Bridging the Gap from Dialysis to Transplantation

Kidney Transplantation : Listing & Allocation

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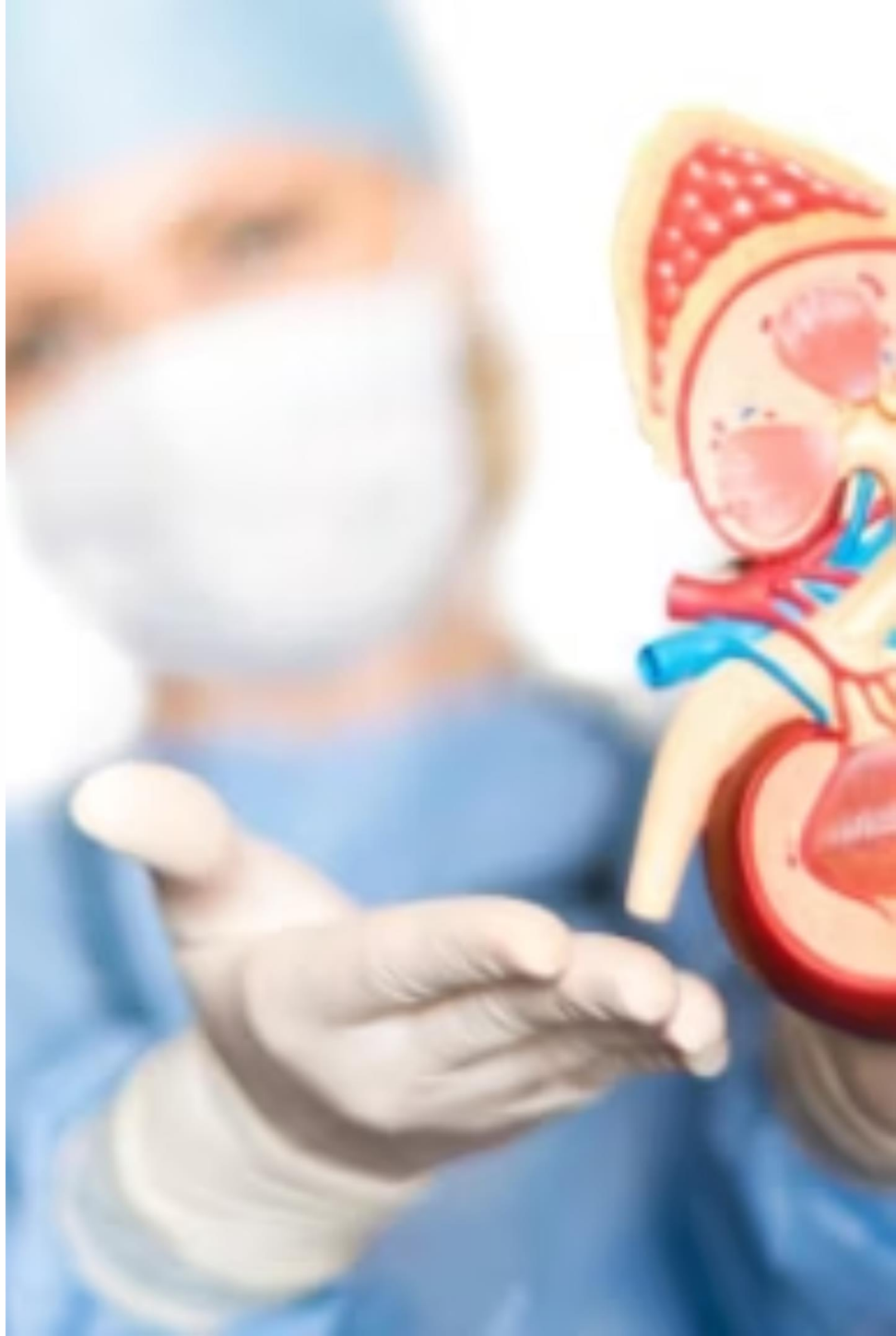


INTRODUCTION

Disclaimers

No Conflicts of Interest

I have no financial disclaimers or conflicts of interest to disclose.

Professional Perspective

I am a transplant nephrologist committed to helping every eligible patient achieve safe and successful transplantation.

Evolving Landscape

The topics we'll discuss today represent an evolving field with ongoing updates to policies and best practices.

This presentation aims to provide dialysis providers and healthcare professionals with a comprehensive overview of kidney transplantation processes, from initial evaluation through allocation systems.

Today's Outline

01

Standard Work Up for Transplantation

Comprehensive evaluation criteria and candidacy assessment

02

Placing the Patient on the Wait List

Timeline, requirements, and registration process

03

Kidney Allocation Score

Understanding how kidneys are matched to recipients

04

Kidney Donor Profile Index

Evaluating donor organ quality and compatibility

05

Expected Post Transplant Survival

Predicting outcomes and long-term success

Kidney Transplantation

Best Modality to Treat CKD/ESKD……But Not for All

- Kidney transplantation is a high-risk medical intervention with associated risks that extend well beyond the surgical procedure itself. Not all candidates are appropriate for an intervention of this magnitude, and careful selection is essential to ensure optimal outcomes.

- It is required that these risks be undertaken only on behalf of a recipient who is expected to do well following transplantation. The evaluation process must balance the potential benefits against the inherent risks for each individual patient.

- The gap between the supply and demand of this scarce societal resource is the basis for needing a national Kidney Allocation System. This obligates transplantation centers to identify recipients who will derive a meaningful duration of benefit from transplantation, ensuring responsible stewardship of donor organs.

Standard Evaluation of Candidacy

A comprehensive transplant evaluation examines multiple dimensions of a candidate's readiness. Success depends not only on medical factors but also on social, financial, and psychological preparedness.

Social Support

Strong caregiver network and family involvement are critical for post-transplant recovery and long-term medication adherence.

Financial Stability

Ability to afford immunosuppression medications, co-pays, and ongoing medical care throughout the transplant journey.

Mental Space

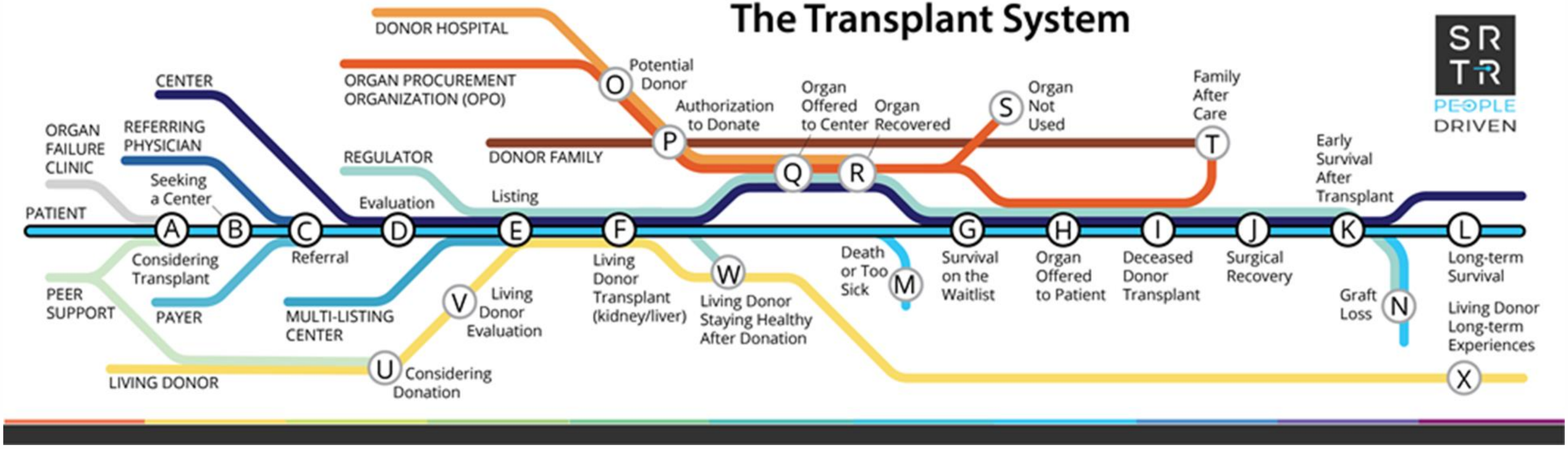
Psychological readiness, understanding of the process, and capacity to manage the demands of post-transplant care.

