Donor Health After Kidney Donation

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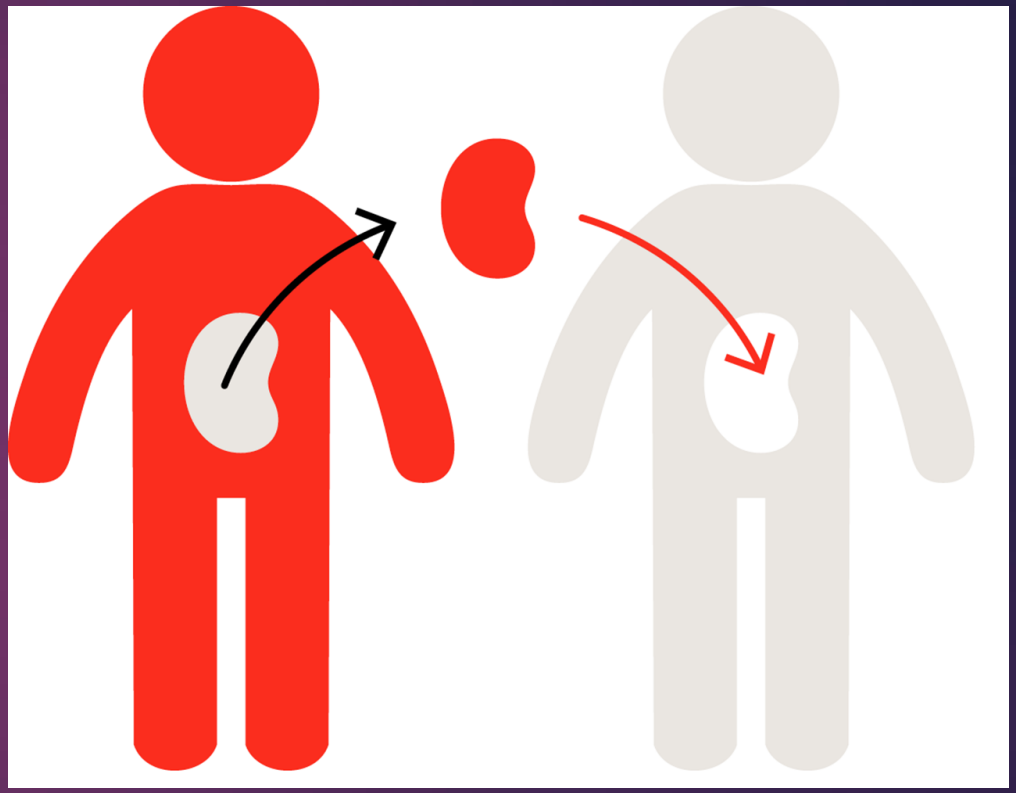
Outline

- Immediate risk
- Long-term risk:
  - Mortality and cardiovascular disease
  - End-stage renal disease
  - Hypertension
  - Maternal and fetal outcomes
  - Gout
  - Metabolic diseases
  - Malignancy
  - Risk among older donors
  - Psychosocial outcomes
- FOLLOW-UP AFTER KIDNEY DONATION

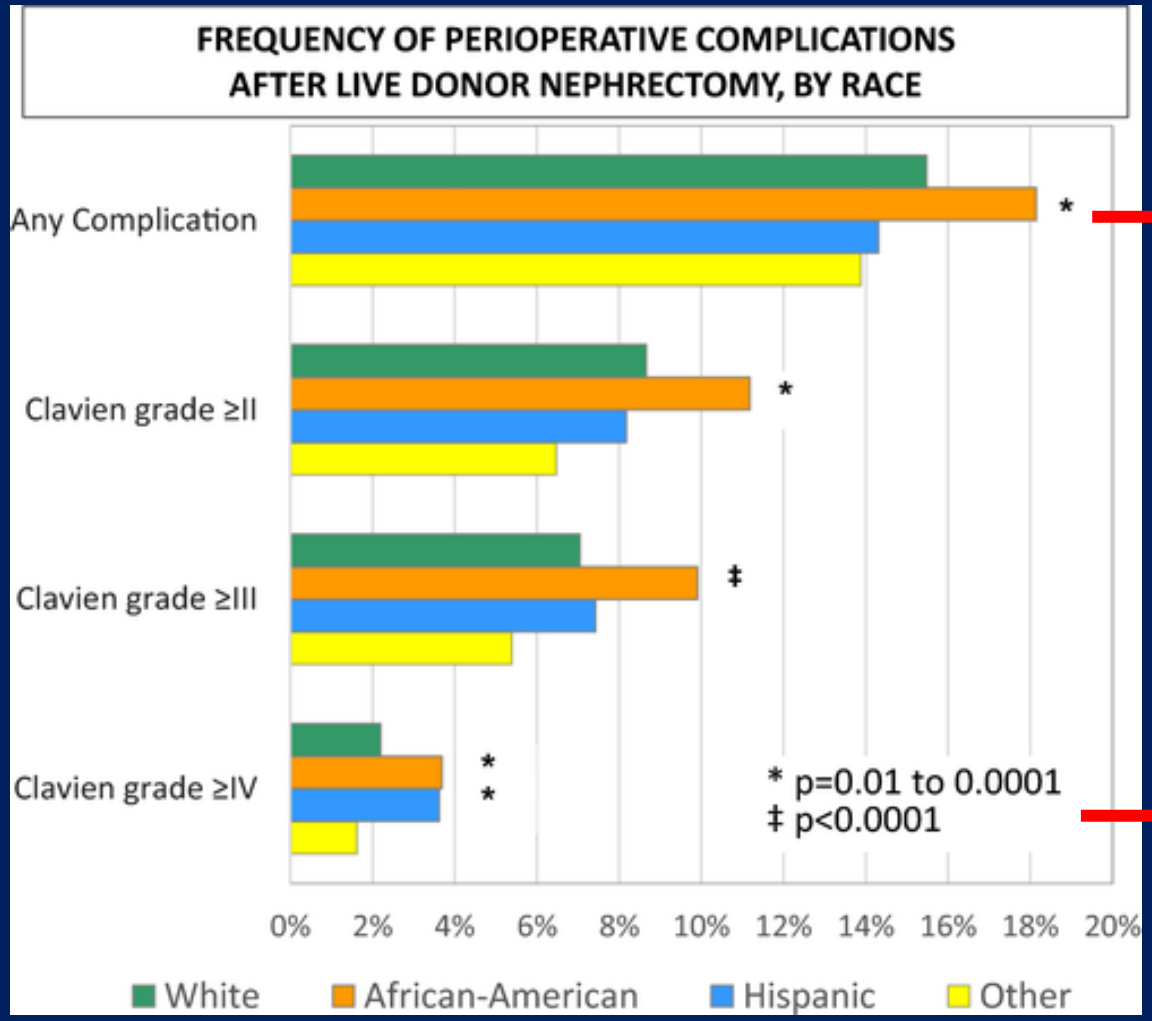
Immediate risk of kidney donation



Immediate risk

- Hemorrhage
- Ileus
- Pneumothorax
- Pneumonia
- Urinary tract infection
- Wound complications including hernia
- DVT
- Death

Perioperative Complications After Living Kidney Donation: A National Study



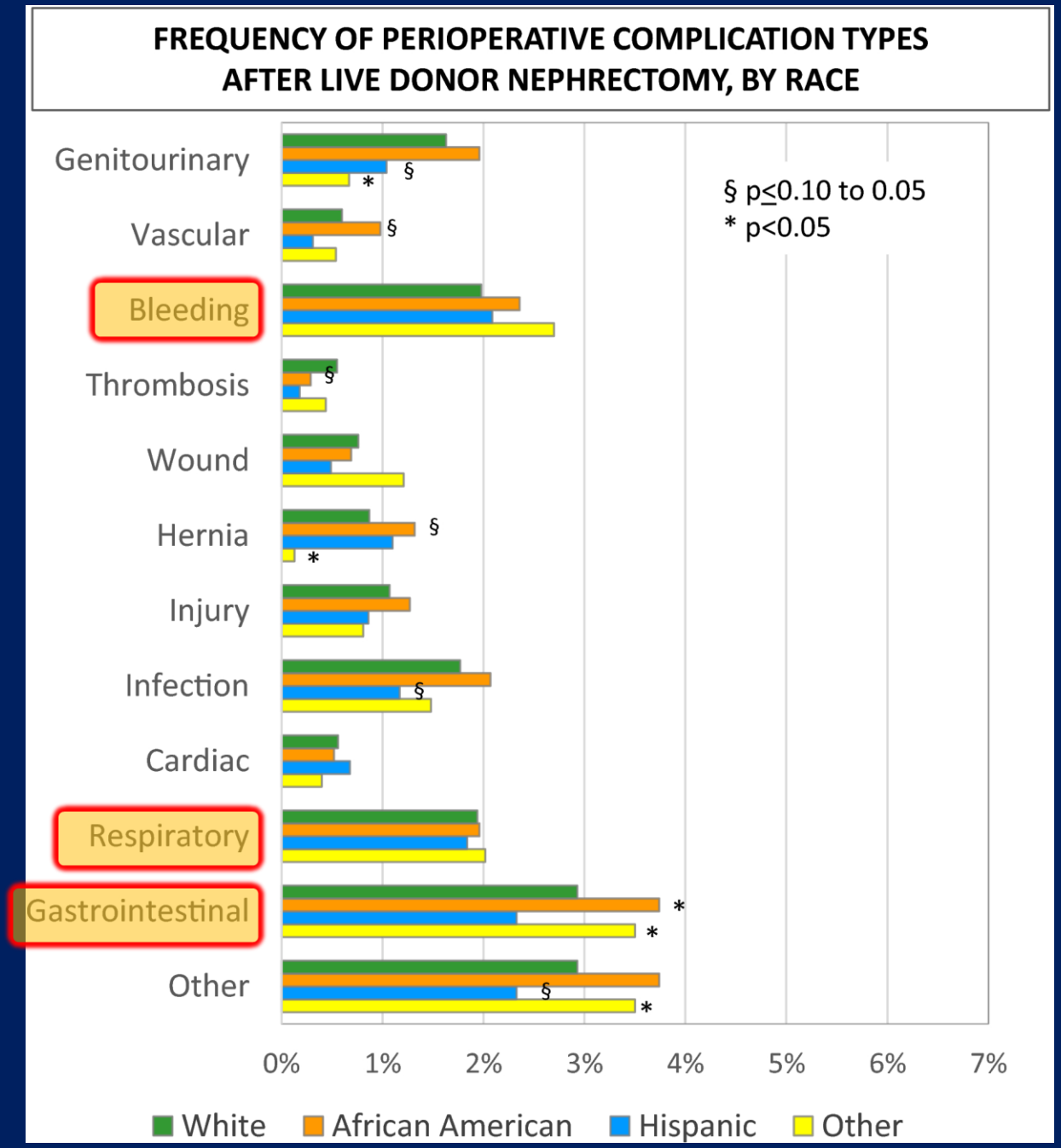
16.8 % of donors experienced a perioperative complication

Major complications affected only 2.5 % of donors.

