Outcomes and care priorities for older people living with frailty and advanced chronic kidney disease: a multi-professional scoping review

SUPPLEMENTARY DATA

Appendix 4: Table of Included Studies

	Aims	Design	Population	Frailty Assessments	PPI	Outcomes	Results
Baddour 2019 USA [1]	Determine the association of self-reported health and surprise question with frailty and functional status in older adults with chronic kidney disease (CKD) and their utility as screening tools	Prospective Cohort study	ACKD	Self-reported health, CFS, Fried, ADL's	N	Frailty and ADL'S	Both patient and provider subjective health assessments were moderately correlated with Fried frailty score, CFS score, and measures of functional status. SRH and the SQ demonstrated a fair correlation with each other. These findings were generally consistent regardless of age, the presence of diabetes or cardiovascular disease, or overall comorbidity burden.
Bancu 2017 Spain [2]	To define a frailty pattern among our dialysis population, to analyse the incidence and clinical evolution of these patients.	Retrospective cross sectional observational study	HD	Fried phenotype	N	Hospitalisation and mortality	Statistically significant differences between the two groups in terms of hospital admissions (0.77727) admissions/year of frail patients versus 0.2838 admissions per year of non-

							frail patients p = 0.005). Mortality in the group of frail patients was 20.45%, while in non-frail patients it was 12.36% (p < 0.005).
Chang et al 2020 China [3]	A randomized parallel controlled trial will be conducted to compare an individualized intervention according to the consequence of the comprehensive geriatric assessment with routine treatment.	Protocol for RCT	CKD3-5	Fried, hand grip strength, SPPB, MMSE	N		N/A
Chao and Huang 2015 Taiwan [4]	We hypothesize that in ESRD patients, frailty might demonstrate significant association with their ECG parameters, thus potentially influencing the arrhythmogenic potential and the subsequent risk of cardiovascular mortality	Prospective Cohort study	HD	Six different self-report questionnaires with Chinese-translation including Strawbridge questionnaire (frailty if >1 positive domain), Edmonton frailty scale (if score ≥8), Simple FRAIL scale (if score ≥3), Groningen frailty instrument (if score ≥4), G8 questionnaire (if score 514), and Tilburg frailty instrument (if score ≥5)	N	ECG and QRS duration	Self-report frailty is significantly associated with QRS duration in chronic haemodialysis patients, and the association is independent of serum electrolyte levels and heart failure status

Chao et al 2015 Taiwan [5]	Prospective cohort study comparing self-reported questionnaires demographic data collected and variables with complications of dialysis	Prospective cohort study	HD	Strawbridge, Edmonton, G8, Groningen, 5 item frailty Tilburg frailty indicator	N	Frailty dialysis complications	Scores from each questionnaire showed significant association with each other, except the G8 questionnaire. FRAIL scale correlated significantly with age (P = 0.02), female gender (P = 0.03), higher Liu's comorbidity index (P = 0.02), lower serum albumin (P = 0.03) and creatinine levels (P < 0.01), and higher ferritin levels (P = 0.02). Multivariate linear regression analysis identified an independently negative association between serum albumin and the simple FRAIL scale results (P = 0.01).
Chao and Huang 2016 Taiwan [6]	We hypothesize that GS could modify the medication adherence status of chronic dialysis patients, and investigate this issue using a prospectively enrolled cohort.	Prospective Cohort study	HD	Frail scale	N	Medication adherence Taiwanese version of the eight-item Morisky Medication Adherence Scale (MMAS)	Using the simple FRAIL scale, 10 (19.6%) patients were categorized as frail, and 24 (47.1%) were pre-frail. Polypharmacy occurred in 48 (94%) patients, and extreme polypharmacy was found in 27 (53%) patients. 80% of chronic dialysis patients had low medication adherence, and the severity of non-adherence increased significantly with younger age, lower degree of frailty, and lower dialysis clearance.

Chao et al 2017 Taiwan [7]	Whether frailty is associated with temporal changes in BMD	Prospective Cohort study	ESKD	Frail scale	N	DEXA and bone health density	Among all ESRD survivors (mean 69.1 9.1 years, 47.2% male; frail 14%, pre-frail 53% robust 33%).. The BMI among those with and without frailty no significant difference (p = 0:88).
Chao et al 2017 Taiwan [8]	We tested the hypothesis that self-report frailty increased the risk of incident Vascular Access (VA) failure after frailty assessment in patients.	Prospective Cohort study	ESKD	Self-reported frailty scale	N	Frailty, death, vascular access complications	Accounting for age, dialysis duration, DM, and laboratory results, Cox proportional regression analysis showed that frailty increased the risk of VA failure during follow up (hazard ratio [HR] 2.63, 95% confidence interval1.03–6.71, P = 0.04
Chao et al 2020 Taiwan [9]	A pilot study to validate the Laboratory deficit-based frailty index (LFI) against other frailty measures and examine outcome predictability (mortality)	Prospective Cohort study	ESKD	LFI and a modified Cardiovascular Health Study (CHS) scale based on self-report responses and six types of existing self-report frailty instruments in Chinese versions: the Strawbridge questionnaire (SQ), Edmonton frail scale (EFS), Groningen frailty indicator (GFI), Tilburg frailty indicator (TFI), G8 questionnaire and FRAIL scale	N	Biochemical and clinical variables	Frailty prevalence was 33.3% (CHS), 78.8% Strawbridge questionnaire, 45.5% (EFS), 57.6% (GFI), 27.3% (Tilburg frailty indicator), 84.8%(G8) and 18.2% (FRAIL) among ESRD participants. LFI-1 results were significantly correlated with those of LFI-2 (P< 0.01), EFS (P= 0.04) and GFI (P< 0.01), while LFI-2 results were not. Those with CHS or GFI-identified frailty had significantly lower 1,25-(OH)2-D levels than those without. After 5.4 months, patients with high LFI-1 scores, but not LFI-2, had higher mortality than those with lower scores.

Chowdhury et al 2017 Australia [10]	Articles before 2016 on frailty in CKD	Systematic Review	Pre dialysis, HD and KT		N	Minimental, ADL, iADL, Medicines	32 met the criteria. Twenty-three (72%) studies used or adapted the Fried phenotype to measure frailty. The prevalence of frailty ranged from 7% in community-dwellers (CKD Stages 1 –4) to 73% in a cohort of patients on haemodialysis. The incidence of frailty increased with reduced glomerular filtration rate. Frailty was associated with an increased risk of mortality and hospitalization.
Coelho 2020 Brazil [11]	AGNES is a prospective observational cohort that aims to investigate clinical, biochemical, and demographic factors associated with RRT initiation and mortality of patients with CKD stage 4 or 5 who are aged 70 years and older	Protocol	CKD 4-5	Full CGA, ADL's Cognition, Fried, CCI, Nutrition	N	Other measures sleep, monitoring device for BP and more biomarkers	N/A
Coppolino et al 2018 Italy [12]	To assess the entity of functional, general health and cognitive impairment and the possible relationship between these types of dysfunction and the severity of renal impairment.	Cross sectional	CKD	Fried phenotype, mini mental, ADL	N	Function, general health and cognition	Mild-to-moderate CKD is highly pervasive among frail elderly individuals and the severity of renal dysfunction is independently correlated with that of cognitive impairment.

