

Emotional and Financial Experiences of Kidney Donors over the Past 50 Years: The RELIVE Study

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Abstract

Background and objectives Most kidney donors view their experience positively, but some may experience psychosocial and financial burdens. We hypothesized that certain donor characteristics, poor outcome of the recipient, negative perceptions of care, and lack of support may be associated with poor psychosocial outcomes for donors.

Design, setting, participants, & measurements The Renal and Lung Living Donors Evaluation Study (RELIVE) examined long-term medical and psychosocial outcomes for kidney donors (at three U.S. transplant centers) who donated between 1963 and 2005. Standardized questionnaires evaluated donor perspectives, recovery time, social support, motivation, financial impact, insurability after donation, and current psychological status. Questionnaires were mailed to 6909 donors.

Results Questionnaires were returned by 2455 donors, who had donated 17 ± 10 years earlier (range, 5–48 years), a response rate of 36%. Most (95%) rated their overall donation experience as good to excellent. Rating the overall donor experience more negatively was associated with donor complications, psychological difficulties, recipient graft failure, and longer time since donation. Nine percent ($n=231$) reported one or more of the following poor psychosocial outcomes: fair or poor overall donor experience, financial burden, regret or discomfort with decision to donate, or psychological difficulties since donation. Recipient graft failure was the only predictor for reporting one or more of these poor psychosocial outcomes (odds ratio, 1.77; 95% confidence interval, 1.33 to 2.34). Donors with lower educational attainment experienced greater financial burden. One of five employed donors took unpaid leave; 2% reported health and life insurability concerns.

Conclusions Although the majority of donors viewed their overall donation experience positively, almost 1 in 10 donors reported at least one negative consequence related to donation. Recipient graft failure was associated with poor psychosocial outcome, defined as one or more of these negative consequences. Some donors were financially disadvantaged, and some experienced insurance difficulties. Interventions to avoid negative psychosocial and financial consequences are warranted.

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Introduction

Most kidney donors experience psychosocial benefits, including improved self-esteem and donor-recipient relationships (1–5); likewise, most report no regrets (6,7) and reaffirm their decision to donate (3,8–13). However, these experiences are not universal. Predonation ambivalence, compromised mental health, strained relationship with the recipient, lack of financial resources, and pressure regarding donation are associated with poor psychological outcomes (14–22). Postdonation factors, such as lack of support, complications, or lack of health insurance, may prevent donors from seeking recommended medical or psychological follow-up, further interfering with recovery. Known psychosocial risks after surgery must be revealed during the education process in an attempt to avoid problems afterward and assure

informed consent. Consequently, it is critical that transplant centers collect this information after donation and attend to those needing intervention.

Most data regarding this topic come from single-center studies with small numbers and limited follow-up. An exception is the Renal and Lung Living Donors Evaluation Study (RELIVE), which examined the medical and psychosocial status of 2455 kidney donors at three major U.S. transplant centers, who donated between 1963 and 2005, from questionnaires and examinations completed 5–48 years after donation; quality of life results for this cohort have been reported (23). We hypothesized that a poor psychosocial outcome (e.g., rating the overall donation experience negatively or recalling adverse psychological or financial effects, discomfort, or regret about decision to donate) would be associated with certain

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donor characteristics, negative recipient outcome, and negative perceptions of support.

Materials and Methods

Questionnaire and Ethical Considerations

Eligible participants donated between June 1963 and June 2005 at the University of Minnesota, Minneapolis, Minnesota; Mayo Clinic, Rochester, Minnesota; and the University of Alabama, Birmingham, Alabama (Supplemental Figure 1). Demographic characteristics were collected by chart review. A packet was mailed to 6909 donors believed to be living (of an original cohort of 8951 donors); the packet included a cover letter, consent form, and 11-page questionnaire. Nonrespondents were mailed a second packet at 4 weeks; they were called if they hadn't returned the packet after another 2 weeks. Efforts to obtain correct contact information for nonresponding donors were made through the Social Security system. Data were collected between 2010 and 2012.

The questionnaire evaluated psychosocial, financial, and donor-specific outcomes after nephrectomy. Questions emphasized donor experience, recovery, current psychological status, motivation, interpersonal relationship with recipient, support available, financial effects, and long-term insurability. Questions were adapted from previous donor surveys, including studies by the authors (8,23), and the extensive donor research conducted by Simmons *et al.* (14). For this analysis, we grouped the following individual responses as a composite endpoint to define "poor psychosocial outcome": (1) fair or poor overall donation experience; (2) great or extreme financial burden due to donation; (3) probably or definitely would not donate again in response to a hypothetical question; (4) emotional, psychological, or substance use difficulty because of donation; or (5) somewhat or very uncomfortable with decision to donate. We assessed clarity, relevance, and validity of our questionnaire through cognitive interviewing in a RELIVE pilot study with a diverse sample of donors. (See Supplemental Material; study details are available elsewhere [24–26].)

