Predictors of 30-day Unplanned Hospital Readmissions among Maintenance Dialysis Patients

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ABSTRACT

Background and Objectives. Patients on dialysis are twice as likely to have early readmissions. This study aimed to identify risk factors for 30-day unplanned readmission among patients on maintenance dialysis in a tertiary hospital.

Methods. We conducted a retrospective, unmatched, case-control study. Data were taken from patients on maintenance hemodialysis admitted in the University of the Philippines–Philippine General Hospital (UP-PGH) between January 2018 and December 2020. Patients with 30-day readmission were included as cases and patients with >30-day readmissions were taken as controls. Multivariable regression with 30-day readmission as the outcome was used to identify significant predictors of early readmission.

Results. The prevalence of 30-day unplanned readmission among patients on dialysis is 36.96%, 95%CI [31.67, 42.48]. In total, 119 cases and 203 controls were analyzed. Two factors were significantly associated with early readmission: the presence of chronic glomerulonephritis [OR 2.35, 95% CI 1.36 to 4.07, p-value=0.002] and number of comorbidities [OR 1.34, 95% CI 1.12 to 1.61, p-value=0.002]. The most common reasons for early readmission are infection, anemia, and uremia/underdialysis.

Conclusion. Patients with chronic glomerulonephritis and multiple comorbidities have significantly increased odds of early readmission. Careful discharge planning and close follow up of these patients may reduce early readmissions.

Keywords: hospital readmission, dialysis, ESKD, risk factors

INTRODUCTION

Hospital readmissions pose significant financial burden to the health care system. In the United States (US), it is estimated that unplanned rehospitalizations cost >$20 billion per year.[1] This problem is more dire among end-stage kidney disease (ESKD) or chronic kidney disease (CKD) stage 5 patients on maintenance hemodialysis (HD), who are readmitted almost twice as much as the non-dialytic population.[2] The 30-day readmission rates among patients on maintenance hemodialysis is >35% according to the US kidney data system 2016 annual data report.[3]

Since Medicare had started levying financial penalties against hospitals with unacceptably high rates of 30-day readmissions, efforts have been made by the medical community to identify modifiable risk factors present in this vulnerable group. Patient-related factors such as presence of comorbidities (drug abuse[4], liver disease[4], depression[4], chronic pulmonary disease[4], myocardial infarction[5], malignancy[5], diabetes mellitus[5], heart failure[6]), younger age[5], functional status[5], multi-comorbidity status[7], biochemical markers (anemia[8] and hypoalbuminemia[9]), and dialysis-related factors (intradialytic hypotension[9], catheter vascular access[9])

are associated with increased 30-day readmission odds. Hospital-related factors, including prior hospitalization history[5,6,9] and length of hospital stay during index admission ≥7 days[4], are also associated with increased risk of readmission. Common readmission diagnoses included complications related to type 2 diabetes mellitus, heart failure, septicemia, acute myocardial infarction, and complications related to cardiac and vascular prosthetic devices.[6] Finally, provider-related factors, such as being discharged to complex continuing care after the index hospitalization[5] and more frequent provider visits posthospitalization[10] were significantly associated with a lower risk for 30-day rehospitalization.

There have been two local research studies exploring the factors associated with 30-day readmissions but not specifically among the ESKD population. These two studies have been conducted in the Philippines' biggest tertiary state-owned hospital, the University of the Philippines-Philippine General Hospital (UP-PGH), which services thousands of non-paying patients a year and remains as the only national referral center for tertiary care. The first local study published in 2020[11] found that the UP-PGH's readmission rate was 16% with time to readmission of 12.4 +/- 7.8 days. The other local study is an unpublished cross-sectional study[12] which found that 18% among UP-PGH's General Medicine admissions for 2019 were readmissions within 30 days of discharge. Predictors of readmission were emergency readmission (OR 3.37, 95% CI 1.72 to 6.60, p=<0.001), having 5-10 medications at discharge (OR 1.78, 95% CI 1.10 to 2.87, p=0.018), and presence of nosocomial infection (OR 1.86, 95% CI 1.09 to 3.17, p=0.024). The most frequent reason for admission is health-care related infection (42.9%).

To date, there are no local published data on the readmissions of ESKD patients. Given that dialytic patients are readmitted almost twice as much as the non-dialytic population, this study aims to identify the predictors of 30-day unplanned readmissions among these patients. This may prompt more careful discharge planning for at-risk patients and lessen the financial burden posed by early readmissions to the health care system.

