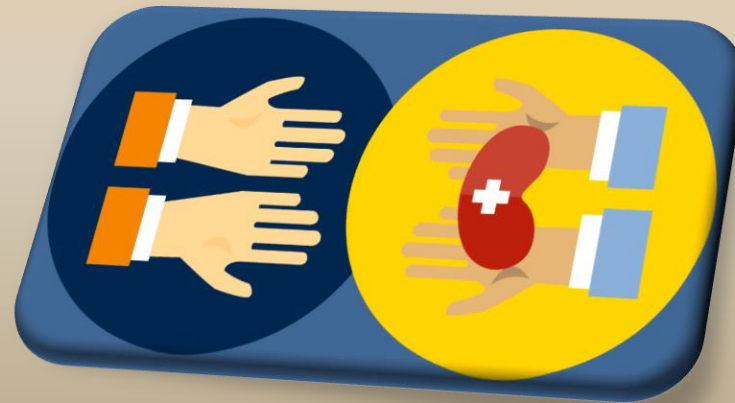


*IN THE NAME OF GOD*

*Assessment of GFR & ESRD Risk  
in living kidney Donor Candidates*



*Dr Sahar Vahdat  
assistant Professor of Nephrology  
Khorshid Kidney Center  
IUMS*

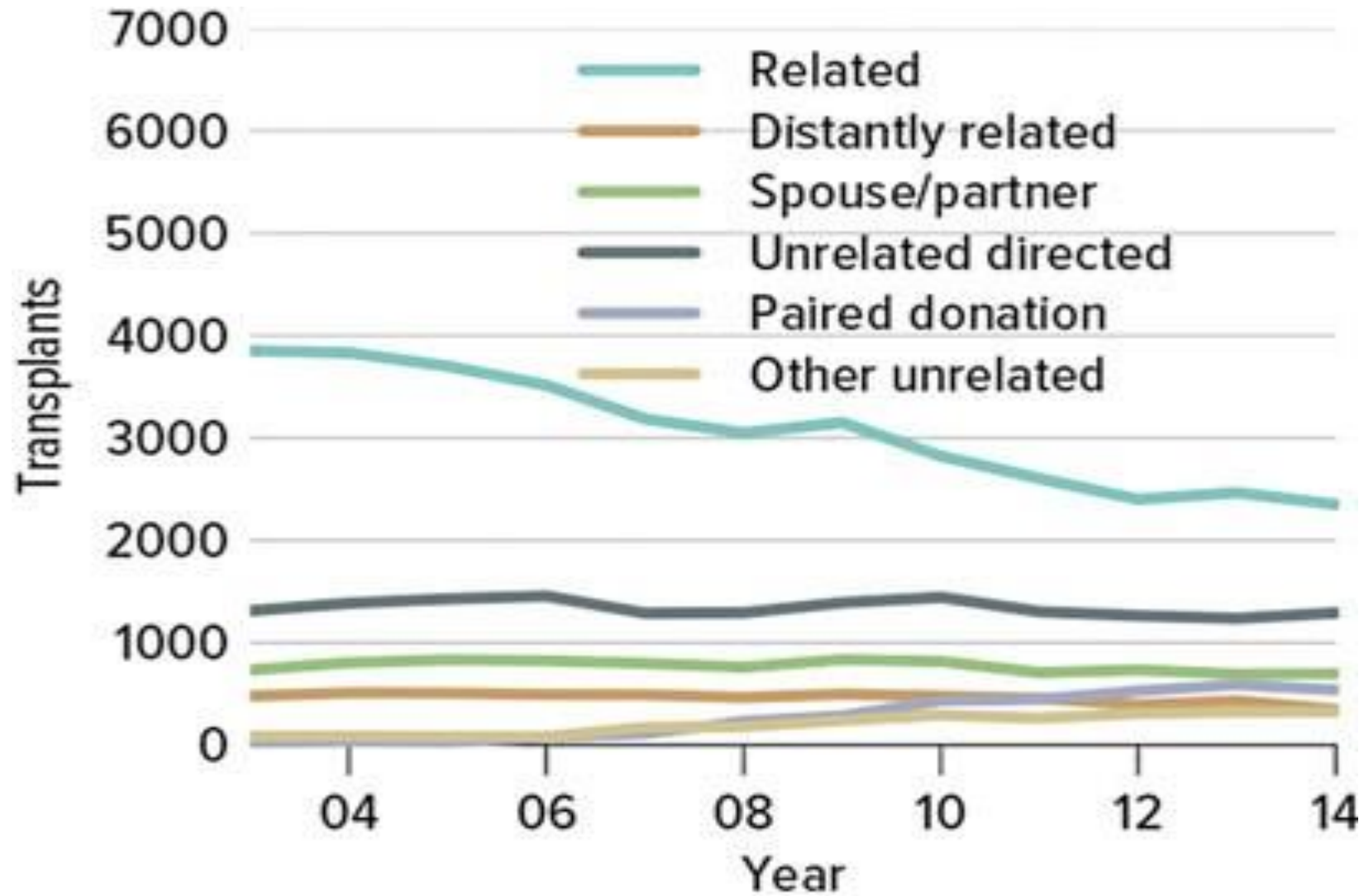
# Table of Contents

---

- Predonation Kidney Function
- Predonation Albuminuria
- Long-term ESRD risk
- Outcome of the living kidney donor
- Postdonation Follow up

# Introduction

- ❑ As per UNOS (United Network for Organ Sharing), there are more than 100,000 patients awaiting renal transplantation
- ❑ living donation rates have declined progressively for more than a decade
- ❑ This decrease has largely been driven by a **reduction** in the number of **living related kidney donations**, from 4340 in 2004 to 2693 as per 2014
- ❑ the Organ Procurement and Transplant Network (OPTN) has defined policies which outline the minimum general and kidney-specific requirements for suitability as a living kidney donor



# PREDONATION KIDNEY FUNCTION

---

1. Evaluation
2. Selection
3. Counseling

# Question 1

---

- Which of the following methods is recommended for the **initial** evaluation of kidney function in a living donor?
  - a. eGFRcr CKD-EPI
  - b. eGFR cr-cys
  - c. mGFR
  - d. mCrCl

# Answer

a. eGFRcr CKD-EPI

b. eGFRcr- cys

c. mGFR

d. mCrCl

< eGFR using CKD-EPI Hide Results ☆ ☰

Questions

Gender? Female >

Race? Not African-American >

Age? 45 Years >

Creatinine? 1 mg/dL >

Results

Estimated GFR using CKD-EPI

**68 mL/min/1.73m<sup>2</sup>**

Estimated GFR using MDRD

**63.7 mL/min/1.73m<sup>2</sup>**

Resources

Free PD Resources to Simplify Your Practice  
*Information from Indus*

**eGFR<sub>cr</sub>**





# Evaluation

---

- ❑ Donor kidney function should be expressed as **GFR & not as serum creatinine** concentration
- ❑ Donor GFR should be expressed in **mL/min per 1.73 m<sup>2</sup>** rather than **mL/min**
- ❑ Donor GFR should be estimated from **serum creatinine (eGFR<sub>cr</sub>)** for **initial** assessment

# Evaluation (cont...)

**Donor GFR should be confirmed using one or more of the following:**

---

- **Measured GFR (mGFR)** using an **exogenous filtration marker**: preferably **urinary or plasma clearance** of inulin, iothalamate, 51Cr-EDTA, iohexol or **urinary clearance** of 99mTc-DTPA
  - **Measured Cr clearance (mCrCl)**: The most commonly used measure of evaluating GFR in clinical practice is based on a 24-h creatinine clearance
- **Estimated GFR** from the combination of serum Cr & cystatin C (eGFRcr-cys)
- **Repeat eGFRcr**
- **Both eGFRcr and eGFRcys are imprecise at high levels of GFR, so confirmatory testing is recommended for all donor candidates**

# Evaluation (cont...)

---

❑ If there are **parenchymal, vascular or urological abnormalities or asymmetry of kidney size:**

(As specified by KDIGO guidelines, considered as a difference in kidney size >10% e.g., a difference in **kidney length >1.2 cm** or **kidney volume >30 ml** on renal imaging)

In these situations, most centers would prefer to **transplant the kidney with lesser function** and leave the donor with the kidney with greater function after all technical considerations

**Single kidney GFR** should be assessed using radionuclides or contrast agents that are excreted by glomerular filtration (**eg, 99mTc-DTPA**)

# Confirmatory test

**mGFR using an exogenous filtration marker is the most accurate confirmatory test**

- mGFR is not available in all centers, so alternatives are acceptable mClcr is not as accurate as mGFR
- **mClcr** overestimates mGFR because of Cr secretion, with the magnitude of overestimation exceeding **15% at normal GFR**, & is prone to error because of inaccurate urine collections
- **eGFRcr–cys** is generally recommended over eGFRcr or eGFRcys
- **Repeat eGFRcr** can be used if no other confirmatory tests are available

# Selection

## Classification of GFR category

Not acceptable  
for donation

< 60

Intermediate  
range

60-89

Acceptable  
for donation

≥90

Figure 3.

