Managing Progressive Kidney Disease

Andrew S. Narva, MD
Managing Progressive Kidney Disease

- Standards of care for patients with CKD
- Key tests for identifying and monitoring CKD
- Key prognostic factors in staging CKD
- Strategy for improving CKD outcomes in the primary care setting
- Educational materials for people with CKD from NKDEP
Guidelines Reflect International Consensus on Treatment of CKD

- Clinic follow-up where modality education, dietary instruction and comprehensive clinical management for at least 6 months prior to initiation
- CVD Risk: exercise, smoking, lipids
- Blood pressure < 130/80
- BMD CKD control of calcium, phosphorus, PTH
- Anemia: Hgb 11-12g
- Hepatitis B immunization
- Nephroprotection: ACEi, ARB
- Assessment for transplant and referral prior to initiation
- Access: functioning fistula or Tenckhoff at initiation

https://www.kdigo.org/nephrology_guideline_database/Compare_guideline_targets.php
Guidelines on Referral

- CARI (Australia)   GFR<30
- CSN (Canada)       GFR<30
- EBPG (Europe)      GFR<30
- KDOQI             GFR<30

https://www.kdigo.org/
HP2010: Increase the Proportion of Persons With Type 1 or Type 2 Diabetes and Chronic Kidney Disease Who Receive Recommended Medical Evaluation. \textbf{Goal = 36}
HP2010: Increase the Proportion of Persons With Type 1 or Type 2 Diabetes and Chronic Kidney Disease Who Receive Recommended Treatment. Goal = 36
Blood Pressure Control in CKD

Hypertensive patients in NHANES

USRDS 2008 ADR

https://www.kdigo.org/
HP2010: Increase the proportion of treated chronic kidney failure patients who have received counseling on nutrition, treatment choices, and cardiovascular care 12 months before the start of renal replacement therapy. Goal = 45%

Percent of incident ESRD patients (2006)

USRDS 2008 ADR
Pre-initiation hemoglobin levels, by nephrologist care, 2006

Figure 3.3 (Volume 2)

Incident ESRD patients, 2006, with new (revised edition) Medical Evidence forms.
HP2020: Increase the proportion of incident hemodialysis who use arteriovenous fistulas or have a maturing fistula as the primary mode of vascular access.
Defining optimal care is not the primary barrier to improved outcomes.

Delivering appropriate care to those who need it is the problem we must overcome.
Lack of Appropriate Care/Late Referral

- More rapid progression
- Worse health status at time of initiation
- Higher mortality after starting RRT
- Decreased access to transplant
Interventions to Improve CKD Outcomes

- Formal CKD education extends time to starting dialysis. Devins et al. AJKD. 2003
- Multidisciplinary care improves survival. Hemmerlgarn et al. JASN 2007
- CKD clinics decreased hospitalizations post initiation., Goldstein et al. AJKD. 2004.
Models of Improving Care

- **Private Office**
  - RPA *Advanced CKD Patient Management Toolkit*
  - Small studies showing improved outcomes with disease management, multidisciplinary teams, nurse practitioners and physician assistants

- **HMO**
  - Kaiser of Southern California

- **Public Health Setting:**
  - Community Health Center
  - Indian Health
- 3 million members
- eGFR reporting implemented 2003
- Modified staging by splitting stage 3 into:
  - High risk: proteinuria, DM, eGFR + 1/2 age <85
  - Low risk: chronic stage 3
- 67% diabetic
- 10% African American
- Integrated approach

Rutkowski et al. AJKD. 2009
### CKD by Stage - KPSC

<table>
<thead>
<tr>
<th>STAGE</th>
<th>No. of Members</th>
<th>Mean Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4048</td>
<td>50.7</td>
</tr>
<tr>
<td>2</td>
<td>7127</td>
<td>61.5</td>
</tr>
<tr>
<td>3 modified</td>
<td>55485</td>
<td>69.3</td>
</tr>
<tr>
<td>4</td>
<td>5009</td>
<td>71.5</td>
</tr>
<tr>
<td>5 future RRT</td>
<td>336</td>
<td>65.6</td>
</tr>
<tr>
<td>Total</td>
<td>72005</td>
<td>67.7</td>
</tr>
</tbody>
</table>
Chronic Stage 3

- Not DM
- UACR < 300mg/g
- eGFR + age/2 < 85
- 48,734 members vs. 55,485 Stage 3 modified
- 71% > 70 years
- Not targeted for population management
Nephrology Referral

- 60 fulltime nephrologists
- No disincentive for primary care to refer early
- Culture of early referral
- 32% CKD patients seen in last 5 years
- 24% CKD patients seen in last 12 months
Nephrology Referral Guidelines

- CKD 4-5 unless aggressive management not indicated
- CKD 1-3, consider referral if:
  - Proteinuria > 1000mg/d
  - Refractory HTN
  - Clarification of diagnosis
  - Unexplained acute decrease in eGFR
- Most CKD 1-3 patients fully integrated with other population care efforts
### Nephrology Visits by CKD Stage

<table>
<thead>
<tr>
<th>CKD Stage</th>
<th>Number</th>
<th>Past 5 Years</th>
<th>Past 12 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4048</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>7127</td>
<td>23</td>
<td>15</td>
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<td>3 modified</td>
<td>55485</td>
<td>29</td>
<td>21</td>
</tr>
<tr>
<td>4</td>
<td>5009</td>
<td>87</td>
<td>77</td>
</tr>
<tr>
<td>5 future RRT</td>
<td>336</td>
<td>97</td>
<td>89</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>48734</td>
<td>32</td>
<td>24</td>
</tr>
</tbody>
</table>
- 85% of visits by CKD patients are to PCP’s
- 79% of these visits coded for CKD
- Patient-specific information and advice provided at time of visit
- EMR includes care management summary sheet and algorithm based reminders
- Decision support through provider education
## Quality Indicators - Stages 1-5

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP &gt; 129/79</td>
<td>42466</td>
<td>56.4</td>
</tr>
<tr>
<td>No UACR in past 12 months</td>
<td>15765</td>
<td>20.9</td>
</tr>
<tr>
<td>DM or Proteinuria No ACEi or ARB</td>
<td>12184</td>
<td>16.2</td>
</tr>
<tr>
<td>No LDL in past 12 months</td>
<td>8350</td>
<td>11.1</td>
</tr>
<tr>
<td>LDL &gt; 100 mg/dl</td>
<td>26557</td>
<td>39.6</td>
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</table>
### Quality Indicators - Stages 4-5

