

Social Support in Older Adults With CKD: A Report From the CRIC (Chronic Renal Insufficiency Cohort) Study



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Rationale & Objective: Social support in older adults with chronic kidney disease (CKD) is a potentially modifiable factor that may affect important clinical outcomes such as health-related quality of life, cognitive function, and frailty. However, limited data about the effects of social support in older patients with non-dialysis-dependent CKD exist. Our objective was to evaluate the association of social support with health-related quality of life, cognitive function, and frailty in older adults with CKD.

Study Design: Cross-sectional analysis of a prospective cohort study.

Setting & Population: 1,851 participants older than 65 years with CKD enrolled in the Chronic Renal Insufficiency Cohort (CRIC) Study.

Exposure: Social support (Lubben Social Network Scale [LSNS]).

Outcomes(s): Health-related quality of life (Kidney Disease Quality of Life-36), cognitive function (Modified Mini-Mental State Examination, Trail Making Test A & B, and Buschke Selective Reminder Tests), and frailty (modified Fried frailty criteria).

Analytic Approach: Multivariable, linear, and logistic regression to determine the association between social support and health-related quality of life, cognitive function, and frailty.

Results: Low social support, defined as LSNS score < 12, was present in 22% of participants. On multivariable analysis, higher social support was associated with higher health-related quality of life (β coefficient per 1-SD increase in LSNS score; burden subscale, 2.57 (95% CI, 1.57-3.56); effects subscale, 2.21 (95% CI, 1.52-2.9); symptoms subscale, 1.64 (95% CI, 0.88-2.41); mental health composite subscale, 1.91 (95% CI, 1.40-2.43); and physical health composite score, 0.64 (95% CI, 0.03-1.24)). Higher social support was associated with better cognitive function (β coefficient per 1-SD increase in LSNS score; Modified Mini-Mental State Examination, 0.81 (95% CI, 0.44 to 1.19); Trail Making Test A & B, -2.53 (95% CI, -4.29 to -0.76) and -6.53 (95% CI, -10.07 to -2.99), respectively; Buschke Selective Reminder Test 1, 2, and 3, 0.19 (95% CI, 0.07 to 0.30); 1.59 (95% CI, 0.96 to 2.22); and 0.40 (95% CI, 0.23 to 0.56), respectively). Higher social support was associated with higher likelihood of being nonfrail (OR, 1.77; 95% CI per 1-SD higher LSNS score, 1.24-2.53).

Limitations: Conclusions about causality cannot be drawn from an observational cross-sectional study.

Conclusions: In older patients with CKD, higher social support was associated with higher health-related quality of life and cognitive function and less frailty.

Visual Abstract included

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Social support is an important aspect of many chronic conditions; social network strength is associated with meaningful outcomes in cardiovascular disease, pulmonary disease, dementia, cancer, diabetes, and end-stage kidney disease (ESKD).¹⁻⁶ In addition, social support appears to be particularly important in older populations. Social isolation and loneliness are very common in older adults, with an estimated prevalence of ~40% in some groups.^{7,8} Though chronic kidney disease (CKD) disproportionately affects older adults,⁹ there is a paucity of research investigating the influence of social support on outcomes in older adults with CKD not receiving dialysis. Consequently, there is a compelling need to better understand the significance of social support in older patients with CKD. Studying the impact of social support on older adults with CKD may allow for better risk assessment of patients with CKD newly diagnosed, as well as facilitate the

creation of social support-based interventions that could potentially improve clinical outcomes.

Poor social support in older adults is associated with adverse outcomes such as poor quality of life, increased risk for falls, dementia, frailty, rehospitalization, and mortality.^{7,8,10,11} Factors such as social support that influence cognitive function, quality of life, and frailty are important to investigate because these outcomes are meaningful in older adults with CKD. For example, cognitive impairment, specifically dementia, was found to be independently associated with increased risk for mortality and decreased functional status in older adults with ESKD.¹² Furthermore, health-related quality-of-life measures are associated with morbidity and mortality in older adults with CKD and also represent an important primary patient-centered outcome.¹³⁻¹⁵

PLAIN-LANGUAGE SUMMARY

Poor social support is a common and potentially modifiable factor associated with adverse outcomes in many disease states. However, it has not been well examined in the growing population of older adults with non-dialysis-dependent chronic kidney disease (CKD). We performed a cross-sectional analysis of data from participants in the Chronic Renal Insufficiency Cohort 65 years and older to examine possible associations between social support and the meaningful clinical outcomes of cognitive function, quality of life, and frailty. We found that higher social support was associated with better measures of cognitive function and quality of life and less frailty in older adults with CKD. This suggests that improving a social support network may have potential to positively affect outcomes.

