WHEN TO INITIATE DIALYSIS?

RENAL FUNCTION TRAJECTORY

Steven Rosansky, MD

Opinion based guidelines, based on conventional wisdom, have resulted in early initiation of dialysis.

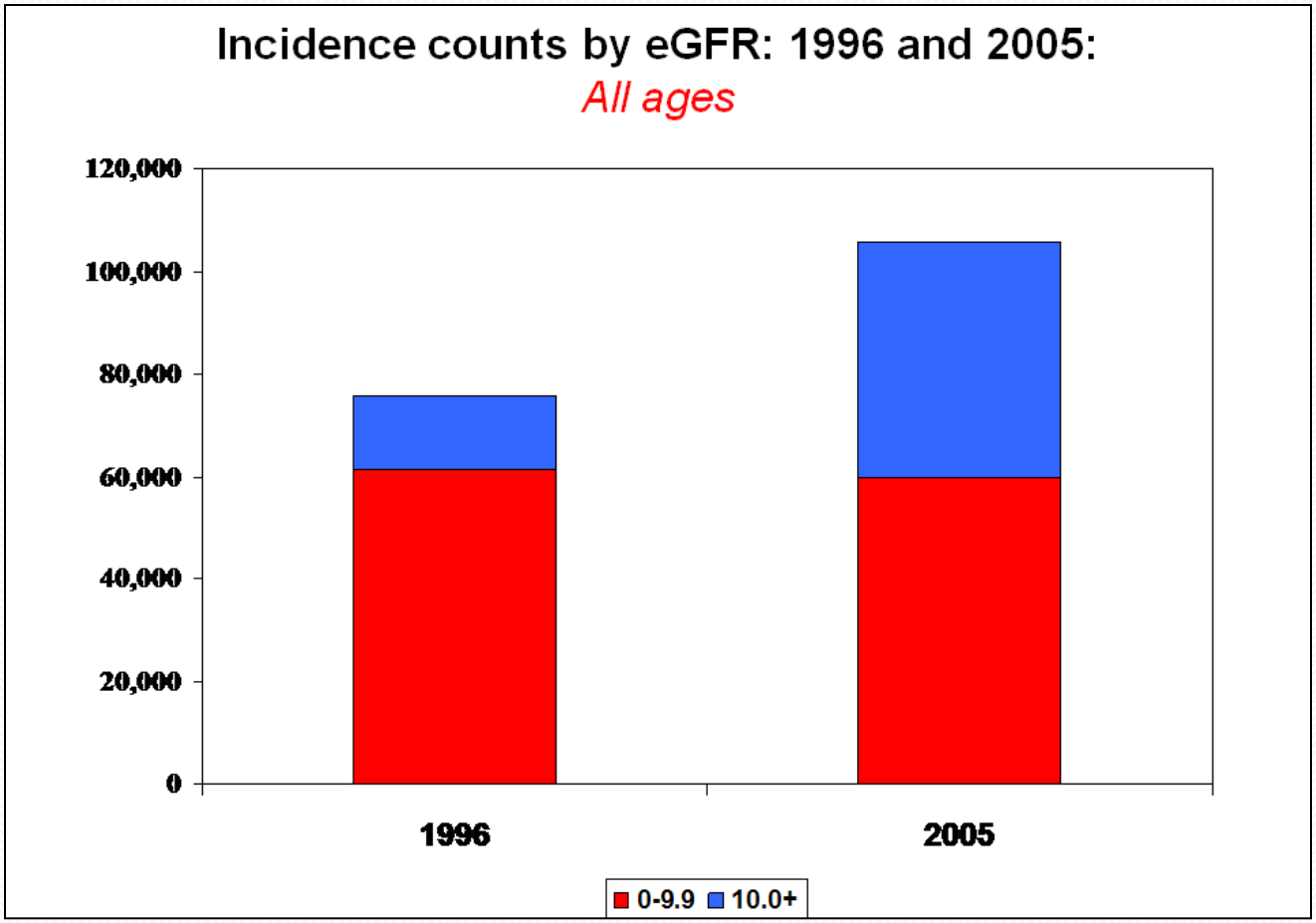
A NEW PARADIGM:
MUST BE A BENEFIT IN AT LEAST ONE