Crespo et al 2020 Spain [13]	Incidence of COVID-19 in prevalent elderly KT patients, the characteristics of the first 16 symptomatic COVID-19 elderly KT recipients from a program and their outcomes until death or a minimum of 2 weeks after symptoms	Cohort	Transplant	Fried phenotype	N	Mortality	Short-term 14-day fatality rate in this group has been 50%, those who died had worse renal function before infection. They were more frequently obese, frail and had underlying heart disease.
De Sousa Meira et al 2016 Brazil [14]	Cross-sectional study to assess the frailty level of elderly under conservative management	Cross sectional	Conservative care	Edmonton Frailty Scale (0-17)	N	Socio-demographic and clinical variables	Minimum score of 1 and maximum of 14, with a mean score 7.71 (±3.10). Women (8.05±3.551) and illiterates (9.57±2.637) showed a higher mean score of frailty. By correlating the frail score, a moderate inverse correlation was found with years of study (p=0.033) and moderate positive correlation with some complications (p<0.05)
Drost et al 2016 Netherlands [15]	Cross-sectional study to measure the prevalence of frailty with two different measures	Cross sectional	ACKD,PD,HD	Frailty index (FI) and Frailty Phenotype (FP)	N	Prevalence of frailty	FI: 43.6% (>65) FP: No prevalence for over 65s provided. Being female and having more comorbidities was associated with higher frailty levels. The FI identified different but overlapping participants as frail compared with the FP; 62.5% of frail participants according to FI were also frail according to the FP

Farragher et al 2019 Canada [16]	The study objective was to formally assess the type and frequency of PD assistance received by patients over 50, and the relationship to observed frailty, functional status, and cognitive ability at the time of PD therapy initiation.	Prospective observational study	PD	Barthel, Lawton Brody IADL, MoCA, Fried, TUG, Hand grip strength	N	Peritoneal dialysis tasks were divided into 9 basic PD activities and 4 instrumental PD activities that need to be performed on a routine basis.	A total of 75 (62%) patients received assistance for a variety of tasks from friends or family (n = 41, 34%) or a paid caregiver (n = 34, 28%) 1 month after starting dialysis. At baseline, there was a high prevalence of functional dependency (79/120, 66%), frailty (71/110, 65%), and impaired cognition (68/115, 59%). Only 5% were fully independent, clinically robust, and scored within the normal range on cognitive testing. Factors associated with PD assistance included comorbidity ($p < 0.03$), cognitive impairment ($p < 0.0001$), and functional dependence ($p < 0.02$).
Fernandez et al 2019 US [17]	Multicentre prospective cohort study to test whether comorbidity is equally associated with waitlist mortality among frail and non-frail transplant candidates and to test whether measuring comorbidity burden and frailty improve mortality risk prediction.	Prospective cohort study	KT	Fried phenotype	N	Transplant waitlist mortality	Among frail KT candidates, a high comorbidity burden is not associated with waitlist mortality. However, among candidates a high comorbidity burden is. These findings are consistent with the conceptual model for frailty in which this phenotype can result from comorbidity but also exist in the absence of comorbidity

Garcia-Canton et al 2019 Spain [18]	Observational prospective longitudinal study to estimate frailty prevalence in a haemodialysis population and its influence on short-term outcomes	Prospective observational study	HD	Edmonton Frailty Scale (EFS) (0-17)	N	Mortality, hospitalization and visits to hospital emergency services	According to the EFS, 82 patients (29.6%) were frail, 53 (19.1%) were vulnerable, and 142 (51.3%) were non-frail. During follow-up, 58.5% frail patients, 30.2% vulnerable, and 16.2% non-frail ones died (p<.005). A higher hazard of mortality was observed in frail than in non-frail patients (HR 2.34; 95% CI 1.39–3.95;p <.001). During follow-up the hospitalization rate was 852 episodes/1000 patient-years for frail patients, 784 episodes/1000 patient-years for vulnerable patients, and 417 episodes/1000 patient-years for non-frail patients (p<0005). The incidence ratio of visits to emergency services was 3216, 1735, and 1545 visits/1000 patient-years for each group (p<.001).
Gigilo et al 2015 Brazil [19]	Observational and cross-sectional study to examine the association between frailty and quality of life (QOL), nutritional status and clinical condition in elderly patients on haemodialysis (HD)	Cross sectional	HD	Fried phenotype	N	KDQOL, SGA and biochemical markers	Prevalence of frailty, prefrail and non-frail was 31% (n=48), 62% (n=97) and 8% (n=12), respectively. In conclusion elderly on HD frailty was associated with worse QOL and nutritional status. The inflammatory status was worse in the Frail and Pre-frail groups

Gopinathan et al 2020 India [20]	The aim of this study is to establish the prevalence of frailty in elderly patients with CKD on HD, measured with two assessment instruments: physical performance measurement and self-report measurement, in one population and to determine the correlates of frailty among the elderly patients on HD in south India	Cross sectional	HD	Fried SF 36, MoCA, self-reported frailty	N	Frailty and cognitive impairment	Prevalence of frailty was 56.4% with method 1 and 64.1% with method 2. Patients having cognitive impairment had a significantly higher prevalence of frailty. The self-report measure-based frailty assessment (method 2) has a lower cut-off point for the definition of frailty as more patients were identified as frail, in comparison with the physical performance measurement-based frailty assessment (method 1) in this dialysis population

Goto et al 2019 Netherlands [21]	The aim of this study was to assess the association at initiation of maintenance dialysis with functional status and caregiver burden. Variables associated with functional change after initiating dialysis were also analysed. This was part of larger prospective multi centre cohort study assessing the relationship of geriatric assessment with outcomes in patients with ESKD	Cohort	HD	ADL's and iADL's, Groningen Frailty Indicator GFI, Caregivers received three questionnaires: the Neuropsychological Inventory, the Interview of Deterioration in Daily Life Dementia , and the Self-Perceived Pressure from Informal Care (a Dutch questionnaire assessing caregiver burden).	N	ADL's and iADL's dependencies were categorized in improvement (score (> +1), stable (score of 0), decline (score >-1), and death.	Prevalence of functional dependence was high; four out of five participants were dependent in functional status (30% ADL, 78% iADL) at initiation of dialysis. Furthermore, almost half of the participants experienced decline in functional status (40%) or died (8%) within the first 6 months after initiating dialysis. This decline was mostly due to loss of iADL abilities (37% decline in IADL versus 16% in ADL). Older age and a high score on the GFI were associated with the composite outcome functional decline/death. In addition, the percentage of caregivers reporting a high burden of care, increased from 23% to 38%(P=0.004) after dialysis initiation

Goto et al 2019 Netherlands [22]	The aim of this study was to assess the prevalence of geriatric impairments and frailty through a GA in a population with ESKD at the time of initiating dialysis and in a population choosing maximal conservative management (MCM). Part of the larger GOLD study	Cohort	HD, PD, Conservative care	7 domains were assessed comorbidity burden (Cumulative illness rating scale for geriatrics, ADL,iADL, depressive symptoms (GDS-15), nutrition (Mini nutritional assessment),mobility (TUG) and mini mental HRQOL and other baseline demographics were done including frailty screening using Fried frailty index and Groningen index		Geriatric impairments	Prevalence of geriatric impairments was very high; 77% of the patients had 2 or more geriatric impairments. Most frequent impairments were seen in functional performance, cognition and severe comorbidity. Of the 89 conservative management population, the prevalence of geriatric impairments was even higher; 88% had 2 or more geriatric impairments.