The institutional review board approved the study sites and the data coordinating center; participants provided written informed consent.

Statistical Analyses

Donor and recipient demographic data are presented as frequencies and percentages for categorical outcomes or as means \pm SDs for continuous variables. Wilcoxon rank-sum tests compared groups, and multivariable models examined relationships between demographic characteristics and donor perceptions. Logistic, multinomial, and linear regression analyses were performed to identify variables associated with donor outcomes. Independent variables were donation age, time (years from donation), sex, race, educational attainment at donation, recipient death or graft failure, relationship to recipient, surgical procedure, and donor-reported complications. To create models, we used a best subsets approach; the final models were selected on the basis of model fit, explained variance, and statistical significance of predictors.

Multiple imputation methods were used for regression covariates with missing data (27). SEMs of multiple

imputed data were increased to account for additional uncertainty, thus minimizing the chance of making incorrect inferences. Statistical data analyses were performed using SAS software, version 9.2 (28). Results were considered statistically significant at $P < 0.01$.

Results

Donor Characteristics

Among 8951 kidney donors, 6909 were thought to be alive and to have donated on or before June 30, 2005. Of the 6909 eligible donors, 14% (938) had no current address and 36% (2501) did not respond to the invitation to participate (totaling 3439). Of the remaining 3470 eligible donors, 2455 (36% of the 6,909) returned the questionnaire (enrollment details in Supplemental Figure 1). All nonparticipants ($n=3516$) had lower educational attainment at donation (odds ratio [OR], 0.75; 95% confidence interval [CI], 0.70 to 0.80); were younger at donation (OR, 0.98; 95% CI, 0.98 to 0.99); and were more likely to be black (OR, 2.43; 95% CI, 1.95 to 3.03), male (OR, 1.28; 95% CI, 1.15 to 1.43), and related to their recipient (OR, 1.72; 95% CI, 1.43 to 2.07) compared with participants ($n=2455$).

Most respondents were white (93%) and women (61%) and were related to their recipient (78%) (Table 1). The mean time from donation was 17 ± 10 years (range, 5–48 years); 30% donated before 1990, 32% from 1990 to 1999, and 38% from 2000 to 2005. Most (79%) were < 50 years of age at donation, and the average age was 58 ± 11 years at survey completion. Respondents were highly educated; 37% had some post-high school education, 21% had a 4-year college degree, and 18% had a postgraduate degree. Most (75%) lived with a spouse or significant other.

Donor Health Status

While most donors (80%) had no medical complications, 8% reported a longer hospitalization than expected or readmission, and 14% reported outpatient medical problems (Table 2). Eighty-seven (4%) reported active treatment for donor-related concerns. Ninety-nine donors (4%) attributed emotional, psychological, or substance use difficulties to donation; of these, nearly a third (29%) had a pre-donation history of psychiatric conditions or substance abuse, and 2% continued receiving psychiatric care for issues attributed to donation.

Recipient Status

Almost all (99%) respondents knew their recipient's status and kidney function (Tables 1 and 2): Forty-seven percent reported their recipient was alive with kidney function, 12% reported the kidney was not functioning but recipient was alive, and 39% reported their recipient had died.

Primary Reason for Donation

Most (91%) were motivated by love for their recipient, 72% said donation was a logical response, 42% were influenced by faith, and 37% believed it was their moral obligation (Supplemental Figure 2).

However, 10% donated because family or friends expected them to, 5% felt pressure to donate, and 12% felt pressure not to donate. Siblings were most likely to feel pressure to donate (z score, 6.43; $P < 0.001$). Unrelated

Table 1. Donor and recipient characteristics	
Characteristic	Questionnaire Respondents, n (%) (n=2455)
At time of donation	
Age	
15–29 yr	505 (20.6)
30–59 yr	1851 (75.4)
60–74 yr	99 (4.0)
Race	
American Indian	16 (0.7)
Asian American	11 (0.4)
Black	113 (4.6)
White	2282 (93.0)
Multiracial	20 (0.8)
Female	1505 (61.3)
Donor relationship to recipient	
Parent	450 (18.3)
Child	316 (12.9)
Sibling	1011 (41.2)
Other relative	130 (5.3)
Spouse/partner	219 (8.9)
Friend	173 (7.0)
Paired exchange	4 (0.2)
Other unrelated	145 (5.9)
Year of donation	
1963–1969	28 (1.1)
1970–1979	275 (11.2)
1980–1989	443 (18.0)
1990–1999	775 (31.6)
2000–2005	934 (38.0)
Employment status	
Working full-time	1777 (72.4)
Working part-time	225 (9.2)
Retired	67 (2.7)
Unemployed	142 (5.8)
Unknown	244 (9.9)
Surgical procedure	
Open	1630 (66.4)
Laparoscopic	822 (33.5)
Unknown	3 (0.1)
At time of questionnaire	
Age	
24–29 yr	20 (0.8)
30–59 yr	1423 (58.0)
60–79 yr	947 (38.6)
80–94 yr	65 (2.6)
Educational attainment	
<High school	66 (2.7)
High school	497 (20.2)
Some college, vocational/technical school, or associates degree	920 (37.5)
4-yr college degree	510 (20.8)
Graduate degree	449 (18.3)
Marital status	
Married or living together	1852 (75.4)
Separated, divorced or widowed	449 (18.3)
Never married	141 (5.7)
Employment status	
Working full-time	1272 (51.8)
Working part-time	299 (12.2)
Not working for pay	770 (31.4)
Unemployed	80 (3.3)
Unknown	34 (1.4)

