

Ultrafiltration Profiling: Association with Clinical Outcomes among Incident Dialysis Patients

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Introduction

- Ultrafiltration (UF) profiling is the practice of varying the UF rate during the dialysis treatment in order to mitigate the consequences of decreased effective circulating volume. 1-3
- In practice, UF profiling may be used on a standing basis, a PRN basis, or not at all.
- We conducted parallel, matched analyses comparing standing UF profiling to PRN UF profiling and to no profiling.

Objective

The objective of this study was to assess the association of UF profiling use with clinical outcomes.

Methods

Study Patients

- We considered all adult (≥ 18 years) patients who initiated in-center hemodialysis at a large dialysis organization (LDO) between 01 January 2010 and 30 June 2015 (Veteran's Affairs beneficiaries were excluded due to contractual stipulation).
- We identified all patients who received a first-ever order for standing UF profiling and considered eligible controls of two types:
- Patients who initiated a first-ever order for UF profiling on a PRN basis in the same vintage month
- Patients who had not used UF profiling through the same vintage month
- Each standing UF profile patient was matched (separately) to an eligible control of each type based on race and Charlson comorbidity index score using an incidence density algorithm.

Outcomes and Statistical Analysis

- The rates of the following outcomes were assessed over 12 months of follow-up using intention-to-treat principles:
- Episodes of intradialytic hypotension (IDH)
- Death
- All-cause hospitalizations
- Missed dialysis treatments
- All outcomes were assessed using linear mixed models including random effects for individual patients and fixed effects for exposure group and time to account for repeated observations and were adjusted for covariates that remained imbalanced after matching.

Results

No Profiling vs UF Profiling

- Patient characteristics in the matched sample are shown in Table 1. - Patients using UF profiling on a standing basis were more likely to be female, had greater target and postdialysis weights, and lower albumin levels.
- Clinical outcomes are presented in Figure 1.
- No UF profiling (vs standing UF profiling) was associated with lower rates of IDH and hospitalization, but indistinguishable rates of death and missed treatments.

PRN Profiling vs UF Profiling

- Patient characteristics in the matched sample are shown in Table 2.
- Patients using UF profiling on a standing basis were more likely to be female, had greater target and postdialysis weights, and lower albumin levels.
- Clinical outcomes are presented in Figure 2.
- PRN UF profiling (vs standing UF profiling) was associated with lower rates of IDH, but higher rates of hospitalization and missed treatments.
- No difference in death rate was observed.

Table 1. Demographics and Characteristics as of Index Month among Matched Patients: No Profile vs UF Profiling

