

Perception of Indications for Nephrology Referral among Internal Medicine Residents: A National Online Survey

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Background and objectives: Many patients with chronic kidney disease (CKD) are seen by primary care physicians who may not be aware of indications or benefits of timely nephrologist referral. Late referral to a nephrologist may lead to suboptimal pre-end stage renal disease care and greater mortality. It is not known whether current postgraduate training adequately prepares a future internist in this aspect of CKD management.

Design, setting, participants, and measurements: The authors performed an online questionnaire survey of internal medicine residents in the United States to determine their perceptions of indications for nephrology referral in CKD management.

Results: Four hundred seventy-nine residents completed the survey with postgraduate year (PGY) distribution of 166 PGY 1, 187 PGY 2 and 126 PGY 3. Few residents chose nephrology referral for proteinuria (45%), uncontrolled hypertension (64%), or hyperkalemia (26%). Twenty-eight percent of the residents considered consulting a nephrologist for anemia of CKD, whereas 45% would do so for bone disorder of CKD. Most of the residents would involve a nephrologist at glomerular filtration rate (GFR) <30 ml/min/1.73 m² (90%) and for rapid decline in GFR (79%). Many residents would refer a patient for dialysis setup at GFR 15 to 30 ml/min/1.73 m² (59%); however, 18% would do so at GFR <15 ml/min/1.73 m². Presence of CKD clinic experience or an in-house nephrology fellowship program did not considerably change these perceptions.

Conclusions: Results show that internal medicine residents have widely differing perceptions of indications for nephrology referral. Educational efforts during residency training to raise awareness and benefits of early referral may improve CKD management by facilitating better collaboration between internist and nephrologist.

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Chronic kidney disease (CKD) is an increasingly prevalent health problem with potential for poor outcomes of end-stage renal disease (ESRD) and cardiovascular disease (1–5). Because of the large number of patients with CKD and the relatively small number of nephrologists, most patients are likely to be seen in the early stages of CKD by a primary care physician (6). Primary care physicians are less likely than a nephrologist to recognize CKD and differ in their clinical evaluation of CKD (7). With progression of CKD, primary care physicians tend to refer the patient to a nephrologist later than when the nephrologists would deem appropriate (7).

Late evaluation of patients with CKD by a nephrologist, especially close to the time of starting dialysis, is associated with suboptimal pre-ESRD management and increased mortality risk (2,8–10). A survey of primary care physicians who made late referrals showed that approximately 90% of the

physicians felt they did not receive adequate training regarding timing or indications for referral of patients with CKD (11).

In 2002, the National Kidney Foundation (NKF) developed the Kidney Disease Outcomes Quality Initiative (KDOQI) clinical practice guidelines to facilitate primary care physician management of CKD by early detection, formulation of an action plan for each stage of CKD, monitoring of CKD progression, assessment of complications, and timely referral to a nephrologist (1). However, many primary care physicians may not be aware of these guidelines (12). It is not known whether current residency training curriculum adequately prepares the future internist in CKD management. We performed this cross-sectional national survey to assess what internal medicine residents perceive to be indications for referral to a nephrologist. To our knowledge, this is the first study to examine this aspect of CKD.

Materials and Methods

We reviewed the official KDOQI guidelines published by the NKF and identified themes pertinent to an internist offering pre-ESRD care. Two authors (V.A. and A.K.G.) designed questions testing for knowledge of definition, classification, risk factors, laboratory evaluation, and management of CKD, as well as management of CKD complications and indications for nephrology referral. Hemodialysis adequacy, peritoneal dialysis, vascular access, transplantation, and management of

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dialysis patients were considered to be outside the realm of a practicing internist. A 14-item paper questionnaire was developed consisting of clinical vignettes with multiple-choice questions. Face and content validity were evaluated by seven nephrologists, one cardiologist, and one internist. Approval for the study was obtained from the Human Investigation Committee at William Beaumont Hospital, Royal Oak MI. A pilot study was performed at our residency program, with internal medicine residents ($n = 37$) and medicine attendings ($n = 6$) who were excluded from the subsequent analysis. On the basis of the feedback obtained, we added one question on complications of CKD, improved the clarity of the questions, and added the option “I don’t know” to few questions. For the purpose of this manuscript, we describe the responses to five questions from the survey that examined the following eight indications for nephrology referral (attached as supplement): proteinuria (>1 g protein/g creatinine; g/g), uncontrolled hypertension, hyperkalemia despite treatment, anemia of CKD, bone disorder of CKD, glomerular filtration rate (GFR) < 30 ml/min/1.73 m², rapid decline in GFR (> 4 ml/min/1.73 m² per year) and dialysis setup at GFR 15–30 ml/min/1.73 m².