Table 1. (Continued)	
Characteristic	Questionnaire Respondents, n (%) (n=2455)
Recipient status reported by donor	
Alive	1468 (59.8)
Graft status	
Functioning	1060 (43.2)
Functioning, but with problems	100 (4.1)
Not functioning (graft failure)	307 (12.5)
Numbers and percentages may not add up to the sample total because of missing data.	

donors were more likely to feel pressure from others not to donate (z score, 9.14; $P < 0.001$).

In a multinomial regression, those asked to donate by their recipient (17%) were more likely related to the recipient (OR, 2.18; 95% CI, 1.42 to 3.35), male (OR, 1.49; 95% CI, 1.20 to 1.85), and longer out from donation (OR, 1.20; 95% CI, 1.07 to 1.34) compared with those autonomously initiating donation (79%) (Table 3).

Recovery Time

The majority (92%) reported returning to functional activities (i.e., daily routine obligations) within 3 months, but only 73% reported nephrectomy recovery within 3 months. Five percent needed >6 months to recover while 0.4% said they never fully recovered (Table 2). Shorter recovery time was reported by white donors ($\beta = -0.13$; 95% CI, -0.22 to -0.04) and those who underwent laparoscopic nephrectomy ($\beta = -0.10$; 95% CI, -0.15 to -0.05). Results are the equivalent of a recovery time of 1.31 points (on a 4-point scale) for a white donor versus 1.44 points for a nonwhite donor and a recovery time of 1.25 points (on a 4-point scale) for a donor with a laparoscopic procedure versus 1.35 points for a donor with an open procedure. Additional interpretations of regression results are presented in the Supplemental Material. Daily activities were resumed sooner by white donors ($\beta = -0.16$; 95% CI, -0.21 to -0.11) and those with higher educational attainment ($\beta = -0.02$; 95% CI, -0.03 to 0.00) (Table 3). Recovery time shorter than expected was experienced by men ($\beta = -0.15$; 95% CI, -0.24 to -0.05) and those who underwent laparoscopic nephrectomy ($\beta = -0.24$; 95% CI, -0.34 to -0.14).

Social Support

Six percent of donors felt they lacked support from family and friends during donation. Related donors were more likely than unrelated donors to feel family or friends' support ($\beta = 0.17$; 95% CI, 0.07 to 0.27). Donors experiencing emotional difficulty related to donation were less likely to feel supported by family or friends ($\beta = -0.39$; 95% CI, -0.54 to -0.23). Of employed donors, 82% felt their employer was supportive.

Sixty-two percent of donors felt that health care providers were supportive after surgery, 20% did not, and 17%

Table 2. Summary of positive, negative, and neutral perceptions related to donation (n=2455)

Positive Outcomes		Neutral Responses		Negative Outcomes		Unknown, %
Outcome	Respondents, %	Outcome	Respondents, %	Outcome	Respondents, %	
Donor health status						
No medical complications	80		0	≥1 medical complication	20	<1
				Medical complication that did not require hospitalization	14	
				Prolonged hospitalization or readmission	8	
				Currently seeing a doctor for donation-related concerns	4	
No emotional, psychological, or substance abuse difficulty	95		0	Emotional, psychological, or substance use difficulty	4	1
				Currently receiving treatment for emotional, psychological, or substance use difficulty	2	
Recipient status						
Alive with functioning graft	47		NA	Alive without function of donor's kidney (graft failure)	12	1
				Deceased	39	
Did not have complications	52		NA	Had complications	40	8
Reasons for donation						
Did not feel pressured to donate	88	Neutral	7	Felt pressured to donate	5	1
Did not feel pressured to not donate	82	Neutral	5	Felt pressured to not donate	12	1
Recovery time						
Returned to usual activities within 3 mo	92	Returned to usual activities in 3–6 mo	6	Longer return	1	<1
				Return to usual activities in >6 mo	1	
Recovered within 3 mo	73	Recovered in 3–6 mo	21	Never returned to usual activities	<1	<1
				Longer recovery	6	
				Recovery took >6 mo	5	
				Never recovered	<1	
Social support						
Family and friends were supportive	94	Neutral	2	Family and friends were not supportive	4	1
Employer was supportive ^a	82	Neutral ^a	12	Employer was not supportive ^a	4	2
Health care providers were supportive	62	Neutral	17	Health care providers were not supportive	20	1
Donor received attention after surgery	85	Neutral	6	No one paid attention to donor after surgery	9	<1