OBJECTIVES

General objective

To identify the factors associated with 30-day unplanned readmission among CKD stage 5 patients on maintenance dialysis at a national tertiary government hospital, the University of the Philippines-Philippine General Hospital (UP-PGH), from January 2018 to December 2020.

Specific Objectives
1. To determine the prevalence rate of 30-day unplanned readmissions among patients on maintenance dialysis admitted at UP-PGH.
2. To identify the characteristics of patients on maintenance dialysis associated with 30-day unplanned readmission.
3. To determine the clinical diagnoses leading to rehospitalization within 30-days from discharge.
4. To obtain the length of time between discharge to readmission
5. To determine the outcomes of patients on maintenance dialysis with 30-day unplanned readmissions.

MATERIALS AND METHODS

Study Design and Setting

This is a retrospective, unmatched, case-control analytic study that was conducted in the University of the Philippines-Philippine General Hospital (UP-PGH), a specialized tertiary government hospital in Manila, Philippines.

Study Population

Census of dialytic patients admitted from January 2018 to December 2020 were requested from the hospital's medical records section. Filipino adult patients (age ≥ 19 years old) on maintenance dialysis from 2018-2020 were included in the study. Patients are considered on maintenance dialysis if they were diagnosed with CKD stage 5 (eGFR < 15) or end-stage kidney disease (ESKD), and prescribed to undergo dialysis (both hemodialysis and peritoneal dialysis) at regular intervals for at least one month from date of readmission. Charts with multiple missing data and patients with missing charts were excluded. Patients with no prior admission at UP-PGH were also excluded. Other exclusion criteria include age <19, planned readmissions, and admissions with length of stay less than 24 hours. Patients with 30-day readmission were included as cases and patients with >30-day readmissions were taken as controls.

Data Collection Procedure/Methods

Outcome

The number of early unplanned readmissions from 2018-2020 was obtained using the hospital's electronic medical records. Early unplanned readmissions were any admissions within 30 days of an index hospitalization discharge date that were not flagged as an elective admission. In case of uncertainty about whether a readmission is planned or unplanned, a consensus is reached among the authors. Emergency room readmissions with length of stay more than 24 hours were also included.

Exposures

Administrative and clinical data were obtained from a thorough review of medical records: Data on age, sex, income category (Charity vs Pay), comorbidities, dialysis-related factors (duration on maintenance HD/PD, frequency of weekly dialysis sessions (if HD), type of dialysis access, occurrence of intradialytic hypotension), healthcare utilization for the year (number of ER consults/previous admissions), characteristics of index admission (length of stay, use of mechanical

ventilator, biomarkers upon discharge). Characteristics of the readmissions (admitting diagnosis of index admission, reason for readmission, time elapsed between discharge and readmission, outcomes, length of stay) were also collected. Charts from the second half of 2020 were reviewed using the hospital's electronic medical records; charts from before then were physically retrieved from the Medical Records Section and reviewed with the aid of a research assistant.

Sample Size Calculation/Sampling Method

Minimum sample size was computed for the univariable logistic regression analysis to screen probable significant predictors of 30-day unplanned readmission using G*Power version 3.1. A sample size of at least 579 subjects was needed to achieve 80% power with 5% two-sided significance level in a logistic regression to detect a desired odds ratio of at least 1.68 (the hazard ratio equivalent to Cohen's d=0.20, small effect size).[13] The sample size was adjusted for an anticipated proportion of at least 35% readmission rate.[3] Proportion of most of the categorical variables was about 30%.[4]

Census that was requested from the hospital's medical records section showed a total of 962 patients diagnosed with ESKD or CKD stage 5 admitted from 2018-2020. After exclusion of pediatric patients, patients with no prior admissions, less than 24 hours admissions, and multiple readmissions (only one readmission per patient was randomly chosen and included for patients with multiple readmissions from 2018-2020), the remaining 575 charts were reviewed. After excluding those that did not meet the inclusion criteria, the planned sample size was not met and only 322 out of the 575 charts were included in the study (Figure 1).

Data management and analysis

Data collected was encoded in MS Excel. Patients on maintenance dialysis in Philippine General Hospital from 2018-2020 were grouped into early readmission and non-early groups. The prevalence of early readmission was computed and presented as estimate and 95% confidence interval.

