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The Association of Psychosocial Factors with 30-day Readmission

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Abstract

The Association of Psychosocial Factors with 30-day Readmission

By Olufunmilola Adisa

Background: Evidence regarding the effect of psychosocial factors on 30-day readmission in dialysis patients is limited in the literature. We examined whether psychosocial factors, as reported by a social worker at the start of hemodialysis treatment, were associated with 30-day readmission.

Methods: This was a retrospective cohort study of prevalent dialysis patients treated at one of the three metropolitan Atlanta centers between 2/1/2010 and 10/05/2016. We extracted data on 14 psychosocial factors from the first available (baseline) psychosocial assessment done by social workers at the initial intake of each patient. Readmission was defined as the first admission within 30 days after discharge from the index admission. Index admission was defined as the first admission recorded in the dialysis record for each patient, after a 60-day lead-in period following the first dialysis session. Logistic regression was used to estimate odds ratios for readmission by each psychosocial factor. Adjustment for the potential confounders age, sex, race, duration of ESRD, hypertension, diabetes and atherosclerotic cardiovascular disease was performed.

Results: Among 494 patients, 17.6% of patients experienced a 30-day readmission. There was a ~2-fold increase in risk of 30-day readmission among patients who reported difficulty in completing dialysis sessions (OR: 1.81, CI: 1.02-3.23), adherence with dietary restrictions (OR: 2.14, CI: 1.24-3.71), and taking medications (OR: 1.94, CI: 1.03-3.67), compared to those who reported ease in these self-management activities, after adjustment. Other psychosocial issues, including depression or anxiety at the time of assessment, substance abuse, living in nursing/assisted living facilities, living alone, lack of daily support and reported difficulty with fluid restriction were associated with higher risk of readmission but the associations were not statistically significant.

Conclusion: We found that dialysis patients' psychosocial issues, particularly reported difficulty with adherence, were associated with higher risk of 30-day readmission. This study adds to the body of knowledge on associations of psychosocial factors with 30-day readmissions. Addressing some of these factors through targeted interventions could potentially reduce readmission rates in the dialysis population.

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Background

Patients with end-stage renal disease (ESRD) have poor kidney function [glomerular filtration rate (GFR) <15 ml/min/1.73 m^2] and require dialysis or kidney transplantation in order to sustain life [1]. Dialysis serves as the only option available for life sustenance to ESRD patients who are not eligible for or interested in transplantation. The U.S. incidence rate of ESRD remained relatively stable in 2014-2016, but the number of prevalent cases of ESRD continued to rise by about 21,000 cases per year [2]. This increased prevalence in the setting of stable incidence is likely due to the decline in the all-cause mortality rate among ESRD patients (~25% from 233.7 deaths per 1,000 patient years in 2001 to 172.8 deaths per 1,000 patient years in 2014) [2]. At the end of 2014, the number of cases of ESRD was 678,383 with a prevalence of 1990 per million (1.3% higher than 2013) after adjusting for age, sex and race [2]. Of these 63.3% (424,219) were treated with hemodialysis, 6.9% (46,121) were treated with peritoneal dialysis and 29.5% (196,119) had a functioning kidney transplant [2]. African American patients remain disproportionately represented among prevalent ESRD patients [2]. In 2014, diabetes was the leading cause of ESRD, followed by hypertension, glomerulonephritis and cystic kidney disease [2].

The costs of ESRD care are covered by Medicare for all Social Security-eligible U.S. residents, regardless of age or disability. In 2014, ESRD spending per patient per year (PPPY) by Centers for Medicare & Medicaid Services (CMS) increased by 0.3% and the hemodialysis (HD) care total and PPPY expenditures were $26.1 billion and $87,638 respectively [2]. The rising cost was attributable to the growth in the number of beneficiaries covered and frequency of readmissions (or rehospitalizations) [2]. On

average, ESRD patients are admitted to the hospital nearly twice a year and about 30% of patients have an unplanned rehospitalization within 30 days following discharge [2]. The cost of hospitalization represents a significant societal and financial burden, accounting for approximately 40% of total Medicare expenditures for dialysis patients [2]. While the frequency of hospital admissions for ESRD patients on hemodialysis decreased by 19%, from 2.1 to 1.7 per patient per year between 2005 and 2014 [2], the 30-day readmission rate in patients on hemodialysis was 36.6% in 2014. In comparison, 18% of admissions among Medicare patients with chronic obstructive pulmonary disease resulted in readmission [2, 3]. Nationally, the risk of hospital admission is 17% higher in females compared to males; 33% higher in whites compared to other races; 31% higher in African Americans vs. whites; and 10% higher among patients with ESRD attributed to diabetes rather than hypertension, glomerular disease or other causes [2]. In addition, 30-day readmission rates are highest among the youngest (aged 20-44; 42.9%) and oldest (75 years and older; 38.5%) adult patients [4]. The top three causes of 30-day readmission in the most recent data for U.S. hemodialysis patients were cardiovascular complications, problems with vascular access and infections. Cardiovascular complications included acute myocardial infarction (42.3%), congestive heart failure (40.0%), stroke (36%) and dysarrthmias (35.8%) [4].

With regards to costs covered by the Centers for Medicare & Medicaid Services (CMS), there is a high capital expenditure to maintain care of patients with ESRD. CMS defines readmission “as a hospital admission occurring within 30 days of a hospital discharge, excluding ER visits and those for rehabilitation purpose” [5]. Readmission has been recognized as an important indicator of both morbidity and quality of life [7]. For

example, in a cohort study comprised of 2133 hospitalized community-dwelling Medicare beneficiaries older than 64 years, researchers compared the 1-year mortality rates among community-dwelling elderly hospitalized Medicare beneficiaries who did and did not experience early (within 30 days) hospital readmission [7]. The readmission rate among ESRD patients was 34.6%, compared to only 15.3% of older Medicare beneficiaries without a diagnosis of kidney disease; when post-discharge death was included, 40.1% of ESRD patients and 19.8% of non-ESRD patients experienced the outcome [2]. Three hundred and four (13.7 %) hospitalized beneficiaries had an early hospital readmission and those with early readmission had higher 1-year mortality (38.7 %) than patients who were not readmitted (12.1 %; $p<0.001$) [6]. Overall, early readmission remained independently associated with 3-fold higher mortality rates after adjustment for sociodemographic factors, health and functional status, medical comorbidity, and index hospitalization-related characteristics [HR (95 % CI) 2.97 (2.24-3.92)] [7].

Given the extraordinarily high burden of readmissions among dialysis patients and universal coverage of ESRD services by CMS, reducing the number of readmissions could both improve the quality of life of dialysis patients and reduce societal costs. As part of its ESRD Quality Incentive Program (QIP), CMS ties reimbursement of ESRD services to clinical performance [4]. Starting in 2017, this pay-for-performance program will include the standardized readmission ratio (SRR), which will hold dialysis facilities accountable for the 30-day readmission of patients treated at the facility. The SRR was adopted as part of the QIP despite the lack of support by stakeholders, nephrologists,

dialysis centers, hospitals, and the National Quality Forum (NQF), which reviews and endorses measures used by CMS [4].

There is currently no model designed to compare facility-level rates of readmission for other chronic diseases. For example, while readmissions in heart failure are well-researched, there is no model for comparison of readmission among facilities in this population [7]. In a systematic review, Ross et. al. noted that there is yet to be a universal model designed to predict heart failure patients' readmission risk; rather, heterogeneous approaches are used, for which there are substantial inconsistencies regarding which patient characteristics predict readmissions [7].

