

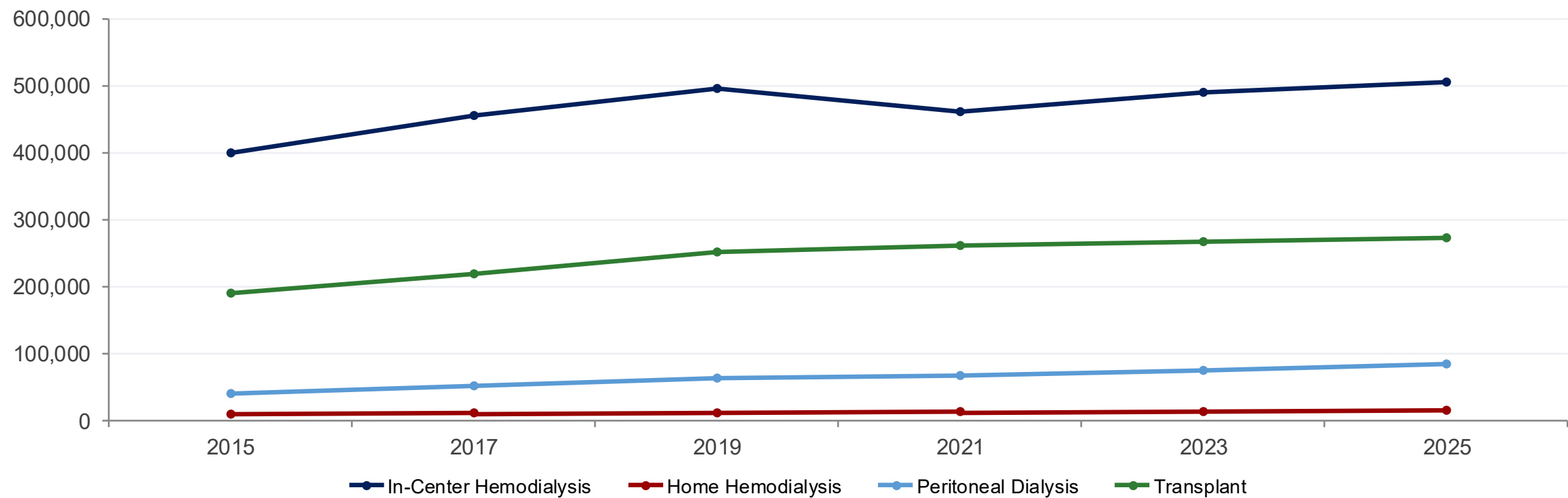


Kidney Disease for the Primary Care Provider: Kidney Replacement Therapy

Pranav Garimella, MD, MPH
Chief Medical Officer

End Stage Kidney Disease Prevalence in the United States, 2025

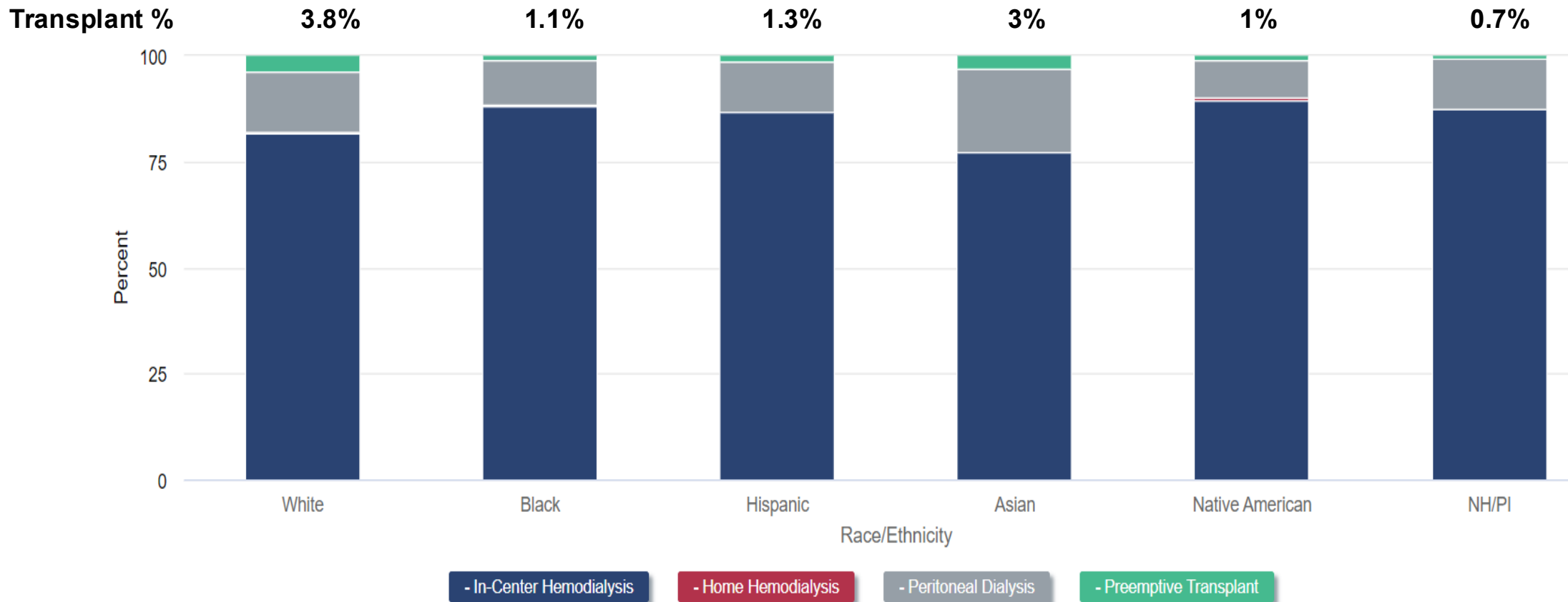
- Kidney replacement therapy — dialysis = 558,095
- Kidney replacement therapy — transplant = 273,097



USRDS Annual Data Report, 2025 (updated from 2023 report)

End Stage Kidney Disease Treatment, 2021

Compared with minorities, higher % of white individuals received a pre-emptive kidney transplant



Kidney Transplant Need, United States 2021

THE NEED

127,671

On the waiting list in 2021

90,223

On the waiting list at end of year

40,856

Added to the waiting list
(112/day average)

5,034

Removed from list, not for transplant

*14 died per day • 97 per week
• 420 per month*

THE SOLUTION

19,184

Total donors in 2021

5,971

Living donors

13,213

Deceased donors

2,357

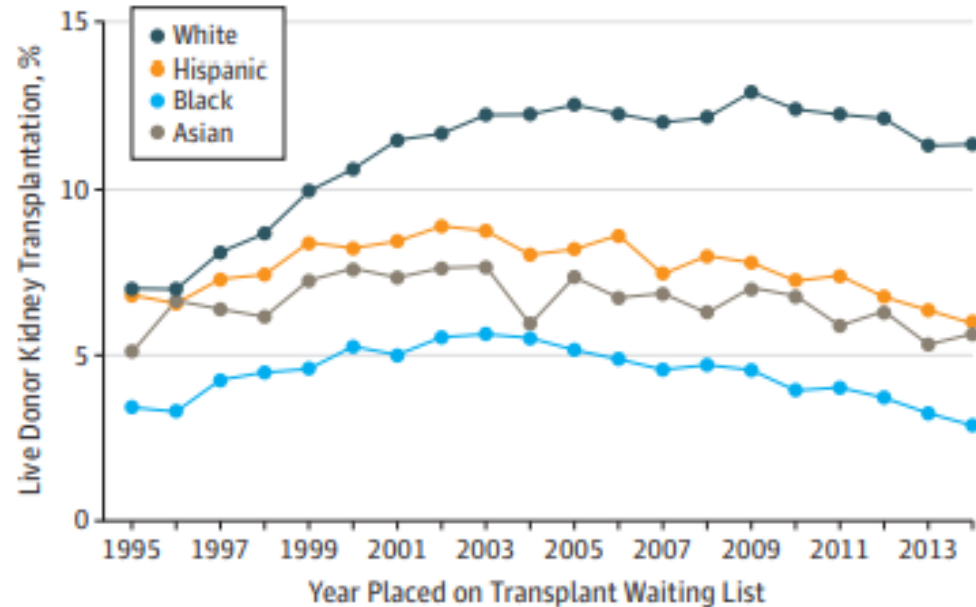
Living-related donors

3,185 living unrelated, directed • 429 living unrelated

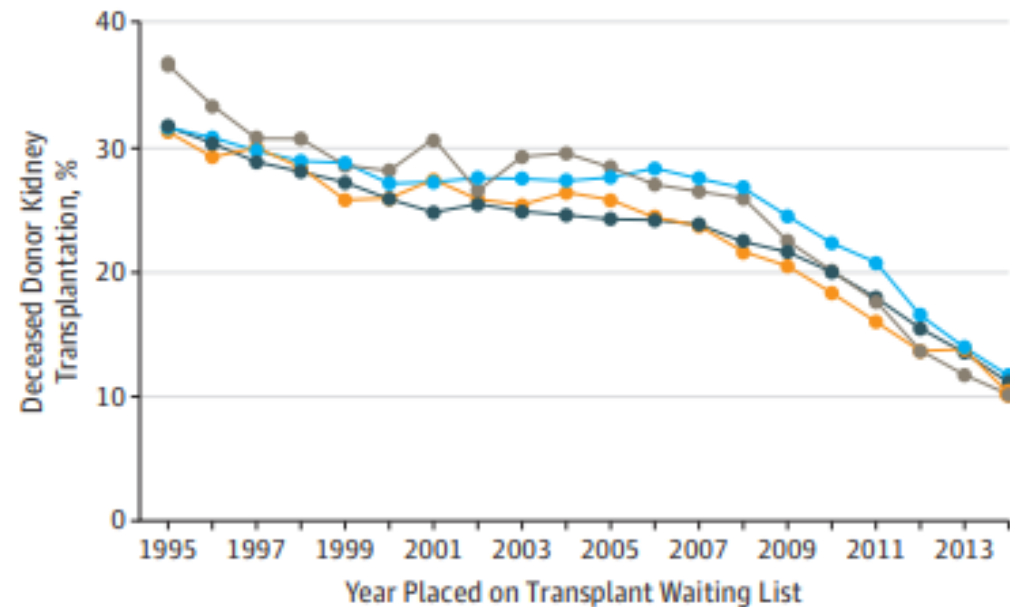
OPTN/SRTR 2021 Annual Data Report: Kidney. Am J Transplant 2023 Feb; 23(2): S21-S120