We posted the questionnaire using an online survey program that allowed the respondent to answer the survey and send us their responses by e-mail. The link to this online survey along with a cover letter was sent by e-mail to the program directors of all of the internal medicine residency programs in United States ($n = 397$). Program directors could choose to forward the survey to their residents or decline participation. Only internal medicine residents actively training in a residency program were eligible ($n = 22,009$). Participation was voluntary, and responses were anonymous. No identifying data were collected, although we did ask the respondent to supply their e-mail address to ensure the uniqueness of their responses, because the survey program would not allow residents with the same e-mail address to answer the questionnaire twice. As an educational incentive to the residents, we offered to send them the answers to the questionnaire and the NKF-published CKD management pocket card. Responses were collected from October 15th, 2007 to November 5th, 2007. Residents with CKD-related clinical experience were identified by their response to the question “Do you see patients in a Chronic Kidney Disease Clinic?” We excluded incomplete questionnaires, and responses from chief residents and attending physicians were excluded from the analysis.

Statistical Analyses

Using the results from the pilot study, we calculated that to look for a 3% difference in the final score among the three PGYs with a SD of 15%, sample sizes of 99, 99, and 99 ($n = 297$) would be needed to achieve 80% power ($\text{Alpha} = 0.05$, $\text{Power} = 0.80097$, $\text{SM} = 2.45$, $\text{SD} = 15.00$). Data are presented as descriptive statistics with cross-tabulation by postgraduate year (PGY). Proportions were calculated on the basis of the total number of respondents for each question and expressed as percentage. Kruskal-Wallis one-way ANOVA was used to compare the ordinal data among the three PGYs. Additional analysis was performed with cross-tabulation by CKD clinic experience and in-house nephrology fellowship program. A P value < 0.05 was considered statistically significant. Statistical analysis was performed with SPSS Version 14.0 (SPSS, Chicago, IL).

Results

Six hundred fifty-one respondents accessed the online survey. After excluding incomplete questionnaires and responses from 16 attending physicians and 9 chief residents, our final sample size consisted of 479 internal medicine residents from 75 residency programs who completed the questionnaire. Their

PGY distribution was 166 PGY 1, 187 PGY 2 and 126 PGY 3. The response rate could not be calculated because we did not know how many residents got the questionnaire from their program directors. Other demographic characteristics of our study sample are listed in Table 1.

A clinical vignette was given that described a 52-yr-old patient with diabetic kidney disease (GFR 70 ml/min/1.73 m²) and microalbuminuria (58 mg albumin/g creatinine; mg/g) who comes for follow-up 1 yr later with worsening GFR (50 ml/min/1.73 m²) and development of proteinuria (>1 g/g) (Table 2). Fewer than half (214, 44.7%) of the residents would refer this patient to a nephrologist for significant proteinuria. Most (378, 78.9%) of the residents would choose to consult a nephrologist for fast progression of her CKD (> 4 ml/min/1.73 m² per year).

Another clinical vignette was given that described a 53-yr-old patient with nondiabetic CKD (GFR of 29 ml/min/1.73 m² and

Table 1. Baseline demographic characteristics of the internal medicine residents in the study

Characteristic	Study value
Year of training, n (%)	
PGY 1	166 (34.7)
PGY 2	187 (39.0)
PGY 3	126 (26.3)
Total	479
Female gender, n (%)	204 (42.6)
International training (medical school/residency/fellowship), n (%)	272 (56.8)
Distribution of residency programs ($N = 75$), n (%)	
northeast	27 (36)
midwest	23 (31)
south	14 (19)
west	11 (14)
Setting of respondent’s program, n (%)	
university program	215 (44.9)
community program	264 (55.1)
Inhouse nephrology fellowship program, n (%)	
present	268 (55.9)
absent	211 (44.1)
CKD clinic experience, n (%)	
yes	160 (33.4)
no	319 (66.6)
Guidelines used to manage CKD, n (%)	
KDOQI	204 (42.6)
Not aware of any guidelines for CKD, n (%)	132 (27.6)
Hypertension (JNC-7) and diabetes (ADA) guidelines, n (%)	160 (33.4)

JNC, Joint National Committee; ADA, American Diabetes Association.

