Predictors of Transplant Outcomes in Wait-Listed Dialysis Patients

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BNS, 08/30/2013, Budapest, Hungary
Financial Disclosure Statement

• None
Q1: The pre-transplant obesity/higher weight is associated with worse post-transplant mortality.

- A) True
- B) False
Q2: Waitlisted hemodialysis patient with BMI=32 kg/m² should lose weight while he/she is on hemodialysis to get transplanted.

• A) True
• B) False
Q3: Which dialysis patients have the best survival chance after transplantation?

- A) Patient with serum albumin = 3.5 mg/dL
- B) Patient with serum albumin = 3.2 mg/dL
- C) Patient with serum albumin = 4.2 mg/dL
- D) Patient with serum albumin = 2.5 mg/dL
Q4: High PTH level before transplantation is increased the risk of post-transplant mortality.

- A) True
- B) False
Q5: Patients on peritoneal dialysis is doing better after transplantation than hemodialysis counterparts.

- A) Likely true
- B) Likely false
- C) True because they usually have less severe comorbidities
- D) False because they are usually sicker than HD patients
Outcomes: deceased donor transplants

Figure 7.17 (Volume 2)

Patients age 18 & older receiving a first-time, kidney-only transplant; unadjusted.
In dialysis patients who are wait-listed for a kidney transplant, it is important to know what affects their post-transplant outcomes: (Transplant kidney survival? Recipient survival?)

- Pre-Transplant Weight and Body Composition
- Pre-Transplant Albumin
- Pre-Transplant Glycemic Control
- Pre-Transplant Minerals & Bone Disorders
- Pre-Transplant Dialysis Modality: HD vs. PD
- Pre-Transplant ESA responsiveness
- Pre-Transplant Blood Pressure
37,766 DaVita MHD patients from 07/2001 to 06/2006 were identified in the SRTR database ending 06/2007

Excluding waitlisted but not yet transplanted (n=20,137)

17,629 Renal Transplant Recipients

Restrict to transplant dates between 07/2001 and 06/2007 (n=2893)

14,736 Renal Transplant Recipients

Exclude patients who were transplanted more than once (n=228 patients excluded)

14,508 Renal Transplant Recipients

n=14,508 dialysis Patients who received their first kidney transplant during 07/2001 – 06/2007
Pre-Transplant Weight & Body Composition
and
Post-Transplant Outcomes
Obesity Paradox or Reverse Epidemiology in Dialysis Patients

BMI Associated Death Risk:
General Population versus Hemodialysis Patients

Obesity (BMI>35 kg/m²): A major cause of kidney transplant denial in dialysis patients

While waiting for a kidney transplant, obese dialysis patients are more likely to survive than thin patients!
Serum Creatinine (Surrogate of MUSCLE) in Dialysis Patients: → Outcomes

While waiting for a kidney transplant, dialysis patients with more muscle mass are more likely to survive than patients with low muscle mass!

Associations of Body Mass Index and Weight Loss with Mortality in Transplant-Waitlisted Maintenance Hemodialysis Patients
Associations of Body Mass Index and Weight Loss with Mortality in Transplant-Waitlisted Maintenance Hemodialysis Patients


Molnar ... Kalantar-Zadeh, Am J Transplant. 2011
Figure 8: Cubic splines models of Cox proportional regression to examine the mortality predictability of the combinations of the changes in dry weight and in adjusted serum creatinine levels over a 6-year observation period (7/2001–6/2007). The Y-axis shows the logarithm of the risk ratio of all-cause mortality over 6 years based on a multivariable Cox regression spline model, adjusted for case-mix. Dashed lines are 95% point wise confidence levels. Each patient received a percentile score between -100 and +100 according to the percentile rank of the change in dry weight or adjusted serum creatinine. The sum of the two percentile scores for each patient resulted in a number between -200 and +200.
Comparing 208,498 waitlisted dialysis patients with 118,662 kidney transplant recipients from the same period (1995-2007)

Source of data: USRDS

Stratified by BMI and race

Table 3: Risk of death in transplant recipients compared to wait-listed patients with the same body mass index 1 year after transplantation