Frailty has been described as a biological syndrome related to declines across multiple physiologic systems, leading to reduced reserve and resistance to stressors.^{16,17} It is associated with adverse health outcomes in older adults with CKD, including higher risk for mortality and hospitalization in older adults with ESKD and elevated risk for dialysis or mortality in adults with predialysis CKD.^{12,18} Although social support has been linked to these important outcomes of cognitive impairment, quality of life, and frailty, it has not been closely examined in older adults with predialysis CKD.^{4,7,8,10,11,19-23}

In this article, we report the cross-sectional association between social support scores and quality of life, cognitive function, and frailty in participants enrolled in the Chronic Renal Insufficiency Cohort (CRIC) Study. We hypothesized that in older patients with CKD, higher social support is associated with better health-related quality of life, better cognitive function, and lower likelihood of frailty.

METHODS**Study Population**

The CRIC Study is a large, multicenter, longitudinal, observational cohort study that is composed of a diverse population of individuals with CKD. The design and baseline characteristics of the CRIC Study have been previously published.^{24,25} During the first phase of recruitment, between 2003 and 2007, a total of 3,612 participants were enrolled into the study. These participants were between the ages of 21 and 74 years and had an age-stratified estimated glomerular filtration rate (eGFR) of 20 to 70 mL/min/1.73 m² between the ages of 21 and 44 years, 20 to 60 mL/min/1.73 m² between the ages of 45 and 64 years, and 20 to 50 mL/min/1.73 m² between the ages of 65 and 74 years. During a second phase of

recruitment between 2013 and 2015, an additional 1,560 patients between the ages of 45 and 79 years with eGFRs between 45 and 70 mL/min/1.73 m² were enrolled into the study. However, participants with eGFRs between 61 and 70 mL/min/1.73 m² had to have proteinuria (defined as either protein excretion > 1+ on urinalysis, >300 mg/g on spot urinary albumin-creatinine ratio, or >500 mg/g on spot urinary total protein-creatinine ratio).

Participants were excluded if they were institutionalized, had received any kind of dialysis for more than a month, had an organ or bone marrow transplant, received immunosuppressive or other immunotherapy for primary kidney disease or systematic vasculitis that affects the kidneys within 6 months of enrollment, known cirrhosis, New York Heart Association class III or IV heart failure at baseline, previous diagnosis of multiple myeloma or renal carcinoma, received chemotherapy within 2 years of enrollment, pregnant or breast feeding, previously diagnosed polycystic kidney disease, or currently participating in an interventional trial.

We included 1,944 participants 65 years and older at the time of Lubben Social Network Scale (LSNS) administration in this analysis; data on social support (LSNS) were available for >95% (1,851) of this group. Measures of frailty, social support, cognitive function, and quality of life were all collected at the same time point.

Study Measures

Data on social support were collected in participants 65 years and older between 2013 and 2015 using the abbreviated LSNS.²⁶ The abbreviated LSNS is a validated measure of social support in older adults consisting of 6 questions that assess social connections between participants in 2 different domains: with family and with friends²⁶ (Item S1). It is scored on a scale of 0 to 30; a higher score reflects a higher level of social support, and a score <12 is considered a low level of social support.²⁶ An abbreviated LSNS score of 12 has been suggested to represent a meaningful cut point to identify individuals who are socially isolated.²⁶

Data on education, income, physical health, and quality of life were collected on a variety of self-reported questionnaires such as the Kidney Disease Quality of Life (KDQOL)²⁷ health care resource use, medical history, and Multi-Ethnic Study of Atherosclerosis (MESA) Physical Activity Questionnaire. The KDQOL is scored in 5 different domains, with lower scores indicating lower quality of life. These 5 components include burden, effects, and symptoms of kidney disease and mental and physical health measures. Patients with KDQOL scores below average are at higher risk for poor health outcomes.²⁷

Cognitive function was measured using the Modified Mini-Mental State Examination (MMSE), Trail Making Test parts A and B (TMT-A and TMT-B), and the Buschke Selective Reminding Test. The MMSE has a range of 0 to 100, with lower scores indicating poorer cognitive abilities.²⁸

TMT-A and -B are timed trials, with longer times indicating more difficulty with the task.²⁹ The Buschke Selective Reminding Tests are scored based on the words remembered through 6 different trials initially and a final trial 20 minutes later. Higher scores indicate better memory.³⁰

Frailty was defined as having 3 or more of the following 5 criteria: unintentional weight loss > 5% of body weight in the last year, slow walking speed from a 15-foot timed walk, grip strength measured with a digital hand grip dynamometer (Creative Health Products), low physical activity based on the MESA Physical Activity Questionnaire, and self-reported exhaustion determined from 2 questions on the Center for Epidemiologic Studies-Depression scale.^{16,31} Prefrailty was defined as having only 1 or 2 of these 5 criteria.^{16,31}

Statistical Analysis

We conducted a cross-sectional analysis of patient demographics, socioeconomic status, laboratory values, self-reported forms, and clinical characteristics as it relates to social support. In addition, we stratified older adults into those aged 65 to 71 years and those 71 years and older. Each age category represents approximately one-half of the entire cohort.