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Number</th>
<th>%</th>
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</thead>
<tbody>
<tr>
<td>No Hgb in past 12 months (CKD 3-5)</td>
<td>8461</td>
<td>13.9</td>
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<tr>
<td>Hgb&lt;11g/dl (CKD 3-5)</td>
<td>6603</td>
<td>12.6</td>
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<tr>
<td>Hospital Days /pt/year</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>No neph. visit in past 12 months</td>
<td>1225</td>
<td>23.0</td>
</tr>
<tr>
<td>Not attending RRT Class</td>
<td>3291</td>
<td>61.9</td>
</tr>
<tr>
<td>Category</td>
<td>Number</td>
<td>%</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>--------</td>
<td>----</td>
</tr>
<tr>
<td>New ESRD</td>
<td>392</td>
<td></td>
</tr>
<tr>
<td>New PD</td>
<td>46</td>
<td>12</td>
</tr>
<tr>
<td>Preemptive Transplants</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>AV Fistula 1st HD</td>
<td>140</td>
<td>36</td>
</tr>
<tr>
<td>AV Graft 1st HD</td>
<td>21</td>
<td>5</td>
</tr>
<tr>
<td>Catheter 1st HD</td>
<td>175</td>
<td>45</td>
</tr>
<tr>
<td>Optimal Start</td>
<td>196</td>
<td>54</td>
</tr>
</tbody>
</table>
Defining optimal care is not the primary barrier to improved outcomes.

Delivering appropriate care to those who need it is the problem we must overcome.
Health Disparities in CKD Must be Addressed

Incident ESRD patients; rates adjusted for age & gender.

USRDS ADR, 2007
The Greatest Opportunity Is in Improving Care of Diabetics

Incident ESRD patients; rates adjusted for age, gender, & race.

USRDS ADR, 2008
Diabetes (DM) and Hypertension (HTN) Often Coexist in CKD


USRDS ADR, 2006
Even Early Referral Is Too Late to Intervene

The graph illustrates the progression of kidney failure over time with different treatment approaches:

- **No Treatment**: A straight line indicating a rapid decline in GFR (glomerular filtration rate) leading to kidney failure.
- **Current Treatment**: A slightly slower decline in GFR compared to no treatment, still leading to kidney failure.
- **Early Treatment**: A slower decline in GFR, delaying the onset of kidney failure.

Key:
- **GFR (mL/min/1.73²)**: The y-axis represents the GFR in milliliters per minute per 1.73 square meters of body surface area.
- **Time (years)**: The x-axis represents the time in years from the start of the condition.
Challenges to Improving CKD Care

- CKD remains under diagnosed
- Implementation of recommended care is poor
- Many clinicians feel inadequately educated
  - Uncertain about how to interpret diagnostic tests
  - Unclear about clinical recommendations
  - Low confidence in their ability to successfully manage CKD
  - Indications for, and process of, referral poorly defined
NKDEP aims to reduce the morbidity and mortality caused by kidney disease and its complications by:

- Improving early detection of CKD
- Facilitating identification of patients at greatest risk for progression to kidney failure
- Promoting evidence-based interventions to slow progression of kidney disease
- Supporting the coordination of Federal responses to CKD
The Chronic Care Model

Community
- Resources and Policies
- Self-Management Support

Health Systems
- Organization of Health Care
- Delivery System Design
- Decision Support
- Clinical Information Systems

Informed, Activated Patient

Productive Interactions

Prepared, Proactive Practice Team

Improved Outcomes

Developed by The MacColl Institute
© ACP-ASIM Journals and Books
What it Means for CKD

- An approach to reducing health disparities in chronic disease through systems change
- CCM provides a much-needed paradigm for how to improve CKD detection and management
- Offers a systematic way to identify needs and set priorities
  - Makes it clear which elements we need to address including the primary care/nephrology relationship
What Can Primary Care Providers Do?

- Recognize and test at-risk patients: monitor eGFR and UACR
- Screen for anemia (Hgb), malnutrition (albumin), metabolic bone disease (Ca, Phos., PTH)
- Treat cardiovascular risk, especially with smokers and hypercholesterolemia
- Refer to dietitian for nutritional guidance
- Educate patients about CKD and treatment
Identifying and Monitoring CKD

- eGFR
- UACR
- Staging
Kidney Function. Glomerular filtration rate (GFR) < 60 mL/min/1.73 m² for ≥ 3 months with or without kidney damage

OR

Kidney damage for ≥ 3 months, with or without decreased GFR, manifested by either
  − Pathologic abnormalities; or
  − Markers of kidney damage, i.e., proteinuria

What is Glomerular Filtration Rate (GFR)?

- GFR is equal to the sum of the filtration rates in all of the functioning nephrons.
- Estimation of the GFR gives a rough measure of the number of functioning nephrons.
- GFR cannot be measured directly.
- Cardiac output = 6 L/min
- X 20% of CO goes to kidneys = 1.2L/min
- X Plasma is 50% blood volume = 600 ml/min
- X Filtration Fraction of 20% = 120 ml/min
- Not the GFR. It’s an estimate
- Population-based
- Like all estimates of kidney function based on creatinine:
  - Cr must be stable
  - Affected by muscle mass
- Creatinine standardization
Diagnosis: Approximately 40% people are identified with CKD based on urine albumin alone. Early marker of kidney damage (ACR >30 mg/g) due to diabetes, glomerular disease, hypertension

Prognosis: Urine albumin is an important prognostic marker (particularly in diabetic kidney disease) and may be used to monitor and guide therapy

Marker for cardiovascular disease. Hypothesized marker of generalized endothelial dysfunction

Hypothesized surrogate outcome for kidney disease progression and CVD risk reduction