American Journal of Transplantation, Volume: 16, Issue: 6, Pages: 1848-1857, First published: 23 December 2015

Perioperative Complications After Living Kidney Donation: A National Study

Among 14 964 living kidney donors



American Journal of Transplantation, Volume: 16, Issue: 6, Pages: 1848-1857, First published: 23 December 2015, DOI: (10.1111/ajt.13687)

Table 2: Adjusted associations of baseline characteristics with risk and severity of perioperative complications in living kidney donors

Demographic trait	Any complication	Clavien grade II or higher	Clavien grade III or higher	Clavien grade IV or higher
	aOR (95% CI)			
Age at donation (per year)	1.01 (1.01–1.01)‡	1.01 (1.01–1.02)‡	1.01 (1.01–1.02)‡	1.01 (1.00–1.02)
Female	0.86 (0.78–0.94)*	0.94 (0.83–1.06)	0.96 (0.84–1.09)	0.88 (0.71–1.10)
Race				
White	Reference	Reference	Reference	Reference
African American	1.26 (1.10–1.45)*	1.39 (1.17–1.65)†	1.56 (1.30–1.88)‡	1.56 (1.15–2.11)*
Hispanic	1.01 (0.86–1.18)	1.04 (0.85–1.27)	1.20 (0.98–1.48)	1.69 (1.24–2.31)†
Other	0.94 (0.75–1.17)	0.79 (0.58–1.07)	0.83 (0.59–1.15)	0.77 (0.43–1.39)
Donor–recipient relationship				
First-degree relative	Reference	Reference	Reference	Reference
Other biological relative	0.94 (0.79–1.12)	0.89 (0.70–1.12)	0.87 (0.67–1.13)	0.83 (0.54–1.27)
Unrelated	1.00 (0.91–1.10)	1.04 (0.92–1.18)	1.04 (0.91–1.19)	0.94 (0.75–1.17)
Donor health insurance				
Insured	Reference	Reference	Reference	Reference
Uninsured	1.07 (0.93–1.24)	1.03 (0.85–1.25)	0.97 (0.79–1.20)	0.97 (0.68–1.39)
Missing	1.25 (1.10–1.41)†	1.75 (1.51–2.03)‡	1.36 (1.15–1.61)†	2.06 (1.60–2.65)‡
Body mass index, kg/m^2				
Nonobese (<30)	Reference	Reference	Reference	Reference
Obese (≥30)	1.05 (0.92–1.18)	1.20 (1.03–1.39)*	1.20 (1.02–1.41)*	1.55 (1.21–1.98)†
Missing	1.05 (0.93–1.19)	0.92 (0.78–1.08)	0.94 (0.79–1.13)	0.64 (0.45–0.92)*
Physical capacity				
No limitations	Reference	Reference	Reference	Reference
Limitations	1.12 (0.57–2.18)	0.91 (0.36–2.30)	0.69 (0.21–2.22)	1.21 (0.28–5.25)
Missing	0.83 (0.62–1.09)	0.49 (0.32–0.76)*	0.63 (0.41–0.97)*	0.10 (0.01–0.69)*
Comorbid conditions				
Hypertension	0.97 (0.84–1.11)	1.00 (0.84–1.19)	1.05 (0.87–1.26)	0.81 (0.58–1.13)
Genitourinary	1.92 (1.48–2.51)‡	2.36 (1.74–3.21)‡	2.62 (1.90–3.60)‡	1.77 (0.96–3.25)
Cardiac	0.90 (0.56–1.44)	0.98 (0.54–1.75)	0.87 (0.45–1.68)	1.25 (0.45–3.44)
Respiratory	1.12 (0.92–1.35)	1.03 (0.80–1.31)	0.92 (0.70–1.22)	1.03 (0.66–1.60)
Gastrointestinal	1.11 (0.94–1.30)	1.08 (0.88–1.32)	1.03 (0.82–1.28)	1.01 (0.70–1.47)
Hematologic	1.60 (1.18–2.18)*	1.75 (1.21–2.54)*	1.72 (1.16–2.54)*	2.78 (1.62–4.76)†
Neurologic	1.26 (0.62–2.57)	0.95 (0.37–2.43)	0.44 (0.11–1.82)	0.73 (0.10–5.33)
Endocrine	1.07 (0.93–1.23)	1.11 (0.93–1.32)	1.08 (0.90–1.31)	1.17 (0.85–1.61)
Rheumatologic	0.87 (0.36–2.14)	0.76 (0.23–2.51)	0.66 (0.16–2.77)	1.98 (0.45–8.60)
Psychiatric	1.29 (1.10–1.52)*	1.43 (1.17–1.75)†	1.52 (1.23–1.88)†	1.45 (1.01–2.08)*
Pain	1.03 (0.81–1.31)	0.92 (0.67–1.26)	0.93 (0.65–1.31)	0.89 (0.49–1.61)
Smoking	1.13 (0.97–1.31)	1.13 (0.93–1.38)	1.17 (0.95–1.45)	1.12 (0.78–1.60)
Other substance use	0.85 (0.49–1.47)	0.76 (0.36–1.59)	0.96 (0.46–2.00)	0.64 (0.15–2.65)
Procedure and center characteristics				
Nephrectomy type, intended				
Laparoscopic (nonrobotic)	Reference	Reference	Reference	Reference
Laparoscopic (robotic)	1.20 (0.90–1.59)	1.09 (0.77–1.54)	1.40 (0.99–2.00)	2.07 (1.30–3.31)*
Open	1.31 (1.06–1.64)*	0.95 (0.69–1.30)	0.85 (0.60–1.21)	1.53 (0.91–2.59)
Side of donated kidney				
Left	Reference	Reference	Reference	Reference
Right	1.02 (0.90–1.17)	0.89 (0.55–1.06)	0.87 (0.71–1.05)	0.57 (0.39–0.83)*
Payer for donation				
Commercial	0.94 (0.85–1.05)	0.78 (0.68–0.90)†	0.92 (0.80–1.07)	1.14 (0.90–1.46)
Medicare	1.05 (0.91–1.21)	1.05 (0.88–1.26)	1.18 (0.98–1.42)	1.35 (0.98–1.87)
Other	Reference	Reference	Reference	Reference
Average annual center volume				
≤10	0.85 (0.61–1.17)	0.84 (0.55–1.27)	0.78 (0.49–1.25)	0.50 (0.22–1.16)
11–50	Reference	Reference	Reference	Reference
>50	0.56 (0.51–0.61)‡	0.61 (0.54–0.69)‡	0.60 (0.53–0.68)‡	0.55 (0.44–0.68)‡
Donation year				
2008–2010	Reference	Reference	Reference	Reference
2011–2012	1.13 (1.04–1.24)*	1.27 (1.13–1.43)‡	1.30 (1.15–1.47)‡	1.69 (1.36–2.08)‡

aOR, adjusted odds ratio; CI, confidence interval.
The p-value compared with reference group: *$p < 0.05$–0.002, †$p = 0.001$–0.0001, ‡$p < 0.0001$.

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Missing	1.05 (0.93–1.19)	0.92 (0.78–1.08)	0.94 (0.79–1.13)	0.64 (0.45–0.92)*

Procedure and center characteristics				
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Open	1.31 (1.06–1.64)*	0.95 (0.69–1.30)	0.85 (0.60–1.21)	1.53 (0.91–2.59)
Side of donated kidney				
Left	Reference	Reference	Reference	Reference
Right	1.02 (0.90–1.17)	0.89 (0.55–1.06)	0.87 (0.71–1.05)	0.57 (0.39–0.83)*
Payer for donation				
Commercial	0.94 (0.85–1.05)	0.78 (0.68–0.90)†	0.92 (0.80–1.07)	1.14 (0.90–1.46)
Medicare	1.05 (0.91–1.21)	1.05 (0.88–1.26)	1.18 (0.98–1.42)	1.35 (0.98–1.87)
Other	Reference	Reference	Reference	Reference
Average annual center volume				
≤10	0.85 (0.61–1.17)	0.84 (0.55–1.27)	0.78 (0.49–1.25)	0.50 (0.22–1.16)
11–50	Reference	Reference	Reference	Reference
>50	0.56 (0.51–0.61)‡	0.61 (0.54–0.69)‡	0.60 (0.53–0.68)‡	0.55 (0.44–0.68)‡
Donation year				
2008–2010	Reference	Reference	Reference	Reference
2011–2012	1.13 (1.04–1.24)*	1.27 (1.13–1.43)‡	1.30 (1.15–1.47)‡	1.69 (1.36–2.08)‡

aOR, adjusted odds ratio; CI, confidence interval.
The p-value compared with reference group: *$p < 0.05$–0.002, †$p = 0.001$–0.0001, ‡$p < 0.0001$.

From: **Perioperative Mortality and Long-term Survival Following Live Kidney Donation**

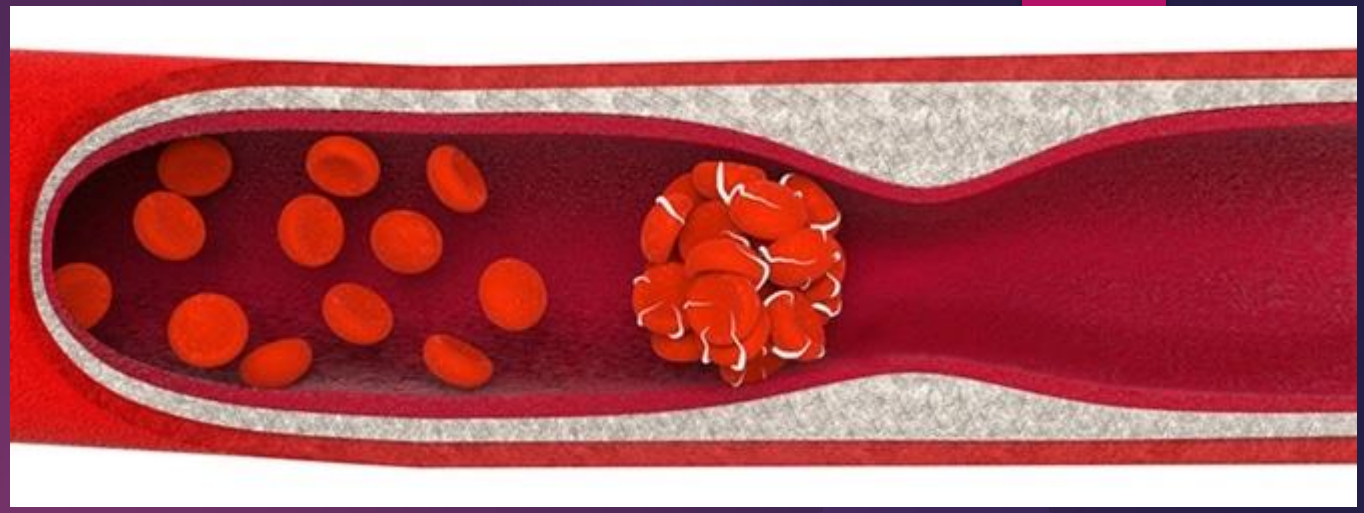
JAMA. 2010;303(10):959-966. doi:10.1001/jama.2010.237

Table 2. Death Within 3 and 12 Months of Live Donor Nephrectomy[a]

Characteristic	Within 3 Months: No. of Deaths	Within 3 Months: Rate per 10 000 Donors (95% CI)	*P* Value	Within 12 Months: Deaths	Within 12 Months: Rate per 10 000 Donors (95% CI)	*P* Value
Live donors (n = 80 347)	25	3.1 (2.0-4.6)	<.001	52	6.5 (4.8-8.5)	.11
Matched cohort (n = 80 347)	3	0.4 (0.1-1.1)		37	4.6 (3.2-6.3)	
Age, y						
18-39	12	3.0 (1.6-5.3)		24	6.1 (3.9-9.0)	.08
40-49					)	
50-59						
≥60	2	6.6 (0.8-23.9)		5	16.6 (5.4-38.7)	
Sex						
Men	17	5.1 (3.0-8.2)	.007	34	10.2 (7.1-14.2)	<.001
Women	8	1.7 (0.7-3.4)		18	3.8 (2.3-6.1)	

90-day mortality was 3.1 per 10,000 donors

Reduce the risk for thromboembolism



- Discontinue 6 weeks prior to donor nephrectomy:
  - Hormonal contraception or hormone replacement therapy
  - Estrogen-containing intrauterine devices
- Low-dose progesterone-only medications or intrauterine devices may be continued.

Wolters Kluwer
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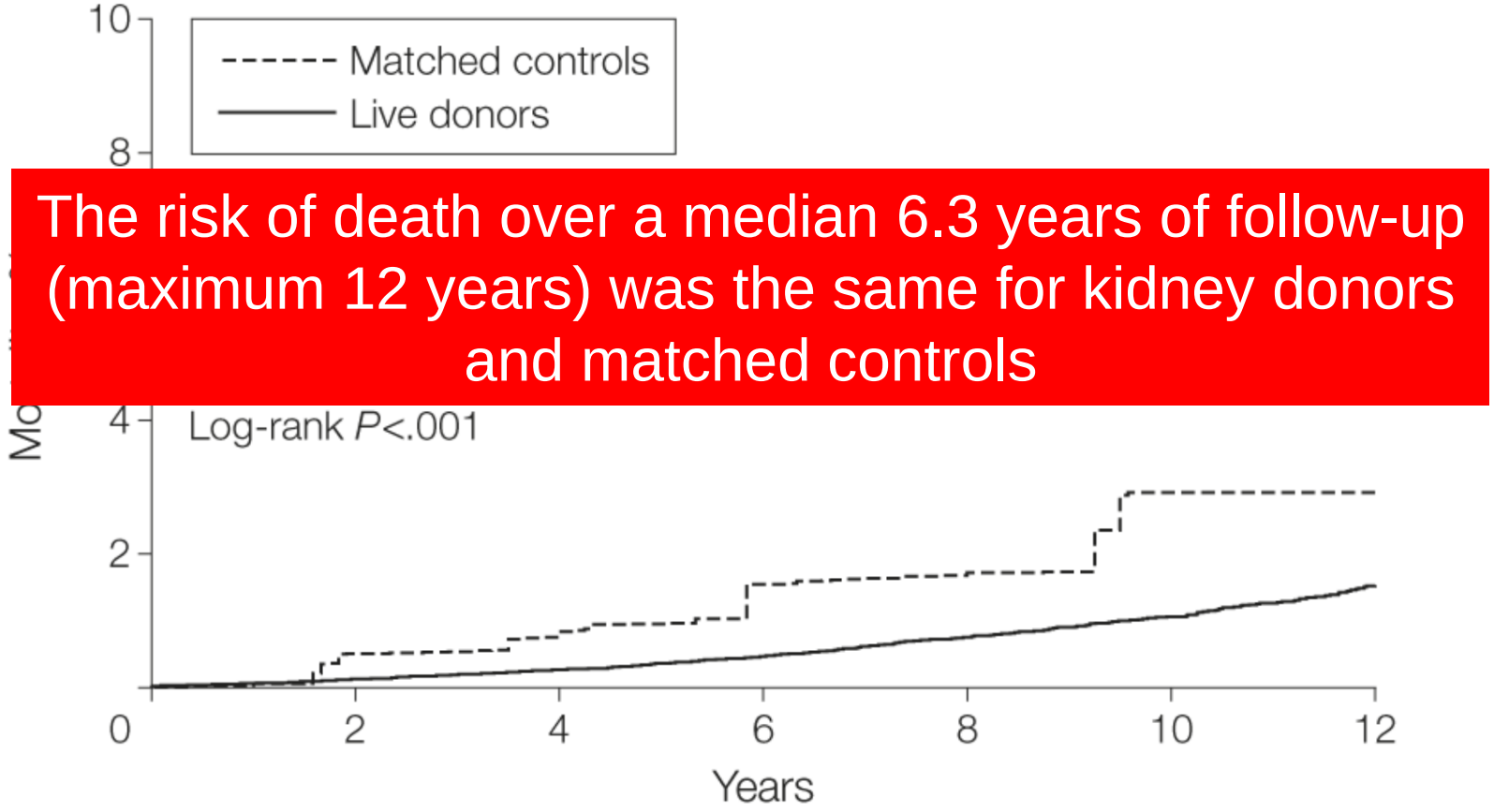
Long-term risk

