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

Anne Slaven, Jesse Hsu, Jeffrey R. Schelling, Sankar D. Navaneethan, Hernan Rincon-Choles, Mara A. McAdams-DeMarco, Marlene Schachere, Noreen O’Malley, Jennifer Deluca, Eva Lustigova, Xue Wang, John Kusek, Anna C. Porter, James P. Lash, Mahboob Rahman, and Edward Horwitz; on behalf of the CRIC Study investigators

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% Cl, 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.

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
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. 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. 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.

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. 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 systemic 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. 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 friends (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. An abbreviated LSNS score of 12 has been suggested to represent a meaningful cut point to identify individuals who are socially isolated.

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) 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.

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.
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 A1c 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
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 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 (18.22%)                                    | 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                     | 488 (26.84%)                                                  | 56 (14.18%)                                    | 432 (30.36%)                                   | <0.001|
| Volunteers                              |                                                               |                                                |                                                |    |
| 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/m²                  | 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 m²                   | 50.30 (16.65)                                                 | 49.82 (16.37)                                  | 50.44 (16.74)                                  | 0.54|
| Urinary protein-creatinine ratio, g/gb  | 0.14 [0.07-0.43]                                              | 0.15 [0.07-0.42]                               | 0.13 [0.07-0.44]                               | 0.43|
| Hemoglobin A₁c, 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)                                   | <0.001|

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.
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 al. 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 al. 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 2. Quality-of-Life, Cognitive, and Frailty Measures 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   |
|------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------------|--------------------------------------------------|-----|
| 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 (0.2%)                                                       | 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.
Table 3. Association Between Social Support and Quality of Life

| KDQOL SF-12 Mental Component Score | KDQOL SF-12 Physical Component Score | KDQOL Burden | KDQOL Effects |
|-----------------------------------|-------------------------------------|--------------|--------------|
| Coefficient (95% CI)              | Coefficient (95% CI)                | Coefficient (95% CI) | Coefficient (95% CI) |
| P                                 | P                                   | P             | P             |
| Model 0 2.95 (2.04–3.86)          | Model 1 2.97 (1.67–2.28)            | Model 2 2.55 (1.69–2.47) | Model 3 2.97 (1.57–3.26) |
| <0.001                            | <0.001                              | <0.001       | <0.001       |
| Model 1 2.07 (1.41–2.72)          | Model 2 1.96 (1.03–2.03)            | Model 3 1.70 (1.06–2.27) | Model 4 2.16 (1.52–2.96) |
| <0.001                            | <0.001                              | <0.001       | <0.001       |
| Model 2 2.03 (1.58–2.48)          | Model 3 1.64 (1.08–2.11)            | Model 4 1.91 (1.40–2.45) | Model 5 2.11 (1.52–2.96) |
| <0.001                            | <0.001                              | <0.001       | <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 A1c level; Model 3 adjusted for covariates in models 1 and 2 and estimated glomerular filtration rate and proteinuria.

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 cardiovascular disease. 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 KDQOL.

To provide some context to the clinical significance of these associations, consider that Mapes et al 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 KDQOL, 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 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. 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.

The importance of quality of life to patient outcomes has been shown in ESKD and non-dialysis-dependent CKD populations. For example, Mapes et al found that lower quality-of-life measures were associated with increased risk for mortality and hospitalization in patients with ESKD, whereas Porter et al 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 1.91 change in the mental component score and 0.64 change in the physical component score of the KDQOL.

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. 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.
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.\(^{14,15}\) 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.\(^{16}\) 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.\(^{16}\) 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 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 |
|-----------------------------------------------------|---------------------------------------------|--------------------------|--------------------------|
|                                                     | \(\beta\) Coefficient (95% CI) | \(P\)                   | \(\beta\) Coefficient (95% CI) | \(P\)                   | \(\beta\) 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 to −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 to −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 A1c 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 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 |
|-----------------------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
|                                                     | \(\beta\) Coefficient (95% CI) | \(P\)                   | \(\beta\) Coefficient (95% CI) | \(P\)                   | \(\beta\) 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 A1c 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 OR (95% CI) | Pre frail OR (95% CI) | P  |
|-------------------------------------------------------------|---------------------|----------------------|----|
| Model 0                                                     | 2.04 (1.56-2.68)    | 1.392 (1.25-1.55)    | <0.001 |
| Model 1                                                     | 2.06 (1.54-2.75)    | 1.36 (1.21-1.52)     | <0.001 |
| Model 2                                                     | 2.06 (1.53-2.77)    | 1.37 (1.22-1.54)     | <0.001 |
| Model 3                                                     | 1.77 (1.24-2.53)    | 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 A1c 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)