KDIGO classification of GFR categories and use in decision-making for donor candidates. Colors are blended together to signify that the threshold for decision-making is imprecise.

# PREDONATION ALBUMINURIA

## Evaluation

---

- ❑ Donor proteinuria should be measured **as albuminuria**, not total urine protein
- ❑ **Initial** evaluation of donor albuminuria screening should be performed using urine albumin-to-creatinine ratio (**ACR**) in a random urine specimen (<0.2mg alb/mg creatinine)

### **Donor albuminuria should be confirmed using:**

- . Albumin excretion rate (AER, mg/day [mg/d]) in a timed urine specimen
  - . Repeat ACR if AER cannot be obtained

# PREDONATION ALBUMINURIA

## Selection

---

- Urine **AER less than 30 mg/d** should be considered an acceptable level for donation
- The decision to approve donor candidates with **AER 30 to 100 mg/d** should be individualized based on demographic and health profile in relation to the transplant program's acceptable risk threshold
- Donor candidates with urine **AER greater than 100 mg/d** should not donate

[Transplant Proc.](#) 2006 Nov;38(9):2796-7.

## Evaluation of proteinuria in healthy living kidney donor candidates.

[Leischner MP](#)<sup>1</sup>, [Naratadam GO](#), [Hou SH](#), [Singh AK](#), [Leehey DJ](#).

### ⊕ Author information

#### Abstract

**BACKGROUND:** Evaluation of living kidney donor candidates includes careful assessment for the presence or absence of kidney disease. Kidney donation has been considered to be at least relatively contraindicated if urinary total protein excretion is above the normal range. However, at the present time, there is no uniformly accepted level of urine total protein excretion that would exclude donation. Albumin excretion instead of total protein excretion as a criterion has not previously been evaluated.

**MATERIALS AND METHODS:** This was a prospective observational study over a 3-year period in a single tertiary care center designed to assess current selection criteria for kidney donation with respect to urine total protein and albumin excretion.

**RESULTS:** Twenty four percent (25 of 105) of healthy adult kidney donor candidates had elevated urinary total protein excretion rates (150 to 292 mg/24 h). Of these 105 candidates, 39 had simultaneous measurements of both urinary total protein and albumin. Although one-third (13/39) had elevated 24-hour urine total protein values, none had elevated urine albumin excretion.

**CONCLUSION:** Measurement of albumin, the most common single protein found in urine, appears to be helpful in the evaluation of proteinuria in donor candidates. Many healthy adult kidney donor candidates have mildly elevated total protein excretion but normal albumin excretion. We believe that such patients should not be excluded from donation.

PMID: 17112832 DOI: [10.1016/j.transproceed.2006.08.126](https://doi.org/10.1016/j.transproceed.2006.08.126)



# Counseling

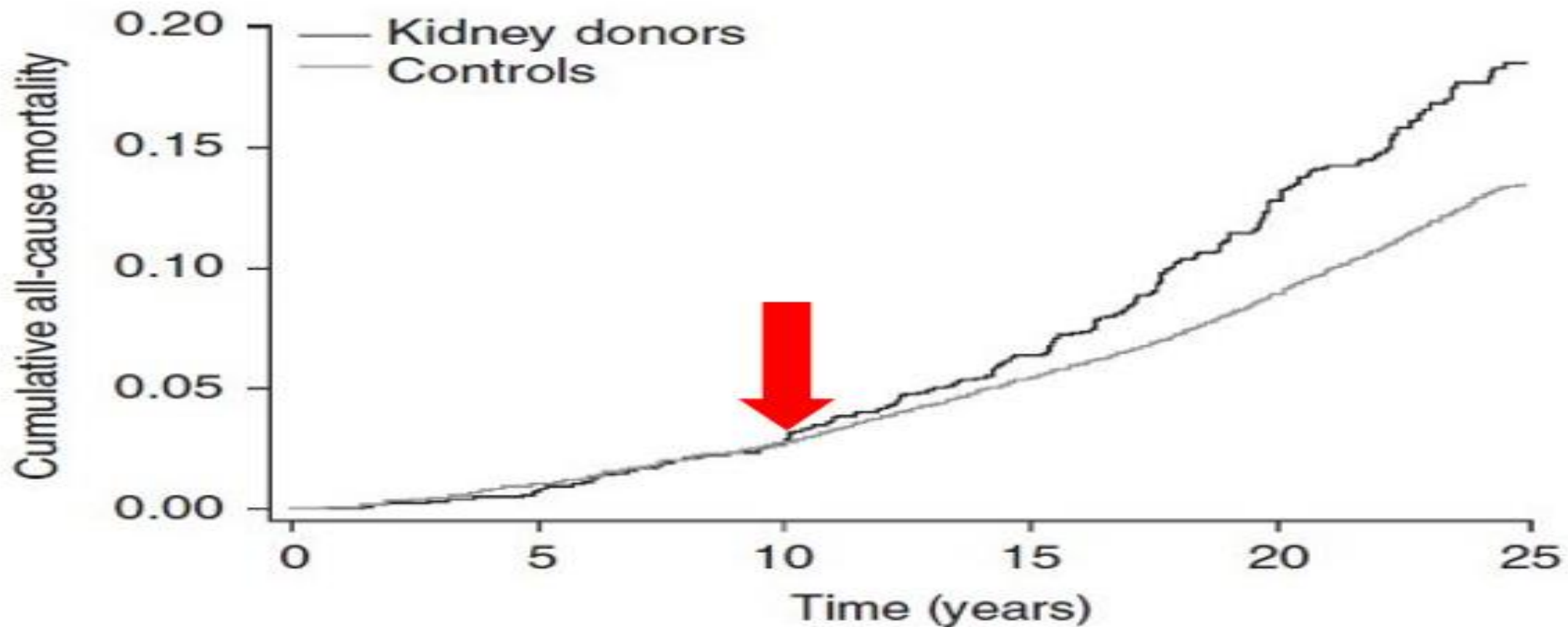
---

- ❑ We suggest that donor candidates be informed that the future risk of developing kidney failure necessitating treatment with dialysis or transplantation is **slightly higher** because of donation
- ❑ **average absolute risk in the 15 years following donation remains low**



# Long-term risks for kidney donors

Geir Mjøen<sup>1</sup>, Stein Hallan<sup>2,3</sup>, Anders Hartmann<sup>1</sup>, Aksel Foss<sup>1</sup>, Karsten Midtvedt<sup>1</sup>, Ole Øyen<sup>1</sup>, Anna Reisæter<sup>1</sup>, Per Pfeffer<sup>1</sup>, Trond Jenssen<sup>1</sup>, Torbjørn Leivestad<sup>4</sup>, Pål- Dag Line<sup>1</sup>, Magnus Øvrehus<sup>2</sup>, Dag Olav Dale<sup>1</sup>, Hege Pihlstrøm<sup>1</sup>, Ingar Holme<sup>5</sup>, Friedo W. Dekker<sup>6</sup> and Hallvard Holdaas<sup>1</sup>



# 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
Ibrahim et al, 2009 (14)	8/255	45/255	+	+++	2.6	4.0



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

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
Mjoen 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				



# Question 2

---

- Do more complicated GFR approval procedures beyond eGFR for all candidates?

