**Table 1**. Potential causes of frailty in patients with CKD reported in the literature

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Category | | Type | | Risk Difference (95% CI) | Patient CKD severity | Frailty Assessment method | Sample Size | Ref |
| Demographic profile | | Advanced age | Age > 60 years | OR 4.0 (1.0-16.2) | stages 3-5 | Modified Fried Phenotypes | 61 | 3 2012 Mansur |
| per year | OR 1.02 (1.01-1.03) | stages 5D | Modified Fried Phenotypes | 2275 | 4 2007 JASN |
| OR 1.03 (1.01-1.04) | stage 5D | Modified CHS scale | 1658 | 49J Ren Nutr |
| Female gender | | OR 11.3 (2.3-55.6) | stages 3-5 | Modified Fried Phenotypes | 61 | 3 2012 Mansur |
| OR 1.55 (1.27-1.88) | stage 5D | Modified Fried Phenotypes | 2275 | 4 2007 JASN |
| OR 11.6 (1.7-79.1) | Elderly with stage 5D (HD) | Multidimensional frailty score | 46 | 62 JKMS |
| Male gender | | OR 0.49 (0.39-0.62) | stage 5D (incident) | Modified Fried Phenotypes | 1576 | 46 JAMA-IM |
| Non-white race | | OR 1.9 (1.1-1.3) | stages 1-4 | Modified CHS scale | 336 | 7 2012 AJKD |
| Unemployed status | | OR 1.89 (1.36-2.62) | stage 5D | Modified CHS scale | 1658 | 49J Ren Nutr |
| Higher education level | | OR 0.67 (0.49-0.91) for 7th-12th grade, 0.53 (0.35-0.82) for >12th grade |
| **Lifestyle** | | Smoking | | RR 1.18 (1.04-1.34) | stage 5D (HD) | Fried Phenotypes | 205 | 1 2017 SJKDT |
| **Anthropometric parameters** | | BMI | | OR 1.2 (1.0-1.4) per 5 kg/m2 | stages 1-4 | Modified CHS scale | 336 | 7 2012 AJKD |
| OR 1.06 (1.02-1.1) per kg/m2 | stage 5D | Modified CHS scale | 1658 | 49J Ren Nutr |
| OR 0.58 (0.38-0.88) per kg/m2 | Elderly with stage 5D | Multidimensional frailty score | 46 | 62 JKMS |
| Waist circumference (cm) | | OR 3.84 (1.39-10.61; 3rd tertile) | stage 5D (HD) | Fried Phenotypes | 151 | 26 J Ren Nutr |
| **CKD severity** | | Mild | | OR 2.21 (1.49-3.28) | stages 1/2 | Modified Fried Phenotypes | 10256 | 5 2009 AJM |
| OR 1.48 (1.00-2.19) | Cre > 1.3 mg/dL | CHS scale | 5888 | 6 2004 AJKD |
| Moderate | | OR 2.48 (1.57-3.93) | stages 3a | Modified Fried Phenotypes | 10256 | 5 2009 AJM |
| Severe | | OR 5.88 (3.40-10.16) | stages 3b-5 |
| OR 2.8 (1.3-6.3) | stage 3b | Modified CHS scale | 336 | 7 2012 AJKD |
| OR 2.1 (1.0-4.7) | stage 4 |
| **Biological** | |  | |  |  |  |  |  |
|  | Cardiovascular | Hypertension | | RR 1.6 (1.26-2.04) | stage 5D (HD) | Fried Phenotypes | 205 | [1](#Yadla) 2017 SJKDT |
| Peripheral vascular disease | | RR 1.58 (1.34-1.8) | stage 5D (HD) | Fried Phenotypes | 205 | [1](#Yadla) 2017SJKDT |
| OR 1.67 (1.16-2.41) | stage 5D (incident) | Modified Fried Phenotypes | 1576 | 46 JAMA-IM |
| Left ventricular dysfunction | | RR 1.18 (1.03-1.36) | stage 5D (HD) | Fried Phenotypes | 205 | [1](#Yadla) 2017SJKDT |
| Cardiac disorder (any) | | OR 1.43 (1.01-1.98) | stage 5D | Modified CHS scale | 1658 | 49J Ren Nutr |
| Endothelial dysfunction | | OR 3.86 (1.00-14.88) | stages 3-5 | Modified Fried Phenotypes | 61 | 3 2012 Mansur |
| Central nervous system | Cerebrovascular Accident | | RR 1.34 (1.19-1.5) | stage 5D (HD) | Fried Phenotypes | 205 | [1](#Yadla) 2017SJKDT |
| OR 1.55 (1.05-2.29) | stage 5D | Modified Fried Phenotypes | 2275 | 4 2007 JASN |
| OR 1.85 (1.04-3.28) | stage 5D (incident) | Modified Fried Phenotypes | 1576 | 46 JAMA-IM |
| OR 1.56 (1.04-2.35) | stage 5D | Modified CHS scale | 1658 | 49J Ren Nutr |
| Pulmonary | COPD | | OR 2.20 (1.20-4.03) | CKD stages 1-5 | Modified Fried Phenotypes | 10256 | 5 2009 AJM |
| Endocrinologic/ Metabolic | Diabetes | | OR 1.68 (1.16-2.45) | CKD stages 1-5 | Fried Phenotypes | 10256 | 5 2009 AJM |
| OR 1.35 (1.10-1.65) | stage 5D | Modified Fried Phenotypes | 2275 | 4 2007 JASN |
| OR 1.52 (1.18-1.96) | stage 5D (incident) | Modified Fried Phenotypes | 1576 | 46 JAMA-IM |
| OR 1.44 (1.11-1.87) | stage 5D | Modified CHS scale | 1658 | 49J Ren Nutr |
| Obesity | | OR 6.63 (1.16-36.77) | stages 3-5 | Modified Fried Phenotypes | 61 | 3 2012 Mansur |
| Cancer | Cancer | | OR 1.89 (1.19-2.99) | CKD stages 1-5 | Modified Fried Phenotypes | 10256 | 5 2009 AJM |
| Musculoskeletal | Arthritis | | OR 3.34 (2.08-5.38) | CKD stages 1-5 | Modified Fried Phenotypes | 10256 | 5 2009 AJM |
| Body composition | Fat mass | | OR 3.27 (1.17-9.09; 2nd tertile) and 4.97 (1.7-14.55; 3rd tertile) | stage 5D (HD) | Fried Phenotypes | 151 | 26 J Ren Nutr |
| ECW to ICW ratio | | OR 3.85 (1.18-10.50; 3rd tertile) |
| Psychological | | Depression | | OR 3.97 (2.28-6.91) | stage 5T | Fried Phenotypes | 773 | 48 Clin Transplant |
