

Examining Facility-Level Data for the USRDS

Yi Li, PhD

Professor of Biostatistics, University of Michigan, Ann Arbor
Director, Kidney Epidemiology and Cost Center (KECC)

Co-Deputy Director, United States Renal Data System
Coordinating Center



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Initial Modality

Peritoneal Dialysis (PD) and Hemodialysis (HD)

- About 90% of ESRD patients started with HD, while 10% started with PD
- However, some argue that the predominance of HD as initial therapy has “little to do with clinical outcomes,” but is “driven by ease of HD initiation” (*Ghaffari et al., 2013*)
- There is an increasing trend of PD usage (*ADR, 2014*) and more interest in starting dialysis with PD

Should We Start with PD?

- PD preserves residual renal function and vascular access sites, lowers cost of therapy, and offers better patient autonomy compared with HD (*Dalal et al., 2011*)
- PD is not associated with myocardial stunning, as opposed to HD (*Selby and McIntyre, 2011*)

Some Studies Comparing PD versus HD

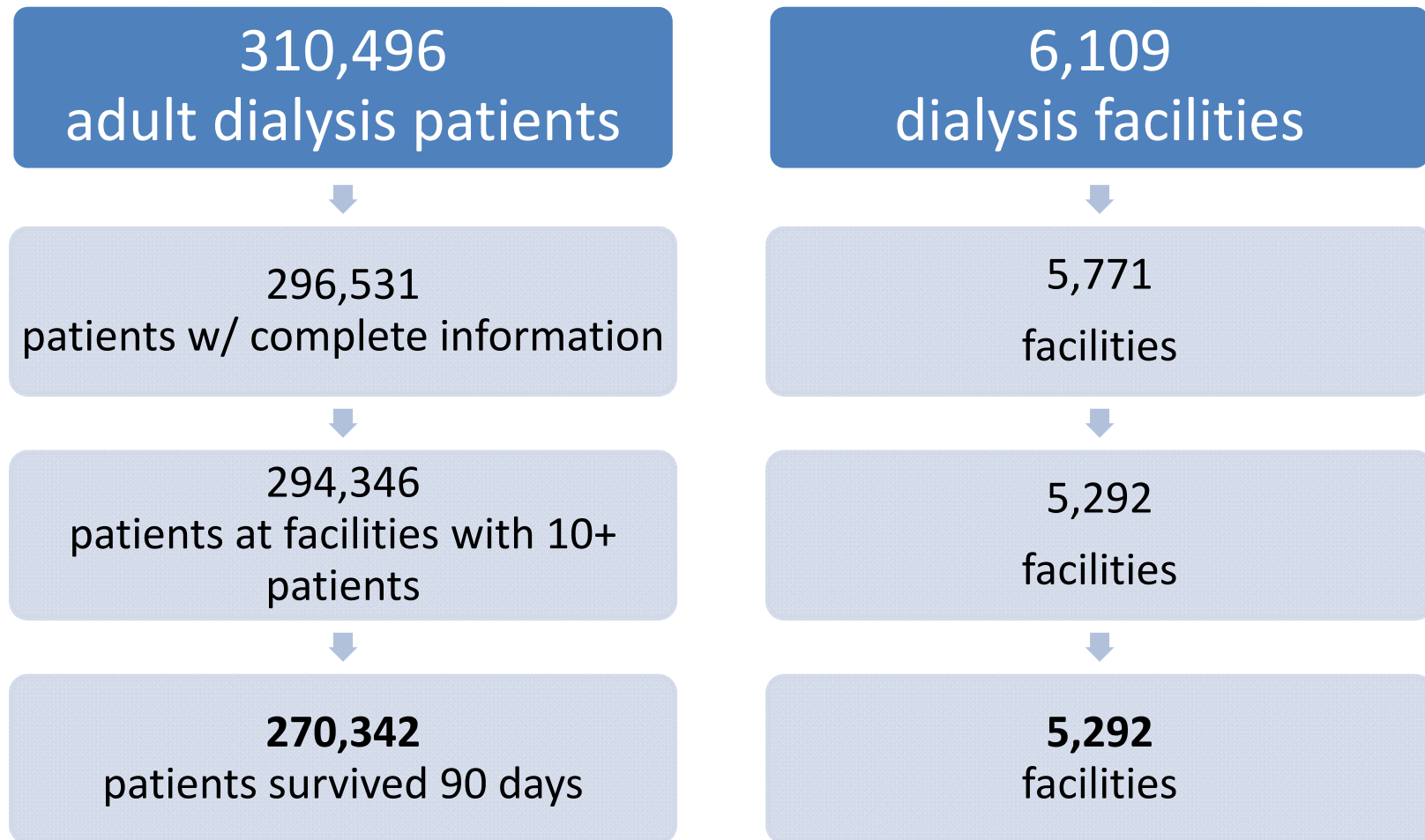
Publication	No. of Patients (duration of study)	Hazard Ratio (PD vs HD)	Follow-up Time	Statistical Methodology
Lukowsky et. al (2013)	23,718 (2001–2006)	0.52	2 years	Marginal structural model
Weinhandl et. al (2010)	98,875 (2003)	0.92	4 years	Propensity score
Mehrotra et. al (2010)	684,426 (1996–2004)	1.03~1.08	5 years	Propensity score
Vonesh et. al (2004)	398,340 (1995–2000)	Varies by subgroups	3 years	Covariate adjustment