ARTICLE INFORMATION

Authors' Full Names and Academic Degrees: Anne Slaven, MSSA, Jesse Hsu, PhD, Jeffrey R. Schelling, MD, Sankar D. Navaneethan, MD, Hernan Rinconc-Choles, MD, Mara A. McAdams-DeMarco, PhD, Marleen Schachere, RN, Noreen O’Malley, RN, Jennifer Deluca, Eva Lustigova, MPH, Xue Wang, MS, John Kusek, PhD, Anna C. Porter, MD, James P. Lash, MD, Mahboob Rahman, MD, and Edward Horwitz, MD; on behalf of the CRIC Study investigators.

Authors' Affiliations: Division of Nephrology and Hypertension, MetroHealth Medical Center, Case Western Reserve University, Cleveland, OH (AS, JRS, EH); Center for Clinical Epidemiology and Biostatistics, University of Pennsylvania, Philadelphia, PA (JH, XW); Selzman Institute for Kidney Health, Section of Nephrology, Department of Medicine, Baylor College of Medicine, Houston, TX (SDN); Department of Nephrology and Hypertension, Cleveland Clinic, Cleveland, OH (HR-C); Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD (MAM-D); MetroHealth Medical Center, Cleveland, OH (MS, NO); Renaissance Renal Research Institute, Detroit, MI (JD); Department of Epidemiology, Tulane University, New Orleans, LA (EL); Division of Kidney, Urologic, and Hematologic Diseases, National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, Bethesda, MD (JK); Department of Medicine, University of Illinois at Chicago, Chicago, IL (ACP); and Department of Medicine, Case Western Reserve University, University Hospitals Cleveland Medical Center, Cleveland, OH (MR).

Address for Correspondence: Edward Horwitz, MD, 2500 MetroHealth Dr, Cleveland, OH 44109. Email: ehorwitz@metrohealth.org

Authors' Contributions: Research idea and study design: AS, JRS, SDN, HR-C, MAM-D, JK, ACP, JPL, MR, EH; data acquisition: AS, MS, NO, JD, EL; data analysis/interpretation: AS, JH, JRS, SDN, HR-C, MAM-D, JD, EL, XW, ACP, JPL, MR, EH; statistical analysis: JH, XW; supervision or mentorship: JRS, JK, JPL, MR. Each author contributed important intellectual content during manuscript drafting or revision and accepts accountability for the overall work by ensuring that questions pertaining to the accuracy or integrity of any portion of the work are appropriately investigated and resolved.

Support: Funding for the CRIC Study was obtained under a cooperative agreement from National Institute of Diabetes and Digestive and Kidney Diseases (U01DK060990, U01DK060984, U01DK061022, U01DK061021, U01DK061028, U01DK060980, U01DK060963, and U01DK060902). In addition, this work was supported in part by the Perelman School of Medicine at the University of Pennsylvania Clinical and Translational Science Award National Institutes of Health (NIH)/National Center for Advancing Translational Sciences (NCATS) UL1TR000003, Johns Hopkins University UL1 TR-000424, University of Maryland General Clinical Research Center M01 RR-16500, Clinical and Translational Science Collaborative of Cleveland, UL1TR000439 from the NCATS component of the NIH and NIH Roadmap for Medical Research, Michigan Institute for Clinical and Health Research (MICHR) UL1TR000433, University of Illinois at Chicago Clinical and Translational Science Awards UL1RR029879, Tulane COBRE for Clinical and Translational Research in Cardiometabolic Diseases P20 GM109036, Kaiser Permanente NIH/National Center for Research Resources UCSF-CTSI UL1 RR-024131. R01-DK072231 (Dr Lash), K24-DK092290 (Dr Lash).

Financial Disclosure: The authors declare that they have no relevant financial interests.

Peer Review: Received November 17, 2020. Evaluated by 2 external peer reviewers, with direct editorial input by the Statistical Editor and the Editor-in-Chief. Accepted in revised form April 18, 2021.