| Functional status | | Disability | | OR 5.6 (4.12-7.62) | stage 5D | Modified CHS scale | 1658 | 49J Ren Nutr |
| Vascular access | | Permanent vascular access (fistula or graft) | | OR 0.71 (0.51-0.98) | stage 5D (HD) | Modified Fried Phenotypes | 2275 | 4 2007 JASN |
| Laboratory Data | | Creatinine < 4 mg/dL\* | | RR 1.46 (1.22-1.71) | stage 5D (HD) | Fried Phenotypes | 205 | 1 2017SJKDT |
| eGFR (per 5 mL/min/1.73m2 increase) | | OR 1.44 (1.23-1.68) | stage 5D (incident) | Modified Fried Phenotypes | 1576 | 46 JAMA-IM |
| Albumin < 3.2 (g/dL) | | OR 1.89 (1.43-2.49) | stage 5D | Modified Fried Phenotypes | 2275 | 4 2007 JASN |
| Lower free testosterone, (per 50% lower) | | OR 1.30 (1.03-1.58) | Male stage 5D (HD) | Fried Phenotypes | 440 | 8 2018 NDT |

**Table 2**. Potential modifiers of frailty trajectories in patients with CKD reported in the literature

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Category | | Type | Risk Difference (95% CI) | Patient CKD severity | Frailty Assessment method | Sample Size | Ref |
| **Ethnicity** | | Hispanic | Frailty scores increase 0.6 (0-1.1) per year | stage 5D (HD) | Fried Phenotypes | 762 | 2 2017 CJASN |
| Black | Frail to non-frail after transplantation (RRR 1.98 [1.07-3.67]) | stage 5 | Fried Phenotypes | 569 | 53 Transplantation |
| **Biological** | |  |  |  |  |  |  |
|  | Endocrinologic/ Metabolic | Diabetes | Remain frail after transplantation (RRR 2.56 [1.22-5.39]) | stage 5 | Fried Phenotypes | 569 | 53 Transplantation |
| Frailty scores increase 0.7 (0.3-1.0) per year | stage 5D (HD) | Fried Phenotypes | 762 | 2 2017 CJASN |
|  | Laboratory data | IL-6 | Frailty scores increase 0.3 (0.1-0.4) per year |
| Serum Albumin Concentrations (g/dL) | Frailty scores decrease 1.1 (0.7-1.5) per g/dL |
| Low free testosterone (< 147 pmol/L) | Developing Frailty over 12 months (OR 1.56, 1.04-2.33) | Male stage 5D (HD) | Fried Phenotypes | 440 | 8 2018 NDT |
| **Dialysis course** | | Time of dialysis (year) | Frail to non-frail after transplantation (RRR 0.88 [0.78-1]) | stage 5 | Fried Phenotypes | 569 | 53 Transplantation |
| **Healthcare utilization** | |  |  |  |  |  |  |
|  | Hospitalization | Hospitalization during past year | Frailty scores increase 0.6 (0.3-0.8) per year | stage 5D (HD) | Fried Phenotypes | 762 | 2 2017 CJASN |

**Table 3.** Unadjusted associates of frailty in CKD patients

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Category** | | | **Type** | | **Prevalence (Frail vs. non-frail, %), values, or correlation** | **Patient CKD Severity** | **Frailty Assessment method** | **Sample Size** | **Ref** |
| **Demographic profile** | | | Age (years) | | r = 0.24, p = 0.04 | stage 5D (HD) | Fried Phenotypes | 74 | 9 2018 Clinics |
| 57.0 vs. 52.0 | stage 5D (HD) | Fried Phenotypes | 324 | 10 2015 CJASN |
| 82.5 vs. 65.4 | stage 5D (PD) | Clinical Frailty Scale | 119 | 12 2018 PDI |
| 62.1 vs. 58.5 | stage 5D (PD) | In-house frailty questionnaire | 178 | 15 2018 KBPR |
| 69.4 vs. 56.6 (severe F vs. NF) | stage 5D (PD) | In-house frailty questionnaire | 193 | 18 2016 KBPR |
| 69 vs. 59 | stage 5D (HD) | Fried Phenotypes | 151 | 26 J Ren Nutr |
| 78.4 vs. 65.5 | stage 5D (HD) | FRAIL scale | 51 | 29 Nephrology |
| 71.7 vs. 61.5 | stage 5D (HD) | CHS scale | 214 | 35 JBMM |
| 58 vs. 53 | stage 5D (HD) | Performance-based frailty | 80 | 36 J Ren Nutr |
| 75.3 vs. 65.1 | stage 5D (HD) | FRAIL scale | 46 | 37 Nephrology |
| 69.5 vs. 63.7 | stage 2-4 | Modified Fried Phenotypes | 168 | 40 HQoLO |
| 64.9 vs. 57.3 | stages 3-5 | Modified Fried Phenotypes | 61 | 41 HQoLO |
| 62.9 vs. 55.1 | stage 5D (HD) | Fried Phenotypes | 146 | 50 JAGS |
| 55.8 vs. 50.7 | stage 5T | Fried Phenotypes | 537 | 54 Am J Transplant |
| Gender (male) | | 56% vs. 21% (moderate/severe vs. NF/mild) | stage 5D (HD) | FRAIL scale | 46 | 16 2017 BMCG |
| 55% vs. 72% | stage 5D (HD) | Performance-based frailty | 80 | 36 J Ren Nutr |
| 11% vs. 51% | stage 5D (HD) | FRAIL scale | 46 | 37 Nephrology |
| 42.3% vs. 71.4% | stages 3-5 | Modified Fried Phenotypes | 61 | 41 HQoLO |
| 51.2% vs. 68.2% | stage 5D (HD) | Self-reported frailty | 1646 | 47 AJN |
| 60.8% vs. 57.9% | stage 5T | Fried Phenotypes | 383 | 51 Am J Transplant |
| **Anthropometric parameters** | | | BMI (kg/m2) | | 31.5 vs. 27.6 (based on DW) | stage 5D (HD) | Fried Phenotypes | 324 | 10 2015 CJASN |
| 22.53 vs. 26.16 | stage 5D (HD) | Fried Phenotypes | 320 | 11 2017 J Aging Res |
| 28.3 vs. 25.6 | stage 5D (HD) | Fried Phenotypes | 151 | 26 J Ren Nutr |
| 28.8 vs. 24.9 | stage 5D (HD) | Performance-based frailty | 80 | 36 J Ren Nutr |
