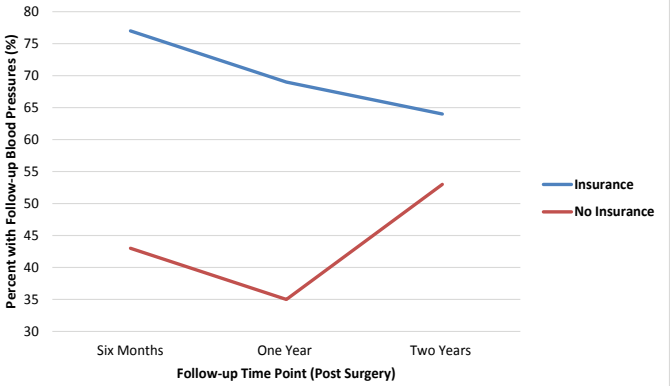
Post-surgery blood pressure

Blood pressures were obtained at six-months for 219 living kidney donors (follow up rate=74%), one-year for 176 donors (follow up rate=66%) and two-years for 116 donors (follow up rate=66%). Follow-up rates were significantly lower for those without insurance at six months (43%) (χ^2=5.203, p=0.029) and one year (35%) (χ^2= 12.563, p<0.001) than those with insurance (77%, 69%). At two years, the follow-up rate of donors without insurance (53%) was lower than those with insurance (64%), but not statistically significant (χ^2=1.778, p=0.204). These response rates are graphed below in Figure 1 based on levels of insurance. Pre-surgical and post-surgical follow-up systolic blood pressures and diastolic blood pressures were graphed by insurance status as seen in Figures 2 and 3 respectively.

A mixed-model linear regression was performed using factors that were significant in between-group analyses for the initial blood pressure including age, gender, race and drug use to compare the changes in blood pressure over the next two years (age was not included in the diastolic analysis as it was not significant in univariate analyses) by health insurance status. The results of this linear regression can be viewed for systolic and diastolic blood pressure in Tables 5 and 6 respectfully.

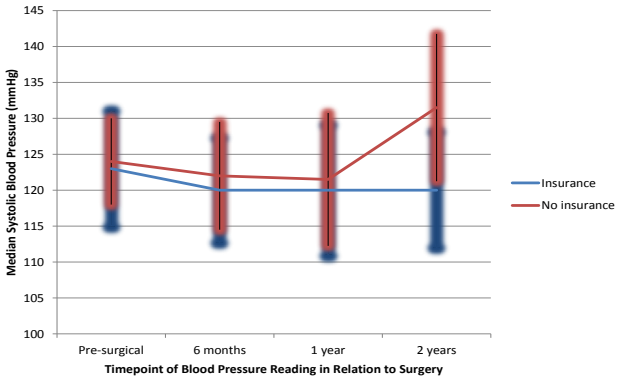
Significant predictors of systolic blood pressure included male gender, (β=7.721; 95% CI, -9.839 to -5.603; p<0.001); non-Caucasian race (β=4.398; 95% CI, 0.984 to 7.811; p=0.012); and older age (β=0.221; 95% CI, 0.125 to 0.316; p<0.001). Health insurance was found to be not a significant predictor of blood pressure although there was a robust trend toward significance after adjusting for these demographic variables (β=-3.409; 95% CI, -6.902 to 0.083; p=0.056). Current drug use did not significantly predict lower follow-up systolic blood pressure (β=-0.190; 95% CI, -2.318 to 1.937; p=0.861).

Significant predictors of diastolic blood pressure included male gender (β=-4.838; 95% CI, -6.155 to -3.522; p<0.001); non-Caucasian race (β=2.532; 95% CI, 0.406 to 4.658; p=0.020); and past drug use (β=-4.644; 95% CI, -7.699 to -1.588; p=0.003). Insurance status did not predict follow-up diastolic blood pressure after adjusting for these factors however a robust trend was observed (β=-4.976; 95% CI, -9.951 to -0.001; p=0.050). No significance was found for the potential interaction effect (p=0.850).



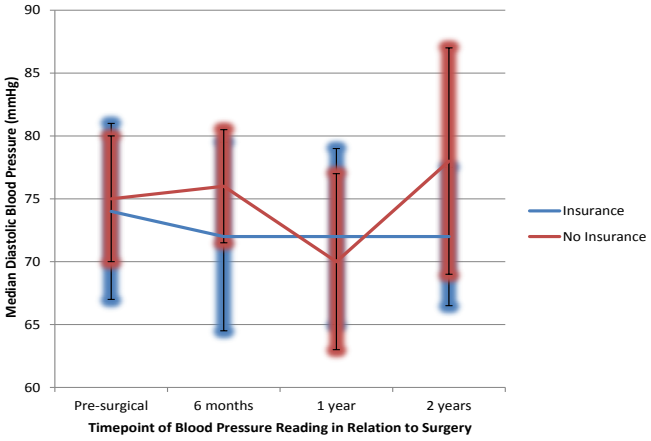
Follow-up rate was calculated for follow-up blood pressures and subdivided by insurance. The response rate of those with insurance was higher than those without insurance.