Prevalence rate (%) = Number of 30-day unplanned readmissions/Number of index admissions x 100%

The clinical profiles of these patients were summarized by descriptive statistics: numerical variables were described as median and interquartile range because they were non-normally distributed as assessed by Shapiro-Wilk test of normality; and categorical variables were described as absolute count and percentages. These characteristics were compared between the two groups by Mann-Whitney U test for numerical variables, and chi-square or Fisher exact test of homogeneity for categorical variables. Reasons for early readmission, admitting diagnoses on index admission, time from discharge from index admission to early readmission, and outcomes of early readmission were also summarized by descriptive statistics.
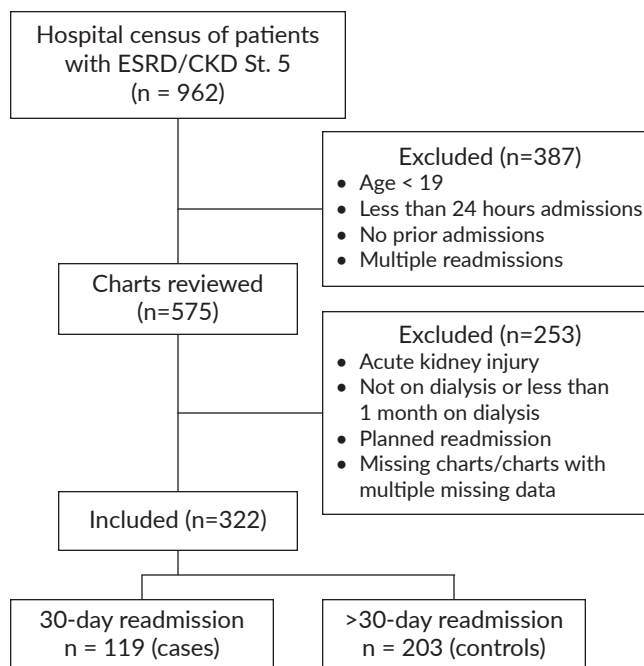

Figure 1. Data collection process.

Factors associated with early readmission were identified by binomial logistic regression analysis. Initial univariable regression was performed to screen for potential factors. All those with p-value <0.200 were included in the multivariable regression full model (presence of coronary artery disease/ischemic heart disease, presence of chronic glomerulonephritis, comorbidity count, frequency of dialysis, type of dialysis access, multiple prior admissions in the past year, and more than seven days of hospital stay during prior admission). Backwards elimination using LR test was done to arrive at a multivariable reduced model (only including comorbidity count and the presence of chronic glomerulonephritis) to identify the significant predictors of early readmission.

Ethical considerations

This study has been approved by the University of the Philippines Manila Research Ethics Board (UPMREB CODE: 2021-242-01). In compliance with the Data Privacy Act of 2012 RA 10173, no personal or identifying information were recorded. Each patient was assigned a designated numerical code. Only the principal investigator had access to these codes, which were stored electronically and deleted after the study was completed.

All information and data were kept confidential.

RESULTS

The prevalence of early readmission among ESKD patients in UP-PGH from 2018-2020 is 36.96%, 95%CI [31.67, 42.48].

Characteristics of patients on maintenance dialysis with 30-day unplanned readmission

Table 1 shows the clinical profile of the patients included in the study. Of the 119 patients on dialysis who had early readmissions, 48 (40%) were female, the median age was 50, and 100 (84%) were under charity service. The median duration of dialysis was 8.5 months, and majority of the patients were on hemodialysis (97%). Sixty-nine (58%) patients were still using their temporary non-tunneled catheters upon readmission. Fifty-five (47%) had dialysis

Table 1. Clinical Profile of Early Readmissions and Non-early Readmissions of Patients on Maintenance Dialysis in UP-PGH from 2018-2020