Linear regression models were used to determine the association between the primary predictor, the social support score based on the LSNS (ie, independent variable) and measures of quality of life (KDQOL) and cognitive function (MMSE, TMT-A and -B, and Buschke Selective Reminding Tests 1, 2, and 3), which were continuous dependent variables. Logistic regression was used to assess the association between LSNS score and frailty (ie, dependent variables), adjusting for age group, and was reported as odds ratio (OR) with 95% CI.

Covariate adjustments were included in sequential models sequentially as follows. Model 0 was adjusted for age. Model 1 was adjusted for age, clinical site, income, education, and race/ethnicity. Model 2 includes covariates in model 1 plus history of hypertension, heart failure, stroke, coronary artery disease, peripheral vascular disease, diabetes, systolic blood pressure, and hemoglobin A_{1c} level. Model 3 includes covariates in models 1 and 2 plus eGFR and proteinuria. These covariates were selected because they were suspected to be potential confounders of the association between social support and the primary outcomes of cognitive function, quality of life, and frailty. All analyses were performed using SAS (SAS Institute Inc), version 9.4, and $P < 0.05$ was considered as statistical significance.

RESULTS

Mean age of the study population who completed the LSNS ($n = 1,851$) was 71.7 years; 42.5% were women, 50.0% were non-Hispanic Whites, and 67.7% of participants had at least some college education. Almost all participants had a reported history of hypertension (92.9%); most also had

diabetes (54.7%), and slightly less than half had a reported history of cardiovascular disease (43.2%). Mean LSNS score was 16.2. Mean eGFR was 50.3 mL/min/1.73 m², and median urinary protein-creatinine ratio was 0.13 g/g (interquartile range, 0.06-0.40; Tables 1 and S1).

Low social support, defined as LSNS score < 12, was seen in 404 of 1,851 (22%) participants with available LSNS scores. Participants with higher social support (≥ 12) when compared with participants with lower social support were more likely to be older, women, and non-Hispanic; have a household income > \$20,000; be non-smokers; have more than a high school education; and be more likely to work/volunteer (Table 1).

Participants with higher social support had higher average scores in quality of life as measured by the KDQOL-36 with regard to burden, effects of kidney disease, symptoms of kidney disease, mental health, and physical health (Table 2). Additionally, those with higher social support scored higher on all cognitive function measures, including the MMSE, TMT-A and -B, and Buschke Selective Reminding Tests (Table 2). Participants with higher social support were less likely than those with lower social support to be frail (25.69% vs 40.98%; $P < 0.001$)

In fully adjusted linear regression models, higher social support was associated with higher quality of life. The β coefficient was 2.57 (95% CI, 1.57-3.56), 2.21 (95% CI, 1.52-2.9), 1.64 (95% CI, 0.88-2.41), 1.91 (95% CI, 1.40-2.43), and 0.64 (95% CI, 0.03-1.24) per each 1 standard deviation (SD) higher in LSNS score for KDQOL burden, effects, symptoms, mental health, and physical health, respectively; $P < 0.05$; Table 3). There was a significant interaction (P for interaction = 0.02) with age on the relationship between social support and KDQOL mental health composite score. For participants aged 65 to 71 years, each 1-SD higher LSNS score was associated with a higher KDQOL mental health composite score of 2.50. For participants 71 years and older, each 1-SD change in LSNS score was associated with an increase in KDQOL mental health composite score of 1.30.