Figure 1: Follow-up blood pressure response rate by insurance.



Follow-up median diastolic blood pressures were obtained for those who had surgery at six months, one year and two years and compared with the pre-surgical diastolic values based on insurance status.

Figure 2: Follow-up median systolic blood pressure by insurance.



Follow-up median diastolic blood pressures were obtained for those who had surgery at six months, one year and two years and compared with the pre-surgical diastolic values based on insurance status.

Figure 3: Follow-up median diastolic blood pressure by insurance.

Post-surgery laboratory results

Univariate analysis for urine creatinine, urine protein, urine albumin, urine-albumin ratios, serum creatinine, and GFR only revealed significant differences between patients with and without insurance in one-week follow-up urine creatinine (p=0.032). A robust trend was also observed for one- week urine protein (p=0.09) and serum creatinine (p=0.057). However, with a Bonferroni corrected and an adjusted p-value of 0.008, no differences in laboratory values was observed between those with and without insurance. The kidney donors without insurance had higher levels of each of these lab values when compared to kidney donors with insurance. However,

Table 5: Mixed models linear regression of predictors of systolic blood pressure at 2 years post-surgery.

Fixed Effect	Estimate	F-statistic	95% CI	p-value
Gender	-7.721	51.210	-9.839 to -5.603	<0.001
Age	0.221	20.600	0.125 to 0.316	<0.001
Race	4.398	6.396	0.984 to 7.811	0.012
Drug use	-4.976	3.855	-9.951 to -0.001	0.050
Insurance	-3.409	3.671	-6.902 to 0.083	0.056

Table 6: Mixed models linear regression of predictors of diastolic blood pressure at 2 years post-surgery.

Fixed Effect	Estimate	F-statistic	95% CI	p-value
Gender	-4.838	52.075	-6.155 to -3.522	<0.001
Race	2.532	5.466	0.406 to 4.658	0.020
Drug use	-4.644	8.900	-7.699 to -1.588	0.003
Insurance	-0.190	0.031	-2.318 to 1.937	0.861

Table 7: Laboratory values pre- and post- surgery by insurance status.

	Health Insurance (Median, IQR)	No Health Insurance (Median, IQR)	p-value
Pre-Surgical			
Creatinine	0.80 (0.20)	0.9 (0.225)	0.718
Urine Creatinine	120.5 (128.7)	163.25 (159.83)	0.376
Urine Protein	0 (9.23)	8 (12.5)	0.104
Urine Albumin	0.40 (0.60)	0 (0.6)	0.122
Urine Albumin Creatinine Ratio	3.5 (2.3)	2.8 (1.4)	0.108
Glomerular Filtration Rate	All >40*	All >60	0.232
1 Week Post-Surgery			
Creatinine	1.2 (0.3)	1.2 (0.5)	0.057
Urine Creatinine	102.45 (150.28)	186 (95.55)	0.032
Urine Protein	9.5 (24.0)	14 (16.5)	0.090
Urine Albumin	0.5 (1.1)	0.5 (0.85)	0.718
Urine Albumin Creatinine Ratio	6.6 (8.9)	4.3 (13.5)	0.147
Glomerular Filtration Rate	56.45 (15.74)	57.9 (23.56)	0.898
6 months Post-Surgery			
Creatinine	1.2 (0.3)	1.3 (0.3)	0.429
Urine Creatinine	94.5 (126.4)	72.25 (128.08)	0.336
Urine Protein	8 (13.68)	6 (12.0)	0.854
Urine Albumin	0 (0.6)	0.35 (0.8)	0.518
Urine Albumin Creatinine Ratio	5 (4.93)	7.1 (12.76)	0.139
Glomerular Filtration Rate	60.16 (16.52)	57.86 (18.61)	0.465
One year Post Surgery			
Creatinine	1.2 (0.4)	1.2 (0.3)	0.431
Urine Creatinine	93.45 (122.25)	72.25 (128.08)	0.862
Urine Protein	6 (12.0)	6 (12.0)	0.944
Urine Albumin	0 (0.5)	0.35 (0.80)	0.149
Urine Albumin Creatinine Ration	4 (7.3)	7.1 (12.78)	0.120
Glomerular Filtration Rate	60.61 (16.99)	57.99 (19.32)	0.686
Two year Post Surgery			
Creatinine	1.17 (0.23)	1.19 (0.37)	0.351
Urine Creatinine	71.4 (125.5)	79 (102.2)	0.233
Urine Protein	5 (12.0)	7 (18)	0.548
Urine Albumin	0 (0.725)	0.3 (1.1)	0.990
Urine Albumin-Creatinine Ratio	5.7 ()	3.9 (2.88)	0.432
Glomerular Filtration Rate	59.71 (16.78)	66.45 (21.95)	0.167

All donors with insurance had a pre-surgical GFR >60 except for six donors who had a GRF 40, 45, 48, 56, 58 and 60
*Significant after adjusting p-value with a Bonferroni correction (p=0.008)

at 6-months, 1 year and 2-year follow-up no significant differences were observed between kidney donor with or without health insurance Table 7.