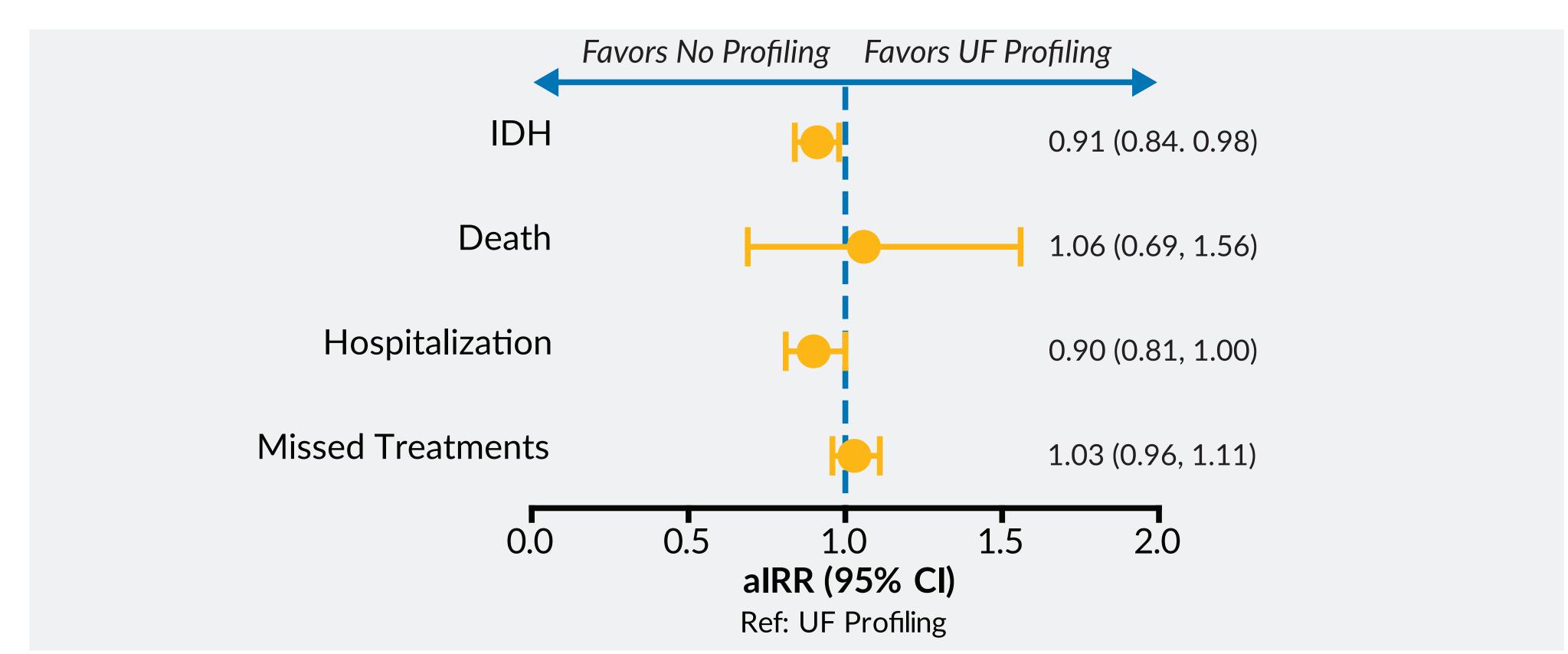
		No Profile N = 1869	Standing UF Profile N = 1869	P-Value
Age, years	mean ± SD	65.5 ± 13.9	65.0 ± 14.1	0.33
Female	n (%)	788 (42.2)	64 (46.2)	0.01
Race ^a White Black Hispanic Asian Other/unknown Vascular access Arteriovenous fistula Arteriovenous graft Central venous catheter	n (%)	1232 (65.9) 499 (26.7) 100 (5.4) 12 (0.6) 26 (1.4) 589 (31.5) 146 (7.8) 134 (60.7)	1232 (65.9) 499 (26.7) 100 (5.4) 12 (0.6) 26 (1.4) 580 (31.0) 124 (6.6) 165 (62.3)	NA ^a
Etiology of ESRD Diabetes Hypertension Other	n (%)	630 (33.7) 480 (25.7) 759 (40.6)	669 (35.8) 497 (26.6) 703 (37.6)	0.16
Vintage, months ^a	mean ± SD median [p25, p75]	3.1 ± 4.2 1.0 [1.0, 4.0]	3.1 ± 4.2 1.0 [1.0, 4.0]	NA ^a
CCI score ^a	mean ± SD median [p25, p75]	5.4 ± 1.4 5 [4, 6]	5.4 ± 1.4 5 [4, 6]	NAª
Diabetes	n (%)	1179 (63.1)	1191 (63.7)	0.68
CHF	n (%)	92 (4.9)	104 (5.6)	0.38
CAD	n (%)	77 (4.1)	79 (4.2)	0.87
PVD	n (%)	20 (1.1)	19 (1.0)	0.87
Predialysis SBP, mm Hg	mean ± SD	143 ± 28	143 ± 28	0.89
Nadir SBP, mm Hg	mean ± SD	115 ± 27	115 ± 27	0.87
Ultrafiltration volume, L	mean ± SD	1.7 ± 1.1	1.7 ± 1.2	0.55
Ultrafiltration rate, mL/kg/h	mean ± SD	6.0 ± 4.5	6.3 ± 9.1	0.29
Interdialytic weight gain, kg	mean ± SD	0.96 ± 2.10	0.98 ± 2.03	0.72
Target weight, kg	mean ± SD	83.9 ± 23.4	85.5 ± 23.5	0.03
Post dialysis weight, kg	mean ± SD	83.5 ± 23.3	85.1 ± 23.5	0.03
Albumin, g/dL	mean ± SD median [p25, p75]	3.5 ± 0.5 3.6 [3.2, 3.9]	3.5 ± 0.5 3.5 [3.2, 3.8]	0.02