Clinically, patient risk stratification is challenging; however, from a policy perspective, a validated risk-standardized statistical model to accurately profile hospitals using readmission rates is unavailable in the published English-language literature to date [7]. Among several potential flaws noted by stakeholders, the penalty imposed on hospitals with higher hospital rates (up to 3% of annual inpatient payments) [5] may be unfair to hospitals with riskier case-mix, since the SRR which adjusts for a limited number of patient characteristics that may adversely affect risk of readmission, most notably sociodemographic [5] and psychosocial factors. Using survey data from the nationally representative Health and Retirement Study (HRS), researchers linked Medicare claims for HRS participants enrolled in Medicare who were hospitalized from 2009 to 2012 (n = 8067 admissions) and showed that 29 additional psychosocial and clinical characteristics from survey data and claims were potential predictors of 30-day readmission when added to standard Medicare adjustments of hospital readmission rates. First, the study assessed the comparison of the distribution of these characteristics

between participants admitted to hospitals with higher vs. lower hospital-wide readmission rates reported by Medicare. Second, the study estimated differences in the probability of readmission between these groups of participants before vs after adjustment for the additional patient characteristics [7]. Of the 29 patient characteristics assessed, 22 significantly predicted readmission beyond standard adjustments, and 17 of these were distributed differently between hospitals in the highest vs lowest quintiles of publicly reported hospital-wide readmission rates ($P \leq .04$ for all comparisons). Most of the differences (16 of 17) indicated that participants admitted to hospitals in the highest quintile of readmission rates were more likely to have characteristics that were associated with a higher probability of readmission [7]. The difference in the probability of readmission between participants admitted to hospitals in the highest vs lowest quintile of hospital-wide readmission rates was reduced by 48% from 4.41 percentage points with standard adjustments used by Medicare to 2.29 percentage points after adjustment for all patient characteristics assessed (reduction in difference: −2.12; 95% CI, −3.33 to −0.67; $P = .003$) [7]. Therefore, patient characteristics not included in Medicare's current risk-adjustment methods explained much of the difference in readmission risk between patients admitted to hospitals with higher vs. lower readmission rates. Hospitals with high readmission rates may be penalized largely based on the patients they serve [5], and one can imagine that the same may be true of dialysis facilities.

Several psychosocial factors may be particularly relevant to dialysis patients. For example, the SRR does not adjust for functional impairment, which is highly prevalent in Medicare patients. Functional impairment was associated with increased risk of 30-day all-cause hospital readmission among Medicare beneficiaries [6, 8]. Therefore, functional

impairment could potentially be an important factor to consider in dialysis patients. In two studies, depression at admission increased the risk of predicting 30-day and 90-day readmission among inpatients in an urban hospital population [9, 10], further showing the potential importance of psychosocial factors in readmission. Other studies have supported the importance of psychosocial factors in predicting risk of readmission in patients with congestive heart failure [11]. For example, in a study linking electronic health record-extracted psychosocial data in real-time to risk of readmission for heart failure, there were five characteristics—dementia, depression, adherence, declining/refusal of services, and missed clinical appointments—associated with an increased risk for hospital readmission [12]. The first four features were captured from unstructured clinical notes, while the last item was captured from a structured data source. Unstructured clinical notes contained important knowledge on the relationship between psychosocial risk factors with missing information about a structured proxy and an increased risk of readmission for heart failure that would otherwise have been missed if only structured data were considered. There are limited studies that have linked psychosocial factors such as social support, depression, and reported quality of life with poor outcomes in patients with ESRD [13]. Kimmel observed that the first three decades of ESRD program were devoted to extending patient survival, with little data regarding the factors associated with successful patient adjustment to care [14]. Depression and perception of the effects of illness were identified as important responses to the experience of ESRD, and these experiences may be associated with poor outcomes. In addition, perception and extent of social support can mitigate these factors and might be important in reducing readmissions in patients with ESRD. This study also noted that the challenges for the next 30 years

include understanding the relationship of psychosocial factors to demographic and medical factors in the ESRD patient population and the refinement of associations between psychosocial factors and patient outcomes, such as readmission [14].

In this study, we aim to leverage rich psychosocial information extracted from both structured and unstructured data from three metropolitan Atlanta dialysis centers and identify psychosocial factors associated with risk of 30-day readmission among dialysis patients. Our study will enhance previous research on readmissions in dialysis patients by informing a holistic approach to reducing cases of readmission in dialysis patients.

Methods

Study Design and Population

This is a retrospective cohort study of prevalent patients initiating dialysis treatment at one of the three Emory Dialysis centers in metropolitan Atlanta between 2/1/2010 and 10/05/2016. We extracted data from the first available (baseline) psychosocial assessment done by social workers at the intake of each patient in the clinics. A total of 1666 patients beginning treatment at Emory Dialysis from 2010 to 2016 were identified; of these, we obtained 786 (47%) baseline psychosocial assessments. These data were then linked via unique chart identifier to the existing Emory Dialysis database, which contains information on patient demographics, treatment modality, cause of ESRD, comorbid conditions, and hospital admissions. A total of 231 patients were further excluded, due to no demographic data (n=73 patients), no index hospitalization (n=73 patients), and no first treatment date at any of the Emory dialysis facilities (n=52 patients) (Figure 1).

Additionally, patients were excluded if they had admissions in the 60-day lead-in period (n=28) or did not survive 30 days after their index admission (n=5), since patients had to be alive 30 days after an index discharge to be at risk for a readmission. A timeline of selection of patients from their first dialysis treatment at Emory Dialysis to readmission can be seen in Figure 2. The total study population was 494 (Figure 1). The study was approved by the Emory University Institutional Review Board.

Study Variables

Readmission

Readmission was defined as any admission (yes vs. no) within 30 days after discharge from the index admission. Index admission was defined as the first admission recorded in the dialysis record for each patient, after a 60-day admission-free lead-in period after the first dialysis session. The admission-free lead-in period allows patients to adjust to the dialysis treatment before recording their index admission and mitigates the influence of frequently readmitted patients. Admission information was obtained from dialysis clinic records of hospitalization.

Psychosocial Factors

We included 14 psychosocial factor variables (all from the baseline psychosocial assessments completed by the social worker) as separate exposures. The assessment items associated with these variables can be found in Appendix Table 1. Psychosocial factors were categorized into four domains: mental health, social support, independence and adherence to treatment.

<u>Mental health domain</u>

This domain consists of measures of history substance abuse and depression or anxiety. Depression or anxiety was defined based on the observation by the social worker for presence of symptoms or signs of depression or anxiety in patients. The history of substance abuse was defined by patient's response to a history of substance abuse and information of substance abuse from prior medical information accessible to the social worker.

Social support domain

This domain consists of measures of marital status, living status, and frequency of social support. Marital status was defined as patient's relationship status, which we categorized as domestic partner/married, single and divorced/widowed/separated. Living status was defined as with whom the patient lived– and were dichotomized as alone vs. not alone. Frequency of social support as defined as the level of involvement of family and friend on a regular basis and was dichotomized as daily vs. less than daily.

Independence domain

This domain consists of measures of memory status, current employment status, type of housing, and need for ambulatory assistance. Memory status was defined based on the social worker's observation of long term or short term memory impairment (yes vs. no). These were combined into a single measurement of any vs. no memory impairment. Current employment was categorized as employed (full-time/employed part-time), medical leave of absence/unemployed disabled, and retired/unemployed-by choice/unemployed-looking for work/other. The type of housing was dichotomized as community-dwelling vs. assisted living/nursing home.

Self-reported ease of adherence domain

This domain consists of patients' ease or difficulty with completion of dialysis session, getting to the dialysis center, fluid restrictions, dietary restrictions and medication intake. Responses were dichotomized as easy or difficult. The category easy included somewhat or very easy while difficult included somewhat or very difficult. The neither easy nor difficult and N/A responses were added to the difficult category.