Hall et al 2016 USA [23]	Two programs of care were evaluated: A geriatrician embedded in a nephrology practice (CGA-4-CKD Program) and a nephrology clinic with extended appointments for geriatric assessments (Renal Silver clinic).	Comparative study	CKD	CGA-4 CKD Criteria and assessments of ADLs, iADLs, falls (self-report of falls within prior 12 months), mobility, cognition (dementia diagnosis or Mini-Cog test), frailty, Study of Osteoporotic Fracture frailty criteria) and urinary incontinence.		Geriatric assessments data, referrals, care processes, qualitative themes	In both programs, at least 25% of veterans had functional limitations that geriatric assessment identified. Cognitive impairment and difficulty with iADLs were commonly identified. Geriatric assessments led to at least one care process in 45.4% (n = 15) of veterans in CGA-4-CKD and 37.1% (n = 13) of those in Renal Silver. In Renal Silver, findings from 20.0% (n = 7) of geriatric assessments contributed to dialysis decision-making discussions that favoured conservative management (instead of dialysis). Additional care processes included social work referrals for assistance with advance directives or ADLs (17.1%, n = 6), and consultations for palliative care (8.6%, n = 3).

Hall et al 2020 USA [24]	To identify quality of life themes that matter most to older adults receiving daily-sis and identify the extent to which existing quality of life instruments, specifically the KDQOL-36 and WHOQOL-OLD, overlap with those important themes.	Qualitative	HD	Screened for cognitive impairment and frailty using the mini-cog and a simple frailty questionnaire	Y	N/A	50% patients classed as frail. Two major quality of life themes were identified: (1) having physical well-being (2) having social support Perspectives on the subthemes often varied by frailty status. The majority of the subthemes did not correspond with domains in the KDQOL-36 and WHOQOL-OLD instruments.
Hernandez-Agudel et al 2021 Argentina [25]	To analyse the socio-demographic and clinical variables of patients who initiate haemodialysis or peritoneal dialysis due to end-stage kidney disease. The FRAIL scale was applied for the diagnosis of frailty syndrome	Cross sectional	HD + PD	CFS, hand grip, physical activity, social isolation	N	Socio demographic, biochemical and KT/V, hospitalisation	Prevalence of frailty in subjects who initiated renal replacement therapy was 55.55%, measured through the FRAIL Scale,higher in women than in men (p = 0.045). Frail patients had a higher Charleston comorbidity index (p =< 0.01). The mean serum creatinine, parathyroid hormone (PTH), and albumin were lower in frail patients, with statistically significant differences.
Hubbard and Peel 2016 Australia [26]	To determine whether the frailty status of patients with chronic kidney disease (CKD) can be measured using a Frailty index (FI)	Cross sectional	CKD	FI CKD, Fried	N	CGA	Mean FI-CKD was 0.25 (SD 0.12). The FI-CKD increased with age at 3% per year, correlated with a modified Fried phenotype (P < 0.001) and increased significantly across CKD stages (P = 0.04)

Hwang et al 2019 Korea [27]	Multicentre retrospective study comparing three risk stratification tools, to identify which is the best prognostic tool for predicting short-term mortality in elderly HD patients undergoing dialysis.	Retrospective	HD	CFS	N	Early mortality	The 3- and 6-month mortality rates were 31 (14.4%) and 48 (22.4%), respectively. Receiver operating characteristic curve analysis revealed that both score systems and the CFS showed similar performance while predicting 3- and 6-month mortality
Iyasere et al 2016 UK [28]	To compare QoL of patients on assisted PD versus ICHD	Observational	Assisted PD and those on ICHD needing transport	CFS, minimental, falls and social	N	QoL assessments included Hospital Anxiety and Depression Scale (HADS), Short Form-12, Palliative Outcomes Symptom Scale (renal), Illness Intrusiveness Rating Scale, and Renal Treatment Satisfaction Questionnaire (RTSQ). Physical function was evaluated by Barthel Score and timed up and go test.	51.9% of aPD and 42.6% of HD patients were frail. Frailty was associated with worse SF-12 MCS, SF-12 PCS, Barthel Index, symptoms, illness intrusion, and HADS scores (P,0.01. In a posthoc analysis of 119 frail patients (frailty score 5) there was no significant difference in any QoL measure between assisted PD and HD after adjusting for the other covariates

Iyasere et al 2019 UK [29]	To compare QoL across aAPD and HD	Observational	aAPD and HD	CFS and Barthel	N	HADS, SF-12 physical and mental scores, symptom score, Illness Intrusiveness Rating Scale (IIRS), Barthel's score, and the Renal Treatment Satisfaction Questionnaire (RTSQ)	There was no statistically significant difference in any of the outcome measures between HD and PD. Longitudinal trends in outcomes were also not significantly different.
Iyasere et al 2019 UK [30]	To compare QoL of conservative care management patients with aPD and ICHD patients	Observational cohort	Conservative management ICHD and aPD	CFS	N	Short Form-12 [SF12; Physical Component Summary scale (PCS)and Mental Component Summary scale (MCS)], HADS, Palliative Outcomes Scale-Symptoms (POS-S) (Renal), Illness Intrusiveness Rating Scale (IIRS), Renal Treatment Satisfaction Questionnaire (RTSQ)and the Barthel score	Frailty CCM: 39.3%; aPD: 60.7% ICHD: 39.3%. Frailty was associated with lower PCS on SF12, higher depression score and illness intrusiveness.

Johansen et al 2007 USA [31]	To explore the prevalence, predictors and outcomes of frailty	Cohort	HD	Questionnaire based frailty from Women's Health Initiative cohort (see text). Measuring physical functioning, fatigue, activity, nutrition	N	Mortality and hospitalisation	75% of patients over 60 are frail. Older age, female sex, and haemodialysis (rather than peritoneal dialysis) were independently associated with frailty. Coxproportional hazards modelling indicated that frailty was independently associated with higher risk of death and with the combined outcome of death or hospitalization
Kakio et al 2018 Japan [32]	Examine association between diabetic nephropathy and frailty	Cross sectional observational	HD	Fried	N	Frailty and diabetic nephropathy	21.3% were frail, 51.6% were prefrail. The prevalence of frailty in the Diabetic Nephropathy group was significantly higher.
Kallenberg et al 2016 [33]	Articles until 2016, reporting on association of functional or cognitive impairment or frailty with adverse outcome	Systematic Review			N	Geriatric impairments and outcomes	30 articles were identified that reported on 35 associations. Mean age was >60years old in 73% of the studies, and geriatric conditions were highly prevalent. Twenty-four studies (80%) reported on functional impairment, seven (23%) reported on cognitive impairment, and four (13%) reported on frailty. Mortality was the main outcome measure in 29 studies (97%), and one study assessed functional status trajectory. In 34 of 35 (97%) associations reported, functional or cognitive impairment or frailty was significantly and

							independently associated with adverse health outcomes.
Kamijo et al 2018 Japan [34]	To evaluate whether sarcopenia and frailty have a negative impact on mortality in PD patients. Also to investigate the morbidity of sarcopenia and frailty, and assessed the factors related to disease conditions, such as malnutrition-inflammation-atherosclerosis (MIA) syndrome	Prospective Cohort study	PD	CFS	N	Mortality	13.1% of patients >60 was classed as frail. Patients with frailty are more likely to be older and exhibit higher BI and CCI values, as well as lower PS, SMI, handgrip strength, and usual walking speed values. After adjustments were made for potential con-founders, including age, CFS, gender, walking speed, SMI, and grip strength, the CFS remained an independent predictor of mortality.
Kuki et al 2020 Japan [35]	This study aimed to prospectively evaluate whether the two physical performance parameters are associated with the onset of fatal/non-fatal CV events in patients undergoing HD	Prospective cohort	HD	Gait speed and HGS	N	CV events	Among Japanese HD outpatients who were able to walk independently, slow usual GS and weak HGS were significantly associated with CV events, independent of age, sex, HD duration, and medical history
Kumarasinghe et al 2021 Australia [36]	The aim of the study was first to assess the feasibility of incorporating CFS assessment into routine outpatient nephrology practice in the pre-dialysis setting and then to explore the association of the degree of frailty with planned ESKD management.	QI project	Pre-dialysis	CFS	N	The primary outcome assessed was feasibility of CFS assessment. The secondary outcomes were associations of frailty assessment with planned ESKD management and clinician perception of the	21% of patients who had completed CFS' were planned for conservative management in contrast to only 5% of those who had 'no CFS completed' (P = 0.013). Even when adjusted for age, gender, assessing clinician, usual nephrologist and clinic setting, the 'completed CFS' group was more likely to be planned for conservative management (P =