^a Variable hard matched

Comorbidities will be considered as any evidence on or before index month; treatment parameters will be assessed for first regular treatment of index month; laboratory measures will be considered as first recorded measurement in index month

Abbreviations: CAD, coronary artery disease; CCI, Charlson comorbidity index; CHF, congestive heart failure; CVD, cerebrovascular disease; IDH, intradialytic hypotension; PVD, peripheral vascular disease; SBP, systolic blood pressure

Figure 1. Comparison of Clinical Outcomes among No Profiling vs Standing UF Profiling Patients



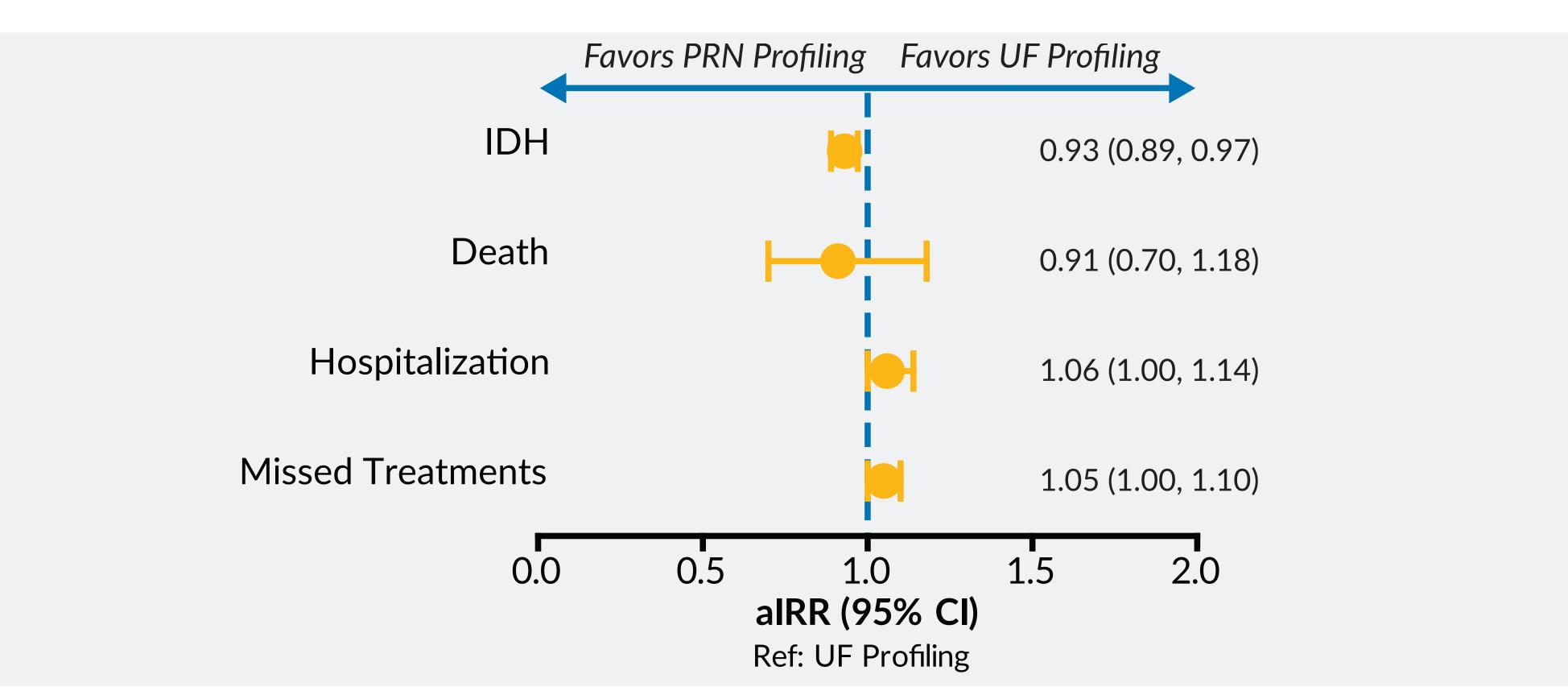
Adjusted for sex, target weight, and serum albumin Abbreviations: aIRR, adjusted incidence rate ratio; CI, confidence interval; IDH, intradialytic hypotension; Ref, referent; UF, ultrafiltration

