



Review

Social Relationships and Frailty in Community-Dwelling Older Adults on Hemodialysis: A Scoping Review

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Abstract

Life expectancy among older adults undergoing hemodialysis (HD) has increased, yet more than 70% experience physical frailty or pre-frailty before progressing to severe disability. Declines in social functioning in this population have also been associated with higher mortality risk and poorer quality of life. Despite this, relatively few studies have explored methods for evaluating social relationships and frailty among older adults receiving HD. This scoping review aimed to identify how previous studies have evaluated social relationships in this population, examine factors associated with frailty, and clarify potential research gaps. Inclusion and exclusion criteria were defined according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews guidelines. Participants were community-dwelling adults aged 60 years and older receiving HD. Using predefined keywords and search terms, literature searches were conducted across Cochrane Reviews, Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, PsycINFO, and gray literature sources (e.g., WorldCat). This review was registered in the University Hospital Medical Information Network (UMIN) Clinical Trials Registry database (UMIN000055770). Twelve studies met the inclusion criteria. Frailty was assessed using physical (7 studies), multidimensional (3 studies), cognitive (1 study), and social measures (1 study). Nineteen social relationship factors were identified and categorized into three dimensions: social attributes, social activities, and social needs. However, none of the studies evaluated the appropriateness or validity of these elements for assessing social relationships among older HD patients. The findings indicate a need to validate assessment tools that integrate physical frailty and social relationship dimensions in older adults undergoing HD, which may allow earlier identification of individuals at risk of adverse outcomes.

Keywords: community-dwelling older adults; hemodialysis; social relationships; frailty; scoping review



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1. Introduction

1.1. Background

Hemodialysis (HD), a principal kidney replacement therapy (KRT) used to compensate for impaired renal function, is currently administered to approximately 80% of patients with end-stage kidney disease (ESKD) in the United States, Japan, and Europe [1]. The global burden of chronic kidney disease (CKD) represents a major public health challenge, with substantial implications for healthcare systems [2]. In response to demographic shifts, particularly population aging and the rising prevalence of lifestyle-related diseases, the International Society of Nephrology (ISN) has projected that the number of individuals living with ESKD will exceed 5.4 million by 2030 [3]. The ISN has therefore emphasized the urgent need for practical, evidence-based strategies to improve access to KRT, optimize treatment quality, and enhance patient survival outcomes [3,4].

The case-mix-adjusted survival rate for patients undergoing HD, an important indicator of treatment outcomes, has improved in recent years [5]. In Japan, one of the world's most rapidly aging societies, national data reported in 2023 showed that 69.7% of individuals receiving KRT were aged ≥ 65 years, with a mean age of 70.09 years [6]. Although Japan is often regarded as having among the highest survival rates for dialysis patients worldwide, further improvements remain necessary [7]. Advances in dialysis have extended survival substantially, with some patients receiving treatment for several decades, highlighting the growing importance of addressing aging-related and cumulative treatment burdens [6].

A critical issue facing aging societies is the growing gap between life expectancy and healthy life expectancy, with frailty regarded as a transition point in functional decline [8,9]. Frailty has been conceptually defined as “a clinically recognizable state in older people who have increased vulnerability, resulting from age-associated declines in physiological reserve and function across multiple organ systems, such that the ability to cope with everyday or acute stressors is compromised” [10,11]. Frailty may be modifiable, particularly in early or less severe stages, through interventions such as structured exercise and nutritional support [12–15]. These observations support the importance of early identification and management, although evidence remains variable and further research is needed to determine which interventions are most effective for reversing frailty across different populations [12–15].

Frailty is highly prevalent among older patients receiving maintenance HD, with reported rates of approximately 30–80%, likely reflecting the high burden of comorbidity, inflammation, and physiological stress associated with both end-stage renal disease and repeated dialysis treatment [16,17]. Although the relationship between frailty and HD is well recognized, evidence on frailty measurement in earlier stages of clinical decline remains limited. A 2023 scoping review of 164 studies examining frailty across nephrology populations (including 92 studies in HD patients) identified 40 distinct frailty assessment tools [18]. The most frequently used tools were the Fried frailty phenotype (54.9%), followed by the Clinical Frailty Scale (CFS; 19.6%), with no clear consensus on an optimal tool for patients with kidney disease [18]. Nevertheless, frailty assessment remains rare in clinical settings among patients with CKD, and diagnostic consensus is lacking [19,20]. Although many studies have demonstrated the clinical utility of frailty assessment in older patients receiving HD, standardized approaches, cutoff values, and core indicators have not yet been established. Importantly, existing approaches have focused primarily on physical aspects of frailty, with less attention to social dimensions that may influence vulnerability and long-term outcomes.

Social relationships encompass structural and behavioral dimensions of social life, including living arrangements, family structure, social participation, and perceived support,

and they have been linked to greater autonomy, functional ability, and well-being in older adults [21–23]. These factors may also influence how older adults manage chronic illness and maintain functional independence [21–23]. In patients undergoing HD, social relationships may be particularly salient, as treatment schedules impose substantial time burdens, restrict mobility, and reduce opportunities for employment and community participation [24]. Frequent hospitalizations, functional decline, and treatment-related fatigue may further disrupt social participation and alter interpersonal dynamics in this population [24].

Social frailty, which is associated with a variety of adverse health outcomes [25], can be understood as a downstream vulnerability state that emerges when meaningful social relationships and resources become insufficient. In this context, social relationships are considered an overarching construct encompassing structural, behavioral, and subjective dimensions of social life, while social support and social isolation represent specific components that may contribute to social frailty. For the purpose of this review, the definition of social frailty follows that of Bunt et al., who described it as “being at risk of losing, or having lost, resources that are important for fulfilling one or more basic social needs” [26]. Their conceptual model of social frailty identifies four interacting categories that influence an individual’s risk of social frailty: general resources (e.g., finances, insurance, home ownership); social resources (e.g., marital status, offspring); social behaviors/activities (e.g., social participation, volunteering, religiosity); and fulfillment of basic social needs (e.g., emotional support, loneliness) [26]. A 2024 systematic review by Hanlon et al. identified five key characteristics of social frailty: social isolation, loneliness, reduced social support, economic insecurity, and living alone [27]. These dimensions may be particularly relevant in patients undergoing HD, where treatment-related demands can restrict mobility and reduce opportunities for social participation [23]. Frequent hospitalizations, functional decline, and treatment-related fatigue may further limit engagement in community and family roles [23]. Social frailty may not only coexist with physical frailty but also interact with it, as weakened social networks and reduced perceived support may impair resilience and self-management capacity, increasing vulnerability to adverse outcomes. Despite this, the role of social frailty in nephrology populations remains underexplored and conceptually fragmented.

Evidence suggests that social dimensions are clinically relevant in patients undergoing HD. Untas et al. analyzed data from 32,332 individuals across 12 countries and found that reduced social activity, feelings of isolation, and inadequate family support were associated with increased mortality, lower treatment adherence, and reduced quality of life (QOL) [28]. They also emphasized the need for intervention studies addressing social vulnerabilities among this population [28]. A subsequent cross-sectional study of older Japanese patients receiving HD suggested that social frailty may precede physical frailty [29]. These findings suggest that social frailty and QOL may be important considerations in the early identification of vulnerability among older adults undergoing HD. Speyer et al. used the Kidney Disease Quality of Life—Short Form (KDQOL-SF) in cohorts from Brazil, the United States, and France and identified symptom burdens such as muscle pain and dyspnea that were associated with reduced QOL [30]. The authors also noted a lack of large-scale studies examining these subjective symptom burdens [30]. In addition, the 2025 WHO World Health Assembly described how patients with CKD frequently experience multimorbidity and mental health problems, both of which adversely affect QOL [31]. Social isolation has also been associated with declines in QOL [32], and evidence has demonstrated that loneliness and social isolation are associated with increased morbidity, mortality, and functional decline [33–37]. Although loneliness is often conceptualized as a psychological construct, Abe et al. noted that psychological and social frailty are interrelated and may

overlap; within broader frameworks, psychological indicators such as loneliness can be incorporated into social frailty [38]. Taken together, these findings support the inclusion of loneliness and social isolation as core elements of social frailty assessment.

