

Prospective Evaluation of the FRAIL Scale as a Predictor of Hospitalization and All-Cause Mortality Among Patients with End-Stage Renal Disease on Hemodialysis

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Background. Despite the increased prevalence of frailty and the unfavorable implications that follow, the implementation of frailty assessment has yet to be established in clinical practice. The 5-item FRAIL scale is an easy-to-apply tool that showed a good correlation with age, presence of comorbidities, and dialysis complications. This study aimed to identify the association between frailty severity and clinical outcomes, including death and hospitalizations.

Method. A prospective cohort study was conducted in the outpatient dialysis unit of a private tertiary hospital in Cebu, Philippines. Between October 2023 and September 2024, 160 eligible patients on maintenance hemodialysis were evaluated for frailty. Clinicodemographic parameters were retrieved. Comparative analyses were performed using chi-square tests and one-way ANOVA with post hoc analysis. Binary logistic regression analysis was conducted to determine significant associations between outcomes and frailty scores.

Results. The majority of patients were categorized as pre-frail, 53.13% (n=85), with a mean age of 59.28 ± 14.50 years, compared to frail patients (28.13%, n=45), who had a significantly higher mean age of 66.16 ± 14.04 years. Regression analysis demonstrated that heart failure, cancer, and coronary artery disease/ischemic heart disease were significantly associated with frailty.

Conclusion. Mortality significantly increased with frailty severity (3.33% of non-frail, 12.94% of pre-frail, and 40% of frail patients). Among the components of the FRAIL scale, ambulation challenges, illness, and weight loss in CKD patients undergoing hemodialysis were identified to have significant burdens and implicate areas for targeted interventions.

Keywords. FRAIL scale, Frailty, Chronic Kidney Disease, Hemodialysis, mortality, hospitalization

Introduction

The current life expectancy for the Philippines in 2023 is 71 years, a 0.18% increase from 2022.¹ This improvement in life expectancy has been a significant success of advancements in healthcare. However, an increase in longevity entails an increase in the prevalence of elderly individuals with multiple comorbidities, which is subsequently associated with frailty. Frailty is a multisystem clinical syndrome resulting from the accumulation of vascular, inflammatory, nutritional, and age-related insults leading to accelerated aging, increased vulnerability, and lack of functional reserve over time.² Chronic Kidney Disease (CKD) patients are at

high risk of being frail. The prevalence of frailty for the elderly general population (i.e., those over 65) is around 11%.³ In contrast, it is as high as 43% in pre-dialysis patients and 73% in the dialysis population, regardless of the numerical age.⁴ However, despite numerous data on the association of frailty in CKD with poorer clinical outcomes and more significant symptom burden, the implementation of frailty assessment has yet to be established in clinical practice. Other outcomes associated with frailty in hemodialysis patients include a lower likelihood of receiving a kidney transplant, higher inpatient costs, and an increased risk of falls.⁵⁻⁶ Studies by Barbosa et al. and Chao et al. showed that the FRAIL Scale proved to be an easy-to-apply, valid, and reliable tool. The FRAIL Scale predicts hospitalization and detects frailty accurately. It's a valuable tool for improving patient outcomes, validated by numerous studies.⁷⁻⁸

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General Objective

This study aimed to determine the association between frailty severity and clinical outcomes among adult CKD patients on maintenance hemodialysis.

Specific Objectives

1. To determine the baseline clinicodemographic characteristics among adult CKD on maintenance hemodialysis.
 - a. Age
 - b. Sex
 - c. Comorbidities
 - d. Body mass index (BMI)
 - e. Length of time on dialysis (months)
 - f. Frequency of dialysis
 - g. Laboratory data
 - i. Serum Creatinine
 - ii. Pre-hemodialysis blood urea nitrogen (BUN)
 - iii. Hemoglobin
 - iv. Serum Albumin
 - v. Inorganic Phosphorus
2. To assess the incidence of frailty among CKD patients on maintenance hemodialysis using the FRAIL Scale and classify them into:
 - a. Non-frail (score 0)
 - b. Pre-frail (score 1-2)
 - c. Frail (score 3-5)
3. To determine the outcomes per patient as follows:
 - a. Mortality
 - b. Hospitalization
4. To correlate the severity of frailty with:
 - a. Mortality using the survival curve
 - b. Associated comorbidities
 - c. Hospitalization