- ✓ **MORTALITY**
- ✓ **MORBIDITY**
- ✓ **QUALITY OF LIFE**

WE'LL EXAMINE…

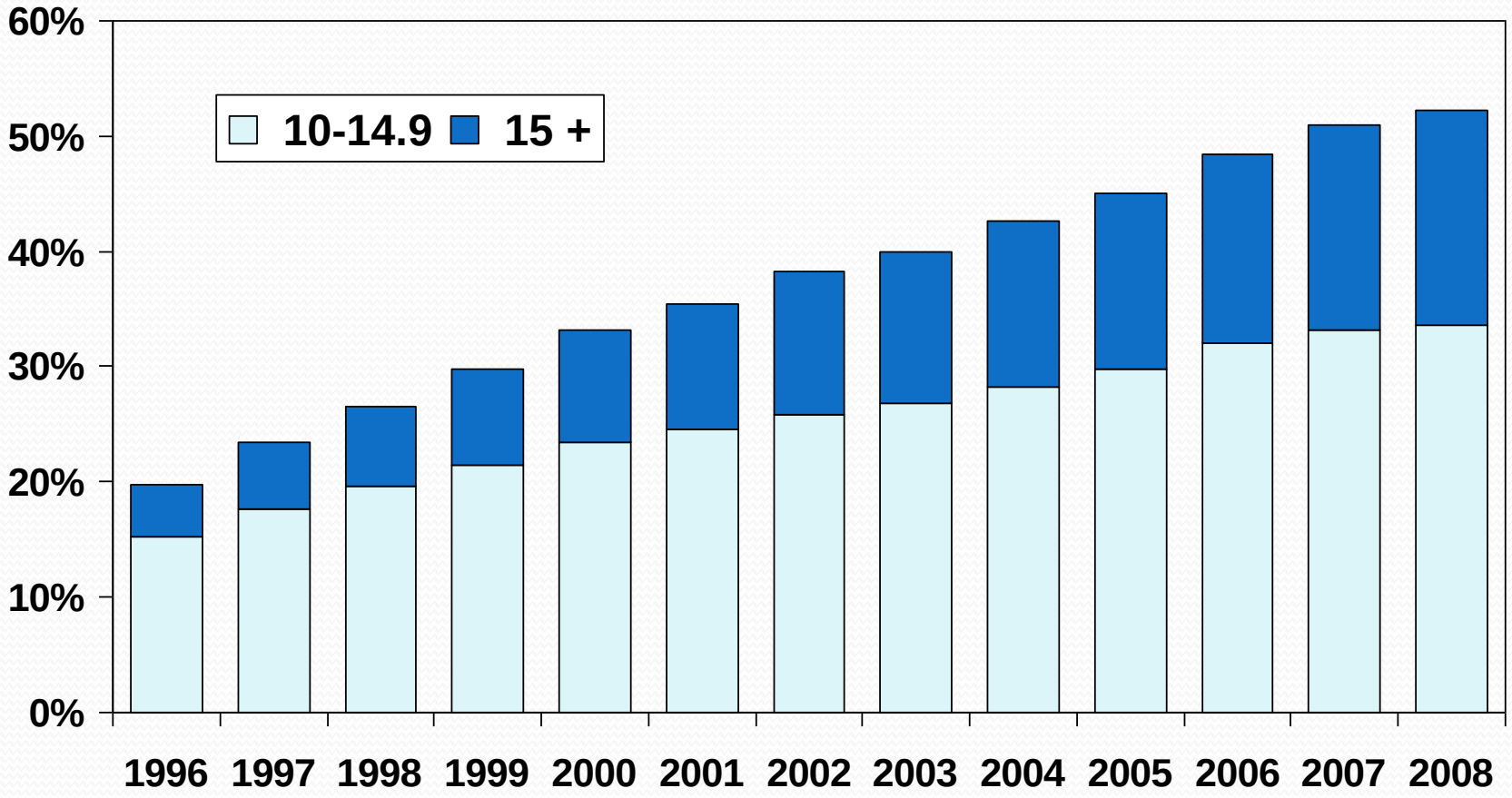
- Trend to early initiation of dialysis (MDRD eGFR ≥ 10 ml/min/1.73m²)
- Conventional wisdoms that have led to this trend
- Evidence of a mortality, morbidity, or quality of life benefit/harm from this trend to early initiation
- Indications to initiate dialytic therapy
  - Renal function trajectory
  - Multidisciplinary pre-dialysis clinic