Table 2. Resident perception (in percentage) of indications for nephrology referral in CKD management

Indications for referral	PGY 1 (n = 166)	PGY 2 (n = 187)	PGY 3 (n = 126)	P	Total (N = 479)
Significant proteinuria (> 1 g/g)	45.2	42.2	47.6	0.637	44.7
Fast progression of CKD (from eGFR 70 to 50 in 1 yr)	75.3	80.2	81.7	0.352	78.9
Uncontrolled BP despite use of four antihypertensives	65.7	61.5	67.5	0.519	64.5
Hyperkalemia due to medications	24.1	28.9	24.6	0.540	26.1
eGFR < 30 ml/min/1.73 m ²	86.1	88.2	96.0	0.018	89.6
Anemia of CKD	28.9	23.0	34.1	0.094	28.0
Bone and mineral disorder of CKD	45.8	39.0	52.4	0.064	44.9

PGY, postgraduate year; eGFR, estimated glomerular filtration rate.

uncontrolled hypertension despite taking four antihypertensives, including angiotensin-converting enzyme inhibitor and potassium-sparing diuretic) and hyperkalemia (Table 2). Essential involvement of a nephrologist at GFR < 30 ml/min/1.73 m² was chosen by 429 residents (89.6%), with improving performance by increasing PGY: PGY 1 (86.1%), PGY 2 (88.2%), PGY 3 (96.0%); P = 0.018 (Figure 1). They were less likely to refer this patient for uncontrolled hypertension (309 residents, 64.5%) and hyperkalemia (125 residents, 26.1%).

Residents were given two clinical vignettes on complications of CKD, namely, anemia and bone and mineral disorder of CKD stage III (GFR 30–59 ml/min/1.73 m², as shown in Table 2. Referral to a nephrologist for management of CKD-related anemia was considered appropriate by 134 residents (28.0%) and for bone and mineral disorder of CKD by 215 residents (44.9%). Finally, residents were asked to choose the range of

GFR at which they would consult a nephrologist for dialysis and vascular access in a patient with CKD (Table 3). Approximately half (281, 58.8%) of the residents would consider referring this patient at a GFR of 15 to 30 ml/min/1.73 m², with more PGY 3 residents choosing to do so (PGY 1 48.8%, PGY 2 60.2%, and PGY 3 69.8%; P = 0.001). Another 87 residents (18.2%) would consult a nephrologist for this indication at a GFR of < 15 ml/min/1.73 m².

Additional analysis (Table 4) was performed that accounted for the presence of CKD-related clinical experience (n = 477; 2 respondents did not specify whether they had CKD clinic exposure) and in-house nephrology fellowship program (n = 474; 5 respondents did not specify if they had nephrology fellowship program in their hospital). Residents with CKD-related clinical experience were more likely than other residents to consider nephrology referral for fast decline in GFR (84.4% versus 76%; P = 0.035) but less likely to do so for GFR < 30 ml/min/1.73 m² (85.0% versus 91.8%; P = 0.022). Residents from hospitals with nephrology fellowship program were no different than the other residents in choosing indications for nephrology referral.