A tool for patient education and self-management (like eGFR, eAG)
“Recently a wave of emails came through on the American College of Clinical Pharmacy's Nephrology Practice Research Network (PRN) listserv regarding microalbumin testing. It seems that every institution has a different (and onerous) way to request a urine albumin/creatinine ratio. As a result, oftentimes, the wrong test (albumin, microalbumin only) gets done.”
<table>
<thead>
<tr>
<th>LOINC Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>12842-1 PROTEIN</td>
<td>MCNC 12H UR QN</td>
</tr>
<tr>
<td>21482-5 PROTEIN</td>
<td>MCNC 24H UR QN</td>
</tr>
<tr>
<td>26034-9 PROTEIN</td>
<td>MCNC PT UR QN</td>
</tr>
<tr>
<td>26801-1 PROTEIN</td>
<td>MRAT 12H UR QN</td>
</tr>
<tr>
<td>2889-4 PROTEIN</td>
<td>MRAT 24H UR QN</td>
</tr>
<tr>
<td>13801-6 PROTEIN/CREATININE</td>
<td>MCRTO 24H UR QN</td>
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<td>2890-2 PROTEIN/CREATININE</td>
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<td>34366-5 PROTEIN/CREATININE</td>
<td>RATIO PT UR QN</td>
</tr>
<tr>
<td>40662-9 PROTEIN^RESTING</td>
<td>MRAT 12H UR QN</td>
</tr>
<tr>
<td>40663-7 PROTEIN^UPRIGHT</td>
<td>MRAT 12H UR QN</td>
</tr>
<tr>
<td>18373-1 PROTEIN</td>
<td>MRAT 6H UR QN</td>
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<tr>
<td>20454-5 PROTEIN</td>
<td>ACNC PT UR ORD TEST STRIP</td>
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<tr>
<td>27298-9 PROTEIN</td>
<td>ACNC PT UR QN</td>
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<tr>
<td>2887-8 PROTEIN</td>
<td>ACNC PT UR ORD</td>
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<td>2888-6 PROTEIN</td>
<td>MCNC PT UR QN</td>
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<td>32209-9 PROTEIN</td>
<td>ACNC 24H UR ORD TEST STRIP</td>
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<tr>
<td>32551-4 PROTEIN</td>
<td>MASS XXX UR QN</td>
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<tr>
<td>35663-4 PROTEIN</td>
<td>MCNC XXX UR QN</td>
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<tr>
<td>5804-0 PROTEIN</td>
<td>MCNC PT UR QN TEST STRIP</td>
</tr>
<tr>
<td>40486-3 PROTEIN/CREATININE</td>
<td>RATIO 24H UR QN</td>
</tr>
<tr>
<td>34535-5 PROTEIN/MICROALBUMIN/CREATININE RATIO PANEL</td>
<td>- PT UR QN</td>
</tr>
<tr>
<td>14956-7 ALBUMIN</td>
<td>MRAT 24H UR QN DETECTION LIMIT = 20 MG/L MICROALE</td>
</tr>
<tr>
<td>14957-5 ALBUMIN</td>
<td>MCNC PT UR QN DETECTION LIMIT = 20 MG/L MICROALE</td>
</tr>
<tr>
<td>1753-3 ALBUMIN</td>
<td>ACNC PT UR ORD</td>
</tr>
<tr>
<td>1754-1 ALBUMIN</td>
<td>MCNC PT UR QN</td>
</tr>
<tr>
<td>1755-8 ALBUMIN</td>
<td>MRAT 24H UR QN</td>
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<td>21059-1 ALBUMIN</td>
<td>MCNC 24H UR QN</td>
</tr>
<tr>
<td>30003-8 ALBUMIN</td>
<td>MCNC 24H UR QN DETECTION LIMIT = 20 MG/L MICROALE</td>
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<tr>
<td>43605-5 ALBUMIN</td>
<td>MCNC 4H UR QN DETECTION LIMIT = 20 MG/L MICROALE</td>
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<tr>
<td>43606-3 ALBUMIN</td>
<td>MRAT 4H UR QN DETECTION LIMIT = 20 MG/L</td>
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<td>43607-1 ALBUMIN</td>
<td>MRAT 12H UR QN DETECTION LIMIT = 20 MG/L</td>
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<td>1757-4 ALBUMIN RENAL CLEARANCE</td>
<td>VRAT 24H UR QN</td>
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<td>13705-9 ALBUMIN/CREATININE</td>
<td>MCRTO 24H UR QN</td>
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<td>14585-4 ALBUMIN/CREATININE</td>
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<td>14958-3 ALBUMIN/CREATININE</td>
<td>MCRTO 24H UR QN DETECTION LIMIT = 20 MG/L MICROALE</td>
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<tr>
<td>14959-1 ALBUMIN/CREATININE</td>
<td>MCRTO PT UR QN</td>
</tr>
<tr>
<td>30000-4 ALBUMIN/CREATININE</td>
<td>RATIO PT UR QN DETECTION LIMIT = 20 MG/L MICROALE</td>
</tr>
<tr>
<td>30001-2 ALBUMIN/CREATININE</td>
<td>RATIO PT UR QN</td>
</tr>
<tr>
<td>32294-1 ALBUMIN/CREATININE</td>
<td>RATIO PT UR QN</td>
</tr>
<tr>
<td>44292-1 ALBUMIN/CREATININE</td>
<td>MCRTO 24H UR QN DETECTION LIMIT = 20 MG/L</td>
</tr>
<tr>
<td>9318-7 ALBUMIN/CREATININE</td>
<td>MCRTO PT UR QN</td>
</tr>
</tbody>
</table>

**Note:** The table lists LOINC codes for urine albumin tests along with their respective measurement units, time frames, and quality control limits.
The ratio of albumin to creatinine in a spot urine specimen correlates closely, in adults, to total albumin excretion:

\[
\frac{\text{Albumin (mg/dl)}}{\text{Creatinine (mg/dl)}} \approx \text{Albumin excretion in grams/24 h}
\]

However, generally expressed as mg albumin/g creatinine:
- Normoalbuminuria <30 mg/g
- micro-albuminuria 30-300 mg/g
- macro-albuminuria >300 mg/g

UACR is a continuous variable and the above terms will be replaced with a single term e.g. urine albumin
Clinical Issue: Clinical usefulness of quantitative urine protein measurements

Our providers have serious questions about the clinical usefulness of quantitative urine protein measurements for diabetics already identified, and on ACEi’s, and the time it would take to convince most of our population to do a quantitative urine protein.
New York Times (1/19, D7, Rabin) reports that a Canadian analysis has determined that routine self-monitoring of blood sugar levels is "not cost effective" for people with type 2 diabetes, since the blood-glucose test strips "can cost almost a dollar each, and they prevent comparatively few complications of diabetes." As a result, the Canadian Agency for Drugs and Technologies in Health has issued "a nonbinding recommendation against routine self-monitoring for many type 2 diabetics -- those who do not take insulin." Instead, Canadian experts said "patients need to be vigilant about their diet, exercise, weight, and blood pressure."
RENAAL; Initial anti-albuminuric response predicts renal outcome

De Zeeuw et al; Kidney Int 2004
Screening

- Perform an annual test to assess urine albumin excretion in type 1 diabetic patients with diabetes duration of > 5 years and in all type 2 diabetic patients, starting at diagnosis
## Stages of Chronic Kidney Disease