TREND TO EARLY INITIATION OF DIALYSIS 1996 - 2005

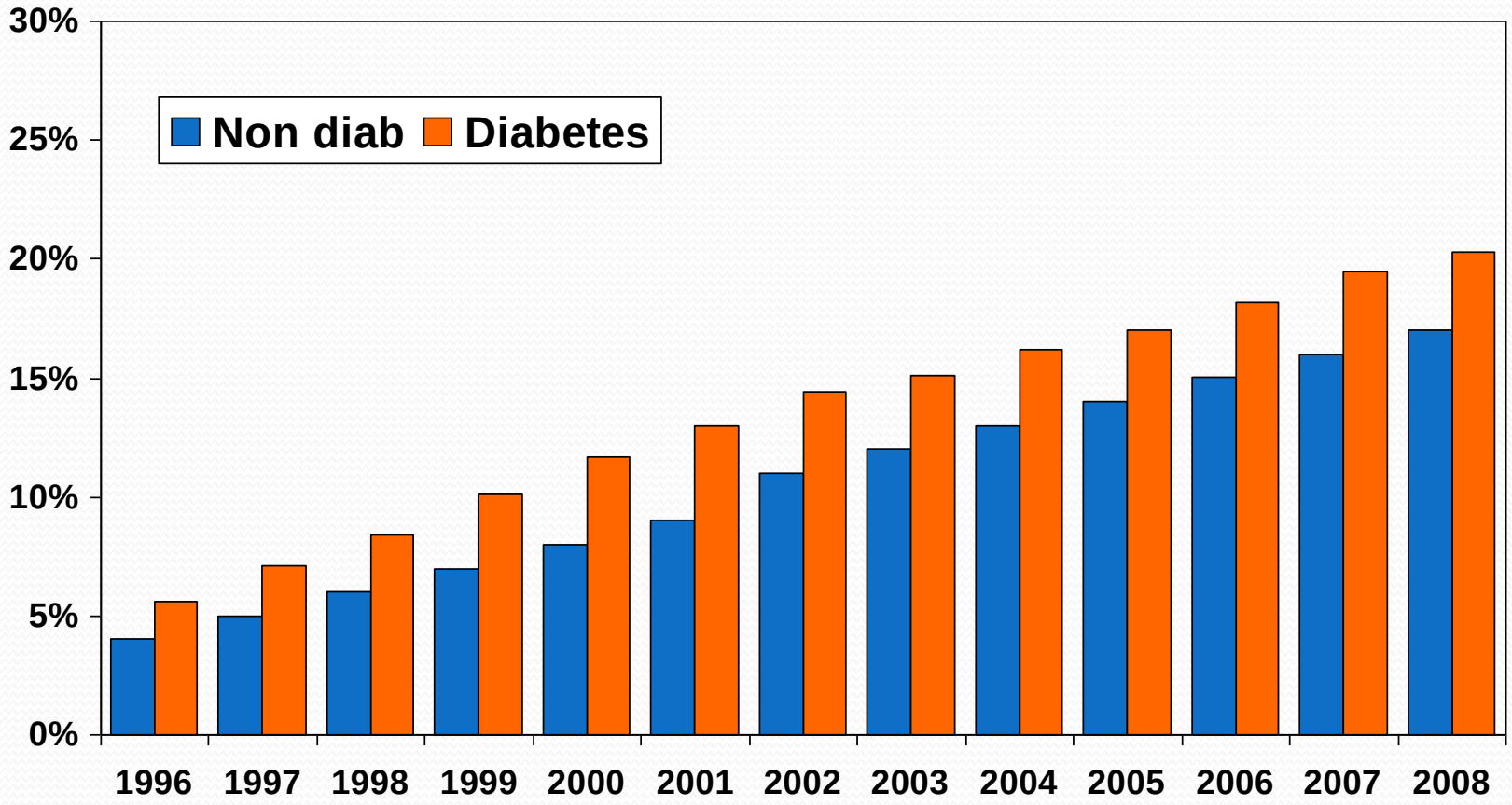


Rosansky, KI, 2009

Incident cases with eGFR ≥ 10
Percent of total Incident Cases



Incident cases with eGFR ≥ 15 Percent of Total Incident cases: all ages



Survival Versus Early Dialysis Initiation – A Historical Perspective/ Conventional Wisdom

CONVENTIONAL WISDOM

- Level of dialytic clearance is associated with a survival/morbidity benefit and is comparable to RRF.

- Diabetics need to initiate dialysis earlier than non-diabetics.

- Nutrition can be improved with increased dialysis clearance.

- Low albumin and nutritional issues are synonymous.

MORE CONVENTIONAL WISDOM

- At low levels of renal function, (eGFR < 15 ml/min/1.73m^2), most nephropathies progress relentlessly to minimal kidney function.

- Waiting until GFR is < 6 ml/min/1.73m^2 is dangerous.

Churchill, Am J Kid Dis, 1997
Ruggenenti, Lancet, 2001
Taal, KI, 2006

NCDS, 1981

- Kt/V is a predictor of survival

Lowrie, KI, 1992

- Albumin concentration is the predictor most closely associated with death.

- After adjusting for albumin and creatinine levels diabetes did not predict higher mortality.

Owen, NEJM, 1993

- Low URR associated with increased risk of death

- Serum albumin, as a predictor of mortality, 21 x URR

- Diabetic patients had lower serum albumin and URR than non diabetics

- Increase of URR did not improve nutritional status

Conventional Wisdom …
Diabetics need to initiate dialysis earlier than non-diabetics.

KT/V Urea/Creatinine Clearance and When to Commence Dialysis

63 patients
6 deaths
Correlated with KT/V urea
Minimum KT/V 1.05 liters per week

Tattersal, Am J Nephrol, 1995

CANUSA
Starting Creatinine Clearance versus One Year Survival
< 3.8 ml/min = 73.6%
> 3.8 ml/min = 82.1%

Churchill, JASN, 1997

WHEN TO INITIATE DIALYSIS?

Indices of malnutrition should be considered objective criteria for the initiation of dialysis.

Hakim, JASN, 1995

This shift in indication may have been one of the prime movers to early dialysis initiation.

1997 K DOQI Guidelines

NKF Workgroup recommended that initiation of dialysis be considered when the arithmetic mean of CCR and urea clearance fell below 10.5 ml/min/1.73^2 except in well-nourished, asymptomatic patients.

MEASUREMENT OF DIALYSIS AND RESIDUAL RENAL CREATININE CLEARANCE

170ml/min X 210 min = 35.7 liters
X 3 days per week = 107 liters

Creatinine Clearance of 10 ml/min
10 ml/min X 60 min X 24 hrs X 7 days = 100.8 liters

Hakim, JASN, 1995

Logic of combined dialytic and endogenous renal clearance

Dialyzer Creatinine Clearance of 10 ml/min

+ Endogenous 10 ml/min (GFR)

Recommended dialysis at 20 ml/min GFR?

RCT PD Patients
Dialytic Clearance Did Not Provide Survival Benefit

ADEMEX, JASN, 2002

RCT Hemo Patients
Higher Doses of KT/V and High Flux = No Survival Benefit

HEMO Study, NEJM, 2002

Conventional Wisdom ….
Level of dialytic clearance is associated with a survival/morbidity benefit and is comparable to RRF.

Does early initiation of dialysis provide a survival benefit?

Studies Examining the Issue Of Comorbidity Adjusted Early Initiation of Dialysis Versus Survival

Traynor, JASN, 2002

Beddhu, JASN, 2003

Kazimi, AJKD, 2005

NONE showed a comorbidty adjusted survival benefit!

Additional Large Population Based Studies Examining the Issue Of Comorbidity Adjusted Early Initiation of Dialysis Versus Survival

- Stel, NDT, 2009
- Sawhney, NDT, 2009
- Hwang, NDT, 2010
- LaSalle, KI, 2010
- Wright, CJASN 2010
- Clark, CMAJ, 2011
- Rosansky, Arch Int Med, 2011

NONE of these studies showed a survival benefit of early dialysis initiation!