a. Yes

b. No

# Answer

---

- Do more complicated GFR approval procedures beyond eGFR for all candidates?

a. Yes

b. No

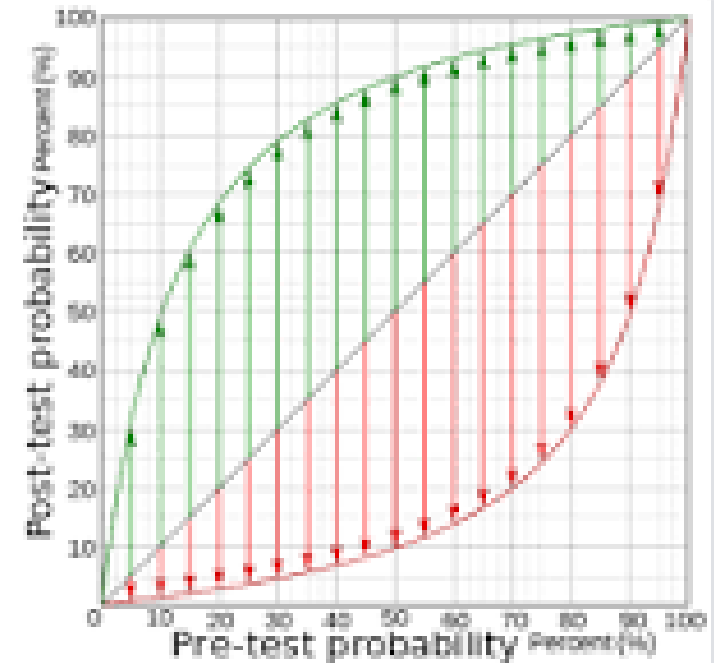
# Assessment of GFR Range

---

A web-based calculator has been developed to **compute post-test probabilities for mGFR above or below various threshold probabilities** (<http://ckdepi.org/equations/donor-candidate-gfr-calculator/>)

Accessed March 1, 2017

# Pre- and post-test probability



Pre-test probability and post-test probability are the probabilities of the presence of a condition before and after a diagnostic test, respectively. Post-test probability, in turn, can be positive or negative, depending on whether the test falls out as a positive test or a negative test, respectively.

## Cont...

---

web-based tool to compute the **probability of mGFR** in living donor candidates based on demographic characteristics obtained from the National Health and Nutrition Examination Survey (NHANES) and the test performance of **eGFR** from **CKD-EPI**

This tool was subsequently validated in a French cohort of 311 living donor candidates, with demonstration of good diagnostic performance

if the post test probability that mGFR is greater than the GFR threshold for decision-making based on this tool (eg, .80 or 90 ml/min per 1.73 m<sup>2</sup>) is extremely high and if urine ACR is very low, then these tests(eGFR) could simply be repeated for confirmation **without mGFR, mCrCl, or timed AER**



## *Assessment of GFR Range (cont..)*

---

Donor candidates with eGFR in intermediate ranges would **require confirmatory** tests with **mGFR, mCrCl**

## Diagnostic Post Test Probability of Disease Calculation

Enter the value of pretest probability

 %

Enter the value of likelihood ratio

+

-

**Calculate**

**Clear**

For a positive diagnostic test, the post test probability is

 %

For a negative diagnostic test, the post test probability is

 %

# CKD-EPI

CKD-EPI (Chronic Kidney Disease Epidemiology Collaboration)

[Home](#)[Assays](#)[GFR](#)[CKD Prevalence](#)[CKD Prognosis](#)[Surrogate Endpoint](#)[CKD-EPI](#)[Links](#)

# Chronic Kidney Disease Epidemiology Collaboration

## [Donor Candidate GFR Calculator: Determining Probability of GFR Above or Below Certain Threshold](#)

The data below are derived from Huang N, Foster M, Lentine K et al. Estimated GFR for living kidney donor evaluation.

*American Journal of Transplantation* [epub ahead of print Nov 23 2015].

# Donor Candidate GFR Calculator: Determining Probability of GFR Above or Below Certain Threshold

The data below are derived from Huang N, Foster M, Lentine K et al. Estimated GFR for living kidney donor evaluation. *American Journal of Transplantation* [epub ahead of print Nov 23 2015].

## Step 1: Describe your patient

Age  years

Sex  Male  Female

Race  Non Black  Black

Creatinine   mg/dL   $\mu\text{mol/L}$

Cystatin C  mg/L

eGFRcr

eGFRcr-cys

## Step 2: Determine pre-test probability

Calculate pre-test probability



**Result** (Pre-test probability based on age, sex and race from US population data)

Measured GFR Thresholds			
<60	<70	≥80	≥90
6	12	77	64

Percentage of NHANES participants who had eGFR<sub>cr-cys</sub> less or above the specified thresholds. If you are interested in the opposite of the threshold (eg < 80), then subtract the value given from 100.

You can use the numbers above or a different number based on knowledge of your patient's medical history. For example, if your patient has a strong family history of CKD, you may wish to alter the pretest probability. If so, write the number to be used as pre-test probability in table below.

### Step 3: Calculate the post-test probability



The calculator will look up the likelihood ratio based on the eGFR calculated from the creatinine and cystatin provided above and will compute post-test probability.

Calculate post-test probability

	Measured GFR Thresholds			
	<60	<70	≥80	≥90
Post-test probability from eGFR <sub>cr</sub> <sup>†</sup>	4	15	52	18
Post-test probability from eGFR <sub>cr-cys</sub> <sup>‡</sup>	2	19	20	2

# Summary report

Based on the information supplied:

Age 50  
Sex Female  
Race Non Black  
Creatinine 1 mg/dL  
Cystatin C 1.1 mg/L  
Estimated GFR from creatinine 66 ml/min per 1.73 m<sup>2</sup>  
Estimated GFR from creatinine-cystatin C 66 ml/min per 1.73 m<sup>2</sup>

	Measured GFR Thresholds			
	<60	<70	≥80	≥90
Pre-test probability	6	12	77	64
Post-test probability from eGFRcr <sup>†</sup>	4	15	52	18
Post-test probability from eGFRcr-cys <sup>‡</sup>	2	19	20	2

## *Assessment of GFR Range( cont...)*

- ❖ A recent study suggested that **eGFR may be sufficiently accurate for decision-making without the need for mGFR or mClcr in many donor candidates**

**In that study, 53% of recent donors in the United States had eGFR sufficiently high to provide a  $\geq 95\%$  post-test probability that mGFR was  $\geq 90$  ml/min per  $1.73 \text{ m}^2$**



### Step 3: Calculate the post-test probability

The calculator will look up the likelihood ratio based on the eGFR calculated from the creatinine and cystatin provided above and will compute post-test probability.

Calculate post-test probability

	Measured GFR Thresholds			
	<60	<70	≥80	≥90
Post-test probability from eGFR <sub>cr</sub> <sup>†</sup>	0	0	100	98

Post-test probability from

<sup>†</sup>Post test probability of mGFR

the threshold (eg < 80), then sul

**No need for confirmatory test if post test probability is ≥95%**

# Summary report

Based on the information supplied:

Age	70
Sex	Female
Race	Non Black
Creatinine	1.3 mg/dL
Cystatin C	1.1 mg/L
Estimated GFR from creatinine	42 ml/min per 1.73 m <sup>2</sup>
Estimated GFR from creatinine-cystatin C	51 ml/min per 1.73 m <sup>2</sup>

	Measured GFR Thresholds			
	<60	<70	≥80	≥90
Pre-test probability	27	47	34	16
Post-test probability from eGFR <sub>cr</sub> <sup>†</sup>	91	98	1	0
Post-test probability from eGFR <sub>cr-cys</sub> <sup>‡</sup>	97	100	0	0

**Necessity for confirmatory test**



The data below are derived from Huang N, Foster M, Lentine K et al. Est. *American Journal of Transplantation* [epub ahead of print Nov 23 2015].