Significance of the Study

Throughout all stages of CKD, impaired physical function, sarcopenia, and increased risk of falls are accelerated. In the dialysis population, frail patients are three times as likely to fall, twice as likely to be admitted to the hospital, and experience a high readmission rate.⁶ Despite the unfavorable implications that follow frailty, it is still empirical to identify subsets of patients at risk for adverse outcomes to improve management and provide interventions to modify frailty severity. It is essential to evaluate the burden of frailty, identify effective interventions to lessen its negative consequences, and increase the utility of frailty measurement in clinical practice, given the rising number of end-stage renal disease (ESRD) patients. Due to its increased prevalence and negative impact on CKD patients on dialysis, this study aimed to identify the association of frailty severity to clinical outcomes, including death and hospitalizations.

Operational Definition of Terms

treat more than five diseases? Have you unintentionally lost 5% or more of your body weight in the last six months? The researcher approached patients during the

Frailty is a multisystem clinical syndrome resulting from the accumulation of vascular, inflammatory, nutritional, and age-related insults leading to accelerated aging, increased vulnerability, and lack of functional reserve over time.

Stage 5 CKD is defined based on a glomerular filtration rate (GFR) ≤ 15 mL/min/1.73 m² using the basal filtration rate value and the creatinine concentration by the CKD Epidemiology Collaboration (CKD-EPI).

Methodology

Study Design and Setting

This prospective, single-center observational study evaluated eligible adult patients on maintenance hemodialysis at the dialysis unit of Chong Hua Hospital–Fuente (Cebu City, Philippines) between October 2023 and September 2024. Written informed consent was obtained from all participants.

Sample Size

This prospective, single-center observational study evaluated eligible adult patients on maintenance hemodialysis at the dialysis unit of Chong Hua Hospital–Fuente (Cebu City, Philippines) between October 2023 and September 2024. Written informed consent was obtained from all participants.^{12,20}

Participants

Inclusion criteria consisted of adult patients (≥ 18 years), of either sex, with stage 5 CKD on maintenance hemodialysis for at least three months, and capable of providing informed consent (see Appendix 2). Exclusion criteria included age < 18 years, refusal to participate, lack of follow-up or transfer to another renal unit, incomplete data, hospitalization within the previous month, psychiatric illness, and pregnancy. The etiology of CKD was determined based on the attending nephrologist's clinical assessment.

Clinical and Biochemical Data

All participants were evaluated for frailty during the study period. At baseline, clinicodemographic and laboratory data were retrieved from medical records. Clinical data included comorbidities, dialysis frequency, dialysis vintage, and BMI. Laboratory parameters included serum creatinine, pre-hemodialysis BUN, hemoglobin, serum albumin, and inorganic phosphorus. Laboratory values within four weeks prior to inclusion were analyzed.

Frailty Assessment

Frailty assessment was done using the FRAIL Scale (see Appendix 1), which included five self-reported questions: Do you feel fatigued? Can you climb a flight of stairs? Can you walk a block without stopping? Do you follow up or

dialysis session and consulted their caregivers when they did not present with acceptable cognitive conditions. To assess the frailty severity for each participant, the

researcher personally conducted one-on-one interviews using the FRAIL Scale protocol to ensure consistency and reliability.

The FRAIL scale has been previously validated in dialysis populations and shown to predict frailty and hospital admissions.⁷ The score ranges from zero to 5 points; each assessment component was worth one point. The researcher classified individuals as “non-frail” (score 0), “pre-frail” (score 1–2), and “frail” (score 3–5).²¹

Bias Control Method

Frailty was assessed using the standardized FRAIL scale to ensure consistency. Recognizing that self-reported measures are prone to social desirability bias—particularly in fatigue and functional domains—interviews were conducted privately, with caregiver input as needed.