Covariates

Our potential confounders, obtained from the electronic medical record, included age at psychosocial assessment (calculated from the dates of birth and assessment), sex, race, duration of ESRD at psychosocial assessment, and comorbid factors [hypertension, congestive heart failure, diabetes, atherosclerotic diseases (such as cerebrovascular disease, myocardial infarction (MI), coronary artery disease (CAD), peripheral vascular disease (PVD), cerebrovascular disease (CVA) and transient ischemic attack (TIA))].

We examined the relationship of these potential cofounders were selected based on their association with 30-day readmission and each of the 14 psychosocial factors (see Appendix Tables 2 and 3). Comorbid factors were obtained from the problem list and were present at any point in the patient's medical record.

Statistical Analysis

Descriptive characteristics of the patients were summaried overall and across the psychosocial factors, using chi-square and t-tests as appropriate. Crude logistic regression was done to determine the bivariate association of each of the potential confounders with the 30-day readmission. Finally, crude and adjusted associations of each of the psychosocial factors with readmission were assessed using multivariable logistic regression analyses, from which odds ratios (ORs) and 95% confidence intervals (CIs) were obtained. A p-value of 0.05 was set as the significance level of all statistical analyses. The software used for the analysis was SAS v. 10.4 (Cary, NC).

Results

Patient Characteristics

Table 1 shows that the mean age of our study population comprising 494 Emory dialysis patients from 2010 to 2016 was 56 years. More than half (54.5%) were male. The patients in this population were predominantly (93.5%) African American. Comorbid conditions were common, with 42.3% having hypertension, 22.5% having diabetes, 8.1% having CHF and 9.1% having atherosclerotic cardiovascular disease. The leading cause of ESRD was hypertension (61.5%), followed by diabetes (19.6%) and glomerular disease (5.7%). The mean duration of ESRD at psychosocial assessment was 3.5 years and 17.3% had Medicaid at baseline psychosocial assessment.

Distributions of Psychosocial Factors

Table 2 shows the distribution of psychosocial factors by domain. In the mental health domain 13.4% had a history of substance abuse and 14.8% had depression or anxiety at the time of psychosocial assessment. In the social support domain, 36.8% were single, 33.7% were married/domestic partner and 29.6% were divorced/separated/widowed; 70.6% self-reported daily social support. In the independence domain, 20.0% lived alone; 14.8% had impaired memory; 11.8% were currently employed; 93.2% resided in the community; and 34.5% required some form of ambulatory assistance such as cane, walker, manual or electric wheelchair or prosthetics. Ease of adherence to dialysis visit, completion of dialysis sessions, fluid restriction, dietary restriction and medication intake were reported by 72.8%, 72.4%, 66.3%, 60.6% and 81.1% of patients, respectively.

Association of Psychosocial Factors with 30-Day Readmissions

The total number of 30-day readmissions were 87 and the overall prevalence of 30-day readmission was 17.6%. Table 3 shows the association of the 14 psychosocial factors with 30-day readmission. Self-reported difficulty with completing dialysis was associated with 76% increased risk of 30-day readmission compared to those who reported easy completion of dialysis [OR: 1.76, CI: 1.03-3.02]. After adjusting, the relative risk was 81% higher for those reporting difficulty vs. ease with completing dialysis [OR: 1.81, CI: 1.02-3.23]. Patients who reported difficulty vs. ease with dietary restriction had nearly 2-fold increased risk of 30-day readmission [OR: 1.96, CI: 1.16-3.29]. After adjustment, the result was still statistically significant [OR: 2.14, CI: 1.24-3.71]. Among patients who also reported difficulty with taking their medication, showed about a 2-fold increase in the risk of 30-day readmission [OR: 1.93, CI: 1.07-3.50]. After adjustment, the result was similar in magnitude and still statistically significant [OR: 1.94, CI: 1.03-3.67].

Other psychosocial factors were associated with the risk of 30-day readmission but were not statistically significant. After adjustment, those with anxiety or depression at the time of assessment had a 78% increased risk compared to those without [OR: 1.78, CI: 0.93-3.44]; those with a history of substance abuse had a 55% increased risk compared with those without [OR: 1.55, CI: 0.79-3.05]; those that reported no daily support vs. daily support had a 39% increased risk [OR: 1.39, CI: 0.82-2.36]; those that are single had a 24% increased risk [OR: 1.24, CI: 0.69-2.21] and widowed/divorced/separated had a 12% decreased risk [OR: 0.88, CI: 0.46-1.68] compared to married/domestic partner; those who lived in nursing/assisted living

facilities had a 93% increased risk compared to those in community-dwellings [OR: 1.93, CI: 0.98-4.69]; those with impaired memory had a 4% increased risk compared to those without [OR: 1.04, CI: 0.50-2.15]; those on medical leave of absence/unemployed disabled had a 22% increased risk [OR: 1.22, CI: 0.69-2.17] and unemployed by choice/retired/unemployed/unemployed and looking had a 38% increased risk [OR: 1.38, CI: 0.65-2.89] compared to those employed; those with ambulatory assistance had a 31% increased risk compared those without [OR: 1.31, CI: 0.74-2.32]; those that live alone had a 49% increased risk compared that do not [OR: 1.49, CI: 0.89-2.68]; those who reported difficulty vs. ease with coming for dialysis had a 12% increased risk [OR: 1.12, CI: 0.60-2.07]; and those who reported difficulty vs. ease with fluid restriction had a 50% increased risk [OR: 1.50, CI: 0.86-2.62].

Discussion

Overall, the point prevalence of 30-day readmission in this metropolitan Atlanta dialysis patient population was 17.6%. The psychosocial factors statistically significantly associated with nearly 2-fold increased risk of 30-day readmission were patient-reported difficulty with adherence to completing dialysis sessions, dietary restriction and taking medication (1.8-, 2.1-, and1.9-fold, respectively). These associations were independent of age, sex, race, duration of ESRD, hypertension, diabetes and atherosclerosis. All other psychosocial factors were associated with 30-day readmission but not statistically significant regardless of adjusting for confounders. Those with anxiety or depression at the time of assessment had a 78% increased risk compared to those without; those with a history of substance abuse had a 55% increased risk compared with those without; those that reported no daily support vs. daily support had a 39% increased risk; those that are single had a 24% increased risk and widowed/divorced/separated had a 12% decreased risk compared to married/domestic partner; those who lived in nursing/assisted living facilities had a 93% increased risk compared to those in community-dwellings; those with impaired memory had a 4% increased risk compared to those without; those on medical leave of absence/unemployed disabled had a 22% increased risk and unemployed by choice/retired/unemployed/unemployed and looking had a 38% increased risk compared to those employed; those with ambulatory assistance had a 31% increased risk compared those without; those that live alone had a 49% increased risk compared that do not; those who reported difficulty vs. ease with coming for dialysis had a 12% increased risk; and those who reported difficulty vs. ease with fluid restriction had a 50% increased risk.

To date, the effect of psychosocial factors on 30-day readmission in dialysis patients has been under-investigated and limited in literature. These factors have been to known to affect a patient's overall well-being generally. Therefore, dialysis patients are not exempt and these factors could potentially impact one's skills in coping and managing the burden of dialysis, including adherence to dietary, fluid intake and medication compliance. In our study, adherence to medication showed that it was an important exposure in this population, since dialysis patients have many comorbid factors and are more likely to have many medications. Thus, patients may face challenges in their ability to coordinate their medication regimen, which might change after an index admission. A study by Flythe et al. showed that an intervention aimed at decreasing the number of medications post-discharge was predictive to the reduction of the odds of 30-day readmission [15].