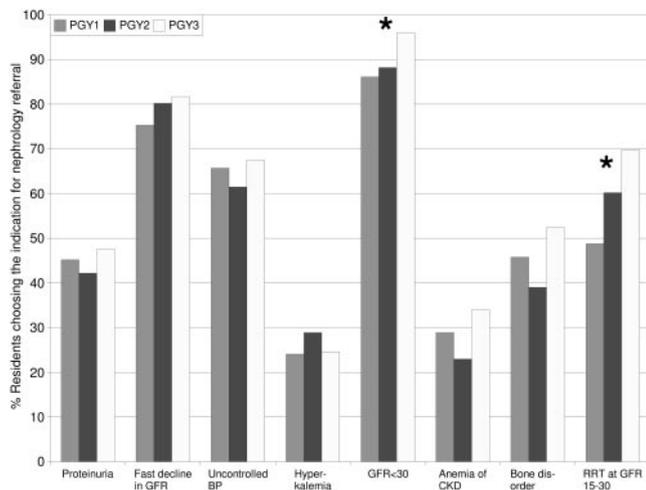


Figure 1. Perception of indications for referral to a nephrologist among internal medicine residents according to the postgraduate year (PGY). The percent of residents choosing an indication is shown on the y-axis. Gray bars represent PGY 1, black bars represent PGY 2, and white bars represent PGY 3. Significant improvement in performance (P < 0.05) with increasing postgraduate year was observed in referral at GFR < 30 ml/min/1.73 m² and referral for dialysis setup at a GFR of 15 to 30 ml/min/1.73 m² (marked with asterisk *). RRT, renal replacement therapy.

Discussion

Our study assessed the perception of indications for referral to a nephrologist in CKD management among a sample of internal medicine residents across the country. The range of perceptions was broad, and CKD-related clinical experience did not seem to significantly alter these perceptions. Our study helps identify opportunities that may potentially improve performance among future internists.

Timing of referral of patients with CKD by their primary care physician to the nephrologist affects patients' prognosis and clinical outcomes (13–15). The prevalence of late referral, defined as first nephrology visit within 1 month of initiation of dialysis, has been found to range from 25% to 46% (16,17). In another study, 22% of patients were referred in CKD stage 5 (GFR < 15ml/min/1.73 m²) (18). Late referral of patients with CKD has numerous serious consequences, including an increased mortality risk (relative risk 1.68 at 1 yr), increased morbidity with lower use of antihypertensives, suboptimal management of bone and mineral disorder, lower serum albumin (malnutrition), more use of temporary vascular access with

Table 3. Resident perception (in percentage) of range of eGFR for referral to a nephrologist for setup dialysis and vascular access

Criterion eGFR (ml/min/1.73 m ²)	PGY 1 (n = 166)	PGY 2 (n = 187)	PGY 3 (n = 126)	Total (N = 479)
45-60	3.6	5.4	1.6	3.8
30-45	15.7	16.7	19.8	17.2
15-30	48.8	60.2	69.8	58.8
< 15	27.7	16.7	7.9	18.2
Not known	4.2	1.1	0.8	2.1

PGY, postgraduate year; eGFR, estimated glomerular filtration rate.

Table 4. Resident perception (in percentage) of indications for nephrology referral stratified by chronic kidney disease clinic experience and in-house nephrology fellowship program

Resident characteristics and responses	CKD clinic experience			In-house nephrology fellowship		
	No	Yes	P	No	Yes	P
Resident characteristics						
PGY1 (n = 166)	117	48		73	91	
PGY2 (n = 187)	116	70		88	96	
PGY3 (n = 126)	84	42		45	81	
Total (n = 479)	317	160		206	268	
Female gender	43.0	41.8	0.812	40.0	44.1	0.379
International medical training	58.0	81.9	<0.0001	84.0	52.6	<0.0001
University hospital setting	43.2	47.5	0.375	14.6	67.5	<0.0001
Indications for nephrology referral						
significant proteinuria (> 1 g/g)	43.5	46.2	0.574	45.6	43.7	0.669
fast progression of CKD (from eGFR 70 to 50 in 1 yr)	76.0	84.4	0.035	79.1	78.4	0.840
uncontrolled BP despite use of four antihypertensives	65.3	62.5	0.548	59.2	67.9	0.051
hyperkalemia due to medications	23.3	30.6	0.086	27.2	24.6	0.529
eGFR < 30 ml/min/1.73 m ²	91.8	85.0	0.022	90.3	88.8	0.603
bone and mineral disorder of CKD	44.8	45.6	0.864	44.7	44.8	0.980
anemia of CKD	27.1	30.0	0.511	30.1	26.5	0.388
dialysis setup at eGFR 15-30 ml/min/1.73 m ²	57.4	61.2	0.423	60.2	58.2	0.664

PGY, postgraduate year; eGFR, estimated glomerular filtration rate.

its attendant complications, longer hospital stay, and reduced access to renal transplantation (2,10,19). The reasons for late referral may be patient related or physician related. Psychologic factors such as denial of the need for dialysis, advanced age, and low socioeconomic status with poor access to care may lead to late referral (20). In addition to the inadequate training perceived by physicians as mentioned earlier, failure to appreciate the benefit of early nephrologist care, the asymptomatic nature of CKD, and clinical inertia might be other plausible causes (11,21). We recognize that the recommendations for nephrology referral published in the KDOQI guidelines are not strongly evidence based but reflect expert opinion (22). Our article is not designed to critique the KDOQI guidelines but to assess the perception of nephrology referral among physicians in training.