Living Donor Kidney Transplantation – Disparities

A Live donor kidney transplantation



B Deceased donor kidney transplantation



- Between 1995-2014, racial disparities increased in candidates for kidney transplantation in the United States

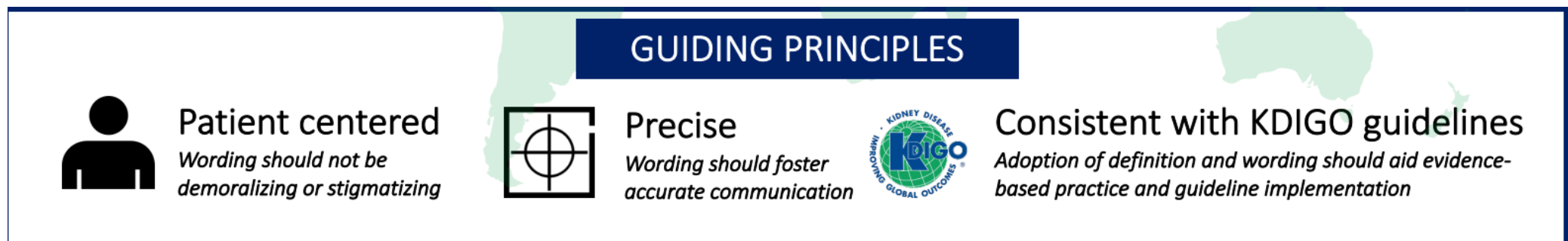
Outline

-
- **Definitions & Treatment Options**
 - **When to Refer for Kidney Replacement Therapy Planning**
 - **Primary Care for the patient with kidney failure**
 - Hypertension
 - Diabetes mellitus
 - Vaccinations
 - Cancer Screening
 - Transplant Readiness
 - **Co-management Care Model for Primary Care & Nephrologist**

End Stage Kidney Disease

- Definitions:

- End stage Kidney Disease – *“a medical condition in which a person’s kidneys cease functioning on a permanent basis leading to the need for a regular course of long-term dialysis or kidney transplant to maintain life.”*
- Kidney Failure – GFR < 15 mL/min or patients with CKD treated by dialysis
 - Duration – *Acute Kidney Injury < 3 months; Kidney failure > 3 months*
 - Symptoms & signs - *Uremia*
 - Treatment – *Kidney replacement therapy*



When to Refer for Kidney Replacement Therapy Planning

- Preparation for dialysis or transplant takes time — early referral improves outcomes and choice
- Consider both eGFR level and kidney failure risk trajectory when deciding to refer
- Risk-based referral (Kidney Failure Risk Equation, KFRE) outperforms eGFR-only criteria — reduces unnecessary referrals by ~25% without missing cases

**eGFR 30–60
or KF risk $\geq$ 3–5% (5 yr)**

Transition from
primary care to
nephrology care

**eGFR < 30
or KF risk $\geq$ 10% (2 yr)**

Transition from
nephrology to
interprofessional care

**eGFR < 20
or KF risk $\geq$ 40% (2 yr)**

Access and
transplant
planning

Kidney Intern 2024; 105 (Suppl 4S), S117-S314. PennChart order: ".kfre2"

KIDNEY FAILURE TREATMENT

Treatment Options for End-Stage Kidney Disease

Example Case

- 75 Y man with CKD G5/A3, multiple myeloma in remission, hypertension, current tobacco use.
- His usual CKD visit includes the following:
 - Screening for symptoms of uremia
 - Medication Reconciliation
 - Prevention of kidney disease progression
 - Hypertension management
 - Smoking cessation counseling
 - Metabolic disease complications
 - Hyperkalemia
 - Metabolic acidosis
 - Mineral bone disease
 - Anemia
 - Cardiovascular disease assessment
 - **Kidney failure treatment options**

Indications for Initiating Dialysis

Refractory acidosis, potassium disorders, or hyperphosphatemia

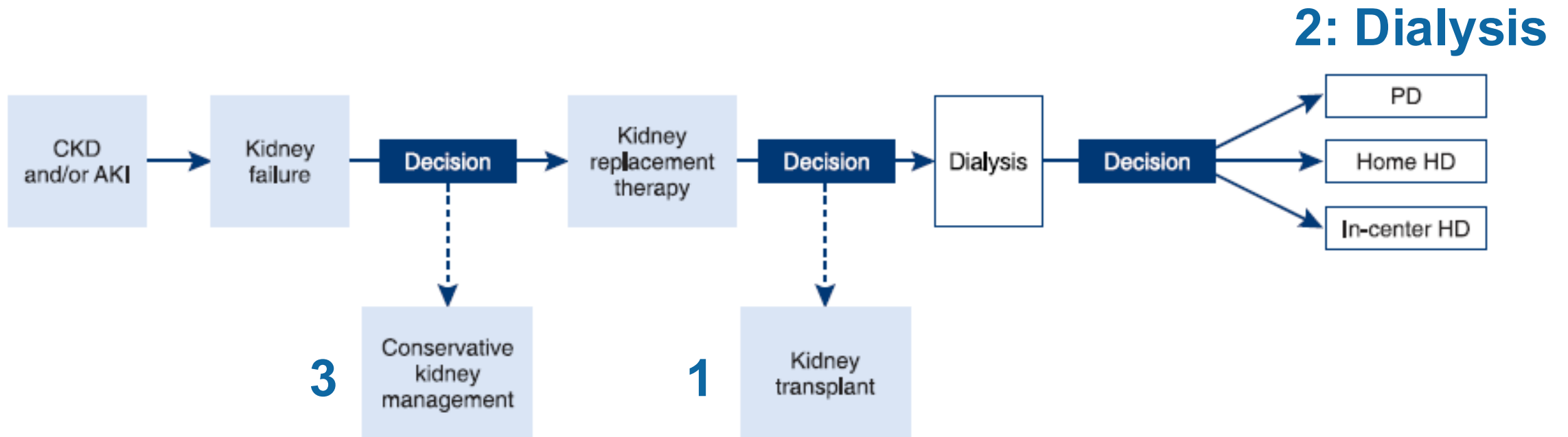
Refractory volume overload

Signs or symptoms of uremia*

Alterations in sense of taste or smell	Nausea
Amenorrhea	Protein-energy wasting
Anorexia	Pruritus
Bleeding/bruising	Reduced body core temperature
Confusion	Restless legs
Encephalopathy	Seizures
Hiccups	Serositis (pleuritis, pericarditis)
Insulin resistance	Sleep disturbance
Lethargy/fatigue	Somnolence
Muscle cramps	

Uncontrolled hypertension

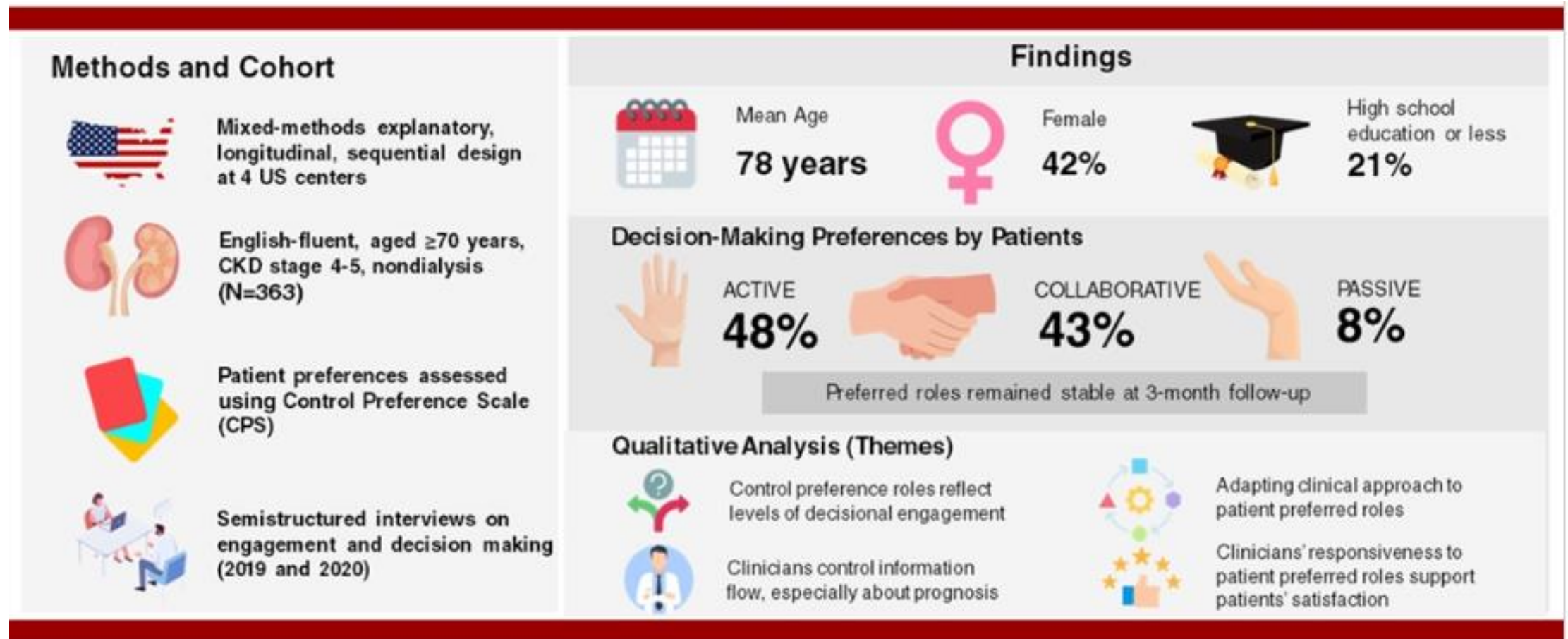
Decision Making in Individuals Living with Kidney Failure