Early Start of Dialysis May Be HARMFUL

Rosansky, Arch Int Med, 2011
81,176 USRDS Hemodialysis Patients
Treated Between 1996 – 2006
Non-diabetic, 20 – 64 years old
"Zero" Report Comorbidity
Stratified by Serum Albumin

Adverse effect of early start vs. survival

Eliminated using 24 hour urine based creatinine clearance, especially if

- lower BMI and lower serum albumin (<19 kg/m^2, < 2.5 g/dl)
- diabetic

Beddhu, JASN, 2003

Grootendorst, NDT, 2011

Healthy Cohort Study

< .6 sensitivity for comorbidity reporting

Higher eGFR = "poorer overall health"

"Suspect comorbidity data" confounds eGFR vs. outcomes

Weiner, Am J Kid Dis, 2011

Healthy Cohort Study

Overestimation of GFR minimized

No diabetics, 6% BMI < 18.5

15% serum albumin < 2.5 gm/dl

Non reported comorbidity equal across eGFR groups?

Rosansky, Arch Int Med, 2011

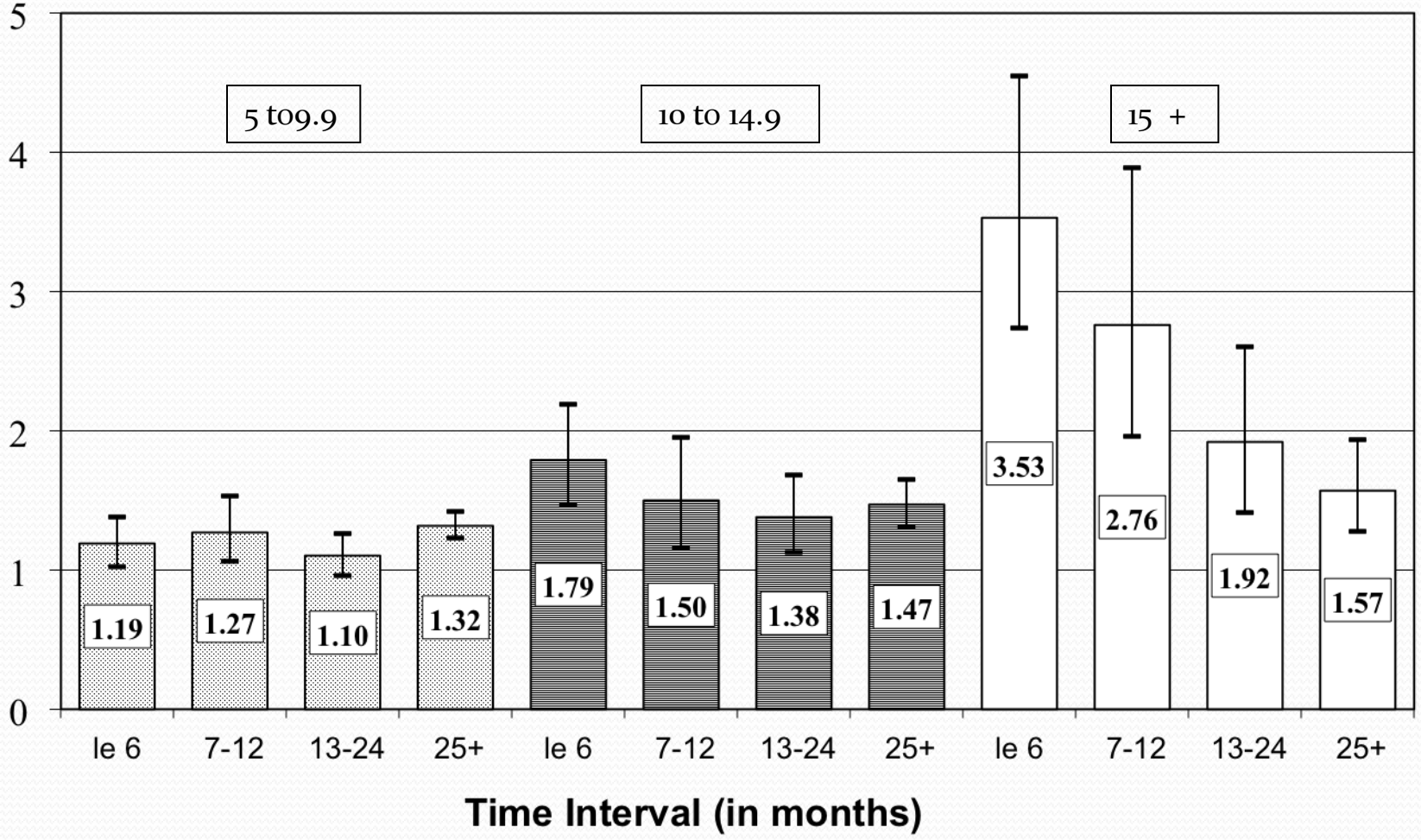
Percent mortality, first year by eGFR (ml/min/1.73m²) healthiest cohort, serum albumin ≥ 3.5 gm/dl

eGFR	First Year Mortality	# of patients
< 5	3.6	10,598
5 – 9.9	4.5	20,131
10 – 14.9	6.7	3,993
≥ 15	12.5	943
USRDS	23.8	

Rosansky, Arch Int Med, 2011

Mortality Hazard Ratios in the Healthiest Cohort

Serum Albumin ≥ 3.5 g/dL



Rosansky, Arch Inter Med, 2011

Does early initiation of dialysis have any comorbidity benefit?

NUTRITION?

CARDIAC MORBIDITY?

ENDOGENOUS RENAL FUNCTION?

NUTRITION

Hemodialysis :

- stimulates protein catabolism
- stimulates whole body degradation of protein including muscle protein.
- results in in loss of aminoacids
- promotes dialyzer blood interaction/inflammation
- corrects metabolic acidosis
    - may decrease protein catabolism but study results are conflicting.