Medical Health

Comprehensive assessment of cardiovascular status, infectious disease screening, and optimization of existing comorbidities.

I've Referred My Patient to the Transplant Center…

After a patient is referred to a transplant center, a structured evaluation process begins. Understanding this pathway helps dialysis providers set appropriate expectations and support patients through each stage of assessment.


The Transplant System
SRTR
PEOPLE DRIVEN
DONOR HOSPITAL
ORGAN PROCUREMENT ORGANIZATION (OPO)
DONOR FAMILY
CENTER
REFERRING PHYSICIAN
ORGAN FAILURE CLINIC
REGULATOR
PATIENT
Seeking a Center
Evaluation
Listing
A Considering Transplant
B
C Referral
D
E
F Living Donor Transplant (kidney/liver)
O Potential Donor
P Authorization to Donate
Q Organ Offered to Center
R Organ Recovered
S Organ Not Used
T Family After Care
G Survival on the Waitlist
H Organ Offered to Patient
I Deceased Donor Transplant
J Surgical Recovery
K Early Survival After Transplant
L Long-term Survival
M Death or Too Sick
N Graft Loss
W Living Donor Staying Healthy After Donation
V Living Donor Evaluation
U Considering Donation
X Living Donor Long-term Experiences
PEER SUPPORT
PAYER
MULTI-LISTING CENTER
LIVING DONOR

- Best ways to collaborate with transplant centers to help patients in the workup process ?

- After Care ?

TIMING

Timing of Referral

When Does a Patient's Wait Time on the DDKT Waitlist Start?

Date GFR Reached ≤20 mL/min

For patients evaluated and registered at GFR greater than 20 mL/min, wait time begins when their GFR first dropped to or below this threshold.

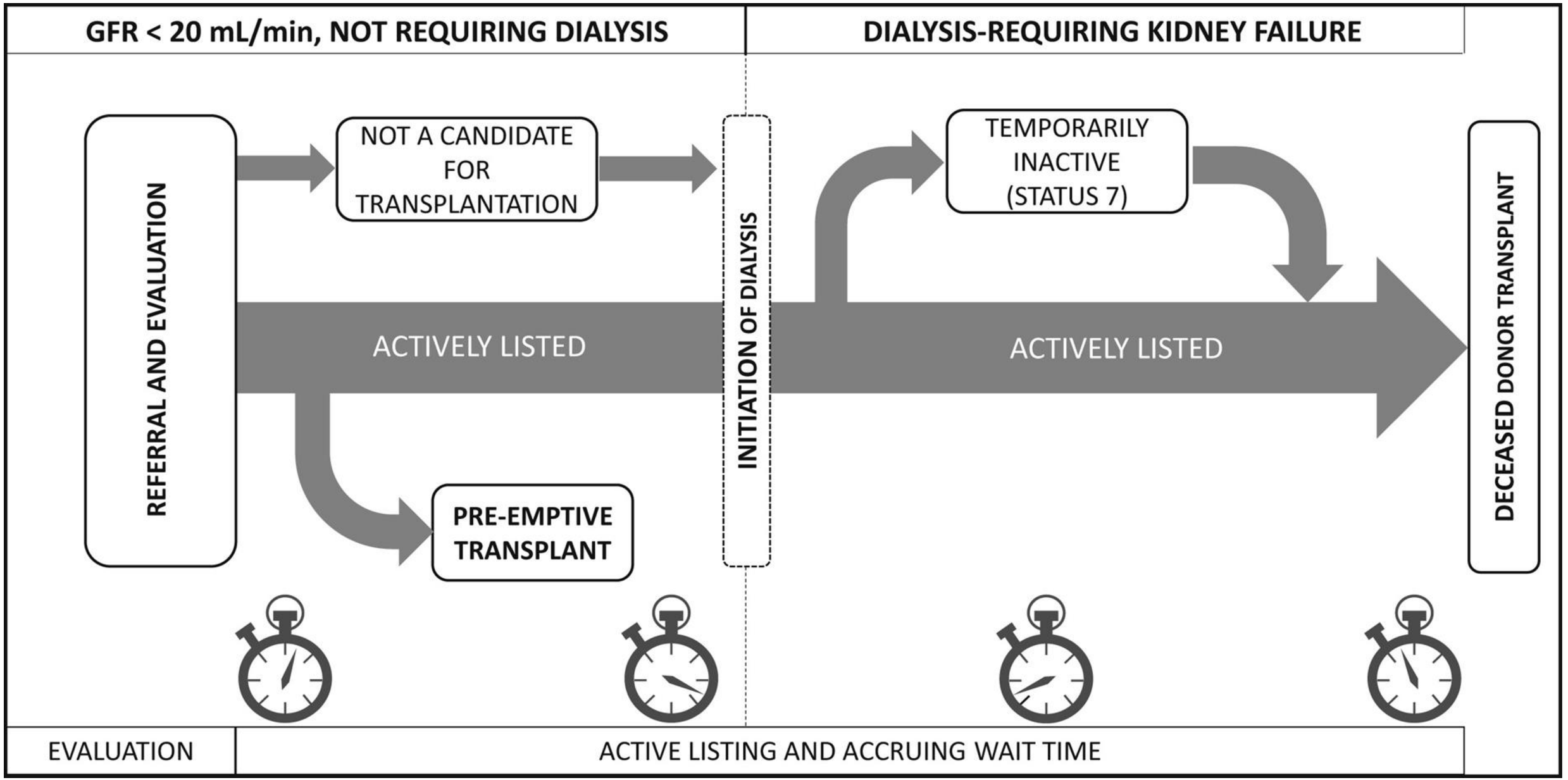
Date of UNOS Registration

If GFR is ≤20 mL/min at time of registration and the patient is not yet on dialysis, wait time starts at registration.

Date of ESKD / Start of Dialysis

Wait time begins on the date of ESKD or start of regularly administered kidney replacement therapy as documented on Form 2728.

Early referral and preemptive listing can significantly reduce total time to transplantation, improving outcomes and quality of life for patients with advanced CKD.