						utility of frailty assessment.	0.026). The 'completed CFS' group was less likely to have haemodialysis (23%) compared with those with 'no CFS' (40%) (P = 0.037). Completed CFS group was more likely to have ESKD management plan 'not documented' (21%) than the 'no CFS' group.
Kutner et al 2014 USA [37]	Aim was to review the Fried Frailty prevalence in large cohort of dialysis patients- this was part of larger study titled ACIVE-ADIPOSE part of USRDS.	Cohort	HD	Fried	N	CV and other parameters	In the > 65 years 45% of this group identified as frail. Increased association with frailty and CVD and PVD
Lee S.J et al 2015 South Korea [38]	The purpose of this study was to compare the factors that influence frailty and to investigate the contribution of frailty to the HRQOL of pre-dialysis CKD patients in Korea. A cross sectional survey	Cross sectional survey	CKD 2-4	Frailty was identified using physical functioning and weakness, then SF36 used as questionnaire for HRQOL	N	HRQOL	37.5% were frail, all older. Frail patients had lower physical and mental quality of life. However, gender, educational level, marital status, CKD stage, average income, blood pressure, BUN, creatinine, and haemoglobin level were not associated with frailty. Influence of frailty on health-related quality of life

Lee S.W et al 2017 South Korea [39]	To identify the association between frailty and adverse outcomes, and the change of frailty before and after dialysis initiation.	Prospective observational cohort	HD	For frailty assessment CGA protocol used. Using the scores of nine items in CGA protocol: diagnosis of malignancy, Charleston comorbidity index, serum albumin levels and IADL, Korean Mini-Mental State Examination score, Nursing Delirium Screening scale , malnutrition based on the Mini Nutritional Assessment (MNA) score, and mid-arm circumference.	N	The outcome was the composite of all-cause death or cardiovascular hospitalization.	In multivariate logistic regression analysis, after adjusting for age, sex, diabetes, body mass index (BMI), and time of predialytic nephrologic care, female sex, and increased BMI were associated with increased and decreased odds of frailty, respectively. In multivariate Cox proportional hazards analysis, after adjusting for age, sex, diabetes, BMI, and time of pre-dialytic nephrologic care, frailty was significantly associated with the composite adverse outcome. In repeated frailty assessments, the multidimensional frailty score significantly improved 12 months after the initiation of dialysis, which largely relied on improved nutrition.
Lin Hsin-Chang et al 2020 Taiwan [40]	The goal of this study is to evaluate the factors, including frailty status and vascular access characteristics, demographic data, BMI, arteriovenous fistula functions, and biochemistry, that may be predictors for recurrent episodes among elderly dialysis patients who have experienced previous VAF.	Retrospective review	HD	5 Point frailty	N	Vascular access failure, KT/V	Age, fatigue, and weight loss are useful prognostic indicators for the identification of recurrent VAF.

Lo et al 2008 Canada [41]	A Prospective Pilot Study to Measure Changes in Functional Status Associated With Hospitalization in Elderly Dialysis-Dependent Patients. To determine functional impairment at the time of admission and again at 1 week after discharge	Prospective Pilot	HD admitted acutely	Version of Fried	N	Tests used included the 4-item Basic Activity of Daily Living (BADL) measure and the Lawton-Brody Scale of Instrumental Activities of Daily Living (IADL). Physical performance was measured using the timed up-and-go (TUG) test and grip strength. In addition, cognitive function was measured using the Trails A & B tests and the clock test.	A total of 73.3% of patients (95% confidence interval, 54.1 to 87.7) experienced a decline in personal functional independence in association with hospitalization.
Lopez-Montes et al 2020 Spain [42]	Study to analyse depression, cognition, and physical function change in older adults on haemodialysis at 12-month follow-up, depending on frailty status.	Cohort	HD	Fried	N	Mortality; disability in basic and iADL, physical function with SPPB, Mini Cognitive Examination, Geriatric Depression Scale (GD). Inflammatory and nutrition profile	53.8% of patients were frail. Frail older adults that initiate haemodialysis present higher mortality than the non-frail ones at 12-month follow-up. Frail patients that survive improve physical function, depression and inflammatory profile compared to the non frail ones

Mc Adams-DeMarco 2017 USA [43]	Whether frailty measured pre kidney transplant (KT) was associated with LOS	Prospective Cohort	KT	Fried	N	LOS post transplant	Frailty was independently associated with longer LOS (RR=1.15, 95%CI: 1.03-1.29; P=0.01) and LOS≥2 weeks (OR=1.57, 95%CI:1.06-2.33; P=0.03) after accounting for registry-based risk factors, including DGF. Frailty also attenuated the association between LOS and mortality (HR:1.55 95%CI:1.30-1.86, P<0.001; frail HR=0.97, 95%CI:0.79-1.19, P=0.80; P for interaction=0.001).
McAdams-DeMarco et al 2017 USA [44]	1)Identify characteristics of frail KT recipients, 2) identify the most common components of frailty among KT recipients and 3) explore which patterns of the frailty components are most strongly associated with mortality risk among KT recipients	Prospective cohort	KT	Fried	N	ADL/IADL disability, CESD depression, education, and HRQOL	Frailty was 23.7% among those aged 65-74 years, and 22.7% for those recipients aged ≥75 years. Pre-frailty was 38.1 for >65s and 50% for >75s. Older Age, IADL disability, depressive symptoms, less than a high school education and low HRQOL predicted frailty. The most common frailty pattern was poor grip strength, low physical activity and slowed walk speed. KT recipients with exhaustion and slowed walking speed and poor grip strength, exhaustion, and slowed walking speed were at increased mortality risk.

Mei et al 2021 China [45]	The inclusion criteria were as follows: (1) retrospective and prospective cohort studies; (2) patients with clinically confirmed CKD; (3) frailty was defined by a recognized criterion and using the established frailty models or modified versions; (4) outcomes were all-cause mortality, all-cause hospitalizations, and falls	Systematic Review and meta-analysis			N/A		Frailty is a risk factor for mortality, hospitalization, and falls, indicating it is important to assess frailty as a prognostic factor for CKD. Included were recent cohort studies using a broader definition of frailty and numerous negative health outcomes, because assessments of frailty are generally correlated. Subgroup analysis based on possible influencing factors to comprehensively understand the effect of frailty on risk factors and prognosis, which may provide clinicians with an indicator to measure the severity, prognosis, and progression or reversal of CKD
Meulendijks et al 2015 Netherlands [46]	Aim to assess whether the Groningen frailty indicator (GFI) can be used to distinguish fit older ESRD patients, likely able to tolerate and benefit from dialysis, from frail older patients who need further evaluation with a geriatrician's comprehensive assessment	Prospective Cohort	Pre-dialysis	GFI is a 15 item frailty assessment (4 geriatric domains-) done at time of referral into pre-dialysis clinic. If scored high referred to geriatric nurse and geriatrician	N	Referral to geriatrics, mortality, hospitalisation	Geriatric impairments were prevalent with percentages ranging from 23% (visual impairment) to 62% (hearing impairment). One-third of patients were identified as frail according to the GFI, (GFI_4) and these patients more frequently required hospitalization. Both the GFI and the nephrologists' assessment failed to identify relevant geriatric impairments that were detected after the geriatric consultation.