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>GFR (mL/min/1.73 m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kidney Damage with Normal or ↑ GFR</td>
<td>≥ 90</td>
</tr>
<tr>
<td>2</td>
<td>Kidney Damage with Mild ↓ GFR</td>
<td>60-89</td>
</tr>
<tr>
<td>3</td>
<td>Moderate ↓ GFR</td>
<td>30-59</td>
</tr>
<tr>
<td>4</td>
<td>Severe ↓ GFR</td>
<td>15-29</td>
</tr>
<tr>
<td>5</td>
<td>Kidney Failure</td>
<td>&lt;15 or Dialysis</td>
</tr>
</tbody>
</table>
Caveats to Staging

- eGFR > 60 too inaccurate for clinical use although staging demands accuracy above 60
- “Damage” criteria is usually proteinuria -? Significance when eGFR>60 and no known kidney disease, HTN or DM
- 40% of NHANES-based CKD estimate have eGFR > 60
Age-related decline makes up much of Stage 3
Most do not progress to ESRD
Still a CVD risk factor but what implications for 75 y.o. with eGFR 59
GFR is probably too narrow a basis on which to make diagnosis and prognosis (stage)
Suggestions

- Eliminate Stages 1 and 2
- Use of numbered stages promises more than it delivers. Instead use descriptive terms: moderate, severe, kidney failure
- Use age as a modifier
- Don’t use measures which are not proven to associated with risk to inflate burden of CKD
- KPSC model
**Materials**

**Quick Reference on UACR and GFR**

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### Urine Albumin-to-Creatinine Ratio (UACR)

#### In Evaluating Patients with Diabetes for Kidney Disease

The two key markers for chronic kidney disease (CKD) are urine albumin and estimated glomerular filtration rate (eGFR).

Assess urine albumin excretion yearly to diagnose and monitor kidney damage in patients with type 1 diabetes for five years or more or with type 2 diabetes.

- More frequent monitoring may be indicated in patients with changing clinical status or after therapeutic interventions.
- Use a spot urine albumin-to-creatinine ratio (UACR). UACR estimates 24-hour urine albumin excretion. Twenty-four-hour collection and timed specimens are not necessary.

\[
\text{Urine albumin (mg/dL)} = \frac{\text{UACR in mg/g}}{\text{Urine creatinine (g/dL)}} = \frac{\text{Albumin excretion in mg/day}}{\text{UACR}}
\]

UACR is a ratio between two measured substances. Unlike a dipstick test for albumin, UACR is unaffected by variation in urine concentration.

Albuminuria is present when UACR is greater than 30 mg/g and is a marker for CKD.

Albuminuria is used to diagnose and monitor kidney disease. Change in albuminuria may reflect response to therapy and risk for progression. A decrease in urine albumin may be associated with improved renal and cardiovascular outcomes.

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### Estimated Glomerular Filtration Rate (eGFR)

#### In Evaluating Patients with Diabetes for Kidney Disease

The two key markers for chronic kidney disease (CKD) are estimated glomerular filtration rate (eGFR) and urine albumin.

Calculate eGFR from stable serum creatinine levels at least once a year in all patients with diabetes.

- eGFR is more accurate than serum creatinine alone. Serum creatinine is affected by muscle mass, and related factors of age, sex, and race.
- eGFR is not reliable for patients with rapidly changing creatinine levels, extremes in muscle mass and body size, or altered diet patterns.

See if your lab reports eGFR routinely. If it does not, ask your lab to do so. You can also calculate an eGFR yourself by using GFR calculators available on NKDEP’s website at [www.nkdep.nih.gov/professionals/gfr_calculators](http://www.nkdep.nih.gov/professionals/gfr_calculators).

#### Interpreting eGFR Results

- **CKD may be present if UACR > 30 mg/g**

- **eGFR < 60 ml/min/1.73 m²**

  - **Kidney Failure**

If CKD is detected, it should be addressed as part of a comprehensive approach to the treatment of diabetes.

---

3 Albuminuria is a term that describes all levels of urine albumin. Microalbuminuria is a term used to describe urine albumin levels not detected by a dipstick test, i.e., 30 mg/g—300 mg/g. Macroalbuminuria is sometimes used to describe albumin levels more than 300 mg/g.
Materials

GFR UA Tear Pad

How well are your kidneys working?

Explaining Your Kidney Test Results

Your GFR result on _______ was _______.

- A GFR of 60 or higher is in the normal range.
- A GFR below 60 may mean kidney disease.
- A GFR of 15 or lower may mean kidney failure.

What is GFR?

GFR stands for glomerular filtration rate. GFR is a measure of how well your kidneys filter blood.

Your urine albumin result on _______ was _______.

- A urine albumin result below 30 is normal.
- A urine albumin result above 30 may mean kidney disease.

What is urine albumin?

Albumin is a protein found in the blood. A healthy kidney does not let albumin pass into the urine. A damaged kidney lets some albumin pass into the urine. The less albumin in your urine, the better.

Your blood pressure result on _______ was _______.

Keeping your blood pressure below 130/80 may help to protect your kidneys.

What your kidneys do

You have two kidneys. Their main job is to filter waste and extra water out of your blood and make urine.

How your kidneys are checked

Two tests are used to check for kidney disease.

- A blood test checks your GFR, which tells how well your kidneys are filtering.
- A urine test checks for albumin in your urine, a sign of kidney damage.

Why your kidneys are being checked

You need to have your kidneys checked because you can't feel kidney disease. Kidney tests are very important for people who have diabetes, high blood pressure, or heart disease. These conditions can hurt your kidneys.

What happens if you have kidney disease

Kidney disease can be treated. The sooner you know you have kidney disease, the sooner you can get treatment to help delay or prevent kidney failure. Treating kidney disease may also help prevent heart disease.

Treatment goals are to:

- Keep your GFR from going down
- Lower your urine albumin

No matter what your results are:

- Keep your blood pressure below 130/80.
- Keep your blood glucose and blood cholesterol in your target range.
- Eat foods that are healthy for your heart and cut back on salt.
- Be physically active.
- Stop smoking.
- Take medicines the way your provider tells you to.

Notes: ________________________________

For more information, visit www.nkdep.nih.gov or call 1-866-4 KIDNEY (1-866-454-3639). The National Kidney Disease Education Program (NKDEP) is an initiative of the National Institutes of Health (NIH).

NIH Publication No. 10-6220 • Revised January 2010
For Providers
Educating Patients About Chronic Kidney Disease

Four Key Concepts and Talking Points

1. **Talk to patients about their kidneys, CKD, and their risk.**
   - **What is CKD?** CKD (chronic kidney disease) means the kidneys are damaged and may no longer filter blood well. This damage happens over many years. As more damage occurs, the kidneys are unable to keep the body healthy—then dialysis or a kidney transplant may be needed.
   - **How can I lower my risk for CKD?** The steps you take to manage your diabetes and high blood pressure also help protect your kidneys. Diet, quitting smoking, and exercise are all important steps.