Step 1: Describe your patient

Age: 50 years

Sex:  Male  Female

Race:  Non Black  Black

Creatinine: 0.7  mg/dL  μmol/L

Cystatin C: [ ] mg/L

eGFRcr: [ ]

eGFRcr-cys: [ ]

GFR CALCULATOR

Glomerular filtration rate (GFR) is the best overall index of kidney function. Normal to age, sex, and body size, and declines with age. The National Kidney Foundation CKD-EPI Creatinine Equation (2009) to estimate GFR.

Serum Creatinine: 0.7  mg/dL  μmol/L

Serum Cystatin C: [ ] mg/L

Age: 50 Years

Gender:  Male  Female

Race:  Black  Other

Standardized Assays:  Yes  No  Not Sure

Remove body surface adjustment:  Yes  No  Not Sure

CALCULATE

Results

CKD-EPI creatinine equation (2009)	101	ml/min/1.73m <sup>2</sup>
CKD-EPI creatinine-cystatin equation (2012)	101	ml/min/1.73m <sup>2</sup>
CKD-EPI cystatin C equation (2013)	101	ml/min/1.73m <sup>2</sup>
MDRD study equation	101	ml/min/1.73m <sup>2</sup>

For persons under 18 years of age, use the pediatric GFR calculator.

Calculate post-test probability

	Measured GFR Thresholds			
	<60	<70	≥80	≥90
Post-test probability from eGFRcr <sup>1</sup>	0	1	96	89
Post-test probability from eGFRcr-cys <sup>2</sup>	N/A	N/A	N/A	N/A

<sup>1</sup>Post test probability of mGFR above or below the threshold based on eGFRcr. If you are interested in the opposite of the threshold (eg = 80), then subtract the value given from 100.

<sup>2</sup>If you also indicated the eGFRcr-cys, the calculator will use the post-test probability from the eGFRcr as the pre-

Necessity for mGFR in spite of eGFR 101 ml/min

## Brief Communication

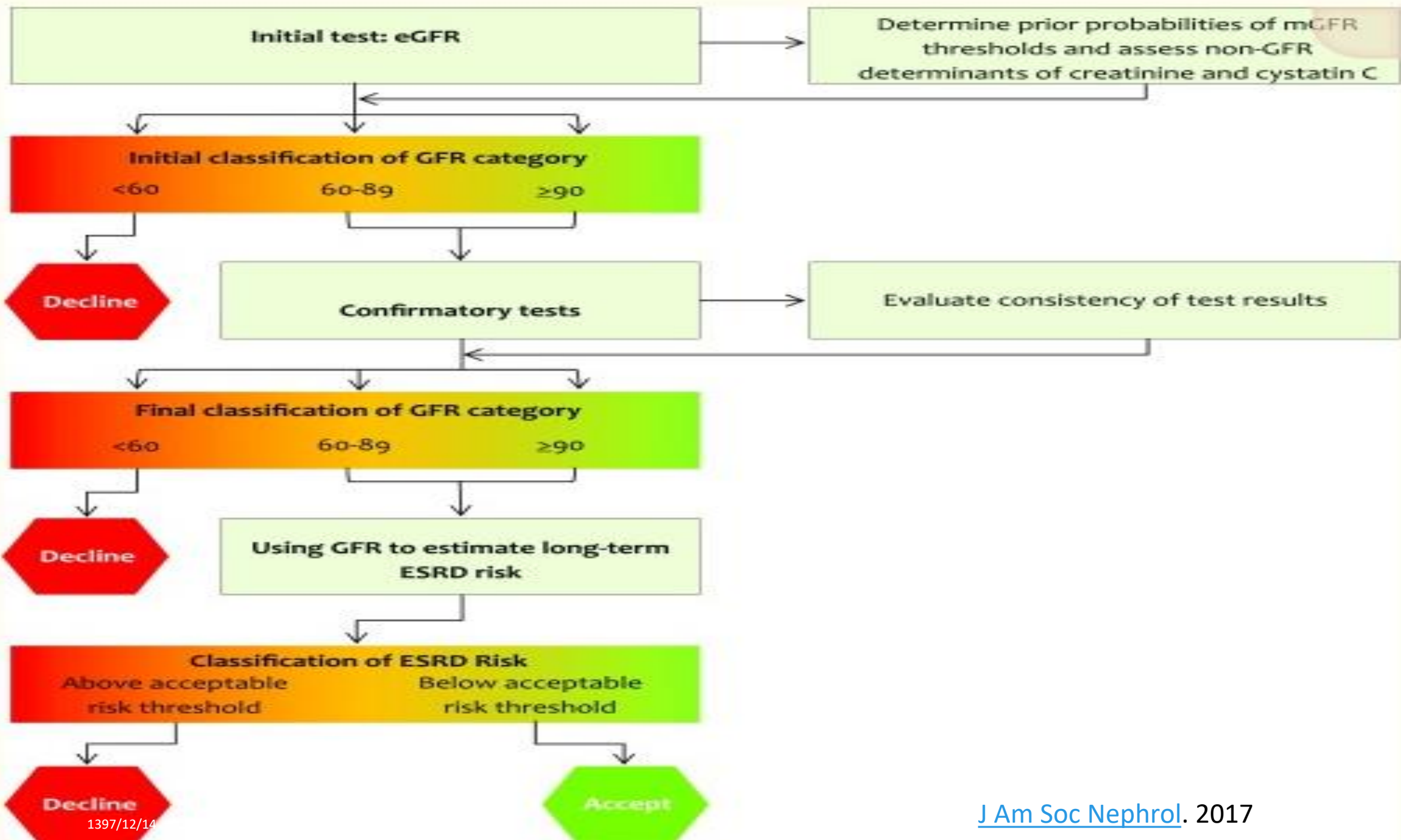
# Estimated or Measured GFR in Living Kidney Donors

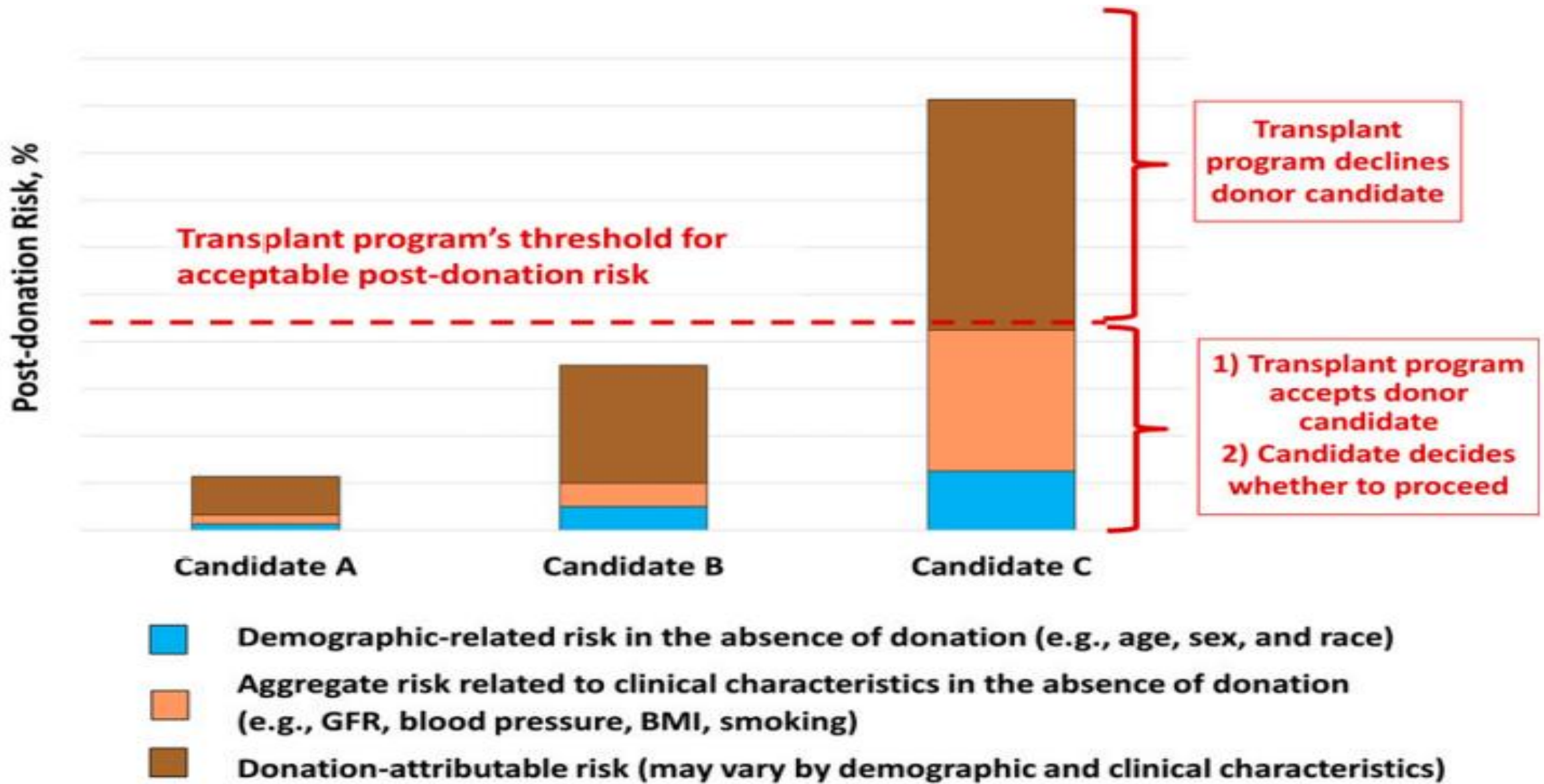
## Work-up?