The prospective design minimized recall bias, and the use of objective outcomes (mortality and hospitalization) reduced measurement bias. Selection bias was addressed through uniform inclusion criteria. Patients with incomplete data or recent acute illness were excluded.

To account for confounding, binary logistic regression was applied, adjusting for relevant comorbidities. Statistical analyses were conducted by an investigator blinded to frailty classification and outcomes. The study received ethical approval, and written informed consent was obtained from all participants.

Follow-up

Patients were followed for one year. All hospital admissions during the study period, regardless of cause or duration, were recorded. Mortality data were also collected. At the end of follow-up, individualized pharmacologic and non-pharmacologic recommendations were provided to support functional status and mitigate frailty progression.

Statistical Analyses

The data were summarized and reported using either the mean and standard deviation or frequency count and percentage. Additionally, 95% confidence intervals were computed to estimate the parameters. Comparative analyses were performed using chi-square tests and one-way ANOVA with post hoc analysis. Binary logistic regression analysis was also conducted to determine significant associations between outcomes and frail scores. Any test statistic with a p-value less than the conventional alpha of 0.05 was considered significant.

Results

Study Population

During the one-year study period, 192 patients were enrolled in the renal unit as outpatients for maintenance hemodialysis, from October 2023 to September 2024. All patients included in the study were enrolled during the first month of the study period and were subsequently

monitored for one year to complete the FRAIL scale assessment. Thirty-two patients were excluded: 7 were transferred to a different renal unit, 21 had a dialysis vintage of less than three months, and 4 were hospitalized within the month preceding the study period. A total of 160 patients were deemed eligible; 30 were categorized as non-frail, 85 as pre-frail, and 45 as frail.

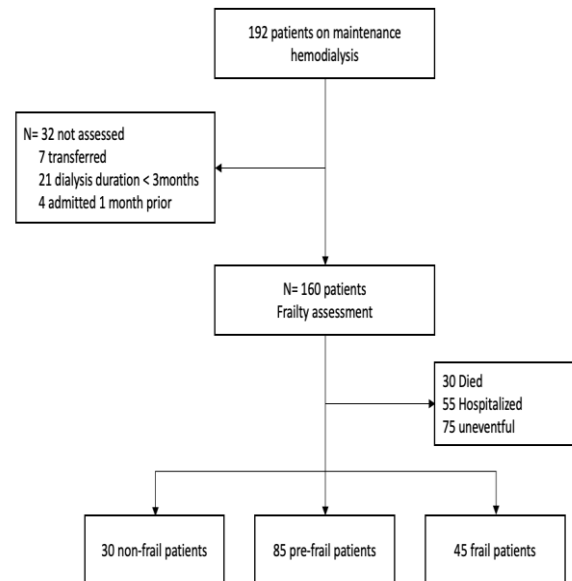


Figure 1. Study flow diagram. Patients who died or were hospitalized contributed to outcome information during follow-up.

suggesting that the true proportion of non-frail patients in the broader population likely fell within this range. A majority, 53.13% (85 patients), were categorized as pre-frail, with a CI of 45.41% to 60.69%, indicating that over half of the cohort exhibited early features of frailty. The remaining 28.13% (45 patients) were classified as frail, with a CI of 21.73% to 35.54%.

The FRAIL scale, which assessed components such as fatigue, resistance, ambulation, illnesses, and weight loss, provided valuable insights into the frailty status of the cohort. The wide confidence intervals reflected the variability in the estimates; however, the overall distribution demonstrated a substantial burden of frailty among these patients.

FRAIL Scale Categories	Frail Score	n =160	%	95% Confidence Interval
Non-frail	0	30	18.75	[13.46, 25.50]
Pre-frail	1-2	85	53.13	[45.41, 60.69]
Frail	3-4	45	28.13	[21.73, 35.54]

Table 1. The Incidence of Frailty among CKD Patients on Maintenance Hemodialysis using the FRAIL Scale

Baseline Clinicodemographic Characteristics

The baseline clinicodemographic and laboratory characteristics of adult CKD patients on maintenance hemodialysis, categorized by frailty status, are presented in Table 2. Patients classified as frail exhibited a significantly higher mean age (66.16 ± 14.04 years) compared to the pre-frail group (59.28 ± 14.50 years; $p = 0.028$), indicating a significant association between frailty and advancing age. There was no significant difference in frailty distribution between genders (male: 55%, female: 45%; $p = 0.56$).