	30-day readmission (n = 119)		>30-day readmission (n = 203)		p-value
	Median/ Count	IQR/ Percent	Median/ Count	IQR/ Percent	
Patient related Factors					
Age, *years*	50	22	54	20	0.287
Sex					0.539
Female	48	40.34%	89	43.84%	
Male	71	59.66%	114	56.16%	
Income					0.855
Charity	100	84.03%	169	83.25%	
Pay	19	15.97%	34	16.75%	
Comorbidities					
Hypertension	94	78.99%	153	75.37%	0.458
Diabetes mellitus	48	40.34%	87	42.86%	0.658
Heart failure	46	38.66%	82	40.39%	0.758
Chronic glomerulonephritis	37	31.09%	38	18.72%	0.011
Smoker	31	26.05%	49	24.14%	0.701
Coronary artery disease/ ischemic heart disease	29	24.37%	37	18.23%	0.187
Peripheral artery disease	14	11.76%	19	9.36%	0.492
Cerebrovascular disease	12	10.08%	19	9.36%	0.832
Obstructive uropathy	9	7.56%	22	10.84%	0.336
Number of comorbidities	4	2	3	2	0.005
Laboratory markers					
Hemoglobin in prior admission, mg/dL	92	16	92	17	0.894
Albumin in prior admission, g/L	32	10	32	11	0.783
Dialysis related factors					
Months in dialysis	8.5	23	9	21	0.553
Mode of dialysis					0.674
Hemodialysis (HD)	116	97.48%	200	98.52%	
Peritoneal dialysis (PD)	3	2.52%	3	1.48%	
Frequency of dialysis					0.005
<2 per week	13	11.11%	14	7.04%	
2 per week	49	41.88%	121	60.80%	
3 per week	55	47.01%	64	32.16%	
Type of access					0.114
Non-tunneled intrajugular (IJ) catheter	60	50.42%	94	46.31%	
Non-tunneled femoral catheter	9	7.56%	5	2.46%	
Tunneled catheter	5	4.20%	8	3.94%	
Arteriovenous (AV) fistula	42	35.29%	89	43.84%	
Arteriovenous (AV) graft	-	-	4	1.97%	
PD catheter	3	2.52%	3	1.48%	
Intradialytic hypotension	13	12.26%	28	14.97%	0.521
Hospital related factors					
Number of ER consults	0	1	0	1	0.608
Number of prior admissions	1	1	1	1	0.002
Length of hospital stay of prior admission, *days*	12	13	8	10	0.002
Mechanical ventilation during prior admission	11	9.24%	17	8.24%	0.800

thrice a week, 49 (42%) had dialysis twice a week, and 13 (11%) had less than 2 dialysis sessions per week.

Table 2 describes the features of early readmissions among ESKD patients. The most common reason for early readmission is infection, majority of which are hospital-acquired pneumonia (45%) and catheter-related bloodstream infections (36%). Anemia (hemoglobin < 8 g/dL) and uremia/underdialysis are also frequent causes of early readmission. The time between discharge and early readmission is 13 days, and the length of stay of early readmission is 10 days. Most

patients who had early readmissions were discharged (85%), but had an overall mortality rate of 12%.

The most common reasons for early readmission were like those of their index hospitalizations (Figure 2). The top three reasons for index hospitalizations were also infection (44%), anemia (30%), and uremia/underdialysis (27%). However, the most common infection causing the index hospitalizations is catheter-related bloodstream infection (CRBSI) (44%), distantly followed by community-acquired pneumonia (21%), hospital-acquired pneumonia (11.5%), and COVID-19 (11.5%).
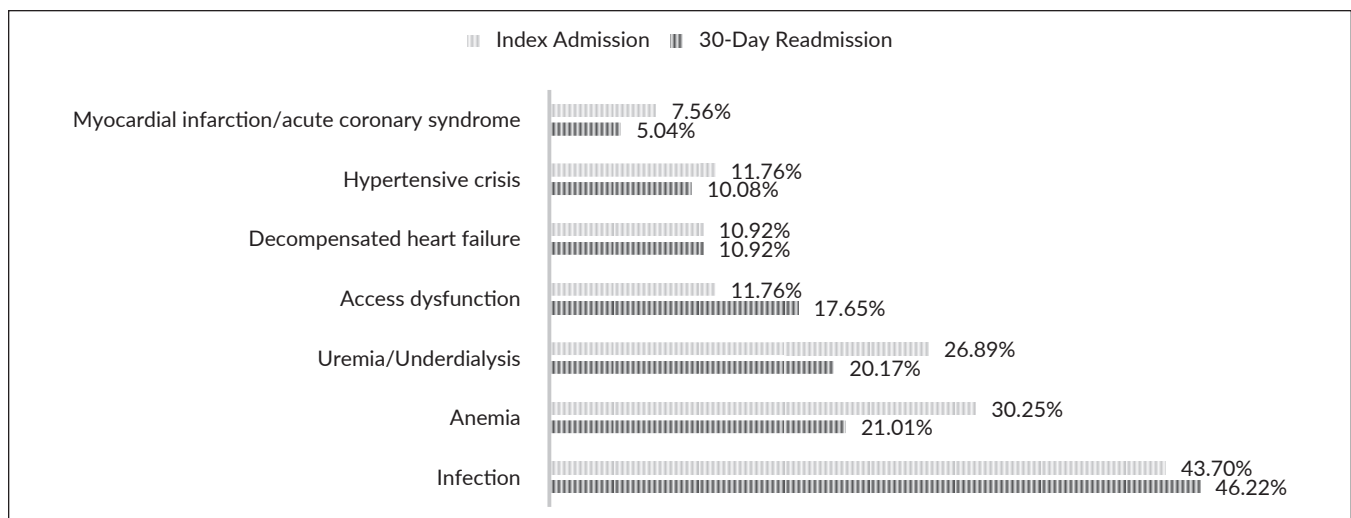
Predictors of 30-day unplanned readmission