Our study identified specific perceptions among internal medicine residents, some of which were of concern. Fewer than

half of the residents would consider nephrology referral for significant proteinuria (>1g/g), hyperkalemia due to medications, anemia of CKD, or bone and mineral disorder of CKD. Approximately two-thirds of the residents would refer the patient for hypertension that was not controlled with four antihypertensives. This indicates that the residents either feel comfortable and confident in managing these CKD comorbidities or do not know or consider these findings to constitute indications for consulting a nephrologist. However, both overconfidence and unfamiliarity with KDOQI guidelines as suggested by lack of improvement by postgraduate year may be a barrier to nephrology referral. Many of the residents chose to refer patients with a fast decline in GFR. Also, residents performed well in involving a nephrologist for the grade B recommendation GFR <30ml/min/1.73m² and this performance improved by postgraduate year probably as clinical experience and learning helps improve knowledge of the residents. Fi-

QUESTIONNAIRE

Chronic kidney disease (CKD) is an increasing health problem. The National Kidney Foundation published the KDOQI clinical guidelines (Kidney Disease Outcomes Quality Initiative) for management of CKD.

Our questionnaire tests if the current residency training adequately prepares a future internist in the management of CKD. Your response will immensely help us further improve the quality of residency training and the care of our patients.

What best describes you?

- PGY1
 PGY2
 PGY3
 Chief resident
 Medicine attending

Gender?

- Male
 Female

Did you have any medical training outside the US? If yes, what at what level?

- Medical School
 Residency
 Fellowship

Name of your residency program? _____

What best describes your residency program?

- University hospital
 Community hospital

Do you have a Nephrology fellowship program at your hospital? Yes No

Do you see patients in a Chronic Kidney Disease Clinic? Yes No

What guidelines do you use for the management of chronic kidney disease?

- KDOQI
 I am not aware of any guidelines for CKD
 The hypertension (JNC-7) and diabetes (ADA) guidelines are sufficient

3. When do you consult a nephrologist to prepare a patient for dialysis and vascular access?

- eGFR 45-60 ml/min/1.73m²
 eGFR 30-45 ml/min/1.73m²
 eGFR 15-30 ml/min/1.73m²
 eGFR < 15 ml/min/1.73m²
 I don't know

4. A 64 year old hispanic male patient comes to you with the following labs:

eGFR 46 ml/min/1.73m²
 Hemoglobin 10.1g/dl
 MCV 79 fl (normal 80-98)
 % saturation 9% (goal ≥ 20%)
 Ferritin 45 ng/ml (goal ≥ 100)

How do you manage his anemia? (Check all that apply)

- Give aranesp or epogen.
 Iron supplementation (po or iv)
 Measure serum erythropoietin.
 Check stool for occult blood and refer for colonoscopy if positive
 Refer to nephrologist for management of anemia of chronic kidney disease

1. Your 52 year old caucasian female patient with type 2 diabetes mellitus has blood pressure (BP) 148/92 mmHg and the following labs:

Serum creatinine 0.9 mg/dl
 eGFR 70 ml/min/1.73m²
 Urine study Microalbuminuria (58mg/g)

Vignette continued...

One year later she comes with BP 152/96 mm Hg and the following labs:

Serum creatinine 1.2 mg/dl
 eGFR 50 ml/min/1.73m²
 Urine study Proteinuria (1100mg/g)

What is your action plan for CKD management at this time? (Check all that apply)

- BP goal < 125/75 mmHg
 Refer her to a nephrologist as she has significant proteinuria.
 Refer her to a nephrologist as she had a progression of CKD (eGFR 70→50)
 Evaluate for anemia of chronic kidney disease
 Evaluate for bone and mineral disorder of chronic kidney disease

2. A 53 year old caucasian man comes to you with BP 178/98 mmHg. He does not have a history of diabetes mellitus. He is on maximum doses of triamterene/hydrochlorothiazide, lisinopril and metoprolol. His labs show

Serum creatinine 1.9 mg/dl
 eGFR 29 ml/min/1.73m²
 Urine study No proteinuria
 K⁺ (potassium) 6.2 meq/l

What is the appropriate action regarding nephrology consultation?