<table>
<thead>
<tr>
<th>BMI</th>
<th>SCD recipients</th>
<th>ECD recipients</th>
<th>LD recipients</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 18.5</td>
<td>0.33 (0.26, 0.41)</td>
<td>0.30 (0.21, 0.42)</td>
<td>0.35 (0.24, 0.52)</td>
</tr>
<tr>
<td>18.5–24.9</td>
<td>0.34 (0.30, 0.39)</td>
<td>0.37 (0.32, 0.42)</td>
<td>0.20 (0.15, 0.26)</td>
</tr>
<tr>
<td>25.0–29.9</td>
<td>0.32 (0.28, 0.37)</td>
<td>0.43 (0.38, 0.50)</td>
<td>0.30 (0.22, 0.47)</td>
</tr>
<tr>
<td>30.0–34.9</td>
<td>0.32 (0.26, 0.39)</td>
<td>0.42 (0.35, 0.51)</td>
<td>0.23 (0.17, 0.32)</td>
</tr>
<tr>
<td>35.0–39.9</td>
<td>0.34 (0.26, 0.46)</td>
<td>0.39 (0.24, 0.52)</td>
<td>0.28 (0.14, 0.50)</td>
</tr>
<tr>
<td>≥ 40.0</td>
<td>0.52 (0.37, 0.72)</td>
<td>0.54 (0.33, 0.78)</td>
<td>0.34 (0.19, 0.59)</td>
</tr>
</tbody>
</table>

Separate multivariate nonproportional hazards analyses with transplantation treated as a time-dependent covariate to account for the fact that patients switched treatment from dialysis to transplantation at different times. Models adjusted for differences in patients characteristics including age, gender, cause of ESRD, history of comorbid conditions (ischemic heart disease, cerebrovascular disease, congestive heart failure, peripheral vascular disease, cancer), year of wait-listing and propensity score for transplantation.
The Survival Benefit of Kidney Transplantation in Obese Patients

J. S. Gill¹,²,³, J. Lan¹, J. Dong¹, C. Rose¹, American Journal of Transplantation 2013; 13: 2083–2090

Table 4: Risk of death in Black and White transplant recipients compared to wait-listed patients with the same body mass index 1 year after transplantation

<table>
<thead>
<tr>
<th>BMI</th>
<th>SCD recipients</th>
<th>ECD recipients</th>
<th>LD recipient</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI &lt; 18.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>0.40 (0.30, 0.60)</td>
<td>0.23 (0.11, 0.46)</td>
<td>0.43 (0.18, 1.00)</td>
</tr>
<tr>
<td>White</td>
<td>0.29 (0.21, 0.39)</td>
<td>0.29 (0.21, 0.42)</td>
<td>0.26 (0.21, 0.54)</td>
</tr>
<tr>
<td>BMI 18.5–24.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>0.35 (0.27, 0.59)</td>
<td>0.42 (0.31, 0.57)</td>
<td>0.26 (0.15, 0.35)</td>
</tr>
<tr>
<td>White</td>
<td>0.29 (0.25, 0.35)</td>
<td>0.35 (0.29, 0.41)</td>
<td>0.22 (0.17, 0.25)</td>
</tr>
<tr>
<td>BMI 25.0–29.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>0.30 (0.22, 0.41)</td>
<td>0.47 (0.35, 0.62)</td>
<td>0.28 (0.23, 0.76)</td>
</tr>
<tr>
<td>White</td>
<td>0.33 (0.28, 0.39)</td>
<td>0.35 (0.26, 0.40)</td>
<td>0.30 (0.20, 0.42)</td>
</tr>
<tr>
<td>BMI 30.0–34.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>0.34 (0.24, 0.49)</td>
<td>0.53 (0.37, 0.75)</td>
<td>0.30 (0.16, 0.32)</td>
</tr>
<tr>
<td>White</td>
<td>0.33 (0.24, 0.41)</td>
<td>0.36 (0.28, 0.41)</td>
<td>0.23 (0.16, 0.33)</td>
</tr>
<tr>
<td>BMI 35.0–39.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black¹</td>
<td>0.41 (0.24, 0.78)</td>
<td><strong>0.77 (0.50, 1.22)</strong></td>
<td>0.40 (0.27, 0.66)</td>
</tr>
<tr>
<td>White</td>
<td>0.35 (0.24, 0.49)</td>
<td>0.42 (0.29, 0.62)</td>
<td>0.32 (0.20, 0.52)</td>
</tr>
<tr>
<td>BMI ≥ 40.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black²</td>
<td><strong>0.56 (0.33, 1.08)</strong></td>
<td><strong>0.76 (0.08, 1.12)</strong></td>
<td><strong>0.75 (0.31, 1.80)</strong></td>
</tr>
<tr>
<td>White</td>
<td>0.54 (0.33, 0.82)</td>
<td>0.44 (0.25, 0.76)</td>
<td>0.22 (0.07, 0.67)</td>
</tr>
</tbody>
</table>