Our Goals and Methods

- Utilize the most recent USRDS data to study the effect of initial dialysis modality on patients' early mortality
- Explore various statistical approaches to compare early survival outcomes in an observational setting
 - descriptive analysis
 - covariate adjustment
 - propensity score
 - instrumental variable
- All analyses are conducted under “intent-to-treat”

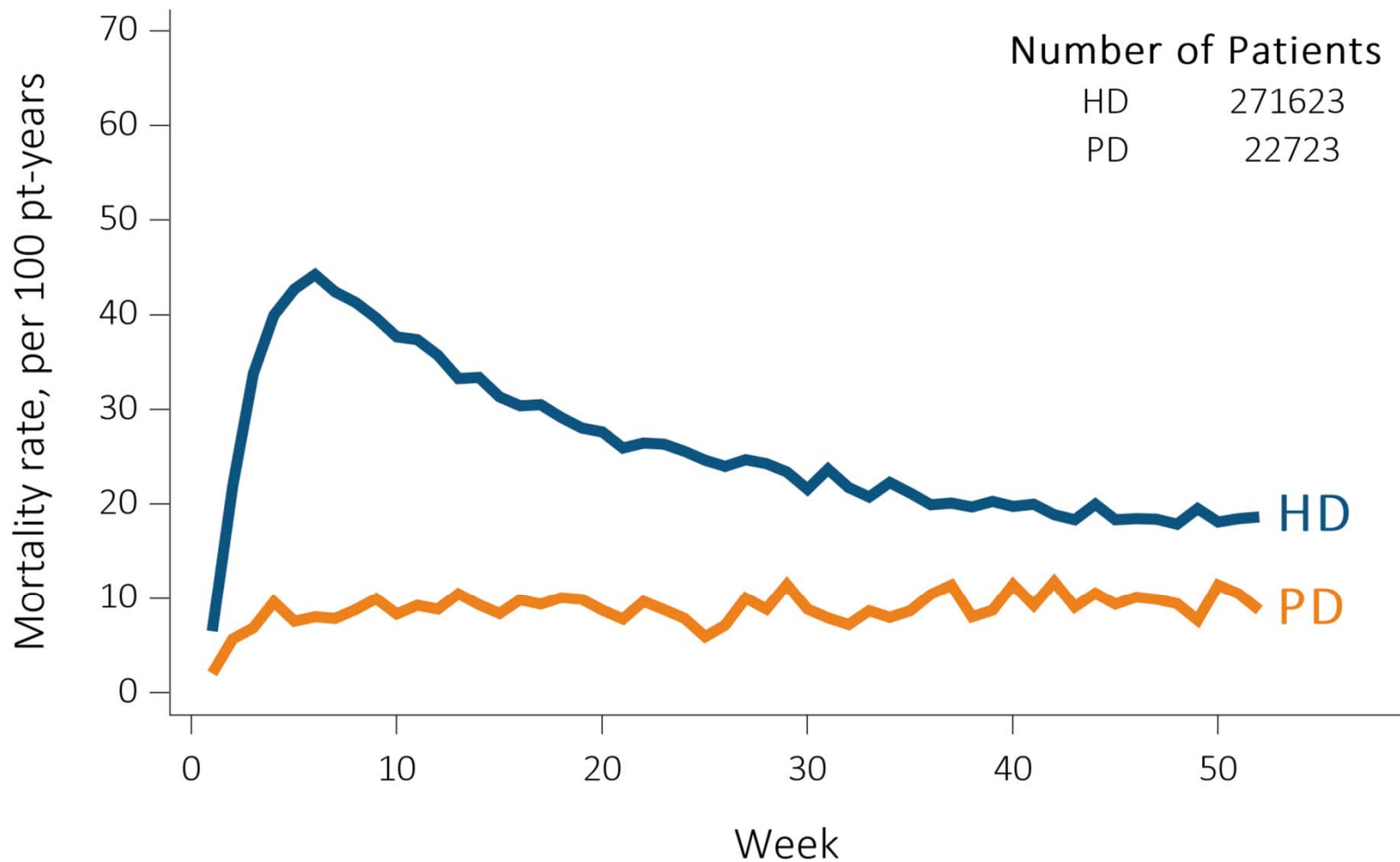
Study Population

2010-2012 Incident Patients



Weekly Mortality Rate