Overall, frailty assessment has clear clinical relevance for older adults undergoing HD; however, the most appropriate tools for evaluating physical frailty in this population remain uncertain. As HD is commonly delivered in outpatient settings, many older adults receiving HD live in the community rather than in institutional care. Maintaining community-dwelling status is widely regarded as a key indicator of healthy aging, autonomy, and functional independence [39]. Remaining in the community reflects not only physical capacity but also the adequacy of social support, participation, and environmental resources, and has been conceptualized as a core dimension of “aging in place” [40]. In Japan, evidence suggests that social vulnerability may accelerate functional decline and the transition to institutional care among community-dwelling older adults [41]. Social relationships may therefore be important for sustaining independence and supporting aging in place. Accordingly, focusing on community-dwelling older adults enables examination of social frailty as a potentially modifiable factor influencing vulnerability trajectories among individuals undergoing HD.

1.2. Research Questions and Objectives

Existing research on older adults undergoing HD has focused primarily on medical outcomes, with comparatively little attention given to social relationships and frailty-related factors that may influence long-term disease management. To address this gap, we conducted a scoping review to examine the following research questions:

1. What is currently known about the social relationships and social frailty of older adults undergoing HD?
2. What measurement scales have been used to assess social relationships in this population?

Accordingly, the objectives of this scoping review were as follows:

1. To summarize, classify, and systematically map existing evidence on frailty and social relationships among older adults undergoing HD.
2. To identify gaps in the current literature and suggest directions for future research.

2. Materials and Methods

2.1. Review Design and Registration

This scoping review was conducted using established methods to map key concepts, major information sources, and types of evidence available within a research field [42]. Reporting followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) [43,44]. This review was registered in the University Hospital Medical Information Network (UMIN) Clinical Trials Registry (UMIN-CTR), part of the WHO Primary Registry Network (Registration No. UMIN000055770; https://center6.umin.ac.jp/cgi-open-bin/ctr_e/ctr_view.cgi?recptno=R000062980; accessed on 27 January 2026).

2.2. Eligibility Criteria and Literature Search

The PCC (Population, Concept, Context) framework was used to structure the research questions and eligibility criteria for this scoping review, in accordance with PRISMA-ScR guidance [43,44]. As summarized in Table 1, the participants were individuals aged 60 years or older undergoing HD therapy; the concept of interest comprised social relationships and frailty; and the context included community-dwelling populations in both domestic and international settings.

Table 1. PCC framework used in this review.

Component	Description
Population	Individuals aged ≥ 60 undergoing HD therapy
Concept	Social relationships, frailty
Context	Community-dwelling populations in domestic and international settings

Eligible documents were peer-reviewed articles published in English or Japanese between 1 January 2000 and 19 June 2024. For clarity, studies were eligible if they: (1) included community-dwelling individuals receiving HD therapy, (2) involved populations aged ≥ 60 years or samples in which at least 30% of participants were aged ≥ 60 years, and (3) examined associations between social relationship variables (e.g., social support, social networks, social participation, or social isolation) and frailty outcomes. Studies were excluded if they focused exclusively on treatment efficacy, included mixed-age samples in which older adults represented only a minor proportion of participants and for which age-specific findings could not be reasonably inferred, or were not primary research articles (e.g., editorials, columns, conference proceedings, newspaper articles, or case reports).

Electronic database searches were conducted in PsycINFO, Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, Cochrane Reviews, and the Japan Medical Abstracts Society (Ichushi-Web). To enhance coverage, gray literature was also searched, including WorldCat, Open Access Theses and Dissertations (OATD), CiNii Research, Latin America and the Caribbean Health Sciences Literature (LILACS), Google Scholar, and citation tracking. Appendix A presents the full search strategy used for the PubMed database and Table A1 shows the literature search terms used to identify relevant studies. The search strategy was structured around four core concepts: older adults, hemodialysis, social relationships, and frailty. For each concept, multiple synonymous or related terms were identified to maximize retrieval of relevant literature across databases. Search terms were combined using Boolean operators (OR within concepts and AND between concepts). Database searches were conducted in June 2024, with gray literature searches extended through October 2024. The search strategy identified 121 records prior to duplicate removal, which were subsequently screened according to the eligibility criteria described above.

2.3. Screening and Data Extraction

Two independent reviewers screened titles and abstracts for eligibility, followed by full-text screening using the predefined inclusion and exclusion criteria. Discrepancies at any stage of the screening process were resolved through discussion, with a third reviewer consulted as needed to ensure consistency and methodological rigor.

Data extraction was conducted by two reviewers using a standardized form to ensure consistency across studies. Extracted information included: (1) study title and authors; (2) study aims; (3) study design; (4) country or region; (5) sample characteristics; (6) outcomes assessed and analytic methods; (7) key findings; (8) reported limitations; (9) funding sources; and (10) bibliographic details, including journal name, publication year, volume, issue, page range, and DOI.

2.4. Methodological Quality Appraisal

Methodological quality of included studies was assessed using the Mixed Methods Appraisal Tool (MMAT), 2018 version [45]. Each study was categorized according to its design, and the corresponding five MMAT criteria were applied. One reviewer [T.M.] eval-

uated each study, with ratings discussed and confirmed by two other reviewers [N.Y. and H.M.]. Item-level ratings were reported rather than an overall score being calculated [45]. Findings from the appraisal were incorporated into the narrative synthesis to support interpretation of the evidence but were not used to exclude studies.

2.5. Data Synthesis

Data were synthesized using a descriptive and narrative approach consistent with scoping review methodology. Study characteristics were summarized to describe the scope and distribution of the available evidence. Findings were organized according to frailty domain and type of social relationship assessed, with corresponding measurement instruments and reported outcomes collated across studies. Quantitative findings were summarized descriptively, focusing on reported prevalence and the direction of associations between social factors and frailty outcomes, while qualitative findings were synthesized narratively. Owing to heterogeneity in study designs, social constructs, and assessment tools, no quantitative synthesis was performed; results are therefore presented as a structured narrative synthesis to support evidence mapping and identification of research gaps.

In addition, social relationship variables were deductively mapped onto a conceptual framework influenced by Bunt et al. [26], with minor adaptations to reflect the specific HD context. Extracted variables (i.e., social relationship elements) were classified into three overarching conceptual domains according to their primary social function: (1) Structural Attributes, referring to relatively stable social circumstances or positions within a social network (e.g., household composition, marital status, presence of children, occupation, and community roles); (2) Social Behaviors, representing active engagement in social interactions and participation (e.g., family interactions, participation in healthcare decision-making, social activities, and communication with others); and (3) Social Needs, capturing subjective perceptions regarding the adequacy or quality of social relationships. Social needs were further categorized as negatively formulated (e.g., loneliness, isolation, and helplessness) or positively formulated (e.g., perceived social support, acceptance, feeling useful to others, and emotional or affirming support). Where constructs overlapped multiple domains, classification was based on the principal social dimension represented in the original study. For each social element, corresponding measurement instruments were identified and cross-referenced across studies to determine whether constructs were assessed using established social frailty scales or broader social or QOL instruments.

3. Results

3.1. Study Selection and Characteristics

Figure 1 shows the study selection process. A total of 121 records were identified through database searching. After removal of nine duplicates, 112 records were screened, resulting in the exclusion of 105 records that did not meet the inclusion criteria and the identification of seven eligible studies. An additional five studies were identified through grey literature searches, yielding a total of 12 included studies [29,46–56].