Reference: Virmani, AJKD 2020

DIAGNOSIS

Etiology of Kidney Failure

Glomerular Diseases

Glomerular diseases account for approximately 20% of death-censored graft failure, making accurate diagnosis essential for patient counseling and post-transplant management.

Common Recurrent Conditions:

- **FSGS** – Primary focal segmental glomerulosclerosis
- **IgA Nephropathy** – Most common primary glomerulonephritis worldwide
- **Membranous Nephropathy** – Risk varies with primary vs. secondary forms
- **Lupus Nephritis** – Requires disease quiescence before listing
- **C3 Glomerulopathy** – Complement-mediated disease with high recurrence risk

Key Considerations

Inform patients of the risk of disease recurrence in the transplanted kidney. This counseling should occur early in the evaluation process.

Obtain pathological or genetic diagnosis to rule out "presumed diagnoses" that may be inaccurate.

Additional work-up may be needed for conditions like ADPKD to screen for associated complications such as cerebral aneurysms or hepatic cysts.

Commonly Accepted Contraindications

- Active coronary disease or cardiopulmonary disease unsafe for anesthesia and noncardiac surgery (eg, decompensated heart failure, pulmonary hypertension)
- Active illicit substance use that may affect activities of daily living
- Active local infections (eg, podiatric or dental infections)
- Active systemic infections (eg, tuberculosis)
- Advanced-stage nonkidney disease (eg, COPD due to both surgical concerns and reduced life expectancy)
- Atherosclerotic vascular disease that precludes successful allograft anastomosis
- Class III obesity (BMI ≥ 40 kg/m^2)
- Expected posttransplantation life expectancy of <5 y
- Frailty with limited medical performance status
- Lack of adequate insurance coverage or plan to cover costs of posttransplantation care
- Lack of robust social support system
- Decompensated cirrhosis, eg, presence of portal hypertension, hepatic encephalopathy (unless simultaneous liver-kidney transplant is planned)
- Nonadherence to prescribed therapies, including medications and dialysis
- Poorly controlled psychiatric illness
- Untreated malignancy or treated but within the period of increased risk for recurrence
- Risks exceed the potential benefits

DEMOGRAPHICS

Age Considerations

No Upper Age Limit

Most centers do not impose a strict age cutoff, recognizing that biological age often differs from chronological age.

Seventh Decade Considerations

Patients in their 70s require careful evaluation of frailty, comorbidities, and expected benefit versus risk.

Evidence-Based Approach

Limited literature exists, but studies show **only a 3.7-year increase** in expected survival versus remaining on the waitlist
(Gill, Kidney International, 2005).

Octogenarian Outcomes

Patients 80 and older face significant challenges, with 55% one-year mortality in some series
(Lonning K, Transplantation, 2016).

The key principle is individualized assessment rather than rigid age cutoffs.
Biological fitness, functional status, and realistic expectations matter more than chronological age alone.

Frailty: An Independent Risk Factor

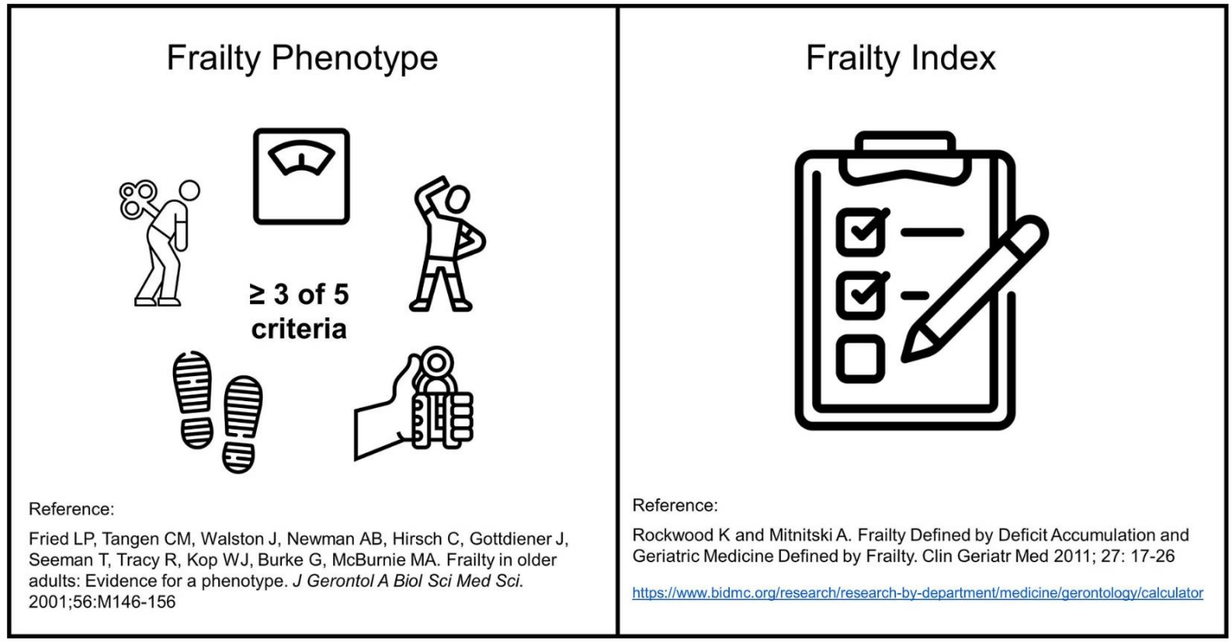
What is Frailty?

Frailty represents a constant state of inflammation with greater vulnerability to stressors due to diminished physiologic reserve and dysregulation of multiple physiologic systems.
Importantly, frailty is **independent of age**—even younger patients can be frail.

Impact on Transplant Outcomes

- **94% increased risk** of Delayed Graft Function (DGF)
- **60% increased risk** of early hospitalizations
- **Double the risk** for death in the first year after transplantation