Overall, strategies to geared toward reducing 30-day readmission in dialysis patients with some of these psychosocial factors can be divided into hospital- and patient-centered from the point of discharge at the hospital to their point of destination which could vary from the patient's home to a nursing home or rehabilitation facility. Hospital-centered strategies might include protocols that incorporate assessment of psychosocial triggers that have shown a strong association with readmission after a patient's index admission. For examples, patients who fall within this category could be transferred to a special coordination team that comprises various specialties such as social workers, nurses, and psychiatric support staff. Patient-centered interventions could include ESRD support groups, visiting home health workers to help with medication and diet adherence, or home delivery of renal diet a few weeks after discharge from the hospital. Of course,

some of these suggestions might be difficult to implement because of the current healthcare system, diverse living conditions of patients and scarcity of funds to support interventions.

Our results suggest that patients with greater psychosocial needs may have higher risk of readmission, independent of other risk factors for readmission. Therefore, the importance of adjusting psychosocial factors which affects indices that measure outcomes could provide a better tool for reimbursement of facilities. For example, CMS' SRR, does not adjust for any of these psychosocial factors which have shown an association with 30-day readmission. Without such adjustment, the SRR may not fairly compare facilities' readmission performance if facilities have vastly different patient populations in terms of their psychosocial needs. In a general population study, which included adjustment for 29 psychosocial and clinical patient characteristics in addition to those already included in the hospital-level SRR, this adjustment was associated with a 48% reduction (4.41% to 2.29%) in the difference in probability of readmission between participants admitted to hospitals in the highest vs lowest quintile of hospital-wide readmission [5]. Therefore, patient characteristics not included in Medicare's current risk-adjustment methods explained much of the difference in readmission risk between patients admitted to hospitals with higher vs. lower readmission rates. Other studies in CHF patients have supported the importance of psychosocial factors as part of a measure for stratifying risk prediction of readmission. For example, the readmission rates for CHF patients with moderate to severe depression were 3 times that of patients with only mild depression or no depression [11]. However, to our knowledge, this is the first study to characterize these associations in dialysis patients.

Reducing nonadherence in the dialysis population would likely reduce readmissions and costs, and potentially improve life expectancy. Nonadherence to dialysis treatment occurs because of patient and facility characteristics, including patients shortening dialysis sessions, percentage of trained staff available and the presence of a dietician [16]. One of the strongest risk factors of nonadherence related to hospitalization is missed dialysis sessions. In a study that compared the risk of hospitalization for urgent hospital dialysis, missing a regular dialysis session was associated with 7-fold increased risk of hospitalization for urgent dialysis [17]. Missing a dialysis session was also associated with 18- and 5-fold increase in admission from hyperkalemia and CHF, respectively. Another study showed a 13% increased risk of admission with missing dialysis session [16]. Some of the issues with significant associations with not coming for dialysis include suboptimal transportation to dialysis, weather, holiday, psychiatric illness, pain and gastrointestinal upset [17]. In our study, we did not examine the association of patient adherence with 30-day readmission risk but we compared readmission by self-reported difficulty with coming for dialysis sessions, completing dialysis sessions, medication intake, and fluid and dietary restriction. Our results showing higher risk of readmission with reported adherence difficulty suggests that lack of adherence after a discharge may be at least partially responsible for some of these readmissions.

The strength of this study is the comprehensive evaluation of multiple psychosocial factors among urban dialysis patients and availability of information on confounders to estimate independent associations of these factors with readmissions. Some of the limitations include potential selection bias due to missing baseline

psychosocial assessment data, in that those missing these data might differ from those included. Misclassification due to under-reporting of comorbid factors is likely; for example, we found that only 8% of our patient population had CHF listed as a comorbidity, whereas the national U.S. data show that 40% of dialysis patients have CHF [2]. There is also potential misclassification of factors such as depression and anxiety, since these factors were based on social worker observation and interpretation of signs and symptoms, rather than patient or provider report or standardized assessment. Other potential misclassification includes patients' self-reported ease of adherence with taking medication, coming to dialysis, completion of dialysis, and fluid and dietary compliance. There might be social desirability bias with patients' response to questions posed by the social workers. In addition, this study may not be generalizable to the U.S. population because the study population is in a single metropolitan area and is comprised mainly of African Americans. This could be one plausible explanation for why hypertension was the predominant cause of ESRD compared to nationwide cause which is diabetes [2].

In conclusion, reported difficulty with adherence to medication and dietary restriction and difficulty with completion of dialysis are some of the underexplored psychosocial that are associated with 30-day readmission. Therefore, this study adds to the body of knowledge on how psychosocial factors may affect 30-day readmission in dialysis patients. Addressing some of these factors through target interventions that could potentially reduce readmission rates, ultimately reduce cost and improve quality of life.