Table 2. (Continued)

Outcome	Positive Outcomes		Neutral Responses		Negative Outcomes		Unknown, %
	Respondents, %	Outcome	Respondents, %	Outcome	Respondents, %	Outcome	
Current relationship with recipient							
Positive effect on relationship with recipient ^a	75	Neutral ^a	22	Negative effect on relationship with recipient ^a	2	1	
Feel closer to the recipient ^b	79	Neutral ^b	9	Feel less close to the recipient ^b	11	1	
Donor does not think the recipient feels indebted ^b	55	Neutral ^b	17	Donor thinks the recipient feels indebted ^b	28	1	
Recipient shows adequate gratitude ^b	88	Neutral ^b	5	Recipient does not show adequate gratitude ^b	7	1	
Perceived experience							
Good, very good, or excellent overall donation experience	95	Neutral	NA	Fair or poor donation experience	5	1	
Comfortable with decision to donate	96	Neutral	2	Uncomfortable with decision to donate	1	1	
Would donate again if possible	94	Neutral	3	Would not donate again	1	1	
Donor disagrees that he/she sometimes wishes he/she would not have donated	93	Neutral	3	Donor agrees with statement “I sometimes wish I would not have donated.”	4	1	
Positive effect on recipient’s general health ^a	92	Neutral ^a	3	Negative impact on recipient’s general health ^a	4	1	
Positive effect on relationships with other people involved in the donation	59	Neutral	38	Negative effect on relationships with other people involved in the donation	3	1	
Positive effect on donor’s own life	56	Neutral	42	Negative effect on donor’s own life	2	<1	
Positive effect on donor’s view of him/herself as a person	50	Neutral	49	Negative effect on donor’s view of self as a person	1	<1	
Positive effect on donor’s meaning of life	65	Neutral	33	Negative effect on donor’s meaning of life	<1	1	

Percentages do not include unknown values, responses of “I don’t know,” and NA (not applicable) questions; when the numbers do not add up to 100% within a row, some responses were unknown and/or missing.

^aAmong donors to whom the questions were applicable.

^bAmong donors whose recipients were alive at the time of the questionnaire.

Table 3. Results of multivariable models predicting donation related outcomes			
Outcome/Predictors (with Ordered Response Options)	Estimate or OR (95% CI)	P Value	Model Fit
Reasons for donating (reference group is "I volunteered to donate on my own")^a			C-statistic=NA
Response: "I was asked by someone other than my recipient"			
Time since donation, per 10 yr	1.71 (1.41–2.08)	<0.001	
Male (ref: female)	1.62 (1.08–2.44)	0.02	
Relation to recipient: parent, child, sibling, spouse, other relative (ref: not related)	1.33 (0.59–3.01)	0.50	
Response: "I was asked by my recipient"			
Time since donation, per 10 yr	1.20 (1.07–1.34)	0.001	
Male (ref: female)	1.49 (1.20–1.85)	<0.001	
Relation to recipient: parent, child, sibling, spouse, other relative (ref: not related)	2.18 (1.42–3.35)	<0.001	
Overall recovery time (<3 mo, 3–6 mo, >6 mo, never recovered)			R ² =0.01
Race: white (ref: nonwhite)	−0.13 (−0.22 to −0.04)	0.005	
Surgical procedure: laparoscopic (ref: open)	−0.10 (−0.15 to −0.05)	<0.001	
Recovery time for daily activities (<3 mo, 3–6 mo, >6 mo, never returned to usual activities)			R ² =0.02
Race: white (ref: nonwhite)	−0.16 (−0.21 to −0.11)	<0.001	
Educational attainment at donation	−0.02 (−0.03 to 0.00)	0.009	
Recovery time compared with expectations (much shorter than, somewhat shorter than, about as long as, somewhat longer than, much longer than I expected)			R ² =0.02
Age at donation, per 10 yr	0.44 (0.19–0.68)	0.004	
Age at donation, per 10 yr, squared	−0.06 (−0.09 to −0.03)	<0.001	
Male (ref: female)	−0.15 (−0.24 to −0.05)	0.002	
Surgical procedure: laparoscopic (ref: open)	−0.24 (−0.34 to −0.14)	<0.001	
Felt supported by friends and family (strongly disagree, disagree, unsure, agree, strongly agree)			R ² =0.02
Time since donation, per 10 yr	−0.07 (−0.11 to −0.04)	<0.001	
Relation to recipient: parent, child, sibling, spouse, other relative (ref: not related)	0.17 (0.07–0.27)	<0.001	
Donor had at least one emotional, psychological, or substance abuse difficulty after donation	−0.39 (−0.54 to −0.23)	<0.001	
Felt supported by health care providers (strongly disagree, disagree, unsure, agree, strongly agree)			R ² =0.04
Age at donation, per 10 yr	0.07 (0.03–0.11)	0.001	
Male (ref: female)	0.16 (0.07–0.26)	0.001	
Donor had at least one medical complication after donation	−0.31 (−0.43 to −0.19)	<0.001	
Donor had at least one emotional, psychological, or substance abuse difficulty after donation	−0.68 (−0.90 to −0.45)	<0.001	
Felt no one paid attention (strongly disagree, disagree, unsure, strongly agree, agree)			R ² =0.03
Donor had at least one medical complication after donation	0.27 (0.17–0.37)	<0.001	
Donor had at least one emotional, psychological, or substance abuse difficulty after donation	0.66 (0.47–0.85)	<0.001	
Feels closer to the recipient since donating (of donors with living recipients) (strongly disagree, disagree, unsure, strongly agree, agree)			R ² =0.04
Age at donation to per 10 yr	0.08 (0.03–0.13)	0.001	
Donor had at least one emotional, psychological, or substance abuse difficulty after donation	−0.58 (−0.87 to −0.28)	<0.001	
Donor type: Parent (ref: other unrelated)	0.56 (0.33–0.79)	<0.001	
Child	0.61 (0.35–0.88)	<0.001	
Sibling	0.35 (0.13–0.57)	0.002	
Spouse	0.55 (0.29–0.81)	<0.001	
Other	0.33 (0.05–0.62)	0.02	
Friend	0.46 (0.20–0.73)	<0.001	