Social support was independently associated with all measures of cognitive function (Tables 4 and 5). In the fully adjusted linear regression model, higher social support scores were associated with higher MMSE scores (0.81 units higher per 1-SD change in LSNS score; $P < 0.001$) and shorter time to complete the timed tests (-2.53 seconds for TMT-A and -6.53 seconds for TMT-B per 1-SD higher LSNS score; $P < 0.01$). Although there was no interaction with age and the relationship between social support and the MMSE, TMT-A, and TMT-B scores, age modified the associations between social support and the Buschke Selective Reminder Tests; each 1-SD change in LSNS score was associated with a 0.04 increase in Buschke Selective Reminder Test 1 score in 65- to 71-year-old participants versus a 0.34 increase in those 71 years and older (P for interaction = 0.009). Similarly, the association between social support scores and Buschke Selective

Table 1. Baseline Characteristics of the Study Population With Lubben Social Network Scale Score, Stratified by Level of Social Support

Variable	All Patients With Lubben Social Network Scale Score (N = 1,851)	Lubben Social Network Scale Score < 12 (n = 404)	- Lubben Social Network Scale Score ≥ 12 (n = 1,447)	P
Age, y	71.7 (4.76)	71.2 (4.92)	71.9 (4.67)	0.02
Female sex	786 (42.5%)	152 (37.62%)	634 (43.82%)	0.03
Race/ethnicity				
Non-Hispanic White	925 (49.97%)	193 (47.77%)	732 (50.59%)	0.006
Non-Hispanic Black	728 (39.33%)	154 (38.12%)	574 (39.67%)	
Hispanic	133 (7.19%)	45 (11.14%)	88 (6.08%)	
Other	65 (3.51%)	12 (2.97%)	53 (3.66%)	
Education				
<High school	285 (15.40%)	84 (20.79%)	201 (13.9%)	0.002
High school graduate	312 (16.86%)	72 (17.82%)	240 (16.60%)	
Some college	510 (27.55%)	110 (27.23%)	400 (27.66%)	
≥College graduate	743 (40.14%)	138 (34.16%)	605 (41.84%)	
Household income				
≤\$20,000	408 (22.04%)	119 (29.46%)	289 (19.97%)	<0.001
\$20,001-\$50,000	525 (28.36%)	128 (31.68%)	397 (27.44%)	
\$50,001-\$100,000	396 (21.39%)	79 (19.55%)	317 (21.91%)	
>\$100,000	255 (13.78%)	25 (6.19%)	230 (15.90%)	
Do not wish to answer	267 (14.43%)	53 (13.12%)	214 (14.79%)	
Smoking				
Lifetime smoked ≥100 cigarettes	1,027 (55.5%)	238 (58.91%)	789 (54.53%)	0.12
Current smoker	119 (6.43%)	36 (8.91%)	83 (5.74%)	0.02
Work as a volunteer or for money				
Works to earn money	377 (20.74%)	51 (12.91%)	326 (22.91%)	<0.001
Volunteers	488 (26.84%)	56 (14.18%)	432 (30.36%)	<0.001
Physical characteristics				
Systolic BP, mm Hg	127.47 (19.45)	127.08 (19.23)	127.58 (19.51)	0.66
Diastolic BP, mmHg	65.91 (10.92)	66.19 (10.91)	65.83 (10.92)	0.58
Body mass index, kg/m ²	31.70 (6.67)	32.21 (6.63)	31.56 (6.68)	0.10
Diabetes	1,013 (54.73%)	232 (57.43%)	781 (53.97%)	0.22
Hypertension	1,718 (92.92%)	380 (94.06%)	1,338 (92.60%)	0.31
History of cardiovascular disease	800 (43.22%)	187 (46.29%)	613 (42.36%)	0.16
Renal and laboratory data				
eGFR ^a , mL/min/1.73 m ²	50.30 (16.65)	49.82 (16.37)	50.44 (16.74)	0.54
Urinary protein-creatinine ratio, g/g ^b	0.14 [0.07-0.43]	0.15 [0.07-0.42]	0.13 [0.07-0.44]	0.43
Hemoglobin A _{1c} , mg/dL	6.41 (1.31)	6.65 (1.59)	6.35(1.22)	<0.001
Medications				
No. of total medications	1.66 (0.88)	1.76 (0.87)	1.64 (0.87)	0.02
ACEI or ARB	1,210 (66.45%)	273 (69.29%)	937 (65.66%)	0.18
Loop diuretics	533 (29.27%)	131 (33.25%)	402 (28.17%)	0.05
Statins	1,285 (70.57)	288 (73.10%)	997 (69.87%)	0.21
Lubben Social Support Scale				
Lubben Social Support Scale score	16.2(5.93)	7.84 (2.63)	18.49 (4.28)	<.001

Note: Values expressed as mean (standard deviation), number (percent), or median [interquartile range].

Abbreviations: ACEI, angiotensin-converting enzyme inhibitor; ZRB, angiotensin receptor blocker; BP, blood pressure; eGFR, estimated glomerular filtration rate.

^aeGFR using CRIC equation.

^bFrom spot sample.