Frail patients had significantly higher rates of heart failure (75.56%; $p = 0.006$), cancer (11.11%; $p = 0.009$), and coronary artery disease/ischemic heart disease (71.11%; $p = 0.018$), emphasizing the contribution of these conditions to frailty progression. Pre-frail and frail

patients also underwent more frequent dialysis sessions (2.60 ± 0.56 and 2.67 ± 0.62 sessions/week, respectively) compared to non-frail patients (2.20 ± 0.71 sessions/week; $p = 0.003$), reflecting greater clinical demand. Furthermore, frail patients had lower serum creatinine (8.09 ± 3.37 mg/dL; $p = 0.004$), pre-hemodialysis BUN (52.59 ± 22.42 mg/dL; $p = 0.047$), and serum albumin levels (2.75 ± 0.52 g/dL; $p < 0.001$), suggesting poorer nutritional status and reduced muscle mass.

These findings indicated that frailty in hemodialysis patients was more common among older individuals and those with comorbidities such as heart failure, cancer, and coronary artery disease. Frail patients also exhibited poorer nutritional markers, including lower serum albumin and creatinine levels.

Characteristic	Overall <i>n</i> = 160	None-Frail <i>n</i> ₁ = 30	Pre-Frail <i>n</i> ₁ = 85	Frail <i>n</i> ₃ = 45	p-value
Age	61.26 ± 14.53	59.53 ± 14.09	59.28 ± 14.50^A	66.16 ± 14.04^B	0.028 *
Sex, <i>n</i> (%)					
Male	88 (55.00)	19 (63.33)	46 (54.12)	23 (51.11)	0.565
Female	72 (45.00)	11 (36.67)	39 (45.88)	22 (48.89)	
Comorbidities, <i>n</i> (%)					
Hypertensive Cardiovascular Disease (HCVD)	157 (98.13)	29 (96.67)	83 (97.65)	45 (100.00)	0.519
Diabetes Mellitus (DM)	103 (64.38)	15 (50.00)	55 (64.71)	33 (73.33)	0.118
Lung Disease	9 (5.63)	0 (0.00)	5 (5.88)	4 (8.89)	0.259
Heart Failure (HF)	92 (57.50)	12 (40.00)	46 (54.12)	34 (75.56)	0.006 *
Cancer	6 (3.75)	0 (0.00)	1 (1.18)	5 (11.11)	0.009 *
Coronary Artery Disease / Ischemic Heart Disease (CAD/IHD)	87 (54.38)	12 (40.00)	43 (50.59)	32 (71.11)	0.018 *

Thyroid Disease	7 (4.38)	1 (3.33)	2 (2.35)	4 (8.89)	0.212
Others	38 (23.75)	4 (13.33)	22 (25.88)	12 (26.67)	0.329
Body mass index (BMI)	23.68 ± 5.09	25.07 ± 5.15	23.50 ± 4.91	23.09 ± 5.31	0.230
Length of time on dialysis <i>in months</i>	3.29 ± 3.20	2.59 ± 2.24	3.33 ± 3.00	3.70 ± 4.01	0.341 0.003 *
Frequency of dialysis	2.55 ± 0.63	2.20 ± 0.71 ^A	2.60 ± 0.56 ^B	2.67 ± 0.62 ^B	
Laboratory data					
Creatinine	9.69 ± 3.82	10.35 ± 4.25 ^B	10.31 ± 3.68 ^B	8.09 ± 3.37 ^A	0.004 *
Pre-HD blood urea nitrogen (BUN)	59.23 ± 21.35	61.52 ± 23.09	61.94 ± 19.56 ^B	52.59 ± 22.42 ^A	0.047 *
Hemoglobin	10.36 ± 1.48	10.72 ± 1.44	10.41 ± 1.45	10.01 ± 1.52	0.113
Albumin	3.06 ± 0.56	3.37 ± 0.47 ^C	3.10 ± 0.53 ^B	2.75 ± 0.52 ^A	<0.001 *
Phosphorus	5.54 ± 2.11	5.68 ± 2.65	5.76 ± 2.07	5.01 ± 1.73	0.142
Thyroid Disease	7 (4.38)	1 (3.33)	2 (2.35)	4 (8.89)	0.212