The early readmission group had significantly higher proportion of patients with chronic glomerulonephritis, higher median number of comorbidities, lower mean-ranks of number of prior admissions in the past year, and longer median length of stay during prior admission compared to the non-early readmission group (Table 1). There was significantly different distribution of the dialysis frequency between the early readmission group and the non-early readmission group; more patients in the non-early readmission group had twice weekly dialysis sessions.

After controlling for all factors, the presence of chronic glomerulonephritis [OR 2.35, 95% CI 1.36 to 4.07, p-value=0.002] and number of comorbidities [OR 1.34, 95% CI 1.12 to 1.61, p-value=0.002] are found to be associated with 30-day admission among dialytic patients (Table 3). Those who have CGN have 135% increased odds of early readmission and for every comorbidity the patient has, the odds of early readmission increased by 34%.

DISCUSSION

The prevalence of early readmission among patients on dialysis in UP-PGH from 2018-2020 is 37%. This finding

Table 2. Characteristics of 30-day Unplanned Readmissions among Dialytic Patients in UP-PGH in 2018-2020

	Median/ Count	IQR/ Percent
Admitting diagnosis of early readmission*		
Infection	55	46.22%
Anemia[a]	25	21.01%
Uremia/Underdialysis[b]	24	20.17%
Access dysfunction	21	17.65%
Decompensated heart failure	13	10.92%
Hypertensive crisis[c]	12	10.08%
Myocardial infarction/acute coronary syndrome	6	5.04%
Time-to-early readmission, days	13	13
Length of stay of readmission, days	10	10
Outcome of readmission		
Discharged	274	85.09%
Mortality	39	12.11%
Home per request/against medical advice	9	2.80%

Non-mutually exclusive.
[a] *Hemoglobin less than 8.0 g/dL.*
[b] *A patient is considered underdialyzed when he or she presents with signs and symptoms of inadequate dialysis such as fluid overload, uremia (seizures, altered sensorium, nausea, vomiting, anorexia), and metabolic derangements (hyperkalemia, metabolic acidosis).*
[c] *Systolic blood pressure of 180 and above upon admission.*

Legend: Index Admission ▥ 30-Day Readmission

Category	Index Admission	30-Day Readmission
Myocardial infarction/acute coronary syndrome	7.56%	5.04%
Hypertensive crisis	11.76%	10.08%
Decompensated heart failure	10.92%	10.92%
Access dysfunction	11.76%	17.65%
Uremia/Underdialysis	26.89%	20.17%
Anemia	30.25%	21.01%
Infection	43.70%	46.22%