| 30.1 vs. 28.1 | stage 5D (HD) | Self-reported frailty | 1646 | 47 AJN |
| Waist circumference (cm) | | 101.0 vs. 97.7 | stage 5D (PD) | In-house frailty questionnaire | 178 | 15 2018 KBPR |
| 103.0 vs. 93.6 | stage 5D (HD) | Fried Phenotypes | 151 | 26 J Ren Nutr |
| **Multimorbidity** | | | Charlson comorbidity index | | 5.0 vs. 2.0 | stage 5D (PD) | Clinical Frailty Scale | 119 | 12 2018 PDI |
| 5.8 vs. 5.1 | stage 5D (PD) | In-house frailty questionnaire | 178 | 15 2018 KBPR |
| 6.6 vs. 4.3 (severe F vs. NF) | stage 5D (PD) | In-house frailty questionnaire | 193 | 18 2016 KBPR |
| Number of comorbidities | | 6 vs. 5 | stages 1-5 | Edmonton Frail Scale (EFS) | 41 | 14 Can J Diabet |
| **Dialysis duration** | | | Duration | | 70.5 vs. 162.1 (weeks) | stage 5D (PD) | Clinical Frailty Scale | 119 | 12 2018 PDI |
| 47.9 vs. 34.3 (months) | stage 5D (PD) | In-house frailty questionnaire | 178 | 15 2018 KBPR |
| 61.5 vs. 45.8 (months) (severe F vs. NF) | stage 5D (PD) | In-house frailty questionnaire | 193 | 18 2016 KBPR |
| **Physical examination** | | | Diastolic blood pressure (mmHg) | | 75.6 vs. 80.2 | stage 5D (PD) | In-house frailty questionnaire | 178 | 15 2018 KBPR |
| 72.7 vs. 82.5 (severe F vs. NF) | stage 5D (PD) | In-house frailty questionnaire | 193 | 18 2016 KBPR |
| Biological | | |  | |  |  |  | ­­ |  |
|  | Cardiovascular | | Heart Failure (%) | | 30% vs 12% | stages 1-4 | Modified CHS scale | 336 | 7 2012 AJKD |
| 44% vs. 11% | stage 5D (HD) | FRAIL scale | 46 | 37 Nephrology |
| 36.4% vs. 25.3% | stage 5D (HD) | Self-reported frailty | 1646 | 47 AJN |
| Peripheral vascular disease (%) | | 38.8% vs. 17.21% | stage 5D (HD) | Fried Phenotypes | 320 | 11 2017 J Aging Res |
| 13.6% vs. 0% (severe F vs. NF) | stage 5D (PD) | In-house frailty questionnaire | 193 | 18 2016 KBPR |
| 42.6% vs. 10.5% | stage 5D (HD) | Fried Phenotypes | 146 | 50 JAGS |
| An­gina (%) | | 34% vs. 22% | stages 1-4 | Modified CHS scale | 336 | 7 2012 AJKD |
| Coronary heart disease (%) | | 27.3% vs. 5.1% (severe F vs. NF) | stage 5D (PD) | In-house frailty questionnaire | 193 | 18 2016 KBPR |
| Atherosclerosis (%) | | 40.1% vs. 30.6% | stage 5D (HD) | Self-reported frailty | 1646 | 47 AJN |
| Central nervous system | | Cerebrovascular Disease (%) | | 26.4% vs. 12% | stage 5D (HD) | Fried Phenotypes | 324 | 10 2015 CJASN |
| Endocrinologic/ Metabolic | | Diabetes (%) | | 64% vs. 49% | stages 1-4 | Modified CHS scale | 336 | 7 2012 AJKD |
| 63.6% vs. 27.1% (severe F vs. NF) | stage 5D (PD) | In-house frailty questionnaire | 193 | 18 2016 KBPR |
| 65% vs. 45% | stage 5D (HD) | Fried Phenotypes | 151 | 26 J Ren Nutr |
| 80% vs. 44% | stage 5D (HD) | FRAIL scale | 51 | 29 Nephrology |
| 60% vs. 36% | stage 5D (HD) | Performance-based frailty | 80 | 36 J Ren Nutr |
| 63% vs. 43.7% | stage 5D (HD) | Self-reported frailty | 1646 | 47 AJN |
| 75.4% vs. 44.7% | stage 5D (HD) | Fried Phenotypes | 146 | 50 JAGS |
| Obesity (%) | | 64% vs. 50% | stages 1-4 | Modified CHS scale | 336 | 7 2012 AJKD |
| 51.8% vs. 23.9% | stage 5D (HD) | Fried Phenotypes | 324 | 10 2015 CJASN |
| Musculoskeletal | | Osteoporosis | | Higher in frail patients (p = 0.01) | stages 3-5 | Modified Fried Phenotypes | 61 | 3 2012 Mansur |
| Immunological | | Viral infection | |  |  |  |  |  |
|  | HCV infection | 21.5% vs. 2.6% | stage 5D (HD) | Fried Phenotypes | 205 | 1 2017 SJKDT |
| Body Composition | | Fat mass | | r = 0.25, p = 0.04 | stages 3-5 | Modified Fried Phenotypes | 61 | 3 2012 Mansur |
| 40.2% vs. 30.5% (severe F vs. NF) (high fat prevalence) | stage 5D (PD) | In-house frailty questionnaire | 193 | 18 2016 KBPR |
| 40.7% vs. 35.0% | stage 5D (HD) | Fried Phenotypes | 151 | 26 J Ren Nutr |
| 30.7 vs. 24.4 kg |
| Total mass | |  |  |  |  |  |
|  | trunk mass (kg) | 40.8 vs. 48.88 | stages 1-5 | Edmonton Frail Scale | 41 | 14 Can J Diabet |
| 29.4 vs. 33.5 | stage 5D (HD) | FRAIL scale | 44 | 32 JPSM |
| Cephalic mass (kg) | 4.64 vs. 4.93 |
| Lower lean body mass | | 57.1% vs .14.7% | stages 1-5 | Edmonton Frail Scale | 41 | 14 Can J Diabet |
| 45.49 vs. 53.62 kg |
| 34.7 vs. 43.1 kg | stage 5D (HD) | FRAIL scale | 44 | 32 JPSM |
|  | Trunk lean mass (kg) | 17.4 vs. 22.1 |
|  | 23.05 vs. 27.98 | stages 1-5 | Edmonton Frail Scale | 41 | 14 Can J Diabet |
| Cephalic lean mass (kg) | 3.74 vs. 4.69 |
| 3.06 vs. 3.29 | stage 5D (HD) | FRAIL scale | 44 | 32 JPSM |
| Gynoid lean mass (kg) | 6.64 vs. 7.91 | stages 1-5 | Edmonton Frail Scale | 41 | 14 Can J Diabet |
| Lean tissue mass | | 37.2 vs. 41.4 kg | stage 5D (PD) | In-house frailty questionnaire | 178 | 15 2018 KBPR |