Berstrom, JASN, 1995

97 hemo patients
initial 6 months – albumin increased.

Mehotra, Am J Kid Dis, 2002

50 hemo patients, first dialysis year
Albumin increase reversal after year one?
No increase in LBM

Pupim, Am J Kid Dis, 2002

132 hemo/118 PD patients, months 3 – 24
Hemo – albumin decreased/PD – albumin increased
No change in LBM

Jager, JASN, 2001

11 patients, 2h pre, during, and post hemo
Whole body and muscle proteolysis
Continued post-hemo

Ikizler, AmJPhysEndMet, 2002

The HEMO study/nutritional aspects

- Increased dialytic clearance /had no effect on serum albumin or post dialysis weight
- All nutritional parameters, except for dietary protein energy intake, had small but statistically significant decline, average follow-up of 3 years.
- Decrease albumin associated with decrease synthesis and increased inflammation.

Rocco, KI, 2004
Kaysen, CJASN, 2009

Conventional Wisdom …
Nutrition can be improved with increased dialysis clearance.

Serum albumin comorbidity factor, not nutritional factor…

- Only in a state of negligible protein intake will albumin decline
- Albumin levels driven by non-dietary factors
- Severe nutritional deprivation, marasmus, anorexia nervosa, maintain normal albumin even with very low BMIs.
- Patients with chronic kidney diseases, albumin catabolism increases
- Associated inflammatory disorders - main reason for low albumin
- Metabolic acidosis increases albumin catabolism

Friedman, JASN, 2010

Conventional Wisdom …
Low albumin and nutritional issues are synonymous.

CARDIAC MORBIDITY

McIntyre KI 2009

- Hemodialysis recurrent ischemia
- Ultrafiltration volume and drops in intradialytic BP
- "Stunned myocardium" even in pediatric patients
- Myocardial structural and function changes
- Systolic dysfunction heart failure

Pun KI 2009
Rates of sudden cardiac death by eGFR category:

eGFR ml/min/1.73m^2	Sudden Death per 1000 Patients
≥60	3.8
15 – 59	7.3
<15	12
On dialysis	24

Endogenous Residual Renal Function

CANUSA

- For each 5 l/wk/1.73m² increase in GFR, 12% decrease in risk RR of death
- 250 cc increase urine out
- 36% decrease RR of death

Bargman JASN 2001

NECOSAD2

- 1 cc increase in RRF = 12% decrease in mortality

Kendrick, CJASN, 2010

BENEFITS OF RRF

Beneficial effect on nutritional parameters

Suda, NDT, 2000

Correlates to:

- Decreased inflammation
- Lower LVH

More rapid decline, worse survival

Kendrick, CJASN, 2009

Improves:

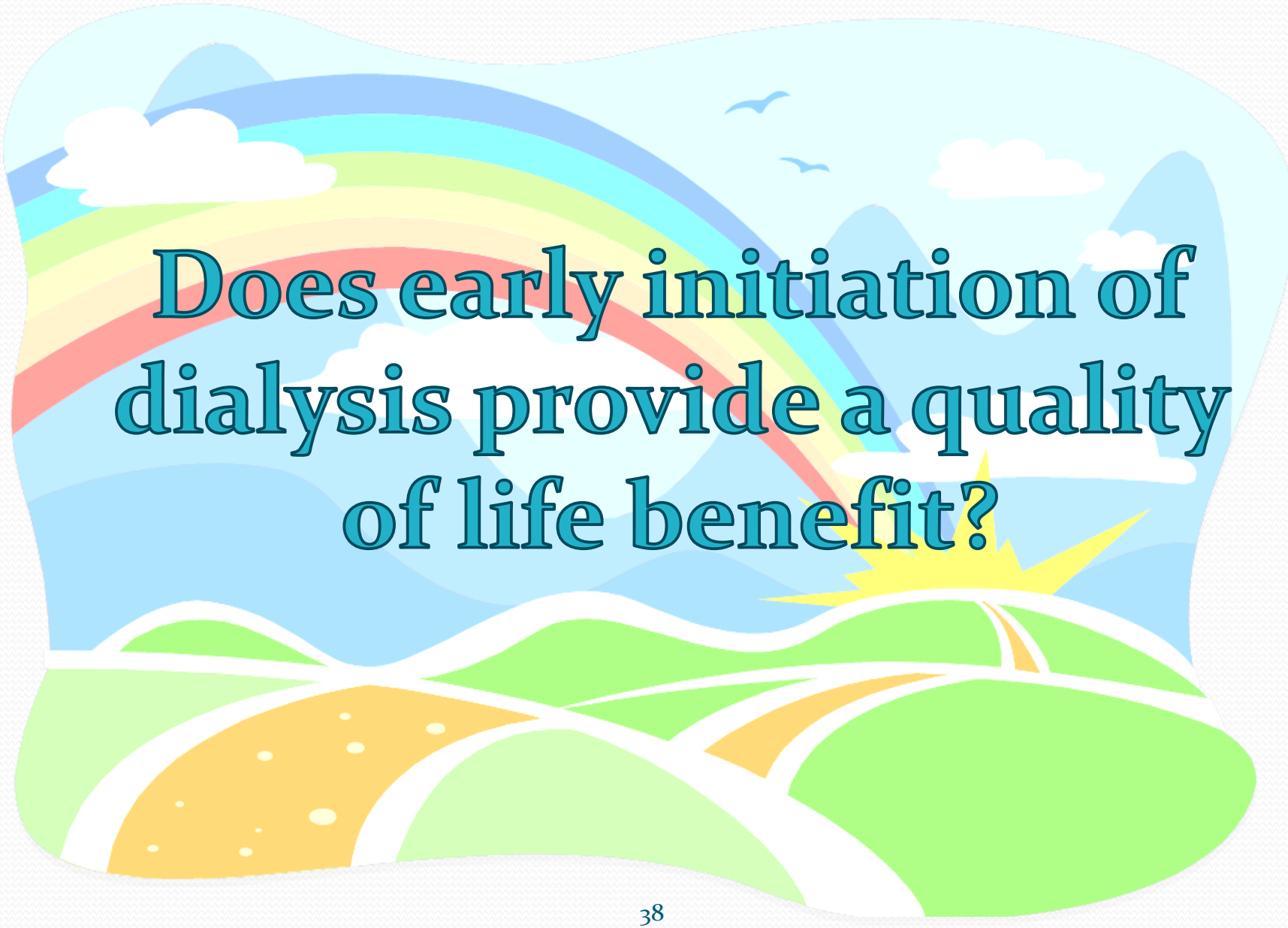
- Survival, hemo and PD
- Fluid balance
- Phosphorus control
- Anemia
- Quality of life