2. **Communicate the importance of testing and how CKD is diagnosed.**
   - **What are the symptoms of CKD?** Most people with CKD have no symptoms until their kidneys are about to fail. The only way to know if you have kidney disease is to get tested. The sooner kidney disease is found, the sooner you can take steps to begin treatment and keep your kidneys healthier longer.
   - **How do you check for CKD?** A blood test and a urine test are used to find kidney disease. Because you are at risk, you should get these tests regularly.
     - **GFR**—A blood test measures how much blood your kidneys filter each minute, which is known as your glomerular filtration rate (GFR).
     - **Urine Protein**—A urine test checks for protein in your urine. Protein can leak into the urine when the filters in the kidneys are damaged.

3. **Explain the progressive nature of CKD and the basics of treatment.**
   - **Can CKD get better?** CKD usually will not get better and is likely to get worse. Treatment helps slow kidney disease and keep the kidneys healthier longer.
   - **How is CKD treated?** Treatment includes keeping blood pressure below 130/80 mmHg, diet counseling to reduce salt and excessive protein, and controlling blood sugar if you have diabetes.
   - **Are there medications for CKD?** People with CKD often take medicines to lower blood pressure, control blood sugar, and lower blood cholesterol. Two types of blood pressure medications—ACE inhibitors and ARBs—can slow CKD and delay kidney failure, even in people who do not have high blood pressure.

4. **Begin to speak about dialysis and transplantation.**
   - **Will I ever need dialysis?** With proper management, you may never need dialysis or, at least, not for a very long time. But if your kidneys fail, we will need to choose a treatment that can replace the job of your kidneys. There are two types of dialysis—one is done at home daily and the other is done in a dialysis center three times a week.
   - **Is kidney transplant an option?** You may be able to receive a kidney transplant. The donated kidney can come from an anonymous donor who has recently died or from a living person. A kidney transplant is a treatment—not a cure.

For a more detailed version of these talking points or to order this tear-off pad, visit www.kidneydisease.gov or call 1-866-KIDNEY (1-866-546-3639).

The National Kidney Disease Education Program is an initiative of the National Institutes of Health.

NIH Publication No. 10-6220 • Revised January 2010
CKD means that your kidneys are damaged and can’t filter blood like they should. This damage can cause wastes to build up in your body. It can also cause other problems that can harm your health.

CKD is often a “progressive” disease, which means it can get worse over time. CKD may lead to kidney failure. The only treatment options for kidney failure are dialysis or a kidney transplant.

You can take steps to keep your kidneys healthier longer:

- Choose foods with less salt (sodium).
- Keep your blood pressure below 130/80.
- Keep your blood glucose in the target range, if you have diabetes.

You’ve been told that you have chronic kidney disease (CKD). What does that mean? And what does it mean for your health and your life? This booklet will help answer some of the questions you might have.

You have two kidneys, each about the size of your fist. Their main job is to filter wastes and excess water out of your blood to make urine. They also keep the body’s chemical balance, help control blood pressure, and make hormones.
CKD and My Health

How does my health care provider know I have CKD?

Chances are, you feel normal and were surprised to hear that you have CKD. It is called a “silent” disease, because many people don’t have any symptoms until their kidneys are about to fail. The only way to know is to get your kidneys checked with blood and urine tests.

1. A blood test checks your GFR, which tells how well your kidneys are filtering. GFR stands for glomerular filtration rate.

2. A urine test checks for albumin. Albumin is a protein that can pass into the urine when the kidneys are damaged. See picture below.

Inside a healthy kidney | Inside a damaged kidney

These two tests are used to monitor CKD and make sure that treatment is working. See pages 9 and 10 to learn more about these tests and track your results.

What causes CKD?

Diabetes and high blood pressure are the most common causes of CKD. There are other causes, too.

Your provider will look at your health history and may do other tests. You need to know why you have CKD, so your treatment can also address the cause of the CKD.

What medicines are used to treat CKD?

People with CKD often take medicines to lower blood pressure, control blood glucose, and lower blood cholesterol. Two types of blood pressure medicines—ACE inhibitors and ARBs—may slow CKD and delay kidney failure, even in people who don’t have high blood pressure. Many people need to take two or more medicines for their blood pressure. They also may need to take a diuretic (water pill). The goal is to keep your blood pressure below 130/80.

Do I need to change my medicines?

Some medicines are not safe for people with CKD. Other medicines need to be taken in smaller doses. Tell your provider about all the medicines you take, including over-the-counter medicines (those you get without a prescription), vitamins, and supplements.
Can CKD affect my health in other ways?
People with CKD often have high blood pressure. They can also develop anemia (low number of red blood cells), bone disease, malnutrition, and heart and blood vessel diseases.

What tests will help track my CKD?
The blood and urine tests used to check for CKD are also used to monitor CKD. You need to keep track of your test results to see how you’re doing.

Track your blood pressure. In most cases, you should keep it below 130/80.

If you have diabetes, monitor your blood glucose and keep it in your target range. Like high blood pressure, high blood glucose can be harmful to your kidneys.

See page 9 of this booklet for more information on tracking your test results.

Will I have to go on dialysis?
Some people live with CKD for years without going on dialysis. Others progress quickly to kidney failure. You may delay dialysis if you follow your provider’s advice on medicine, diet, and lifestyle changes.

If your kidneys fail, you will need dialysis or a kidney transplant. Most people with kidney failure are treated with dialysis.

Will I be able to get a kidney transplant instead of going on dialysis?
Some people with kidney failure may be able to receive a kidney transplant. The donated kidney can come from someone you don’t know who has recently died, or from a living person—a relative, spouse, or friend. A kidney transplant isn’t for everyone. You may have a condition that makes the transplant surgery dangerous or not likely to succeed.
CKD and My Lifestyle

People with CKD can and should continue to live their lives in a normal way: working, enjoying friends and family, and staying active. They also need to make some changes as explained here.

Do I need to change what I eat?

What you eat may help to slow down CKD and keep your body healthier. Some points to keep in mind:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Choose and prepare foods with less salt (sodium). Use less salt at the table.</td>
</tr>
<tr>
<td></td>
<td>Select the right kinds and smaller amounts of protein.</td>
</tr>
<tr>
<td></td>
<td>Choose foods that are healthy for your heart, like lean cuts of meat, skinless chicken, fish, fruits, vegetables, and beans.</td>
</tr>
<tr>
<td></td>
<td>Read the Nutrition Facts Label, especially for sodium, to help you pick the right foods and drinks.</td>
</tr>
</tbody>
</table>

Your provider may refer you to a dietitian. Your dietitian will teach you how to choose foods that are easier on your kidneys. You will also learn about the nutrients that matter for CKD.