2010-2012 incident patients

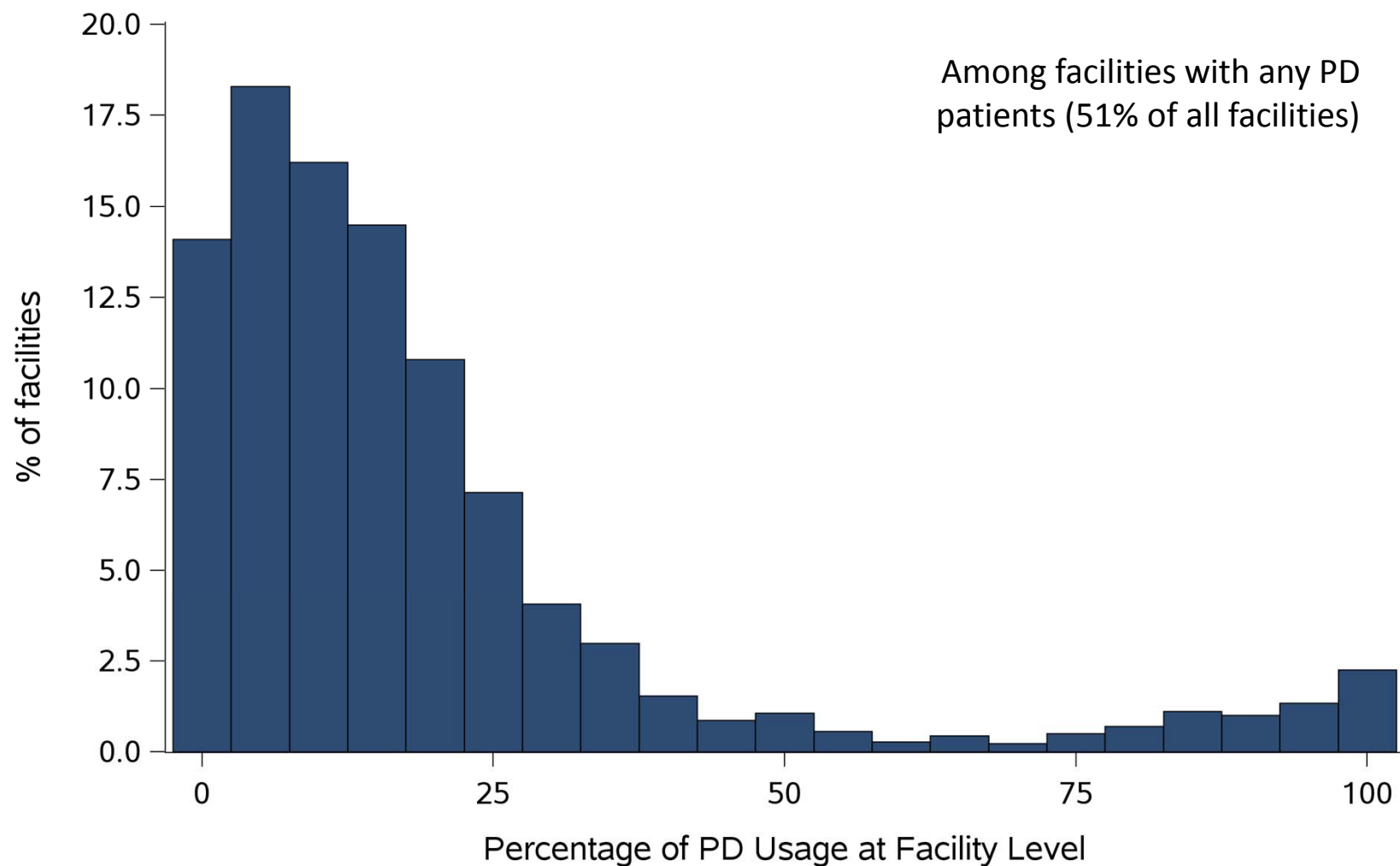


Comparisons of Patient Characteristics by Initial Modality

Patient characteristic	Hemodialysis	Peritoneal Dialysis
Age (M)	64.3	59.0
Black (%)	28.4	22.7
Nephrology care >6 months (%)	42.1	67.2
eGFR (M)	11.7	11.2
Diabetes (%)	60.4	53.0
CAD (%)	20.2	13.4
PAD (%)	13.4	8.5
Number of comorbidities* (M)	1.9	1.4

*Excluding CAD, PAD and diabetes.

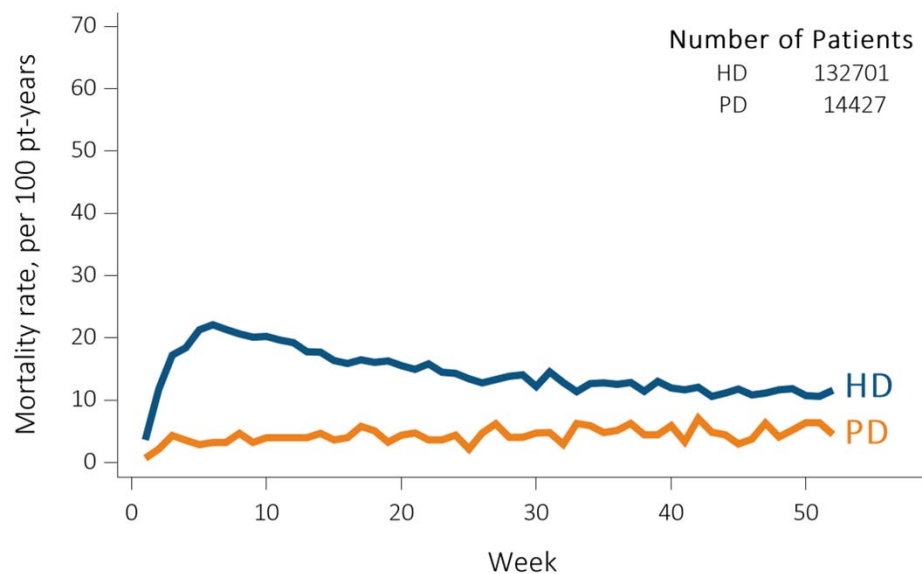
Distribution of Facility-Level PD Usage (2012)