Quinn & Lam. CJASN, 2023; 18: 1351-1358

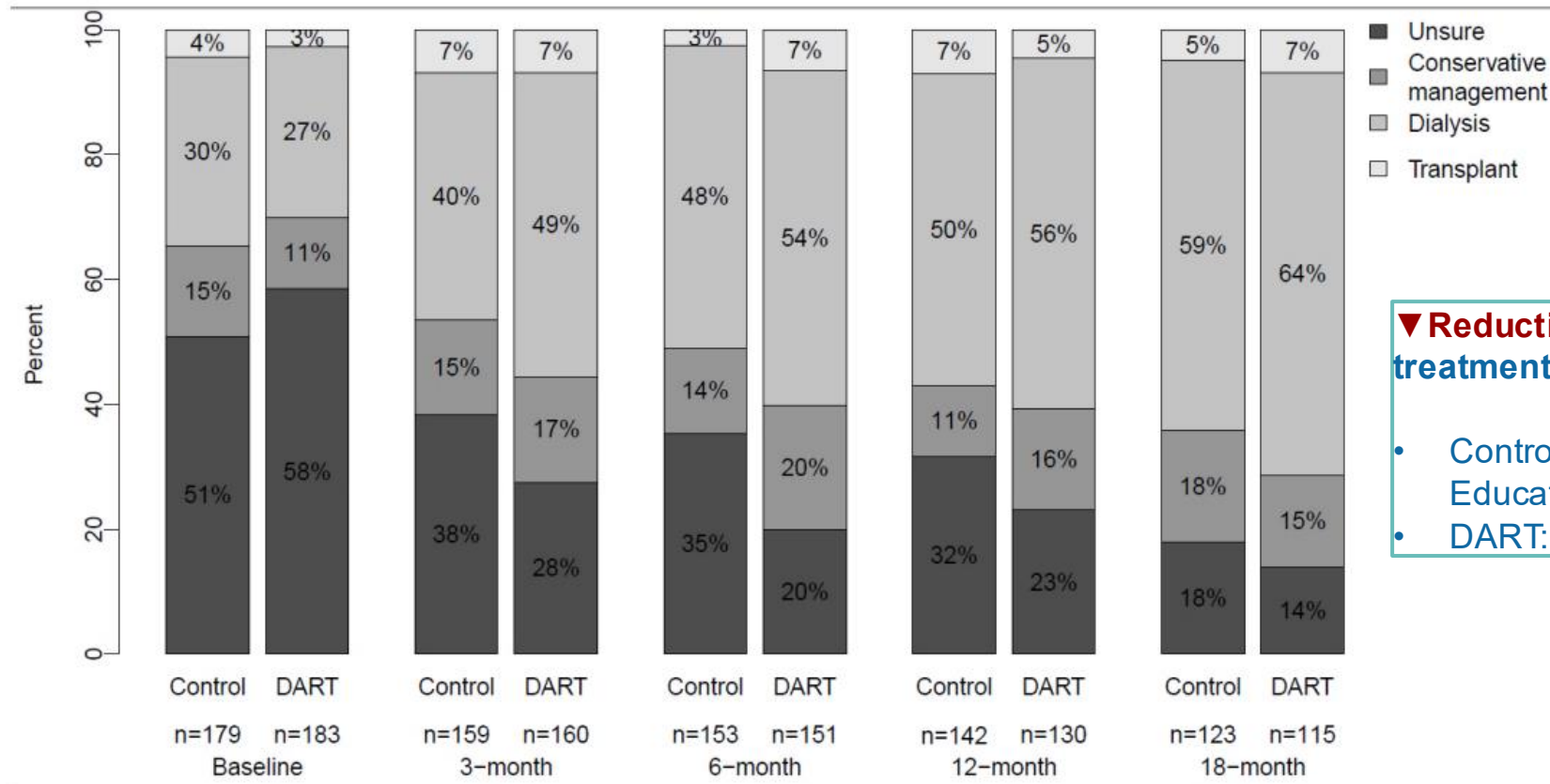
Decision-Making Engagement Preferences

- Older adults with CKD prefer active or collaborative role



Treatment Preferences over Time

- Decision aid for renal therapy (dart) trial



Abbreviation: DART, Decision Aid for Renal Therapy.

▼ **Reduction in patients unsure of treatment preferences over time**

- Control: Kidney Disease Education (written)
- DART: includes decision aid

Kidney Failure – Treatment Options

Conservative Management

Active medical management without dialysis

Transplant

Deceased donor • Living donor

Home Dialysis

Peritoneal Dialysis (PD) • Home hemodialysis (HHD)

In-Center Dialysis

Traditional 3x/week • Nocturnal 3x/week

Kidney Failure Treatment At-A-Glance

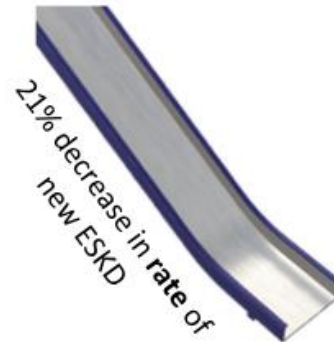
Total Medicare Expenditures (2023): \$55.3 Billion

- High prevalence but decrease in incident ESKD
- More common in racial minority populations
- Increased trend for home dialysis & transplantation
- High morbidity

New ESKD in the last two decades



By the end of 2023, the **total** number of Americans living with ESKD was at an all-time high of 831,192



New ESKD is **2X** more common in Hispanic people and **4X** more common in Black people than in White people



Black, 922 per million

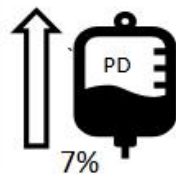


Hispanic, 514 per million



White, 243 per million

In the last 21 years, a shift away from in-center dialysis, more **new** ESKD are using at-home PD or receiving preemptive kidney transplant



Death after ESKD start



Start



Expected remaining years of life in patients with ESKD, 2021

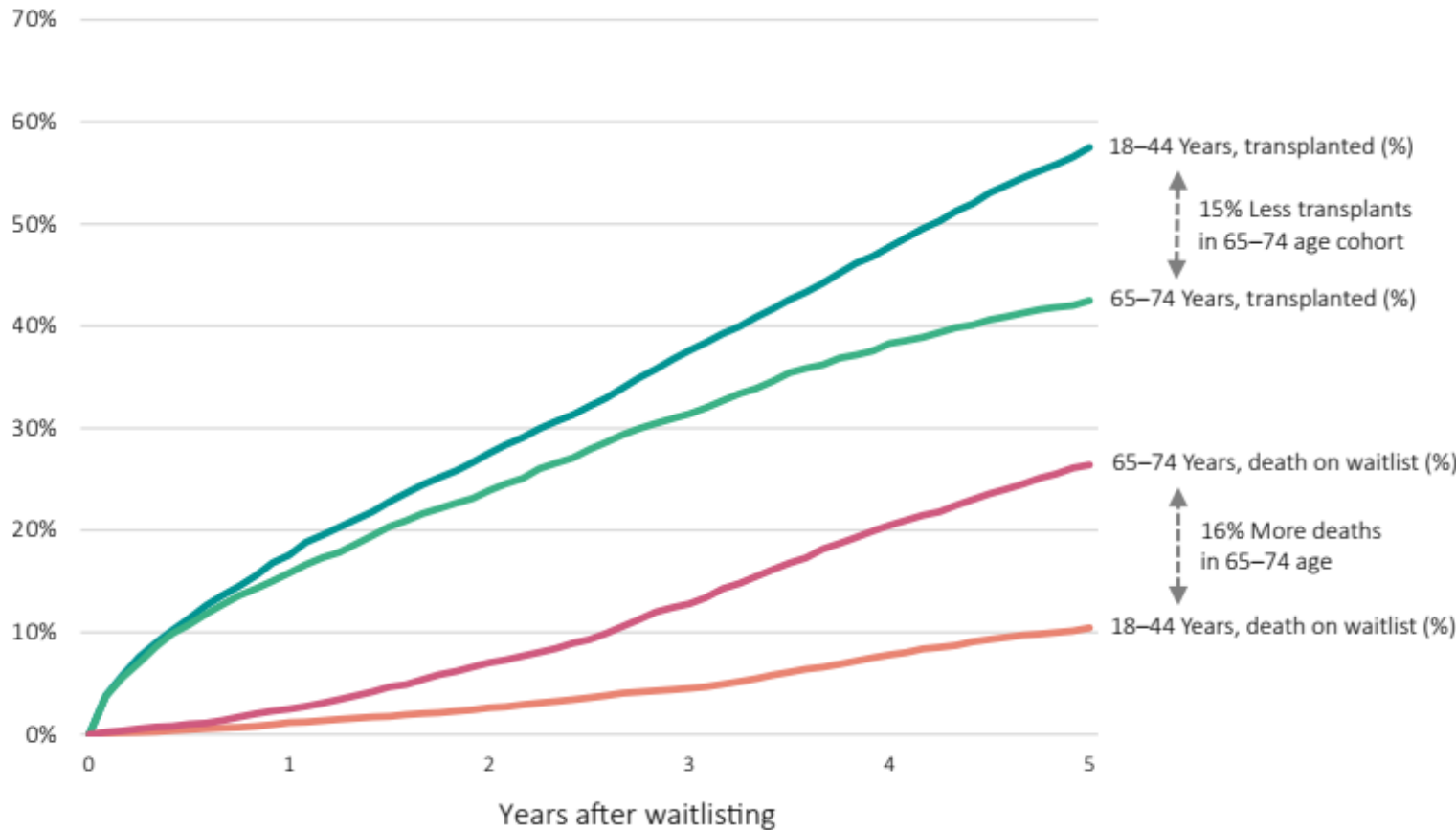
ESRD patients, 2021					US General Population, 2021	
Age	Dialysis		Transplant		Female	Male
	Female	Male	Female	Male		
40-44	8.6	9.4	24.0	22.1	38.7	34.3
45-49	7.6	8.1	20.6	18.8	34.2	30.1
50-54	6.7	7.0	17.6	15.7	29.8	26.0
55-59	5.9	5.9	14.8	13.2	25.6	22.2
60-64	5.1	5.0	12.2	10.8	21.6	18.7
65-69	4.3	4.3	10.0	8.9	17.7	15.3
70-74	3.8	3.6	7.9	7.2	14.1	12.2
75-79	3.3	3.1	6.4 ^a	5.7 ^a	10.7	9.3
80-84	2.9	2.6			7.8	6.8
85+	2.5	2.2			3.9	3.6