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Tables and Figures

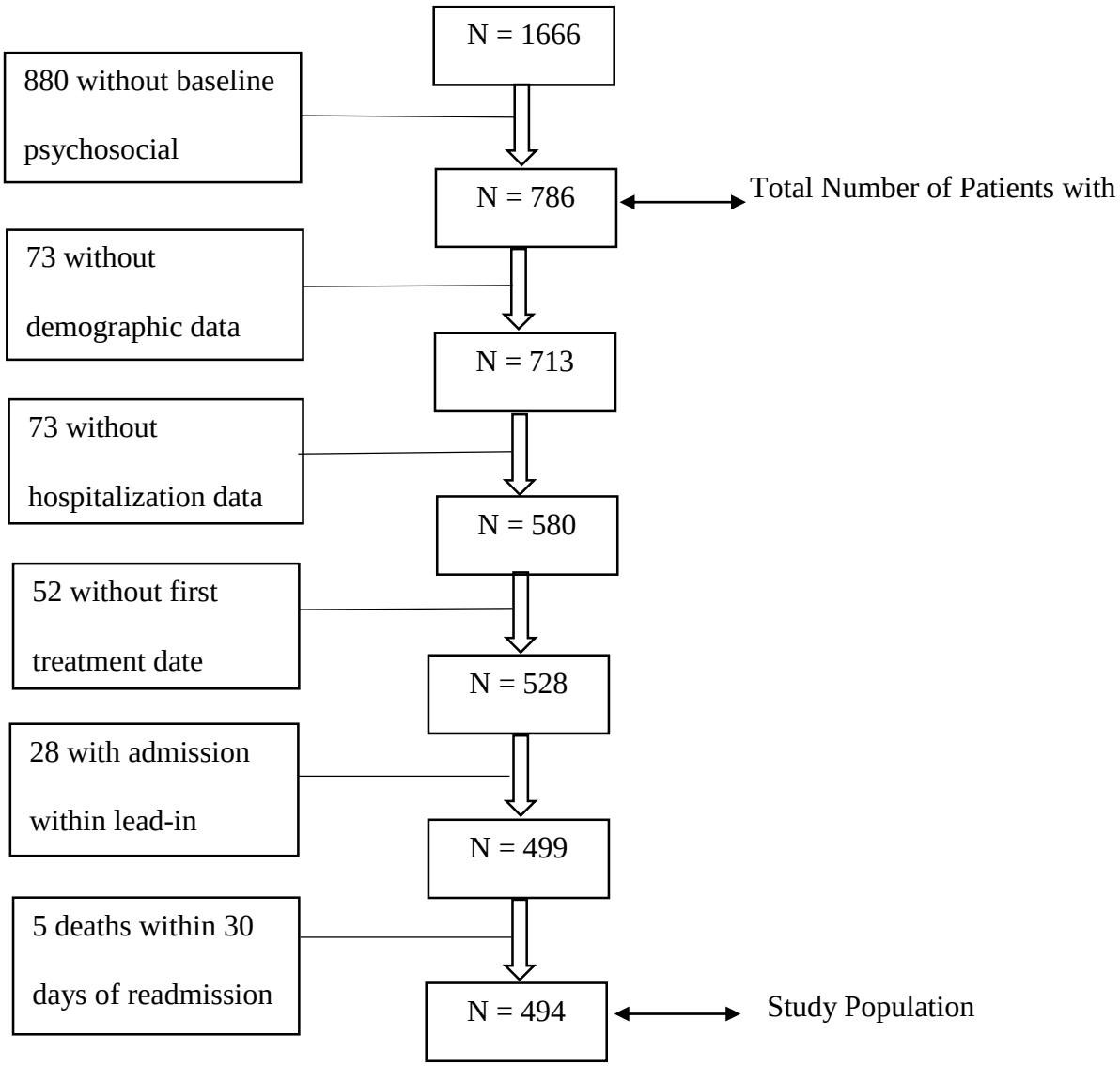

Figure 1. Study participant flow diagram

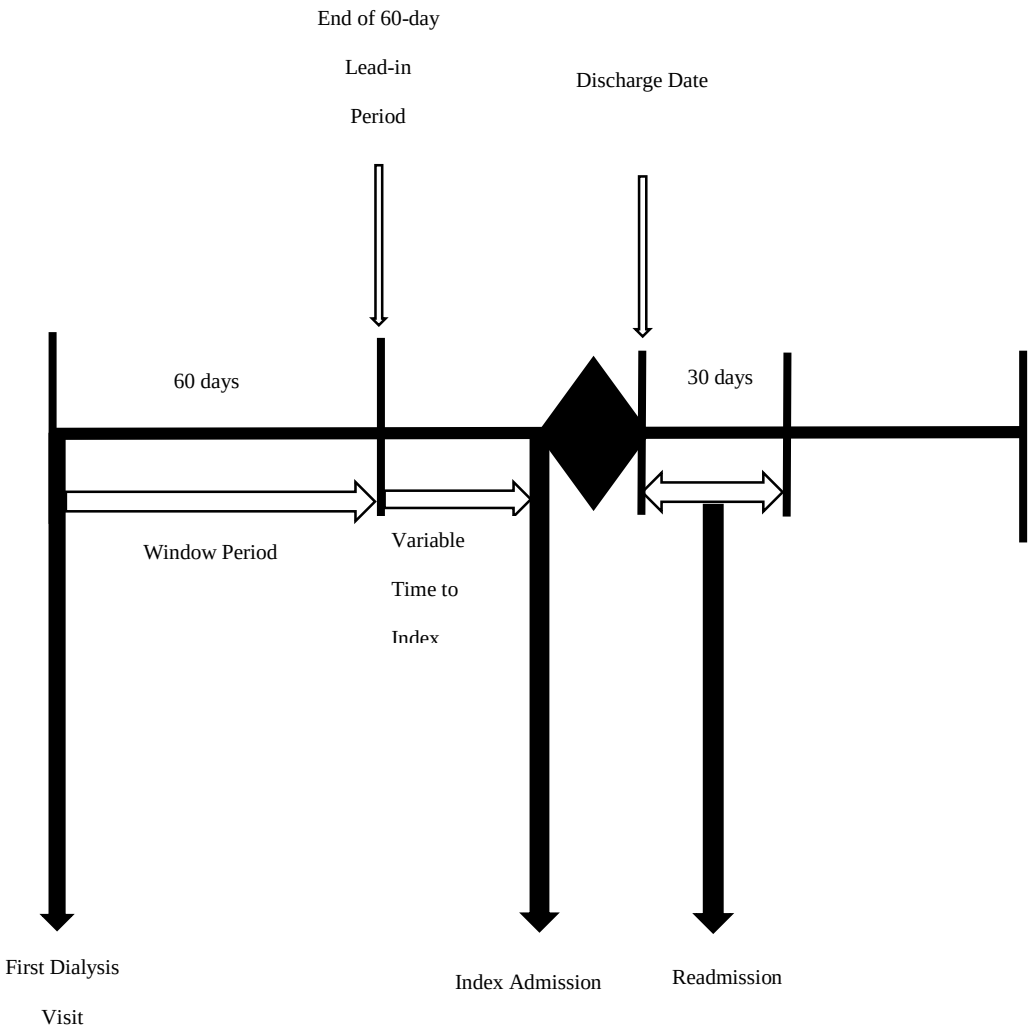

Figure 2. Timeline for Assessing Index Admission and Readmission from the First Dialysis Session at Emory Dialysis Centers.

Table 1. Descriptive Characteristics at Baseline Psychosocial Assessment among Prevalent Patients Treated at Emory Dialysis Centers from 2010 to 2016.

Patient characteristic	N	No. (%)
Mean age (SD), years	494	56.0 (14.0)
Sex Male	494	269 (54.5)
Race African American	494	462 (93.5)
Comorbid Factors	494	
Congestive Heart Failure		40 (8.1)
Hypertension		209 (42.3)
Diabetes		111 (22.5)
Atherosclerotic Cardiovascular Disease[+]		45 (9.1)
Cause of ESRD	494	
Hypertension		304 (61.5)
Diabetes		97 (19.6)
Glomerulonephritis		28 (5.7)
Other		65 (13.2)
Mean Duration of ESRD (SD), years[++]	488	3.5 (4.1)
Medicaid Insurance at Psychosocial Assessment**	127	22 (17.3)

ESRD, end-stage renal disease.
*[+]Atherosclerotic Diseases: Coronary Artery Disease (CAD), Myocardial Infarction (MI), Peripheral Vascular Disease (PVD), Cerebrovascular Disease (CVD), Transient Ischemic Attack (TIA), [++] (6 missing, End-Stage Renal Disease) **367 Missing, Medical Insurance information from 2013 to 2016.*

Table 2. Distributions of Psychosocial Factors by Domain

Psychosocial Domain/Measure	N	No. (%)
Mental Health		
History of Substance Abuse[+]	457	61 (13.4)
Anxiety or Depression**	453	67 (14.8)
Social Support		
Marital Status***	466	
Single		171 (36.7)
Married/ Domestic Partner		157 (33.7)
Divorced/ Separated/Widowed		138 (29.6)
Living Status	470	
Alone vs. Not Alone*[+]		94 (20.0)
Frequency of Social Support[++]		
Daily vs. <Daily		320 (70.6)
Independence		
Memory Status	452	
Impaired Memory vs. Not Impaired		67 (14.8)
Current Employment Status	399	
Employed		47 (11.8)
Unemployed Disabled/Medical Leave of Absence		238 (59.7)
Unemployed by Choice/ Retired/Unemployed/ Unemployed and looking		114 (28.6)
Type of Housing[+++]	458	
Community-Dwelling		427 (93.2)
Assisted Living/Nursing Home		31 (6.8)
Ambulatory Assistance[+*] Yes	469	164 (35.0)

Patient-Reported Ease of Adherence		
Dietary Restriction^{++*}	391	
Easy		237 (60.6)
Difficult		154 (39.4)
Fluid Restriction^{+++*}	392	
Easy		260 (66.3)
Difficult		132 (33.7)
Medication Intake**$^{++}$	391	
Easy		317 (81.1)
Difficult		74 (18.9)
Dialysis Visit***$^{+}$	397	
Easy		289 (72.8)
Difficult		108(27.2)
Dialysis Session (complete)$^{+-}$	395	
Easy		286 (72.4)
Difficult		109 (27.6)

29 Missing, $^{+}$41 Missing, **37 Missing, ***28 Missing, *$^{+}$24 Missing, $^{++}$41 Missing $^{+++}$36 Missing, $^{+*}$25 Missing, $^{++*}$ 103 Missing, $^{+++*}$102 Missing, **$^{++}$103 Missing, *$^{+}$ 97 Missing, $^{+-}$ 99 Missing*

N=391 for logistic regression models.