Source: McAdams-DeMarco, AJT, 2015



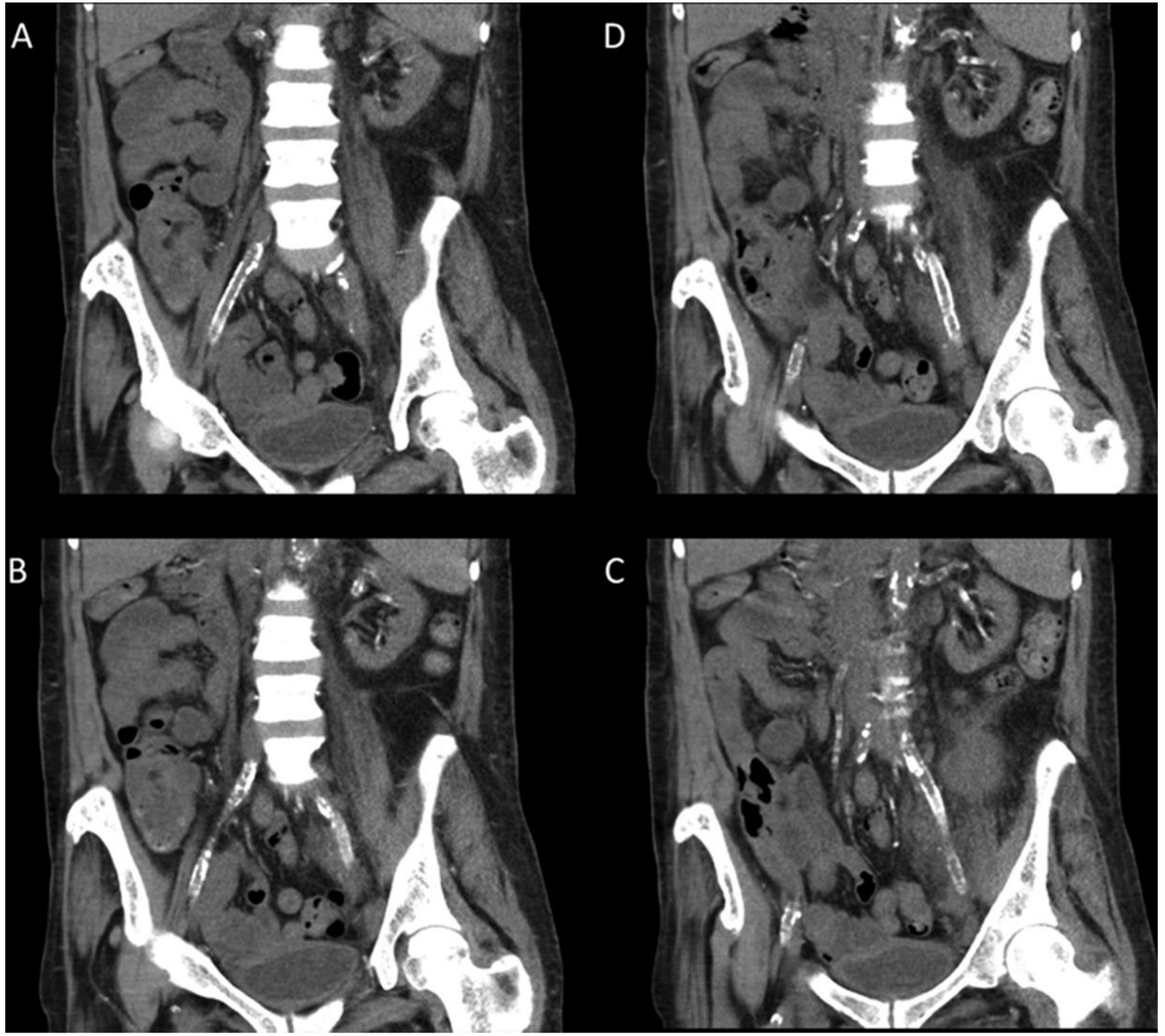
Frailty assessment should be a standard component of transplant evaluation.
Interventions such as physical therapy, nutritional optimization, and rehabilitation programs may help improve frailty status before transplantation.

✳ VASCULAR ASSESSMENT

Vascular Imaging

- Comprehensive vascular imaging helps identify anatomical barriers to transplantation and guides surgical planning.

- Significant vascular disease may require revascularization procedures before transplant candidacy can be approved.



Cardiovascular Risk Stratification

Increased Risk with CKD

The probability of cardiovascular disease (CVD) increases as GFR declines, with ESKD patients facing markedly elevated risk.

Risk Extends to Early Transplant Period

Cardiovascular events remain a significant concern in the immediate post-transplant timeframe, requiring careful monitoring.

ASCVD and Heart Failure

Both atherosclerotic cardiovascular disease and heart failure contribute to morbidity and mortality in transplant candidates.

Leading Cause of Death

Major adverse cardiac events (MACEs) are the most common cause of death in patients with working grafts, highlighting the importance of cardiac evaluation.

BODY COMPOSITION

Obesity Considerations

Center-Specific Approaches

Approaches to obesity vary significantly from center to center, influenced by surgical resources, expertise, and institutional experience.

Some centers have strict BMI cutoffs, while others evaluate each case individually.

Obesity as an Independent Risk Factor

- **Cardiovascular mortality** – Increased perioperative and long-term cardiac risk
- **Delayed Graft Function** – Higher rates of initial poor graft function
- **Wound dehiscence** – Separation of surgical incisions
- **Wound infections** – Increased susceptibility to surgical site infections
- **Peri-allograft fluid collections** – Seromas and lymphoceles

Patients with obesity face a significantly greater need for surgical "re-exploration" and negative pressure wound management devices.

Despite these complications, transplantation reduces overall mortality by approximately 50%, though this benefit diminishes as BMI approaches or exceeds 40 kg/m² (Hossain, CKJ, 2017).

Initial evaluation provides an opportunity to motivate patients to set weight loss targets. Referral to obesity medicine specialists and consideration of GLP-1 agonists may help candidates achieve healthier weights before transplantation.

Malignancy Screening and Waiting Periods

A history of malignancy requires careful assessment of recurrence risk before transplantation. Immunosuppression **can promote cancer recurrence or development of de novo malignancies**, making cancer screening and waiting periods essential components of candidate evaluation.

The required disease-free interval varies by cancer type, stage, and grade.
Low-risk skin cancers may require minimal waiting, while high-grade malignancies often necessitate several years of remission.
Consultation with oncology and adherence to consensus guidelines helps inform these decisions.

Age-appropriate cancer screening should be up to date for all candidates, including colonoscopy, mammography, PAP smears, and prostate screening as indicated.
This proactive approach identifies occult malignancies before immunosuppression begins.

Box 5. Suggested Disease-Free Wait Times for Various Treated Malignancies

No recurrence-free interval required
- Asymptomatic T1 renal cell carcinoma
- Carcinoma in situ, cervix
- Microscopic prostate cancer
- Monoclonal gammopathy of undetermined significance
- Nonmetastatic nonmelanoma skin cancer
- Superficial bladder cancer

Minimum 2 years of recurrence-free interval recommended
- Breast cancer, in situ
- Invasive bladder cancer
- Kaposi sarcoma
- Leukemias
- Lymphomas
- Macroscopic prostate cancer
- Melanoma in situ
- Multiple myeloma
- Renal cell carcinoma with suspicious features
- Stage A/B colorectal cancer
- Testicular cancer
- Thyroid or other endocrine tumors
- Uterine cancer
- Wilm tumor

Minimum 5 years of recurrence-free interval recommended
- Colorectal cancer, stage C
- Malignant melanoma
- Stage II breast cancer
- Symptomatic renal cell carcinoma (lesion > 5 cm)

Transplantation not recommended
- Advanced breast cancer (stage III)
- Colorectal cancer, stage D
- Liver cancer, not meeting the Milan criteria
- Uncontrolled or untreated malignancies

PRACTICE VARIATION

Areas of Variation Among Centers

Transplant centers demonstrate considerable variation in their evaluation protocols and acceptance criteria. Understanding this variability helps providers guide patients to programs that best match their individual circumstances.

- Upper age limit and specific age thresholds
- Cardiovascular testing requirements and preferred modalities
- BMI cutoffs and weight management expectations
- Need and modality of pelvic and lower limb vascular imaging
- Control of secondary hyperparathyroidism and iPTH goal targets
- Frailty assessment methods and non-frailty requirements
- Tobacco and marijuana use policies, including substance-free period duration
- Duration of disease-free survival required for previously diagnosed malignancies
- Dental evaluation and clearance protocols
- Policies for candidates unwilling to accept blood products for religious reasons

These variations reflect differences in institutional philosophy, patient populations, and available resources. Patients facing barriers at one center may find acceptance at another, making knowledge of program-specific criteria valuable for referring providers.