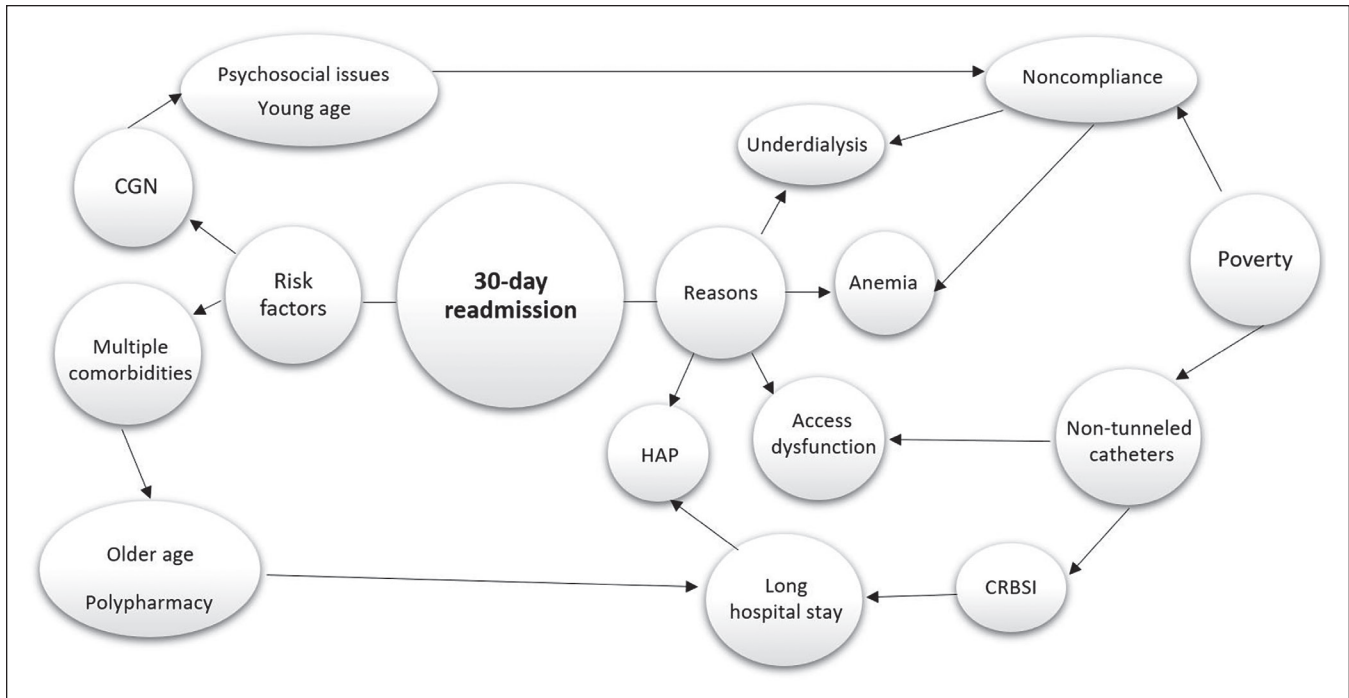**Figure 2.** Reasons for Index Hospitalizations of Early Readmissions.

is on par with United States (US) data wherein the 30-day readmission rates among patients on maintenance hemodialysis is >35%.[3] Like in the US, dialytic patients are twice as likely to have early readmission compared to the non-dialytic population in UP-PGH, which has an average 30-day readmission rate of 17%.[11,12]

In contrast to the US where the most common reason for early readmission is cardiac,[4-6,8] the most common cause of 30-day readmission in UP-PGH is infection. Almost half of the infection is nosocomial pneumonia (45%). This is consistent with the unpublished study of Balane et al. which found that the most common reason for early readmission in the General Medicine Department is health-care related infection (42.9%).[12] Median length of hospital stay—a well-established risk factor for acquiring nosocomial infections—of the index hospitalizations is 12 days among

Table 3. Factors Associated with Early Readmission among Patients on Maintenance Dialysis