Table 3. Association of Psychosocial Factors with Readmission

Psychosocial factor	No. (%) readmitted within 30 days	Unadjusted OR (95% CI) for Readmission	Adjusted** OR (95% CI) for Readmission
Anxiety or Depression			
Overall[a]	80/453 (17.7%)	---	---
No	63/80 (78.8%)	1.00 (referent)	1.00 (referent)
Yes	17/80 (21.2%)	1.74 (0.94 -3.2)	1.78 (0.93-3.44)
Substance Abuse			
Overall[b]	80/457(17.5%)		
No	65/80 (81.2%)	1.00 (referent)	1.00 (referent)
Yes	15/80 (18.8%)	1.66 (0.88 -3.15)	1.55 (0.79-3.05)
Frequency Social Support			
Overall[c]	84/453 (50.0%)	---	---
Daily	56/84(66.7%)	1.00 (referent)	1.00 (referent)
No Daily	28/84 (33.3%)	1.26 (0.76-2.09)	1.39 (0.82-2.36)
Marital status			
Overall[d]	83/466 (17.8%)	---	---
Married/Domestic Partner	26/83 (31.3%)	1.00 (referent)	1.00 (referent)
Single	38/83 (45.8%)	1.48 (0.87-2.51)	1.24 (0.69-2.21)
Widowed/Divorced/ Separated	19/83 (22.9%)	0.83 (0.44-1.54)	0.88 (0.46-1.68)
Living Status			
Overall[e]	81/458 (17.7%)	---	---
Community-Dwelling	73/81 (90.1%)	1.00 (referent)	1.00 (referent)
Nursing/Assisted Living	8/81 (9.9%)	1.687 (0.73-3.92)	1.93 (0.98-4.69)
Impaired Memory			
Overall[f]	82/452 (18.1%)	---	---
No	70/82 (85.4%)	1.00 (referent)	1.00 (referent)
Yes	12/82 (14.6%)	0.98 (0.50-1.93)	1.04 (0.50-2.15)

Psychosocial factor	No. (%) readmitted within 30 days	Unadjusted OR (95% CI) for Readmission	Adjusted** OR (95% CI) for Readmission
Current Employment			
Overall[g]	75/399 (18.8%)	---	---
Employed	10/75 (13.3%)	1.00 (referent)	1.00 (referent)
Medical Leave of Absence/Unemployed Disabled	46/75 (61.3%)	1.31 (0.75-2.28)	1.22 (0.69-2.17)
Unemployed by Choice/Retired/ Unemployed/Unemployed and looking	19/75 (25.3%)	1.09 (0.56-2.13)	1.38 (0.65-2.89)
Ambulatory assistance			
Overall[h]	84/469 (17.9%)	---	---
No	55/84 (65.5%)	1.00 (referent)	1.00 (referent)
Yes	29/84 (34.5%)	0.98(0.60-1.60)	1.31 (0.74-2.32)
Lives Alone			
Overall[i]	84/470 (17.9%)	---	---
No	64/84(76.2%)	1.00 (referent)	1.00 (referent)
Yes	20/84 (23.8%)	1.32(0.75-2.31)	1.49 (0.83-2.68)
Come for Dialysis			
Overall[j]	72/397 (18.1%)	---	---
Easy	51/72 (70.8%)	1.00 (referent)	1.00 (referent)
Difficult	21/72 (29.2%)	1.13 (0.64-1.98)	1.12 (0.60-2.07)
Complete Dialysis			
Overall[k]	72/395 (18.2%)	---	---
Easy	45/72 (62.5%)	1.00 (referent)	1.00 (referent)
Difficult	27/72 (37.5%)	1.76 (1.03-3.02)	1.81 (1.02-3.23)

Psychosocial factor	No. (%) readmitted within 30 days	Unadjusted OR (95% CI) for Readmission	Adjusted** OR (95% CI) for Readmission
Adherence: Fluid Intake			
Overall[l]	70/392 (17.9%)	---	---
Easy	41/70 (58.6%)	1.00 (referent)	1.00 (referent)
Difficult	29 (41.4%)	1.50 (0.89-2.56)	1.50 (0.86-2.62)
Adherence: Diet			
Overall[m]	70/391 (17.9%)	---	---
Easy	33/70 (47.1%)	1.00 (referent)	1.00 (referent)
Difficult	37.70 (52.9%)	1.96 (1.16-3.29)	2.14 (1.24-3.71)
Adherence: Medication			
Overall[n]	71/391(18.2%)	---	---
Easy	51/71 (71.8%)	1.00 (referent)	1.00 (referent)
Difficult	20/71 (28.2%)	1.93 (1.07-3.50)	1.94 (1.03-3.67)

Missing *a=41, b=37, c=41, d=28, e=36, f=42, g=95, h=25, i=24, j=97, k=99, l=102, m=103, n=103*

***Adjusted for Age, Sex, Race, Mean Duration of ESRD, Hypertension, Diabetes and Atherosclerotic Diseases.*

Number of observations for logistic regression models: ***a=453, b=457, c=453, d=466, e=458, f=452, g=399, h=469 i=470, j=397, k=395, l=392, m=391, n=39***

Appendix

Supplementary Tables

Table 1. Items from Psychosocial Assessments Used to Define Psychosocial Exposures

Psychosocial Factors	Questions	Responses
Mental Health Domain		
Depression or anxiety	Are there signs/symptoms present for depression or anxiety problems?	No or Yes
Substance abuse	Has the patient ever had a history of substance abuse?	No or Yes
Social Support Domain		
Relationship status	What is the patient's relationship status?	Domestic partner or Married or Divorced or Single or Widowed or Separated
Living status	With whom does the patient live?	Lives alone or Parents or Spouse or Children or Significant other or Significant friend or Significant relative or Other
Frequency of social support	What is the level of involvement of family and friend on a regular basis?	Daily or Weekly or Monthly or Less frequently than monthly
Independence Domain		
Memory status	Does the patient appear to have a problem with the following?	Short term memory: No or Yes Long term memory: No or Yes
Current employment	Current employment?	Employed Full-time or Employed Part-time or Retired or Medical Leave of Absence or Unemployed-by choice or Unemployed disabled or Unemployed-looking for work Other

Psychosocial Factors	Questions	Responses
Mobility status	Ambulatory assistance?	None or Cane/crutch or Walker or Manual wheelchair or electric wheelchair or Limb prosthesis
Type of housing	Living Status?	Home or Condo or Mobile home or Apartment or Rents house or Assisted living or Homeless or Public housing shelter or Long term care facility(SNF) or Acute rehabilitation center or Correctional facility or Adult family home or Adult group home
Self-Reported Ease of Adherence Domain		
Dietary restriction	Over the past month, how easy or difficult has it been for you to follow dietary restrictions?	N/A or Very easy or Somewhat easy or Neither easy nor difficult or Somewhat difficult or Very difficult
Fluid restriction	Over the past month, how easy or difficult has it been for you to follow fluid restrictions?	N/A or Very easy or Somewhat easy or Neither easy nor difficult or Somewhat difficult or Very difficult
Medication intake	Over the past month, how easy or difficult has it been for you to take medications as prescribed?	N/A or Very easy or Somewhat easy or Neither easy nor difficult or Somewhat difficult or Very difficult

Psychosocial Factors	Questions	Responses
Dialysis visit	Over the past month, how easy or difficult has it been for you to come to each hemodialysis treatment?	N/A or Very easy or Somewhat easy or Neither easy nor difficult or Somewhat difficult or Very difficult
Dialysis session (complete)	Over the past month, how easy or difficult has it been for you to complete the full-prescribed hemodialysis treatment time?	N/A or Very easy or Somewhat easy or Neither easy nor difficult or Somewhat difficult or Very difficult