Do I need to change what I drink?

- **Water** — You don’t need to drink more water unless you have kidney stones. Drink as much water as you normally do.
- **Soda and other drinks** — If you are told to limit phosphorus, choose light-colored soda (or pop), like lemon-lime, and homemade iced tea and lemonade. Dark-colored sodas, fruit punch, and some bottled and canned iced teas can have a lot of phosphorus.
- **Juice** — If you are told to limit potassium, drink apple, grape, or cranberry juice instead of orange juice.
- **Alcohol** — You may be able to drink small amounts of alcohol. Drinking too much can damage the liver, heart, and brain and cause serious health problems.

Is smoking cigarettes bad for my kidneys?

Take steps to quit smoking as soon as you can. Cigarette smoking can make kidney damage worse.
CKD: Tracking My Test Results

You are the most important person on your health care team. Know your test results and track them over time to see how your kidneys are doing. Bring this card to your health care visits and ask your provider to complete it.

**Blood pressure** — The most important thing you can do to slow down CKD is keep your blood pressure below 130/80. This can delay or prevent kidney failure.

**GFR** — The GFR tells you how well your kidneys are filtering blood. You can’t raise your GFR. The goal is to keep your GFR from going down to prevent or delay kidney failure. See the dial picture below.

**Urine albumin** — Albumin is a protein in your blood that can pass into the urine when kidneys are damaged. You can’t undo kidney damage, but you may be able to lower the amount of albumin in your urine with treatment. Lowering your urine albumin is good for your kidneys.

**A1C** — A1C test is a lab test that shows your average blood glucose level over the last 3 months. The goal is less than 7 for most people with diabetes. Lowering your A1C can help you to stay healthy. (For people with diabetes only.)
Where can I get more information?

National Kidney Disease Education Program
www.nkdep.nih.gov
1-866-4 KIDNEY (1-866-454-3639)

National Kidney and Urologic Disease Information Clearinghouse
www.kidney.niddk.nih.gov • 1-800-891-5390

American Association of Kidney Patients
www.aakp.org • 1-800-749-2257

American Kidney Fund
www.kidneyfund.org • 1-800-638-8299

National Kidney Foundation
www.kidney.org • 1-800-622-9010

Participants in clinical trials can play a more active role in their own health care, gain access to new research treatments before they are widely available, and help others by contributing to medical research.
For more information, visit www.clinicaltrials.gov.

The National Kidney Disease Education Program (NKDEP) encourages people to get tested for kidney disease and educates those with kidney disease and their health care providers about treatments that can help delay or prevent kidney failure. NKDEP is a program of the National Institutes of Health (NIH).

NIH Publication No. 10-7408 • Printed April 2010
# Kidney Test Results

**Name:** __________________________  **Date:** __________________________

## Chronic Kidney Disease (CKD) Tests

<table>
<thead>
<tr>
<th>Test</th>
<th>Results</th>
<th>Why It Is Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glomerular Filtration Rate (GFR)</td>
<td>CKD is less than 60</td>
<td>GFR estimates how well your kidneys are filtering blood. Your goal is to keep your GFR from going down.</td>
</tr>
<tr>
<td></td>
<td>Your Result:</td>
<td></td>
</tr>
<tr>
<td>Urine Albumin-to-Creatinine Ratio (UACR)</td>
<td>CKD is more than 30</td>
<td>Urine albumin checks for kidney damage. The lower the result, the better.</td>
</tr>
<tr>
<td></td>
<td>Your Result:</td>
<td></td>
</tr>
</tbody>
</table>

## Other Important Tests

<table>
<thead>
<tr>
<th>Test</th>
<th>Results</th>
<th>Why It Is Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Pressure</td>
<td>Goal: Below 130/80</td>
<td>High blood pressure makes the heart work harder and can damage blood vessels in the kidneys.</td>
</tr>
<tr>
<td></td>
<td>Your Result:</td>
<td></td>
</tr>
<tr>
<td>Serum Albumin</td>
<td>Normal: 3.4 to 5.0*</td>
<td>Albumin is a protein that helps measure how well you are eating.</td>
</tr>
<tr>
<td></td>
<td>Your Result:</td>
<td></td>
</tr>
<tr>
<td>Bicarbonate</td>
<td>Normal: More than 22</td>
<td>Bicarbonate measures the acid level in your blood.</td>
</tr>
<tr>
<td></td>
<td>Your Result:</td>
<td></td>
</tr>
<tr>
<td>Blood Urea Nitrogen (BUN)</td>
<td>Normal: Less than 20</td>
<td>BUN checks how much urea, a waste product, is in your blood.</td>
</tr>
<tr>
<td></td>
<td>Your Result:</td>
<td></td>
</tr>
<tr>
<td>Potassium</td>
<td>Normal: 3.5 to 5.0*</td>
<td>Potassium affects how your nerves and muscles are working. High or low levels can be dangerous.</td>
</tr>
<tr>
<td></td>
<td>Your Result:</td>
<td></td>
</tr>
<tr>
<td>Calcium</td>
<td>Normal: 8.5 to 10.2*</td>
<td>Calcium keeps your bones strong and your heart rhythm steady. ODD can lower the amount of calcium in your bones.</td>
</tr>
<tr>
<td></td>
<td>Your Result:</td>
<td></td>
</tr>
<tr>
<td>Phosphorus</td>
<td>Normal: 2.7 to 4.6*</td>
<td>Phosphorus is important for strong bones and healthy blood vessels. High levels may cause soft bones, hard blood vessels and itchy skin.</td>
</tr>
<tr>
<td></td>
<td>Your Result:</td>
<td></td>
</tr>
<tr>
<td>Parathyroid Hormone (PTH)</td>
<td>Normal: Less than 65</td>
<td>PTH controls the calcium and phosphorus levels in your blood. It is needed to keep bones and blood vessels healthy.</td>
</tr>
<tr>
<td></td>
<td>Your Result:</td>
<td></td>
</tr>
<tr>
<td>Vitamin D</td>
<td>Normal: More than 30</td>
<td>Vitamin D is important for bones and heart health.</td>
</tr>
<tr>
<td></td>
<td>Your Result:</td>
<td></td>
</tr>
</tbody>
</table>

*Normal ranges may vary.