Moffatt et al 2018 Canada [47]	Qualitative study to 1) explore the nurse experience of screening for frailty using the frailty assessment for care planning tool (FACT) tool 2) determine how, if at all, provider perceptions of frailty changed after implementation of the frailty screening tool; and 3) determine the perceived factors that influence uptake and administration of the FACT screening tool.	Qualitative	Nurses	Frailty Assessment for Care Planning Tool/ Clinical Frailty Scale	N	N/A	Nurse participants reported an overall positive experience using the FACT method to screen for frailty and indicated that their understanding of the multiple dimensions and subtleties of "frailty" were enhanced. Future nurse-led FACT screening initiatives should incorporate those factors identified as being integral to program success: realistic goals, clear guidelines, and ongoing training.
Moreno-Useche et al 2020 Columbia [48]	The aim of this research is to analyse the socio-demographic and clinical variables of patients who initiate haemodialysis or peritoneal dialysis due to end-stage kidney disease. The FRAIL scale was applied for the diagnosis of frailty syndrome	Cross sectional	HD/PD	Self-reported Frail scale		Biochemical, social and frailty	Prevalence of frailty syndrome in subjects who initiated renal replacement therapy was 55.55%, measured through the FRAIL Scale, The prevalence of frailty syndrome was higher in women than in men (p = 0.045). Frail patients had a higher Charleston comorbidity index (p =< 0.01). The mean serum creatinine, parathyroid hormone (PTH), and albumin were lower in frail patients, with statistically significant differences.

Nakazota et al 2020 Japan [49]	Our aims for this study were (1) to examine whether the PC1 score is an appropriate measure of physiological dysregulation and frailty, and (2) to validate our interpretation of biomarker variability.	Cross sectional	HD	Fried	N	Blood based parameters	The PC1 score was associated with the prevalence of frailty and was an independent predictor for frailty (odds ratio per SD: 2.31, P=0.01) using a multivariate logistic regression model, which showed good discrimination (c-statistic: 0.85). Therefore, the PC1 score represents principal information shared by biomarker variabilities and is a reasonable measure of homeostatic dysregulation and frailty
Neradova et al 2021 UK/Brazil [50]	The aim of this study was to determine whether pre-existing frailty was a risk factor for hospital admissions and mortality in renal patients in the first wave of the COVID pandemic.	Retrospective cohort study	Dialysis, CKD, KT	CFS	N	Mortality and hospitalisation	In the 174 patients who had a CFS recorded, the age was 65.4 years ± 15.8 (mean ± SD) and 57,5% were male. At the end of follow up, 26% had died. Frail patients (CFS 5-7) were more than three times more likely to die compared to less frail patients (CFS of 1-4) (odds ratio (OR) 3.3, 95% confidence interval (CI) 1.0-10.6). 118 patients (68%) required admission, but there was no difference in hospital admission rates for frail vs non-frail patients (OR 0.6, CI 0.3-1.7).

Nixon et al 2019 UK [51]	An evaluation of the diagnostic accuracy of several frailty screening methods	Convenience series	CKD 4-5	Baseline data , Charleston comorbidity, karnofsky performance status, minimental risk evaluation for eating and nutrition. Frailty screening methods CFS, PRISMA 7, CKD FI, CKD FI LAB, walking speed, hand grip strength and short physical performance battery (SPPB). Frailty phenotype used as standard reference point	N	Clinical Frailty Scale, PRISMA-7, CKD Frailty Index, CKD FILAB, walking speed, hand grip strength and Short Physical Performance Battery	Overall walking speed had the highest accuracy for physical screening, The CFS had the highest AUC for non physical screening in this population. Nineteen (21%) patients were categorised as frail, 42 (47%) as pre-frail and 29 (32%) as robust.
Nixon et al 2020 UK [52]	The EX-FRAIL CKD trial aims to inform the design of a definitive randomised controlled trial (RCT) that investigates the effectiveness of a progressive, multicomponent home-based exercise programme in prefrail and frail older adults with CKD.	Protocol 2 arm parallel RCT	CKD 3b-5	CFS	N	Primary feasibility outcome measures include rate of recruitment, intervention adherence, outcome measure completion and participant attrition.	N/A
Nixon et al 2020 UK [53]	This study aimed to evaluate the relationship between frailty and HRQOL in patients with CKD Stages 4 and 5 (G4–5)	Secondary analysis	CKD4-5/HD	Fried	N	QOL	Frailty is independently associated with worse HRQOL in patients with CKD G4–5D. Exhaustion, or fatigue, is the most significant Frailty Phenotype component

	and those established on haemodialysis (G5D).						contributing to worse HRQOL in those with advanced CKD
Nixon et al 2021 UK [54]	The aims of this quality improvement project were to: (1) proactively identify people living with frailty and CKD; (2) introduce a practical assessment, using the principles of the comprehensive geriatric assessment (CGA), for people living with frailty and chronic kidney disease (CKD) able to identify problems; and (3) introduce person-centred management plans for people living with frailty and CKD.	QI project	CKD/HD	CFS/GA	N	Hospitalisation and mortality, number and type of problems encountered	One hundred and fifty patients (33%) were screened as frail (i.e. CFS ≥ 5). Frail patients were older than non-frail patients (median age 81 years [IQR 14] vs. 74 years [IQR 11], $p < 0.001$). This quality improvement project demonstrates the high burden of frailty and problems experienced by those with CKD. It also details an approach to the implementation of a frailty screening programme and GA service so that problems can be identified and a person-centred management plan developed.

Nixon et al 2021 UK [55]	The aim of the EX-FRAIL CKD Trial, a pilot randomised controlled trial (RCT), is to inform the design of a definitive RCT that evaluates the effectiveness of a home-based exercise intervention in pre-frail and frail older adults with CKD	Pilot RCT	CKD 3b-5	SPBB, FP, Barthel index, FES-1, RENAL POS, Short SF -12	N	Primary outcome measures included eligibility, recruitment, intervention adherence, outcome measure completion and participant attrition rate. Secondary outcomes PF, Frailty, ADL. Falls, Symptom burden, HRQOL	A median of 28 (IQR 16) exercise sessions were completed during the 12-week intervention period. Eleven (73%; 95% CI 45, 91) exercise group participants completed 2 exercise sessions per week, with a mean of 36.5±8.5 minutes spent exercising each session. The mean RPE score for exercises 2–6 was 12±2. The main reasons for missing exercise sessions were pain (n = 14; 56%; 95% CI 35, 75), participant wishes (n = 7; 28%; 95% CI 13, 50) and feeling unwell (n = 4; 16%; 95% CI 5, 37).