Table 2. Demographics and Characteristics as of Index Month among Matched Patients: PRN Profiling vs UF Profiling

		PRN Profile N = 5166	Standing UF Profile N = 5166	P-Value
Age , years	mean ± SD	64.0 ± 14.3	63.9 ± 14.0	0.61
Female	n (%)	2142 (41.5)	2327 (45.0)	< 0.001
Race ^a White Black Hispanic Asian Other/unknown	n (%)	2998 (58.0) 1483 (28.7) 484 (9.4) 62 (1.2) 139 (2.7)	2998 (58.0) 1483 (28.7) 484 (9.4) 62 (1.2) 139 (2.7)	NAª
Vascular access Arteriovenous fistula Arteriovenous graft Central venous catheter	n (%)	1839 (35.6) 450 (8.7) 2876 (55.7)	1911 (37.0) 483 (9.4) 2772 (53.7)	0.14
Etiology of ESRD Diabetes Hypertension Other	n (%)	2095 (40.6) 1367 (26.5) 1704 (33.0)	2083 (40.3) 1366 (26.4) 1717 (33.2)	0.96
Vintage , months ^a	mean ± SD median [p25, p75]	4.8 ± 5.7 2 [1, 7]	4.8 ± 5.7 2 [1, 7]	NAª
CCI score ^a	mean ± SD median [p25, p75]	5 ± 2 6 [4, 6]	5 ± 2 6 [4, 6]	NAª
Diabetes	n (%)	3429 (66.4)	3459 (67.0)	0.53
CHF	n (%)	366 (7.1)	401 (7.8)	0.19
CAD	n (%)	282 (5.5)	299 (5.8)	0.47
PVD	n (%)	124 (2.4)	111 (2.2)	0.39
Predialysis SBP, mm Hg	mean ± SD	145 ± 27	145 ± 27	0.80
Nadir SBP, mm Hg	mean ± SD	112 ± 25	112 ± 25 110 [95, 129]	0.96
Ultrafiltration volume, L	mean ± SD	1.9 ± 1.2	1.9 ± 1.1 1.8 [1.2, 2.5]	0.67
Ultrafiltration rate, mL/kg/h	mean ± SD	6.8 ± 8.5	6.7 ± 8.0 6.0 [4.1, 8.3]	0.29
Interdialytic weight gain, kg	mean ± SD	1.6 ± 2.4	1.6 ± 2.6 2 [1, 2]	0.73
Target weight, kg	mean ± SD	83.4 ± 23.4	85.7 ± 23.7	< 0.001
Post dialysis weight, kg	mean ± SD	83.2 ± 23.4	85.7 ± 23.7	< 0.001
Albumin , g/dL	mean ± SD median [p25, p75]	3.6 ± 0.5 4 [3, 4]	3.5 ± 0.5 4 [3, 4]	0.05

Comorbidities will be considered as any evidence on or before index month; treatment parameters will be assessed for first regular treatment of index month; laboratory measures will be considered as first recorded measurement in index month Abbreviations: CAD, coronary artery disease; CCI, Charlson comorbidity index; CHF, congestive heart failure; CVD, cerebrovascular disease; IDH, intradialytic hypotension; PVD, peripheral vascular disease; SBP, systolic blood pressure

Figure 2. Comparison of Clinical Outcomes among PRN Profiling vs Standing UF Profiling Patients



Adjusted for sex, target weight, and serum albumin Abbreviations: aIRR, adjusted incidence rate ratio; CI, confidence interval; IDH, intradialytic hypotension; Ref, referent; UF, ultrafiltration

Summary and Conclusions

- We did not detect a benefit of standing vs no UF profiling, nor evidence to suggest that PRN UF profiling is superior to standing UF profiling.
- These data call into question the rationale underlying commonplace use of UF profiling in clinical practice.
- Unfortunately, data limitations precluded studying the impact of UF profiling in patients with residual renal function.

References

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