| 53.6% vs. 67.5% (severe F vs. NF) | stage 5D (PD) | In-house frailty questionnaire | 193 | 18 2016 KBPR |
| Skeletal muscle index (kg/m2) | | 6.55 vs. 7.41 | stage 5D (PD) | Clinical Frailty Scale | 119 | 12 2018 PDI |
| Phase angle (degree) | | 5.24 vs. 6.24 | stage 5D (HD) | Performance-based frailty | 80 | 36 J Ren Nutr |
| Over-hydration (L) | | 4.19 vs. 2.49 (severe F vs. NF) | stage 5D (PD) | In-house frailty questionnaire | 193 | 18 2016 KBPR |
| Bone mineral density (g/cm2) | |  | stage 5D (HD) | FRAIL Scale | 43 | 34 JAGS |
|  | L3 | 0.81 vs. 0.97 |
| L4 | 0.73 vs. 0.92 |
| Femoral neck | 0.43 vs. 0.63 |
| T-score | |  |
|  | L3 | -1.97 vs. -0.64 |
| L4 | -2.6 vs. -0.95 |
| Femoral neck | -3.47 vs. -1.68 |
| Laboratory Data | | Prealbumin (mg/dL) | | 28.9 vs. 38.3 | stage 5D (PD) | Clinical Frailty Scale | 119 | 12 2018 PDI |
| Serum albumin (g/dL) | | 3.6 vs. 3.9 | stages 1-4 | Modified CHS scale | 336 | 7 2012 AJKD |
| r = -0.263, p = 0.025 | stage 5D (HD) | Fried Phenotypes | 74 | 9 2018 Clinics |
| 3.8 vs. 4.1 | stages 1-5 | Edmonton Frail Scale (EFS) | 41 | 14 Can J Diabet |
| 2.92 vs. 3.48 | stage 5D (PD) | Clinical Frailty Scale | 119 | 12 2018 PDI |
| 3.61 vs. 3.85 | stage 5D (HD) | Fried Phenotypes | 320 | 11 2017 J Aging Res |
| 3.29 vs. 3.49 vs. 3.58 (F + D vs. F – D vs. NF ) | stage 5D (PD) | In-house frailty questionnaire | 178 | 15 2018 KBPR |
| 3.17 vs. 3.62 (severe F vs. NF) | stage 5D (PD) | In-house frailty questionnaire | 193 | 18 2016 KBPR |
| 3.7 vs. 3.9 | stage 5D (HD) | Fried Phenotypes | 151 | 26 J Ren Nutr |
| 3.5 vs. 3.9 | stage 5D (HD) | FRAIL scale | 51 | 29 Nephrology |
| 3.7 vs. 3.9 | stage 5D (HD) | CHS scale | 214 | 35 JBMM |
| 3.5 vs. 3.8 | stage 5D (HD) | FRAIL scale | 46 | 37 Nephrology |
| 3.2 vs. 3.4 | Elderly with stage 5D | Multidimensional frailty score | 46 | 62 JKMS |
| Creatinine | | 299 vs. 115 umol/L | stages 1-5 | Edmonton Frail Scale (EFS) | 41 | 14 Can J Diabet |
| 11.6 vs. 9.9 mg/dL (moderate/severe vs. NF/mild) | stage 5D (HD) | FRAIL scale | 46 | 16 2017 BMCG |
| 12.2 vs. 10.4 mg/dL (F/PF vs. NF) | stage 5D (HD) | FRAIL scale | 44 | 32 JPSM |
| 8.1 vs. 11.1 mg/dL | stage 5D (HD) | FRAIL scale | 46 | 37 Nephrology |
| eGFR (mL/min/1.73m2) | | 41.1 vs. 52.5 (cystatin C) | stages 1-4 | Modified CHS scale | 336 | 7 2012 AJKD |
| 18 vs. 50 | stages 1-5 | Edmonton Frail Scale (EFS) | 41 | 14 Can J Diabet |
| Albuminuria (mg/g Cre) | | 311.2 vs. 102 | stages 1-4 | Modified CHS scale | 336 | 7 2012 AJKD |
| Phosphate (mg/dL) | | 4.1 vs. 3.7 | stages 1-4 | Modified CHS scale | 336 | 7 2012 AJKD |
| Hemoglobin (g/dL) | | 10.35 vs. 10.97 | stage 5D (HD) | Fried Phenotypes | 320 | 112017 J Aging Res |
| r = -0.336, p = 0.004 | stage 5D (HD) | Fried Phenotypes | 74 | 9 2018 Clinics |
| 12.2 vs. 13.2 | stages 1-4 | Modified CHS scale | 336 | 7 2012 AJKD |
| 10.1 vs. 9.2 (moderate/severe vs. NF/mild) | stage 5D (HD) | FRAIL scale | 46 | 16 2017 BMCG |
| Total cholesterol | | 4.48 vs. 5.18 mmol/L (severe F vs. NF) | stage 5D (PD) | In-house frailty questionnaire | 193 | 18 2016 KBPR |
| 134 vs. 148 mg/dL | stage 5D (HD) | Fried Phenotypes | 151 | 26 J Ren Nutr |
| LDL cholesterol (mmol/L) | | 2.51 vs. 3.02 (severe F vs. NF) | stage 5D (PD) | In-house frailty questionnaire | 193 | 18 2016 KBPR |
| HDL cholesterol | | 1.18 vs. 1.38 mmol/L (severe F vs. NF) |
| 40 vs. 46 mg/dL | stage 5D (HD) | Fried Phenotypes | 151 | 26 J Ren Nutr |
| iPTH (pg/mL) | | 248.8 vs. 127.9 | stages 3-5 | Modified Fried Phenotypes | 61 | 3 2012 Mansur |
| Ferritin (ng/mL) | | 1202 vs. 534 | stage 5D (HD) | FRAIL scale | 46 | 37 Nephrology |
| Transferrin saturation (%) | | 30.1 vs. 37.1 | stages 3-5 | Modified Fried Phenotypes | 61 | 3 2012 Mansur |
| 25-OH-D (ng/dL) | | r = -0.363, p = 0.002 | stage 5D (HD) | Fried Phenotypes | 74 | 9 2018 Clinics |
| CRP (mg/dL) | | 3.8 vs. 2.1 | stages 1-4 | Modified CHS scale | 336 | 7 2012 AJKD |
| 1.12 vs. 0.28 (natural Log transformed) | stage 5D (PD) | Clinical Frailty Scale | 119 | 12 2018 PDI |
| IL-6 (pg/mL) | | 2.45 vs. 1.58 (natural Log transformed) | stage 5D (PD) | Clinical Frailty Scale | 119 | 12 2018 PDI |
| nPNA (g/kg/day) | | 1.10 vs. 1.19 | stage 5D (PD) | In-house frailty questionnaire | 178 | 15 2018 KBPR |
| **CKD-related complications** | | | Counts of complications | | r = 0.666, p < 0.0001 | Elderly with unknown CKD stages | Edmonton Frail Scale | 35 | 17 2016 Rev Rene |
| **Residual renal function** | | | Residual eGFR (ml/min/1.73m2) | | 1.54 vs. 2.46 | stage 5D (PD) | In-house frailty questionnaire | 178 | 15 2018 KBPR |