REFERENCES

1. Mookadam F, Arthur HM. Social support and its relationship to morbidity and mortality after acute myocardial infarction: systematic overview. Arch Intern Med. 2004;164(14):1514-1518.
2. Grodner S, Prewitt LM, Jaworski BA, Myers R, Kaplan RM, Ries AL. The impact of social support in pulmonary rehabilitation of patients with chronic obstructive pulmonary disease. Ann Behav Med. 1996;18(3):139-145.
3. Kroenke CH, Kubzansky LD, Schernhammer ES, Holmes MD, Kawachi I. Social networks, social support, and survival after
breast cancer diagnosis. *J Clin Oncol.* 2006;24(7):1105-1111.

4. Crooks VC, Lubben J, Petitti DB, Little D, Chiu V. Social network, cognitive function, and dementia incidence among elderly women [see comment in PubMed Commons]. *Am J Public Health.* 2008;98(12):2234-2242.

5. Shao Y, Liang L, Shi L, Wan C, Yu S. The effect of social support on glycemic control in patients with type 2 diabetes mellitus: the mediating roles of self-efficacy and adherence. *J Diabetes Res.* 2017;2017:2804178.

6. Kimmel PL, Peterson RA, Weihs KL, et al. Psychosocial factors, behavioral compliance and survival in urban hemodialysis patients. *Kidney Int.* 1998;54(1):245-254.

7. Nicholson NA. Review of social isolation: an important but underassessed condition in older adults. *J Primary Prevent.* 2012;33:137-152.

8. Cohen-Manuelidis E, Hsueh YC, Sisk K, et al. Assessing loneliness in older adults: a review of quantitative and qualitative results informed by qualitative insights. *Int Psychogeriatr.* 2016;28(4):557.

9. US Renal Data System. *USRDS 2017 Annual Data Report: Epidemiology of Kidney Disease in the United States.* National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases; 2017.

10. Perissinotto CM, Stijacic Cenzer I, Covinsky KE. Loneliness in older persons: a predictor of functional decline and death. *Arch Intern Med.* 2012;172(14):1078-1084.

11. Jarach CM, Tettamanti M, Nobili A, D’Avanzo V. Correlates and predictors of loneliness in older-adults: a review of quantitative results informed by qualitative insights. *Int Psychogeriatr.* 2016;28(4):557.

12. Kallenberg MH, Kleinveld HA, Dekker FW, et al. Functional and cognitive impairment, frailty, and adverse health outcomes in older patients reaching ESRD—a systematic review. *Clin J Am Soc Nephrol.* 2016;11(9):1624-1639.

13. Porter AC, Lash JP, Xie D, et al. Predictors and outcomes of health-related quality of life in adults with CKD. *Clin J Am Soc Nephrol.* 2016;11(7):1154-1162.

14. Porter A, Fischer MJ, Brooks D, et al. Quality of life and psychosocial factors in African Americans with hypertensive chronic kidney disease. *Transl Res.* 2012;159(1):4-11.

15. Mapes DL, Lopes AA, Satayathum S, et al. Health-related quality of life as a predictor of mortality and hospitalization: the Dialysis Outcomes and Practice Patterns Study (DOPPS). *Kidney Int.* 2003;64(1):339-349.

16. Fried LP, Tangen CM, Walston J, et al. Frailty in older adults: evidence for a phenotype. *J Gerontol A Biol Sci Med Sci.* 2001;56:M146-M156.

17. Clegg A, Young J, Iliffe S, Rikkert MO, Rockwood K. Frailty in elderly people. *Lancet.* 2013;381(9868):752-762.

18. Rosano B, Khatri M, Robinson-Cohen C, et al. A prospective study of frailty in nephrology-referred patients with CKD. *Am J Kidney Dis.* 2012;60(6):912-921.

19. Evans IEM, Llewellyn DJ, Matthews FE, Woods RT, Brayne C, Clare L; CFAS-Wales research team. Social isolation, cognitive reserve, and cognition in healthy older people. *PLoS One.* 2018;13(8):e0201008.

20. Holtzman RE, Rebok GW, Saczynski JS, Kouzis AC, Wilcox Doyle K, Eaton WW. Social network characteristics and cognition in middle-aged and older adults. *J Gerontol B Psychol Sci Soc Sci.* 2004;59(6):P278-P284.