Table 2 summarizes the key characteristics of the included studies and study populations, including study design, geographic distribution, participant demographics, HD duration, reported comorbidities, and MMAT ratings. The 12 included studies comprised quantitative ($n = 9$) and qualitative ($n = 3$) designs and were conducted across eight countries: China ($n = 5$) [48,50,51,53,54], Spain [46], Japan [29], the United States [49], the United Kingdom [47], Portugal [52], Brazil [55], and Norway [56]. Publication years ranged from 2012 to 2024, with most studies published after 2020 [29,46–51,53,54]. Sample sizes varied substantially, from small qualitative samples of 11–25 participants [47,49,56] to larger quantitative cohorts exceeding 400 participants [48,50]. Across all studies, participants

were predominantly older adults, with reported ages ranging from 60 to over 90 years, and a total pooled sample of 1431 individuals receiving HD. Treatment duration was heterogeneous, most commonly reported as ≥ 3 months [48,50–54], with several studies including patients receiving HD for more than five years [29,49]. Comorbid conditions were frequently reported and included diabetes, hypertension, cardiovascular disease, and diabetic nephropathy [29,46,48,50–54]. Four studies [46–49] quantified comorbidity burden using the Charlson Comorbidity Index (CCI) [57,58], consistently reporting high scores indicative of substantial multimorbidity.

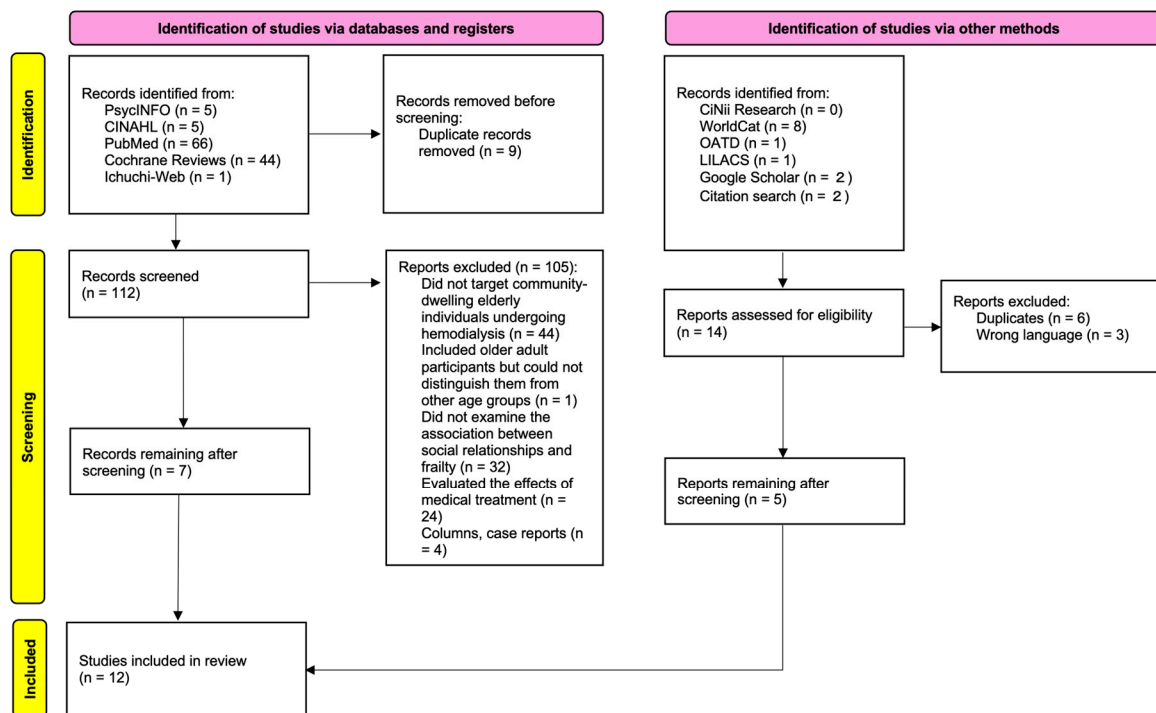


Figure 1. PRISMA flow diagram for this scoping review including searches of databases and other sources. Abbreviations: OATD, Open Access Theses and Dissertations; LILACS, Latin America and the Caribbean Health Sciences Literature.

Across the 12 included studies, methodological quality was generally moderate to high. Most quantitative studies employed appropriate measurement tools and multivariable statistical analyses. However, several relied on convenience sampling from single or regionally concentrated centers, limiting representativeness. Nonresponse bias was rarely explicitly reported. The predominance of cross-sectional designs limits causal inference. The three qualitative studies demonstrated strong methodological coherence, clear analytic procedures, and adequate support for their findings. Overall, while methodological rigor was acceptable, the evidence base is limited by design heterogeneity, geographic concentration, and the lack of longitudinal studies. Full MMAT item ratings for each study are presented in Table S1.

Table 2. Characteristics of included studies and participants.

Study ID	Country	Study Design	Research Objectives	Characteristics of Research Participants Mean ($\pm$ SD), Median (IQR)		MMAT Rating
				Age (Years); Sex (M/F) No. of Participants (<i>n</i>)	HD Duration (Years or Months) * Comorbid Conditions, etc.	
Pereira 2024 [46]	Spain	Quantitative study	Analysis and description of the clinical status of elderly HD patients. Particular focus on Barthel Index (BI) dependency and frailty	Age: 81.3 ± 4.535 M: 61 (57.0%); F: 46 (43.0%) (<i>n</i> = 107)	51.71 ± 51.04 months diabetic nephropathy: <i>n</i> = 24 (22%) CCI: 9.24 ± 2.02 MIS: 6.85 ± 3.89	Moderate-High
Jiang 2024 [50]	China	Quantitative study	Pre-frailty and frailty prevalence and risk factors among HD patients in central China	Age: 59 (47–69) M: 216 (52.9%); F: 192 (47.1%) (aged ≥ 60 <i>n</i> = 198; 48.5%)	≥ 3 months hypertension: <i>n</i> = 338 (82.8%) diabetes: <i>n</i> = 139 (34.1%) heart disease: <i>n</i> = 110 (27.0%)	Moderate
Young 2022 [47]	United Kingdom	Qualitative study	A qualitative study on the lived experiences of frail individuals receiving home-based nursing care	Age: 69 ± 10 M: 12 (48%); F: 13 (52%) (<i>n</i> = 25)	≥ 3 months History of ≥ 1 fall in the last 6 months diabetic nephropathy: <i>n</i> = 11 (44%) CCI: 6 ± 2	High
Zhu 2022 [53]	China	Quantitative study	A study investigating the correlation between frailty in elderly patients receiving regular HD and the quality of life of their family carers	Age: ≥ 60 M: 52 (57.8%); F: 38 (42.2%) (<i>n</i> = 90) Carer M: 45 (50%) F: 45 (50%)	≥ 3 months BMI 18.4: <i>n</i> = 25 (27.8%) hypertension: <i>n</i> = 48 (53.3%) diabetes: <i>n</i> = 25 (27.7%)	Moderate
Chen 2022 [48]	China	Quantitative study	Comparison of the Prevalence of Cognitive Frailty in Older Adults and Middle-Aged Adults and Differences in Its Influencing Factors	Age: 55 (26–88) M: 523 (61.4%); F: 329 (38.6%) (aged ≥ 60 <i>n</i> = 340; 39.9%)	≥ 3 months Diabetic nephropathy (aged ≥ 60): <i>n</i> = 135 CCI $3 \geq$ aged ≥ 60 : <i>n</i> = 129	High
Gong 2022 [54]	China	Quantitative study	Prevalence of frailty, including physical, psychological and social frailty, among HD patients in southern China and its associated factors	Age: 61.96 ± 13.68 M: 184 (61.3%); F: 116 (38.7%) (age ≥ 60 <i>n</i> = 181; 60.33%)	≥ 3 months Diabetes: <i>n</i> = 133 (44.33%)	Moderate-High

Table 2. Cont.