Novais et al 2020 France [56]	The aim of this study was to assess the prevalence of geriatric impairment and frailty in older patients with advanced CKD using a pretransplant CGA model. The secondary objectives of this study were to compare the geriatric impairments between dialysis and non dialysis patients and to identify the main geriatric impairments influencing the geriatricians' recommendations for KT.	Observational retrospective study	CKD and dialysis	Cumulative illness rating scale, MNA, cognition SPPB, Fried, polypharmacy	N	Geriatrician recommendations for KT	On univariate analysis, the geriatric impairments influencing the geriatricians' recommendations for KT were multiple comorbidities, cognitive and physical impairment, symptoms of depression, nutritional status, and dependence on ADL and IADL
Orlandi & Gesualdo et al 2014 Brazil [57]	To assess frailty levels of elderly HD patients	Cross sectional study	HD	Edmonton Frailty Scale (0-17)	N	Frailty and falls	Around 35.0% of the elderly showed no frailty, 26.7% were vulnerable, 20.0% showed mild frailty, 13.3% moderate frailty and 5.0% severe frailty.
Painter et al 2013 USA [58]	To compare two methods to operationalise fried phenotype frailty scores 1. Using actual measures of walking speed and strength (FRAIL meas). 2. The substitution of the PF scale for walking speed and strength (FRAILsubst). A second aim of this analysis was to identify clinical and self-reported health-related quality of life (HRQoL) factors that	Cross sectional	HD	Fried , Physical function in SF-36	N	Sub analysis of renal exercise demonstration study	The proportion of patients in the REXDP who met the criterion of frailty was 24% when actual measures were used for walking speed and weakness components. It was higher in the older > 65 year age group The correlation between gait speed and the PF score was 0.34 and the grip strength measures were 0.14, both of which were statistically significant

	are associated with frailty in haemodialysis patients.						
Parlevliet et al 2012 Netherlands [59]	Cross sectional multicentre study to assess the use of a CGA on randomly selected ESRD patients for prevalence and feasibility. Secondary aims were to compare to similar cohort of cancer patients	Cross sectional	HD and PD	A full CGA including all four domains (plus A DL's) completed by face to face interview in the patients home, followed by interviews with the MDT on acceptability and relevance of CGA questionnaire	Y	Domains of CGA, feasibility of implementation as perceived by professionals, patients and carers	The most prevalent geriatric condition was polypharmacy (94.6%). Frequently observed were hearing impairment (36.8%), malnourishment (32.7%), social or emotional loneliness (30.6% combined) and depressive symptoms (24.5%). 24.0% o reported pain. Reported difficulties related to housekeeping, travelling and walking. Caregivers reported a number of behavioural problems eating behaviour most prevalent (34.0%). 84.4% of caregivers experienced care as a large burden.

Perez-Saez et al 2021 Spain [60]	To study the potential effects of multimodal rehabilitation as a prognostic variable to predict the 90-day primary endpoint based on clinical and functional outcomes achieved in frail and non-frail KT candidates	Protocol RCT	KT	Fried phenotype, frail scale, CFS, Edmonton frail scale, Frail-VIG index		The primary endpoint will be a composite achievement of clinical and functional main outcomes in frail and non-frail KT candidates at 90 days post-transplantation.	N/A
Pugh et al 2016 UK [61]	The aim of the current study was to assess the impact of both frailty and comorbidity on the outcome of patients referred to the pre-dialysis service.	Observational	Pre dialysis.	CFS CCI	N	Mortality	Statistically significant difference between the groups, with the increasingly frail or comorbid subgroups having the worst survival. The percentage of patients dying within 3 years of the home visit increased with each increase in CFS score. Patients with higher levels of frailty were more likely to choose conservative care

Pyrat et al 2020 UK [62]	We sought to describe the choices and outcomes of a large cohort of older pre-dialysis patients who underwent pre-dialysis education in our centre	Cohort	CKD-5 Pre dialysis	CFS	N	Patient characteristics influenced whether patients chose to receive HD,PD, HHD, transplant or opted for MCM. Impact of patient characteristics and treatment decisions on survival were compared from the time of final choice	By adding CFS to the model (n = 486)–sex, age, choice and CFS all predicted 3-year survival while comorbidity had no significant effect. However, when only patients with CFS 6 (at least moderate frailty, needing assistance with all outside activities or unable to undertake outside activities without support) were included in the analysis (n = 140, MCM 83 and HD 57), only age rather than the choice of RRT vs MCM significantly affected survival
Reece et al 2013 USA [63]	1) determine if greater CKD severity was independently associated with the end points of poor physical performance and frailty in a large, racially diverse sample of adults with CKD, and (2) identify additional risk factors for poor physical performance and frailty in CKD.	Cross sectional	CKD 4-5	Fried	N	Fried frailty measure, SPPB	Worse renal function demonstrated a graded association with worse physical performance and frailty, independent of age, sex, race, BMI, anaemia, socioeconomic status and major comorbidities

Salter et al 2015 USA [64]	A cross sectional study examining perceived frailty, patient nurse and nephrologists.	Cross sectional	HD	Fried criteria. Perceived frailty documented by patient, nephrologist and nurse, patients also asked 'how frail do you think you are'	N	Perceived and measured frailty	In multivariable models, only disability was associated with measured frailty (adjusted OR [aOR] = 1.47, 95% CI: 1.04-2.08, P = 0.03 for each additional ADL difficulty). Among frail participants, only 42.0% and 39.2% were correctly perceived as frail by their nephrologist or NP, and only 4.9% perceived themselves as frail.. Older adults were more likely to be perceived as frail by nephrologist but less likely by themselves.
Sclauzero et al 2013 Italy [65]	The study aimed to evaluate the effect of the different components of frailty on the QoL of people on dialysis.	Cross sectional	HD	ADL's, Cognition, Karnofsky Index, SF 36, SGA	N	QOL	32.5% of patients revealed one or more disabilities (ADL scale) and that 38.4% were totally or partially dependent (IADL scale). KI demonstrated that 42.9% of subjects needs help to take care of themselves. Malnutrition was present in 34% of the subjects investigated.
Song et al 2020 China [66]	Inclusion criteria: (1) risk factors for mortality of elderly haemodialysis patients were the subject; (2) haemo dialysis patients included an elderly population; and (3) study data included odds ratio(OR) values and 95% confidence intervals (CIs)	Systematic Review and meta-analysis	HD		N	Geriatric impairments	Functional impairment (OR = 1.45, 95% CI: 1.20–1.75), cognitive impairment (OR = 1.46, 95% CI: 1.32–1.62) and falls (OR = 1.14, 95% CI: 1.06–1.23) were significantly and independently associated with increased mortality in elderly haemodialysis patients

	or data that could be transformed to OR values and 95% CIs by statistical methods.						
Suzuki et al 2019 Japan [67]	Effects of electrical muscle stimulation in frail elderly patients during haemodialysis (DIAL): rationale and protocol for a crossover randomised controlled trial	Protocol Intervention RCT	HD	SPBB, Mini Cog, Nutrition	N	Change in quadriceps isometric strength after intervention, improvement in physical function.	N/A
Takeuchi et al 2018 Japan [68]	Cross-sectional study to determine the prevalence of frailty and associated factors	Cross sectional	HD	Fried and self-reported frailty	N		Frail (over 65s): 26.1% over 75s: 32.7%. Pre-Frail over 65s: 51%, over 75s: 56.6%. Frailty was significantly associated with female gender, age, age >75, BMI<18.5, number of medications, diabetes and nutrition status (MNA-SF).
Tan et al 2018 Australia [69]	Prospective study to explore the impact of initiating dialysis on symptom burden and functional status as well as its trajectory as dialysis progresses in the elderly patient.	Prospective cohort	Supportive care, HD, PD	Fried	N	Symptom burden	The commencement of dialysis in a younger cohort of elderly patients was associated with a small but significant decrease in overall symptom burden. There was no change in functional status in both groups over a six-month follow-up period.

Van Loon et al 2016 Netherlands [70]	The aim of this review is to give an overview of all currently available evidence regarding the relation of geriatric impairments and the accumulation of impairment across these domains at initiation of dialysis with mortality and dialysis-related complications.	Systematic review			N	N/A	Only 7 studies carried out an analysis of elderly patients (>70 years old). Malnutrition and frailty were systematically assessed, and their relation with mortality was clear although it is lacking in the elderly population specifically. In addition, cognitive impairment and functional outcomes at the initiation of dialysis were related to an increased mortality in most studies. However, not all studies applied systematic assessment tools, thereby potentially missing relevant impairment. None of the studies applied a geriatric assessment across multiple domains.