Outcome/Predictors (with Ordered Response Options)	Estimate or OR (95% CI)	P Value	Model Fit
Thinks recipient feels indebted (strongly disagree, disagree, unsure, strongly agree, agree)			$R^2=0.05$
Donor type: Parent (ref: other unrelated)	-0.69 (-0.97 to -0.41)	<0.001	
Child	-0.28 (-0.60 to 0.04)	0.08	
Sibling	-0.22 (-0.48 to 0.05)	0.11	
Spouse	-0.42 (-0.74 to -0.11)	0.01	
Other	-0.26 (-0.60 to 0.09)	0.14	
Friend	-0.02 (-0.34 to 0.31)	0.93	
Donor kidney is no longer functioning for the recipient (ref: is functioning)	-0.32 (-0.47 to -0.16)	<0.001	
Thinks recipient does not show enough gratitude (strongly disagree, disagree, unsure, agree, strongly agree)			$R^2=0.06$
Age at donation, per 10 yr	-0.09 (-0.13 to -0.04)	<0.001	
Donor had at least one medical complication after donation	0.32 (0.20–0.44)	<0.001	
Donor had at least one emotional, psychological, or substance abuse difficulty after donation	0.63 (0.36–0.90)	<0.001	
Donor type: Parent (ref: other unrelated)	-0.24 (-0.45 to -0.03)	0.02	
Child	-0.33 (-0.58 to -0.09)	0.007	
Sibling	-0.13 (-0.33 to 0.06)	0.09	
Spouse	-0.03 (-0.27 to 0.21)	0.79	
Other	-0.17 (-0.42 to 0.09)	0.20	
Friend	-0.25 (-0.50 to -0.01)	0.04	
Overall donation experience (poor, fair, good, very good, excellent)			$R^2=0.11$
Time since donation, per 10 yr	-0.05 (-0.09 to -0.01)	0.008	
Donor had at least one medical complication after donation	-0.49 (-0.57 to -0.40)	<0.001	
Donor had at least one emotional, psychological, or substance abuse difficulty after donation	-0.93 (-1.09 to -0.76)	<0.001	
Donor kidney is no longer functioning for the recipient (ref: is functioning)	-0.11 (-0.18 to -0.04)	0.003	
If possible, would donate again (definitely not, probably not, not sure, probably yes, definitely yes)			$R^2=0.04$
Time since donation, per 10 yr	-0.04 (-0.06 to -0.01)	0.003	
Race: white (ref: non-white)	0.14 (0.05–0.22)	0.002	
Relation to recipient: parent, child, sibling, spouse, other relative (ref: not related)	0.10 (0.03–0.17)	0.005	
Donor had at least one medical complication after donation	-0.09 (-0.15 to -0.03)	0.002	
Donor had at least one emotional, psychological, or substance abuse difficulty after donation	-0.44 (-0.55 to -0.33)	<0.001	
Difficulty paying monthly household bills^a (no, yes)			C-statistic=0.75
Age at donation, per 10 yr	0.62 (0.51–0.75)	<0.001	
Time since donation, per 10 yr	0.75 (0.60–0.93)	0.009	
Educational attainment at donation	0.58 (0.46–0.73)	<0.001	
Donor had at least one medical complication after donation	2.21 (1.46–3.34)	<0.001	
Donor had at least one emotional, psychological, or substance abuse difficulty after donation	4.30 (2.48–7.46)	<0.001	
Donation caused a financial burden (no burden, little burden, moderate burden, great burden, extreme burden)			$R^2=0.07$
Age at donation, per 10 yr	-0.05 (-0.07 to -0.02)	<0.001	
Educational attainment at donation	-0.06 (-0.08 to -0.03)	<0.001	
Donor had at least one medical complication after donation	0.18 (0.11–0.25)	<0.001	
Donor had at least one emotional, psychological, or substance abuse difficulty after donation	0.65 (0.52–0.78)	<0.001	