- Refer to nephrologist as he has uncontrolled BP despite being on 4 antihypertensives.
 Refer to nephrologist as he has hyperkalemia.
 Refer to nephrologist as he has GFR <30
 He does not need a nephrology consult

5. Your patient with CKD comes with the following labs:

eGFR 56 ml/min/1.73m²
 Phosphorus 6.7 mg/dl (normal 2.7-4.6)
 Calcium 9.9 mg/dl (normal 9-11)
 Parathyroid Hormone 130 pg/ml (goal 30-70)

How do you manage the mineral disorder? (Check all that apply)

- Dietary phosphorus restriction (800-1000 mg/day).
 Use of phosphate binders
 Check 25(OH) Vitamin D level
 Refer to nephrologist for management of bone and mineral disorder of chronic kidney disease
 I don't know

-----THE END-----

We thank you for taking your time to answer the questionnaire.
 Please enter any comments about this questionnaire. _____

Figure 2. Questionnaire.

nally, a little more than half of the residents would refer to a nephrologist for dialysis and vascular access at a GFR of 15 to 30 ml/min/1.73 m², but more concerning was the finding that approximately one-fifth of the residents would wait until GFR was <15 ml/min/1.73 m². The presence of CKD clinic experience or nephrology fellowship program, two measures that may demonstrate commitment of an academic center to provide high-quality care in a research and teaching environment, did not result in considerable differences among the residents.

Our study has important implications for program directors of internal medicine residency programs and nephrologists working with residents. Residents have an opportunity to learn CKD management in their medicine clinic or in rounds under the supervision of internal medicine attending physicians and hospitalists. Internists may be adept at implementing the guidelines for hypertension and diabetes but may be less aware of the CKD guidelines (12). Thus, training strategies directed at internists, who would in turn teach the residents, may be a useful approach. Educational efforts to improve resident awareness and knowledge of CKD management through noon conference, grand rounds, and lectures by nephrologists may be other helpful measures. The impact of these traditional learning methods on resident learning have not been very encouraging (23). Problem-based learning or case-based learning may be more effective in improving knowledge (24,25). Inpatient nephrology elective rotation may be beneficial in imparting knowledge of CKD management and nephrology referral, although our survey did not study this. The performance of residents from programs that incorporate learning in a CKD clinic did not suggest considerable benefits of this exposure, probably because of differences in the structure and teaching practices in CKD clinic. Efforts during postgraduate training could potentially have a positive impact in the management of CKD as residents graduate and become independent physicians. Lastly, future clinical studies are needed to determine what indications for nephrology referral in the early stages of CKD would yield the best clinical outcomes and to establish guidelines implementing this approach to CKD management.

Our study has several strengths. The multi-institutional random sample of residents with almost equal distribution from university and community programs improves the generalizability of our findings to other institutions. We developed the survey from the official KDOQI guidelines, thus avoiding differences in opinion to a large extent. We designed the questions by incorporating indications for referral in different clinical vignettes thus reducing the probability of random guess. The online nature of the survey allowed the respondents to complete the survey quickly. This is evident from the number of responses we received during the short study period.

We recognize several limitations in our study as well. We do not have the data on the nonresponders, and this bias could not be accounted for. The respondents self-selected to answer the questionnaire. The questionnaire could not differentiate whether residents chose not to refer to a nephrologist because of either their competence in CKD management or their lack of knowledge. We did not survey the attending physicians, which may have helped establish a level of performance expected for residents and may have been useful for comparison. We did not ascertain the nature of CKD clinic experience; this may be a limitation because there is no uniform structure to resident learning in the CKD clinic. Our study was conducted over a short period, and we did not send any reminders that may have further increased the number of responses. Most of the residents were from programs in the Northeast and Midwest. Although there are links between theoretical knowledge and practical application, our study could not identify whether the

residents behave in a manner consistent with the reported answers.

Conclusion

Internal medicine residents have widely differing perceptions of the indications for referral of a patient to a nephrologist for CKD management. Educational efforts during residency training to improve awareness and benefits of early nephrology referral may improve CKD management and clinical outcomes through early collaborative care by the internist and the nephrologist.

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Disclosures

None.

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