Table 2. Crude Associations of Potential Confounders with Psychosocial Factors

A. Anxiety or Depression			
Variables	Yes	No	P-value
Mean (SD) age, years	52.3 (16.3)	56.2(13.4)	0.04
Sex			0.83
Male	36/67(53.7%)	213/386(55.2%)	
Race	60/67(89.6%)	363/386 (94.0%)	0.17
Mean (SD) Duration of ESRD, years	2.7 (4.3)	3.7 (4.5)	0.09
Comorbid Factors			
Congestive Heart Failure	5/62 (7.5%)	29/386 (7.5%)	0.99
Hypertension	30/67 (44.9%)	166/386 (43.0%)	0.79
Diabetes	14/67 (20.9%)	86/386 (22.3%)	0.80
Atherosclerotic Diseases[+]	2/65(3.0%)	40/386 (10.4%)	0.05

[+]*Atherosclerotic Diseases: Coronary Artery Disease (CAD), Myocardial Infarction (MI), Peripheral Vascular Disease (PVD), Cerebrovascular Disease (CVD), Transient Ischemic Attack (TIA).*

B. Marital Status				
Variables	Single	Married/Domestic Partner	Widowed/Divorced/ Separated	P-value
Mean (SD) age, years	48.5 (13.3)	59.2 (12.5)	61.5 (11.8)	<.0001
Sex				<.0001
Male	97/171 (56.7%)	104/157 (66.2%)	53/138 (38.4%)	
Race	163/171 (95.3%)	140/157 (89.2%)	132/138 (95.7%)	0.04
Mean (SD) Duration of ESRD, years	3.5 (4.4)	3.3 (3.7)	3.9 (5.2)	0.59
Comorbid Factors				
Congestive Heart Failure	17/171 (9.9%)	9/157 (5.7%)	8/138 (5.8%)	0.25
Hypertension	77/171 (45.0%)	69/157 (44.0%)	54/138 (39.1%)	0.55
Diabetes	30/171 (17.5%)	43/157 (27.4%)	32/138 (23.3%)	0.10
Atherosclerotic Diseases[+]	14/171 (8.2%)	14/143 (8.9%)	14/138 (10.1%)	0.84

[+]*Atherosclerotic Diseases: Coronary Artery Disease (CAD), Myocardial Infarction (MI), Peripheral Vascular Disease (PVD), Cerebrovascular Disease (CVD), Transient Ischemic Attack (TIA).*

C. Living Status			
Variables	Not Alone	Alone	P-value
Mean (SD) age, years	55.3 (14.4)	57.8 (12.5)	0.12
Sex			0.31
Male	210/376 (55.9%)	47/94(50.0%)	
Race	347/476 (92.3%)	92/94 (97.9%)	0.05
Mean (SD) Duration of ESRD, years	3.4 (4.2)	4.5 (5.4)	0.07
Comorbid Factors			
Congestive Heart Failure	30/376 (8.0%)	6/94 (6.4%)	0.60
Hypertension	161/376 (42.8%)	41/94(43.6%)	0.89
Diabetes	84/376 (22.3%)	23/94(24.5%)	0.66
Atherosclerotic Diseases[+]	32/376 (8.5%)	10/94 (23.8%)	0.52

[+]*Atherosclerotic Diseases: Coronary Artery Disease (CAD), Myocardial Infarction (MI), Peripheral Vascular Disease (PVD), Cerebrovascular Disease (CVD), Transient Ischemic Attack (TIA).*

D. Frequency of Support			
Variables	Yes	No	P-value
Mean (SD) age, years	55.5 (14.2)	56.5 (13.6)	0.49
Sex			0.61
Male	172/320 (53.8%)	75/133(56.4%)	
Race	301/320 (94.1%)	122/133 (91.7%)	0.36
Mean (SD) Duration of ESRD, years	3.8 (4.5)	2.8 (3.6)	0.02
Comorbid Factors			
Congestive Heart Failure	21/320 (6.6%)	10/133(7.5%)	0.71
Hypertension	137/320 (42.8%)	60/133 (45.1%)	0.65
Diabetes	66/320 (20.6%)	36/133 (27.1%)	0.13
Atherosclerotic Diseases[+]	32/320 (10.0%)	11/133 (8.3%)	0.57

[+]*Atherosclerotic Diseases: Coronary Artery Disease (CAD), Myocardial Infarction (MI), Peripheral Vascular Disease (PVD), Cerebrovascular Disease (CVD), Transient Ischemic Attack (TIA).*

E. Impaired Memory Status			
Variables	Yes	No	P-value
Mean (SD) age, years	60.4 (12.1)	54.9 (14.0)	0.003
Sex			0.05
Male	29/67 (43.3%)	216/385 (56.1%)	
Race	58/67 (86.6%)	367/385 (95.3%)	0.01
Mean (SD) Duration of ESRD, years	2.6 (3.0)	3.7 (4.7)	0.01
Comorbid Factors			
Congestive Heart Failure	7/67(10.5%)	28/385 (7.3%)	0.37
Hypertension	34/67 (50.8%)	158/385 (41.0%)	0.14
Diabetes	16/67 (23.4%)	86/385(22.3%)	0.78
Atherosclerotic Diseases[+]	5/67 (7.5%)	36/385 (9.4%)	0.62

[+]*Atherosclerotic Diseases: Coronary Artery Disease (CAD), Myocardial Infarction (MI), Peripheral Vascular Disease (PVD), Cerebrovascular Disease (CVD), Transient Ischemic Attack (TIA).*

F. Current Employment Status				
Variables	Employed	Medical Leave of Absence/ Unemployed Disabled	Unemployed by Choice/ Unemployed/ Unemployed and Looking/ Retired	P-value
Mean (SD) age, years	49.6 (12.9)	51.3 (12.4)	67.7 (10.4)	<.0001
Sex				0.15
Male	28/47 (59.6%)	140/238 (58.8%)	55/114 (48.3%)	
Race	41/47 (87.2%)	224/238 (94.1%)	106/114 (93.0%)	0.24
Mean (SD) Duration of ESRD, years	4.3 (4.9)	3.3 (4.5)	2.9 (3.1)	0.16
Comorbid Factors				
Congestive Heart Failure	2/47 (4.3%)	19/238 (8.0%)	9/114 (7.9%)	0.66
Hypertension	24/47 (51.1%)	96/238 (40.3%)	46/114 (40.4%)	0.37
Diabetes	9/47 (19.2%)	58/238 (24.4%)	29/114 (25.4%)	0.69
Atherosclerotic Diseases[+]	2/47 (4.3%)	19/238 (8.0%)	15/114 (13.2%)	0.14

[+]*Atherosclerotic Diseases: Coronary Artery Disease (CAD), Myocardial Infarction (MI), Peripheral Vascular Disease (PVD), Cerebrovascular Disease (CVD), Transient Ischemic Attack (TIA).*

G. Type of Housing			
Variables	Community-Dwelling	Assisted Living	P-value
Mean (SD) age, years	55.5 (14.0)	60.7 (13.5)	0.04
Sex			0.72
Male	234/427(54.8%)	18/31 (58.1%)	
Race	401/427 (93.9%)	27/31 (87.1%)	0.14
Mean (SD) Duration of ESRD, years	3.8 (4.6)	1.4 (1.6)	<.0001
Comorbid Factors			
Congestive Heart Failure	34/427 (8.0%)	1/31 (3.2%)	0.34
Hypertension	179/427 (41.9%)	17/31 (54.8%)	0.16
Diabetes	100/427 (23.4%)	3/31 (9.7%)	0.08
Atherosclerotic Diseases[+]	39/427 (9.1%)	3/31 (9.7%)	>0.9