Perl, Am J Kid Dis 2009

RRF Declines With Time on Dialysis

- Hemo Greater Than Peritoneal
- Hemo Decline 10.7% Per Mo.
- PD Decline 8.1% Per Mo.
- BP Control, with UF, can hasten decrease in RRF

Jansen, KI, 2002


Does early initiation of dialysis provide a quality of life benefit?

NECOSAD Study

- Transient HRQOL benefit with early start
- Disappeared after one year of treatment

Korevaar, NDT, 2003

PCS QOL Score

- 10 point lower PCS = 1 gram serum albumin as survival predictor

Mapes, KI, 2003

ADEMEX

- Kt/V had no effect on quality of life
- Baseline QOL score predictor of survival and hospitalization

Paniagua, KI, 2005

- Temporal trends in HRQOL, 1997 - 2006
- No change in over one decade

Gabbay, CJASN, 2010

When to Initiate Dialysis?

MULTIDISCIPLINARY CARE

Attending multidisciplinary pre dialysis clinic

- Better biochemistry parameters at start of therapy and fewer hospitalizations
- Lower chance of Death in 3 year follow up after dialysis initiation.

Goldstein, Am J Kid Dis, 2004

Multidisciplinary care - pre dialysis and four months post initiation

- 22% decrease in mortality
- 8% decrease in hospitalizations

Wingard, CJASN, 2009

CMS mandate to improve HRQOL, optimize medical, psychological, and social intervention.

Finklestein, KI, 2009

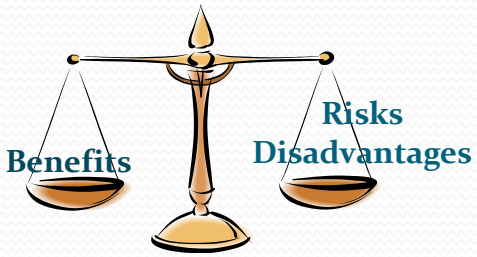
What is the contribution of

3 X weekly non-dialytic care

to morbidity, mortality and quality of life?

In 2006, the NKF Workgroup Updated Guidelines for Initiating Dialysis

"… at CKD stage 5, when eGFR is less than 15ml/min/1.73m^2, nephrologists should examine the benefits, risks and disadvantages of beginning renal replacement therapy"



They also stated that the initiation of dialysis before CKD stage 5 may be appropriate for patients who have symptoms believed to be related to both their comorbities and their level of RRF.

European Guidelines for Dialysis Initiation

A. Dialysis should be instituted whenever the GFR is <15 ml/min and there is one or more of the following: symptoms or signs of uraemia, inability to control hydration status or blood pressure, or a progressive deterioration in nutritional status. In any case, dialysis should be started before the GFR has fallen to 6 ml/min/1.73 m2, even if optimal pre-dialysis care has been provided and there are no symptoms.

B. High-risk patients e.g. diabetics may benefit from an earlier start.

C. To ensure that dialysis is started before the GFR is <6 ml/min, clinics should aim to start at 8–10 ml/min.

NDT 2002

OTHER DIALYSIS INITIATION GUIDELINES

Australia New Zealand 2005

- Start at GFR less than 10 ml/min/1.73m²
- If evidence of uremia or its complications such as malnutrition
- If not symptomatic start dialysis when GFR falls below 6ml/min/1.73m²

Canada 2008

GFR < 20 patients may need to start dialysis if symptomatic including Nutritional decreasing albumin or LBM not responsive to dietary interventions

United Kingdom 2009

- Start RRT for CKD 5
- Based on a discussion of risks benefits
- Consider starting at eGFR < 6ml/min/1.73m² even if asymptomatic

ADDRESSING CONVENTIONAL WISDOM

- At low levels of renal function, (eGFR < 15 ml/min/1.73m^2), most nephropathies progress relentlessly to minimal kidney function.

- Waiting until GFR is < 6 ml/min/1.73m^2 is dangerous.

Low eGFR Dialysis Initiation

Hwang, NDT, 2010
23,351 Taiwan Patients
Median eGFR = 4.7 ml/min/1.73m²

- Inverse relationship between eGFR and survival
- < 3.29 ml/min/1.73m² reference group
- eGFR > 6.52 ml/min/1.73m²
- HR 2.44 vs. reference group

SURVIVOR BIAS

“Survival of the fittest”

Vs.