Van Loon et al 2017 Netherlands [71]	Cross sectional study of incident dialysis patients part of the GOLD study. Consecutive patients eligible for dialysis were included between 3 weeks before and 2 weeks after the first dialysis session.	Cross sectional	HD	ADL's, iADL's, Timed-Up-and-Go , the Geriatric Depression Scale , nutrition (the MiniNutritional Assessment, comorbidity burden. The cognitive test battery. In addition: the Groningen Frailty Indicator, the Fried Frailty Index, Geriatric8, the Identification of Seniors at Risk-Hospitalized Patients screening , the Hospital Safety Program criteria and the clinical judgment of the nephrologist (frailty question).	N	Geriatric assessment, frailty and clinician view	Functional impairment was high: 78% needed help with iADL's, 34% needed help with basic ADL, and in 25% of patients, mobility was severely impaired. Cognitive impairment was present in 66% of patients. Severe comorbidity burden in 35% of patients. Of all 75% (n=92) had impairment in two or more domains and were considered frail. lowest percentage of frailty was found with the Fried Frailty Index (48%), and the highest percentage was with Geriatric8 (88%). Not one showed overall 100% sensitivity. Of the frailty screening tools, the Identification of Seniors at Risk has the best discriminating abilities in the ESRD population, showing the highest specificity and a fairly good sensitivity, and 91% of patients with a positive Identification of Seniors at Risk are frail according to the geriatric assessment (high positive predictive value).

Van Loon et al 2019 Netherlands [72]	To assess quality of life in patients starting dialysis and patients choosing maximal conservative care.	Cohort	Pre dialysis	Frailty as measured by geriatric screening	N	QOL	Frailty in 88% of patients who chose conservative care, 78% who chose dialysis. Baseline QoL did not differ significantly between the groups. After six months, EQ-5D Index did not improve significantly in the dialysis group, but a small but clinically relevant decline was seen in the conservative group. Hospitalization occurred in 50% of dialysis patients vs. 24% of conservative patients (p< 0.01). In the extended 12-months analysis, mortality rate in conservative patients was 34% compared to 16% in dialysis patients (p= 0.01). In patients over 80 years old, no survival benefit could be found for dialysis patients starting dialysis vs. MCM.
Van Loon et al 2019 Netherlands [73]	Multicentre, prospective, cohort study assessing the relation between a GA and poor outcome in ESKD patients.	Prospective cohort	Pre-dialysis	Geriatric assessment: including assessment of (instrumental) activities of daily living (ADL), mobility, cognition, mood, nutrition, and comorbidity. In addition, a frailty screening (Fried Frailty Index, [FFI]) was applied	N	Mortality and hospitalisation	Twelve-month mortality risk was higher in patients with ≥3 impairments (hazard ratio [HR] 2.97 [95% CI 1.19–7.45]) compared to less impaired patients. FFI frail patients had a higher risk of 12-month mortality (HR 7.22 [95% CI 2.47–21.13]) and hospitalization (OR 1.93 [95% CI 1.00–3.72]) compared to fit patients.

Van Loon et al 2019 UK [74]	To assess the prevalence of falls and the impact on mortality and quality of life in frail elderly patients on assisted PD (aPD) and haemodialysis (HD) from the FEPOD Study.	Longitudinal observational study	HD,PD aPD	Canadian Study of Health and Aging Scale	N	Falls, other outcomes were ALD, HADS, QOL SF-12	Mean frailty score 4.3 (SD1.2), frailty was slightly higher in aPD group. patients with diabetes mellitus were twice as likely to report falls at baseline and falls at baseline were associated with falls during follow-up. Literature revealed frailty was a strong risk factor for falling and falling results in a higher mortality and hospitalization rate. Fall incidence was comparable in aPD and HD.
Van Munster et al 2016 Netherlands [75]	Prospective cohort study of prevalence of frailty by screening using different instruments	Prospective cohort	HD,PD Pre dialysis	FI, GFI self reported items, the VMS (Dutch assessment), ISAR-HP	N		Different short questionnaire–based screening instruments, i.e. the GFI, ISAR-HP and VMS, can all be applied to the ESRD population to screen for frailty in both young and older ESRD patients. Of these three screening instruments, the GFI showed the highest sensitivity and negative predictive value for screening frailty in dialysis and pre-dialysis patients, with the FI as the gold standard. In addition, the ISAR-HP also showed comparable performance to that of the GFI, with slightly lower negative predictive value, and had the highest positive predictive value of all three instruments.

Van Oevelen et al 2021 Netherlands [76]	A prospective, observational cohort study. Initial stage when dialysis is initiated or eGFR drops to 10 mL/min/1.73m2 or lower, the second stage of the study commences. In both stages nephrogeriatric assessments will be performed annually, consisting of questionnaires and tests to assess most common geriatric domains, i.e. functional, psychological, somatic, and social status.	Protocol prospective cohort	CKD 5	Nephrogeriatric assessments	N	The primary outcome is HRQoL, measured with the Twelve-item Short-Form Health Survey. Secondary outcomes are clinical outcomes (mortality, hospitalisation, functional status, cognitive functioning, frailty), cost effectiveness, and decisional regret	N/A
Vettoretti et al 2020 Italy [77]	We evaluated if Frailty Phenotype (FP) could identify older CKD-patients that may benefit the most from a CGA.	Cross sectional	Pre dialysis	Fried , nutritional assessment, SPPB, mini mental, clock drawing	N	Fried phenotype	Frail patients (F-CKD) had higher prevalence of malnutrition (58 vs 29%, $p = 0.0005$), physical impairment (100% vs 78%; $p < 0.0001$), cognitive dysfunction (83% vs 37%; $p < 0.0001$) and depression (50% vs 21%; $p < 0.001$) compared to robust ones (NF-CKD). Moreover, F-CKD patients had higher probability to have > 2 impaired domains (83% sensitivity and 76% specificity) respect to NF-CKD individuals.

Vezza et al 2019 Italy [78]	To retrospectively calculate FI in a sample of patients with advanced CKD. Its capacity to predict hospitalizations, initiation of renal replacement therapy (RRT), and death.	Retrospective	Pre dialysis	Frailty index (FI)	N	Mortality and hospitalisation	66% of patients were frail (FI>0.25). Mean FI was 0.29 (standard deviation 0.10, range 0.08-0.66). The FI was significantly correlated with age and eGFR. The FI was predictive of hospitalization and mortality, even after adjustment for age and sex
Villareal et al 2014 Spain [79]	To determine predictive factors for the decision between HD or conservative care in over75's	Cohort	Pre dialysis	Fried phenotype	Y	Choice of conservative care	Of the 20 patients scheduled for CC, 18 (90%) were prefrail versus 10 (28%) in the HD group (p = 0.000). Non-frail patients included 2 (10%) in the CC group versus 26 (72%) in the ITD group (p = 0.000). In multivariate analysis age and pre-frailty remained as independent predictors for the election of CC. During follow-up an increase of frail patients in both groups was observed.

Voorend et al 2021 Netherlands [80]	The primary aim was to elicit perspectives and experiences of patients and professionals with geriatric assessment (GA) in the care for older (≥65 years) patients approaching ESKD (estimated glomerular filtration rate < 20 ml/min/1.73m2), and to identify benefits, facilitators and barriers for implementation into routine nephrological care	Qualitative	ESKD	> 65 years with a geriatric impairment	Y	N/A	Patients and professionals recognized increased vulnerability and (cognitive) comorbidity often unrelated to calendar age. Both believed patients need additional support in various geriatric domains. Patients regarded content/time spent on the GA predominantly positive. Professionals emphasised assessment increased awareness among the whole team for cognitive and social problems Outcomes of GA were enhanced dialogue on suitability of treatment options,(re)adjust treatment and provide/seek additional (social) support.