Mortality and cardiovascular disease

JAMA Network

Perioperative Mortality and Long-term Survival Following Live Kidney Donation

More than 80,000 living kidney donors



The risk of death over a median 6.3 years of follow-up (maximum 12 years) was the same for kidney donors and matched controls

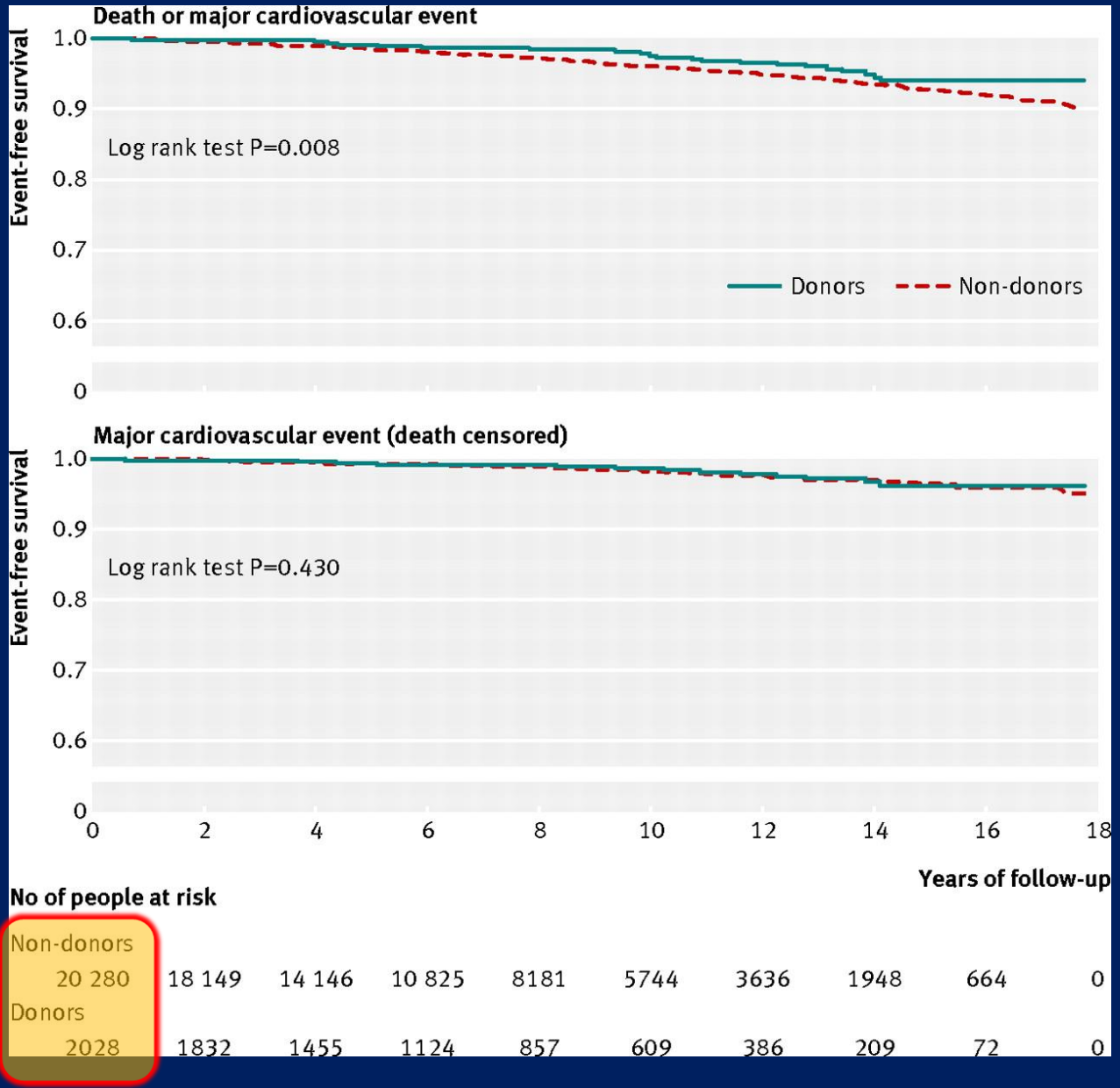
No. at risk							
Matched controls	80 347	67 966	54 998	41 679	19 259	5896	127
Live donors	80 347	68 230	55 282	42 154	29 657	18 960	10 436

JAMA. 2010;303(10):959-966. doi:10.1001/jama.2010.237

Fig 1 Kaplan-Meier estimates of survival probability without death or major cardiovascular event (top) and without major cardiovascular event (censored for death, bottom).

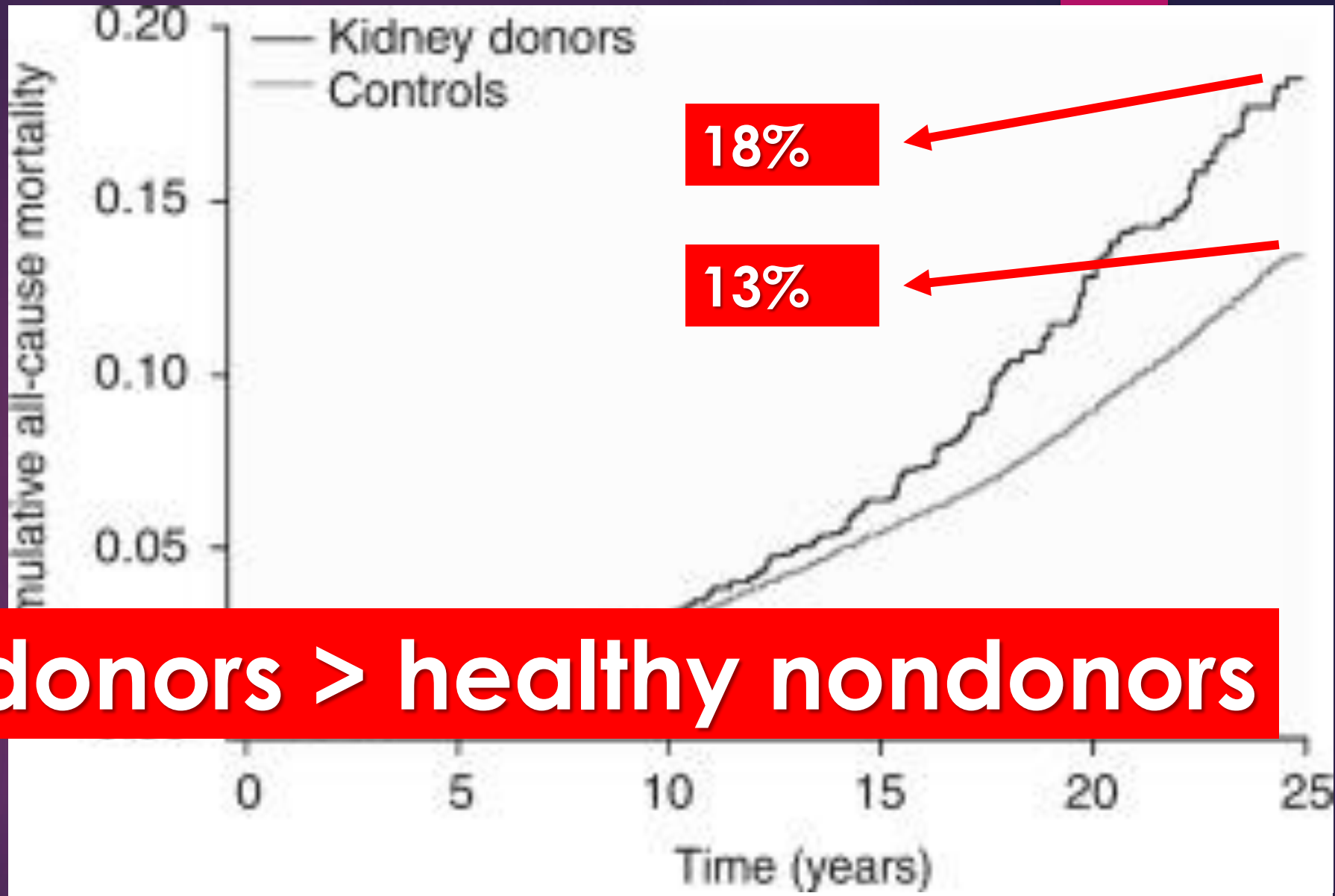
The risk of death or major cardiovascular events

donors < healthy nondonors



Amit X Garg et al. BMJ 2012;344:bmj.e1203

Cumulative mortality risk in kidney donors and controls

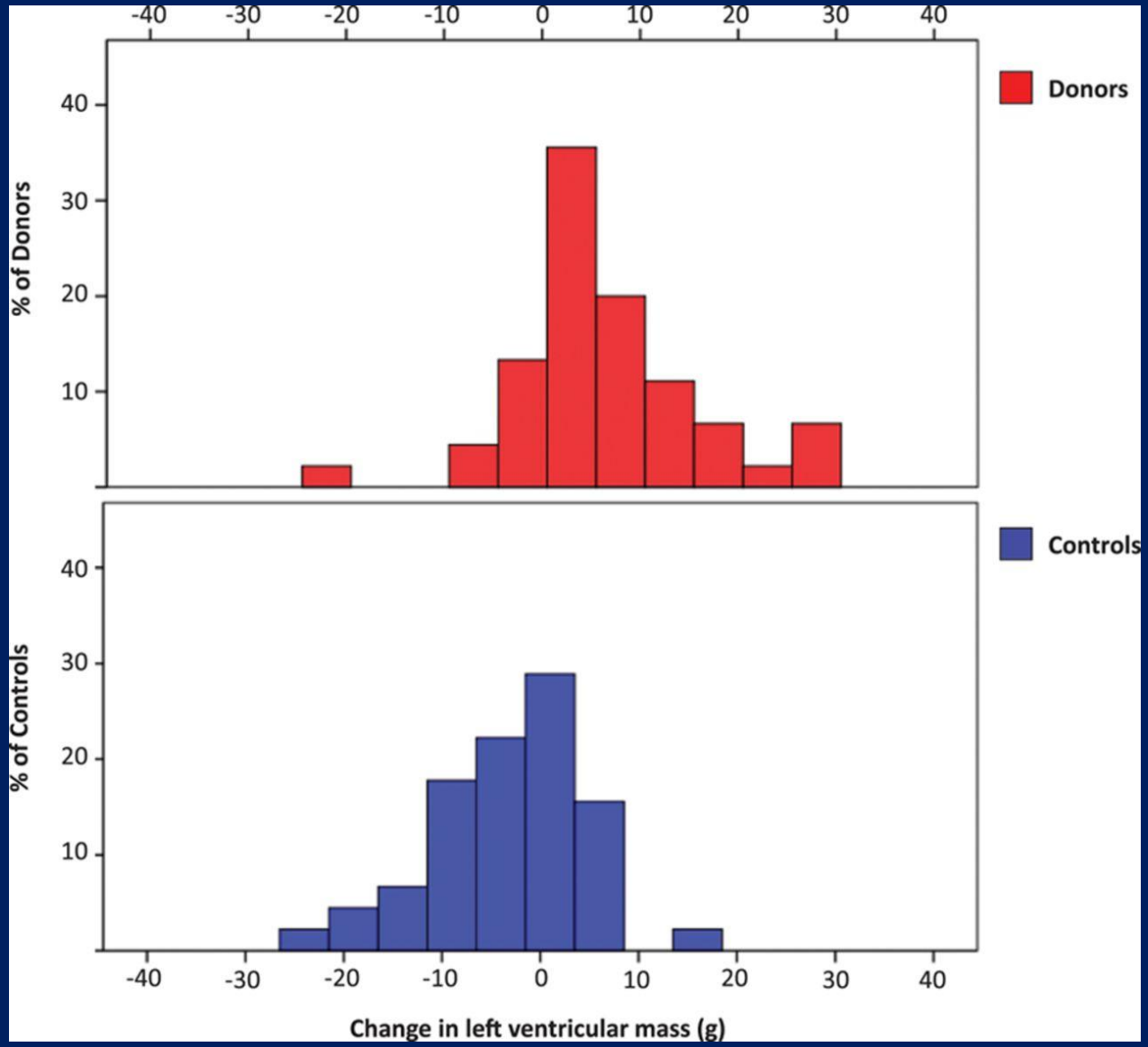


Mortality: donors > healthy nondonors

1901 kidney donors
32,621 healthy, matched controls in Norway

Cardiovascular Effects of Unilateral Nephrectomy in Living Kidney Donors.