	Univariable			Multivariable - Full Model			Multivariable - Reduced Model		
	OR	95% CI	p-value	OR	95% CI	p-value	OR	95% CI	p-value
Patient related Factors									
Age	0.99	0.98, 1.01	0.223						
Male sex	1.15	0.73, 1.83	0.539						
Pay patient	0.94	0.51, 1.74	0.855						
Hypertension	1.23	0.71, 2.12	0.458						
Heart failure	0.93	0.59, 1.48	0.758						
Diabetes mellitus	0.90	0.57, 1.43	0.658						
Multiple access failure	1.29	0.62, 2.68	0.493						
Coronary artery disease/ ischemic heart disease	1.45	0.83, 2.5	0.189	1.36	0.70, 2.66	0.366			
Cerebrovascular disease	1.09	0.51, 2.32	0.832						
Smoker	1.11	0.66, 1.86	0.702						
Obstructive uropathy	0.67	0.3, 1.51	0.339						
Chronic glomerulonephritis	1.96	1.16, 3.31	0.012	2.38	1.32, 4.29	0.004	2.35	1.36, 4.07	0.002
Comorbid count	1.29	1.08, 1.54	0.005	1.22	0.98, 1.50	0.070	1.34	1.12, 1.61	0.002
Hemoglobin in prior admission	1.00	0.98, 1.02	0.965						
Albumin in prior admission	1.00	0.97, 1.04	0.853						
Dialysis related factors									
Months in dialysis	1.00	1, 1.01	0.360						
Peritoneal dialysis	1.72	0.34, 8.68	0.509						
Frequency of dialysis									
<2 per week	Reference			Reference					
2 per week	0.44	0.19, 0.99	0.049	0.50	0.21, 1.20	0.119			
3 per week	0.93	0.4, 2.14	0.856	1.08	0.44, 2.63	0.863			
Type of access									
Non-tunneled catheter	Reference			Reference					
Tunneled catheter	0.90	0.28, 2.86	0.854	0.66	0.19, 2.33	0.521			
AV fistula/AV graft	0.65	0.4, 1.04	0.074	0.63	0.38, 1.04	0.073			
PD catheter	1.43	0.28, 7.32	0.664	0.91	0.05, 16.41	0.947			
Intradialytic hypotension	0.79	0.39, 1.61	0.521						
Hospital related factors									
With previous ER consult/s	1.06	0.74, 1.53	0.738						
More than 2 prior admissions	2.60	1.23, 5.53	0.013	2.14	0.94, 4.87	0.071			
More than 7 days stay on prior admission	1.80	1.11, 2.92	0.017	1.63	0.97, 2.75	0.066			
Mechanical ventilation during prior admission	1.11	0.5, 2.45	0.800						

Figure 3. Interrelationship between the risk factors and reasons for 30-day readmissions.

dialytic patients with 30-day readmissions. The long hospital stays may be explained by the most common cause of index hospitalization, which is catheter-related bloodstream infection (CRBSI) (44%); CRBSI typically takes more than a week of intravenous antibiotics to resolve. UP-PGH dialytic patients are highly susceptible to CRBSI because most of them have non-tunneled hemodialysis catheters (52%). Upon initiation of dialysis, most patients are discharged from the hospital on temporary non-tunneled catheters because they cannot afford tunneled catheters while waiting for their long-term accesses to mature. This correlates with another common cause of readmission, which is access dysfunction (18%) (Figure 3).

Anemia is the second most common cause of 30-day readmission among patients on maintenance dialysis in UP-PGH. Like tunneled catheters, many of UP-PGH's indigent patients are unable to afford Erythropoietin injections once they are discharged. Most freestanding dialysis units also refuse to dialyze patients with hemoglobin levels less than 8 g/dL and refer these patients for in-hospital dialysis.

The third most common reason for early readmission is uremia and underdialysis. Many factors contribute to patients' inability to sustain their dialysis sessions once discharged from the hospital, foremost of which is financial constraints. Most, if not all, of the patients under UP-PGH's charity service belong in socioeconomic classes D and E with monthly income levels less than ₱20,000 (roughly equivalent to $385). Anemia, specifically hemoglobin levels less than 8 g/dL, and access dysfunction also cause dialytic patients to miss their scheduled dialysis sessions.

The COVID-19 pandemic played a significant part in hospital operations in UP-PGH. In March 2020, UP-PGH was declared a COVID-19 referral hospital. It is therefore unexpected that only 11.5% and 5% of index hospitalizations and early readmissions, respectively, were caused by COVID-19. This is because many of the patients on maintenance dialysis referred to UP-PGH in 2020 were transfers from other hospitals and had no prior admissions. These patients were therefore excluded.

In the multivariate analysis, the presence of chronic glomerulonephritis [OR 2.35, 95% CI 1.36 to 4.07, p-value=0.002] and number of comorbidities [OR 1.34, 95% CI 1.12 to 1.61, p-value=0.002] are found to be associated with 30-day admission among dialytic patients (Table 3).

Chronic glomerulonephritis (CGN) is one of the top three causes of end-stage kidney disease in the Philippines, along with diabetic kidney disease and hypertensive kidney disease. Patients with CGN are younger than the non-CGN population. The median age of patients with CGN in this study is 34 years old. Hickson et al.[5] reported that younger age was associated with increased 30-day readmission odds. The high prevalence of early readmissions among young dialytic patients may reflect the culmination of psychosocial disturbances brought about by chronic illness occurring during their anticipated "prime" years.[5] Young patients initiated into dialysis experience a period of resistance over the abrupt changes in their lives. The normal transition from adolescence to adulthood is disrupted, and young adults receiving dialysis may view themselves as 'burdens' to their parents and family who provide financial support.[14]

Consistent with prior studies, the other significant predictor of early readmission in our study is the number of comorbidities per patient. The odds of early readmission are increased by 34% for every comorbidity a patient has. Patients with greater comorbidity burden generally are older, have poorer health, and have excessive polypharmacy, which have been associated with early readmission.[7,12] Patients with multiple comorbidities are also more likely to have longer hospital stays, putting them at risk for hospital-acquired infections.