Table 3. (Continued)			
Outcome/Predictors (with Ordered Response Options)	Estimate or OR (95% CI)	P Value	Model Fit
Poor psychosocial outcome (defined as having at least one of the following: fair/poor overall donation experience; great/extreme financial burden due to donation; probably/definitely not donate again; emotional, psychological or substance abuse use difficulty due to donation; or discomfort with decision to donate)^a			C-statistic=0.57
Donor kidney is no longer functioning for the recipient (ref: functioning)	1.77 (1.33–2.34)	<0.001	
OR, odds ratio; 95% CI, 95% confidence interval; ref, reference; NA, not available.			
^a Modeled using binary logistic or multinomial logistic regression; statistics reported are ORs and 95% CIs. Models not marked with the "a" footnote used linear regression, and statistics reported are β coefficients and 95% CIs. When assessing the fit of a binary (but not available for multinomial) logistic regression, a c-statistic of 0.5 indicates prediction no better than chance, whereas a c-statistic of 1.0 indicates perfect prediction of the outcome. Multinomial logistic regressions do not provide a c-statistic. In linear regression, R^2 is the proportion of variance of the outcome that is explained by the predictor variables; R^2 ranges between 0 (no prediction) and 1 (perfect prediction). Estimates from linear regressions can be interpreted as the difference in the outcome per one-unit higher value in the predictor. For instance, the -0.13 estimate for race in the model predicting overall recovery time indicates that white donors recovered 1/8 point faster on a 4-point scale relative to nonwhite donors. Without adjustment for surgical procedure, 74% of white donors recovered within 3 months, compared with 67% of nonwhite donors. ORs can be interpreted as the difference in the odds of the outcome, per one unit higher value in the predictor. For example, the odds of donors with at least one medical complication having difficulty paying household bills are 121% higher (OR, 2.21) than the odds of donors without a medical complication having difficulty paying household bills.			

were unsure. Older donors ($\beta=0.07$; 95% CI, 0.03 to 0.11) and men ($\beta=0.16$; 95% CI, 0.07 to 0.26) felt more support from health care providers. Nine percent agreed that "nobody paid much attention" to them after donation. Donors reporting postoperative medical complications ($\beta=-0.31$; 95% CI, -0.43 to -0.19) or emotional difficulties ($\beta=-0.68$; 95% CI, -0.90 to -0.45) were less likely to feel support from health care providers.

Current Donor-Recipient Relationship

Most donors (75%) felt that donation had positively influenced their relationship with their recipient (Table 2). Of donors whose recipient was still alive, most (79%) felt closer to them, 28% believed their recipients felt indebted to them, and 7% believed their recipient did not show enough gratitude.

Predictors of outcomes regarding the donor-recipient relationship are shown in Table 3. Respondents who were older at donation felt closer to their recipient after nephrectomy ($\beta=0.08$; 95% CI, 0.03 to 0.13) and were less likely to feel that their recipient did not show enough gratitude ($\beta=-0.09$; 95% CI, -0.13 to -0.04).

Feeling closer to the recipient was less common among donors experiencing emotional difficulty after donation ($\beta=-0.58$; 95% CI, -0.87 to -0.28). Donors were more inclined to feel that their recipient did not adequately show gratitude if they experienced a medical complication ($\beta=0.32$; 95% CI, 0.20 to 0.44) or emotional difficulty ($\beta=0.63$; 95% CI, 0.36 to 0.90) after donation. Donors who were offspring ($\beta=0.61$; 95% CI, 0.35 to 0.88), parents ($\beta=0.56$; 95% CI, 0.33 to 0.79), siblings ($\beta=0.35$; 95% CI, 0.13 to 0.57), spouses ($\beta=0.55$; 95% CI, 0.29 to 0.81), or friends ($\beta=0.46$; 95% CI, 0.20 to 0.73) claimed that their

relationship with their recipient grew stronger compared with unrelated donors (Table 3).