- Mortality is lower in transplanted patients compared to dialysis
- As age increases, mortality increases in dialysis patients

Wachterman et al JAMA Intern Med 2019
USRDS Data, 2021

Kidney Transplant Candidates

- Cumulative incidence of death or transplant after waitlisted



- Older adults represent the second largest group of adults on kidney transplant waitlist

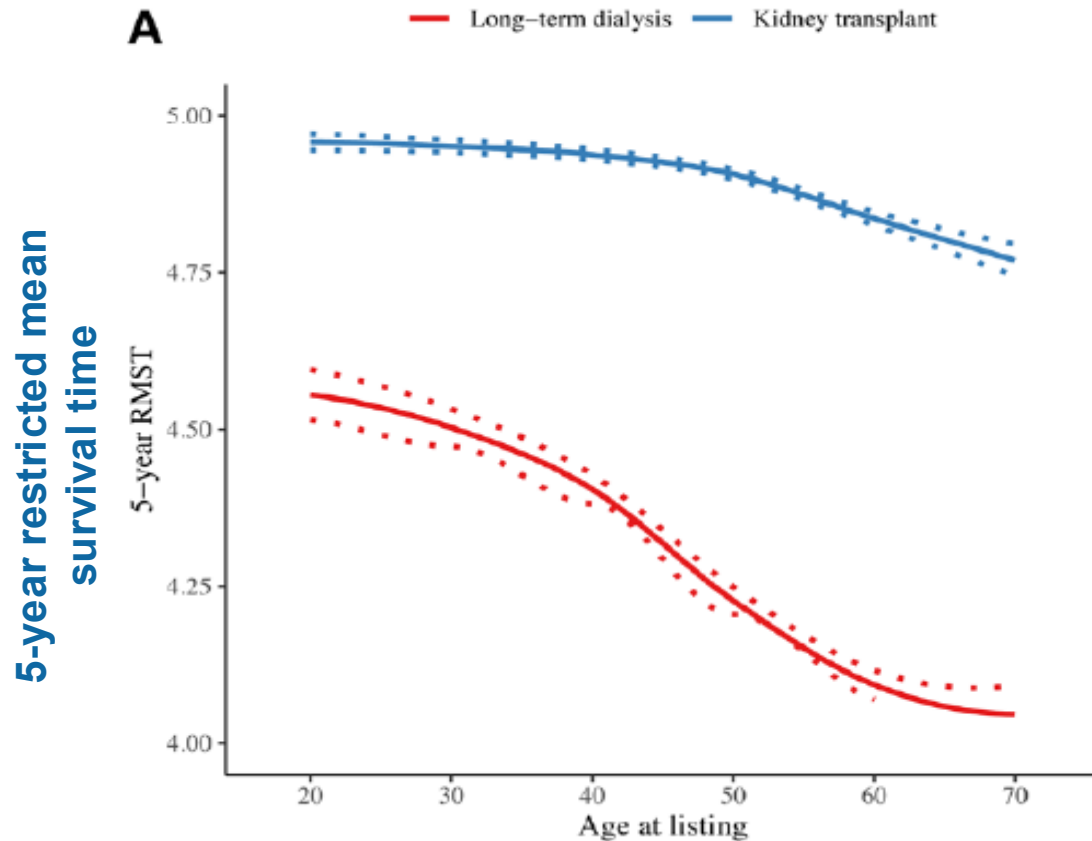
Different underlying etiologies and different comorbidities

Lower likelihood of transplantation in older cohort

- Higher waitlist mortality in older cohort

Kidney Transplant: Survival Benefit

- All cause mortality and difference across all age groups



- **Population:**

- Kidney transplant (KTx) recipients, 2008-2020
- US Renal Data System database

- **Outcomes:**

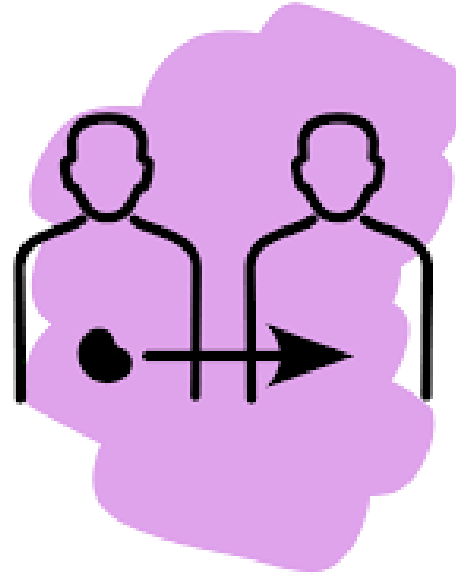
1. Survival advantage across all age groups comparing kidney transplant vs dialysis
2. Greater survival advantage among older patients receiving KTx compared to long-term dialysis [increase in 0.75 years (0.70-0.80)]
3. Survival advantage remains consistent across all ages even after adjustment for social vulnerability

Yang et al Transplantation, 2025;109(1): e64-e74

Contraindications to Kidney Transplantation

- **Absolute Contraindications**

1. Inability to tolerate surgery
2. Severe cardiac disease
3. Severe pulmonary disease
4. Active malignancy
5. Active Infection
6. Active drug use
7. Uncontrolled psychiatric disease



- **Relative Contraindications***

1. Obesity
2. History of noncompliance with medical care (including dialysis or medication regimen)
3. Frailty
4. Psychiatric problems
5. Limited life expectancy

- *center-specific contraindications apply

Dialysis Modalities

- Comparison of peritoneal dialysis and home hemodialysis

Peritoneal Dialysis (CAPD/APD)	Home Hemodialysis (HHD)
Better survival (APD = HHD)	Chance of a customized dialysis prescription (5–7/week)
More mobility and flexibility	Improved outcomes for longer and better survival
Continuous treatment can improve wellness	Performing dialysis in the comfort of your own home
Less fluid and diet restrictions	Increased sense of responsibility for self-treatment
It may be the best condition for transplantation	Flexibility in choosing a dialysis schedule
Better preservation of residual kidney function	Considerable reduction of travel to the dialysis center
Safeguarding vessels for future hemodialysis access	

PD Contraindications (Absolute & Relative)	HHD Contraindications (Absolute & Relative)
inflammatory abdominal diseases	lack of vascular access
unrepaired/unreparable hernia	hemodynamically unstable patient
ostomies/feeding tubes	coagulopathy

J Clin Med. 2023, 12: 3328

Dialysis Modalities

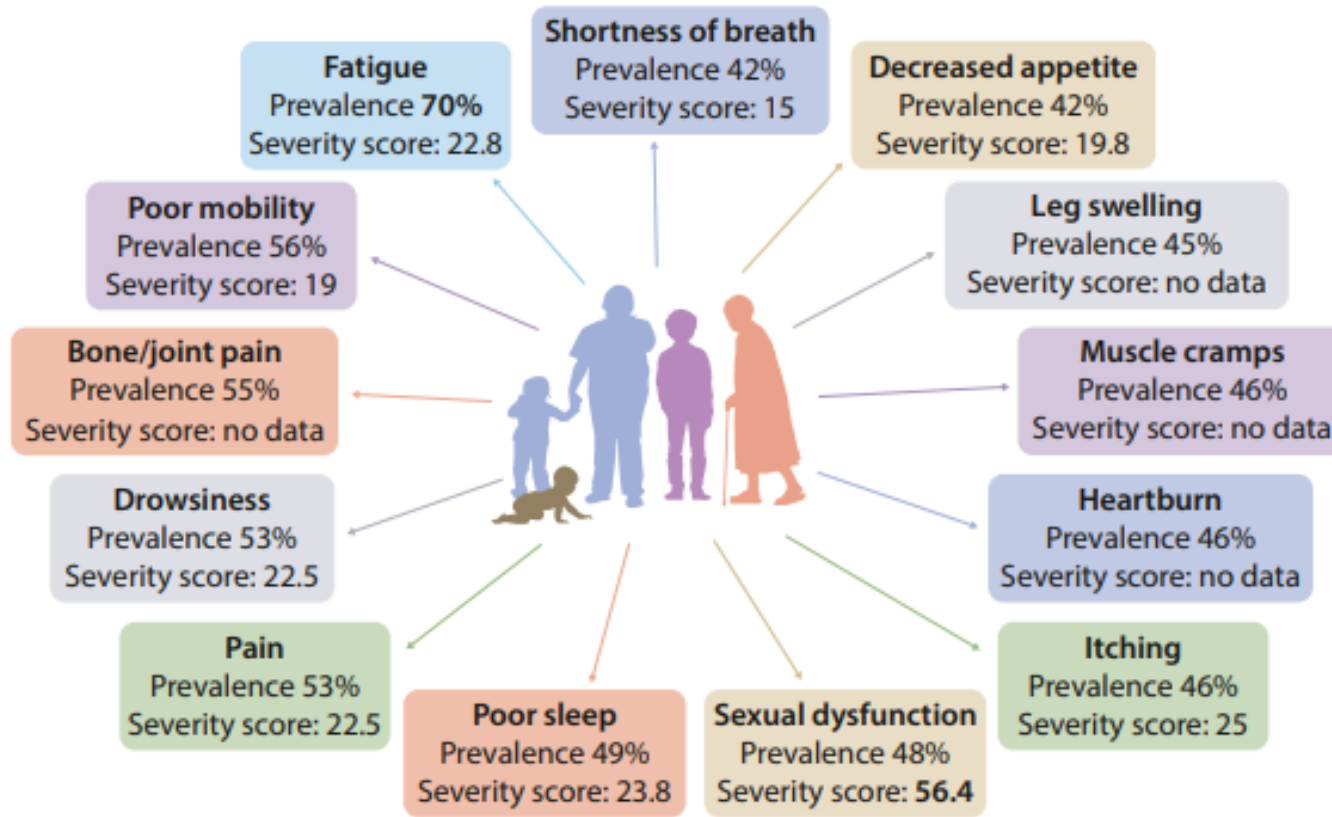
• Comparison of peritoneal dialysis vs in center hemodialysis