Study ID	Country	Study Design	Research Objectives	Characteristics of Research Participants Mean ($\pm$ SD), Median (IQR)		MMAT Rating
				Age (Years); Sex (M/F) No. of Participants (<i>n</i>)	HD Duration (Years or Months) * Comorbid Conditions, etc.	
Usui 2021 [29]	Japan	Quantitative study	The relationship between social frailty preceding the onset of physical frailty and the decline in physical function and motor ability in elderly individuals with HD	Age: 74.1 ± 6.8 M: 113 (71.5%); F: 45 (28.5%) (<i>n</i> = 158)	5.5 (2.5–10.2) year Diabetic nephropathy: <i>n</i> = 71 Diabetes: (49.4%) Cardiovascular disease: (44.3%)	Moderate
Hall 2020 [49]	United States	Qualitative study	Identifying key quality-of-life themes for elderly individuals with dementia and their impact on existing quality-of-life indicators	Age: 81.0 ± 4.2 M: 6 (50%); F: 6 (50%) (<i>n</i> = 12)	5.4 $\pm$ 3.1 years ≥ 2 comorbid chronic conditions CCI: 8.3 ± 2.5	High
Yuan 2020 [51]	China	Quantitative study	Current Status of Frailty in HD Patients and Its Correlation with Psychosocial Factors	Age: 53.2 ± 14.4 M: 98 (52.4%); F: 89 (47.6%) (aged ≥ 60 <i>n</i> = 57; 30.5%)	≥ 3 months BMI 18.5: <i>n</i> = 21 (11.2%) Diabetes: <i>n</i> = 33 (17.6%) Hypertension: <i>n</i> = 142 (76.0%)	Moderate
Pilger 2017 [55]	Brazil	Quantitative study	Relationship between Mental Well-being in Older Adults and Variables Related to Socio-demographic, Economic, Religious, and Health Factors and QOL	Age: 70.1 ± 6.98 M: 125 (74.0%); F: 44 (26.0%) (<i>n</i> = 169)	≥ 6 months	Moderate
Poveda 2017 [52]	Portugal	Quantitative study	To evaluate the prevalence of frailty in HD patients and its association with sociodemographic, clinical, and biochemical markers	Age: 64.3 ± 14.6 M: 44 (53.0%); F: 39 (47.0%) (<i>n</i> = 83)	≥ 3 months	Moderate
Aasen 2012 [56]	Norway	Qualitative study	Perceptions of patient participation in dialysis units among elderly hemodialysis patients with end-stage renal disease	Age: 72: <i>n</i> = 1; 75–78: <i>n</i> = 2; 80–85: <i>n</i> = 6; 90 <i>n</i> = 2 M: 7; F: 4 (<i>n</i> = 11)	2 months to less than 1 year: <i>n</i> = 4 1 to 2 years: <i>n</i> = 3 4 to 6 years: <i>n</i> = 4 No history of kidney transplantation; no plans transplantation; stable condition	High

* HD duration was reported in the original units (months or years); no conversions were made. Abbreviations: M, male; F, female; HD, hemodialysis; BI, Barthel Index; BMI, body mass index; QOL, quality of life; CCI, Charlson Comorbidity Index; MIS, Malnutrition-inflammation score; MMAT, Mixed Methods Appraisal Tool.

3.2. Findings Related to Frailty and Social Relationships Among Older Adults Undergoing HD

Table 3 presents the main findings related to frailty and social relationships among older adults undergoing HD, summarizing the frailty constructs examined, the measurement instruments used, the social relationship constructs assessed, and the direction of associations reported across studies (further details are provided in Table S2). Frailty was assessed using a range of validated instruments targeting physical, cognitive, or multidimensional frailty, including the Cardiovascular Health Study criteria (CHS/J-CHS) [29,46,48], the FRAIL Scale [49–52], the Tilburg Frailty Indicator (TFI) [53,54], and the Clinical Frailty Scale (CFS) [47]. Alongside these primary frailty instruments, seven studies also employed additional clinical or functional indicators (e.g., Barthel Index [BI], CCI, body mass index (BMI), and the Lawton Instrumental Activities of Daily Living [IADL] measure) to characterize patient vulnerability. The frailty instruments differ conceptually in their operationalization of frailty, with CHS and FRAIL primarily reflecting phenotypic or performance-based biological vulnerability, whereas CFS and TFI adopt broader multidimensional or deficit-accumulation approaches incorporating functional and psychosocial elements. Several quantitative studies reported a high prevalence of physical frailty or pre-frailty among older adults undergoing HD, with frailty affecting approximately 38–46% of participants in studies that reported prevalence estimates [46,50,52].

Social relationships were operationalized using diverse indicators, including social support [48,49,51,55], household composition and family structure [50,54], social participation and isolation [47,54,55], and social frailty scales [29]. In the analytical synthesis presented in Table 3, these social variables were grouped conceptually into structural attributes (e.g., living arrangements or family composition), behavioral engagement (e.g., participation or interpersonal interaction), and relational needs or resources (e.g., perceived social support or loneliness). These measures capture distinct but overlapping constructs, ranging from structural network characteristics (e.g., living arrangements) to perceived support (e.g., MSPSS), participation and QOL-based social domains (e.g., WHOQOL), and explicit social vulnerability states (e.g., Makizako Social Frailty Index). Quantitative analyses consistently demonstrated associations between poorer social relationships (such as living alone, limited social support, or higher social frailty scores) and increased physical or cognitive frailty [29,48,50,51,54]. Conversely, social support and family presence were identified as protective factors against physical or cognitive frailty in multiple studies [48,50,51]. Qualitative studies provided complementary findings, describing reduced autonomy in decision-making, increased dependence on family and healthcare professionals, loss of community participation, and persistent feelings of isolation and loneliness among frail HD patients [47,49,56]. Overall, despite heterogeneity in measurement approaches, a consistent pattern emerged in which weaker social resources and greater social vulnerability were associated with higher levels of physical or cognitive frailty among older adults undergoing HD.

Table 3. Key outcomes from the included studies regarding frailty and social relationships and the scales used.

Study ID	Frailty Construct	Primary Frailty Measure	Measurement Level	Additional Measures Used	Social Construct	Social Measure	Direction of Association/Key Pattern
Pereira 2024 [46]	Physical (phenotypic)	CHS	Biological/performance	BI; CCI	Behavioral/functional	SF-12 (social functioning)	Lower social functioning observed in frail group; frailty associated with greater ADL dependence
Jiang 2024 [50]	Physical (phenotypic)	FRAIL	Biological/functional		Structural	Presence of children	Presence of children associated with lower odds of frailty
Young 2022 [47]	Multidimensional	CFS	Global clinical vulnerability	CCI	Behavioral + experiential	Qualitative themes	Reduced participation, increased dependence, loneliness, reduced decision-making autonomy
Zhu 2022 [53]	Multidimensional	TFI	Multidimensional vulnerability	BI; BMI	Structural	Family/caregiver context	Frailty associated with greater caregiving burden and reduced self-care capacity
Chen 2022 [48]	Cognitive + Physical	CHS + cognitive frailty criteria	Biological + cognitive	CCI	Needs/support	Social support	Lower social support associated with cognitive frailty
Gong 2022 [54]	Multidimensional	TFI	Multidimensional vulnerability		Structural + experiential	Household composition; TFI social domain	Single-person households and higher social domain scores associated with physical frailty
Usui 2021 [29]	Physical + Social frailty	J-CHS; Makizako Index	Biological + social vulnerability	IADL; leg strength	Social frailty	Makizako Social Frailty Index	Social frailty associated with reduced leg strength and IADL impairment
Hall 2020 [49]	Physical (phenotypic)	FRAIL	Biological/functional	CCI	Needs/support	Social support (qualitative)	Social support described as important for maintaining health and quality of life
Yuan 2020 [51]	Physical (phenotypic)	FRAIL	Biological/functional	BMI	Needs/support	Social support	Higher support associated with lower physical frailty prevalence
Pilger 2017 [55]	Physical health status/QOL	WHOQOL physical domain	Functional/QOL		Needs/relational	WHOQOL social domain; spiritual well-being	Positive correlations between social relationship domains and psychological well-being

Table 3. Cont.

