In-Center Hemodialysis Absenteeism: Prevalence and Association with Outcomes

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Introduction

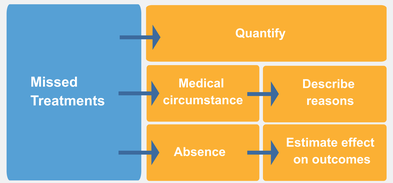
- In-center hemodialysis patients frequently miss treatments.[1]
  - Missed treatments may arise due to adverse medical circumstances (hospitalization, emergency department (ED) visit, vascular access procedure) or due to other reasons (absence).[2]
  - The proportion of missed treatments due to medical circumstance vs. absence has not been rigorously determined.
  - The association between a single absence from treatment and clinical outcomes over the short- and long-term is not known.

Objectives

- To determine the proportion of missed in-center hemodialysis treatments due hospitalizations, ED visits, vascular access procedures, and absences
- To determine the association between a single absence from treatment and a variety of clinical outcomes

Methods

Study Schema



- Study data were derived from the US Renal Data System (USRDS) data set and the electronic health records of a large dialysis organization (LDO), which were directly linked without the need for probabilistic matching.

Descriptive quantification of missed treatments during 2012

- During the period 01 January - 31 December 2012, patients considered were adults who recieved in-center hemodialysis at the LDO, were enrolled in Medicare Parts A and B and were not Veteran's Affairs beneficiaries (contractual stipulation).
- Patients were followed until study end or censoring for death, transfer, transplant, withdrawal from dialysis, renal recovery, modality change, or disenrollment from Medicare Parts A and B.
- Missed treatments were identified in LDO attendence records. Hospitalizations were identified from Part A claims. Primary ICD-9 diagnosis codes were used to identify causes (applying Clinical Classifications Software [CCS] multi-level categories) and fluid-related hospitalizations (LDO categorization system). ED visits were identified from Part B claims. Outpatient procedures were identified from claims data.
- Missed treatments were ascribed to medical events occuring on that date, applying the heirarchy hospitalization > ED > procedure if multiple events occurred on the same date. Missed treatments with no corresponding medical event were considered absences.

Associative analysis between absence and outcomes

- Patients considered were as above, with the additional requirements that they dialyzed on a Monday/Wednesday/Friday schedule, had received dialysis at the LDO for ≥90 days as of index date, and had not missed a treatment or been hospitalized during the 30 days prior to index date
- Index dates were 21, 23, and 25 May 2012. **Exposure status was assigned based on whether the patient attended treatment or was absent** (ie not due to a medical event as defined above). Patients who were absent were propensity score matched to patients who attended on that index date.
- Outcomes were considered over the subsequent 30 and 180 days. Data were then pooled across the 3 index dates.

Results

Descriptive quantification of missed treatments during 2012

- 47.2% of missed treatments were due to adverse medical circumstance (mainly hospitalizations); 52.8% were due to absence (Table 1).
- Only 8.1% of patients had perfect attendance during follow-up. 44.6% of patients missed treatments at a rate of ≥13 per patient year (10% or more of scheduled treatments, Figure 1).
- The causes of hospitalization resulting in the most missed treatments were diseases of the circulatory system, injury and poisoning, and diseases of the respiratory system (Figure 2).
- An internal ICD9 classification system was used to identify missed treatments arising from fluid-related hospitalizations, of which there were 22,358 (11.2% of all missed treatments due to hospitalization). These were mostly drawn from diseases of the circulatory system (Figure 3).

Table 1: Frequency of Missed Treatments by Cause in 2012

	All	Hospitalization	ED Visit	Procedure	Absence
Events, n	462,028	208,478	8885	546	244,119
Rate, per pt-yr	15.31	6.91	0.29	0.02	8.09
% of all missed tx	100	45.1	1.9	0.1	52.8

Total time at risk: 30,178 pt-yrs. Total number of missed treatments per patient was capped at 78.
Abbreviations: ED, emergency department; pt-yr, patient-year; tx, treatment

Figure 1: Distribution of Patients by Missed Treatment Rate

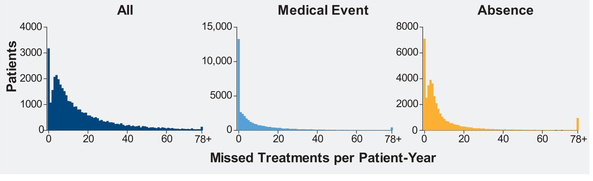


Figure 2: Missed Treatments Arising from a Hospitalization by CCS Multi-Level Diagnosis Category

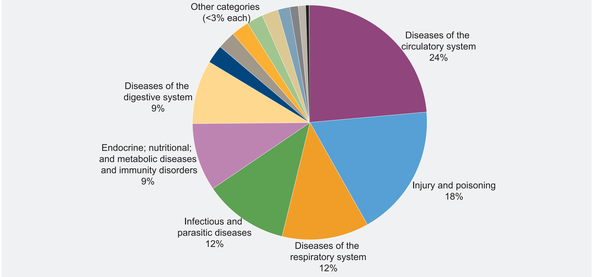
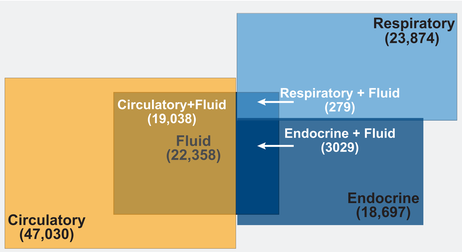


Figure 3: Missed Treatments Arising from Fluid-Related Hospitalizations: Overlap with CCS Multi-Level Diagnosis Categories