Separate multivariate nonproportional hazards analyses with transplantation treated as a time-dependent covariate to account for the fact that patients switched treatment from dialysis to transplantation at different times. Models adjusted for differences in patient characteristics including age, gender, cause of ESRD, history of comorbid conditions (ischemic heart disease, cerebrovascular disease, congestive heart failure, peripheral vascular disease, cancer), year of wait-listing.

¹There were n = 5785 Black patients with BMI 35.0–39.9 including n = 671 who received and ECD transplant during follow-up.

²There were n = 3832 Black patients with BMI ≥ 40 including n = 763, n = 335 and n = 350 who received and SCD, ECD and LD transplant during follow-up.
The Survival Benefit of Kidney Transplantation in Obese Patients

J. S. Gill\(^1,2,3\), J. Lan\(^1\), J. Dong\(^1\), C. Rose\(^1\), E. Hendren\(^1\), O. Johnston\(^1\) and J. Gill\(^1,2,\)∗


Table 5: Time (days) to equal risk of death and equal survival* in transplant recipients compared to wait-listed patients with the same body mass index

<table>
<thead>
<tr>
<th></th>
<th>&lt;18.5 (n = 13 714)</th>
<th>18.5–24.9 (n = 67 260)</th>
<th>25–29.9 (n = 64 655)</th>
<th>30–34.9 (n = 37 453)</th>
<th>35–39.9 (n = 16 070)</th>
<th>≥40 (n = 9 346)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death rate on waiting list per 100 patient years</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Days to equal risk of death</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCD</td>
<td>68</td>
<td>50</td>
<td>70</td>
<td>80</td>
<td>85</td>
<td>145</td>
</tr>
<tr>
<td>ECD</td>
<td>135</td>
<td>95</td>
<td>90</td>
<td>160</td>
<td>150</td>
<td>200</td>
</tr>
<tr>
<td>LD</td>
<td>55</td>
<td>Immediate</td>
<td>33</td>
<td>57</td>
<td>60</td>
<td>65</td>
</tr>
<tr>
<td>Days to equal survival</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCD</td>
<td>118</td>
<td>100</td>
<td>137</td>
<td>210</td>
<td>179</td>
<td>245</td>
</tr>
<tr>
<td>ECD</td>
<td>216</td>
<td>226</td>
<td>210</td>
<td>331</td>
<td>257</td>
<td>387</td>
</tr>
<tr>
<td>LD</td>
<td>116</td>
<td>Immediate</td>
<td>75</td>
<td>121</td>
<td>135</td>
<td>157</td>
</tr>
</tbody>
</table>

*Calculated from separate multivariate nonproportional hazards regression models.
A ‘Weight-Listing’ Paradox for Candidates of Renal Transplantation?


USRDS (1990-2003)
18-70 years old
124,713 patients received transplant

Table 5: Adjusted cox proportional hazard for overall graft loss associated with rate of BMI change during waitlisted period

<table>
<thead>
<tr>
<th>Rate of Change</th>
<th>Underweight or normal weight (&lt;25 kg/m²)</th>
<th>Overweight (25–30 kg/m²)</th>
<th>Obese (&gt;30 kg/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Hazard ratio</td>
<td>95% CI</td>
</tr>
<tr>
<td>&gt;12%</td>
<td>9153</td>
<td>1.13</td>
<td>1.09–1.18</td>
</tr>
<tr>
<td>+8 to 12%</td>
<td>2613</td>
<td>1.06</td>
<td>0.99–1.14</td>
</tr>
<tr>
<td>+4 to 8%</td>
<td>4479</td>
<td>0.93</td>
<td>0.88–0.98</td>
</tr>
<tr>
<td>−4 to +4%</td>
<td>24377</td>
<td>Ref</td>
<td>–</td>
</tr>
<tr>
<td>−8 to −4%</td>
<td>2523</td>
<td>1.07</td>
<td>1.00–1.14</td>
</tr>
<tr>
<td>−12 to −8%</td>
<td>1339</td>
<td>1.05</td>
<td>0.96–1.15</td>
</tr>
<tr>
<td>&lt;−12%</td>
<td>4707</td>
<td>1.07</td>
<td>1.02–1.13</td>
</tr>
</tbody>
</table>