Other predictors of early readmission reported by available literature such as length of stay during index admission ≥7 days[4], longer duration of dialysis[5], greater healthcare utilization[5,6,9], mechanical ventilation use in previous admission[6], hypoalbuminemia[9], catheter vascular access[9], and intradialytic hypotension[9] were not found to be significant in our study. These factors often coexist and may have been superseded by the presence of chronic glomerulonephritis and multiple comorbidities.

To the best of our knowledge, this study is the first identifying the factors associated with unplanned 30-day readmission among patients receiving maintenance dialysis in the Philippines. Moreover, we found several key action areas that may reduce early readmission.

We have identified two types of population who are vulnerable to 30-day readmission: young patients with CGN and older patients with multiple comorbidities. We suggest early post-discharge follow up for these patients to assess for infection, anemia, and underdialysis. Early interventions such as adjusting Erythropoietin dosage and outpatient treatment of CRBSI may halt the progression of anemia and CRBSI, and consequent need for hospital readmission.

Having identified hospital-acquired pneumonia as the most common reason for early readmission, efforts to prevent nosocomial infections among patients receiving dialysis must be strengthened. The importance of vaccinating patients on maintenance dialysis against pneumonia should be revisited.

Because CRBSI is the most common cause of initial admission and the second most common cause of early readmission, its prevention may play a crucial role in decreasing the overall rate of readmissions (both early and non-early). Discharging patients on tunneled catheters, which have less infection risk, may be considered while waiting for their arteriovenous fistulas or grafts to mature.

Strengthening some of UP-PGH's existing programs may attenuate the risk of early readmission among the hospital's indigent patients. Because peritoneal dialysis costs less than hemodialysis and is associated with lower erythropoietin requirements, building up the hospital's peritoneal dialysis program may decrease the readmissions due to anemia and underdialysis. Fortifying the existing transition program between adult and pediatric nephrology may address the psychosocial issues faced by young adults receiving maintenance dialysis. Finally, providing additional support to the hospital's kidney transplant program may lead to increased enrolment of patients and shift the demand away from dialysis as kidney replacement therapy.

Our results must be considered in the context of study limitations:

First, our data were collected from a single center. As the country's biggest state-owned hospital, most of the study participants were indigent patients. Our findings may not be generalizable to privately run hospitals or in centers catering to richer patients.

Second, the target sample size was not met. However, we believe that this limitation poses minimal threat to the validity of our findings because when we computed for the power achieved by the multivariable-reduced model, it achieved 99%. Investigating the power achieved during screening, it is noted that there are still a handful of factors (12) with high power in univariable analysis using α=0.20 as cut-off for inclusion in the multivariable model. Relatively, it is already a modest number of variables with 80% power during screening, because trying to include more variables in the multivariable model may result to over-fitting.

Third, for patients with multiple readmissions, we randomly selected one readmission to facilitate data abstraction and data from the other readmissions were not extracted.

Fourth, we initially planned to determine if high utilization of outpatient services was associated with decreased risk of readmission. However, many of the patients had missing outpatient department charts and the decision to exclude it as a variable was made. This may be why, contrary to multiple studies[5,6,9], our study did not find healthcare utilization as a significant predictor of early readmission.

CONCLUSION

We found that young patients with CGN and older patients with multiple comorbidities have significantly increased odds of early readmission. Careful discharge planning and close follow up of these patients may reduce early readmissions. Targeted interventions that prevent nosocomial infections and CRBSI, address anemia, and frequent HD or even shift to PD might help reduce the odds of early readmission. Further research on the role of outpatient care post-discharge in preventing early readmission may be explored.

Disclaimer
The views expressed in this article are the authors' own and not an official position of the University of the Philippines-Philippine General Hospital or funder.

Statement of Authorship
All authors contributed in the conceptualization of work, acquisition and analysis of data, drafting and revising of manuscript, and final approval of the version to be published.

Author Disclosure

All authors declared no conflicts of interest.

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