EPTS

Estimated Post-Transplant Survival: Predicting Recipient Longevity

EPTS Score Range

The EPTS score (0-100%) estimates how long a transplant candidate will benefit from receiving a kidney relative to all other candidates on the waiting list.

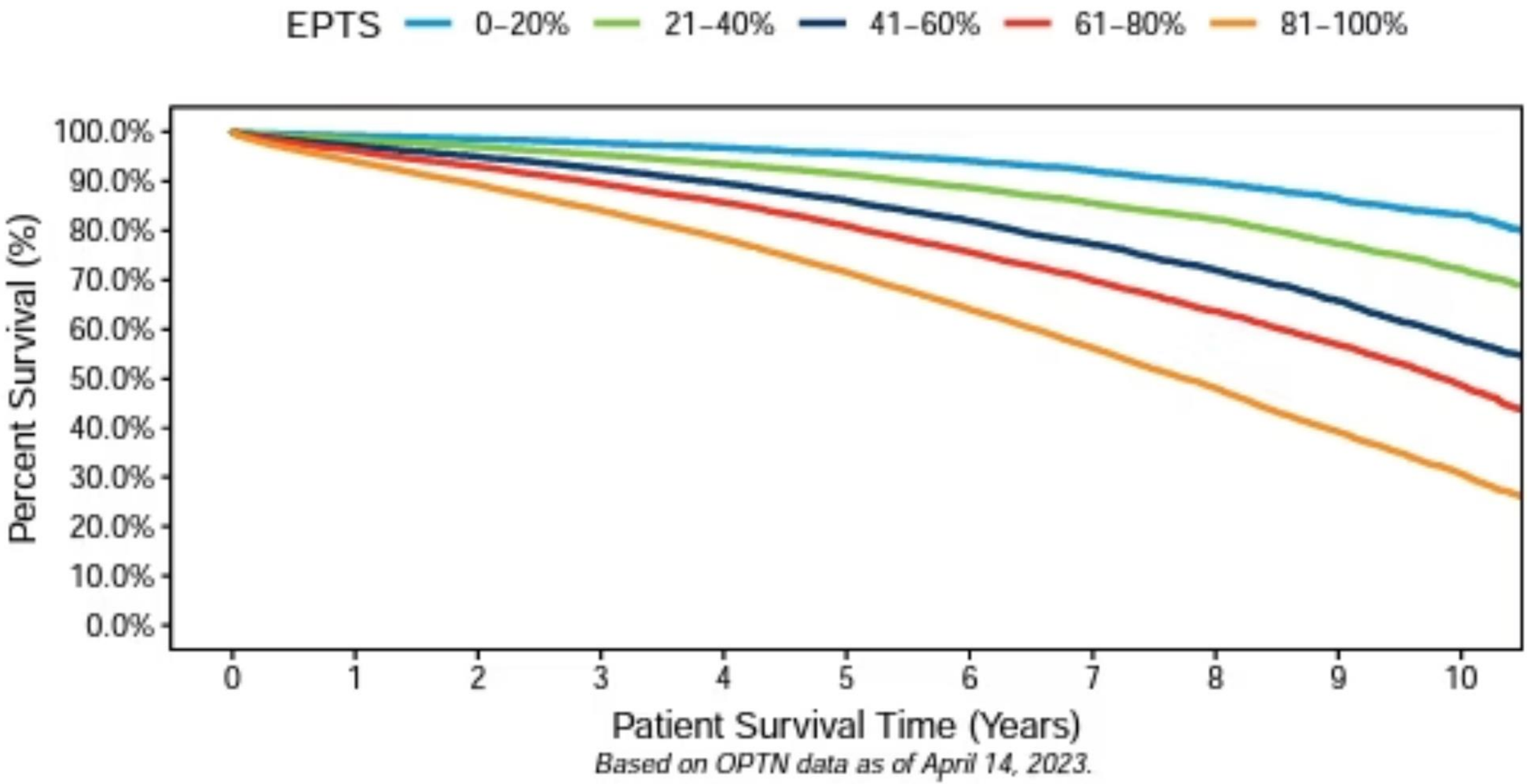
Lower is Better

A lower EPTS indicates longer expected post-transplant survival. An EPTS of 20% means the candidate is expected to survive longer than 80% of other candidates.

EPTS is determined by four critical factors:

1. Candidate age at time of listing
2. Total time on dialysis treatment
3. History of prior organ transplantation, and
4. Current diabetes diagnosis status.

EPTS Score Overview



Based on OPTN data as of April 14, 2023.

Understanding Kidney Transplant Allocation

- How the Organ Transplant system optimizes organ matching for better patient outcomes.

> Immunological Matching

- HLA typing and matching
- cPRA and role in the KAS

> Longevity Matching

- KDPI / EPTS

> Peri-Mortem Data

- Ischemic Time / Perfusion Methods / Transportation

BACKGROUND

What is the Kidney Allocation System (KAS)?

01

Implementation in 2014

The United Network for Organ Sharing (UNOS) introduced KAS to revolutionize kidney transplantation fairness and improve long-term outcomes for recipients nationwide.

02

Balancing Quality & Need

KAS carefully matches organ quality with recipient needs, maximizing both graft survival rates and overall patient benefit through evidence-based algorithms.

03

Key Innovations

The system introduces longevity matching principles **(KDPI/EPTS)** and sensitization considerations **(HLA Matching)**, creating a more equitable and medically optimized allocation process.

HLA Typing: The Foundation of Transplant Compatibility

Human Leukocyte Antigens (HLA) are proteins, or markers, found on the surface of nearly all cells in your body. These markers are unique to each individual and play a critical role in your immune system's ability to distinguish between "self" and "non-self."

In kidney transplantation, matching HLA types between a donor and recipient is paramount. A close HLA match significantly reduces the risk of the recipient's immune system recognizing the new kidney as foreign and attacking it, a process known as rejection. HLA typing identifies these specific markers in both the donor and recipient.

By precisely characterizing these genetic markers, medical teams can select the most compatible organs, vastly improving the chances of long-term graft survival and overall patient well-being post-transplant.

HLA Matching: Loci and Antigen Compatibility

Human Leukocyte Antigens (HLA) are genetic markers on cells crucial for immune system recognition. In kidney transplantation, a close HLA match is vital to prevent rejection and ensure long-term graft survival. Understanding the specific loci and antigen compatibility is key to successful outcomes.

Key HLA Loci

The primary HLA loci considered for kidney transplantation are HLA-A, HLA-B, and HLA-DR. Each person inherits two antigens for each of these loci (one from each parent), resulting in up to six measurable antigens.

The 6-Antigen Match

A "perfect match" or 6-antigen match occurs when all six HLA-A, HLA-B, and HLA-DR antigens are identical between the donor and recipient. While rare, these matches offer the best prognosis for graft survival.

Impact of Mismatches

Each mismatch increases the risk of immune rejection. Modern immunosuppressive drugs help manage this, but fewer mismatches (e.g., 0, 1, or 2) generally lead to better long-term outcomes and reduced need for aggressive medication.