Rate of change calculated as percentage change divided by time to transplant (in years). Models adjusted for recipient primary diagnosis, gender, age, race, time of pretransplant dialysis, donor age, donor race and number of HLA-mismatches. Reference group is patients with −4 to +4% rate of change during listing.

BMI = body mass index.
N= 10,090 long-term HD patients who underwent renal transplantation and were observed over a 6-year observation period (July 2001 to June 2007).

Streja, Molnar ... Kalantar-Zadeh, *CJASN*. 2011
N= 10,090 long-term HD patients who underwent renal transplantation and were observed over a 6-year observation period (July 2001 to June 2007).
Conclusions: Pre-transplant obesity does not appear to be associated with poor post-transplant outcomes.

Higher recipient body mass index is associated with post-transplant delayed kidney graft function

Miklos Z. Molnar\textsuperscript{1,2}, Csaba P. Kovesdy\textsuperscript{3,4}, Istvan Mucsi\textsuperscript{2,5,6}, Suphamai Bunnapradist\textsuperscript{7}, Elani Streja\textsuperscript{1}, Mahesh Krishnan\textsuperscript{8} and Kamyar Kalantar-Zadeh\textsuperscript{1,7,9}
Although current data have not defined limits of body composition that preclude clinical benefit from transplantation ..., work such as the study by Streja et al. should be pursued to help define **accurate, practical measures of body composition** that predict clinical outcomes.
Pre-Transplant Nutritional/Inflammatory Status (Serum ALBUMIN) and Post-Transplant Outcomes
Serum Albumin: \( \rightarrow \) STRONG, ROBUST, LINEAR Predictor of Survival

- **Unadjusted HR**
- **Case-mix adjusted HR**

N= 56,920 hemodialysis patients (7/2001-6/2003)

Kalantar-Zadeh ... Ikizler, Nature Nephrol Review 2011
Associations of Pretransplant Serum Albumin with Post-Transplant Outcomes in Kidney Transplant Recipients

M. Z. Molnar\textsuperscript{a,b}, C. P. Kovesdy\textsuperscript{c,d}, S. Bunnapradist\textsuperscript{e}, E. Streja\textsuperscript{a,f}, R. Mehrotra\textsuperscript{a,e}, M. Krishnan\textsuperscript{g}, A. R. Nissenson\textsuperscript{g} and K. Kalantar-Zadeh\textsuperscript{a,e,f,*}
Pre-Transplant Albumin → Post Transplant Outcomes

n= 8,961 Kidney Transplanted Patients (2001-2007, DaVita, USA)
Composite of Mortality & Graft Failure

The higher serum albumin before transplant → the better the post-transplant outcomes

Pre-Transplant Glycemic Control (Hb A1c) and Post-Transplant Outcomes
Glycemic Control and Cardiovascular Mortality in Hemodialysis Patients With Diabetes
A 6-Year Cohort Study

Joni Ricks,1 Miklos Z. Molnar,1,2 Csaba P. Kovesdy,3,4 Anuja Shah,5 Allen R. Nissenson,6,7 Mark Williams,8 and Kamyar Kalantar-Zadeh1,7,8,9

All Cause Mortality Hazard Ratio

Unadjusted
Case-Mix
Case-Mix & MICS

Cardiovascular Mortality Hazard Ratio

Unadjusted
Case-Mix
Case-Mix & MICS

N= 54,757 long-term HD patients observed over a 5-year observation period (July 2001 to June 2006).