Reminder Tests 2 and 3 was stronger in participants 71 years and older compared with those between the ages of 65 and 71 years.

Participants with higher social support were more likely to be nonfrail (OR, 1.77; $P < 0.05$) and prefrail

(OR, 1.33; $P < 0.05$; Table 6) than participants with lower social support; this association was consistent across age groups. In sensitivity analysis comparing high social support (LSNS score ≥ 12) versus low social support (LSNS score < 12), high social support

Table 2. Quality-of-Life, Cognitive, and Frailty Measures Stratified by Level of Social Support

Variable	All Patients With Lubben Social Network Scale (N = 1,851)	Lubben Social Network Scale Score < 12 (n = 404)	Lubben Social Network Scale Score ≥ 12 (n = 1,447)	P
Kidney Disease Quality of Life scores				
KDQOL Burden	88.42 (19.87)	82.64 (24.86)	90.02 (17.92)	<0.001
Missing	16 (0.9%)	5 (1.2%)	11 (0.8%)	
KDQOL Effects	91.23 (13.38)	86.99 (17.34)	92.40 (11.79)	<0.001
Missing	16 (0.9%)	5 (1.2%)	11 (0.8%)	
KDQOL Symptoms	83.42 (14.48)	80.25 (15.81)	84.30 (13.97)	<0.001
Missing	16 (0.9%)	5 (1.2%)	11 (0.8%)	
KDQOL Mental health composite	51.57 (9.71)	47.66 (10.90)	52.655 (9.06)	<0.001
Missing	27 (1.5%)	7 (1.7%)	20 (1.4%)	
KDQOL Physical health composite	40.43 (11.37)	38.80 (11.26)	40.88 (11.36)	0.001
Missing	27 (1.5%)	7 (1.7%)	20 (1.4%)	
Cognitive testing				
Modified Mini-Mental State Examination	90.98 (8.25)	88.90 (9.49)	91.55 (7.78)	<0.001
Missing	116 (6.3%)	29 (7.2%)	87 (6.01%)	
Trail Making test Part A, s	50.51 (32.57)	55.93 (34.74)	49.05 (31.82)	0.001
Missing	156 (8.4%)	43 (10.6%)	113 (7.8%)	
Noncomplete	4 (0.22%)	2 (0.49%)	2 (0.14%)	
Trail Making Test Part B, s	134.26 (69.52)	145.7 (69.69)	131.35 (69.21)	<0.001
Missing	185 (0.1%)	52 (12.87%)	133 (9.19%)	
Noncomplete	89 (4.8%)	32 (7.92%)	57 (3.94%)	
Buschke Selective Reminding Test 1	6.22 (2.18)	5.70 (2.08)	6.37 (2.19)	<0.001
Missing	182 (9.8%)	48 (11.9%)	134 (9.3%)	
Buschke Selective Reminding Test 2	47.55 (12.43)	43.66 (12.27)	48.60 (12.27)	<0.001
Missing	204 (11.0%)	52 (12.9%)	152 (10.5%)	
Buschke Selective Reminding Test 3	7.37 (3.14)	6.39 (3.02)	7.63 (3.12)	<0.001
Missing	205 (11.1%)	53 (13.2%)	152 (10.5%)	
Frailty status				
Not frail	67 (3.9%)	5 (1.4%)	62 (4.6%)	
Prefrail	1,147 (67.1%)	211 (57.7%)	936 (69.7%)	
Frail	495 (29.0%)	150 (41.0%)	345 (25.7%)	<0.001
Missing, n	142	38	104	

Abbreviation: KDQOL, Kidney Disease Quality of Life.

remained associated with improved KDQOL scores for burden, effects, symptoms, and mental composite score but not with the physical composite score. The association between the binary predictors of high versus low social support and cognitive measures of the MMSE, TMT-B, and Buschke Selective Reminder Tests 1, 2, and 3 also remained robust in this sensitivity analysis (Tables S2-S4).

DISCUSSION

In this large multicenter well-curated study of CKD, we demonstrate that 22% of older patients with CKD had scores consistent with poor social support. Higher social support in this cohort was associated with better quality of life and cognitive performance and lower measures of frailty. With the exception of the mental health composite score and selective reminder tests, the associations between

social support and quality-of-life measures, cognitive assessments, and frailty were consistent across age strata.