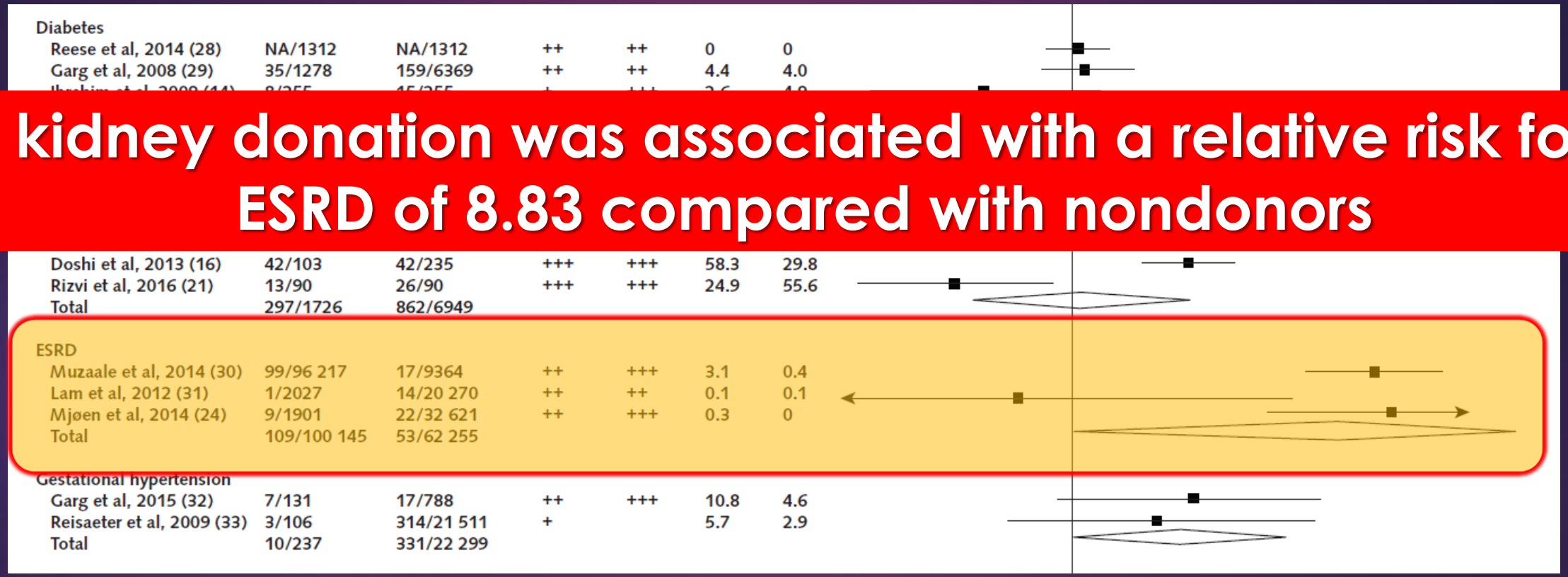
There was a significant increase in left ventricular mass in donors vs controls at 12 months.



Volume: 67, Issue: 2, Pages: 368-377, DOI: (10.1161/HYPERTENSIONAHA.115.06608)

End-stage renal disease

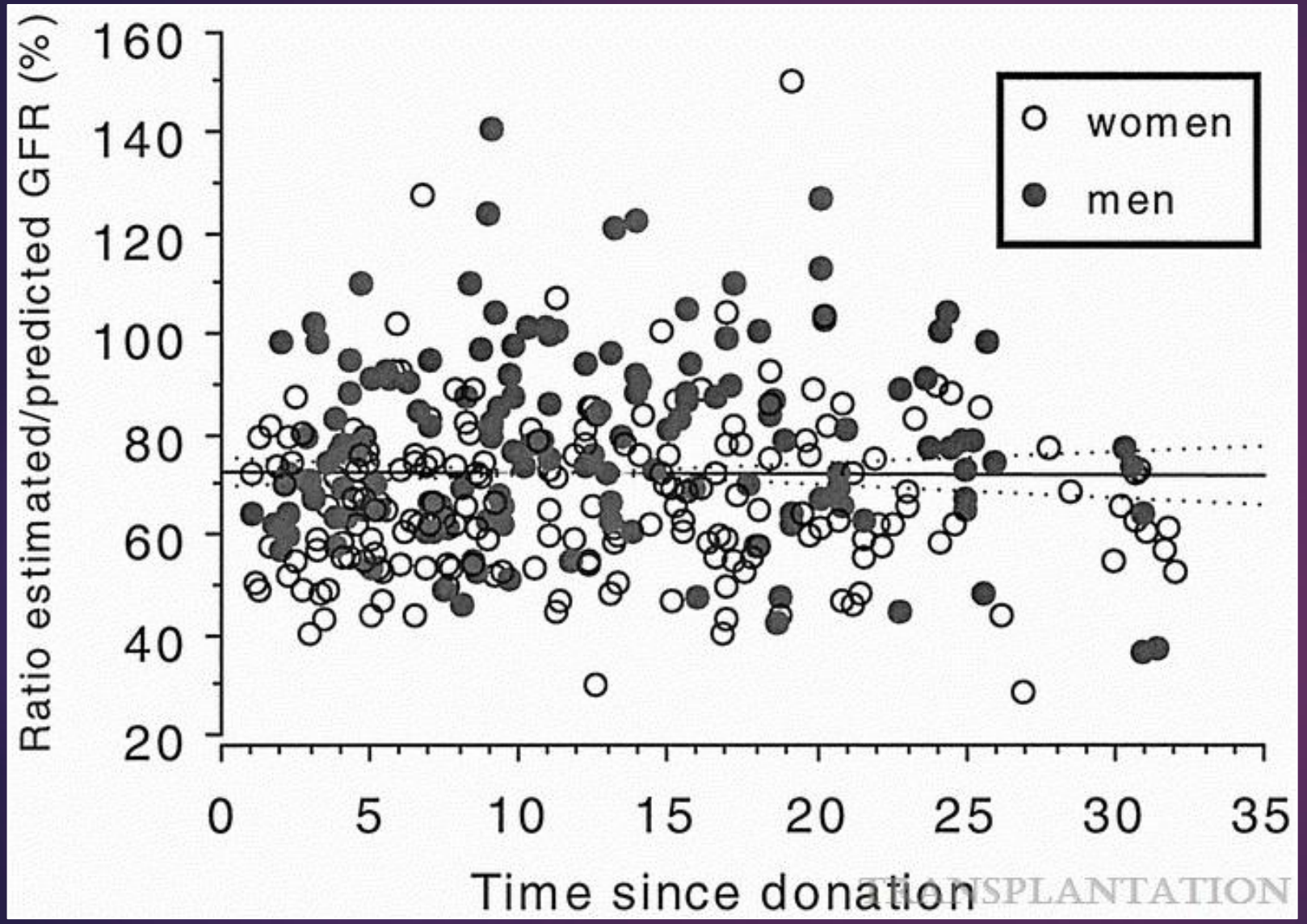
Mid- and Long-Term Health Risks in Living Kidney Donors: A Systematic Review and Meta-analysis.



Diabetes						
Reese et al, 2014 (28)	NA/1312	NA/1312	++	++	0	0
Garg et al, 2008 (29)	35/1278	159/6369	++	++	4.4	4.0
Doshi et al, 2013 (16)	42/103	42/235	+++	+++	58.3	29.8
Rizvi et al, 2016 (21)	13/90	26/90	+++	+++	24.9	55.6
Total	297/1726	862/6949				
ESRD						
Muzaale et al, 2014 (30)	99/96 217	17/9364	++	+++	3.1	0.4
Lam et al, 2012 (31)	1/2027	14/20 270	++	++	0.1	0.1
Mjøen et al, 2014 (24)	9/1901	22/32 621	++	+++	0.3	0
Total	109/100 145	53/62 255				
Gestational hypertension						
Garg et al, 2015 (32)	7/131	17/788	++	+++	10.8	4.6
Reisaeter et al, 2009 (33)	3/106	314/21 511	+		5.7	2.9
Total	10/237	331/22 299				

kidney donation was associated with a relative risk for ESRD of 8.83 compared with nondonors

Mid- and Long-Term Health Risks in Living Kidney Donors: A Systematic Review and Meta-analysis." Ann Intern Med 168(4): 276-284.



Ratio (%) of estimated to predicted glomerular filtration rate (GFR), according to age and gender in relation to time elapsed since kidney donation.

$$\frac{eGFR}{predicted\ GFR} = 75\text{-}85\%$$

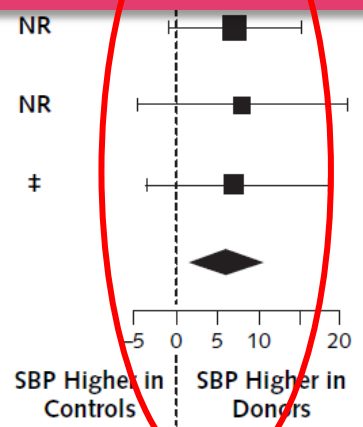
Transplantation 72(3):444-449, August 15th, 2001.

Hypertension

Meta-analysis: risk for hypertension in living kidney donors

Figure 1. Meta-analysis of controlled studies of systolic blood pressure (*SBP*) and diastolic blood pressure (*DBP*) at least 5 years after kidney donation.

Study, Year (Reference)		Donors, after Donation			Control Participants			Mean Difference in SBP (95% CI), *mm Hg*
Undurraga et al., 1998 (53)	11 (1–21)	30	125 (18)	NR	30	118 (13)	NR	7 (–0.9 to 15.2)
Talselth et al., 1986 (54)	11 (10–12)	32	140 (23)	10	32	132 (29)	NR	8 (–4.8 to 20.8)
Williams et al., 1986 (57)	13 (10–18)	38	136 (25)	‡	16	129 (16)	‡	7 (–3.7 to 18.5)
Pooled estimate		157	133 (6)		128	126 (8)		6 (1.6 to 10.5)

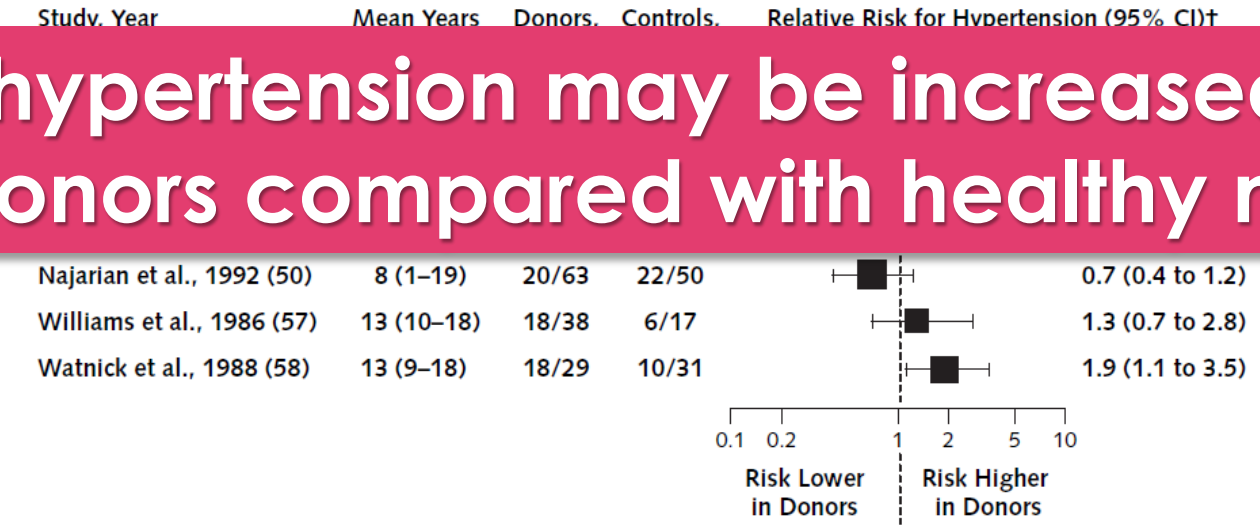


SBP and DBP were 6 and 4 mmHg higher in kidney donors

Meta-analysis: risk for hypertension in living kidney donors.