| 0.9 vs. 2.2 | stage 5D (PD) | In-house frailty questionnaire | 193 | 18 2016 KBPR |
| **Care modality** | | | Assisted PD | | 38.6% vs. 0% (severe F vs. NF) | stage 5D (PD) | In-house frailty questionnaire | 193 | 18 2016 KBPR |
| Living with caregivers | | 45% vs. 72% | Elderly with stages 4/5 CKD | Groningen frailty indicator | 65 | 19 Ren Fail |
| Renal conservative care | | 45% vs. 2% | Elderly with stages 4/5 CKD | Groningen frailty indicator | 65 | 19 Ren Fail |
| **Dialysis related parameters** | | | Kt/V | | 1.69 vs. 1.55 (moderate/severe vs. NF/mild) | stage 5D (HD) | FRAIL scale | 46 | 16 2017 BMCG |
| 1.44 vs. 1.58 | stage 5D (HD) | Fried Phenotypes | 151 | 26 J Ren Nutr |
| Weekly total Kt/V | | 1.74 vs. 1.96 (severe F vs. NF) | stage 5D (PD) | In-house frailty questionnaire | 193 | 18 2016 KBPR |
| URR | | 76.2% vs. 72.5% (moderate/severe vs. NF/mild) | stage 5D (HD) | FRAIL scale | 46 | 16 2017 BMCG |
| Daily exchange volume (L) | | 6.5 vs. 7.0 (severe F vs. NF) | stage 5D (PD) | In-house frailty questionnaire | 193 | 18 2016 KBPR |
| **Vascular access** | | | Catheter, AVF, and AVG use | | Catheter: 61.6% vs. 17.8%  AVF: 27.78% vs. 77.5%  AVG: 11.11% vs. 5% | stage 5D (HD) | Fried Phenotypes | 320 | 11 2017 J Aging Res |
| Microbiota | | | Bacterial Abundance of some genera (Mogibacteriacee, Coriobacteriacee, Eggerthella, Erwinia, Coprobacillus, Anaerotruncus, etc) | | Higher in F group | stages 3b/4 | Fried Phenotype | 79 | 20 NDT |
| Neurological | | | Quantitative EEG findings | |  | stage 5D (HD) | FRAIL scale | 46 | 16 2017 BMCG |
|  | Delta wave (central, right/left TO, left frontal area) | Lower in F group |
| Delta to alpha ratio (global, central, left frontal, right/left TO area) | Lower in F group |
| Delta/theta to alpha/beta ratio (global, central, left frontal, right/left TO area) | Lower in F group |
| Cognitive impairment | |  | stage 5T | Fried phenotypes | 665 | 30 JASN |
|  | Prevalence | 11% vs. 6.6% |
| Pre-transplant 3MS scores | 93.0 vs. 96.0 |
| 3MS memory | 20.0 vs. 21.0 |
| 3MS identification/association | 23.0 vs. 24.0 |
| Psychological | | |  | |  |  |  |  |  |
|  | Mood | | Mood Change | | Negative correlation | stage 5D (HD) | Edmonton Frail Scale | 60 | 21 Act Paul Enferm |
| Anxiety | | Hospital Anxiety and Depression Scale | | Higher global, psychological and social components (women)  Higher physical component (men) | stage 5D (online-HDF) | N/A | 97 | 22 NDT |
| Depression | | Depression | | 38.8% vs. 12.58% | stage 5D (HD) | Fried Phenotypes | 320 | 11 2017 J Aging Res |
| Hospital Anxiety and Depression Scale | | Higher global, psychological, physical component (men) | stage 5D (online-HDF) | N/A | 97 | 22 NDT |
| Self-reported major depression | | 83% vs. 6% | stages 1-5 | Edmonton Frail Scale (EFS) | 41 | 14 Can J Diabet |
| Physical activity | | | Minnesota Leisure Time Activity (LTA) | | 95 vs. 735 | stage 5D (HD) | Fried Phenotypes | 68 | 25 J Ren Nutr |
| Low Physical Activity Questionnaire (LoPAQ) | | 280 vs. 798 |
| Sitting (hours/day) | | 6.5 vs. 5 |
| Grip strength (kg) | | 16.4 vs. 24.6 | stage 5D (PD) | Clinical Frailty Scale | 119 | 12 2018 PDI |
| Walk speed (m/s) | | 0.79 vs. 1.67 |
| Nutritional Status | | | SGA scores | | 5.25 vs. 5.75 | stage 5D (PD) | In-house frailty questionnaire | 178 | 15 2018 KBPR |
| 4.2 vs. 5.3 (severe F vs. NF) | stage 5D (PD) | In-house frailty questionnaire | 193 | 18 2016 KBPR |
| MIS scores | | 8.14 vs. 5.12 | stage 5D (PD) | In-house frailty questionnaire | 178 | 15 2018 KBPR |
| 12.2 vs. 6.0 (severe F vs. NF) | stage 5D (PD) | In-house frailty questionnaire | 193 | 18 2016 KBPR |
| 7.6 vs. 3.9 | stages 3b/4 | Fried Phenotype | 79 | 20 NDT |
| MNA scores | | 18.0 vs. 22.0 | Elderly with stage 5D | Multidimensional frailty score | 46 | 62 JKMS |
| Quality of Life | | | Kidney Disease Quality of Life (KDQoL) components | |  |  |  |  |  |
|  | Mental health | 43.6 vs. 48.9 | stage 5D (HD) | Fried Phenotypes | 151 | 26 J Ren Nutr |
| Kidney disease symptoms | 67.8 vs. 79.1 |
| SF-36 | |  |  |  |  |  |
|  | Physical functioning | 46 vs. 84 | stages 3-5 | Modified Fried Phenotypes | 61 | 41 HQoLO |
| Role physical | 53.8 vs. 75 |
| Bodily pain | 58.4 vs. 76.5 |
| General health | 48.9 vs. 62 |
| Vitality | 58.8 vs. 77.4 |
| Mental health | 69.5 vs. 80.8 |
| **Functional outcomes** | | | Ability for basic ADL | | 33.33% vs. 76.4% | stage 5D (HD) | Fried Phenotypes | 320 | 11 2017 J Aging Res |