Study ID	Frailty Construct	Primary Frailty Measure	Measurement Level	Additional Measures Used	Social Construct	Social Measure	Direction of Association/Key Pattern
Poveda 2017 [52]	Physical (phenotypic)	FRAIL	Biological/functional		Structural	Social network	No clear association between social network and frailty categories
Aasen 2012 [56]	Multidimensional (contextual)		Relational/experiential		Behavioral + experiential	Qualitative themes	Limited patient participation; feelings of helplessness and isolation within dialysis care context

Abbreviations: SF-12, 12-item Short Form Survey; CHS, Cardiovascular Health Study; J-CHS, Japanese version of the Cardiovascular Health Study; TFI, Tilburg Frailty Indicator; CFS, Clinical Frailty Scale; BI, Barthel Index; CCI, Charlson comorbidity index; MIS, Malnutrition-inflammation score; BMI, Body Mass Index; WHOQOL, World Health Organization Quality of Life scale; IADL, lawton Instrumental Activities of Daily Living; FRAIL scale, Fatigue, Resistance, Ambulation, Illnesses, and Loss of Weight scale.

3.3. Scales and Assessment of Physical, Cognitive, and Comprehensive Frailty

An overview of the frailty assessment instruments used across the included studies, including their conceptual orientation, primary domains assessed, and analytical application, is provided in Table 4. These instruments reflect several distinct conceptual models of frailty, including physical (phenotypic), social, cognitive, and multidimensional constructs. Physical frailty was most commonly assessed using phenotype-based instruments, including the CHS [59], J-CHS [60], and the FRAIL scale [61], all of which classify frailty based on combinations of weight loss, fatigue, physical activity, walking speed, and muscle strength [29,46,48,50–52]. Social frailty was evaluated in a single study [29] using the Makizako Social Frailty Index, which captures aspects of social participation, social contact, and perceived social usefulness [62]. Cognitive frailty was defined in one study [48] according to the International Academy on Nutrition and Aging and the International Association of Gerontology and Geriatrics (IANA/IAGG) criteria [63], incorporating mild cognitive impairment in the absence of dementia alongside physical frailty. Comprehensive frailty was assessed using multidimensional tools, including the CFS [64] in one study [47] and the TFI [65] in two studies [53,54] which integrate physical, psychological, and social components of frailty.

Table 4. Conceptual classification of frailty assessment instruments used in studies of community-dwelling older adults undergoing HD.

Frailty Construct Type	Conceptual Model of Frailty	Assessment Instrument	Core Domains Measured	Studies Using Instrument	Analytical Focus in Included Studies
Physical (Phenotypic)	Biological/functional vulnerability	Cardiovascular Health Study (CHS)	Weight loss; fatigue; physical activity; walking speed; grip strength	Pereira 2024 [46]; Chen 2022 [48]	Prevalence; association with ADL, QOL, cognitive status
Physical (Phenotypic)	Biological/functional vulnerability	Japanese CHS (J-CHS)	Weight loss; muscle strength; fatigue; walking speed; physical activity	Usui 2021 [29]	Prevalence; association with physical function and motor ability
Physical (Phenotypic)	Biological/functional vulnerability	FRAIL Scale	Fatigue; resistance; ambulation; illness; weight loss	Hall 2020 [49]; Jiang 2024 [50]; Yuan 2020 [51]; Poveda 2017 [52]	Prevalence; association with psychosocial and social relationship variables
Social Frailty	Social vulnerability state	Makizako Social Frailty Index	Going out frequency; social contact; perceived usefulness; living alone; conversational frequency	Usui 2021 [29]	Association with physical frailty and functional impairment
Cognitive Frailty	Physical frailty + mild cognitive impairment	IANA/IAGG definition	Mild cognitive impairment + CHS ≥ 3 ; absence of dementia	Chen 2022 [48]	Prevalence; association with social support
Multidimensional/ Comprehensive	Integrated physical, psychological, and social vulnerability	Clinical Frailty Scale (CFS)	Activity level; dependency; cognition	Young 2022 [47]	Lived experience of frailty in HD context
Multidimensional/ Comprehensive	Integrated physical, psychological, and social vulnerability	Tilburg Frailty Indicator (TFI)	Physical; psychological; social domains	Zhu 2022 [53]; Gong 2022 [54]	Prevalence; association with household composition and social domain scores

Abbreviations: ADL, activities of daily living; CHS, Cardiovascular Health Study; J-CHS, Japanese version of the Cardiovascular Health Study; CFS, Clinical Frailty Scale; TFI, Tilburg Frailty Indicator; IANA, the International Academy on Nutrition and Aging; IAGG, the International Association of Gerontology and Geriatrics; MCI, mild cognitive impairment; QOL, quality of life.

As mentioned above, seven studies also used additional clinical or functional indicators alongside primary frailty instruments [29,46–49,51,53]. The BI [66] is a scale used to assess ADL across 10 items, with a total score of 100 points, and it was used in two studies [46,53]. The reported evaluations were “moderate or greater dependence” and a mean score of 45.94 ± 20.92 , respectively. A total BI score of 80 points or higher indicates independence, while a cutoff point of 60 points is considered the threshold distinguishing partial independence from the need for care [67]. Across studies, frailty assessments were frequently linked to prevalence estimates and individual characteristics, with some studies additionally examining associations with physical function, motor ability, psychosocial factors, quality of life, or caregiver outcomes, demonstrating heterogeneity in both measurement approaches and analytic applications across the included literature. This conceptual diversity in frailty measurement frameworks indicates the importance of considering both biological vulnerability and broader functional and social dimensions when interpreting frailty outcomes in HD populations.

3.4. Conceptual Domains of Social Relationships and Social Frailty

Table 5 summarizes the conceptual classification of social relationship and social frailty elements identified across the included studies and maps these elements to the measurement instruments used to operationalize them. Eight studies assessed social relationships using measures related to social frailty, including the Makizako Social Frailty Index [62], the social domain of the TFI [65], and broader social or quality-of-life instruments such as the Lubben Social Network Scale-6 (LSNS-6) [68], the 12-item Short Form Survey (SF-12) [69], the Multidimensional Scale of Perceived Social Support (MSPSS) [70], the Social Support Rating Scale (SSRS) [71], the WHOQOL-BREF [72], and the WHOQOL-OLD [73]. Across all studies, a total of 19 distinct elements related to social frailty were identified.

Table 5. Classification of social relationship elements and corresponding assessment instruments in older adults undergoing HD.

Conceptual Domain	Social Element	References	Measurement Instruments/Methods
Structural Attributes	Household composition (living alone/with others)	[29,47,50,53–56]	Makizako Social Frailty Index; TFI
	Presence of children	[50]	Household attribute (study-specific)
	Marital status (spouse presence)	[47,48,50,51,53–55]	Study-specific demographic variables
	Occupation	[50,55,56]	Study-specific demographic variables
	Community role	[47]	Qualitative thematic analysis
Social Behaviors	Family relationships/interaction patterns	[46,47,49,51–53,55,56]	LSNS-6; SF-12; MSPSS; WHOQOL-BREF
	Participation in healthcare decision-making	[47,49,51,52,55,56]	WHOQOL-BREF; qualitative themes
	Frequency of going out	[29]	Makizako Social Frailty Index
	Religious activities	[49,50,55]	Study-specific participation indicators
	Conversation frequency/visiting friends/peer interaction	[29,46,47,49,51,52,55]	LSNS-6; SF-12; MSPSS; WHOQOL-BREF; WHOQOL-OLD
Social Needs (negatively formulated)	Isolation	[47,54,56]	TFI (social domain); qualitative themes
	Loneliness	[47]	Qualitative thematic analysis
	Helplessness	[56]	Qualitative thematic analysis

Table 5. Cont.

Conceptual Domain	Social Element	References	Measurement Instruments/Methods
Social Needs (positively formulated)	Acceptance	[47,56]	Qualitative thematic analysis
	Perceived social support	[29,47,48,51,52,54–56]	TFI; LSNS-6; MSPSS; SSRS; WHOQOL-BREF
	Feeling useful to others	[29]	Makizako Social Frailty Index
	Financial and material support	[47,49]	Qualitative themes; support indicators
	Emotional/affirming support	[47,49,51,52,55,56]	MSPSS; WHOQOL-OLD

Abbreviations: TFI, Tilburg Frailty Indicator; SF-12, 12-item Short Form Survey; LSNS-6, Lubben Social Network Scale-6; MSPSS, Multidimensional Scale of Perceived Social Support; WHOQOL-BREF, World Health Organization Quality of Life—Brief Version; WHOQOL-OLD, World Health Organization Quality of Life—Older Adult Version.