Risk of hypertension may be increased among kidney donors compared with healthy nondonors.

Figure 2. Controlled studies of hypertension risk after kidney donation.



Results were not mathematically pooled because of statistical heterogeneity between studies (chi-square, 10.1; $P = 0.074$; $I^2 = 50\%$). The size of each square is inversely proportional to the variability of the study estimate. *Studies are arranged by the average number of years after donation. †Definitions of hypertension and a summary of various methods to assess blood pressure are presented in the Results section.

Cardiovascular disease and hypertension risk in living kidney donors: an analysis of health administrative data

Higher incidence of hypertension diagnoses among living donors compared with healthy controls

TABLE 2. Death or major cardiovascular events and hypertension among donors and controls

	Donors (n =1,278)	Controls (n=6,369)
Death or major cardiovascular events		
No. of events (%)	16 (1.3)	107 (1.7)
Mean (SD) years of follow-up (%)	6.2 (3.2)	6.2 (3.2)
Total follow-up (person years)	7920	39393
No. events per 1000	2.0	2.7
		1.0 (reference)
		56 (0.9)
		27 (0.4)
		9 (0.1)
		≤5 (≤0.1)
aneurysm repair or aortic bypass (%)		
Coronary artery angioplasty or bypass graft surgery (%)	≤5 (≤0.4)	30 (0.5)
Diagnosis of hypertension		
Number of events (%)	205 (16.3)	746 (11.9)
Number of events per 1000 person years	29.1	20.6
Model based risk ratios (95% CI)	1.4 (1.2–1.7)	1.0 (reference)

[a] Between 1 and 5 individuals developed some events, with exact numbers not reported for reasons of privacy.

Cardiovascular disease and hypertension risk in living kidney donors: an analysis of health administrative data in Ontario, Canada." Transplantation 86(3): 399-406.

Maternal and fetal outcomes

Maternal and fetal outcomes

- Living kidney donation appears to increase the risk of gestational hypertension and preeclampsia compared with experience among otherwise similar healthy women.
- We generally advise women that it is ideal to have completed planned childbearing prior to kidney donation.

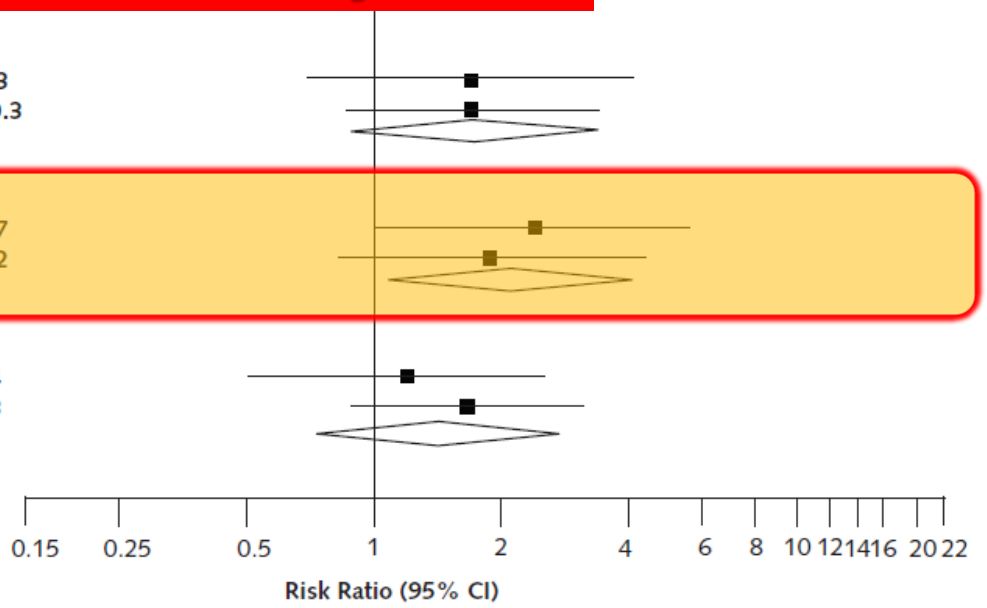
- Consistent with recommendations of a 2015 AST consensus statement and KDIGO clinical practice guidelines, OPTN policy requires informing female donor candidates that risks of preeclampsia or gestational hypertension are increased in pregnancies after donation.

Mid- and Long-Term Health Risks in Living Kidney Donors: A Systematic Review and Meta-analysis.

Figure 3. Meta-analysis of relative risks for selected clinical end points in living kidney donors compared with nondonor control participants.

Study, Year (Reference)	Events, *n*/*n*		Selection	Matching	Incidence Rate*	
	Donor	Control			Donor	Control
Gestational hy						
Garg et al, 2						
Reisaeter et						
Total						
Low birthweight						
Garg et al, 2015 (32)	8/131	31/788	++	+++	12.4	8.3
Reisaeter et al, 2009 (33)	9/106	1110/21 511	+		17.0	10.3
Total	17/237	1141/22 299				
Preeclampsia						
Garg et al, 2015 (32)	8/131	21/788	++	+++	12.4	5.7
Reisaeter et al, 2009 (33)	6/106	666/21 511	+		11.3	6.2
Total	14/237	687/22 299				
Preterm birth						
Garg et al, 2015 (32)	10/131	52/788	++	+++	15.5	14
Reisaeter et al, 2009 (33)	11/106	1397/21 511	+		20.8	13
Total	21/237	1449/22 299				

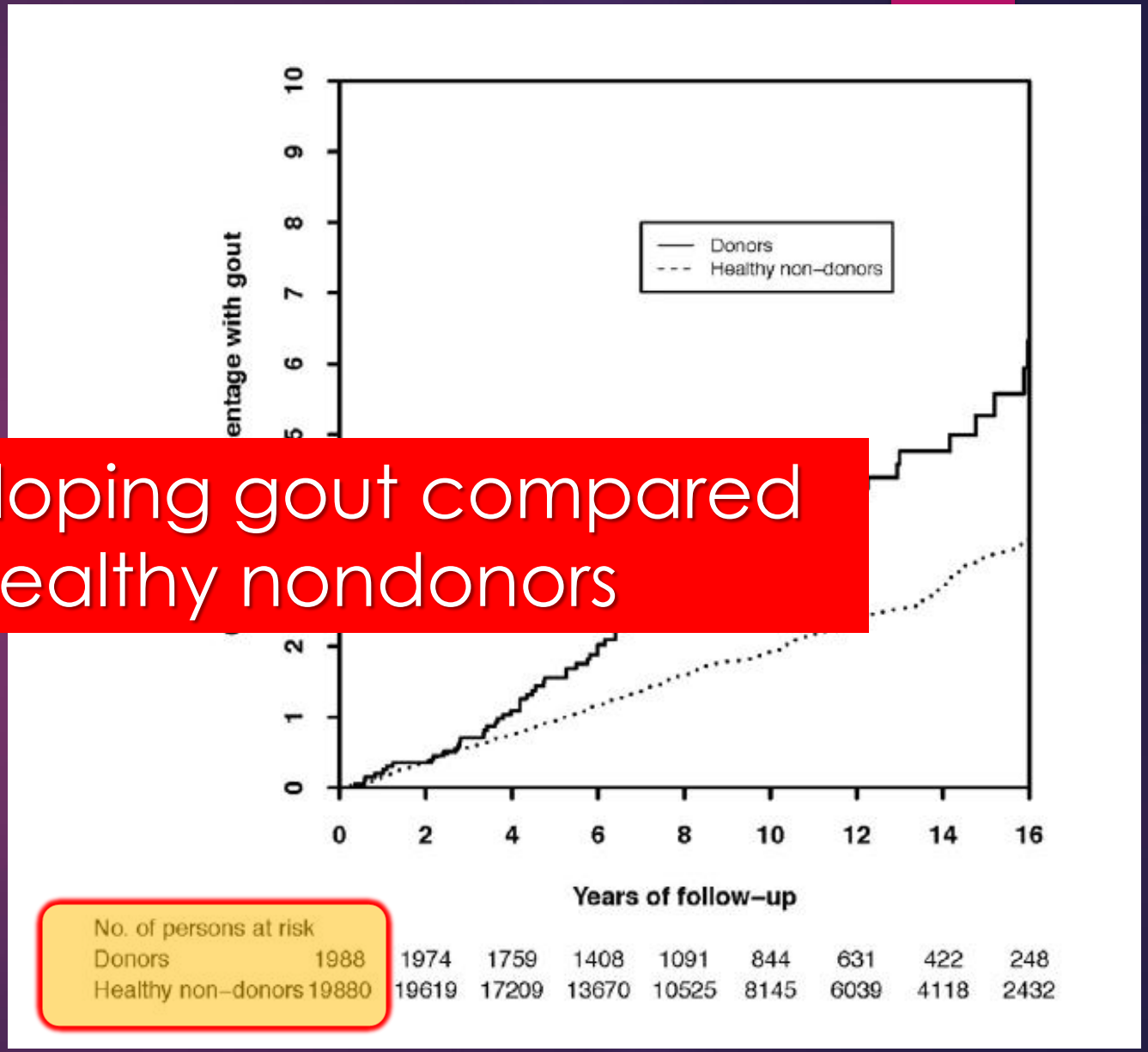
↑ relative risk for preeclampsia



Gout

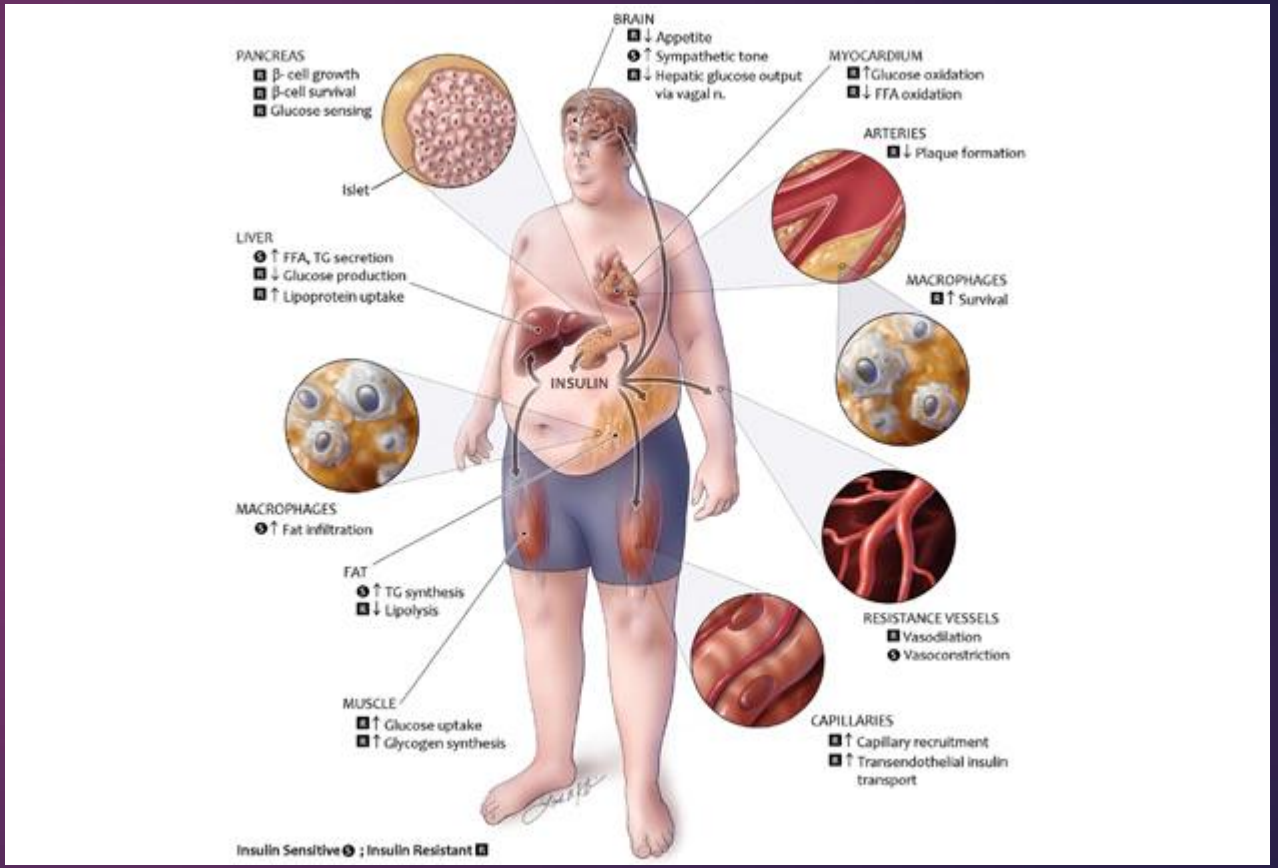
Gout after living kidney donation

Higher risk for developing gout compared with equally healthy nondonors



Lam, N. N., et al. (2015). "Gout after living kidney donation: a matched cohort study." Am J Kidney Dis 65(6): 925-932.