21. Ding YY, Kuha J, Murphy M. Multidimensional predictors of physical frailty in older people: identifying how and for whom they exert their effects. *Biogerontology.* 2017;18(2):237-252.

22. Kimmel PL, Peterson RA, Weihs KL, et al. Aspects of quality of life in hemodialysis patients. *J Am Soc Nephrol.* 1995;6:1418-1426.

23. Gallicchio L, Hoffman SC, Helzlsouer KJ. The relationship between gender, social support, and health-related quality of life in a community-based study in Washington County, Maryland. *Qual Life Res.* 2007;16(5):777-786.

24. Feldman HI, Appel LJ, Chertow GM, et al. Chronic Renal Insufficiency Cohort (CRIC) Study Investigators. The Chronic Renal Insufficiency Cohort (CRIC) Study: design and methods. *J Am Soc Nephrol.* 2003;14(7)(suppl 2):S148-S153.

25. Lash JP, Go AS, Appel LJ, et al. Chronic Renal Insufficiency Cohort (CRIC) Study Group. Chronic Renal Insufficiency Cohort (CRIC) Study: baseline characteristics and associations with kidney function. *Clin J Am Soc Nephrol.* 2009;4(8):1302-1311.

26. Lubben J, Blozik E, Gillmann G, et al. Performance of an abbreviated version of the Lubben Social Network Scale among three European community-dwelling older adult populations. *Gerontologist.* 2006;46(4):503-513.

27. Hays RD, Kallich JD, Mapes DL, Coons SJ, Carter WB. Development of the Kidney Disease Quality of Life (KDQOL) instrument. *Qual Life Res.* 1994;3(5):329-338.

28. Teng EL, Chui HC. The Modified Mini-Mental State (3MS) Examination. *J Clin Psychiatry.* 1987;48:314-318.

29. Reitan RM. Validity of the Trail Making Test as an indicator of organic brain damage. *Percept Mot Skills.* 1958;8:271-276.

30. Buschke H, Fuld PA. Evaluating storage, retention, and retrieval in disordered memory and learning. *Neurology.* 1974;24:1019-1025.

31. Reese PR, Cappola AR, Shults J, et al. Physical performance and frailty in chronic kidney disease. *Am J Nephrol.* 2013;38(4):307-315.

32. Sachs GA, Carter R, Holtz LR, et al. Cognitive impairment: an independent predictor of excess mortality: a cohort study. *Ann Intern Med.* 2011;155(5):300-308.

33. Lv X, Li W, Ma Y, et al. Cognitive decline and mortality among community-dwelling Chinese older people. *BMC Med.* 2019;17:63.

34. McAdams-DeMarco MA, Law A, Salter ML, et al. Frailty as a novel predictor of mortality and hospitalization in individuals of all ages undergoing hemodialysis. *J Am Geriatr Soc.* 2013;61(6):896-901.

35. Delgado C, Grimes BA, Gildden DV, Shipak M, Sarnak MJ, Johansen KL. Association of frailty based on self-reported physical function with directly measured kidney function and mortality. *BMC Nephrol.* 2015;16:203.

36. Dickens AP, Richards SH, Greaves CJ, Campbell JL. Interventions targeting social isolation in older people: a systematic review. *BMC Public Health.* 2011;11:647.
What are the effects of social support in older adults with CKD?
A report from the CRIC study

| Methods | Exposure | Findings |
|---------|----------|----------|
| Chronic Renal Insufficiency Cohort (CRIC) study | Social support- Lubben Social Network Score (LSNS) | Low social support (LSNS <12) was present in 22% |
| Cross sectional analysis | Outcomes | Higher social support associated with |
| n = 1,851 | Health-related quality of life (HRQOL) | Higher HRQOL | Higher likelihood of being non-frail |
| Age ≥ 65 years | Cognitive function | • Burden sub-scale 2.57 (1.57-3.55) | OR 1.37 (1.24-2.53) |
| Non dialysis dependent CKD | Frailty | • Effects sub-scale 2.21 (1.12-2.39) | |
| | Modified Fried frailty criteria | • Symptoms sub-scale 1.64 (0.88-2.41) | |
| | | • Mental health composite sub-scale 1.91 (1.65-2.43) | |
| | | • Physical health composite score 0.64 (0.53-1.24) | |

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, Scvelling 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 Kritika Mohan, MD