Parental ($\beta=-0.69$; 95% CI, -0.97 to -0.41) and spousal ($\beta=-0.42$; 95% CI, -0.74 to -0.11) donors were least likely to think their recipient felt indebted; children who donated to parents felt their recipients showed gratitude ($\beta=-0.33$; 95% CI, -0.58 to -0.09). Donors whose recipients had a graft that no longer functioned reported that the recipients felt less indebted than recipients with graft function or whose graft status was unknown ($\beta=-0.32$; 95% CI, -0.47 to -0.16).

Perceived Overall Experience

Most donors (95%) rated their overall donor experience as good to excellent (Supplemental Figure 3). Table 3 demonstrates that donors with medical complications ($\beta=-0.49$; 95% CI, -0.57 to -0.40) or emotional difficulty ($\beta=-0.93$; 95% CI, -1.09 to -0.76) and those who donated longer ago ($\beta=-0.05$; 95% CI, -0.09 to -0.01) rated their experience more negatively. Donors whose graft still functioned or who did not know the graft status were the most positive about their overall donation experience ($\beta=-0.11$; 95% CI, -0.18 to -0.04).

Most (96%) were comfortable with their decision to donate; 94% would donate again, but 1.2% would probably, or definitely, not donate again. The decision to donate was more often affirmed by white donors ($\beta=0.14$; 95% CI, 0.05 to 0.22) and by related donors ($\beta=0.10$; 95% CI, 0.03 to 0.17) (Table 3). Those less likely to affirm their donation decision were donors with a medical complication ($\beta=-0.09$; 95% CI, -0.15 to -0.03), an emotional difficulty ($\beta=-0.44$; 95% CI, -0.55 to -0.33), or donated longer ago ($\beta=-0.04$; 95% CI, -0.06 to -0.01) (Table 3).

Donors felt donation had positive effects on their recipient's general health (92%), their own meaning of life (65%), and self-perception (50%) (Supplemental Figure 4).

Financial Experience

Some donors (5%) reported problems paying routine monthly household bills (Table 4). Donation caused financial burden to 20% of donors. Greater financial problems were more likely in those with medical complications ($\beta=0.18$; 95% CI, 0.11 to 0.25) or emotional difficulty ($\beta=0.65$; 95% CI, 0.52 to 0.78). Problems covering monthly bills were more likely in recent donors (OR, 0.75; 95% CI, 0.60 to 0.93). Older donors and those with higher education were less likely to have difficulty paying household bills (OR, 0.62 [95% CI, 0.51 to 0.75] and 0.58 [95% CI, 0.46–0.73], respectively) and experienced less financial burden ($\beta=-0.05$ [95% CI, -0.07 to -0.02] and -0.06 [95% CI, -0.08 to -0.03], respectively).

Nearly 20% of donors (18.8%) took unpaid work leave. Some reported negative impacts on insurability: 1.8% were denied health insurance and 2.1% were denied life insurance (Table 4). Problems paying donor-related medical bills were reported by 1.7%.

Predictors of Poor Psychosocial Outcome

Separately from rating just the overall donor experience (above), we defined a poor psychosocial outcome as when one or more of the following was reported: (1) fair or poor overall donation experience ($n=114$); (2) great or extreme financial burden due to donation ($n=45$); (3) probably or definitely would not donate again ($n=29$); (4) emotional, psychological, or substance use difficulty because of donation ($n=99$); or (5) somewhat or very uncomfortable with decision to donate ($n=27$). In total, 231 donors (9%) met this definition. Of these, 172 (74%) reported a single area, 42 (18%) reported two, 10 (4%) reported three, seven (3%) reported four, and no donor experienced all five. Nearly half (49%) of the donors (114 of 231) with a poor psychosocial outcome by this composite variable rated their overall donation experience as fair or poor. The only factor associated with the composite poor psychosocial outcome variable was recipient graft failure (OR, 1.77; 95% CI, 1.33 to 2.34) (Table 3).

Discussion

Our results reaffirm that most living kidney donors had a positive donor experience, were satisfied with their decision to donate, didn't feel pressured, and were not negatively affected over time. Nevertheless, some reported adverse psychosocial and financial consequences related to donation.

A few donors felt pressure to donate; they were more likely to be siblings, consistent with prior reports (9,23,29,30). Unrelated donors felt pressure not to donate. Resistance to donation by others may occur when individuals don't know their recipient or are without direct attachment or benefit (31,32). Assessing levels of pressure in these two groups might be heightened.