SENSITIZATION

Sensitization and the Role of cPRA in Allocation

What is cPRA?

Calculated Panel Reactive Antibody (cPRA) measures sensitization by reflecting the immune system's likelihood to reject available donor kidneys based on existing antibodies.

> Pregnancy
>
> Previous Transplantation
>
> Blood Transfusions

The Challenge of High Sensitization

Higher cPRA scores (approaching 100%) indicate it's significantly harder to find compatible donors due to the presence of preformed antibodies against common tissue types.

Priority Point System

KAS awards additional priority points for candidates with higher cPRA scores, improving access to transplantation for highly sensitized patients who face the longest waits.

How Sensitization Affects Wait Time and Allocation Priority

100%

Maximum cPRA

Patients approaching 100% cPRA face extreme difficulty finding matches

Years

Extended Waiting

Highly sensitized patients can wait years without finding a compatible donor

Priority

KAS Adjustment

System grants increased priority to reduce disparities

Enhanced Priority Points

KAS awards sliding-scale priority points based on cPRA percentage, with the highest sensitized patients receiving maximum allocation priority.

Equity Improvements

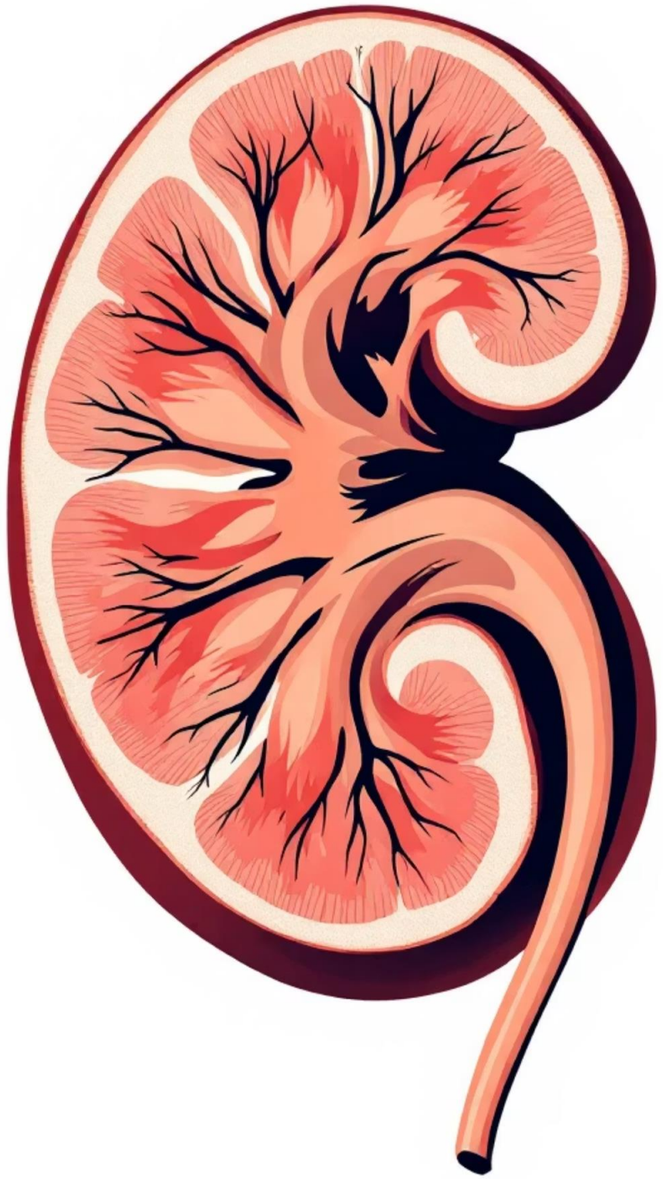
These interventions reduce disparities in access and improve overall equity in transplant opportunities for immunologically disadvantaged patients.

Broader Geographic Sharing

Highly sensitized candidates benefit from expanded geographic sharing zones, increasing their pool of potential compatible donors significantly.

Factor	Points Awarded
For qualified time spent waiting	1 per year (as 1/365 per day)
Degree of sensitization (CPRA)	0–202
Prior living organ donor	4
Pediatric candidate if donor KDPI<0.35	1
Pediatric candidate (age 0–10 yr at time of match) when offered a zero antigen mismatch	4
Pediatric candidate (age 11–17 yr at time of match) when offered a zero antigen mismatch	3
Share a single HLA-DR mismatch with donor	1
Share a zero HLA-DR mismatch with donor	2

These points will be used to rank candidates in each of the categories listed in Table 1, with more points leading to higher priority for receiving a kidney offer.



KDPI

Kidney Donor Profile Index: Measuring Kidney Quality

KDPI is a comprehensive percentage score ranging from 0-100% that estimates how long a donor kidney is expected to function compared to all other donated kidneys in a given year.

Understanding the Score

Lower KDPI indicates superior quality. For example, a KDPI of 20% means the kidney is expected to outlast 80% of all other donor kidneys.

KDPI calculator.

Factors Evaluated

- Donor age, height, and weight
- Cause of death circumstances
- Medical history: hypertension and diabetes
- Serum creatinine levels