Few studies in predialysis CKD populations have examined the relationship between social support and sociodemographic, psychosocial, and other clinically meaningful measures such as cognitive function or frailty. Our results are consistent with previously reported data; in an urban and primarily African American hemodialysis population, Kimmel et al²² found a positive correlation between measures of social support and quality of life and an inverse correlation between measures of social support and patient perception of the effects of their illness. In the study of African American adults with hypertensive CKD, Porter et al¹⁴ found a positive association between social support and quality-of-life physical and mental health measures. Taken together with the results from our study, social support and quality of life in patients with CKD appear to relate to each other, with higher social support

Table 3. Association Between Social Support and Quality of Life

Primary Predictor: LSNS Score per 1-SD Change in LSNS Score	KDOOL Burden		KDOOL Effects		KDOOL Symptoms		KDOOL SF-12 Mental Component Score		KDOOL SF-12 Physical Component Score	
	β Coefficient (95% CI)	P	β Coefficient (95% CI)	P	β Coefficient (95% CI)	P	β Coefficient (95% CI)	P	β Coefficient (95% CI)	P
Model 0	2.95 (2.04-3.85)	<0.001	2.27 (1.67-2.88)	<0.001	2.07 (1.41-2.72)	<0.001	2.23 (1.79-2.66)	<0.001	1.19 (0.67-1.71)	<0.001
Model 1	2.58 (1.69-3.47)	<0.001	2.07 (1.46-2.67)	<0.001	1.69 (1.03-2.34)	<0.001	2.02 (1.58-2.46)	<0.001	0.9 (0.39-1.41)	<0.001
Model 2	2.64 (1.73-3.54)	<0.001	2.16 (1.55-2.77)	<0.001	1.70 (1.02-2.37)	<0.001	2.03 (1.58-2.48)	<0.001	0.84 (0.31-1.37)	0.002
Model 3	2.57 (1.57-3.56)	<0.001	2.21 (1.52-2.9)	<0.001	1.64 (0.88-2.41)	<0.001	1.91 (1.40-2.43)	<0.001	0.64 (0.03-1.24)	0.04

Note: Model 0 adjusted for age, clinical site, income, education, and race/ethnicity. Model 1 adjusted for age, clinical site, income, education, and race/ethnicity. Model 2 adjusted for covariates in model 1 plus history of hypertension, heart failure, stroke, coronary artery disease, peripheral vascular disease, diabetes, systolic blood pressure, and hemoglobin A_{1c} level. Model 3 adjusted for covariates in models 1 and 2 and estimated glomerular filtration rate and proteinuria. Abbreviations: KDOOL, Kidney Disease Quality of Life; LSNS, Lubben Social Network Scale; SD, standard deviation; SF-12, 12-Item Short Form Health Survey.

associated with higher quality of life. Our analysis of CRIC participants adds to this body of knowledge by reporting findings in a diverse racial ethnic group of older patients with non-dialysis-dependent CKD.

The importance of quality of life to patient outcomes has been shown in ESKD and non-dialysis-dependent CKD populations.^{6,13,15} For example, Mapes et al¹⁵ found that lower quality-of-life measures were associated with increased risk for mortality and hospitalization in patients with ESKD, whereas Porter et al¹³ found that lower quality-of-life measures in patients with CKD not receiving dialysis were associated with higher risk for incident cardiovascular disease and mortality. In fully adjusted models from our study, a 1-SD change in LSNS score was associated with a 1.91 change in the mental component score and 0.64 change in the physical component score of the KDOOL.

To provide some context to the clinical significance of these associations, consider that Mapes et al¹⁵ found in a large international dialysis population from the Dialysis Outcomes and Practice Patterns Study (DOPPS) that for each 10-point lower score on the mental health component summary and physical component summary of the KDOOL, there was a 1.13 and 1.29 relative risk increase for death and hospitalization, respectively. Social support networks can help provide patients with the tools they need to ensure their basic needs are being met by helping with finances, housing costs, and food acquisition. This reinforces the need to study factors that are associated with quality of life, and social support may be one such factor that is potentially modifiable.

Our results also corroborate prior research that describes relationships between social networks and cognitive function. For example, interactions in larger social networks in adults older than 50 years were associated with maintenance of cognitive function and lower risk for incident dementia.^{4,20} Our study complements this existing literature by demonstrating the association between social support and cognition in a CKD population, using a more extensive battery of cognitive tests compared with many prior reports. Cognitive impairment has also been associated with increased risk for mortality.³²

Considering the relationship between social support and cognitive function seen in our study, it is plausible that social support may affect how cognitive function affects mortality. The influence of family or friends to help guide patients through a complex health system, gain access to the health system, or promote adherence to complicated treatment regimens in older adults may be magnified in those who are cognitively impaired.