Based on the conceptual categorization proposed by Bunt et al. [26], these elements were grouped into three domains: structural attributes (five elements, including household composition, presence of children, marital status, occupation, and community roles); social behaviors (six elements, such as participation in healthcare decision-making, social participation, religious activities, and frequency of going out); and social needs, which were further divided into two subcategories: negatively formulated needs (three elements: isolation, loneliness, and helplessness) and positively formulated needs (five elements, including acceptance, perceived social support, feeling useful to others, and financial or material support). This conceptual grouping reflects the multidimensional nature of social relationships in HD populations, encompassing structural network characteristics, behavioral engagement, and perceived relational resources or deficits.

Table 5 further shows which elements were captured by established social frailty scales and which are assessed only through broader social or QOL instruments, illustrating variability in how social relational constructs are operationalized across studies. Seven studies reported associations between social factors and physical or cognitive frailty. Social frailty was associated with older age, male sex, and greater impairment in IADL [29], and higher TFI social domain scores were observed among physically frail individuals [52]. Household composition and family structure, including the presence of children or cohabitation, were linked to physical frailty outcomes [50,52]. Several studies reported associations between social support and physical frailty or quality of life [47–49,51], with social support identified as a protective factor against physical frailty in one cohort [51]. In qualitative studies, social isolation was frequently described in relation to difficulties in family communication or interactions with healthcare professionals [47,55,56]. Together, these findings indicate that social relationships can be operationalized through diverse structural, behavioral, and experiential dimensions, yet consistently demonstrate relevance to frailty vulnerability among older adults receiving HD.

4. Discussion

This scoping review mapped existing evidence on frailty and social relationships among community-dwelling older adults undergoing HD, identified measurement scales used to assess social relationships, and synthesized key findings in this field. A total of 12 studies from eight countries were included, with China contributing the largest number of studies ($n = 5$), accounting for 866 participants (60.5%) of the total sample of 1431.

This geographic distribution likely reflects, in part, the rapid expansion of HD services and the introduction of health insurance coverage for KRT in China since 2012, resulting in a high proportion of patients receiving HD (82.4%) and potentially facilitating increased research in this area [74]. The predominance of Chinese studies also warrants consideration

when interpreting the findings. Social relationships in China may be influenced by culturally specific family structures, expectations of filial responsibility, and the frequent role of adult children or family members as primary sources of care and support [75–77]. Previous literature has noted that Confucian traditions place strong emphasis on family responsibility and intergenerational caregiving, which may differ from more individual-centered models of aging and long-term care commonly described in Western settings [75–77]. In such contexts, social support, living arrangements, and patterns of social participation may function differently from those in European, Latin American, or North American settings. These cultural factors may provide additional context for understanding the associations between social vulnerability and frailty observed in the included studies.

In terms of publication trends, nine of the included studies were published after 2020, suggesting increasing scholarly and clinical attention to the role of social relationships and functional health among older adults receiving HD. However, the overall number of available studies remains modest, and several were based on relatively small samples, indicating that the evidence base remains limited despite growing interest in this area.

4.1. Assessment Tools for Physical and Comprehensive Frailty

Among the studies included in this scoping review, seven evaluated physical frailty; of these, four employed the FRAIL scale, while three used the CHS criteria. The CHS criteria have traditionally been widely used internationally as a relatively simple and objective assessment method. However, limitations have been noted when applying CHS criteria to populations with progressive disease, along with practical challenges related to its implementation, including specialized equipment, adequate space, and physical examination techniques not routinely performed in clinical practice [78,79]. Older adults receiving HD experience substantial physiological stress related to treatment, including fluid shifts, as well as pronounced symptoms such as weakness and fatigue [80–83]. Because CHS assessment requires additional physical exertion (e.g., grip strength testing and gait speed measurement) beyond routine care, concerns regarding patient burden have perhaps reduced its application in clinical practice [84]. In contrast, the FRAIL scale relies on self-reported symptoms and functional status, which may reduce burden for both older adults on HD and clinical staff [61]. A longitudinal study involving men aged 75 years and older demonstrated that the FRAIL scale predicts both mortality and disability [85]. However, its reliance on self-report and limited use in HD populations indicate that further validation is required.

The CFS was used in one study as a measure of comprehensive frailty [29]. Among older adults undergoing HD, the CFS has been reported to show high concordance with CHS criteria and to be associated with adverse outcomes, including symptom progression, hospitalization, and mortality [86,87]. However, its reliance on clinician judgment may limit its ability to capture HD-specific characteristics [88]. In the study by Young et al., frailty severity among participants ranged from 4 to 7 (mild to severe frailty) [47]. These levels reflect a broader frailty continuum than CHS, which does not encompass stages requiring full-time care, suggesting that frailty assessment in HD populations may require frameworks that better account for multimorbidity and care dependency [89].

Overall, although physical and comprehensive frailty assessment tools were reviewed, none of the included studies provided a clear rationale for tool selection or discussed their suitability for older adults undergoing HD. Nevertheless, all seven studies employed additional physical or functional measures alongside frailty measures. For example, the BI was used alongside the CHS and the TFI, indicating a state of “partial independence” [46,53], while BMI was assessed in conjunction with the TFI and the FRAIL scale, with participants characterized as having normal to slightly underweight body mass [51,53]. These

complementary measures appear useful for providing additional clinical context when interpreting frailty status.

Although prognostic prediction has been a primary focus of physical frailty assessment, none of the included studies examined associations with severe comorbidity burden (i.e., very high CCI scores). Previous research involving patients with CKD, those undergoing dialysis, and kidney transplant recipients has similarly shown heterogeneity among frailty measures and difficulties in cross-study comparison [18]. Given that older adults receiving HD commonly experience multimorbidity and functional limitations, consensus regarding optimal frailty assessment remains lacking. Standardization of frailty measurement, incorporating feasibility, patient burden, and predictive validity in HD-specific contexts, remains an important priority for future research.

4.2. Social Relationships, Social Frailty, and the Possible Association with Physical Frailty

We identified 19 distinct elements related to social relationships and social frailty among older adults receiving HD, spanning three domains: social attributes, social behaviors, and social needs (both negatively and positively framed). These elements were derived from the use of the Makizako Social Frailty Index [62], the social domain of the TFI [58], and several other established instruments. Qualitative studies also contributed to identifying social behaviors and social needs, highlighting subjective dimensions such as relationships with family members and healthcare professionals, participation in decision-making, QOL, and perceived usefulness. These qualitatively derived findings suggest that important aspects of social vulnerability may not be adequately captured by existing standardized frailty or social support scales. However, given the limited number of included studies, and the prominence of qualitative findings, the thematic synthesis should be interpreted with appropriate caution.

In a prior literature review by Abe et al. [38], 11 elements across five categories were judged to have content validity as indicators of social frailty. In contrast, several elements identified in the present review, particularly loneliness and helplessness, were not included in that framework. Additionally, concepts such as social isolation, participation in healthcare processes, and involvement in decision-making were not represented. Historically, constructs such as loneliness and helplessness have been viewed as conceptually diffuse or difficult to operationalize [38]. More recent evidence, including reports from the WHO Commission on Social Connection [85] and studies from Japan [35–37], recognizes loneliness and social isolation as major determinants of health, morbidity, and mortality in aging populations. The WHO defines social connection as “how people relate to and interact with others,” emphasizing loneliness and social isolation as central concerns, with contributing factors including worsening health status, living alone, and insufficient community infrastructure [90]. These dimensions may be particularly relevant in older HD populations, who frequently experience treatment-related time constraints, physical exhaustion, and a progressive narrowing of social networks. Accordingly, refinement of questionnaire items to better capture these dimensions represents an important direction for future research.