PD	HD
Advantages • Home-based treatment: reduces risk of nosocomial infection, avoids burden associated with transport, is more flexible than in-centre HD (days off treatment possible if sufficient residual kidney function) • Assistance is possible if required, either by family/friend or trained professional • Greater preservation of residual kidney function • Less haemodynamic disturbance and not associated with same 'washed out' feeling reported by patients undergoing HD • Does not require routine anticoagulation Disadvantages • Impact on quality of life (frequency of exchanges on CAPD, adjusting to nocturnal treatment with APD)• • Where assistance is not possible, access to PD is reduced among older and frail adults • Risk of peritonitis • Clinical teams tend not to be as comfortable dealing with PD-related issues	• Dialysis procedure performed by others • In-centre HD represents an important social outlet for many older people • Pathways for establishing a person on HD are well developed within most nephrology units • Inferior vascular access outcomes with increasing frailty; frailer patients typically require a tunnelled CVC which is associated with an increased risk for infection• • Impact on quality of life (need to factor in transport time and 'washed-out' feeling experienced by many people after a standard HD session • Risk of intradialytic hypotension and more rapid loss of residual kidney function compared with PD



Initiation of Dialysis

- When to initiate?



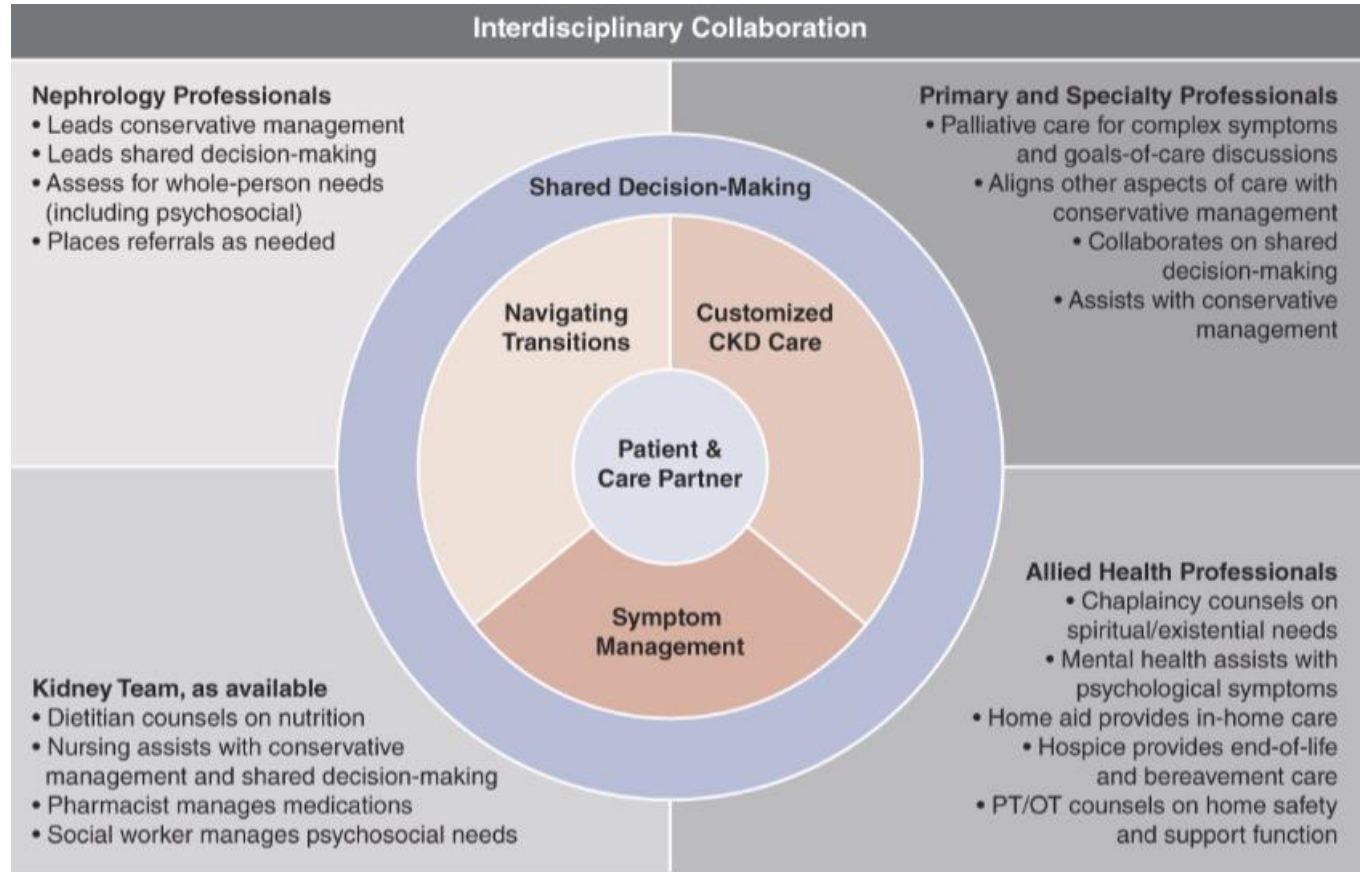
- **Composite assessment of:**

1. Signs and symptoms attributable to kidney failure
2. Quality of life
3. Laboratory abnormalities
4. Level of GFR*

*GFR range between 5-10 mL/min per 1.73m²

Conservative Kidney Management

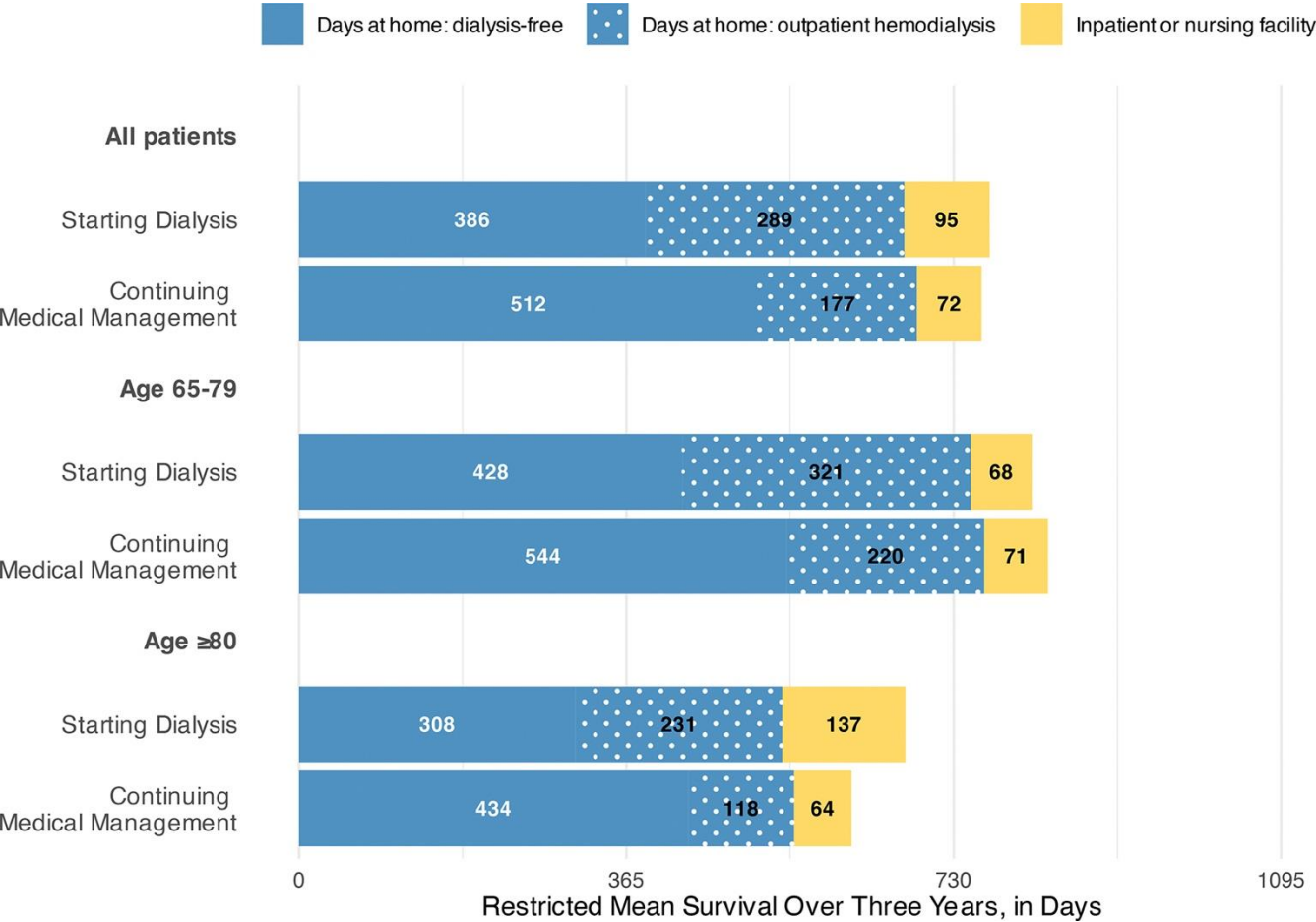
1. Part of the standard of care for kidney failure management
2. Tailors kidney care to align with individual goals and values
3. Involves a multidisciplinary team to provide:
 - Customized CKD care
 - Symptom management
 - Navigation across care transitions