Our results appear to also be clinical meaningful. For example, changes in MMSE score over a 3-year span in a cohort of older Chinese adults of >1.62 points per year were associated with 75% higher risk for death.³³ The magnitude of change associated with a 1-SD increase in LSNS score in our study in a fully adjusted model was similar at 0.81.

Table 4. Association Between Social Support and Cognitive Function (Modified Mini Mental State Examination and Trail Making Test parts A and B)

Predictor: LSNS Score per 1-SD Change in LSNS Score	Modified Mini Mental State Examination Score		Trail Making Test Part A		Trail Making Test Part B	
	β Coefficient (95% CI)	P	β Coefficient (95% CI)	P	β Coefficient (95% CI)	P
Model 0	1.20 (0.81 to 1.59)	<0.001	-3.59(-5.24 to -1.94)	<0.001	-8.48(-12.09 to -4.88)	<0.001
Model 1	0.81(0.48 to 1.13)	<0.001	-2.91(-4.44 -1.38)	<0.001	-7.00(-10.08 to -3.92)	<0.001
Model 2	0.75(0.42 to 1.08)	<0.001	-2.45(-3.98 to -0.93)	0.002	-6.47(-9.57 to -3.37)	<0.001
Model 3	0.81(0.44 to 1.19)	<0.001	-2.53(-4.29,-0.76)	0.005	-6.53(-10.07 to -2.99)	0.0003

Note: Model 0 adjusted for age. Model 1 adjusted for age, clinical site, income, education, and race/ethnicity. Model 2 adjusted for covariates in model 1 plus history of hypertension, heart failure, stroke, coronary artery disease, peripheral vascular disease, diabetes, systolic blood pressure, and hemoglobin A_{1c} level. Model 3 adjusted for covariates in models 1 and 2 and estimated glomerular filtration rate and proteinuria.

Abbreviations: LSNS, Lubben Social Network Scale; SD, standard deviation.

Frailty is commonly recognized as a biological syndrome in older adults characterized by a decline in multiple physiologic systems, leading to decreased reserve, reduced resistance to stressors, and increased risk for adverse health outcomes.^{16,17} In a general geriatric population in the United Kingdom, poor social support predicted the development of frailty.²¹ In both dialysis patients and those with non-dialysis-dependent CKD, frailty has also been shown to be associated with mortality.^{34,35} In addition, previous studies in CRIC found that severity of CKD was associated with frailty.³¹ We extend these findings by demonstrating an association between social support and frailty; strong social support may modify the susceptibility of frail patients with CKD to adverse outcomes by allowing for more access to medical care or improving treatment adherence.

The associations observed in this study between social support and quality of life, frailty, and cognitive function are significant for several reasons. Cognitive function, frailty, and quality of life represent meaningful outcomes for patients. Our findings suggest that these outcomes may share a potentially modifiable factor in social support. A systematic review examining interventions to address social isolation in older adults found that 79% of group-based interventions and 55% of 1-on-1 interventions led to improvement in at least 1 participant-based outcome.³⁶ Therefore, social support represents an appealing target for intervention because it is linked to a number of important outcomes in older patients with

CKD, and evidence exists that social support may be improved by interventions such as home visiting programs, social activity programs, physical activity programs, self-management groups, counseling groups, and discussion groups.³⁶ It is also worth noting that the older adults most likely to benefit from social support, the adults with impaired cognitive function, lower quality of life, and increased frailty, are the older adults least likely to have strong social support.

The strengths of this analysis include the fact that CRIC is a diverse well-characterized large cohort with CKD. By virtue of the multicenter design, CRIC participants come from many different cities within the United States and have mild to advanced CKD. Consequently, our results may be generalizable to a wide range of patients with mild to advanced CKD.

However, there are several limitations to this study. The main one is that this is a cross-sectional observational study and thus we cannot assume causality or direction. It is possible that low quality of life, cognitive impairment, and frailty could lead to a low LSNS score. Additionally, there may be unmeasured confounders that could have some impact on the outcomes. For instance, although we collect data on depression, this information is not collected at the same time as social support data and was unable to be used in this analysis.