Fewer than 10% of donors experienced one or more of the negative psychosocial or financial consequences that made up our definition of poor psychosocial outcome, and

Table 4. Donors reporting financial issues related to donation

Because of donation. . .	Yes, %
My health insurance premium increased	1.2
I was denied health insurance	1.8
My life insurance premium increased	1.7
I was denied life insurance	2.1
I had problems paying medical bills	1.7
I had problems paying household/routine monthly bills	4.8
I took unpaid leave from work	18.8
Percentages among donors with nonmissing data.	

recipient graft failure, the only predictor of this composite outcome, is unknown before donation.

In addition, unrelated donors and those with emotional difficulty after donation were more likely to feel unsupported. The finding regarding unrelated donors is crucial because living donor transplants among individuals with no prior relationship to their recipient continue to increase (e.g., public solicitations, nondirected donations).

The Organ Procurement and Transplantation Network policy requires that centers complete follow-up surveys on each donor (33). Data related to medical/psychological complications, lifestyle changes, and financial impact can be collected simultaneously. Enriching national donor data after donation could allow for tailored donor follow-up.

Lost wages and unpaid time off (affecting nearly 20% of this sample) should be addressed. Donor reimbursement programs might consider the direction of the National Bone Marrow Program, which covers donor-associated travel expenses for donors and a companion, regardless of economic status (34). Klarenbach *et al.* quantified donor expenses and recommended cost neutrality options (35), while LaPointe *et al.* suggested ways to financially support donors (36).

Of concern, 38% of our cohort did not feel supported by hospital staff. Donors with postoperative complications felt ignored by both hospital staff and family, similar to other studies reporting that donors "feel forgotten" after donation (3,8,11,16,18,37,38). Our study reinforces on a grander scale the need for improved attention afterward.

One in 20 donors experienced a moderate to extreme financial burden attributable to donation. After donation, 19% took unpaid leave—in effect, a fiscal donation and additional sacrifice on their part. Reimer *et al.* reported that 25% of donors needed to resume work before feeling fully rehabilitated, an observation similar to ours (11). Those with medical or emotional complications, and those with lower education attainment, were more likely to report problems paying household bills because of donation.

Apart from direct and indirect costs, donors find future insurability a stressor (40,41). Yang *et al.* reported that 2%–11% of donors had problems obtaining insurance after donation (17). In our study, some respondents were denied health or life insurance (1.8% and 2.1%, respectively). Given the demographic characteristics of respondents versus nonrespondents, we believe those are an underestimate: More nonrespondents were from groups (younger,

male, and ethnic minorities) that are less likely to have health insurance at donation (42). Additionally, lack of health insurance may impede some from seeking medical or psychological follow-up.

Recipient graft failure was a statistically significant predictor of the composite poor psychosocial outcome, consistent with reports from smaller studies (8). Tong and colleagues' review verified that "the donor's well-being 'depended' on the well-being of the recipient," and feelings of regret, sense of loss, or psychiatric complications were reported when the recipient died or had a poor outcome (43).

Our study provides information on the largest number of donors to date and extends over five decades. However, there are limitations. First, our data are limited to information from three large transplant centers. Second, response rates were less than ideal; differences between respondents and nonrespondents exist. Donors with similar demographic characteristics might not respond at different points in their lives for various reasons; information from previous time points was unavailable for donors who had died. Therefore, response and survival bias are obvious limitations. Third, recall bias is an inherent limitation of any study with this design, and donors might not be accurately recalling items directly related to donation but rather might be thinking of current life circumstances. Fourth, we chose not to test for center effects, in part because we were interested in testing for racial differences and race was somewhat confounded with center. In addition, we had no hypotheses regarding center-level differences on donor outcomes and did not collect center-level data that could be used to explain differences. Finally, only 6% of participants were nonwhite. Participants may not represent regional or national living donor demographics over the same time span because response rates were lower in the nonwhite subgroup.

Our data support the following recommendations to improve psychosocial outcomes for donors:

The hospital should enhance their support of donors, especially those with postoperative complications.

Donor programs should give additional consideration to donors whose recipient's graft has failed, and to those who are unrelated or experiencing emotional difficulty.

Tailored donor follow-up to improve the donor's psychosocial well-being should be studied. The Centers for Medicare & Medicaid Services could incorporate psychosocial/financial status questions into existing follow-up interval surveys (beyond medical follow-up) to determine (and prioritize) areas needing attention.

A donor financial plan addressing income concerns should be confirmed before donation to minimize economic distress postdonation. Further studies should be conducted that deal with promoting cost neutrality.

In conclusion, the RELIVE cohort of donors spanning 50 years indicates that the majority had a positive donation experience. Rating the overall donation experience more negatively was associated with recipient graft failure, donor medical complications or emotional difficulty, and having donated longer ago. Recipient graft failure was the only statistically significant predictor of poor psychosocial

outcome, as defined in this study. In addition, some donors were financially disadvantaged. Enhanced postdonation monitoring and attention to donors at greater psychosocial risk may improve long-term donor outcomes.

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None.

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