## Other Important Tests, continued

<table>
<thead>
<tr>
<th>Test</th>
<th>Results</th>
<th>Why It Is Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1C (for patients with diabetes)</td>
<td>Goal: Less than 7</td>
<td>A1C measures average blood sugar levels over 2 - 3 months.</td>
</tr>
<tr>
<td></td>
<td>Your Result:</td>
<td></td>
</tr>
<tr>
<td>Total Cholesterol</td>
<td>Normal: Less than 200</td>
<td>Cholesterol measures the amount of fat in your blood. Too much cholesterol can clog blood vessels or arteries in the heart and kidneys.</td>
</tr>
<tr>
<td></td>
<td>Your Result:</td>
<td></td>
</tr>
<tr>
<td>HDL Cholesterol</td>
<td>Normal: More than 40</td>
<td>HDL is the good cholesterol and clears bad fats out of your arteries.</td>
</tr>
<tr>
<td></td>
<td>Your Result:</td>
<td></td>
</tr>
<tr>
<td>LDL Cholesterol</td>
<td>Normal: Less than 150</td>
<td>LDL is the bad cholesterol and can clog your arteries.</td>
</tr>
<tr>
<td></td>
<td>Your Result:</td>
<td></td>
</tr>
<tr>
<td>Triglycerides</td>
<td>Normal: Less than 150</td>
<td>Triglyceride is a type of fat in the blood.</td>
</tr>
<tr>
<td></td>
<td>Your Result:</td>
<td></td>
</tr>
<tr>
<td>Hemoglobin (Hgb)</td>
<td>Normal: 11 to 12*</td>
<td>Low hemoglobin is a sign of anemia. Anemia occurs when you don’t have enough red blood cells and feel tired.</td>
</tr>
<tr>
<td></td>
<td>Your Result:</td>
<td></td>
</tr>
</tbody>
</table>

## Notes

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For more information, visit www.nkdep.nih.gov or call 1-866-4 KIDNEY (1-866-454-3639).

The National Kidney Disease Education Program (NKDEP) encourages people to get tested for kidney disease and educates those with kidney disease and their providers about treatments that can help delay or prevent kidney failure. NKDEP is a program of the National Institutes of Health. NIDDK is part of the U.S. Department of Health and Human Services.

NIH Publication No: 10-7677 • April 2010

NKDEP

NIDDK

NKDEP
Chronic Kidney Disease (CKD) and Diet: Assessment, Management, and Treatment

Treating CKD Patients Who Are Not on Dialysis
An Overview Guide for Dietitians

National Kidney Disease Education Program
National Institutes of Health
About CKD

The kidneys regulate the composition and volume of blood, remove metabolic wastes in the urine, and help control the acid/base balance in the body. They activate vitamin D needed for calcium absorption, and produce erythropoietin needed for red-blood-cell synthesis.

CKD is typically a progressive disease. It is defined as:
- reduction of kidney function—defined as an estimated glomerular filtration rate (eGFR) <60 mL/min/1.73 m²; and/or
- evidence of kidney damage, including persistent albuminuria—defined as ≥30 mg of urine albumin per gram of urine creatinine.

Kidney failure is typically defined as an eGFR <15 mL/min/1.73 m².

CKD is detected and monitored by two tests:
- Estimated glomerular filtration rate (eGFR) and
- Urine albumin-to-creatinine ratio (UACR).

The purpose of diet therapy for CKD is to maintain good nutritional status, slow progression, and to treat complications. The key diet components to slowing progression of CKD are:
- controlling blood pressure by reducing sodium intake
- reducing protein intake, if excessive
- managing diabetes

CKD RISK FACTORS

- Diabetes
- Hypertension
- Family history of kidney failure
- Cardiovascular disease
- Recurrent urinary tract infections
- HIV infection
- Immunological diseases

As eGFR declines, complications occur more commonly and are more severe. These may include:
- malnutrition
- metabolic acidosis due to reduced acid (hydrogen ion) excretion
- hyperkalemia
- mineral imbalance and bone disorder (calcium, phosphorus, and vitamin D)
- anemia due to impaired erythropoiesis and low iron stores
- cardiovascular disease (CVD) (dyslipidemia)
## II. Assess Kidney Function and Damage

<table>
<thead>
<tr>
<th>Test and Its Relevance</th>
<th>Results</th>
<th>Assessment</th>
</tr>
</thead>
</table>
| **Estimated Glomerular Filtration Rate (eGFR)** | eGFR (mL/min/1.73m²) | • Evaluate eGFR to assess kidney function; track over time to monitor effectiveness of diet therapy.  
• Stable eGFR may indicate therapy is working.  
• Decline of eGFR reflects progression of CKD. |
| eGFR estimates kidney function. As eGFR declines, complications are more likely and more severe. | Normal >60  
CKD 15-60  
Kidney failure <15 | Additional Information  
Each filtering unit of the kidney, or nephron, filters a tiny amount of plasma each minute. eGFR reflects the total filtration of all two million nephrons. As nephrons are damaged or destroyed, eGFR declines. The quantity or volume of urine may not change significantly as eGFR declines. However, what is excreted into the urine does change. Rapidly declining eGFR may warrant appropriate discussion of renal replacement therapies.  
In adults, the best equation for estimating eGFR from serum creatinine is the Modification of Diet in Renal Disease (MDRD) Study equation (Levey, 1999).  
NKDEP offers calculators online and as downloadable applications for estimating GFR.  
Serum creatinine level, age, gender, and race are needed. Many laboratories routinely report eGFR with all serum creatinine determinations. |
| **Urine Albumin-to-Creatinine Ratio (UACR)** | UACR (mg/g) | • Evaluate UACR over time to assess response to therapy and monitor progression of CKD.  
• Change in albuminuria may reflect response to therapy and risk for progression.  
• A decrease in urine albumin may be associated with improved renal and cardiovascular outcomes. |
| UACR is the preferred measure for screening, assessing, and monitoring kidney damage. UACR estimates 24-hour urine albumin excretion. Unlike a dipstick test for urine albumin, UACR is unaffected by variation in urine concentration. | Normal 0-29  
Albuminuria >30 | Additional Information  
Normally, functioning kidneys excrete very small amounts of albumin into the urine. Albuminuria usually reflects damage to the glomerulus—the "filter" of the nephron. Albuminuria is an independent risk factor for CKD progression (Hemmelgarn, 2010) and is considered a marker for CVD and mortality in hypertension. Reducing urine albumin to normal or near-normal levels may improve cardiovascular prognoses. |
### III. Slow Progression