Ricks, Molnar.....Kalantar-Zadeh, Diabetes 2012
N=2,872 long-term dialysis patients who underwent renal transplantation and were observed over a 6-year observation period (July 2001 to June 2007).
Pre-Transplant Mineral and Bone Disorders (Phos, Ca, PTH, Alk.Phos.) and Post-Transplant Outcomes
Mineral Metabolism, Mortality, and Morbidity in Maintenance Hemodialysis

GEOFFREY A. BLOCK,* PRESTON S. KLASSEN,† J. MICHAEL LAZARUS,‡ NORMA OFSTHUN,‡ EDMUND G. LOWRIE,‡ and GLENN M. CHERTOW§

40,538 maintenance HD patient
Association of Pretransplant Serum Phosphorus with Posttransplant Outcomes

Marcelo S. Sampaio,* Miklos Z. Molnar,† Csaba P. Kovesdy,‡ Rajnish Mehrotra,¶ Istvan Mucsi,‖ John J. Sim,‖ Mahesh Krishnan,‖ Allen R. Nissenson,‖ and Kamyar Kalantar-Zadeh\\n
N= 9,384 long-term dialysis patients who underwent renal transplantation and were observed over a 6-years (2001-2007)
N= 11,776 long-term dialysis patients who underwent renal transplantation and were observed over a 6-year observation period (July 2001 to June 2007).
Associations of Serum Skeletal Alkaline Phosphatase with Elevated C-Reactive Protein and Mortality

Rebecca Filipowicz,* Tom Greene,* Guo Wei,* Alfred K. Cheung,*† Kalani L. Raphael,*† Bradley C. Baird,* and Srinivasan Beddhu*†


Figure 2. Associations of serum total, skeletal, and nonskeletal alkaline phosphatase (residuals) levels with elevated serum CRP in non-CKD (n=936) and CKD (n=9771) subpopulations in the 1999–2004 National Health and Nutrition Examination Survey (n=10,707). Adjusted for demographics (age, sex, and race), systolic and diastolic BP, waist circumference, estimated GFR, liver disease, serum calcium, serum phosphorus, serum aspartate transaminase, alanine transaminase, γ-glutamyl transeptidase, bilirubin, albumin, and hemoglobin. CRP, C-reactive protein.

Figure 3. Associations of serum total, skeletal, and nonskeletal alkaline phosphatase (residuals) levels with mortality in non-CKD (n=936) and CKD (n=9771) subpopulations in the 1999–2004 National Health and Nutrition Examination Survey (n=10,707). Adjusted for demographics (age, sex, and race), systolic and diastolic BP, waist circumference, estimated GFR, liver disease, serum calcium, serum phosphorus, serum aspartate transaminase, alanine transaminase, γ-glutamyl transeptidase, bilirubin, albumin, and hemoglobin.
Pre-Transplant Dialysis Modality (HD vs. PD) and Post-Transplant Outcomes
Dialysis Modality (HD vs. PD) and Post-Transplant Outcomes

Who has better post-transplant outcomes (longer kidney and patient survival)?

A. Hemodialysis (HD)?

B. Peritoneal Dialysis (PD)?
A comparison of transplant outcomes in peritoneal and hemodialysis patients

252,402 US patients from Centers for Medicare and Medicaid Service between 1995-1998

**Outcome (PD vs HD)**

- **RR of Graft failure**
  - 1.05 (0.97-1.13)

- **RR of Death-Censored Graft failure**
  - 1.15 (1.04-1.26)

- **RR of Death**
  - 0.95 (0.85-1.06)

*Fig. 2. Unadjusted (Kaplan-Meier) outcomes comparing transplant recipients treated with either peritoneal dialysis (PD, gray line) or hemodialysis (HD, black line) pre-transplant. Shown are mortality (A), graft failure due to death, return to dialysis or re-transplantation (B), or death-censored graft failure due to dialysis or re-transplantation (C). Log rank, \( P = 0.001 \); Wilcoxon, \( P = 0.0002 \).*
The Role of Pretransplantation Renal Replacement Therapy Modality in Kidney Allograft and Recipient Survival

Alexander S. Goldfarb-Rumyantsev, MD, PhD, John F. Hurdle, MD, PhD, John D. Scandling, MD, Bradley C. Baird, MS, MStat, and Alfred K. Cheung, MD

American Journal of Kidney Diseases, Vol 46, No 3 (September), 2005: pp 537-549

Outcome
(PD vs HD)

HR of Graft Survival
0.97 (0.94-1.00)

HR of Recipient Survival
0.94 (0.91-0.97)

92,844 US patients from USRDS between 1990-2000

Fig 1. Predominant RRT modality and (A) graft and (B) recipient survival. The worst graft and recipient outcome is associated with HD.
The role of pretransplant dialysis modality on renal allograft outcome


Vedat Schwenger¹, Bernd Döhler², Christian Morath¹, Martin Zeier¹ and Gerhard Opelz²

Fig. 1. Unadjusted graft (a), death-censored graft (b) and patient (c) survival rates for the first 5 posttransplant years according to pretransplant dialysis modality. In total, 60 008 deceased-donor kidney transplants were analysed.