Metabolic diseases



A prospective controlled study of kidney donors: baseline and 6-month follow-up.

Table 7. Laboratory Values

Variable	Baseline Visit		6-mo Visit		P^a		
	Controls	Donors	Controls	Donors	Controls vs Donors[b]	Baseline vs 6 mo[c]	Interaction[d]
mGFR (mL/min)	106.5 ± 19.3 (n = 186)	106.7 ± 18.6 (n = 181)	104.9 ± 20.2 (n = 194)	74.3 ± 12.9 (n = 193)	0.8	<0.001	<0.001
mGFR (mL/min/1.73 m^2)	96.9 ± 15.3 (n = 186)	96.9 ± 15.3 (n = 181)	94.6 ± 15.1 (n = 194)	67.6 ± 10.1 (n = 193)	0.5	<0.001	<0.001
SCr (mg/dL)	0.79 ± 0.15 (n = 200)	0.80 ± 0.15 (n = 199)	0.80 ± 0.17 (n = 198)	1.16 ± 0.22 (n = 199)	0.8	<0.001	<0.001
$eGFR_{cr}$ (mL/min/1.73 m^2)	100.1 ± 16.0 (n = 200)	99.2 ± 14.4 (n = 199)	99.0 ± 16.0 (n = 198)	65.5 ± 13.1 (n = 199)	0.6	<0.001	<0.001
CysC (mg/dL)	0.81 ± 0.14 (n = 198)	0.80 ± 0.12 (n = 180)	0.81 ± 0.14 (n = 198)	1.11 ± 0.17 (n = 199)	0.6	<0.001	<0.001
$eGFR_{cys}$ (mL/min/1.73 m^2)	102.8 ± 17.6 (n = 198)	103.2 ± 15.4 (n = 180)	102.1 ± 17.5 (n = 198)	71.6 ± 15.3 (n = 199)	0.7	<0.001	<0.001
$eGFR_{cr\text{-}cys}$ (mL/min/1.73 m^2)	102.0 ± 16.3 (n = 198)	102.0 ± 13.9 (n = 180)	101.3 ± 16.8 (n = 198)	67.4 ± 11.6 (n = 198)	0.8	<0.001	<0.001
Urea nitrogen (mg/dL)	14.3 ± 3.8 (n = 199)	14.0 ± 3.3 (n = 181)	14.5 ± 4.0 (n = 198)	18.0 ± 4.4 (n = 200)	0.2	<0.001	<0.001
UPCR (g/g)	61 [50-114] (n = 196)	66 [50-128] (n = 175)	62 [50-128] (n = 195)	70 [50-116] (n = 201)	0.3[e]	0.9[e]	0.5[e]
UACR (mg/g)	5.0 [4.0-6.9] (n = 186)	5.0 [3.8-5.8] (n = 167)	5.0 [4.0-6.6] (n = 193)	5.0 [3.3-5.4] (n = 198)	0.07[e]	0.1[e]	0.5[e]

A prospective controlled study of kidney donors: baseline and 6-month follow-up.

Table 7. Laboratory Values

Variable	Baseline Visit		6-mo Visit		*P*[a]		
	Controls	Donors	Controls	Donors	Controls vs Donors[b]	Baseline vs 6 mo[c]	Interaction[d]
Hemoglobin (g/dL)	13.6 ± 1.2 (n = 194)	13.6 ± 1.2 (n = 198)	13.6 ± 1.4 (n = 193)	13.1 ± 1.2 (n = 194)	0.9	<0.001	<0.001
Leukocyte count (/μL)	6.1 ± 1.6 (n = 195)	5.9 ± 2.0 (n = 198)	6.1 ± 1.7 (n = 193)	5.7 ± 1.5 (n = 194)	0.3	0.2	0.4
Serum albumin (mg/dL)	4.08 ± 0.28 (n = 199)	4.18 ± 0.29 (n = 199)	4.07 ± 0.33 (n = 198)	4.06 ± 0.31 (n = 200)	0.002	<0.001	<0.001
CRP (mg/dL)	1.1 [0.5-2.7] (n = 199)	0.9 [0.4-1.7] (n = 182)	1.4 [0.6-3.1] (n = 198)	1.2 [0.7-2.9] (n = 199)	0.1[e]	<0.001[e]	0.2[e]
Fibrinogen (mg/dL)	295 ± 69 (n = 197)	292 ± 64 (n = 181)	305 ± 67 (n = 198)	300 ± 72 (n = 198)	0.8	0.004	0.7
Homocysteine (mg/L)	1.20 ± 0.35 (n = 193)	1.22 ± 0.39 (n = 176)	1.20 ± 0.34 (n = 196)	1.49 ± 0.43 (n = 198)	0.8	<0.001	<0.001
Uric acid (mg/dL)	4.8 ± 1.1 (n = 200)	4.6 ± 1.1 (n = 198)	4.9 ± 1.2 (n = 198)	5.3 ± 1.1 (n = 200)	0.08	<0.001	<0.001

A prospective controlled study of kidney donors: baseline and 6-month follow-up.

Table 7. Laboratory Values

Variable	Baseline Visit		6-mo Visit		*P*[a]		
	Controls	Donors	Controls	Donors	Controls vs Donors[b]	Baseline vs 6 mo[c]	Interaction[d]
Serum calcium (mg/dL)	9.16 ± 0.38 (n = 200)	9.26 ± 0.38 (n = 199)	9.19 ± 0.38 (n = 198)	9.24 ± 0.42 (n = 200)	0.02	0.8	0.4
Serum phosphorus (mg/dL)	3.49 ± 0.52 (n = 198)	3.52 ± 0.50 (n = 199)	3.49 ± 0.48	3.30 ± 0.48	0.5	<0.001	<0.001
PTH (pg/mL)	42.8 ± 16.3 (n = 199)	42.3 ± 17.8 (n = 180)	42.8 ± 15.6 (n = 198)	52.7 ± 20.9 (n = 200)	0.6	<0.001	<0.001
Cholesterol (mg/dL)	186 ± 37 (n = 200)	185 ± 35 (n = 198)	186 ± 36 (n = 197)	186 ± 35 (n = 199)	0.7	0.7	0.6
LDL cholesterol (mg/dL)	112 ± 33 (n = 198)	110 ± 31 (n = 196)	111 ± 30 (n = 193)	110 ± 31 (n = 193)	0.6	0.7	0.6
HDL cholesterol (mg/dL)	55.2 ± 16.5 (n = 200)	56.2 ± 14.5 (n = 198)	54.9 ± 16.4 (n = 198)	54.1 ± 13.9 (n = 197)	0.5	0.002	0.03
Triglycerides (mg/dL)	77 [55-113]	76 [57-111]	80 [59-119]	84 [64-124]	0.8[e]	<0.001[e]	0.05[e]

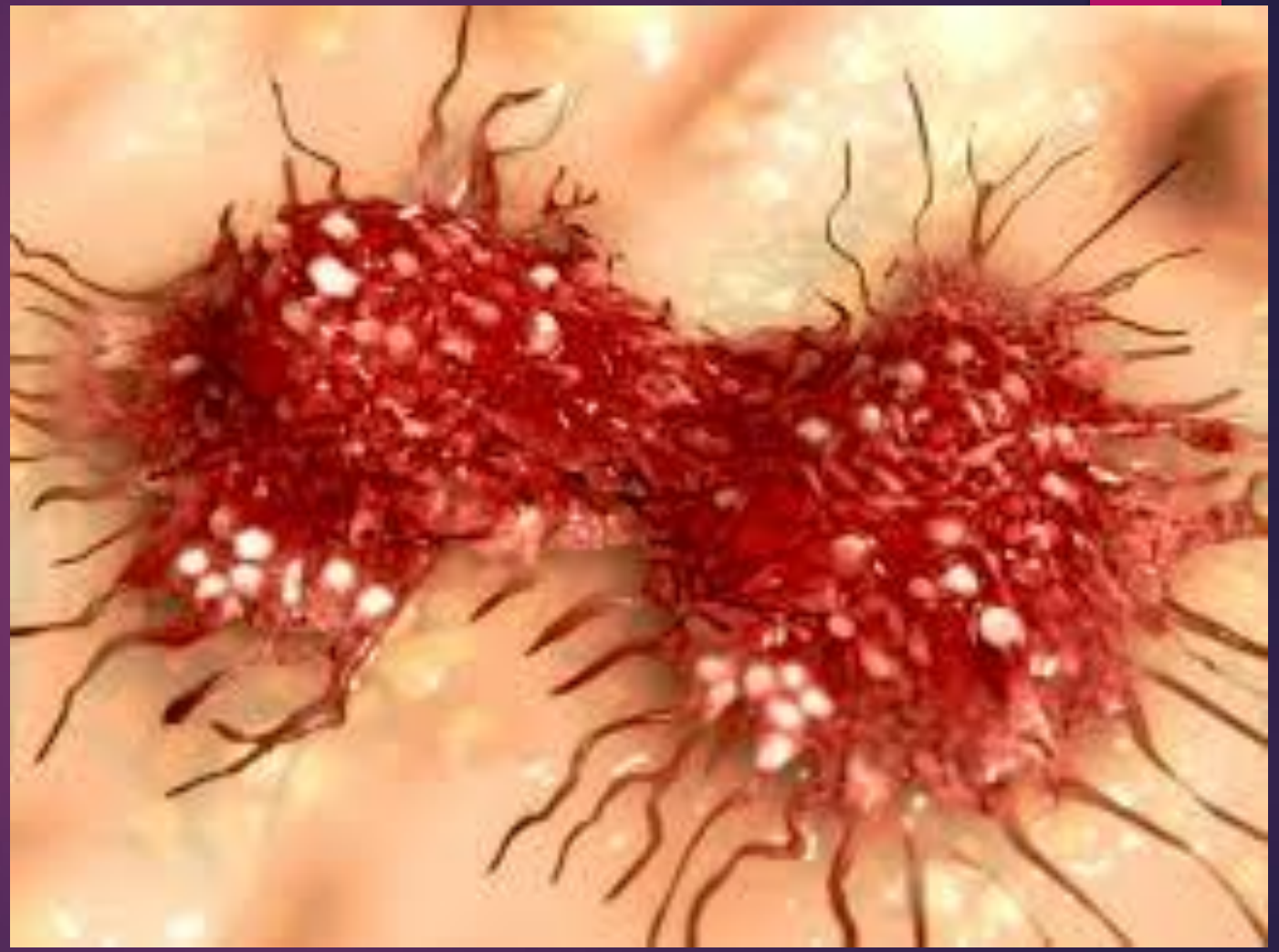
A prospective controlled study of living kidney donors: three-year follow-up.

Table 6. Laboratory Measurements at 6, 12, 24, and 36 Months After Kidney Donation