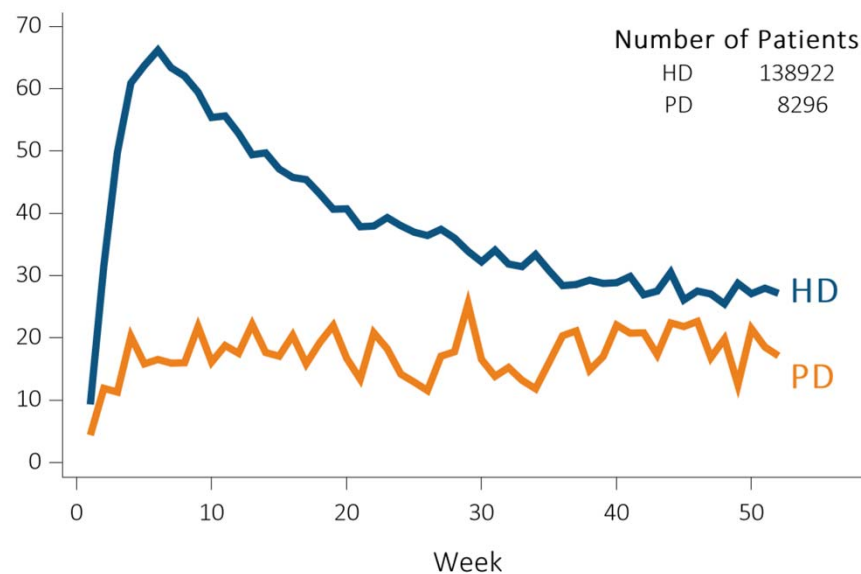
Weekly Mortality Rate

Patient Age

Age <65



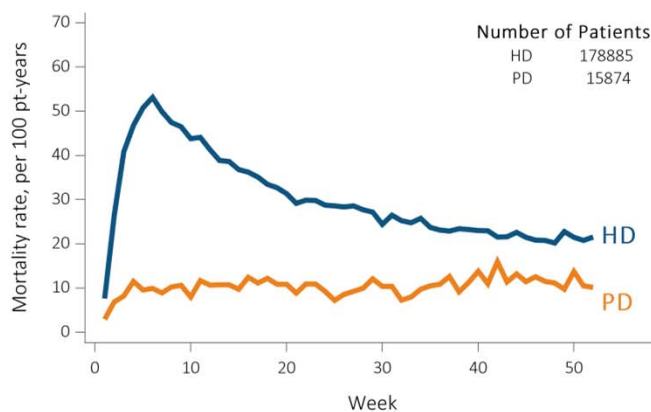
Age 65+



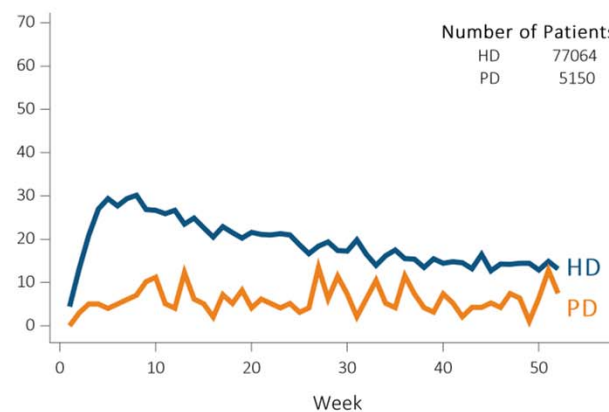
Weekly Mortality Rate

Race

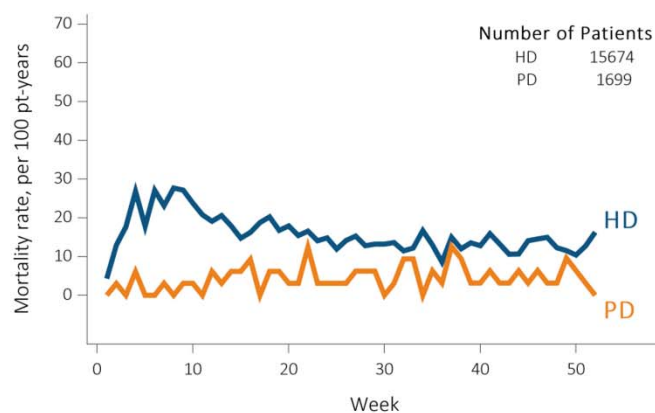
White



Black



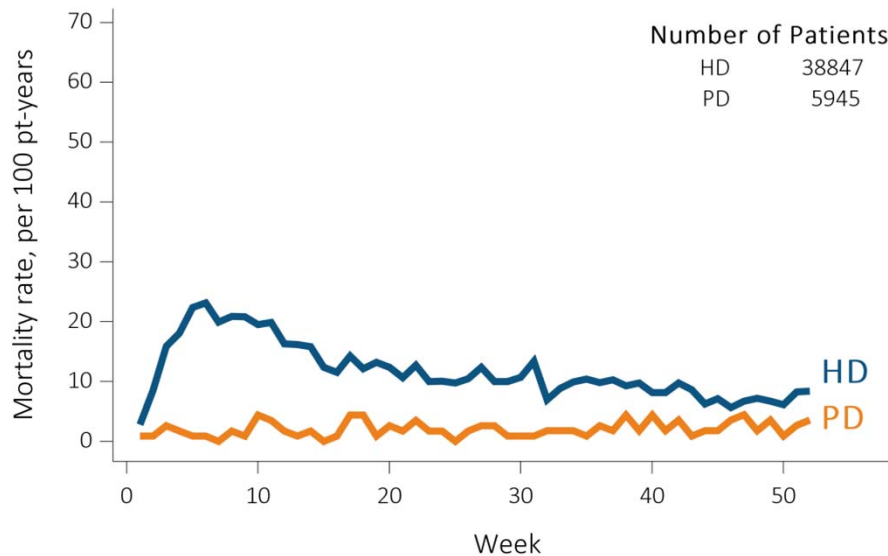
Other



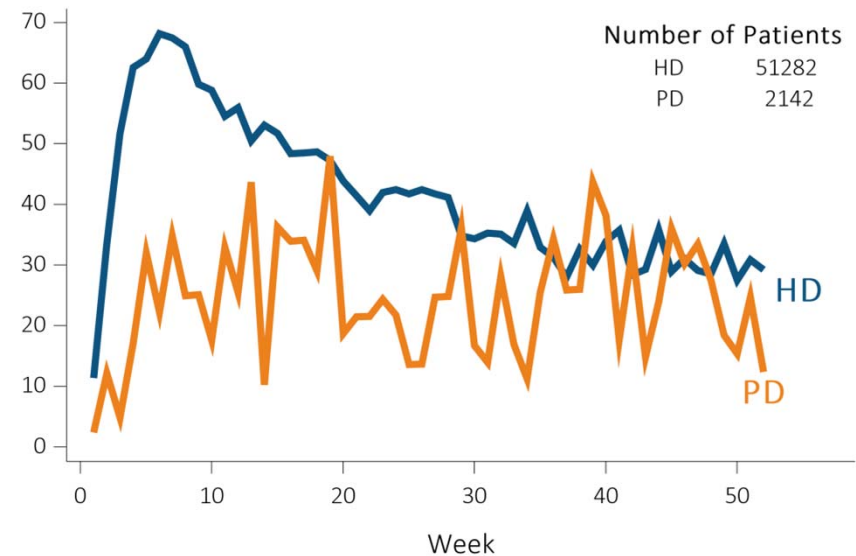
Weekly Mortality Rate

Patient Health Status

Healthier



Less Healthy



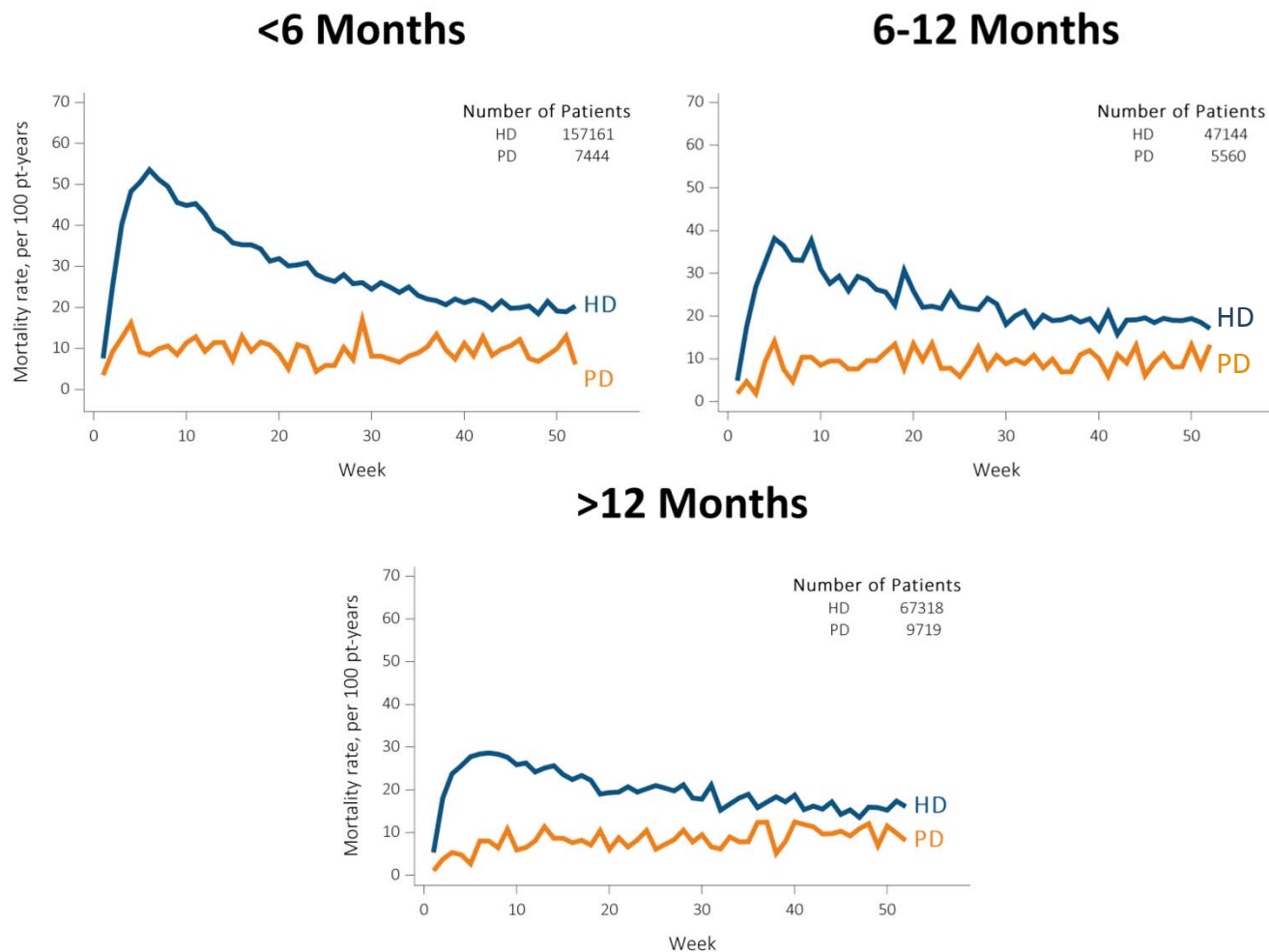
Healthier:

< 65 years old, no diabetes, no coronary artery disease (CAD) or peripheral artery disease (PAD)

Less Healthy:

> 65, diabetes, either CAD or PAD

Weekly Mortality Rate Pre-ESRD Nephrologist Care



Crude Comparison of PD vs HD in Early Mortality

	Day 0–90 (n = 294,346)	Day 91–365 (n = 270,342)
Hazard Ratio	0.23	0.41
95% Confidence Interval	0.21–0.26	0.39–0.44

Potential Issues

- Differences in patient-level and facility-level characteristics among the treatment groups
- Unobserved confounders could also render bias

Statistical Approach

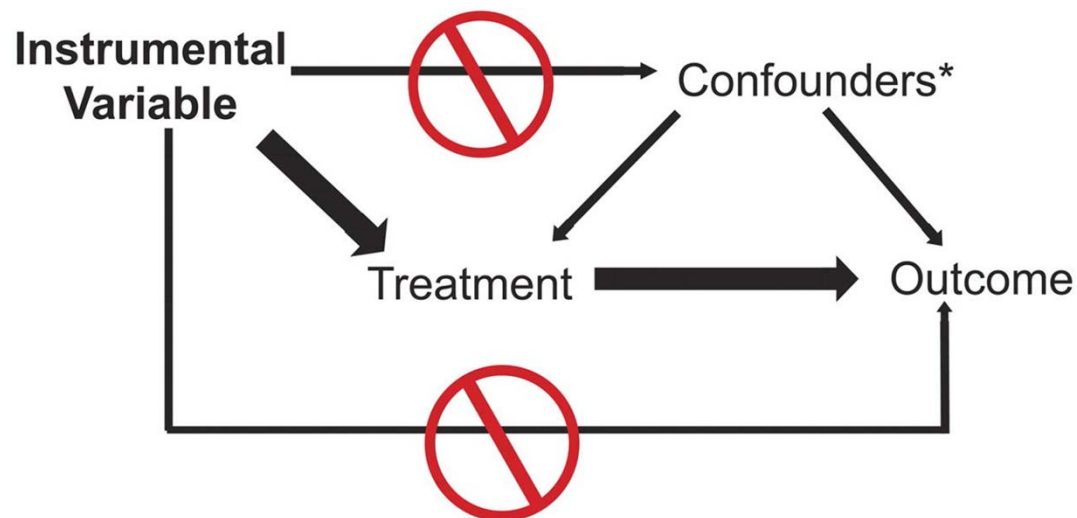
Propensity Score

- Aims to create a pseudo-randomized trial setting by accounting for the covariates that predict treatment assignment
- Balances comparison groups on a large number of covariates without losing many observations
- One main disadvantage is that it only accounts for observed (and observable) covariates

Statistical Approach

Instrumental Variable (IV)

- Accounts for unobserved confounders
- Selection of instrumental variables depends on subject-matter knowledge, and “weak” instruments cause instability