| 55% vs. 91% | Elderly with stages 4/5 CKD | Groningen frailty indicator | 65 | 19 Ren Fail |
| Ability to transfer | | 38.8% vs. 84.7% | stage 5D (HD) | Fried Phenotypes | 320 | 11 2017 J Aging Res |
| Barthel Index | | 90 vs. 100 | stage 5D (PD) | Clinical Frailty Scale | 119 | 12 2018 PDI |
|  | | Disability | ≥1 disability in ADL | | 15% vs. 5% | CKD stages 1-4 | Fried Phenotypes | 336 | 7 2012 AJKD |
| ≥1 disability in IADL | | 60% vs. 28% |
| ≥1 disability in mobility | | 40% vs. 18% |
| Functional status | Karnofsky scores | | 44.4 vs. 95.36 | stage 5D (HD) | Fried Phenotypes | 320 | 11 2017 J Aging Res |
| Health-care utilization | | | Hospitalization >= 1 time per year | | 90% vs. 53% | Elderly with stages 4/5 CKD | Groningen frailty indicator | 65 | 19 Ren Fail |
| Hospitalization frequency (per year) | | 0.78 vs. 0.28 episodes | stage 5D (HD) | Fried Phenotypes | 320 | 11 2017 J Aging Res |
| Hospitalization episode count | | 3.31 vs. 2.12 vs. 0.9 (in 2 years) (F + D vs. F – D vs. NF ) | stage 5D (PD) | In-house frailty questionnaire | 178 | 15 2018 KBPR |
| 5.2 vs. 2.4 per year (severe F vs. NF) | stage 5D (PD) | In-house frailty questionnaire | 193 | 18 2016 KBPR |
| Cardiovascular origin hospitalization count | | 1.4 vs. 0.5 per year (severe F vs. NF) |
| Hospital stay (days per year) | | 26.62 vs. 14.05 vs. 8.04 (2 years) (F + D vs. F – D vs. NF ) | stage 5D (PD) | In-house frailty questionnaire | 178 | 15 2018 KBPR |
| 58.5 vs. 18.3 per year (severe F vs. NF) | stage 5D (PD) | In-house frailty questionnaire | 193 | 18 2016 KBPR |
| **Technique survival** | | | Technique failure | | 42.5% vs. 35.8% vs. 13.7% (2 years) (F + D vs. F – D vs. NF ) | stage 5D (PD) | In-house frailty questionnaire | 178 | 15 2018 KBPR |
| **Mortality** | | | Overall mortality | | 20.45% vs. 12.36% (1 year) | stage 5D (HD) | Fried Phenotypes | 320 | 11 2017 J Aging Res |
| 37.5% vs. 28.6% vs. 13.4% (2 years) (F + D vs. F – D vs. NF ) | stage 5D (PD) | In-house frailty questionnaire | 178 | 15 2018 KBPR |
| 30% vs. 10% (1 year) | Elderly with stages 4/5 CKD | Groningen frailty indicator | 65 | 19 Ren Fail |

**Table 4**. Confounder-adjusted risk of complications resulting from frailty in CKD patients

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Category | | Type | | | Hazard/odds ratio, Risk Difference (95% CI), or values in F vs. NF groups | Patient CKD Severity | Frailty Assessment method | Sample Size | Ref |
| Physical examination | | Blood pressure | | | Lower in Frail group (adjusted *p* = 0.001) | stages 1-5 | Edmonton Frail Scale | 41 | 14 2019 Can J Diabet |
| **Biological** | |  | | |  |  |  |  |  |
|  | Cardiovascular | QRS duration | | | β= −0.29, t = −2.03, p = 0.048 | stage 5D (HD) | Edmonton frailty scale | 41 | 28 PeerJ |
| β= −0.27, t = −1.84, p = 0.05 | FRAIL scale |
| Musculoskeletal | Vertebral compression fracture (any) | | | OR 1.8 per FRAIL score (p = 0.01) | stage 5D (HD) | FRAIL Scale | 43 | 34 JAGS |
| Cognitive function | 3MS scores | | At baseline | -2.37 (-4.21 to -0.53) compared to NF | stage 5D (HD) | Fried Phenotypes | 324 | 10 2015 CJASN |
| 1-year | -2.80 (-5.37 to -0.24) compared to NF |
| Pre-transplant | -1.8 compared to NF | stage 5T | Fried phenotypes | 665 | 30 JASN |
| 1-4 years post-transplant | -0.04 per year (-0.06 to -0.01) |
| TMT-A | | At baseline | 12.08 (4.73 to 19.43) compared to NF | stage 5D (HD) | Fried Phenotypes | 324 | 10 2015 CJASN |
| TMT-B | | At baseline | 33.15 (9.88 to 56.42) compared to NF |
| Body composition | Lean mass | | | Lower lean mass over cephalic, trunk, and 4 extremities than NF group | stage 5D (HD) | FRAIL scale | 44 | 32 JPSM |
| BMD at 1 year follow up | | |  | stage 5D (HD) | FRAIL Scale | 43 | 33 PeerJ |
|  | Total | | ß = −0.53, t = −3.27, p < 0.01 |
|  | L1 | | ß = −0.4, t = −2.18, p = 0.04 |
|  | L4 | | ß = −0.39, t = −2.1, p = 0.046 |
|  | Femoral neck | | ß = −0.5, t = −2.96,  p < 0.01 |
| Average L-spine areas | | |  |
|  | 1 year of follow up | | ß = −0.48, t = −2.84, p < 0.01 |
|  | Interval changes | | ß = −0.5, t = −3.02, p < 0.01 |
| Interval changes in L-spine Z-score percentages | | | ß = −0.45, t =−2.11, p=0.049 |
| QUS parameters | | |  |  |  |  |  |
|  | SOS | | 1487.8 vs. 1537.8 (female)  1493.7 vs. 1542.2 (male) | stage 5D (HD) | CHS scale | 214 | 35 JBMM |
|  | BUA | | 86.2 vs. 100.7 (female)  93.8 vs. 107.8 (male) |
|  | Stiffness index | | 54.0 vs. 77.7 (female)  60.9 vs. 83.6 (male) |
| Muscles | | |  |  |  |  |  |
|  | Quadriceps muscle area | | r = -30.28,p = 0.02 | stage 5D (HD) | Performance-based frailty | 80 | 36 J Ren Nutr |