Observational Studies

IDEAL RCT Study
828 Patients
Mean Age = 60.4

- Early start = eGFR 7.2 ml/min/1.73m², late start = eGFR 9.0 ml/min/1.73m²

- No significant survival difference between early and late starts

EDITORIAL REGARDING IDEAL RCT

- "Just in time dialysis"
- Contends most nephrologists start dialysis on the basis of clinical factors rather than numerical data such as eGFR.

Lamiere, NEJM, 2010

Clinical Symptoms at Dialysis Initiation

- Non-specific nature of symptoms correlate to comorbity
- Low serum albumin, older age, more symptoms
- Fatigue, nausea, anorexia most common symptoms

Curtis, Clin Nephrol, 2002

Nephrologists' Opinions on Dialysis Initiation 1999 Questionnaire

Most important factor:

- Uremia 38%
- GFR 32%
- Nutrition 20%

Decision for early start:

- DM 90%
- Malnutrition.....72%
- Improved QOL ... 39%

Ledebo, NDT, 2001

ERBP Guidelines
When to start dialysis: updated guidance following publication of the Initiating Dialysis Early and Late (IDEAL) study

MDRD eGFR not useful to decide on when to initiate

- **Support for pre-dialysis clinics**
- **Emphasis on preparation of patients for dialysis, before GFR 15ml/min/1.73m² and before they become symptomatic**
- **Consider dialysis at GFR < 15 when any symptoms of uremia, including deterioration of nutritional status**
- **Patients with eGFR declining over 4 ml/min/yr/1.73m² and diabetics need close supervision**
- **If this is not feasible and the uremic symptoms may be difficult to detect**
- **Consider a planned start to dialysis while asymptomatic**

Tattersal, NDT, 2011

ERBP Guidelines Continued

"High quality evidence that patients will have uremic symptoms" before eGFR of 6 ml/min/1.73m²

"Delaying dialysis until there are symptoms would carry a risk of harm or death due to uremia."

Tattersal, NDT, 2011

IDEAL Protocol Violations

Reason for not starting dialysis in assigned GFR range (protocol violations)	Randomized to early start group but started with GFR < 10ml/min/1.73m^2 (n=75)	Randomized to late start group but started with GFR > 7ml/min/1.73m^2 (n=322)
Uremia	5	234
Physician discretion	10	25
Fluid overload	1	28
Delay in access creation	21	1
Unavailability of resources	6	6
Malnutrition	.	5
Sudden improvement in GFR	.	2

MedScape

"The term uremia, which literally means urine in the blood, was first used by Piorry to describe the clinical condition associated with renal failure.

Uremia can occur once the creatinine clearance is below 10-20 mL/min, and it is heralded by the clinical onset of nausea, vomiting, fatigue, anorexia, weight loss, muscle cramps, pruritus, mental status changes, visual disturbances, and increased thirst. Uremic encephalopathy can progress to seizures, stupor, coma, and, eventually, death."

Wikipedia

"Because uremia mostly is a consequence of kidney failure, its signs and symptoms often occur concomitantly with other signs and symptoms of kidney failure, such as hypertension due to volume overload, hypocalcemic tetany, and anemia due to erythropoietin deficiency. These, however, are not signs or symptoms of uremia. Still, it is not certain that the symptoms currently associated with uremia actually are caused by excess urea, as one study showed that uremic symptoms were relieved by initiation of dialysis, even when urea was added to the dialysate to maintain the blood urea nitrogen level at approximately 90 mg per deciliter (that is, approximately 32 mmol per liter)."

DiMicco, NDT, 2009
30 patients
Initial eGFR ≤ 11

- Prospective study start at eGFR 6 ml/min/1.73m²
- Used nine indications to start, one was uremia
- Half of the patients had no indication to start by eGFR 6 ml/min/1.73m²
- Only seven(23%), of the 30 patients had any of nine listed indications, one of which was “uremia”
- Eight patients did not start dialysis after 21.8 months

ADDRESSING CONVENTIONAL WISDOM

- At low levels of renal function, (eGFR < 15 ml/min/1.73m^2), most nephropathies progress relentlessly to minimal kidney function.

- Waiting until GFR is < 6 ml/min/1.73m^2 is dangerous.

Dialysis "early" starts for age > 75
(eGFR ≥ 10 ml/min/1.73m²)

1996	25%	Only 36% justified
2009	64%	

First year mortality by age

80 – 84 yrs	34.6%
≥ 85 yrs	40.4%

Rosansky, JAMA, 2012

WHEN TO INITIATE DIALYSIS?

This Discussion EXCLUDES
End Stage Liver Disease
or
Heart Failure
where Dialysis is not used as a treatment for ESRD, but as a management tool.

WHEN TO INITIATE DIALYSIS?

Three Additional Scenarios

1. ARF to ESRD
2. ARF on CRF to ESRD
3. Gradual Loss of Renal Function to ESRD

WE WILL ADDRESS #3

2 year pre-dialysis slope eGFR change/yr N=5606

Group	Baseline eGFR	N	Trajectory (ml/min/yr)	eGFR >15 at dialysis initiation (%)
1	< 30	63%	7.7	6.4
2	30 - 59	25%	16	19.9
3	>60	9.5%	32	17

O'Hare, AJKD, 2011

WHEN TO INITIATE DIALYSIS?

New Definition for the New Paradigm

ESRD = eGFR ≤ 5 ml/min/1.73m²

Suggested reference point for dialysis initiation

eGFR > 5 – 9 ml/min/1.73m²

For uremia related:

- Pericarditis
- Coagulopathy
- Gastroenteropathy
- Anorexia
- Encephalopathy
- Volume Overload/Hypertension - Not Responsive to Diuretic Therapy

CONCLUSIONS

1. The US incident hemodialysis population with initial MDRD eGFR s > 10 ml/min/1.73m² increased from < 20 to > 50% between 1996 and 2008.