Table 2. The Baseline Clinicodemographic Characteristics among Adult Chronic Kidney Disease (CKD) on Maintenance Hemodialysis

Note: Values are presented in mean ± standard deviation unless otherwise stated; * Significant at 0.05; Values with different superscripts are statistically different

FRAIL scale

The incidence of individual components of frailty among CKD patients on maintenance hemodialysis is presented in Table 3. Fatigue was reported by 20.63% of the study population, closely aligning with the baseline prevalence of 20.10%, with no significant difference ($p = 0.844$). Similarly, resistance—referring to difficulty performing tasks such as climbing stairs—was observed in 19.38% of patients, which was slightly lower than the baseline prevalence of 25.50%, though not statistically significant ($p = 0.084$).

In contrast, ambulation difficulty was significantly more prevalent in the study cohort, affecting 50.63% of

patients compared to a baseline prevalence of 27.70% ($p < 0.001$). Illness, defined as the presence of five or more chronic medical conditions, was reported in 33.13% of patients—substantially higher than the baseline prevalence of 2.10% ($p = 0.008$). Additionally, unintentional weight loss was significantly more common in the cohort, affecting 50.63% of patients compared to a baseline of 21.00% ($p < 0.001$).

These findings highlighted the disproportionate burden of specific frailty components—particularly ambulation difficulty, illness burden, and weight loss—among patients undergoing hemodialysis. These disparities suggested the need for targeted interventions to address their impact on clinical outcomes and quality of life.

Table 3. The Prevalence of FRAIL Scale Components among CKD Patients on Maintenance Hemodialysis

FRAIL Scale Components	Baseline Prevalence (%)	Study Cohort			P-Value
		Prevalence		95% Confidence Interval	
		<i>n</i> = 160	%		
Fatigue	20.10	33	(20.63)	[15.08, 27.55]	0.844
Resistance	25.50	31	(19.38)	[14.00, 26.19]	0.084

Ambulation	27.70	8	50.63	[42.95, 58.27]	<0.001 *
Illness	2.10	53	33.13	[26.30, 40.74]	0.008 *
Weight loss	21.00	81	50.63	[42.95, 58.27]	<0.001 *

Note: * Significant at 0.05; Confidence intervals are in Wilson score interval

Outcomes

The outcomes of adult CKD patients on maintenance hemodialysis, stratified by frailty status, are shown in Table 4. Mortality significantly increased with frailty severity: 3.33% among non-frail patients, 12.94% among pre-frail patients, and 40% among frail patients ($p < 0.001$). Hospitalization occurred in 34.38% of the cohort. The highest rate was observed among pre-frail patients (40%), followed by frail (28.89%) and non-frail patients (26.67%), although these differences were not statistically significant.

Survival rates also varied notably by frailty status. At the end of the one-year follow-up, 70% of non-frail patients were alive, compared to 47.06% of pre-frail and 31.11% of frail patients. These findings underscored the strong association between frailty and adverse outcomes, particularly increased mortality and reduced survival.

Table 4. The Outcomes of Adult Chronic Kidney Disease (CKD) on Maintenance Hemodialysis, $n = 160$

Outcomes	Overall	None-Frail $n_1 = 30$	Pre-Frail $n_1 = 85$	Frail $n_3 = 45$	p-value
Expired	30 (18.75)	1 (3.33)	11 (12.94)	18 (40.00)	<0.001 *
Hospitalized	55 (34.38)	8 (26.67)	34 (40.00)	13 (28.89)	
No events	75 (46.88)	21 (70.00)	40 (47.06)	14 (31.11)	

Note: * Significant at 0.05; Confidence intervals are in Wilson score interval

Correlation Analysis of the Severity of Frailty to Outcome and Comorbidities

Table 5 presents the correlation between frailty severity and clinical outcomes in the study population. Higher frailty scores were significantly associated with increased mortality, with an odds ratio (OR) of 1.933 (95% CI: 1.412–2.647; $p < 0.001$), indicating that more frail patients were nearly twice as likely to die.