Outcome (PD vs HD)

HR of Graft Survival

1.06 (1.00-1.11)

HR of Death-censored Graft Survival

1.03 (0.97-1.10)

HR of Survival

1.10 (1.02-1.18)
Association between initial and pretransplant dialysis modality and graft and patient outcomes in live- and deceased-donor renal transplant recipients

Wai H. Lim,1,2 Philip Clayton,2,3 Germaine Wong,2,4 Gursharan Dogra,1 Charley A. Budgeon,5 Kevin Murray,5 Scott B. Campbell,2,6 Solomon Cohney,2,7 Graeme R. Russ,2,8 Kevan R. Polkinghorne,2,9 Steve J. Chadban2,4 and Stephen P. McDonald2,8

<table>
<thead>
<tr>
<th></th>
<th>Overall graft failure (HR, 95% CI)</th>
<th>Death-censored graft failure (HR, 95% CI)</th>
<th>Death (HR, 95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unadjusted model</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PD-PD</td>
<td>0.83 (0.74, 0.92)*</td>
<td>0.85 (0.71, 0.99)*</td>
<td>0.81 (0.70, 0.94)*</td>
</tr>
<tr>
<td>PD-HD</td>
<td>1.14 (1.01, 1.30)*</td>
<td>1.25 (1.03, 1.52)*</td>
<td>1.07 (0.90, 1.28)</td>
</tr>
<tr>
<td>HD-HD</td>
<td>0.90 (0.83, 0.98)*</td>
<td>0.90 (0.79, 1.02)</td>
<td>0.91 (0.81, 1.01)</td>
</tr>
<tr>
<td>HD-PD</td>
<td>1.17 (1.03, 1.33)*</td>
<td>1.05 (0.86, 1.29)</td>
<td>1.28 (1.08, 1.50)*</td>
</tr>
<tr>
<td><strong>Adjusted model</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dialysis modality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PD-PD</td>
<td>0.89 (0.79, 0.99)*</td>
<td>0.84 (0.71, 1.01)</td>
<td>0.91 (0.78, 1.06)</td>
</tr>
<tr>
<td>PD-HD</td>
<td>0.99 (0.86, 1.14)</td>
<td>1.15 (0.94, 1.42)</td>
<td>0.89 (0.73, 1.07)</td>
</tr>
<tr>
<td>HD-HD</td>
<td>0.96 (0.88, 1.04)</td>
<td>0.99 (0.87, 1.12)</td>
<td>0.93 (0.83, 1.04)</td>
</tr>
<tr>
<td>HD-PD</td>
<td>1.19 (1.04, 1.36)*</td>
<td>1.04 (0.85, 1.29)</td>
<td>1.34 (1.13, 1.59)*</td>
</tr>
</tbody>
</table>

ANZDATA between 1997-2009, 6,701 renal transplant recipients
Is PD better or HD for the best post-transplant outcomes?

**Major Limitations of Prior Studies:**

- All of them observational (unknown confounders)
- Inconclusive results
- Most of them included few patients
- NOT adjusting for important confounders
- NOT balancing for MEASURED confounders
- NOT used novel statistical techniques:
  - Patients who are selected on PD are already healthier people!
  - \( \rightarrow \) Propensity Scoring \( \rightarrow \) match \( \rightarrow \) re-analyze
Dialysis Modality and Outcomes in Kidney Transplant Recipients


N= 12,416 long-term HD and 2,092 PD patients who underwent renal transplantation and were observed over a 6-year observation period (July 2001 to June 2007).