Average PD Usage of Other Patients in Facilities as IV

- Represents the facility preference of PD usage
- Possibly independent of unmeasured patient-related confounders (conditional on measured covariates)
- Fairly strong instrument (i.e., the large variation of PD usage across facilities)

Comparisons of PD and HD in Early Mortality

Estimates from Competing Methods

	Day 0–90 (n = 294,346)	Day 91–365 (n = 270,342)
	Hazard Ratio (95% CI)	Hazard Ratio (95% CI)
Crude	0.23 (0.21, 0.26)	0.41 (0.39, 0.44)
Covariate adjusted	0.40 (0.37, 0.44)	0.62 (0.59, 0.65)
Propensity score	0.38 (0.34, 0.42)	0.63 (0.59, 0.66)
Instrumental variable	0.39 (0.34, 0.45)	0.62 (0.57, 0.67)

Comparisons of PD and HD in Early Mortality Subgroup Analysis

Healthier (Age 65, no diabetes, CAD or PAD)		
	Day 0–90 (n = 44,792)	Day 91–365 (n = 42,601)
Crude	0.09 (0.06, 0.14)	0.21 (0.17, 0.44)
Covariate adjusted	0.19 (0.13, 0.27)	0.34 (0.28, 0.42)
Propensity score (stratified)	0.21 (0.12, 0.36)	0.32 (0.24, 0.44)
Instrumental variable	0.18 (0.11, 0.30)	0.29 (0.21, 0.40)
Less Healthy (Age 65, diabetes and either CAD or PAD)		
	(n = 53,424)	(n = 46,879)
Crude	0.41 (0.34, 0.49)	0.68 (0.61, 0.76)
Covariate adjusted	0.56 (0.47, 0.66)	0.83 (0.75, 0.91)
Propensity score (stratified)	0.53 (0.44, 0.63)	0.83 (0.75, 0.91)
Instrumental variable	0.51 (0.38, 0.70)	0.89 (0.74, 1.08)

Summary

- There is an increasing trend of PD usage recently
- There is a mortality peak around 6 weeks among the initial HD group, while no obvious peaks are found among the initial PD group
- Different approaches hint at early survival advantages of initial PD, and these advantages differ by subgroups
- Statistical approaches are useful for the analysis of observational data, although more effort is needed to verify certain assumptions
- Accounting for duration of PD usage and modality switch is an ongoing project

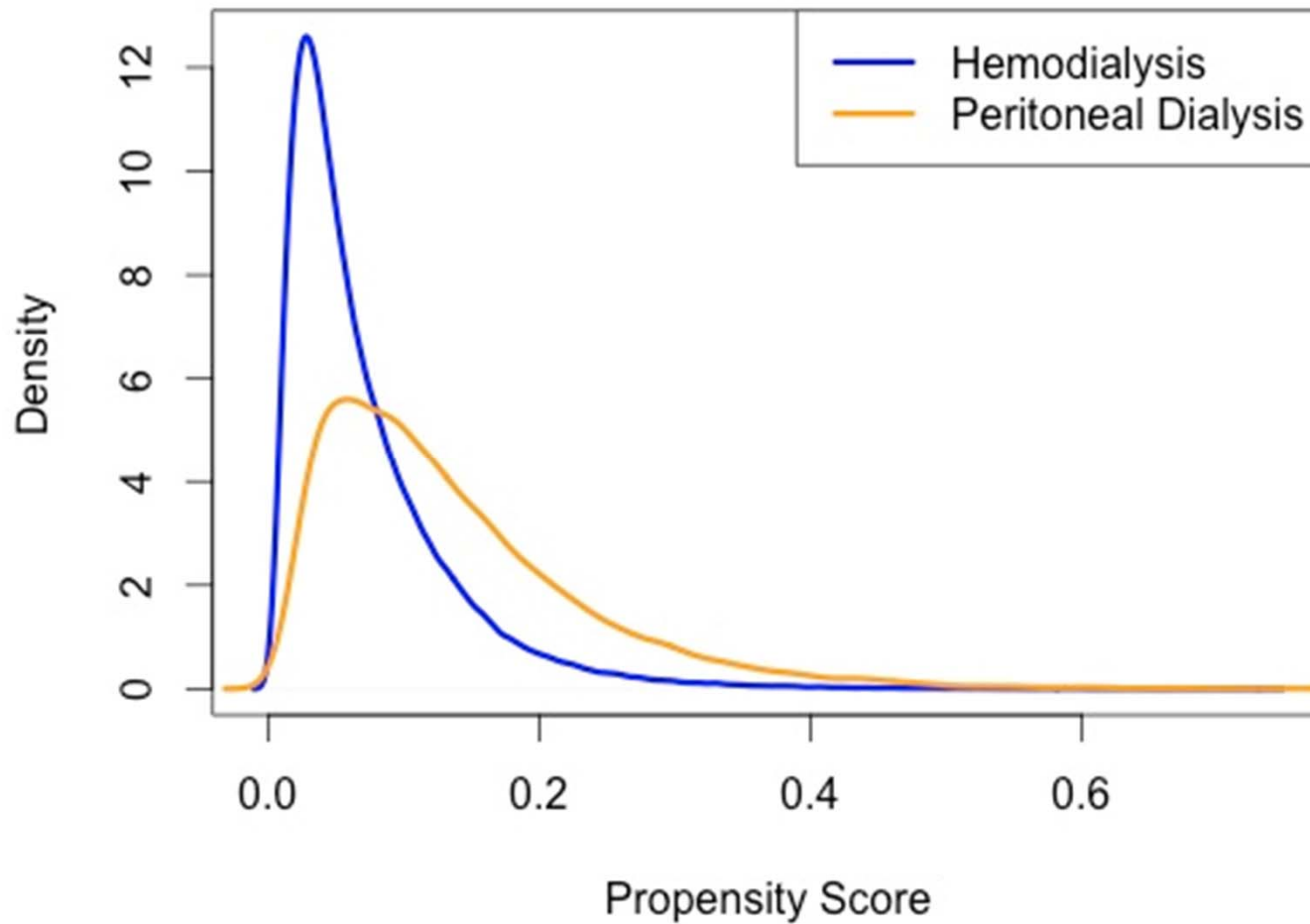
Should Peritoneal Dialysis as Initial Modality Become a Standard of Care?