Significant associations were also observed between

frailty and specific comorbidities. Frailty was correlated with heart failure (OR: 1.542; 95% CI: 1.189–2.001; $p = 0.001$), cancer (OR: 2.962; 95% CI: 1.430–6.135; $p = 0.003$), and coronary artery disease/ischemic heart disease (OR: 1.492; 95% CI: 1.159–1.920; $p = 0.002$). Additionally, frailty was associated with “other conditions” (OR: 1.308; 95% CI: 1.004–1.705; $p = 0.046$). However, no significant associations were found between frailty and hospitalization, or with comorbidities such as hypertensive cardiovascular disease, diabetes mellitus, chronic lung disease, or thyroid disorders.

Table 5. The Correlation Analysis of the Severity of Frailty to Outcome and Comorbidities, $n = 160$

Dependent Variables	Independent Variable: Frailty Score				P-Value
	Coefficient	Standard Error	Odds Ratio (OR)	CI for OR	
Mortality	0.659	0.160	1.933	[1.412, 2.647]	<0.001 *
Hospitalization	-0.075	0.124	0.928	[0.728, 1.184]	0.548
Comorbidities					
HCVD	0.521	0.561	1.684	[0.561, 5.053]	0.353
DM	0.158	0.125	1.171	[0.916, 1.498]	0.208
Lung Disease	0.200	0.241	1.221	[0.762, 1.959]	0.406
Heart Failure	0.433	0.133	1.542	[1.189, 2.001]	0.001 *

Cancer	1.086	0.372	2.962	[1.430, 6.135]	0.003 *
CAD/IHD	0.400	0.129	1.492	[1.159, 1.920]	0.002 *
Thyroid Disease	0.286	0.268	1.331	[0.787, 2.252]	0.287
Others [†]	0.269	0.135	1.308	[1.004, 1.705]	0.046 *

Note: Significant at 0.05 using binary logistic regression; † other comorbidities not specified include SLE, Gouty Arthritis, Osteoarthritis, Rheumatoid arthritis, Pheochromocytoma, Prolactinoma, Peripheral Artery Disease, Seizure Disorder, Hepatitis B, Human Immunodeficiency Virus (HIV), and Beta Thalassemia

Discussion

Data on frailty showed that it was a consequence of degeneration across multiple systems resulting from the accumulation of vascular, inflammatory, nutritional, and age-related insults. This process led to accelerated aging, increased vulnerability, and diminished functional reserve over time.² Its development predicted increased susceptibility to stressors, resulting in adverse clinical outcomes, including falls, hospitalization, decreased quality of life, and mortality.¹¹

This study reported that among 160 patients with CKD on maintenance hemodialysis, the majority (53.13%) were categorized as pre-frail using the FRAIL scale, while 28.13% were considered frail. Mortality significantly increased with frailty severity: 3.33% among non-frail, 12.94% among pre-frail, and 40% among frail patients ($p < 0.001$). Hospitalization affected 34.38% of the total cohort. These findings aligned with other studies showing that frailty was significantly and independently associated with mortality and hospitalization across kidney disease populations, particularly among those on hemodialysis.^{2,17,22,23} Most deaths and hospitalizations were attributed to cardiovascular causes, especially acute coronary syndrome and acute decompensated heart failure. Sepsis also contributed substantially to mortality, highlighting the susceptibility of this cohort to both cardiac and infectious complications.