- ~~Donor ethnicity~~
- ~~Hepatitis C antibody status~~

Longevity Matching: Pairing Kidneys and Recipients for Maximum Benefit

Top 20% Priority

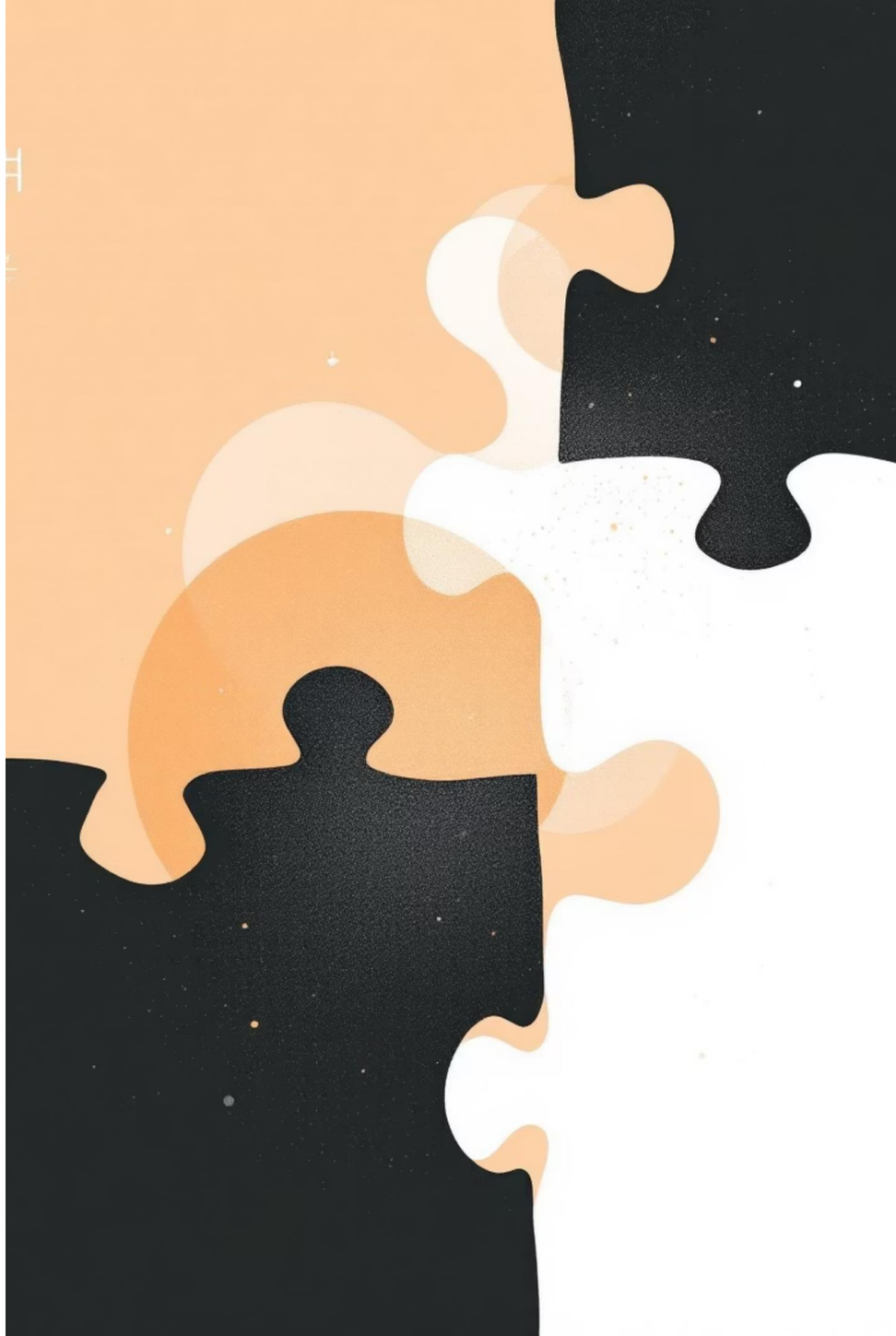
Kidneys with KDPI ≤ 20% (highest quality organs) are prioritized for candidates with EPTS ≤ 20% (longest expected survival).

Maximize Graft Years

The primary goal is to maximize total years of graft function by strategically matching the best quality kidneys to recipients who will benefit longest.

Flexible Allocation

If no suitable match exists within the top 20% EPTS candidates, kidneys are offered to next qualified candidates regardless of their EPTS score.



Visualizing the Matching Process

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1

KDPI Assessment (0-100%)

Donor kidneys evaluated on quality scale: 0% represents best quality, 100% represents lowest quality available for transplant.

2

EPTS Evaluation (0-100%)

Recipients scored on survival expectations: 0% indicates longest predicted survival, 100% indicates shortest predicted post-transplant survival.

3

Longevity Matching

Top 20% KDPI kidneys preferentially allocated to top 20% EPTS candidates to maximize graft longevity and patient benefit.

4

Sensitization Priority Boost

Highly sensitized patients (high cPRA) receive additional priority points, moving them higher in allocation queues for compatible organs.

OUTCOMES

Impact of KAS: Improved Outcomes and Equity

Reduced Graft Failure

Longevity matching has significantly reduced premature graft failure rates and decreased the need for re-transplantation procedures.

Increased Access

Sensitization priority has dramatically increased transplant rates for difficult-to-match patients who previously faced near-impossible odds.

Enhanced Fairness

Waitlist time now starts from first dialysis or GFR <20 ml/min, improving fairness especially for minority populations historically disadvantaged.

Summary: KAS Balances Quality, Longevity & Equity

KDPI + EPTS

KDPI quantifies donor kidney quality while EPTS predicts recipient post-transplant survival, creating a scientific foundation for allocation.

Longevity Matching

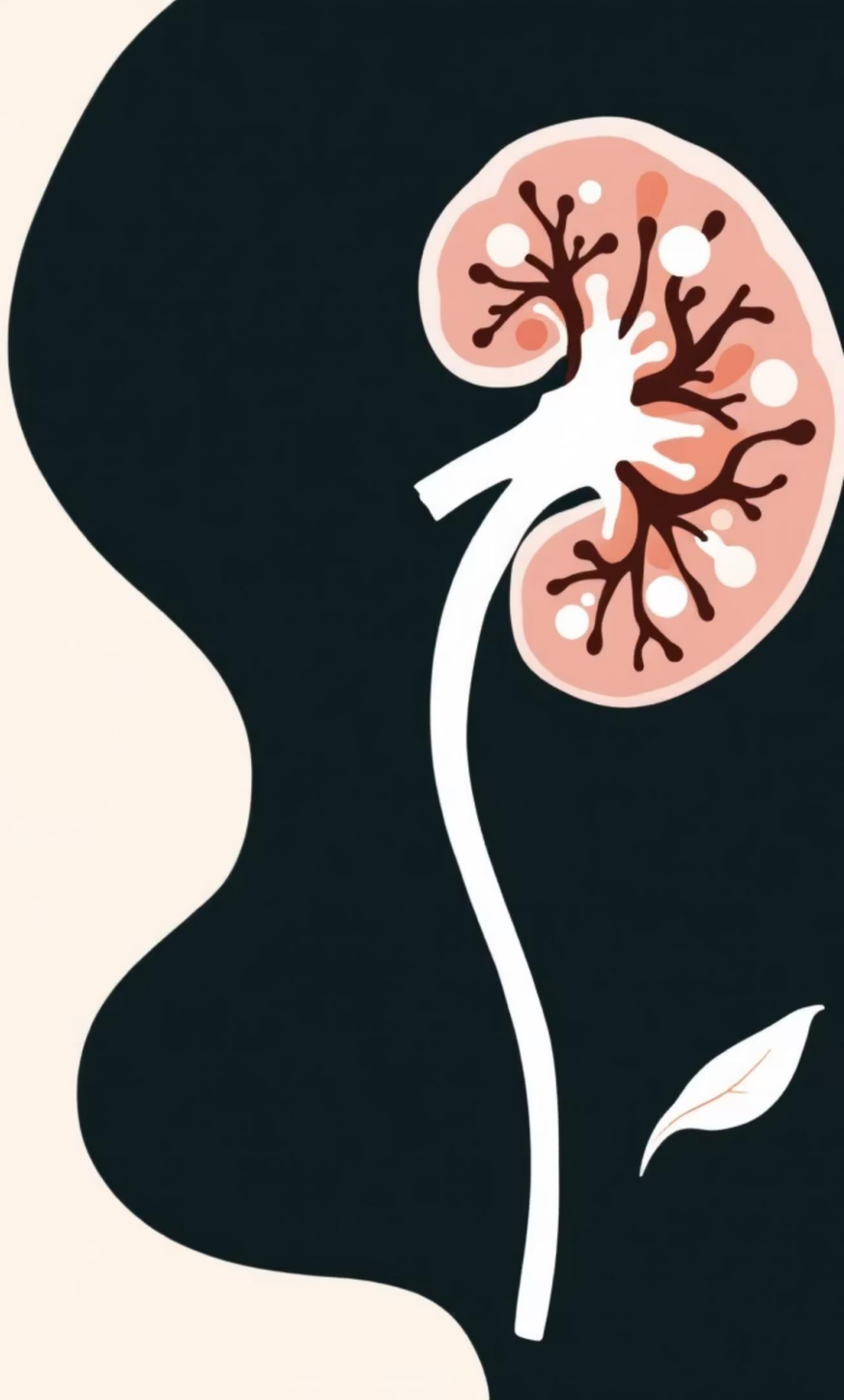
Strategically pairs highest quality kidneys with recipients expected to benefit longest, maximizing overall graft function years.