Weiss et al J Am Soc Nephrol, 2026; doi: 10.1681/ASN.0000001069

Wong SPY et al J Am Soc Nephrol, 2026; doi: 10.1681/ASN.0000001068

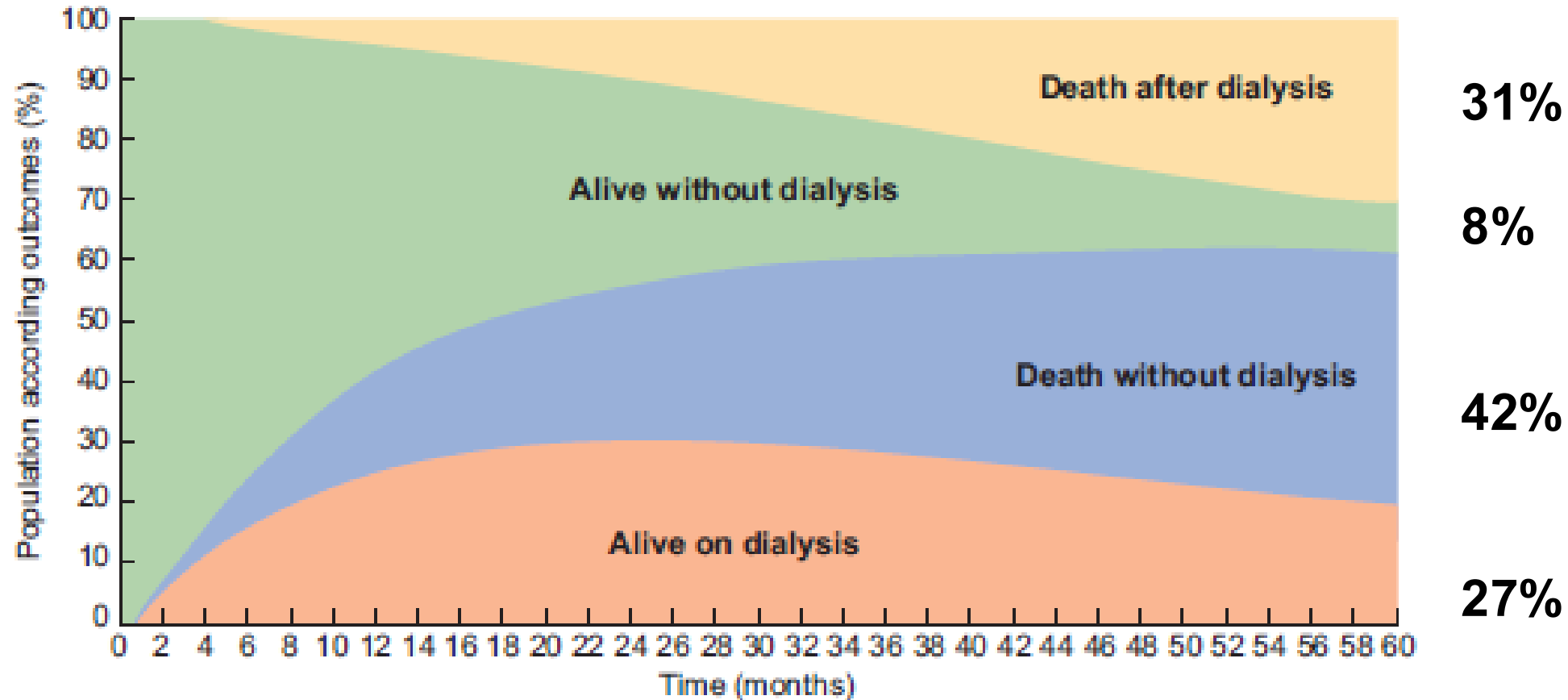
Comparison of Outcomes: Conservative Care vs. Dialysis



2024 Target Trial Emulation (Annals of Internal Medicine)

- Intention-to-treat: no survival difference between starting dialysis and continuing medical management
- Per-protocol (accounting for crossover): starting dialysis was associated with improved survival vs. forgoing dialysis
- **In patients ≥ 80 y: starting dialysis meant longer survival, but fewer days at home compared with continuing medical management**

Comparison of outcomes: conservative care vs dialysis



Inclusion criteria: > 75 YO + eGFR < 20 mL/min/1.73m² + >1 nephrology clinic appointment

LONGITUDINAL CARE

Primary Care for the Patient on Dialysis

The Typical Patient Receiving Hemodialysis

Total spending for hemodialysis care in 2014 was \$52.3 billion (\$67,000–\$98,000 per patient, dependent on insurance)

19

pills per day

12 hrs

in dialysis center / week

5-10 yrs

life expectancy after starting HD

2/yr

hospitalizations on average

1x/wk

sees nephrologist

q2wk

labwork

What is the role of a primary care physician in an ESRD patient's care? Cost-effectiveness • Primary care essentials, including preventive care and cancer screening • Patient expectations

Care for the Patient Receiving Dialysis

- Beyond clinical care

SONG-HD



1 CORE OUTCOMES

Critically important to all stakeholder groups
Report in all trials

2 MIDDLE TIER

Critically important to some stakeholder groups
Report in some trials

3 OUTER TIER

Important to some or all stakeholder groups
Consider for trials

1 FATIGUE CARDIOVASCULAR DISEASE VASCULAR ACCESS MORTALITY

2

Ability to travel
Ability to work
Anemia

Blood pressure
Depression

Dialysis adequacy
Dialysis-free time
Drop in blood pressure
Hospitalization
Impact on family/ friends
Infection/Immunity