Physiology Department, Paris Descartes University, and  
INSERM, Unit 1151, Paris, France <sup>12</sup>AP-HP, Hôpital Europeen  
Georges Pompidou, Paris, France

**In conclusion**, we recommend calculating posttest 90 for each potential kidney donor

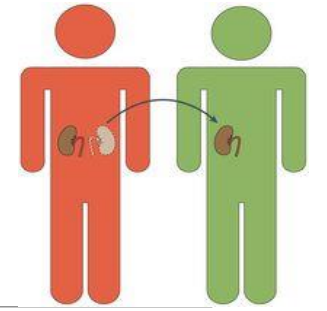






**Figure 1.** KDIGO proposed framework for a transplant center to accept or decline a donor

# Long-term ESRD risk



- A. Long-term risk in the **absence of donation** can be computed from **demographic and clinical characteristics**, including GFR (<http://www.transplantmodels.com/esrdrisk/>)
- B. **Additional risk attributable to donation** is likely to be **3.5–5.3 times higher** than **risk in the absence of donation depending on sex and race**, but there is substantial uncertainty, especially in younger donor candidates, and we suggest caution in decision-making

[J Am Soc Nephrol](#). 2017 Apr; 28(4): 1062–1071

# Prediction Models

---

This model projects 15 year and lifetime predonation ESRD risks (ie, without donation-attributable risk) in donor candidates based on **age, sex, race, GFR, ACR, diabetes, smoking, blood pressure, antihypertensive drug use, and BMI**

- The tool was developed from a meta-analysis of data from nearly 5 million healthy persons from 7 cohorts, with calibration to annual ESRD incidence in the US healthy population, and is now available online: [http:// www.transplantmodels.com/esrdrisk](http://www.transplantmodels.com/esrdrisk)

[Grams ME, Sang Y, Levey AS, et al. N Engl J Med 2016;374\(5\):411-421](#)



# Use of prediction tool to estimate ESRD risk in donor candidates

---

1. Use the online tool (<http://www.transplantmodels.com/esrdrisk>) to estimate the projected lifetime risk of kidney failure **in the absence of donation** according to baseline demographic and health characteristics included in the online tool
2. **Multiply** the projected **predonation risk** by the best available estimate for **donation-attributable risk** to obtain the projected **postdonation risk**. For example, Grams et al report a **relative risk of 3.5-5.3** for 15-year ESRD risk, according to sex and race
3. Compare the projected risk estimate to the program's postdonation threshold of acceptable risk
4. **Exercise caution** when there is concern that the individual has risk factors not captured in the online tool (eg, **familial or genetic risk**) and for **younger** candidates

[KDIGO Clinical Practice Guideline on the Evaluation and Care of Living Kidney Donors. Transplantation. 2017;101\(8S Suppl 1\):S1-S109](#)

# ESRD Risk Tool for Kidney Donor Candidates

Projected Incidence of End-Stage Renal Disease:	
<b>0.04%</b> Pre-Donation 15-Year*	<b>0.30%</b> Pre-Donation Lifetime*
? Post-Donation 15-Year**	? Post-Donation Lifetime**

**blue:** < 1%, **green:** 1-2%, **yellow:** 2-3%, **orange:** 3-5%, **red:** >5%

The pre-donation risks represent projections if a person does not donate

## Patient Characteristics:

Age (18-80yrs)

40



Gender

Female



Race (White or Black)

White



eGFR (mL/min/1.73m<sup>2</sup>)

90



Systolic Blood Pressure (mmHg)

120



Hypertension Medication

No Medication



BMI (kg/m<sup>2</sup>)

25



Non-Insulin Dependent Diabetes

No Diabetes



Urine Albumin to Creatinine ([mg/g](#))

click on units to change between mg/g and mg/mmol

4



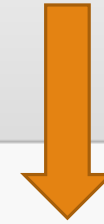
Smoking History

Non-Smoker



# Postdonation Risk of ESRD in Living Kidney Donors

## Kidney Donor Risk of ESRD



Select your donor characteristics below. This prediction model is intended for adults who have already donated a kidney in the United States. It provides an estimated risk of developing ESRD.

### Patient Characteristics:

Sex

Female



Race (African American or non-African American)

Non-African American



Age (18-80yrs)

40



BMI (kg/m<sup>2</sup>)

25



Donor is 1st degree biological relative to recipient

No



# Question3

Do you accept the following candidate for donation?

a. yes

b. No

Projected Incidence of End-Stage Renal Disease:	
<b>0.16%</b> Pre-Donation 15-Year*	<b>2.35%</b> Pre-Donation Lifetime*
?	?
Post-Donation 15-Year**	Post-Donation Lifetime**

**blue:** < 1%, **green:** 1-2%, **yellow:** 2-3%, **orange:** 3-5%, **red:** >5%

The pre-donation risks represent projections if a person does not donate a kidney. Details about estimating post-donation risk are provided below.

[reset](#) [print summary](#)

**Patient Characteristics:**

Age (18-60yrs)	30	✓
Gender	Male	✓
Race (White or Black)	White	✓
eGFR (mL/min/1.73m <sup>2</sup> )	95	✓
Systolic Blood Pressure (mmHg)	130	✓
Hypertension Medication	No Medication	✓
BMI (kg/m <sup>2</sup> )	30	✓
Non-Insulin Dependent Diabetes	No Diabetes	✓
Urine Albumin to Creatinine (mg/g) <small>click on units to change between mg/g and mg/mmol</small>	20	✓
Smoking History	Current Smoker	✓

# answer

Do you accept the following candidate for donation?

a. yes

b. No

Projected Incidence of End-Stage Renal Disease:	
<b>0.16%</b> Pre-Donation 15-Year*	<b>2.35%</b> Pre-Donation Lifetime*
? Post-Donation 15-Year**	? Post-Donation Lifetime**

**blue:** < 1%, **green:** 1-2%, **yellow:** 2-3%, **orange:** 3-5%, **red:** >5%

The pre-donation risks represent projections if a person does not donate a kidney. Details about estimating post-donation risk are provided below.

[reset](#) [print summary](#)

**Patient Characteristics:**

Age (18-80yrs)	30	▼
Gender	Male	▼
RACE (White or Black)	White	▼
eGFR (mL/min/1.73m <sup>2</sup> )	95	▼
Systolic Blood Pressure (mmHg)	130	▼
Hypertension Medication	No Medication	▼
BMI (kg/m <sup>2</sup> )	30	▼
Non-Insulin Dependent Diabetes	No Diabetes	▼
Urine Albumin to Creatinine (mg/g) <small>click on units to change between mg/g and mg/mmol</small>	20	▼
Smoking History	Current Smoker	▼



## Patient Characteristics:

Age (18-80yrs)

32

Gender

Male

Race (White or Black)

White

eGFR (mL/min/1.73m<sup>2</sup>)

85

Systolic Blood Pressure (mmHg)

145

Hypertension Medication

No Medication

BMI (kg/m<sup>2</sup>)

28

Non-Insulin Dependent Diabetes

No Diabetes

Urine Albumin to Creatinine (mg/g)

45

click on units to change between mg/g and mg/mmol

Smoking History

Non-Smoker

### Projected Incidence of End-Stage Renal Disease:

**0.21%**

Pre-Donation 15-Year\*

**3.15%**

Pre-Donation Lifetime\*

?