2. Early initiation of dialysis cannot be justified since it does not provide a mortality, morbidity or quality of life benefit.

3. Serum albumin level is a strong predictor of dialysis patient mortality.

4. Conventional wisdom of relating albumin levels to nutritional state appears to be wrong.

5. Low serum albumin is a marker of comorbidity and poor prognosis.

6. Despite general acceptance of the practice, there is no evidence that diabetic patients benefit form early dialysis initiation.

7. The two randomized controlled trials examining the effect of dialytic clearance on survival have shown that increasing dialytic clearance is not accompanied by a survival benefit.

8. Residual renal function correlates with dialysis patient survival. Every effort should be made to preserve a patients residual renal function.

9. Renal function trajectory must be considered in the decision to prepare a patient for dialytic therapy. Younger patients and patients with heavy proteinuria are more likely to have a rapid decline in residual renal function. Elderly patients have a slower decline of residual renal function.

10. Available studies do not support the conventional wisdom that at low levels of renal function, (MDRD eGFR < 8ml/min/1.73m^2), renal function will inevitably decline rapidly. Preemptive dialytic therapy in these patients is not justified on the basis of eGFR levels alone.

11. Use of multidisciplinary interventions in patients with eGFR in the 10-20 ml/min/1.73m^2 range is strongly encouraged and may decrease the high initial mortality of the incident dialysis population.

12. Multidisciplinary pre-dialysis clinics may be of great benefit to the elderly population who choose maximal conservative management and whose renal function may decline at a rate that will not require dialysis.

13. Recent observational studies utilizing large national and international databases and the randomized controlled trial, IDEAL, have demonstrated that dialytic therapy at eGFR levels of 5 - 9 ml/min/1.73m^2 or less may be the most appropriate time to consider dialysis initiation. Definitive uremic complications at higher levels of renal function are appropriate reason to initiate dialysis.

14. The decision to initiate dialysis must be a patient/ physician joint decision with full disclosure.

QUESTIONS

COMPETING RISK AND ACCESS
The Great Dilemma

- **20 – 50% of primary AV access fail.**
- **Success rate lower with increasing age.**

Alon, KI, 2002

78K Prevalent Patients

Catheter vs AVF

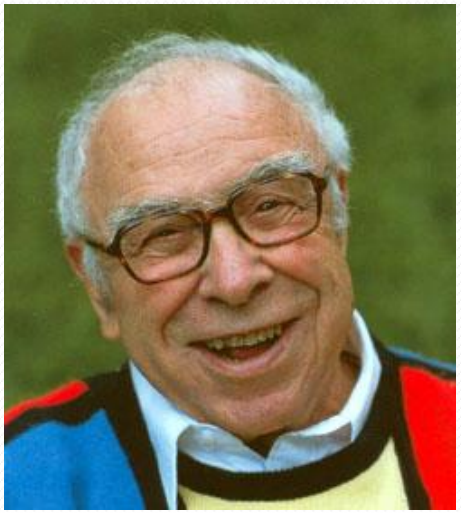
- **39% > death**
- **45% > hospitalizations**

Lacson, AmJKidDis, 2008

EXPECTED LIFE YEARS

Age Group	Dialysis Population	General Population
40 – 44	8 yrs	35 yrs
60 – 64	4.5 yrs	20 yrs
75 – 79	2.8 yrs	10.8 yrs
80 – 84	16 mos	8.2 yrs
85+	< 12 mos	4.4 yrs

USRDS
Kurella, Ann Int Med, 2007



Art Buchwald,
Pulitzer Prize Winner
Author of *Too Soon to Say Goodbye*

- Chose to stop dialysis treatments
- Doctors said he would die in 2 – 3 weeks
- Lived approximately one year after

Choosing Wisely

Five Things Physicians and Patients

1	Don't perform routine cancer screening for dialysis patients with limited life expectancies without signs or symptoms.
2	Don't administer erythropoiesis-stimulating agents (ESAs) to chronic kidney disease (CKD) patients with hemoglobin levels greater than or equal to 10 g/dL without symptoms of anemia.
3	Avoid nonsteroidal anti-inflammatory drugs (NSAIDS) in individuals with hypertension or heart failure or CKD of all causes, including diabetes.
4	Don't place a peripherally inserted central catheters (PICC) in stage III-V CKD patients without consulting nephrology.
5	Don't initiate chronic dialysis without ensuring a shared decision-making process between patients, their families, and their physicians.

ABIM ASN 2012

Don't initiate chronic dialysis without ensuring a shared decision-making process between patients, their families, and their physicians.

The decision to initiate chronic dialysis should be part of an individualized, shared decision-making process between patients, their families, and their physicians. This process includes eliciting individual patient goals and preferences and providing information on prognosis and expected benefits and harms of dialysis within the context of these goals and preferences. Limited observational data suggest that survival may not differ substantially for older adults with a high burden of co-morbidity who initiate chronic dialysis versus those managed conservatively.

ABIM ASN 2012

WHAT IS UREMIA?

BetterMedicine.com

"Uremia is a state in which the blood urea nitrogen level, an indicator of nitrogen waste products, is elevated. In uremia, the kidneys' failure to filter nitrogen waste properly leads to excessively high levels of nitrogen wastes in the bloodstream. Uremia is life-threatening because too much nitrogen in the blood is toxic to the body. Symptoms of uremia include confusion, loss of consciousness, low urine production, dry mouth, fatigue, weakness, pale skin or pallor, rapid heart rate (tachycardia), edema (swelling), and excessive thirst. Uremia may also be painful."