Mobility
Pain

Potassium

Target weight

Washed out after dialysis

3

Anxiety/stress

Bone health

Calcium

Cognition

Cramps

Financial impact

Food enjoyment

Itching

Nausea/vomiting

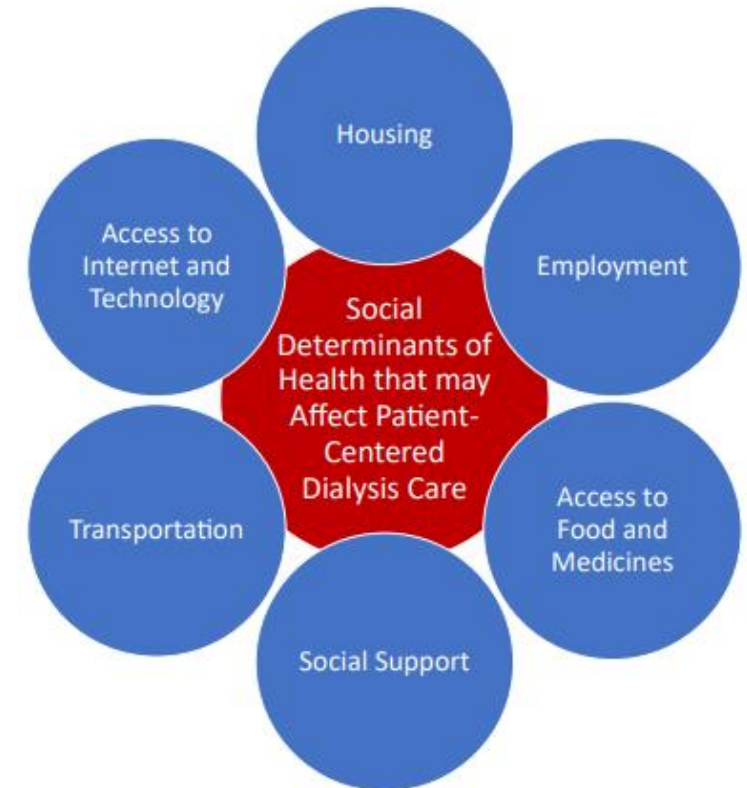
Parathyroid hormone

Phosphate

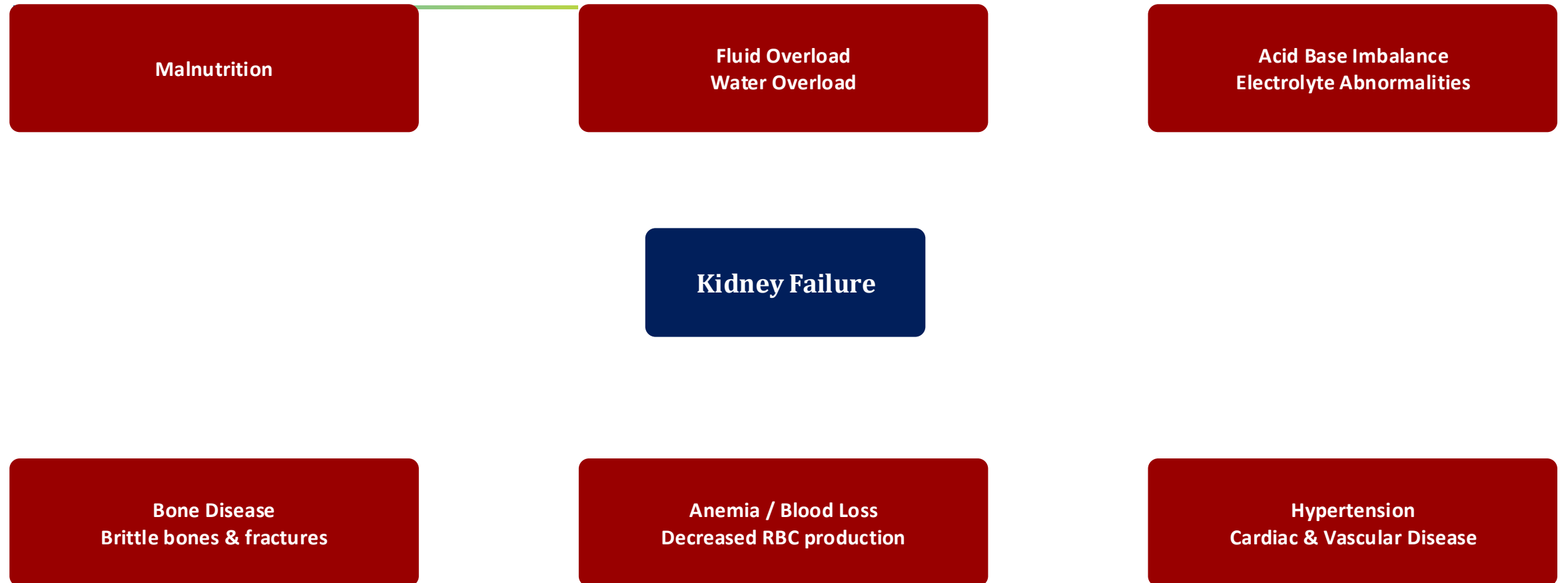
Restless legs syndrome

Sexual function

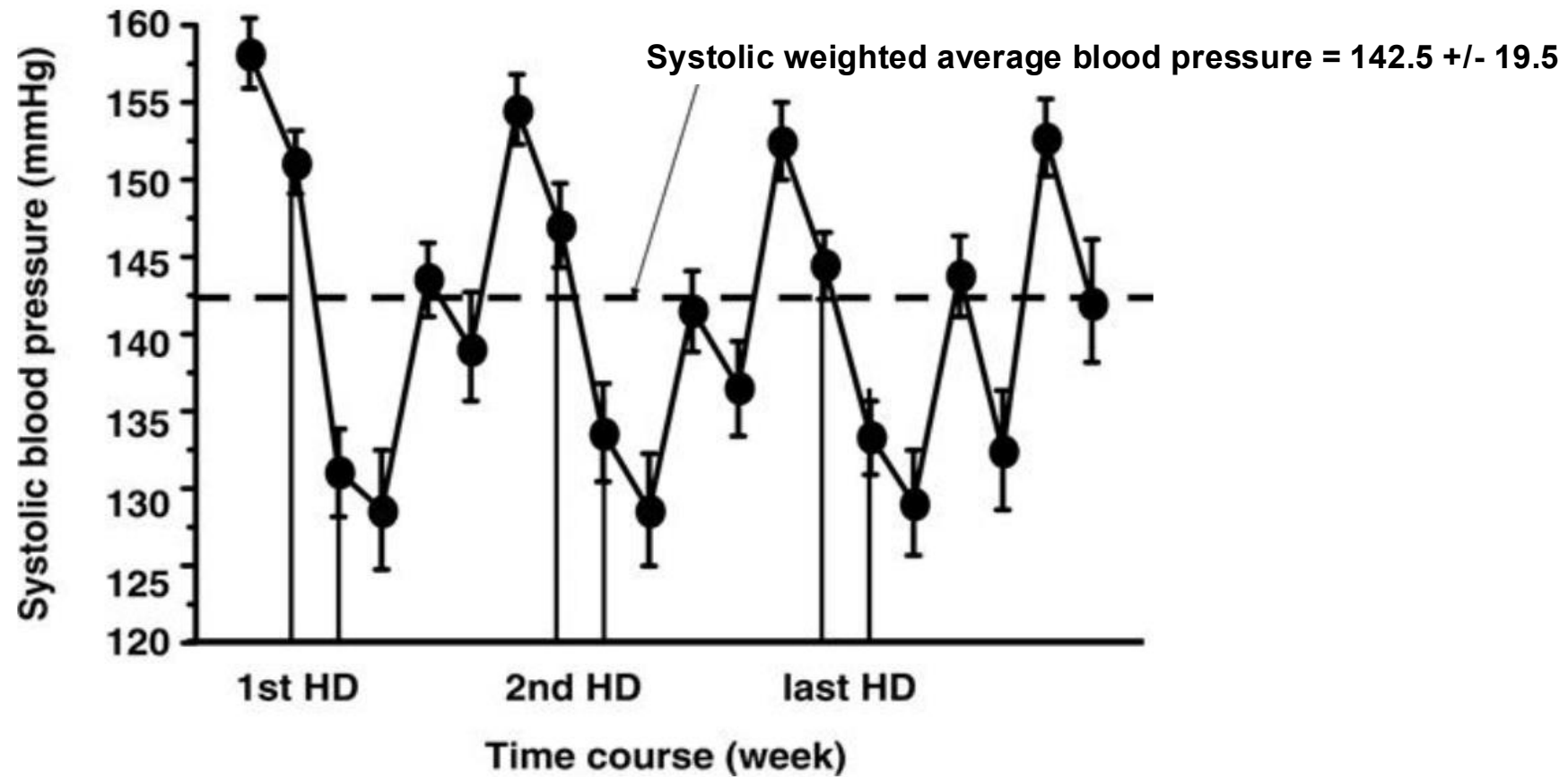
Sleep



Complications Associated with Kidney Failure



Hypertension Management



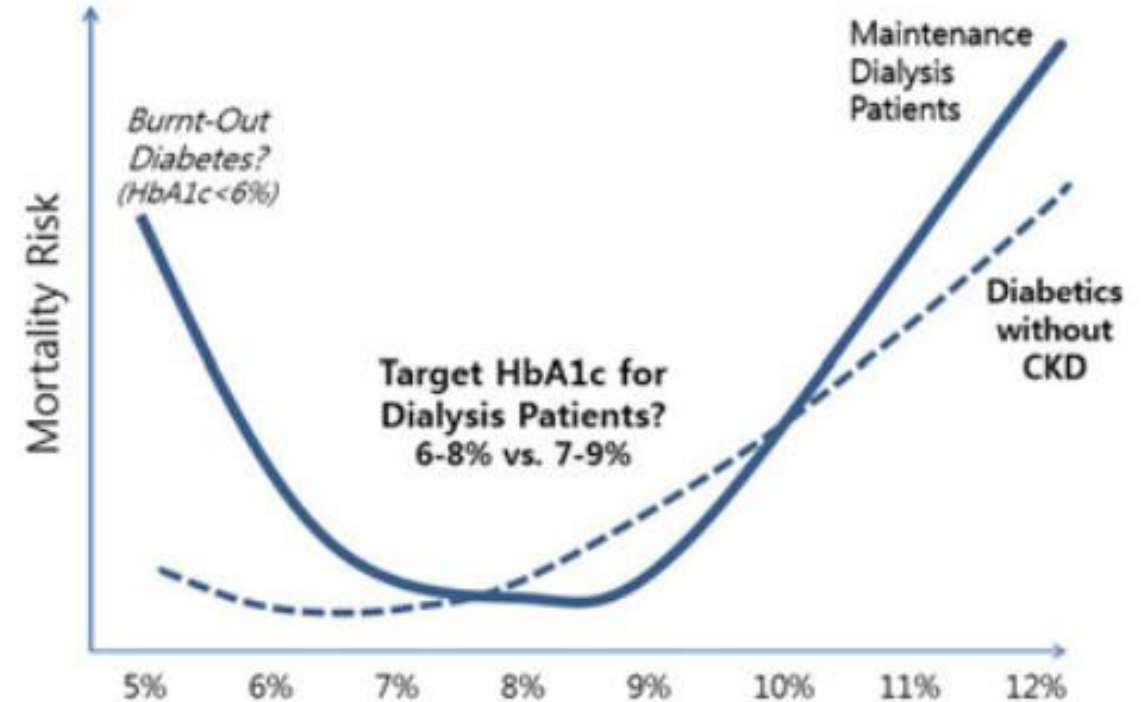
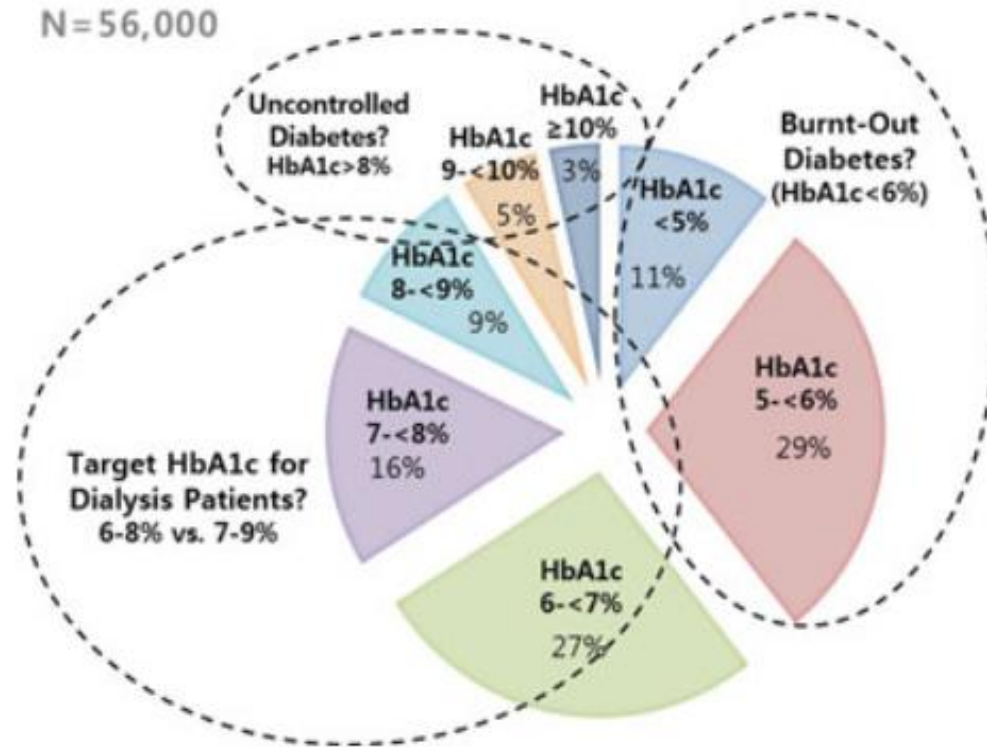
Hypertension Management

- Nephrologist Responsibility
- “Challenge dry weight” - systematically reduce estimated dry weight (EDW)
- Dietary sodium counseling
 - May have greater impact in anuric patients
- Medication Management
- PCP Responsibility
- Assess interdialytic blood pressure
- Dietary sodium counseling
 - < 2.5 gm/day
- Medication Adherence