Post-Donation 15-Year\*\*

?

Post-Donation Lifetime\*\*

blue: < 1%, green: 1-2%, yellow: 2-3%, orange: 3-5%, red: >5%

**No, I do´nt accept this**

Projected Incidence of End-Stage Renal Disease:	
<b>0.19%</b> Pre-Donation 15-Year*	<b>0.75%</b> Pre-Donation Lifetime*
? Post-Donation 15-Year**	? Post-Donation Lifetime**

blue: < 1%, green: 1-2%, yellow: 2-3%, orange: 3-5%, red: >5%

The pre-donation risks represent projections if a person does not donate a kidney. Details about estimating post-donation risk are provided below.

[reset](#)

[clear](#)

**Yes! I'll Take It ...**

Characteristics:

Age (18-80yrs)	50	<input checked="" type="radio"/>
Gender	Male	<input checked="" type="radio"/>
Race (White or Black)	White	<input checked="" type="radio"/>
eGFR (mL/min/1.73m <sup>2</sup> )	95	<input checked="" type="radio"/>
Systolic Blood Pressure (mmHg)	130	<input checked="" type="radio"/>

For example, if a transplant program sets the acceptable lifetime postdonation ESKD risk threshold at 5%, and assumes a donation attributable RR of 3.5 to 5.3 according to sex and race, then the acceptable predonation lifetime ESKD risk threshold would be approximately 1.0-1.5.



Projected Incidence of End-Stage Renal Disease:

**0.16%**

Pre-Donation 15-Year\*

**2.35%**

Pre-Donation Lifetime\*

?

Post-Donation 15-Year\*\*

?

Post-Donation Lifetime\*\*

blue: < 1%, green: 1-2%, yellow: 2-3%, orange: 3-5%, red: >5%

Projected Incidence of End-Stage Renal Disease:

**0.38%**

Pre-Donation 15-Year\*

**0.76%**

Pre-Donation Lifetime\*

?

Post-Donation 15-Year\*\*

?

Post-Donation Lifetime\*\*

blue: < 1%, green: 1-2%, yellow: 2-3%, orange: 3-5%, red: >5%

The pre-donation risks represent projections if a person does not donate a kidney. Details about estimating post-donation risk are provided below.

[reset](#)

[print summary](#)

Patient Characteristics:

Age (18-80yrs) **30**

Gender **Male**

RACE (White or Black) **White**

eGFR (mL/min/1.73m<sup>2</sup>) **95**

Systolic Blood Pressure (mmHg) **130**

Hypertension Medication **No Diabetes**

BMI (kg/m<sup>2</sup>) **20**

Non-Insulin Dependent Diabetes **No Diabetes**

Urine Albumin to Creatinine [\(mg/g\)](#)  
click on units to change between mg/g and mg/mmol **20**

Smoking History **Current Smoker**

The pre-donation risks represent projections if a person does not donate a kidney. Details about estimating post-donation risk are provided below.

[reset](#)

[print summary](#)

Patient Characteristics:

Age (18-80yrs) **55**

Gender **Male**

RACE (White or Black) **White**

eGFR (mL/min/1.73m<sup>2</sup>) **95**

Systolic Blood Pressure (mmHg) **130**

Hypertension Medication **No Diabetes**

BMI (kg/m<sup>2</sup>) **30**

Non-Insulin Dependent Diabetes **No Diabetes**

Urine Albumin to Creatinine [\(mg/g\)](#)  
click on units to change between mg/g and mg/mmol **20**

Smoking History **Current Smoker**

**OLDER AGE AT DONATION; LOWER RISK OF ESRD**  
Higher risk particularly among young black persons



Younger age, same albuminuria even with higher GFR

Age (18-80yrs) **30**

Gender **Male**

Race (White or Black) **White**

eGFR (mL/min/1.73m<sup>2</sup>) **95**

Systolic Blood Pressure (mmHg) **130**

Hypertension Medication **No Medication**

BMI (kg/m<sup>2</sup>) **30**

Non-Insulin Dependent Diabetes **No Diabetes**

Urine Albumin to Creatinine (mg/g) **90**

Smoking History **Current Smoker**

Age (18-80yrs) **65**

Gender **Male**

Race (White or Black) **White**

eGFR (mL/min/1.73m<sup>2</sup>) **85**

Systolic Blood Pressure (mmHg) **130**

Hypertension Medication **No Medication**

BMI (kg/m<sup>2</sup>) **30**

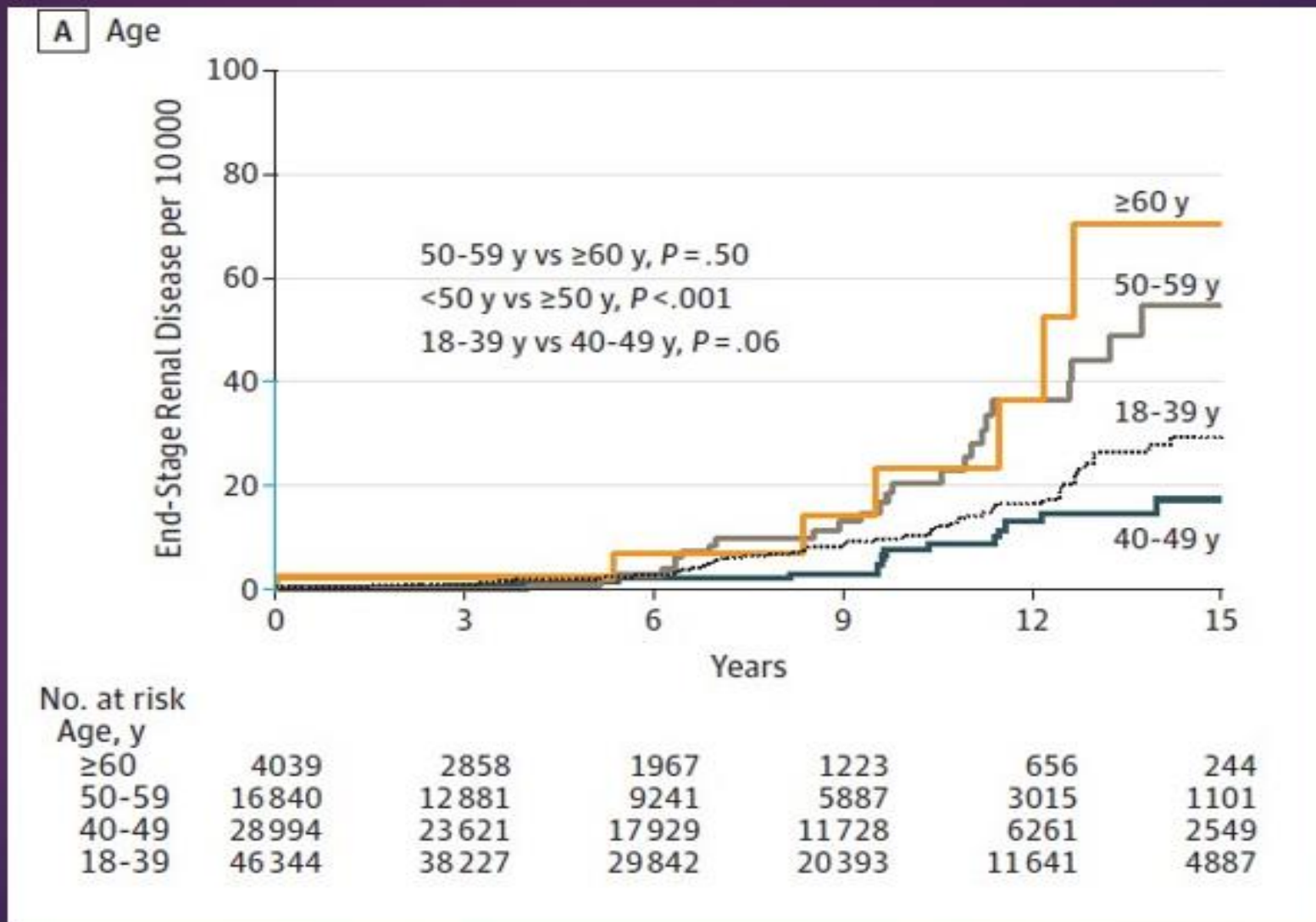
Non-Insulin Dependent Diabetes **No Diabetes**