|  | Appendicular skeletal muscle mass index (ASMI) | | Lower in Frail group (adjusted *p* < 0.05) | stages 1-5 | Edmonton Frail Scale (EFS) | 41 | 14 2019 Can J Diabet |
| Appendicular fat percentage | | |  | stage 5D (HD) | FRAIL scale scores | 44 | 32 JPSM |
|  | Left/Right lower extremity | | β=0.34, t = 2.32; p = 0.03 (left);β=0.3, t = 2.05; p = 0.048 (right) |
|  | Left/Right upper extremity | | β=0.37, t = 2.66; p = 0.01 (left);β=0.43, t = 3.09; p <0.01 (right) |
| Sarcopenia | | | OR 12.2 (2.27-65.5) | stage 5D (PD) | Clinical Frailty Scale | 119 | 12 2018 PDI |
| Laboratory data | | Serum albumin (g/dL) | | | Negative relationship (p = 0.01) | stage 5D (HD) | FRAIL scale | 46 | 37 Nephrology |
| Psychological | | Hospital anxiety and depression scale | | | OR 1.21 (1.11-1.31) | stage 5D | Clinical Frailty Scale | 251 | 42 2016 CJASN |
| Functional status | | Physical functioning | | | Lower in Frail group (adjusted *p* = 0.004) | stages 1-5 | Edmonton Frail Scale (EFS) | 41 | 14 2019 Can J Diabet |
| Need assistance in ADL | | | OR 1.93 (1.01-3.68) for pre-frail  OR 11.32 (5.49-23.32) for frail | stage 5D (HD) | Modified Fried Phenotypes | 742 | 31 HDI |
| Barthel index scores | | | OR 0.89 (0.86-0.93) | stage 5D | Clinical Frailty Scale | 251 | 42 2016 CJASN |
| **Psychological** | |  | | |  |  |  |  |  |
|  | Delirium | Post-transplantation delirium | | | OR 2.05 (1.02-4.13) | stage 5T | Fried Phenotypes | 893 | 23 JASN |
| Distress | Self-reported distress thermometer | | | β = 0.35 (0.12-0.58), t = 3.0, p = 0.003 | stage 5D (HD) | Canadian frailty score | 382 | 38 Nutr Clin Pract |
| Fall | | Any fall | | | HR 2.1 (1.21-3.92) | stage 5D (HD) | Fried Phenotypes | 205 | 1 2017SJKDT |
| OR 2.39 (1.22-4.71) | Stage 5D (HD) | Modified Fried Phenotype | 762 | 44 CKJ |
| Increased numbers of falls | | | HR 3.09 (1.38-6.90) | stage 5D (HD) | Modified Fried Phenotype | 95 | 45 BMCN |
| Time to first fall | | | HR 1.60 (1.16-2.20) | stage 5D (HD) | Self-reported frailty | 1646 | 47 AJN |
| **Quality of Life** | | KDQoL | | |  |  |  |  |  |
|  | Physical health | | 33.7 vs. 40.7 | stage 5D (HD) | Fried Phenotypes | 151 | 26 J Ren Nutr |
| Effects of disease | | 51.6 vs. 66.8 |
| KDQoL short form | | |  |  |  |  |  |
|  | Physical component | | Difference -6.31 (-8.16 to -4.46) | stage 5T | Fried Phenotypes | 443 | 43 Transplantation |
| Physical functioning | | Difference -14.17 (-18.58 to -9.76) |
| Role limitations | | Difference -15.37 (-22.96 to -7.78) |
| Bodily pain | | Difference -9.45 (-14.33 to -4.57) |
| General health | | Difference -11.76 (-15.94 to -7.59) |
| Emotional well-being | | Difference -3.05 (-6.01 to -0.09) |
| Social functioning | | Difference -6.19 (-10.98 to -1.41) |
| Energy | | Difference -11.66 (-16.3 to -7.03) |
| Kidney disease-specific HRQoL | | | Difference -6.53 (-9.17 to -3.89) |
|  | Symptoms | | Difference -5.5 (-8.2 to -2.79) |
| Effects | | Difference -7.69 (-11.66 to -3.72) |
| Burden | | Difference -10.19 (-15.94 to -4.44) |
| Cognitive function | | Difference -5.51 (-9 to -2.02) |
| Social interaction | | Difference -4.7 (-7.85 to -1.56) |
| Sleep | | Difference -6.29 (-10.56 to -2.02) |
| Social support | | Difference -5.69 (-9.92 to -1.47) |
| HRQoL | | |  |  |  |  |  |  |
|  | Fair/Poor HRQoL at follow-up | | OR 2.79 (1.32-5.90) | stage 5D | Fried Phenotypes | 233 | 39 J Frailty Aging |
| Worse HRQOL after follow-up | | RR 2.91 (1.08-7.80) |
| SF-36 | | |  |  |  |  |  |  |
|  | Physical components | | Lower in Frail group (adjusted *p* = 0.002) | stages 1-5 | Edmonton Frail Scale | 41 | 14 2019 Can J Diabet |
| β = -0.566, t = -8.792, p < 0.001 | stage 2-4 | Modified Fried Phenotypes | 168 | 40 HQoLO |
| Mean difference -1.12 (-1.47 to -0.76) | stages 3-5 | Modified Fried Phenotypes | 61 | 41 HQoLO |
| Mental components | | Mean difference -0.75 (-1.4 to -0.16) |
| β = -0.485, t = -6.709, p < 0.001 | stage 2-4 | Modified Fried Phenotypes | 168 | 40 HQoLO |
| SF-12 | | |  |  |  |  |  |
|  | MCS | | OR 0.94 (0.91-0.97) | stage 5D | Clinical Frailty Scale | 251 | 42 2016 CJASN |
| PCS | | OR 0.88 (0.84-0.91) |
| Symptom scores | | | OR 1.23 (1.13-1.34) |
| KDQOL-SF scores 3 months after transplant | | |  | stage 5T | Fried Phenotypes | 443 | 43 Transplantation |
|  | Physical HRQoL | | 0.34/month vs. 1.35/month |
| Kidney disease-specific HRQoL | | | 2.41/month vs. 3.75 points/month |
|  | Effects | | 4.01/month vs. 7.1/month |
| Cognitive function | | 1.28/month vs. 2.88/month |
| Social interaction | | -0.57/month vs. 1.18/month |