Baseline clinicodemographic profiles revealed that frailty was associated with older age, as evidenced by the significantly higher mean age among frail patients (66.16 ± 14.04 years) compared to pre-frail individuals (59.28 ± 14.50 years; $p = 0.028$). Chowdhury et al. reported similar findings, with frailty most prevalent among elderly dialysis patients aged >65 years who experienced a higher symptom burden.⁴

Frail patients had significantly higher rates of heart failure (75.56%, $p = 0.006$), cancer (11.11%, $p = 0.009$), and coronary artery disease/ischemic heart disease (71.11%, $p = 0.018$). Frailty has been shown to emerge earlier in disorders of accelerated physiologic aging such as congestive heart failure. Multimorbidity has also been recognized as a major risk factor for frailty development and progression.²²

Pre-frail and frail patients required more frequent dialysis sessions (2.60 ± 0.56 and 2.67 ± 0.62 per week, respectively) compared to non-frail patients (2.20 ± 0.71 ; $p = 0.003$), indicating greater clinical demands. Frail

patients also exhibited lower levels of serum creatinine (8.09 ± 3.37 mg/dL, $p = 0.004$), pre-hemodialysis BUN (52.59 ± 22.42 mg/dL, $p = 0.047$), and albumin (2.75 ± 0.52 g/dL, $p < 0.001$), suggestive of poorer nutritional status and reduced muscle mass. Sarcopenia in CKD has been attributed to increased catabolism caused by hypogonadism, insulin resistance, uremia, and vitamin D deficiency, further aggravated by inflammation, metabolic acidosis, anorexia, and malnutrition. Increased renin-angiotensin system (RAS) activity generates reactive oxygen species, promotes fibroblast proliferation, and impairs muscle regeneration, contributing to the cycle of deconditioning.⁹ Dietary limitations, dysgeusia, mental stress, social isolation, and polypharmacy may also contribute to frailty etiology in this population.¹³

Higher frailty scores were strongly associated with an increased risk of mortality (OR 1.933, 95% CI: 1.412–2.647, $p < 0.001$), indicating that more frail patients are nearly twice as likely to die. Among comorbidities, frailty was significantly linked to heart failure (OR: 1.542, 95% CI: 1.189–2.001, $p = 0.001$), cancer (OR: 2.962, 95% CI: 1.430–6.135, $p = 0.003$), and CAD/IHD (OR: 1.492, 95% CI: 1.159–1.920, $p = 0.002$). A correlation between frailty and some laboratory parameters, such as reduced hemoglobin, albumin, and pre-albumin levels, was also demonstrated. Lower muscle mass brought on by sarcopenia linked with frailty may cause the correlation between frailty and blood creatinine and creatine kinase. Sarcopenia is common in hemodialysis and linked to protein-energy-wasting (PEW) syndrome and frailty. A poor prognosis is related to malnutrition and inflammation complex syndrome (MICS). Additionally, they discovered a link between frailty and serum albumin and pre-albumin as indicators of malnutrition.¹⁷

Dialysis patients may have a higher cardiovascular risk due to traditional and uremia-specific risk factors, such as mineral and bone disease (MBD). A 25%–30% reduction in kidney function can lead to phosphorus retention, hyperphosphatemia, aberrant vitamin D metabolism, and changes in parathyroid gland function (such as mixed renal osteodystrophy and secondary hyperparathyroidism). Furthermore, unfavorable cardiovascular outcomes and mortality have been linked to hyperphosphatemia in dialysis patients due to increases in fibroblast growth factor-23 (FGF-23) levels and vascular calcification.¹⁴ Since dietary phosphorus is mainly obtained from meals high in protein, restricting dietary phosphorus is frequently accompanied by

decreased protein consumption. The latter can result in protein-energy wasting and malnutrition, which are significant risk factors for an elevated death risk in maintenance dialysis patients.¹⁵