Although most available evidence was cross-sectional and did not establish temporal relationships, several findings from the included studies are consistent with the hypothesis that social frailty may precede, accompany, or interact with physical frailty. Declines in leg strength have been observed even among socially frail individuals who did not yet meet criteria for physical frailty [29], suggesting an association between social vulnerability and early functional changes. Other studies reported associations between higher levels of social support and lower prevalence of physical frailty [47], as well as associations between household composition and frailty status [51]. Qualitative evidence further described progressive social withdrawal, reduced participation in clinical decision-making, and

increasing dependence on others, often accompanied by feelings of isolation and reduced autonomy. For example, some older adults on dialysis did not perceive dialysis initiation as a voluntary choice, reporting that decisions were influenced primarily by clinicians and family members rather than by their own preferences [91]. Interviews also described uncertainty and reliance on others in daily life and treatment experiences [92], while recent studies have identified social isolation as a persistent challenge among maintenance HD patients [93].

Evidence from general older adult populations provided support for this hypothesis. Longitudinal studies have consistently demonstrated that social frailty predicts subsequent development of sarcopenia, physical frailty, and functional decline [41,94,95]. However, to the best of our knowledge, no comparable longitudinal studies have examined the relationship between social frailty and other forms of frailty among older adults receiving HD, representing an important gap in the literature. Given the prolonged treatment trajectories and high symptom burden associated with HD among older adults, social vulnerability may be associated with differences in the extent of physical decline. However, no longitudinal evidence was identified in the included studies. Accordingly, assessment of social relationships and social frailty may help identify individuals at increased risk of functional deterioration.

4.3. An Integrative Framework of Social and Physical Frailty for Patients Undergoing HD

Based on the conceptual clustering of findings across included studies, we propose a possible HD-specific relational vulnerability framework in which social relationships may be conceptualized as structural and behavioral components within frailty trajectories among community-dwelling older adults undergoing HD (Figure 2). This framework is derived from recurring patterns observed across the included studies, particularly the consistent co-occurrence of structural (e.g., living arrangements), behavioral (e.g., social participation), and needs-based (e.g., loneliness, perceived support) elements, and their reported associations with frailty-related outcomes in older adults undergoing HD. Structural attributes (e.g., marital status, presence of children) can influence the relational and emotional context (and potentially the physical context) of care, while behavioral engagement (e.g., interaction with family and healthcare professionals, involvement in clinical decision-making) reflects the maintenance of these relational resources. Together, these dimensions form a social context that may support chronic illness management, resilience, and functional capacity, and may be associated with lower frailty vulnerability.

In the HD context, however, this social environment is influenced by treatment modality. Fixed dialysis schedules, transportation dependence, post-dialysis fatigue, and recurrent hospitalizations may restrict community participation and narrow interpersonal networks. Over time, this contraction of social relationships may contribute to social frailty, characterized by loneliness, helplessness, reduced autonomy, and reduced perceived usefulness. We conceptualize this accumulated relational erosion as an aspect of HD-related social frailty, involving compromised social resilience and unmet relational needs.

This pattern suggests a context-specific interpretive pathway in which treatment-related constraints limit social engagement, which may in turn be associated with reduced interaction, increased perceived isolation, and diminished functional resilience. These interrelated processes may help explain how social vulnerability co-occurs with physical and functional decline. Within this model, social and physical frailty may be interrelated within a dynamic, treatment-mediated process, in which social frailty may occur in the absence of measurable physical decline in some individuals, while also being associated with worsening physical and cognitive vulnerability through mechanisms such as reduced

motivation, impaired self-management, and diminished adaptive reserve. However, these relationships remain hypothetical and require confirmation through longitudinal research.

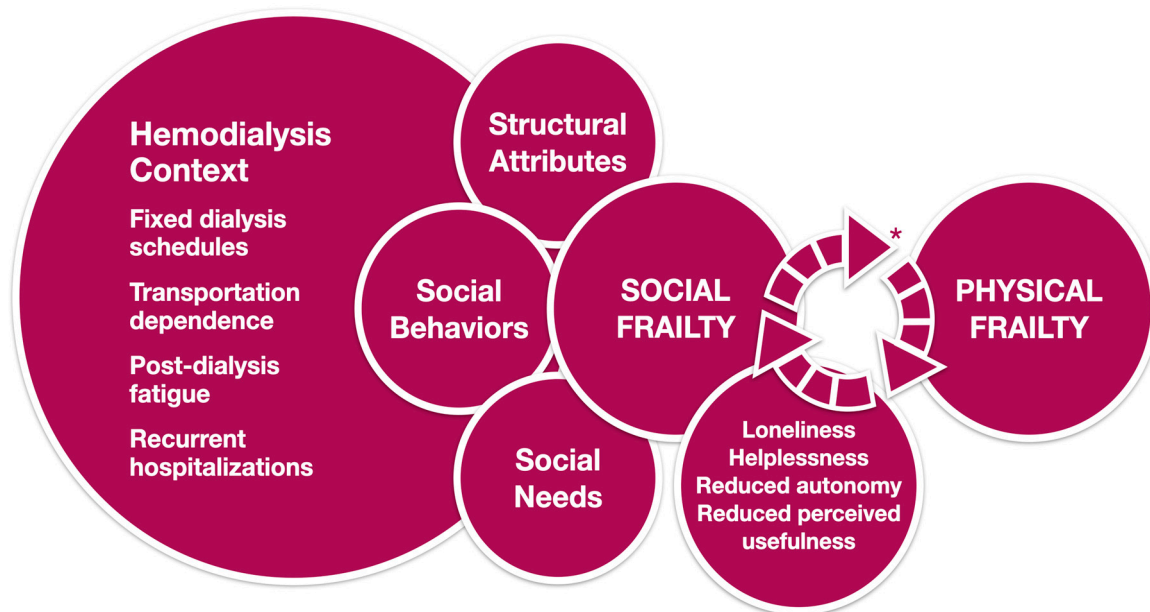


Figure 2. Conceptual framework of social and physical frailty among community-dwelling older adults undergoing HD. The framework illustrates how structural attributes, social behaviors, and social needs influence the social environment of patients undergoing HD. Treatment-related factors such as fixed dialysis schedules, transportation dependence, fatigue, and hospitalizations may be associated with restricted social participation and reduced social engagement. These constraints may, in turn, be linked to social vulnerability, including loneliness, reduced autonomy, and unmet relational needs. The framework represents an interpretive, hypothesis-generating model in which social and physical frailty are interrelated within a dynamic vulnerability process in this population. The overlapping circles are intended to illustrate the conceptual interrelatedness of these domains and do not represent quantitative relationships, proportional effects, or direct causal pathways. * Note: Dashed arrows indicate hypothesized relationships derived from patterns observed across the included studies. As all included studies were cross-sectional, these relationships should not be interpreted as causal and require confirmation through future longitudinal research.

Within this integrative framework, the heterogeneity of frailty assessment tools identified in this review may reflect not only methodological variation but also conceptual fragmentation. Phenotypic instruments such as the CHS and FRAIL scale assess biological and performance-based vulnerability, whereas measures such as the CFS and TFI capture broader dependency or multidimensional deficit accumulation. However, most commonly used physical frailty measures do not explicitly account for relational vulnerability, despite the importance of social engagement in sustaining autonomy and functional independence among HD patients. As a result, frailty in this population may be incompletely characterized when evaluated solely through traditional phenotypic or deficit-based paradigms. An HD context-sensitive approach integrating relational, behavioral, and biological dimensions may therefore provide a more comprehensive understanding of frailty trajectories and may highlight potential opportunities for earlier identification and supportive intervention. The findings summarized in Table 5 show social elements potentially relevant for comprehensive assessment of social relationships and social frailty risk in community-dwelling older adults undergoing HD. Figure 2 illustrates a proposed framework linking the HD treatment context with the development and interaction of social and physical frailty.

4.4. Implications for Clinical Practice

Although this scoping review does not permit conclusions regarding effectiveness or causality, several implications for clinical practice can be considered. First, the consistent reporting of high frailty prevalence and substantial multimorbidity among community-dwelling older adults undergoing HD supports the need for routine frailty awareness in outpatient dialysis settings. Physical frailty screening tools that minimize patient burden, such as brief self-report instruments, may be more feasible in routine care, although further validation in HD populations is required.