Abbreviations: Circulatory, Diseases of the circulatory system; Endocrine, Endocrine; nutritional; and metabolic diseases and immunity disorders; Fluid, fluid-related hospitalizations; Respiratory, Diseases of the respiratory system

Associative analysis between absence and outcomes

- Compared to patients who attended their treatment, patients with an absence were (prior to matching) younger, more likely to be black, slightly newer to dialysis, more likely to have diabetes, with lower albumin and nPCR, and higher serum phosphorus. These characteristics were **well balanced after matching** (Table 2).
- An absence was associated with a **40% greater risk of hospitalization** and a **118% higher risk of mortality** in the subsequent 30 days compared to attending treatment (Figure 4).
  - Associations were still observed even when the outcome window was extended to 180 days.
- Absence was also associated with modestly lower hemoglobin levels and modestly higher ESA utilization. No measurable effects were detected on any other outcomes considered (serum potassium, ultrafiltration rate, ultrafiltration volume, blood pressure, ESA administrations, and ESA dose).

Figure 4: 30-day Risk of Hospitalization or Mortality by Absence Status

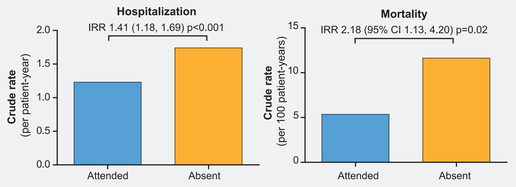


Table 2: Baseline Characteristics of Patients by Absence Status (Matched Cohort)

	Overall N = 7692	Attended N = 6410	Absent N = 1282	Standardized Difference (%)	*P*-Value
Age, years, mean ± SD	60.6 ± 14.8	60.6 ± 14.8	60.5 ± 14.5	-0.9	0.76
Gender, female, %	46.3	46.5	45.7	-1.5	0.62
Race, %					0.99
White	34.4	34.4	34.6	0.4	
Black	46.0	46.0	46.0	0.0	
Hispanic	15.0	15.0	14.8	-0.5	
Asian	1.2	1.2	1.2	-0.7	
Other/unknown	3.4	3.4	3.4	0.3	
Vascular access, %					0.72
Arteriovenous fistula	63.9	63.7	64.8	2.3	
Arteriovenous graft	24.9	25.0	24.5	-1.3	
Central venous catheter	11.2	11.3	10.7	-1.8	
Dialysis vintage, months, median [p25, p75]	46 [25, 75]	46 [25, 75]	45 [24, 76]	-1.1	0.97
Target weight, kg, mean ± SD	82.0 ± 23.0	82.2 ± 23.2	81.3 ± 22.2	-3.6	0.24
Etiology of ESRD, %					0.99
Diabetes	46.4	46.4	46.3	-0.1	
Hypertension	31.5	31.5	31.6	0.2	
Other	22.1	22.1	22.1	0.0	
Atrial fibrillation, %	0.1	0.1	0.1	-1.0	0.75
Diabetes, %	72.6	72.8	72.1	-1.5	0.61
Congestive heart failure, %	16.3	16.4	15.7	-1.9	0.53
Coronary artery disease, %	12.0	12.1	11.5	-1.6	0.60
Cerebrovascular disease, %	1.0	1.1	0.9	-1.3	0.69
Peripheral vascular disease, %	8.0	8.0	7.9	-0.5	0.87
Serum albumin, g/dL, mean ± SD	3.9 ± 0.4	3.9 ± 0.4	3.9 ± 0.4	-1.1	0.73
Serum calcium, mg/dL, mean ± SD	9.0 ± 0.7	9.0 ± 0.7	9.0 ± 0.7	0.7	0.82
Creatinine, mg/dL, mean ± SD	8.6 ± 3.0	8.6 ± 3.0	8.6 ± 2.9	0.6	0.84
Ferritin, ng/mL, mean ± SD	765.1 ± 362.3	765.5 ± 361.5	763.3 ± 366.2	-0.6	0.85
Hemoglobin, g/dL, mean ± SD	10.9 ± 1.1	10.9 ± 1.1	10.9 ± 1.1	-0.3	0.92
Serum phosphorus, mg/dL, mean ± SD	5.1 ± 1.4	5.1 ± 1.4	5.1 ± 1.4	3.7	0.23
Parathyroid hormone, ng/mL, median [p25, p75]	335 [217, 519]	334 [214, 518]	338 [227, 522]	4.2	0.33
Transferrin saturation, %, mean ± SD	31.1 ± 12.3	31.1 ± 12.3	31.0 ± 12.4	-0.9	0.76
nPCR, g/kg/day, mean ± SD	1.0 ± 0.3	1.0 ± 0.3	1.0 ± 0.3	-2.9	0.35
Kt/V, mean ± SD	1.6 ± 0.3	1.6 ± 0.3	1.6 ± 0.3	-2.7	0.37

Abbreviations: ESRD, end-stage renal disease; nPCR, normalized protein catabolic rate; p25, 25th percentile; p75, 75th percentile; SD, standard deviation.

Conclusions

- Hemodialysis patients miss ~15 treatments/year, approximately half of which are due to adverse medical circumstance and half due to absenteeism.
- A single absence was associated with a significantly increased risk of hospitalization or death in the subsequent 30 days.
  - This implies that absenteeim imposes a significant burden in terms of patient health and associated costs
- Implementation of programs to reduce patient absenteeism may represent an under-appreciated approach for improving outcomes among hemodialysis patients.

References

1. Bleyer AJ, Hylander B, Sudo H, et al. An international study of patient compliance with hemodialysis. *JAMA*. 1999;281(13):1211-1213.
2. Chan KE, Thadhani RI, Maddux FW. Adherence barriers to chronic dialysis in the United States. *J Am Soc Nephrol*. 2014;25(11):2642-2648.

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