Investigations of frailty used at least 67 different metrics to determine frailty in the general population, and studies of individuals with kidney disease also exhibit similar variations.¹³ Frailty encompasses physical domains, cognitive function, psychosocial factors, and psychological factors. There still needs to be a consensus among CKD patients on a standard tool to identify frailty. According to Nair et al., the prevalence of frailty ranges from 14%-40% in patients with CKD, 31%- 82% in hemodialysis, 14.2%- 69.4% in peritoneal dialysis, and 13.3%- 17% in kidney transplant populations. The results in this study may have underestimated the prevalence of frailty among CKD patients on hemodialysis at 28.13%.²² Two scales have gained attention for their easy application, modality of assessment (self-reported or scored by the evaluator), and associations with outcomes- the Clinical Frail Scale (CFS) and the 5-item FRAIL Scale. In a study by Barbosa et al., they assessed the prevalence of frailty using the 5-item FRAIL Scale (fatigue, resistance, ambulation, illnesses, and weight loss) and CFS, which compared the association of hospitalization in hemodialysis patients. Their study showed that the FRAIL Scale proved to be an easy-to-apply tool, identifying a high prevalence of frailty and predicting hospital admission. Barbosa et al. compared their study to a small cohort of rural Chinese subjects undergoing chronic dialysis who were also assessed using the FRAIL scale and showed a good correlation with age, presence of comorbidities, and dialysis complication compared with other self-reported questionnaires (Strawbridge questionnaire, Edmonton Frail Scale, simple FRAIL scale, Groningen Frail Indicator, G8 questionnaire, and Tilburg Frail Indicator), although outcomes like hospitalization or mortality were not assessed.⁷ A study by Chao et al. also demonstrated that the FRAIL Scale is a valid and reliable tool in HD patients and is a better frailty metric when compared to other tools.⁸ The 5-item FRAIL Scale was utilized in this study to evaluate frailty among dialysis patients due to the ease of use in typical clinical settings, which makes it the ideal choice.

Strict blood pressure goals, tight glycemic control, and protein restriction all have a known role in managing healthy patients with CKD, but they may hasten the decline in frail patients. Extended observational data reveal that frailty is not a fixed state, and interventions to address inflammation, malnutrition, and physical deconditioning account for significant year-to-year variability in frailty scores. Successful frailty interventions are likely to be multidisciplinary and multifactorial, addressing numerous contributing factors simultaneously.¹³ In ESRD patients, worse frailty scores lead to poorer outcomes, and frailty assessment could recommend incorporating factors like polypharmacy and the effects of interventions in the treatment of frailty. In the center where the study was conducted, attending physicians can be informed of the FRAIL scores of their

guide therapeutic judgment and enhance patient and caregiver counseling. Patients deemed as frail and pre-frail were notified and advised accordingly. According to Guillén et al., frail and pre-frail patients needed more substantial dietary intervention than non-frail patients. Recent research has demonstrated that clinicians should use protein-rich diets and supplements to enhance nutritional status in ESRD patients receiving hemodialysis, with the most significant benefit in those patients with the worst baseline nutritional status.¹⁹ Therefore, these data highlight the significance of classifying frailty in dialysis patients since this can help in providing interventions that can improve their quality of life with holistic management.

At the conclusion of this study's one-year follow-up period, patients were counseled on individualized pharmacologic and non-pharmacologic interventions specifically designed for this study, with the aim of preventing further progression of frailty and supporting overall functional well-being.

Limitations of the Study

This study determined the risk for hospitalization and mortality among patients on maintenance hemodialysis from a single dialysis center. All the patients in the study were evaluated for frailty during inclusion and followed up for one year to observe for hospitalizations or mortality. The researcher only assessed the laboratory parameters and frailty assessment at baseline. This study did not determine the trend of these parameters in correlation to the clinical presentation. This study only established associations but not causal relationships between parameters.

Conclusion

Mortality significantly increased with frailty severity (3.33% of non-frail, 12.94% of pre-frail, and 40% of frail patients). Among the components of the FRAIL scale, ambulation challenges, illness, and weight loss in CKD patients undergoing hemodialysis were identified to have significant burdens and implicate areas for targeted interventions.

Recommendations

This study recommends a multi-center cohort to produce more generalizable results and validate its usefulness. A collaborative investigation among different institutions is recommended to provide a high-quality result involving a larger sample size that may reflect the general Filipino population. Future researchers can design and conduct a stratified analysis to determine the variations and quantify the stress response among the FRAIL scale categories, including the duration of frailty and time to recovery after a health-related stressor. This study also patients, and frequent monitoring of frailty status on follow-up can be done in order for necessary interventions to be made, especially for those who have severe frailty scores.

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