Urine Albumin to Creatinine (mg/g) **90**

Smoking History **Current Smoker**

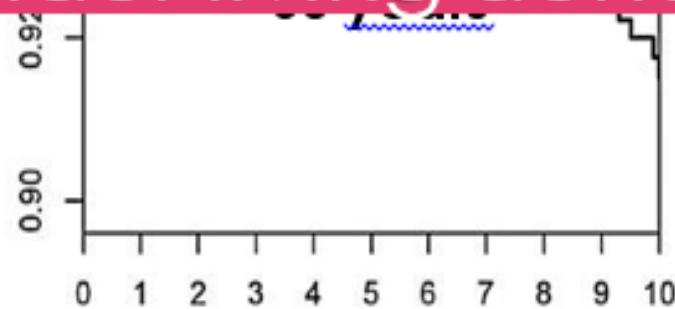
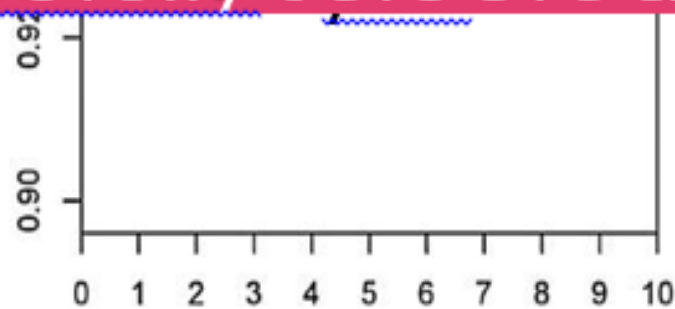
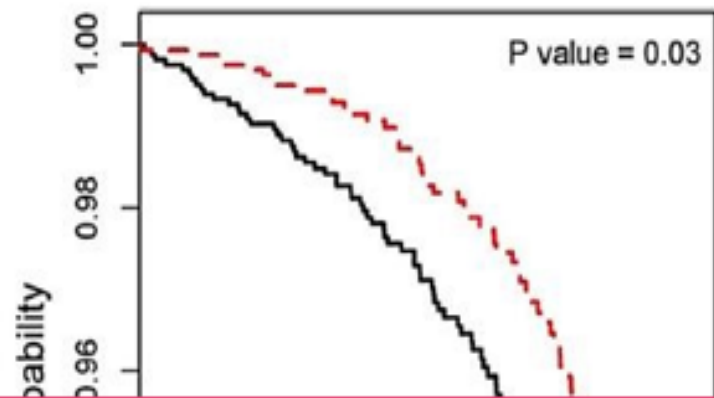
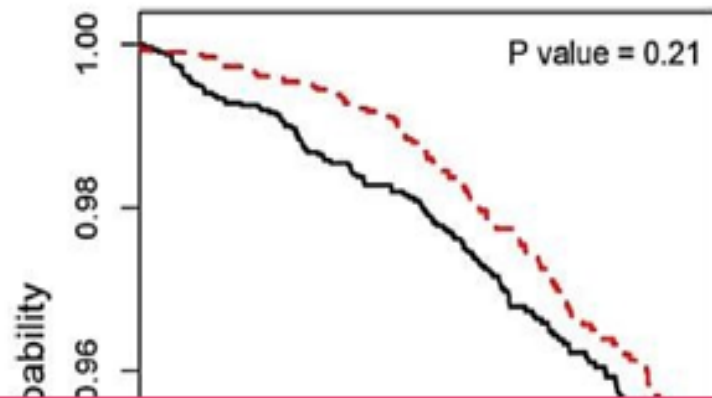


# Cumulative Incidence of End-Stage Renal Disease in Live Kidney Donors



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

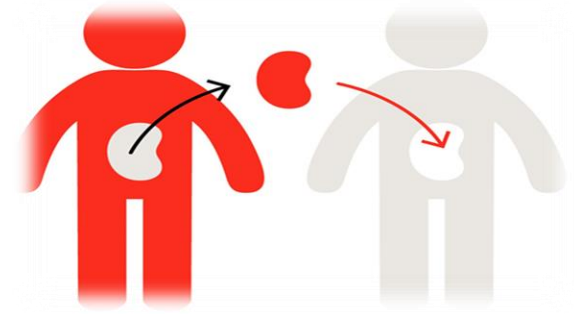
Outcomes are generally acceptable among  
 carefully selected older living donors.



— Non-donor  
 3368 3352 3338 3036 2797 2541 2249 1948 1623 1286 915  
 - - - Donor  
 3368 3365 3352 3059 2821 2555 2263 1962 1631 1287 921

— Non-donor  
 1648 1641 1632 1423 1242 1068 903 755 611 478 369  
 - - - Donor  
 1648 1647 1644 1436 1260 1085 921 769 620 489 377

# Outcome of the living kidney donor



consequences of kidney donation on the living donor health, considering:

- ✓ *very short term (linked to the surgery)*
- ✓ *short term (effect of nephrectomy on glomerular filtration rate)*
- ✓ *long term (risk of mortality, chronic kidney disease, proteinuria and hypertension)*



**The following should be performed **at least annually** postdonation:**

- ❑ Blood pressure measurement
- ❑ BMI measurement
- ❑ Serum creatinine measurement with GFR estimation
- ❑ Albuminuria measurement
- ❑ Review and promotion of a healthy lifestyle including regular exercise, healthy diet and abstinence from tobacco
- ❑ Review and support of psychosocial health and well-being

# LONG-TERM POST NEPHRECTOMY ISSUES

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- ❑ Within **days to weeks** after uninephrectomy, hyperfiltration in the remaining kidney **increases the GFR to about 75% to 80%** of predonation value
- ❑ Similar to the nondonating population, an additional **5 mL per minute loss in GFR per decade** occurred after donating
- ❑ This acute compensation is, however, **less efficient in elderly or obese patients** as it is related to the use of the renal functional reserve

# LONG-TERM POST NEPHRECTOMY ISSUES

## proteinuria

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- ❑ Urine albumin excretion, attributable to single nephron hyperfiltration may be elevated but **is usually low grade** and not associated with a higher risk for renal dysfunction
- ❑ this complication occurs only in a minority of donors
- ❑ The proteinuria **will be <1 g/24 h** in the **vast majority** of donors  
More severe and nephrotic proteinuria are exceptional