Voorend et al 2021 Netherlands [81]	The current study aimed to reach agreement on a nephrology tailored geriatric assessment (NGA) suitable to routinely identify major geriatric impairments in the target population, which was defined as older patients (≥65 years of age) with stage G4–G5 CKD	Pragmatic consensus based study		Physical functioning is assessed by Katz-ADL-6, Lawton iADL, handgrip strength, and falls questionnaire, 6CIT, GDS-15, LOT-R, CFS,SF-12, Care giver burden, polypharmacy, SGA	Y	Consensus of assessments and measures to be used in practice for NGA	The NGA contains instruments in functional, cognitive, psychological, somatic, patient preferences, nutritional status, and social domains. Selection of instruments resulted from focus group meetings with patients and professionals, literature evidence, inventory of current geriatric screening practices, consensus between clinicians from nephrology and geriatrics, and pilot testing
Walker et al 2013 Canada [82]	Cross sectional and prospective studies in the general population and in the CKD population examining the association between frailty and CKD and those relating frailty in patients with CKD to clinical outcomes	Systematic Review			N		The review identified 7 studies associating frailty or physical function to CKD. Of those, only two studies related frailty in patients with CKD to a clinical outcome. CKD was consistently associated with increasing frailty or reduced physical function [odds ratios (OR) 1.30 to 3.12]. In patients with CKD, frailty was associated with a greater than two-fold higher risk of dialysis and/or death [OR from 2.0 to 5.88

Walker et al 2015 Canada [83]	To determine the clinical history, prevalence of perceived and measured frailty and its association with dialysis treatment choices and adverse outcomes in patients with advanced CKD	Protocol CanFIT longitudinal observational study	Dialysis	Fried SPPB MoCA	N	Multiple Frailty Definitions: Short Physical Performance Battery (SPPB), Fried Frailty Criteria, Frailty Index. Dialysis start: In-Centre Haemodialysis, Home Haemodialysis or Peritoneal Dialysis Outcomes: Death, Opt-out or Lost to follow up	N/A
Wu et al 2021 UK [84]	Our study aims to evaluate risk factors for mortality and the relative prognostic accuracy of various clinical assessment tools following hip fracture for patients living with CKD.	Secondary analysis of large prospective cohort study	CKD 3b-5	CFS CKD-F1, CI,KPS, DASI, Pre op risk	N	Mortality	The CFS had the best overall prognostic performance amongst the tools assessed. The CKD FI-LAB, CCI and KPS demonstrated good predictive accuracy for 30 day and 1 year mortality. AUC values for the pre-operative assessment scores, ASA index and NHFS were statistically signif cant for 30 day, but not for 1 year mortality
Wystma-Fisher et al 2021 [85]	The proposed Move More study will assess the feasibility of a physical activity intervention offered to the kidney failure inpatients	Protocol-intervention	CKD 5 and dialysis	Fried, GLTECQ,KDQOL, grip strength, sit to stand walking 15	N	The primary outcome of the study is the feasibility of administering an individualized early exercise/	N/A

						mobility intervention	
Yoneki et al 2019 Japan [86]	To assess the association between frailty and bone loss in patients undergoing haemodialysis	Cross sectional study	HD	Fried	N	Fried frailty measure, bone mass/Quantitative ultrasound calcaneal measurements	According to CHS criteria, 19 (21.1%) subjects were robust, 41 (45.6%) were pre-frail, and 30 (33.3%) were frail. ANOVA and chi-squared tests revealed that age, corrected Ca, and frailty components (with the exception of weight loss) significantly differed by frailty status. In this cross-sectional study of patients undergoing haemodialysis, frailty (according to CHS criteria) was significantly associated with calcaneal QUS parameters, including low SOS, BUA, and stiffness index for both sexes, even after adjusting for clinical characteristics. Interestingly, all QUS parameters declined significantly with increasing levels of frailty for both sexes.
Yoshida et al 2020 [87]	The aim of this study examined the correlation among CFS and other indices representing comorbidities, nutritional disorders, and geriatric syndrome, considering the prognosis.	Prospective cohort study	HD	CFS, SPICES score, CCI nutrition	N	Prognosis and morbidity	This study showed the relationship between CFS and CONUT score, CCI, and SPICES score in consideration of prognosis. As far as we know, there are no reports evaluating relationships of these indices and prognosis in the same patients with CKD. The CFS allows frailty to be defined and graded using simple clinical

							descriptors available from routine clinical assessment. The prognosis after initiation of dialysis is poor if the patient is frail during the preservation period.
Young et al 2020 UK [88]	To explore the perceptions of frail HD patients in relation to participating in clinical research, IDC and a tailored exercise intervention.	Qualitative component of main study	HD	CFS	Yes	Outcomes important to patients	Important outcome identified form the qualitative data included animating mobility, maintaining activities of daily living and social support. Reporting of falls was not deemed important
Zanotto et al 2021 USA [89]	The objective of this study was to explore the diagnostic accuracy of several frailty screening methods, using the Fried phenotype as reference standard, in people receiving HD.	Cross sectional study	HD	Fried SF 36 TUG, STS-5, 15M Walk, IPAQ-SF	N	Accuracy of frailty assessments and Falls risk	The examined methods significantly discriminated frail from non-frail individuals, gait speed and TUG exhibiting the highest AUC values and elevated PPV/NPV. Gait speed had the highest specificity (93%) and PPV (0.86), TUG had the highest NPV (0.93). Accuracy of the same methods for fall-risk screening the Tinetti FES revealed the highest AUC value. While gait speed had an excellent diagnostic performance in people under 65 years of age, the TUG may be a more appropriate screening method for patients ≥ 65 years old). Importantly, the Tinetti FES was the only measure showing good diagnostic accuracy for both frailty and fall-risk screening.

Zhao et al 2020 China [90]	Studies were considered potentially eligible for inclusion if they met the following criteria: (1) study designs observational or interventional providing cross-sectional data on the prevalence of frailty in patients on haemodialysis based on any specific form of frailty assessment, (2) sample or subsample consisted of patients on haemodialysis. Studies were excluded if they were review, editorial, comment, or conference abstract	Systematic Review and meta-analysis	HD		N		The prevalence of frailty range from 6.0% [5] to 82.0% [23] among studies and the pooled prevalence of frailty in patients on dialysis was 34.3% (95% CI 24.5–44.1%; z = 6.87; Age showed related to prevalence of frailty (β=0.54±0.19, t = 2.74, p = 0.018) p=0.00)

Abbreviations used in the table (Full descriptor of assessments can be seen in appendix 2 of main paper)

ESRD/ESKD-End stage kidney disease

CKD-Chronic kidney disease

ACKD-Advanced chronic kidney disease

HD-Haemodialysis

PD- Peritoneal dialysis a= assistance

APD-Automated peritoneal dialysis a=assistance

GA- Geriatric assessment

HHD- Home haemodialysis

CFS-Clinical Frailty score

ADL-Activities of daily living

TUG-Timed up and go

SPPB-Short physical performance battery

MoCA-Montreal cognitive assessment

IPAQ- International physical activity short form

ISAR-H- Identification of seniors at risk of hospitalisation

F1-L-Frailty index lab

HGS-Hand grip strength

STS-Sit to stand

DMMS- Dialysis Morbidity Mortality Study definition

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