[+]*Atherosclerotic Diseases: Coronary Artery Disease (CAD), Myocardial Infarction (MI), Peripheral Vascular Disease (PVD), Cerebrovascular Disease (CVD), Transient Ischemic Attack (TIA).*

H. Ambulatory Assistance			
Variables	Yes	No	P-value
Mean (SD) age, years	63.4 (11.4)	51.8 (13.4)	<.0001
Sex			
Male	83/164 (50.6%)	173/305 (56.7%)	0.20
Race	154/164(93.9%)	285/305 (93.4%)	0.85
Mean (SD) Duration of ESRD, years	3.2 (4.0)	3.8 (4.7)	0.18
Comorbid Factors			
Congestive Heart Failure	16/164(9.8%)	19/305 (6.2%)	0.17
Hypertension	58/164 (35.4%)	143/305 (46.9%)	0.02
Diabetes	46/164 (28.1%)	58/305 (19.0%)	0.02
Atherosclerotic Diseases[+]	20/164 (12.2)	23/305 (53.5%)	0.10

[+]*Atherosclerotic Diseases: Coronary Artery Disease (CAD), Myocardial Infarction (MI), Peripheral Vascular Disease (PVD), Cerebrovascular Disease (CVD), Transient Ischemic Attack (TIA).*

I. Patient-Reported Ease of Adherence: Dietary Restriction			
Variables	Easy	Not Easy	P-value
Mean (SD) age, years	55.7 (13.7)	55.8 (13.7)	>0.9
Sex			0.09
Male	121/237 (51.1%)	92/154 (59.4%)	
Race	226/237 (95.4%)	146/154 (94.8%)	0.80
Mean (SD) Duration of ESRD, years	3.7 (4.5)	3.4 (4.0)	0.48
Comorbid Factors			
Congestive Heart Failure	19/237(8.0%)	13/154 (8.4%)	0.88
Hypertension	106/237 (44.7%)	54/154 (35.1%)	0.06
Diabetes	46/237 (19.4%)	45/154 (29.2%)	0.02
Atherosclerotic Diseases[+]	25/237 (10.6%)	13/154 (8.4%)	0.49

[+]*Atherosclerotic Diseases: Coronary Artery Disease (CAD), Myocardial Infarction (MI), Peripheral Vascular Disease (PVD), Cerebrovascular Disease (CVD), Transient Ischemic Attack (TIA).*

J. Patient-Reported Ease of Adherence: Fluid Restriction			
Variables	Easy	Not Easy	P-value
Mean (SD) age, years	55.7 (13.7)	55.8 (13.5)	>0.9
Sex			0.03
Male	132/260 (50.8%)	82/132 (62.1%)	
Race	250/260 (96.2%)	123/132 (93.2%)	0.19
Mean (SD) Duration of ESRD, years	4.0 (4.7)	2.9 (3.2)	0.01
Comorbid Factors			
Congestive Heart Failure	20/260 (7.7%)	12/132 (9.1%)	0.63
Hypertension	113/260 (43.5%)	49/132 (37.1%)	0.23
Diabetes	55/260 (21.2%)	37/132 (28.0%)	0.13
Atherosclerotic Diseases[+]	25/260 (9.6%)	12/132 (9.1%)	0.87

[+]*Atherosclerotic Diseases: Coronary Artery Disease (CAD), Myocardial Infarction (MI), Peripheral Vascular Disease (PVD), Cerebrovascular Disease (CVD), Transient Ischemic Attack (TIA).*

K. Patient-Reported Ease of Adherence: Dialysis Session			
Variables	Yes	No	P-value
Mean (SD) age, years	56.4 (13.5)	54.1 (13.8)	0.13
Sex			>0.9
Male	157/289 (54.3%)	59/108 (54.6%)	
Race	283/289 (97.9%)	95/108 (88.0%)	<.0001
Mean (SD) Duration of ESRD, years	4.0 (4.6)	2.6 (3.4)	0.001
Comorbid Factors			
Congestive Heart Failure	23/289 (8.0%)	9/108 (8.3%)	0.90
Hypertension	129/289 (44.6%)	36/108 (33.3%)	0.04
Diabetes	54/289 (18.7%)	38/108 (35.2%)	0.001
Atherosclerotic Diseases[+]	32/289 (11.1%)	6/108 (5.6%)	0.10

[+]*Atherosclerotic Diseases: Coronary Artery Disease (CAD), Myocardial Infarction (MI), Peripheral Vascular Disease (PVD), Cerebrovascular Disease (CVD), Transient Ischemic Attack (TIA).*

L. Patient-Reported Ease of Adherence: Taking Medication			
Variables	Easy	Not Easy	P-value
Mean (SD) age, years	56.7 (13.4)	52.4 (13.6)	0.01
Sex			0.01
Male	162/317 (51.1%)	51/74 (68.9%)	
Race	304/317 (95.9%)	68/74 (91.9%)	0.15
Mean (SD) Duration of ESRD, years	3.8 (4.4)	3.2 (4.2)	0.25
Comorbid Factors			
Congestive Heart Failure	24/317 (7.6%)	8/74 (10.8%)	0.36
Hypertension	138/317 (43.5%)	24/74 (32.4%)	0.08
Diabetes	69/317 (21.8%)	21/74 (28.4%)	0.22
Atherosclerotic Diseases[+]	33/317 (10.4%)	5/74 (6.8%)	0.34

[+]*Atherosclerotic Diseases: Coronary Artery Disease (CAD), Myocardial Infarction (MI), Peripheral Vascular Disease (PVD), Cerebrovascular Disease (CVD), Transient Ischemic Attack (TIA).*

M. Patient-Reported Ease of Adherence: Complete Dialysis Session			
Variables	Easy	Not Easy	P-value
Mean (SD) age, years	56.0 (14.0)	55.4 (12.8)	0.73
Sex			0.56
Male	159/286 (55.6%)	57/109 (52.3%)	
Race	278/286 (97.2%)	98/109 (89.9%)	0.003
Mean (SD) Duration of ESRD, years	3.9 (4.3)	3.1 (4.3)	0.09
Comorbid Factors			
Congestive Heart Failure	22/386 (7.7%)	10/109 (9.2%)	0.63
Hypertension	126/386 (44.1%)	38/109 (34.9%)	0.10
Diabetes	58/386 (20.3%)	34/109 (31.2%)	0.02
Atherosclerotic Diseases[+]	31/386 (10.8%)	7/109 (6.4%)	0.18

[+]*Atherosclerotic Diseases: Coronary Artery Disease (CAD), Myocardial Infarction (MI), Peripheral Vascular Disease (PVD), Cerebrovascular Disease (CVD), Transient Ischemic Attack (TIA).*

Table 3. Crude Association of Confounders with Readmission using Bivariate Logistic Regression

Variables	OR (95% CI)
Age, per +10 years	0.82 (0.70- 0.97)
Sex, Male vs. Female	1.04 (0.65-1.65)
Race, black vs. White and Asian	0.75 (0.31-1.79)
Duration of ESRD, per +1 year	1.00 (0.95-1.06)
Comorbid Factors, yes vs. no	
Hypertension	1.27 (0.80- 2.02)
Diabetes	0.55 (0.30-1.04)
Congestive Heart Failure	0.36 (0.11-1.19)
Atherosclerotic Diseases[+]	2.06 (1.03-4.11)

[+]*Atherosclerotic Diseases: Coronary Artery Disease (CAD), Myocardial Infarction (MI), Peripheral Vascular Disease (PVD), Cerebrovascular Disease (CVD), Transient Ischemic Attack (TIA).*