Discussion

In the U.S., access to and affordability of health insurance remains an important topic of debate [1,2]. A few potential links between lack of health insurance status and health include lower access to quality care and lower likelihood of going to a physician, which then may result in later diagnoses and poorer health [1-4,16]. Living kidney donors are no exception, as the incidence of living donor nephrectomy has increased with evidence of better recipient outcomes [7]. Despite the increase in living kidney donor surgeries, the majority of donor candidates are still not required to have health insurance in the U.S. [10,14]. Furthermore, living kidney donors may experience financial hardships as roughly 2-9% may have trouble acquiring health insurance post donation as the surgery may be considered a pre-existing condition [11]. While there has been research to suggest that living kidney donors may be at certain risks for increases in blood pressure as a result of surgery, limited research has been performed to examine the potential risk factors of long-term complications from kidney donation by health insurance status [11,16].

In the present single center study, we observed fewer patients without insurance prior to surgery (13%) than reported by Dew et al. [11] in a multiple center trial (18-25%). In our study, patients without health insurance were found to be significantly younger in age, which has also been reported by Fang et al as one of the predictors of insurance status [5]. Fang et al. [5] found that being from a minority background also was associated with lack of insurance. Although we did not observe this, donors from our transplant center were predominantly Caucasian Furthermore, Fang et al. [5] found that insurance status was indicative of whether or not a patient has visited a physician within the past year. These findings are particularly concerning for patients who have donated a kidney as the lack of insurance may risk a delay in diagnosis of treatable diseases such as hypertensions [5,16].

We then examined reasons for donors to be declined from donating a kidney. These reasons included hypertension, high BMI, risk of kidney stones, cardiovascular problems, structural kidney issues and substance abuse disorders, and the rates of which were similar to other studies [8,9]. In this study, we expanded these analyses to examine patient insurance status. No difference was observed with regard to insurance status and being declined, however those without insurance were three times more likely to be declined from surgery for psychosocial reasons, such as substance abuse and unstable psychiatric disorders. These results were similar to the general population, which indicated that those without insurance were more likely to need mental health treatment. In a survey conducted by the American Psychological Association in 2004, 87% of participants felt that lack of health insurance prohibits one from obtaining mental health care [23-25]. Specific to this study, the donors who were uninsured may not have sought psychiatric care and thus could have more untreated psychiatric problems when evaluated for donor surgery [24-26].

In order to examine potential short-term consequences to donors without health insurance, blood pressures and laboratory tests were analyzed and compared for living donors at baseline (pre-surgery), and at six months, one year and two years post-surgery. Furthermore, laboratory results were similarly compared for laboratory tests by donors with and without health insurance prior to surgery, 1 week, and 6, 12- and 24-months post-surgery. Insurance status was not found to be a significant predictor of follow-up systolic or diastolic blood pressure. However, there appeared to be a robust trend with systolic blood pressure being higher at two years post-donation for those kidney donors without health insurance. These findings may be an underestimate as there was a much lower response rate for those without insurance. We found that participants without health insurance had much lower follow up rates with the transplant center or their primary care physician post-surgery than those with insurance. Lack of follow-up could lead to later diagnoses of hypertension and potentially more complications from the disease, and thus careful monitoring of the blood pressure of those without insurance is warranted [5,12,16]. Furthermore, these results cannot be accurately compared to the five-year study conducted by Boudville et al. [16], as our analysis only encompassed only two years of follow-up.

Conclusion

Insurance status did not ultimately impact one of the most common complications from kidney donor surgery, high blood pressure, after adjusting for other significant predictors of hypertension [16,17,22]. However, the trend was robust and warrants further research specifically following donors over a longer period of time and with a larger number of transplant centers. High blood pressure may go unrecognized within a limited two-year period and necessitates longer monitoring [1,16,18]. For example, Van den Hoogen et al. [18] found a significant relative risk in mortality as a result of CHD comparing six worldwide populations related to blood pressure, but analyzed over a twenty-five-year period, suggesting a need for longer follow-up of living kidney donors. While it may be ideal to follow donors after surgery for longer periods of time to get a more definitive conclusion regarding the risks of donation based on insurance status limitations such as cost of follow up care, donor willingness to be followed, and limitations regarding the requirements for follow up by UNOS decrease the ability for donors and the transplant community to know the true risk of cardiovascular disease in living kidney donors [11,12]. Other limitations of this study include not examining other potential medical conditions such as end-stage renal disease, gestational hypertension and preeclampsia (in women), and gout and albuminuria that may develop in kidney donors [27,28]. While living kidney donation has significant benefits to the transplant recipient and even the donor [7], continued investigation of the short- and long-term consequences to health are warranted.

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