- Patient education
- Bundled payment
- Technique failure
- Patient satisfaction

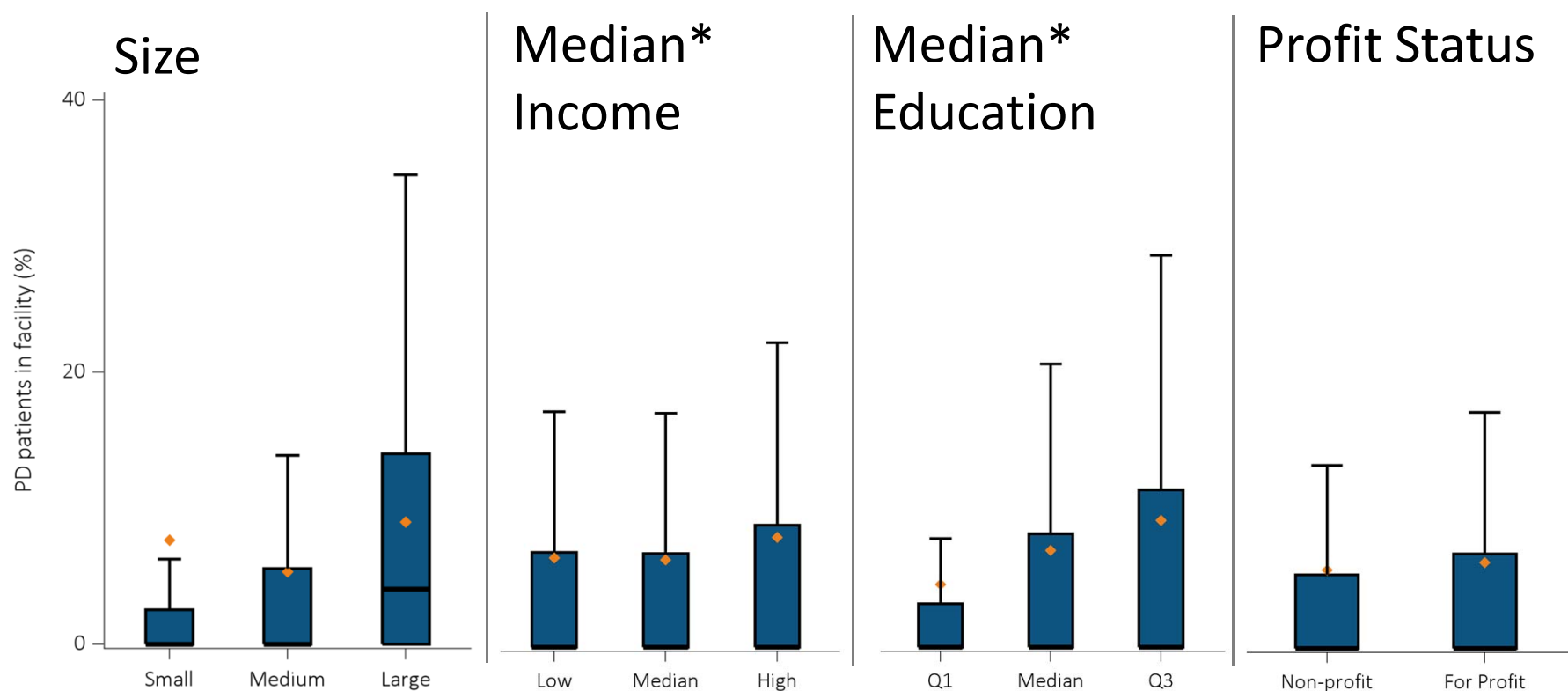
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Distribution of Propensity Scores, by Modality



Facility-Level PD Usage, by Facility Characteristics



* Median for each facility's ZIP code. *Education* represents the median percentage of bachelor's degrees in the ZIP code.