Second, the findings suggest that social vulnerability is common and multifaceted in older HD patients, involving not only social isolation and reduced participation but also subjective experiences such as loneliness and reduced autonomy. These dimensions are not routinely captured in standard clinical assessments but may influence treatment adherence, self-management, and functional outcomes. Incorporating simple assessments of social relationships or social frailty, such as questions about living arrangements, social support, and participation, may help identify patients at increased risk of decline.

Third, recent Kidney Disease: Improving Global Outcomes (KDIGO) guidance has emphasized that CKD management should aim not only to delay disease progression and manage complications but also to maximize health-related quality of life, physical function, capacity to work, and the ability to socialize [96,97]. Thus, the social dimensions identified in the present review, including social participation, perceived support, loneliness, and social isolation, may represent important but underexplored aspects of patient-centered care among older adults undergoing HD. Future research should examine whether interventions targeting social participation and social support can improve both social and health-related outcomes in this population.

Finally, the observed association between social frailty and physical frailty may indicate opportunities for earlier identification and supportive intervention. While further longitudinal research is needed, attention to social factors within multidisciplinary HD care teams may support more holistic management, promoting functional independence and QOL alongside other health outcomes.

4.5. Limitations

This scoping review has several limitations. First, inclusion was restricted to studies published in English or Japanese, which may have led to the exclusion of relevant research from other linguistic and regional contexts. Second, the overall evidence base remains limited, with only 12 studies identified over a 24-year period, reflecting the emerging nature of research on social relationships and frailty in older adults undergoing HD. Third, the included studies were geographically concentrated, with a substantial proportion conducted in China, which may limit the generalizability of findings to other healthcare systems and cultural contexts. It is also possible that some relevant studies were not identified despite the comprehensive search strategy encompassing multiple databases, gray literature, and citation tracking. Fourth, some included studies had relatively small sample sizes, with several enrolling fewer than 60 participants, and several studies recruited participants from a single center or geographically limited setting, which may limit generalizability and introduce heterogeneity in reported findings. Fifth, three of the included studies employed qualitative methodologies. Although qualitative findings provided valuable contextual insight into patients' lived experiences, the qualitative studies were based on relatively small cohorts, and they may have exerted a proportionally greater influence on thematic synthesis given the small number of available studies. Sixth, most of the included studies involved mixed-age samples, and age-specific analyses for older adults were not consistently reported, potentially limiting the precision of findings specific to older

adults undergoing HD. Seventh, most of the included studies employed cross-sectional designs. Consequently, although associations between social relationships, social frailty, and physical frailty were frequently reported, the temporal ordering and directionality of these relationships could not be determined, and causal inferences cannot be made. It remains unclear whether social vulnerability contributes to frailty, whether frailty leads to reduced social engagement and support, or whether these processes are bidirectional. Finally, substantial heterogeneity in study designs, frailty definitions, and measurement tools (particularly for social relationships and social frailty) precluded quantitative synthesis and limited direct comparison across studies. Accordingly, the conclusions of this review should be interpreted as exploratory and hypothesis-generating rather than definitive, particularly given the predominance of cross-sectional designs and the limited geographic diversity of the available evidence.

4.6. Future Directions

Despite growing interest in frailty among patients undergoing HD, important gaps remain in the current evidence base. Longitudinal studies are needed to clarify the temporal sequencing and potential causal pathways linking social and physical frailty in HD populations. The development and validation of context-sensitive assessment tools that incorporate relational dimensions may improve the assessment of frailty in HD populations. Finally, intervention studies examining whether strengthening social participation or support networks can mitigate frailty risk would provide valuable insights for clinical practice.

5. Conclusions

This scoping review identified substantial variation in how physical frailty and social relationships are assessed among community-dwelling older adults undergoing HD. In particular, the wide variation in assessment tools and conceptual frameworks points to the need for feasible and valid measures that capture both physical vulnerability and social dimensions of long-term disease management. Clarifying which aspects of frailty and social relationships function as early indicators of adverse outcomes remains an important priority for future research. Given the projected global increase in ESKD and the growing population of older adults receiving long-term HD, greater attention to social frailty and the broader social environments in which patients live is warranted. Emerging evidence suggests an association between social frailty and physical frailty, and social frailty may represent an early component of vulnerability, although the temporal relationship between these constructs remains unclear. This association may offer opportunities for earlier identification of physical frailty and supportive interventions; however, longitudinal evidence is needed to clarify causal pathways. Further longitudinal and mixed-methods research will be important for understanding frailty trajectories and informing more holistic, patient-centered care for older adults undergoing HD.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/kidneydial6030045/s1>, Table S1: Mixed Methods Appraisal Tool (MMAT, 2018 version) full item-level ratings for each study; Table S2: Summary of frailty findings and social relationship findings across included studies.

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Abbreviations

The following abbreviations are used in this manuscript:

ADL	Activities of Daily Living
BI	Barthel Index
BMI	Body Mass Index
CCI	Charlson Comorbidity Index
CDR	Clinical Dementia Rating
CFS	Clinical Frailty Scale
CHS	Cardiovascular Health Study
CKD	Chronic Kidney Disease
ESKD	End-Stage Kidney Disease
FRAIL scale	Fatigue, Resistance, Ambulation, Illnesses, and Loss of Weight scale
HD	Hemodialysis
IADL	Instrumental Activities of Daily Living
IANA	International Academy on Nutrition and Aging
IAGG	International Association of Gerontology and Geriatrics
ISN	International Society of Nephrology
J-CHS	Japanese version of the Cardiovascular Health Study
KDIGO	Kidney Disease: Improving Global Outcomes
KDQOL-SF	Kidney Disease Quality of Life—Short Form
KRT	Kidney Replacement Therapy
LSNS-6	Lubben Social Network Scale–6
MCI	Mild Cognitive Impairment
MIS	Malnutrition–Inflammation Score
MSPSS	Multidimensional Scale of Perceived Social Support
OATD	Open Access Theses and Dissertations
OR	Odds Ratio
PRISMA-ScR	Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews
QOL	Quality of Life
SF-12	12-item Short Form Survey
SSRS	Social Support Rating Scale
TFI	Tilburg Frailty Indicator
UMIN	University Hospital Medical Information Network
WHO	World Health Organization
WHOQOL-BREF	World Health Organization Quality of Life—Brief Version
WHOQOL-OLD	World Health Organization Quality of Life—Older Adult Version
95% CI	95% Confidence Interval

Appendix A

Electronic Search Strategy

As an example of the search strategies used in the database, we provide details of our PubMed search strategy. The PubMed search strategy combined Medical Subject Headings (MeSH) and free-text terms related to older adults, hemodialysis, social relationships, and

frailty. Search terms within each concept were combined using OR, and concepts were combined using AND. The search was conducted in June 2024.

(“Aged”[MeSH] OR “Aged, 80 and over”[MeSH] OR older adults[tiab] OR aged[tiab] OR elderly[tiab] OR elder*[tiab] OR geriatric*[tiab] OR senior*[tiab]) AND (“Renal Dialysis”[MeSH] OR hemodialysis[tiab] OR haemodialysis[tiab] OR dialysis[tiab]) AND (“Social Support”[MeSH] OR “Social Isolation”[MeSH] OR “Social Participation”[MeSH] OR social relationship*[tiab] OR social support[tiab] OR social network*[tiab] OR social isolation[tiab] OR social inclusion[tiab] OR social exclusion[tiab] OR social frailty[tiab])AND(“Frailty”[MeSH] OR frailty[tiab] OR frail*[tiab] OR vulnerable elderly[tiab] OR vulnerability[tiab] OR functional impairment[tiab])

Limits: Publication dates from 1 January 2000 to 19 June 2024; English or Japanese language.

Table A1. Literature search formula.

Concept	Older	Hemodialysis	Social Relationships	Frailty
Search term	older adults; aged; elderly people; elderly; older; elder; geriatric; old people; senior	hemodialysis; dialysis	social relationships; social support; social networks; social inclusion; social exclusion; social isolation	frailty; frail elderly; vulnerable elderly; vulnerability; functionally; impaired elderly

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