Test	Group	Visit (time after donation)				*P*[a]		
		6 mo	12 mo	24 mo	36 mo	Donors vs Controls[b]	Visit[c]	Interaction[d]
Hemoglobin (g/dL)	Controls	13.6 ± 1.4 (195)	13.4 ± 1.4 (191)	13.6 ± 1.2 (175)	13.6 ± 1.2 (173)	0.003	<0.001	0.02
	Donors	13.2 ± 1.2 (200)	13.1 ± 1.3 (197)	13.4 ± 1.3 (183)	13.5 ± 1.4 (172)			
Leukocyte count (/μL)	Controls	6.0 ± 1.7 (195)	6.1 ± 1.8 (190)	6.0 ± 1.6 (174)	6.0 ± 1.8 (157)	0.1	0.6	0.8
	Donors	5.8 ± 1.5 (200)	5.9 ± 1.8 (196)	5.7 ± 1.5 (182)	5.8 ± 1.6 (169)			
Serum albumin (mg/dL)	Controls	4.07 ± 0.33 (198)	4.03 ± 0.30 (193)	4.06 ± 0.32 (182)	4.02 ± 0.27 (173)	0.9	0.008	0.9
	Donors	4.06 ± 0.31 (200)	4.03 ± 0.30 (198)	4.05 ± 0.30 (185)	4.00 ± 0.27 (182)			
CRP (mg/dL)	Controls	1.4 [0.6-3.1] (198)	1.2 [0.5-2.8] (193)	1.2 [0.5-2.6] (182)	1.0 [0.6-2.4] (173)	0.7[e]	0.6[e]	0.01[e]
	Donors	1.2 [0.7-2.9] (200)	1.3 [0.6-2.5] (196)	1.1 [0.6-2.5] (185)	1.2 [0.6-3.0] (182)			
Fibrinogen (mg/dL)	Controls	305 ± 67 (198)	306 ± 74 (193)	311 ± 65 (182)	306 ± 67 (173)	0.8	0.2	0.3
	Donors	300 ± 72 (198)	310 ± 66 (196)	309 ± 81 (185)	309 ± 70 (181)			
Homocysteine (mg/L)	Controls	1.21 ± 0.34 (196)	1.21 ± 0.37 (193)	1.28 ± 0.43 (182)	1.23 ± 0.38 (173)	<0.001	0.6	0.05
	Donors	1.49 ± 0.43 (198)	1.46 ± 0.42 (196)	1.50 ± 0.42 (185)	1.41 ± 0.43 (182)			
Uric acid (mg/dL)	Controls	4.9 ± 1.2 (198)	4.9 ± 1.2 (193)	4.9 ± 1.2 (182)	5.0 ± 1.1 (173)	<0.001	<0.001	0.2
	Donors	5.3 ± 1.1 (200)	5.2 ± 1.2 (196)	5.4 ± 1.2 (185)	5.5 ± 1.3 (182)			
Serum potassium (mmol/L)	Controls	4.14 ± 0.32 (197)	4.10 ± 0.29 (187)	4.12 ± 0.31 (177)	4.11 ± 0.28 (172)	0.006	0.1	0.9
	Donors	4.20 ± 0.29 (199)	4.19 ± 0.35 (193)	4.20 ± 0.32 (181)	4.17 ± 0.27 (178)			
Serum calcium (mg/dL)	Controls	9.19 ± 0.38 (198)	9.18 ± 0.42 (193)	9.17 ± 0.41 (182)	9.21 ± 0.40 (173)	0.4	0.2	0.7
	Donors	9.24 ± 0.42 (200)	9.18 ± 0.41 (196)	9.24 ± 0.38 (185)	9.26 ± 0.40 (182)			
Serum phosphorus (mg/dL)	Controls	3.49 ± 0.48 (198)	3.55 ± 0.46 (190)	3.52 ± 0.46 (178)	3.51 ± 0.46 (172)	<0.001	0.007	0.003
	Donors	3.30 ± 0.48 (200)	3.37 ± 0.51 (195)	3.43 ± 0.51 (182)	3.42 ± 0.51 (178)			
PTH (pg/mL)	Controls	42.8 ± 15.6 (198)	42.4 ± 16.7 (193)	43.6 ± 16.3 (182)	43.2 ± 17.5 (173)	<0.001	0.7	0.3
	Donors	52.7 ± 20.9 (200)	52.9 ± 22.1 (196)	51.7 ± 20.6 (185)	52.5 ± 24.1 (182)			

AJKD. 2015;66(1):114-24.

Malignancy



Cancer diagnoses after living kidney donation

	Living Donors Rate Per 1000 Person-Years	Matched Controls Rate Per 1000 Person-Years	Donor vs Control Rate Ratio (95% CI)
All LKD			
Total Non-skin	11.9	16.2	0.74 (0.55–0.99)*
Total Skin	6.1	6.8	0.91 (0.59–1.40)
			1.67 (0.61–4.59)
Colon	0.3	1.4	0.22 (0.05–1.03)
Lung	0.8	0.9	0.83 (0.25–2.73)
Kidney	0.3	0.9	0.33 (0.07–1.65)
Lymphoma	0.6	1.6	0.40 (0.13–1.28)
Hodgkin's	--	0.6	--
Leukemia	0.3	0.3	1.00 (0.14–7.10)
Myeloma	0.2	0.5	0.33 (0.03–3.20)
Central nervous system	0.6	0.2	4.00 (0.45–35.8)

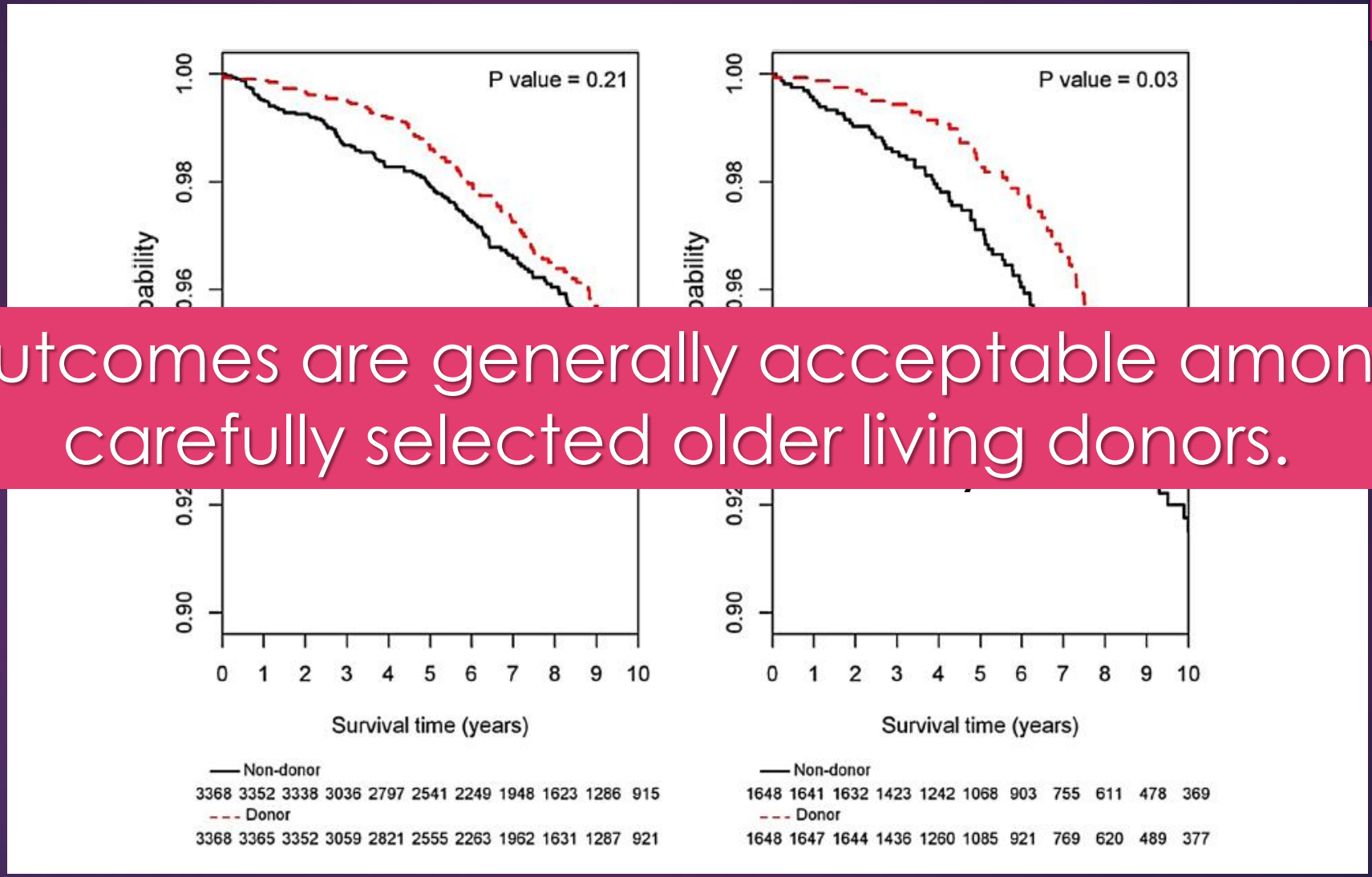
The overall risk of developing cancer does not appear to be increased among donors.

Cancer diagnoses after living kidney donation: linking U.S. Registry data and administrative claims. Transplantation. 2012;94(2):139-44.

Risk among older donors

Mortality among older live kidney donors

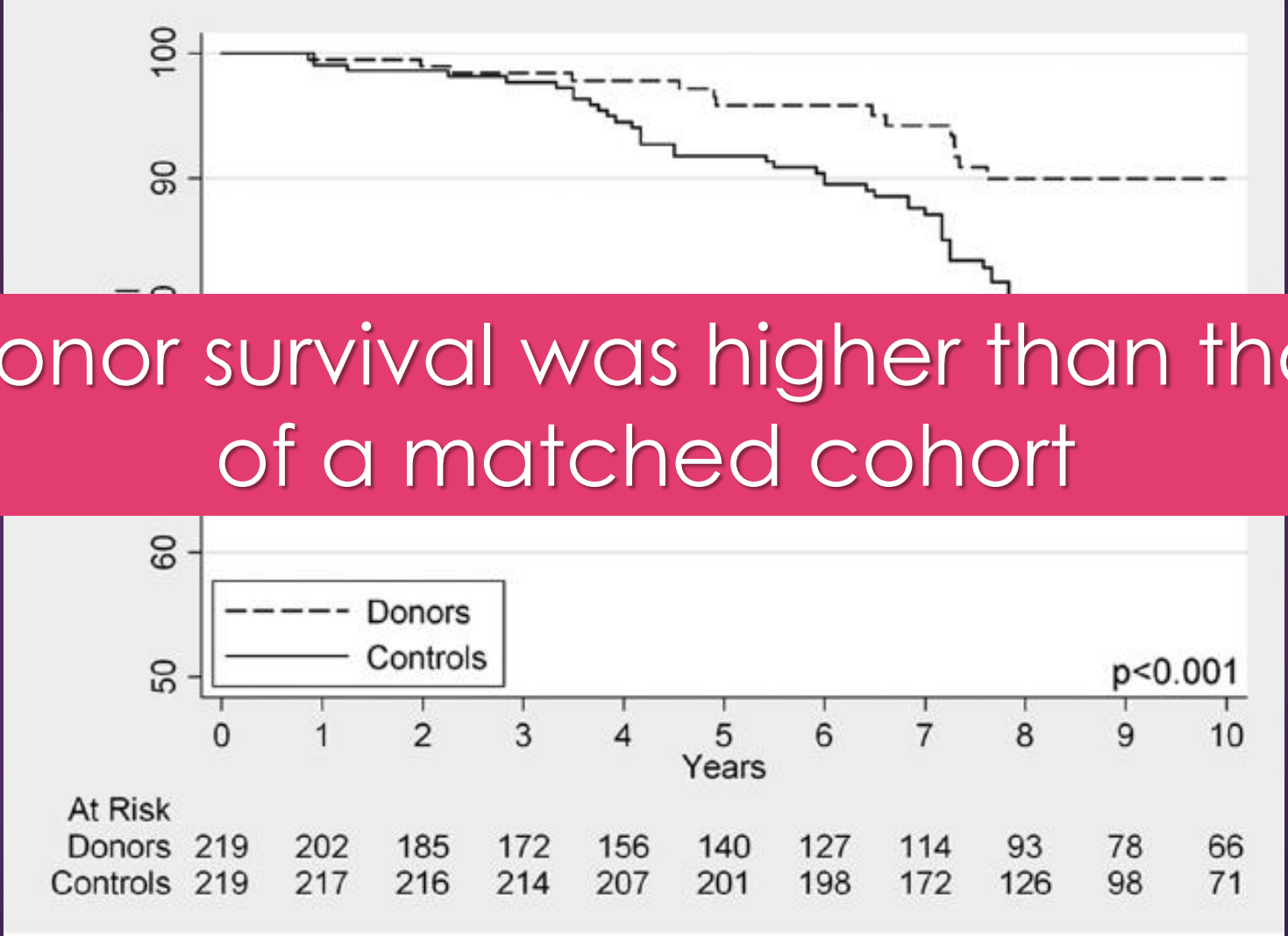
a study of 3368 older donors (≥55 years) in the United States (1996 to 2006)



Outcomes are generally acceptable among carefully selected older living donors.