In summary, among older patients with CKD, social support is associated with a variety of domains that directly affect patient's health and quality of life. Our study sets the

Table 5. Association Between Social Support and Cognitive Function (Buschke selective reminder tests)

Predictor: LSNS Score per 1-SD Change in-LSNS Score	Buschke Selective Reminder Test 1		Buschke Selective Reminder Test 2		Buschke Selective Reminder Test 3	
	β Coefficient (95% CI)	P	β Coefficient (95% CI)	P	β Coefficient (95% CI)	P
Model 0	0.28 (0.17-0.38)	<0.001	2.12 (1.53- 2.71)	<0.001	0.52 (0.37-0.67)	<0.001
Model 1	0.22 (0.12-0.32)	<0.001	1.69 (1.14-2.24)	<0.001	0.43 (0.28-0.57)	<0.001
Model 2	0.19 (0.09-0.30)	0.0002	1.5 (0.94-2.06)	<0.001	0.39 (0.25-0.54)	<0.001
Model 3	0.19 (0.07-0.30)	0.001	1.59 (0.96-2.22)	<0.001	0.40 (0.23-0.56)	<0.001

Note: Model 0 adjusted for age. Model 1 adjusted for age, clinical site, income, education, and race/ethnicity. Model 2 adjusted for covariates in model 1 plus history of hypertension, heart failure, stroke, coronary artery disease, peripheral vascular disease, diabetes, systolic blood pressure, and hemoglobin A_{1c} level. Model 3 adjusted for covariates in models 1 and 2 and estimated glomerular filtration rate and proteinuria.

Abbreviations: LSNS, Lubben Social Network Scale; SD, standard deviation.

Table 6. Association Between Social Support and Frailty

Primary Predictor: LSNS Score per 1-SD Change in LSNS Score	Nonfrail		Pre frail	
	OR (95% CI)	P	OR (95% CI)	P
Model 0	2.04 (1.56-2.68)	<0.001	1.392 (1.25-1.55)	<0.001
Model 1	2.06 (1.54-2.75)	<0.001	1.36 (1.21-1.52)	<0.001
Model 2	2.06 (1.53-2.77)	<0.001	1.37 (1.22-1.54)	<0.001
Model 3	1.77 (1.24-2.53)	0.002	1.33 (1.16-1.53)	<0.001

Note: Model 0 adjusted for age. Model 1 adjusted for age, clinical site, income, education, and race/ethnicity. Model 2 adjusted for covariates in model 1 plus history of hypertension, heart failure, stroke, coronary artery disease, peripheral vascular disease, diabetes, systolic blood pressure, and hemoglobin A_{1c} level. Model 3 adjusted for covariates in models 1 and 2 and estimated glomerular filtration rate and proteinuria.

Abbreviations: LSNS, Lubben Social Network Scale; OR, odds ratio; SD, standard deviation.

stage for future trials to determine whether modifying social support leads to improved clinical outcomes.

SUPPLEMENTARY MATERIAL

Supplementary File (PDF)

Item S1: Lubben Social Network Scale-6 Item version

Table S1: Baseline characteristics of study population stratified by age

Table S2: Association between social support (binary Lubben Scale score) and quality of life

Table S3: Association between social support (binary Lubben score) and cognitive function (MMSE, Trails Making Test parts A and B)

Table S4: Association between social support (binary Lubben score) and cognitive function (Buschke Selective Reminder Tests 1, 2, and 3)

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**What are the effects of social support in older adults with CKD?
A report from the CRIC study**



Methods

Chronic Renal Insufficiency Cohort (CRIC) study



Cross sectional analysis



n = 1,851



Age ≥ 65 years



Non dialysis dependent CKD

Exposure



Social support-
Lubben Social Network
Score (LSNS)

Outcomes



Health-related quality of life (HRQOL)
Kidney Disease QOL-36



Cognitive function
• Mini mental state exam (MMSE)
• Trail making test (TMT) A & B
• Buschke selective reminder tests (BSRT)



Frailty
Modified Fried frailty criteria

Findings



Low social support (LSNS <12) was present in **22%**



Higher social support associated with

Higher HRQOL β coefficient (95%CI)



- Burden sub-scale **2.57** (1.57-3.56)
- Effects sub-scale **2.21** (1.52-2.9)
- Symptoms sub-scale **1.64** (0.88-2.41)
- Mental health composite sub-scale **1.91** (1.40-2.43)
- Physical health composite score **0.64** (0.03-1.24)

Better Cognitive function



- MMSE **0.81** (0.44-1.19)
- TMT A & B **-2.53** (-4.29, -0.76) & **-6.53** (-10.07, -2.99)
- BSRT 1, 2 & 3 **0.19** (0.07- 0.30), **1.59** (0.96-2.22) & **0.40** (0.23- 0.56)

Higher likelihood of being non-frail

OR **1.77** (1.24-2.53)



Conclusion: In older patients with CKD, higher social support was associated with higher HRQOL, better cognitive function and less frailty.

Reference: Slaven A, Hsu J, Schelling JR, et al. Social support in older adults with CKD: A report from the Chronic Renal Insufficiency Cohort (CRIC) study. *Kidney Medicine*, 2021.

Visual Abstract by Krithika Mohan, MD

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