Molnar.....Kalantar-Zadeh, CJASN, 2012
Propensity score of probability of being on PD

BEFORE matching

AFTER matching
N= 2,092 PS matched HD and 2,092 PD patients who underwent renal transplantation and were observed over a 6-year observation period (July 2001 to June 2007).

Molnar.....Kalantar-Zadeh, CJASN, 2012
Hazard ratio (95% confidence intervals) of post-transplant death (all-cause or cardiovascular) or graft failure or delayed graft function for PD patients (n=2,092) compared to 1:1 propensity-score matched cohort of HD patients (n=2,092) (reference) who underwent renal transplantation and followed for up to 6 years (7/2001-6/2007)

<table>
<thead>
<tr>
<th></th>
<th>minimally adjusted</th>
<th>+ case-mix adjusted*</th>
<th>+ MICS adjusted**</th>
<th>+ transplant data adjusted ***</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HR (95% CI)</td>
<td>P-value</td>
<td>HR (95% CI)</td>
<td>P-value</td>
</tr>
<tr>
<td>Graft failure censored all-cause death</td>
<td>0.74 (0.58-0.95)</td>
<td>0.02</td>
<td>0.71 (0.54-0.92)</td>
<td>0.01</td>
</tr>
<tr>
<td>Graft failure censored cardiovascular death</td>
<td>0.37 (0.21-0.64)</td>
<td>&lt;0.001</td>
<td>0.37 (0.21-0.65)</td>
<td>0.001</td>
</tr>
<tr>
<td>Death censored graft failure</td>
<td>0.79 (0.66-0.95)</td>
<td>0.01</td>
<td>0.81 (0.67-0.98)</td>
<td>0.03</td>
</tr>
<tr>
<td>Combined all-cause death or graft failure</td>
<td>0.79 (0.68-0.92)</td>
<td>0.003</td>
<td>0.80 (0.68-0.94)</td>
<td>0.008</td>
</tr>
<tr>
<td>Delayed Graft Function</td>
<td>0.69 (0.58-0.81)</td>
<td>&lt;0.001</td>
<td>0.66 (0.55-0.79)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Molnar.....Kalantar-Zadeh, CJASN, 2012
Conclusions

Compared to HEMODIALYSIS, pre-transplant treatment with PERITONEAL DIALYSIS appears to be associated with BETTER post-transplant PATIENT SURVIVAL:

- Lower all-cause and cardiovascular → 44% better
- Lower mortality post-transplantation. → 68% better

In our study, there was no robust association between pre-transplant dialysis modality and risk of graft failure or delayed graft function in multivariate adjusted models, although a trend towards better graft survival was observed.

Hence, all things equal, PD appears to lead to better post-transplant patient outcomes than HD
Thank you for your attention!

Harold Simmons Center for Kidney Disease Research & Epidemiology
Pre-Transplant ESA Responsiveness and Post-Transplant Outcomes
Mortality Associated with Dose Response of Erythropoiesis-Stimulating Agents in Hemodialysis versus Peritoneal Dialysis Patients

Uyen Duong\textsuperscript{a} Kamyar Kalantar-Zadeh\textsuperscript{a--d} Miklos Z. Molnar\textsuperscript{a,h}
Joshua J. Zaritsky\textsuperscript{c} Isaac Teitelbaum\textsuperscript{e} Csaba P. Kovesdy\textsuperscript{f,g} Rajnish Mehrotra\textsuperscript{b,c}

139,103 HD and 10,527 PD were observed over a 5-year observation period (July 2001 to June 2006)
Association of pre-transplant erythropoiesis-stimulating agent responsiveness with post-transplant outcomes

Miklos Z. Molnar, Suphamai Bunnapradist, Edmund Huang, Mahesh Krishnan, Allen R. Nissenson, Csaba P. Kovesdy and Kamyar Kalantar-Zadeh

N= 8,795 long-term HD patients who underwent renal transplantation and were observed over a 6-year observation period (July 2001 to June 2007).

NDT 2012
Pre-Transplant Blood Pressure and Post-Transplant Outcomes

Under review, not published yet
N= 13,881 long-term dialysis patients who underwent renal transplantation and were observed over a 6-year observation period (July 2001 to June 2007).
N = 13,881 long-term dialysis patients who underwent renal transplantation and were observed over a 6-year observation period (July 2001 to June 2007).

No association between pre-transplant blood pressure and post-transplant graft loss.