American Journal of Transplantation 2014; 14: 1853–1861

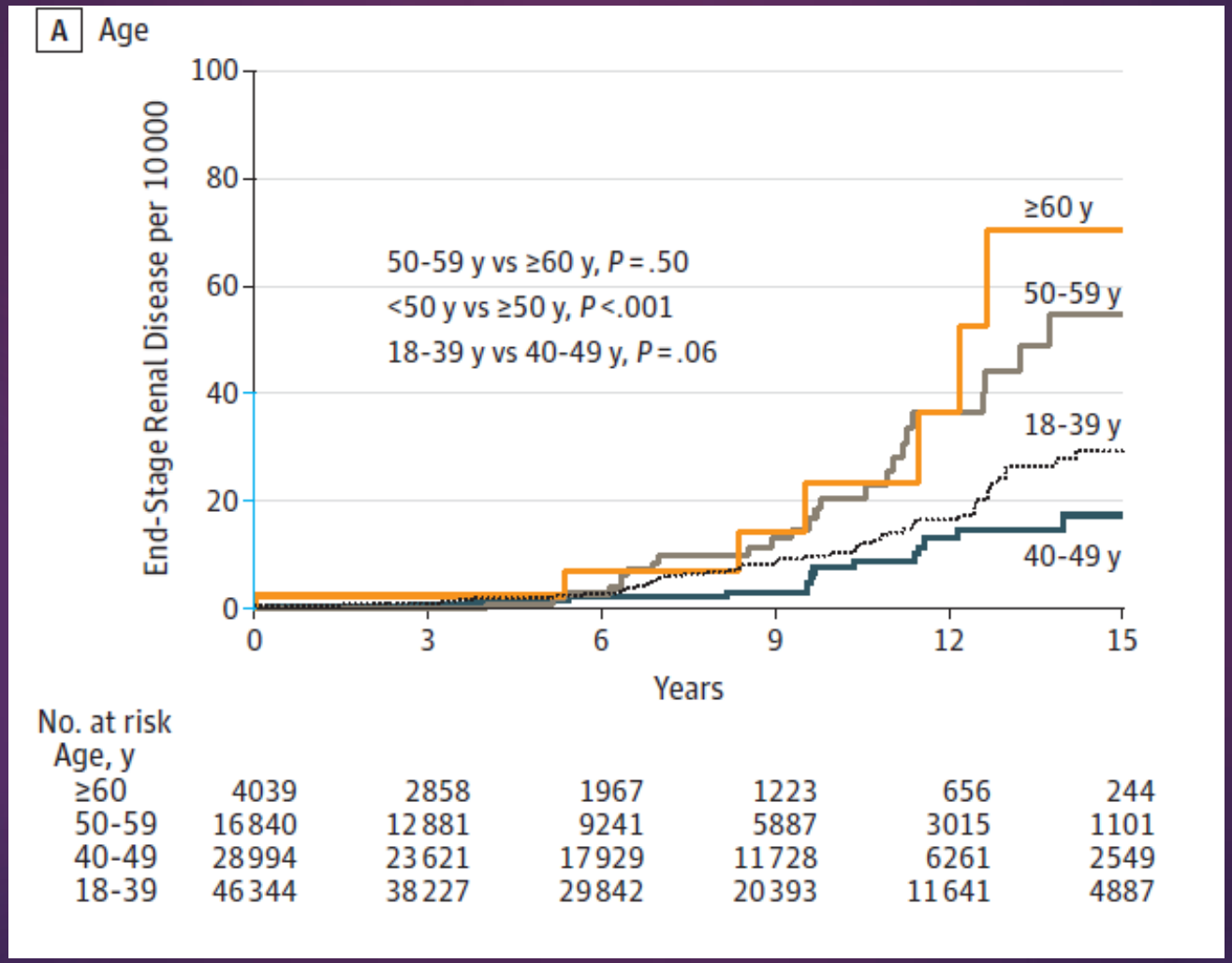
Survival of live kidney donors aged >70, compared with matched healthy controls



Donor survival was higher than that of a matched cohort

Clin J Am Soc Nephrol 6: 2887–2893, December, 2011

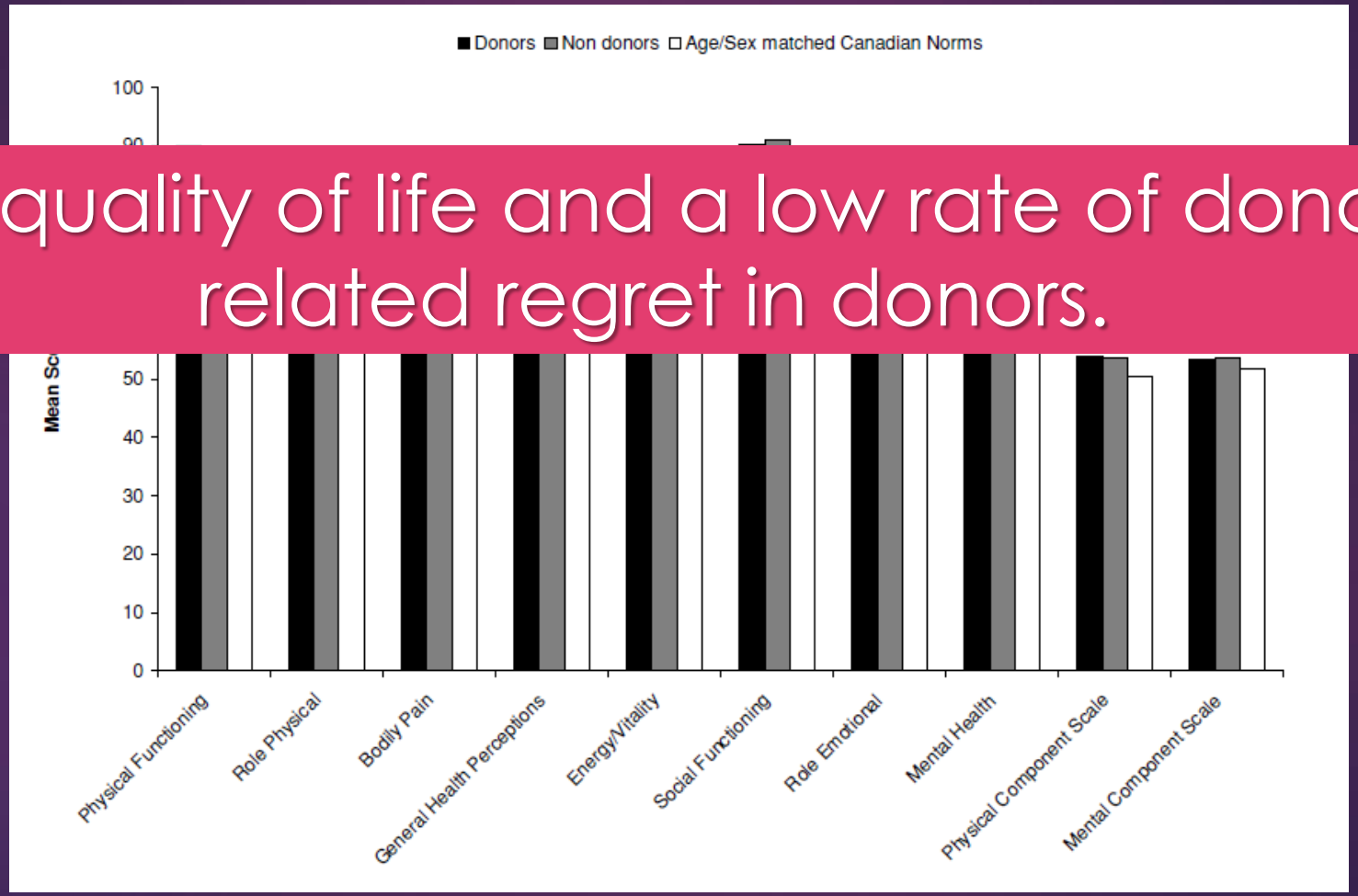
Cumulative Incidence of End-Stage Renal Disease in Live Kidney Donors



Risk of end-stage renal disease following live kidney donation. Jama. 2014;311(6):579-86.

Psychosocial outcomes

The long-term quality of life of living kidney donors



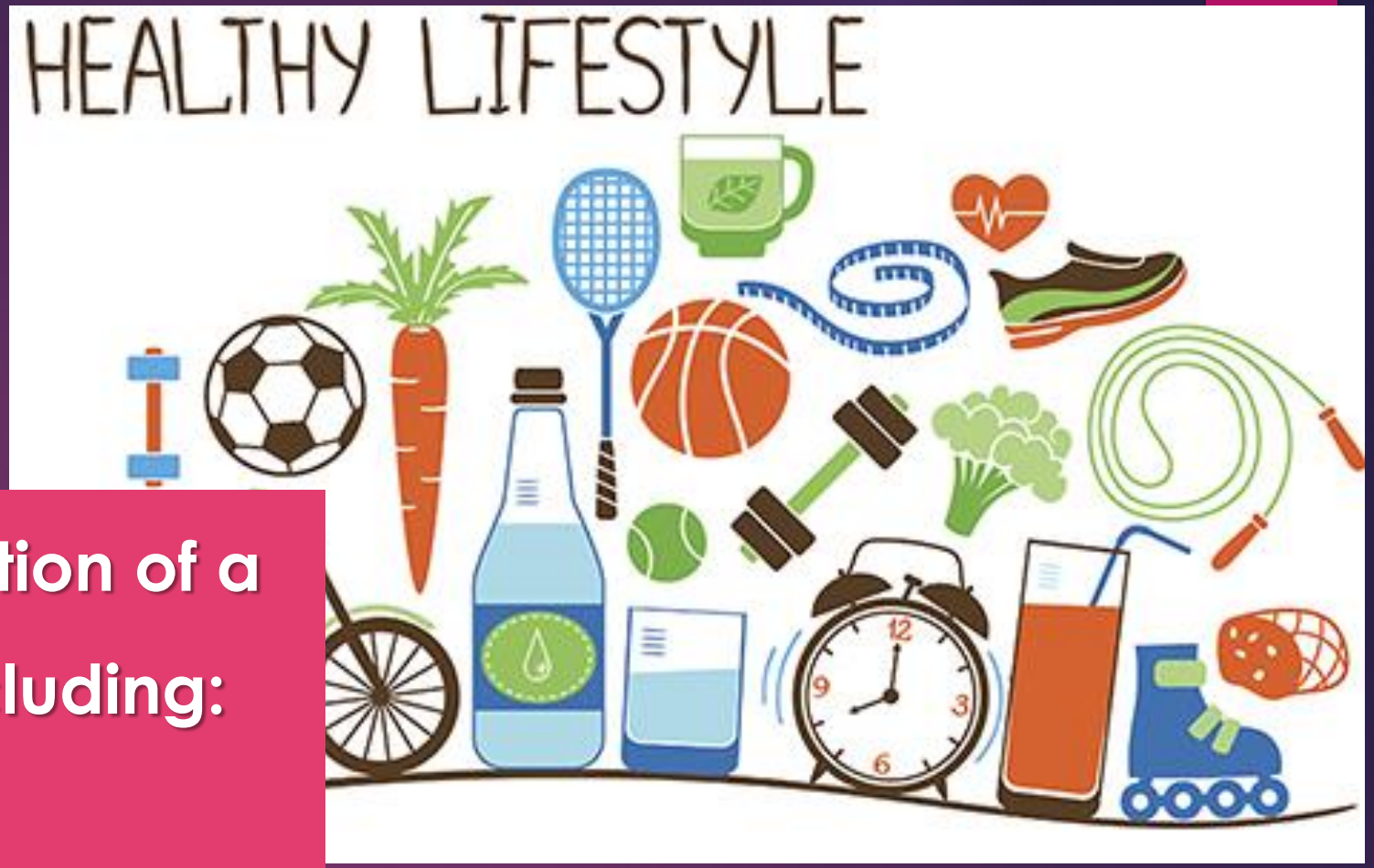
Good quality of life and a low rate of donation-related regret in donors.

The long-term quality of life of living kidney donors. American journal of transplantation : official journal of the American Society of Transplantation and the American Society of Transplant Surgeons. 2011;11(3):463-9.


FOLLOW UP!

KDIGO Clinical Practice Guideline on the Evaluation and Care of Living Kidney Donors

Annually post-donation

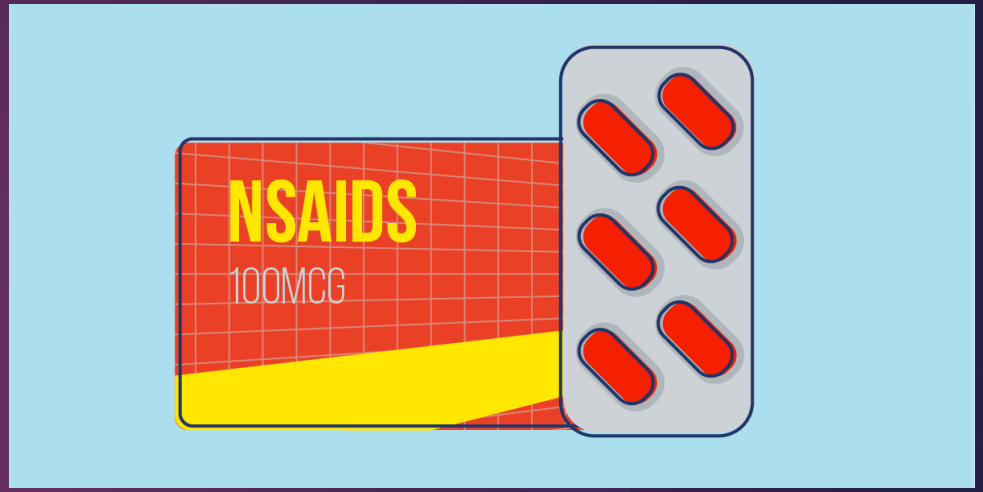


Review and promotion of a healthy lifestyle including:

- Regular exercise
- Healthy diet
- Abstinence from tobacco

CARE AFTER KIDNEY DONATION

- Avoidance of potentially nephrotoxic exposures (eg, tobacco use, NSAIDs, nephrotoxic medications)



- Prevention of diseases that may cause CKD (eg, hypertension, diabetes mellitus, CVD)

Take home messages

- Kidney donors are at increased long-term risk for ESRD, cardiovascular, and all-cause mortality.
- Living kidney donation appears to increase the risk of preeclampsia.
- The overall risk of developing cancer does not appear to be increased among donors.
- Outcomes are generally acceptable among carefully selected older living donors.
- BP, BMI, creatinine, and albuminuria measurement should be performed at least annually.
- Review and promotion of a healthy lifestyle.