Sensitization Priority

cPRA-based priority ensures fair access for highly sensitized patients, addressing historical inequities in transplant opportunities.

Optimized Outcomes

Together, these integrated scoring systems optimize kidney allocation for superior patient and graft outcomes nationwide.



HLA Matching Within the KAS Framework

Human Leukocyte Antigen (HLA) matching is the cornerstone of successful kidney transplantation, ensuring biological compatibility between donor and recipient.

While KDPI assesses donor kidney quality and EPTS predicts recipient longevity, and cPRA addresses sensitization challenges, HLA compatibility acts as the initial filter, identifying viable donor-recipient pairs. A high degree of HLA match significantly reduces the risk of immune rejection, paving the way for long-term graft survival.

The KAS algorithm meticulously weighs HLA compatibility alongside these other factors. A near-perfect HLA match can elevate a patient's priority, especially when combined with appropriate KDPI/EPTS scores. This comprehensive approach ensures that not only are the best quality kidneys used efficiently, but also that highly sensitized patients and those with the best biological matches receive equitable consideration, ultimately enhancing both fairness and successful outcomes.

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Patient Tools

SRTR Transplant Decision Aid

What are your likely outcomes on the kidney transplant waiting list?

Choose your state:
United States

Choose your transplant program:
National average

Choose your age:
55

Choose your sex:
- (•) Male
- ( ) Female

Choose your race:
- ( ) Asian
- ( ) Black
- ( ) Native American
- ( ) Pacific Islander
- (•) White
- ( ) Multiracial

Choose your ethnicity:
- ( ) Latino
- (•) Not Latino

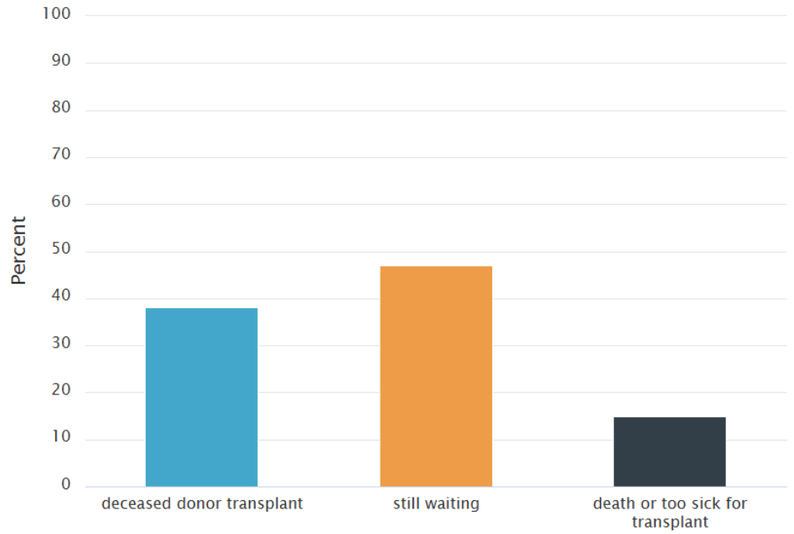
Enter your height:
Feet: 5 **Inches:** 8

Enter your weight:
Pounds:

How many years into the future do you want to predict?
1 2 3 4 5

Outcomes in 5 Years

Of patients like you:
38% will get a deceased-donor transplant
47% will still be waiting
15% will die or become too sick for transplant



National average • 55-Year-Old White Not Latino Male • Height: 5' 8" • Weight: 150 lbs •
Blood Type: O • cPRA: 0 • 0 Years on Waitlist • 0 Years on Dialysis • Health Issues: None

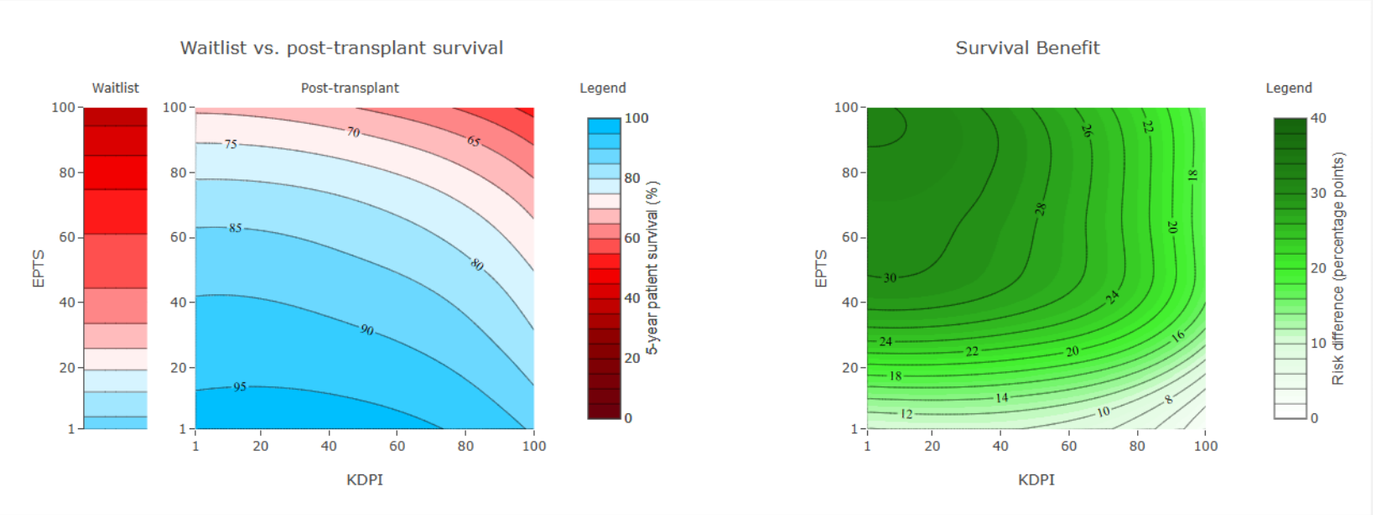
Patient Tools

KDPI-EPTS Survival Benefit Estimator

Please enter the candidate's Estimated Post-Transplant Survival (EPTS) and the kidney's Kidney Donor Profile Index (KDPI). Values are between 1 and 100.

Candidate EPTS [ ] **Kidney KDPI** [ ] Estimate

Predicted 5-year survival if the candidate..	
Remains on waitlist, based on the candidate's EPTS	
Receives this kidney, based on the candidate's EPTS and the offered kidney's KDPI	
Survival benefit, based on the candidate's EPTS and the offered kidney's KDPI	



The yellow marker indicates predicted 5-year survival for the candidate's EPTS and the offered kidney's KDPI.
To explore other combinations of EPTS and KDPI, enter new values or place your mouse pointer on the charts.

Thank You !

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