# *LONG-TERM POST NEPHRECTOMY ISSUES*

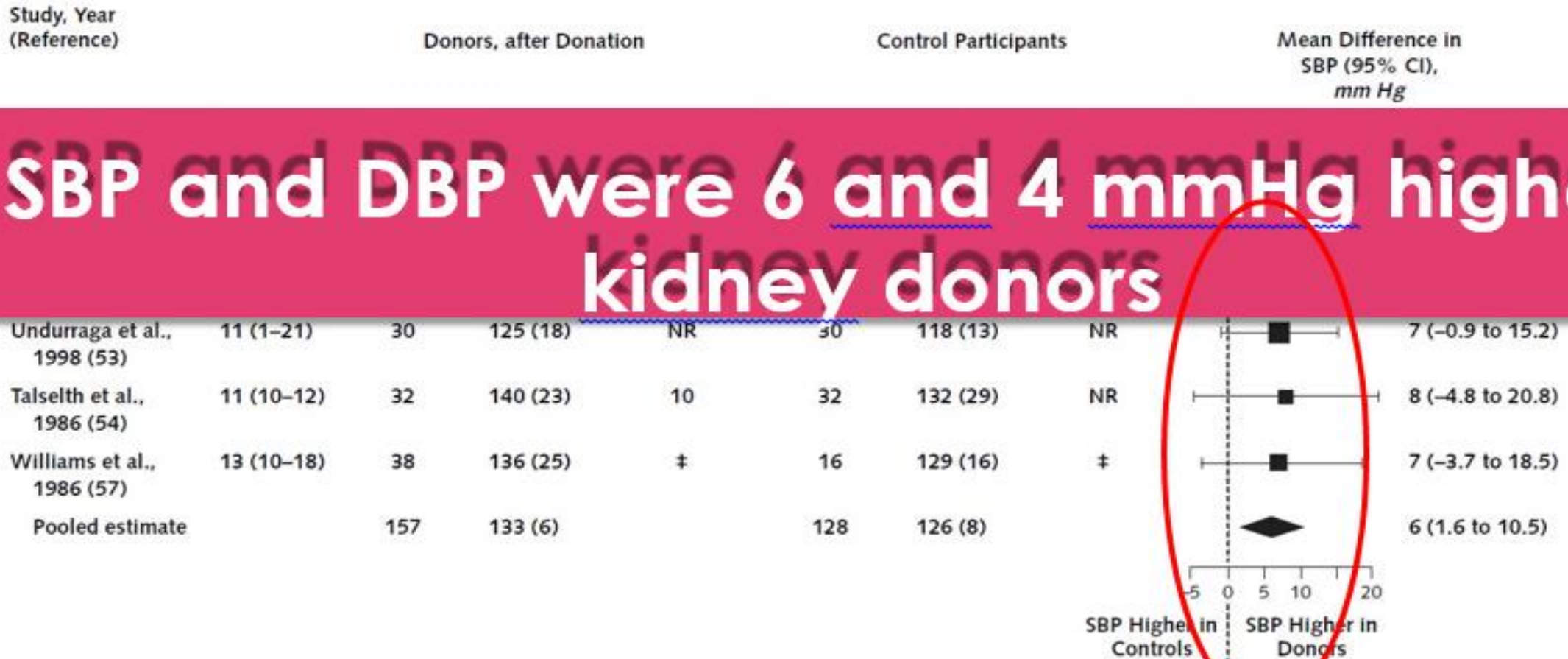
## **hypertension**



- ❑ The incidence of **hypertension requiring treatment** increases with time following kidney donation, but most studies suggest a similar frequency compared with an age-matched population
- ❑ it would appear reasonable to **target a SBP ≤ 130 mm Hg** for long-term follow-up of donors

# 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.



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

# Long-Term Medical Care

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- In the United States, transplant centers are required to report follow-up donors **at discharge (or 6 weeks postdonation, whichever comes first) 6 months, 1 year, and 2 years after donation**
- Routine checkups, cancer screening appropriate for age, regular aerobic exercise, weight reduction, tobacco avoidance, and excessive alcohol abstinence should be emphasized

## *Long-Term Medical Care(cont..)*

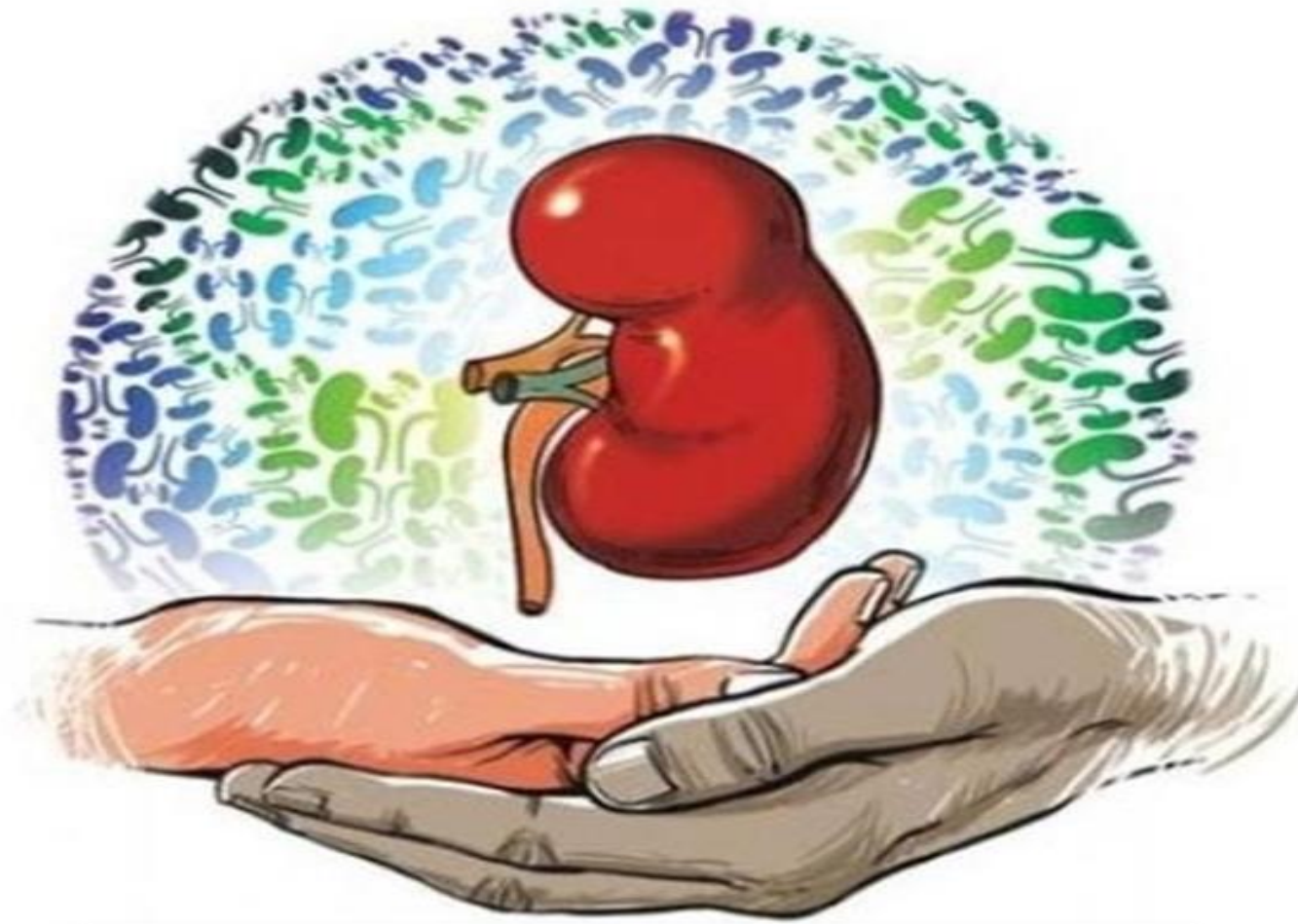
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- ❑ Kidney donors with established medical issues before donation, such as **mild hypertension, history of nephrolithiasis, or obesity**, should have **more frequent** follow-up
- ❑ Donors should be **discouraged** from using **high-protein diets** for weight loss or **protein supplements** for body building because they may contribute to hyperfiltration injury
- ❑ They should be advised to avoid **longterm regular use** of nonsteroidal anti-inflammatory drugs

# Summary

- Donor kidney function **should be expressed** as GFR(mL/min per 1.73 m<sup>2</sup>) & **not** as serum creatinine concentration
- **mGFR** using an exogenous filtration marker is the **most accurate** confirmatory test
- The **most commonly** used measure of evaluating GFR in clinical practice is based on a 24-h creatinine clearance (**mCrCl**)
- future risk of developing kidney failure necessitating treatment with dialysis or transplantation is **slightly higher**
- A web-based calculator has been developed to compute **post-test probabilities** <http://ckdepi.org/equations/donor-candidate-gfr-calculator> for mGFR above or below various threshold probabilities
- **Long-term risk** in the absence of donation can be computed from <http://www.transplantmodels.com/esrdrisk>
- **Advanced age can increase the risk for perioperative complications, but there is no mandated upper age limit for living kidney donation**

thanks



**GIVE HOPE**  **SHARE LIFE**