| **Graft Loss** | | Risk of graft loss in depressive patients | | | aHR 6.20 (1.67 to 22.95) | stage 5T | Fried Phenotypes | 773 | 48 Clin Transplant |
| Immunosuppressant use | | MMF dose reduction | | | HR 1.29 (1.01-1.66) | stage 5T | Modified Fried Phenotypes | 525 | 13 2015 Transplant |
| Dialysis access survival | | Access failure | | | HR 2.63 (1.03-6.71) | stage 5D (HD) | FRAIL scale | 51 | 29 Nephrology |
| Health-care utilization | | Hospitalization or mortality | | | HR 1.56 (1.36-1.79) | stage 5D | Modified Fried Phenotypes | 2275 | 4 2007 JASN |
| Hospitalization | | | HR 2.06 (1.18-3.58) | stage 5D (HD) | Fried Phenotypes | 205 | 1 2017SJKDT |
| aHR 1.83 (1.41-2.37) | stage 5D | Modified CHS scale | 1658 | 49J Ren Nutr |
| HR 1.43 (1.00-2.03) | stage 5D (HD) | Fried Phenotypes | 146 | 50 JAGS |
|  | Number of all-cause hospitalizations | | beta = 0.29, p < 0.0001 | stage 5D (PD) | In-house frailty questionnaire | 193 | 18 2016 KBPR |
| Number of cardiovascular hospitalizations | | beta = 0.37, p < 0.0001 |
|  | Time to first hospitalization | | HR 1.26 (1.09-1.45) | stage 5D (incident) | Modified Fried Phenotypes | 1576 | 46 JAMA-IM |
| Early Hospital Readmission | | | RR 1.59 (1.17-2.17) | stage 5T | Fried Phenotypes | 383 | 51 Am J Transplant |
| Longer Length of Stay | | |  |  |  |  |  |
|  | LOS (days) | | RR 1.15 (1.03-1.29) | stage 5T | Fried Phenotypes | 589 | 52 Ann Surg |
| > 2 weeks | | OR 1.57 (1.06-2.33) |
| OR 2.02 (1.20-3.40) for increased frail category; OR 1.92 (1.13-3.25) for increased frail scores | stage 5 | Fried Phenotypes | 569 | 53 Transplantation |
| In depressive patients | | aRR 1.88 (1.70-2.08) | stage 5T | Fried Phenotypes | 773 | 48 Clin Transplant |
| Hospitalization frequency | | | Higher in Frail group (adjusted *p* < 0.001) | stages 1-5 | Edmonton Frail Scale (EFS) | 41 | 14 2019 Can J Diabet |
| Emergency department visit frequency | | | Higher in Frail group (adjusted *p* = 0.002) |
| Total medical visit frequency | | | Higher in Frail group (adjusted *p* = 0.001) |
| **Mortality** | | Overall mortality | | | HR 2.17 (1.01-4.65) after transplantation | stage 5T | Fried Phenotypes | 537 | 54 Am J Transplant |
| HR 2.0 (1.5-2.7) | stages 1-5 | Modified Fried Phenotypes | 10256 | 5 2009 AJM |
| HR 1.57 (1.25-1.97) | stage 5D (incident) | Modified Fried Phenotypes | 1576 | 46 JAMA-IM |
| HR 2.24 (1.60-3.15) | stage 5D | Modified Fried Phenotypes | 2275 | 4 2007 JASN |
| HR 1.22 (1.04-1.43) | stage 5D | Clinical Frailty Scale | 390 | 55 2015 CJASN |
| HR 4.28 (1.22-14.98) | stages 4/5 | PRISMA questionnaire & TUGT | 104 | 56 SJKDT |
| HR 9.83 (1.80-53.7) | stage 5D (PD) | Clinical Frailty Scale | 119 | 12 2018 PDI |
| HR 2.60 (1.04-6.49) | stage 5D (HD) | Fried Phenotypes | 146 | 50 JAGS |
| HR 2.08 (1.04-4.16) | stage 5D | Modified CHS scale | 1658 | 49J Ren Nutr |
| HR 1.78 (1.15-2.8) for performance-based frailty; HR 1.66 (1.06-2.6) for self-reported frailty; HR 1.95 (1.19-3.2) for both definition positivity | stage 5D (HD) | Modified Fried Phenotypes and self-reported frailty | 771 | 57 CJASN |
| HR 1.66 (1.03-2.67) in general; HR 3.77 (1.10-12.92) in general obesity; HR 2.38 (1.17-4.82) in abdominal obesity | stage 5D (HD) | Fried Phenotypes | 370 | 59 NDT |
| HR 2.43 (1.48-3.99) | stage 5D and 5T from ANCA vasculitis | Inability to walk without help | 425 | 60 QJM |
| HR 1.93 (1.58-2.36) | stage 5D and 5T from MM or amyloidosis | Inability to walk without help | 1462 | 61 CJASN |
|  | In depressive patients | | aHR 2.62 (1.03 to 6.70) | stage 5T | Fried Phenotypes | 773 | 48 Clin Transplant |
| Modify the association between comorbidity and mortality | | | HR 0.75 (0.44-1.29) in F group vs. 1.66 (1.17-2.35) in NF group | stage 5 | Fried Phenotypes | 2086 | 58 Am J Nephrol |
|  | | | HR 1.93 (1.58-2.36) | stage 5D and 5T from MM or amyloidosis | Inability to walk without help | 1462 | 61 CJASN |
| Post-transplant mortality | | | HR 2.27 (1.11-4.65) for increased frail category; OR 2.36 (1.12-4.99) for increased frail scores | stage 5 | Fried Phenotypes | 569 | 53 Transplantation |
| **Composite** | | Mortality or dialysis | | | HR 2.5 (1.4-4.4) | stages 1-4 | Modified CHS scale | 336 | 7 2012 AJKD |
| Mortality or cardiovascular hospitalization | | | HR 23.58 (1.61-346.03) | Elderly with stage 5D (HD) | Multidimensional frailty score | 46 | 62 JKMS |
| 30-day post-transplant complications | | | β=13.31 (5.72-20.89), p = 0.0007 | stage 5T | Groningen Frailty Indicator | 150 | 63 Transplant Int |

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