Hypertension Management –

Drug Class	Removal By HD	Benefit for ESRD	Adverse Effects
ACE inhibitors	Yes	- May derive benefit if reduced EF - Inconsistent results re: reduction in major CV events	Monitor for hyperkalemia (rare)
ARBs	No		
Aldosterone antagonists	Unknown	- May derive benefit if reduced EF - Sustained reduction in BP, LV mass - Reduction in CV deaths and hospitalizations	Unclear if leads to hyperkalemia (↑K 0.3-0.5 mEq/L preHD)
B-blockers	Some	- Reducing arrhythmias - Rx for ischemic heart disease - Rx for high catecholamine state	Similar to non HD patients
CCB	No	- Amlodipine: longer acting, mono-pill - Nifedipine: shorter acting, can hold pre-HD	
Central α-adrenergic agonists	No	- Useful for acute, short term reduction in BP	Sedating, abrupt drop in BP Reflex tachycardia
Diuretics	N/A	- Can be useful to manage interdialytic weight gain - Requires residual kidney function	Need large doses

Diabetes Management



- Approximately 1/3 of patients on dialysis with diabetes have an average HbA1c < 6%
- Optimal target for patients on dialysis may be different compared to non-dialysis diabetic group

Diabetes Mellitus: Special considerations

- Timing of insulin administration may be different
 - Consider time of dialysis, meals before dialysis and during dialysis
 - Preference for long-acting insulin vs shorter acting insulin
- Asymptomatic hypoglycemia can occur
 - Pathophysiology may be related to blunted adrenergic response to hypoglycemia
 - Dialysate glucose concentration is ~ 200 mg/dL
- Other end-organ damage can still occur
 - Microvascular changes including retinopathy, neuropathy need to be addressed
 - Macrovascular complications are common: PVD, coronary artery disease

Healthcare Maintenance – Vaccinations

Vaccine	Notes
Influenza	Age ≥ 19 y, 1 dose trivalent vaccine annually
Tetanus, diphtheria, pertussis	1-time dose of Tdap, then boost with Td every 10 y
Zoster	Age > 60 y, 1 dose
Pneumococcal	1 or 2 doses
Hepatitis B	40 μ g Recombivax HB (3-dose) or 2 doses of 20 μ g Energix B (4-dose)

Key Points

- Annual influenza vaccine for all adults
- Polyvalent pneumococcal vaccine: PPSV23 anytime + 2nd dose after 5 yrs or if > 65 ; PCV13 ≥ 1 yr after PPSV
- Hepatitis B immunization

AJKD 2013;61(1):171-183 | KDIGO Kidney Int Suppl 2013;3:1-150

Prevalence of Vaccinations among dialysis patients

Variable	Eligible for service and data available	Up-to-date	With PCP (n = 118) # up-to-date/# eligible and with data (%)	Without PCP (n = 14) # up-to-date/# eligible and with data (%)	P-value
Vaccinations					
Influenza vaccine	132 (100%)	116 (87.9%)	106/118 (89.8%)	10/14 (71.4%)	0.046
Pneumococcal vaccine	130 (98.5%)	93 (71.5%)	87/116 (75.0%)	6/14 (42.9%)	0.012
Tetanus/Tdap vaccine	125 (94.7%)	118 (94.4%)	107/111 (96.4%)	11/14 (78.6%)	0.006
Human papilloma virus (HPV) vaccine	132 (100%)	26 (19.7%)	24/118 (20.3%)	2/14 (14.3%)	0.590
Hepatitis B (HBV) vaccine	132 (100%)	100 (75.8%)	91/118 (77.1%)	9/14 (64.3%)	0.289
Shingles vaccine	69 (52.3%)	25 (36.2%)	24/64 (37.5%)	1/5 (20%)	0.433

PCP group: Higher proportion of those up to date with vaccinations

Cancer Screening – Similar to General Population

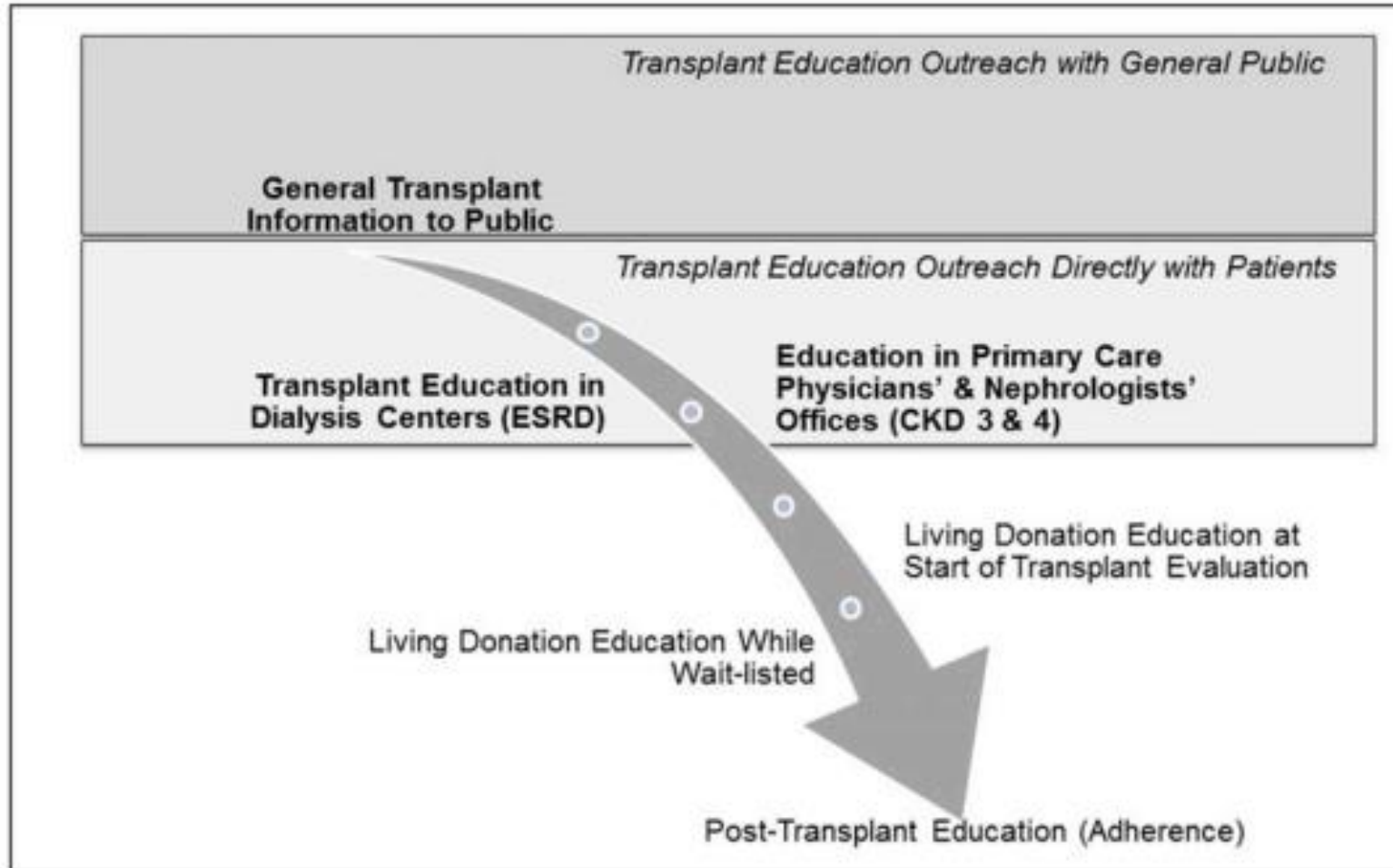
Cancer	Screening to Consider
Breast	Mammogram yearly at age > 40 and on transplant waiting lists
Colon and rectal	Beginning age 50: yearly FOBT/FIT for transplant candidates; consider in high-risk with long expected survival
Cervical	Yearly Pap test ~3 yrs after vaginal intercourse, no later than 21 y; consider HPV DNA/vaccine, esp. in transplant candidates
Prostate	Annual PSA + digital rectal exam beginning age 50 for men on transplant waiting list
Renal cell	Yearly CT or MRI in patients on dialysis > 3 yrs and on transplant waiting list

Key point: screening utility and cost-effectiveness may depend on life expectancy and transplant candidacy — recommend an individualized approach.

Holley. CJASN 2007; 2: 604

Kidney Transplant Management

Living kidney donation has superior outcomes



Kidney Transplant Management

Living kidney donation has superior outcomes

- Medical Readiness for transplant
 - Cancer screening
 - Diabetes management

- Post-transplant care
 - Diabetes mellitus
 - Metabolic syndrome
 - Heart disease
 - Metabolic syndrome
 - Opportunistic infections



Challenges to Primary Care Delivery for Dialysis Patients

Suboptimal Care Coordination	Limited Capacity to Deliver Primary Care		Intensity of Dialysis Care
• Lack of clarity in role and responsibilities of each provider • Lack of timely and effective information exchange	Nephrologists	Primary Care Providers	• Limited time to see other health care providers may contribute to: -Patients' greater reliance on nephrologist to address non-kidney-related issues -Patients' reactive health care-seeking behaviors to address acute (rather than chronic or preventative) health care needs
	• Limited knowledge and skills to address general medicine issues • Lack of time • Lack of infrastructure (eg, adequate private space) • Inadequate reimbursement for non-kidney issues	• Lack of familiarity with unique care considerations of hemodialysis patients • Limited knowledge or suboptimal application of preventative medicine guidelines for dialysis patients • Limited access to nephrology guidance	

Food for thought:

- Frequency of visits?
- What to discuss?
- How to communicate?
- How to see lab work?

Suboptimal Primary Care Delivery
Patients' broad health needs not or inadequately addressed

Adversely Impact:

- Patients' experience with care
- Patients' Outcomes
- Quality of Life
- Health Care Utilization
- Mortality
- Health care costs

Conclusions

- Kidney failure is defined as a GFR < 15 mL/min or receipt of kidney replacement therapy
- Disparities exist re: treatment options for kidney replacement therapy
- Care is complicated for patients receiving kidney replacement therapy
- Consider co-management strategies with your patients and consultants
- How can we do better?
 - Provision of high quality and equitable care
 - Complex patient care management

Thank You
pgarimella@kidneyfund.org



With Acknowledgement to Dr
Amanda Leonberg-Yoo for content