<table>
<thead>
<tr>
<th>Therapeutic Goal and Its Relevance</th>
<th>Ranges/Goals</th>
<th>Dietary Intervention</th>
</tr>
</thead>
</table>
| **Control Blood Pressure**        | Goal <130/80mm Hg | - Limit sodium intake to 2,300mg a day or less (Sacks, 2001).  
- Weight reduction may be beneficial.  
- Monitor serum potassium in patients on renin angiotensin system (RAS) antagonists; limit dietary potassium intake when serum potassium >5mEq/L. |
| Sodium plays a large role in blood pressure control in CKD as a result of alterations in sodium excretion by the kidneys. |
| **Reduce Albuminuria**            | Reduce or stabilize the amount of albumin lost in the urine (see UACR above on page 2). | Limit excessive dietary protein as follows:  
- Nondiabetic: 0.8g protein/kg/day  
- Diabetic: 0.8-1.0g protein/kg/day |
| Decreased albuminuria is associated with slower progression of CKD, particularly in diabetics. Limiting dietary protein may reduce albuminuria and improve blood glucose control, hyperlipidemia, blood pressure, renal bone disease, and metabolic acidosis. |

**Additional Information**

For patients with hypertension, reduction of dietary sodium has been associated with improved blood pressure control in clinical trials and epidemiological studies.

Multiple medications may be required to control blood pressure. RAS antagonists, such as angiotensin-converting enzyme inhibitors (ACEI) or angiotensin receptor blockers (ARBs), are often used to control blood pressure, delay progression, reduce albuminuria, and protect against heart disease.

Diuretics are prescribed to treat fluid overload and high blood pressure, and may help control serum potassium levels.

Limiting excessive protein may activate adaptive responses that decrease albuminuria and increase serum albumin, without increasing risk for protein malnutrition.
<table>
<thead>
<tr>
<th>Therapeutic Goal and Its Relevance</th>
<th>Ranges/Goals</th>
<th>Dietary Intervention</th>
</tr>
</thead>
</table>
| Manage Diabetes                   | A1C ≤7%     | • Consider less-stringent control for patients with histories of hypoglycemia, the elderly, and patients with multiple co-morbid conditions.  
• Instruct patients to treat hypoglycemia with cranberry juice cocktail, grape or apple juice, glucose tablets, or 10 jelly beans to prevent hyperkalemia. |

**Additional Information**
As eGFR declines, renal metabolism of insulin and certain oral diabetes medications are reduced, potentially causing hypoglycemia in diabetes (Snyder, 2004). Unexplained improvement in glucose control may reflect progression of CKD.

Low-protein diets have been associated with improved insulin sensitivity and fasting serum insulin levels, lower insulin requirements and blood glucose levels; and a decrease in endogenous glucose production in patients with diabetes.
## IV. Prevent, Monitor, and Treat Complications

Data is limited for CKD. Many of the recommendations for CKD are extrapolated from renal replacement therapies literature.

<table>
<thead>
<tr>
<th>Complication and its Relevance</th>
<th>Ranges/Goals*</th>
<th>Dietary Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Malnutrition</strong></td>
<td></td>
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</tr>
</tbody>
</table>
| Malnutrition is common in CKD; as eGFR declines, so may appetite. Malnutrition in CKD patients is associated with increased morbidity and mortality. | Albumin >4g/dL  
Normal range: 3.4-5.0g/dL  
Serum albumin <4g/dL, prior to initiation of dialysis, may predict morbidity and mortality (Lowrie, 1990).  
Blood urea nitrogen (BUN) <20mg/dL | • Manage with adequate calories and nutrients.  
• Water-soluble vitamin supplementation may be indicated due to the restricted protein intake. Vitamin C is typically not supplemented above the Dietary Reference Intake, as it may cause oxalosis. Vitamins A, E, and K can accumulate more rapidly in CKD and are not recommended for supplementation. Specific renal vitamin formulas are available for dialysis patients. |
| **Metabolic Acidosis**        |               |                      |
| Patients with CKD are at risk for metabolic acidosis as a result of reduced excretion of acid load. | Bicarbonate (CO₂) >22mEq/L  
Normal range: 21-28mEq/L | • Dietary protein is a source of metabolic acid. Serum bicarbonate levels may increase with dietary protein restriction.  
• Sodium bicarbonate supplementation may be prescribed to improve nutritional parameters and slow rate of CKD progression (de Brito-Ashurst, 2000). Monitor blood pressure closely when this medication is used, as some patients may experience elevated blood pressure associated with increased sodium load. |

### Additional Information

Serum albumin is used to monitor nutritional status. Hypoalbuminemia may result from reduced protein and/or calorie intake, uremia, metabolic acidosis, albuminuria, inflammation, or infection.

Although not used to indicate nutritional status, elevated BUN may be associated with aversion to certain high-biological-value protein foods. Appetite may improve in renal failure with adequate renal replacement therapy (i.e., dialysis treatment or kidney transplantation).

Metabolic acidosis is thought to result in loss of bone and muscle mass, negative nitrogen balance, increased protein catabolism, and decreased protein synthesis (ibid).
<table>
<thead>
<tr>
<th>Complication and Its Relevance</th>
<th>Ranges/Goals*</th>
<th>Dietary Intervention</th>
</tr>
</thead>
</table>
| **Hyperkalemia**             | Potassium 3.5–5.0 mEq/L | - Counsel patients to restrict dietary potassium when serum level is 5mEq/L or higher.  
- Caution patients to avoid potassium-containing salt substitutes.  
- Instruct patients with diabetes to treat hypoglycemia with cranberry juice cocktail, grape or apple juice, glucose tablets, or 10 jelly beans to prevent hyperkalemia.  
- Counsel patients to adhere to sodium bicarbonate, if prescribed. Correction of acidosis may lower potassium. |

**Additional Information**

The potassium content of most vegetables can be decreased through a process of leaching. Leaching entails slicing and soaking the vegetable overnight in water, then draining and boiling the vegetable in new water. A recent study, however, shows that white potatoes do not need to be soaked overnight (Bethke & Jansky, 2006). The potassium content of other tuberous root vegetables commonly eaten in the Caribbean and South America has been shown to be reduced somewhat by double-cooking, however, most still remained higher than 200mg per serving (Burrowes & Ramer, 2006).
<table>
<thead>
<tr>
<th>Complication and Its Relevance</th>
<th>Ranges/Goals</th>
<th>Dietary Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CKD Mineral and Bone Disorder (CKD-MBD)</strong>&lt;br&gt;CKD-MBD is renal bone disease that occurs when the kidneys fail to maintain serum calcium and phosphorus levels.</td>
<td>See sections on calcium, phosphorus, parathyroid hormone (PTH), and vitamin D.</td>
<td>Existing guidelines on management of CKD-MBD reflect consensus rather than high-grade evidence. Early intervention may help prevent vascular calcification and secondary hyperparathyroidism. The kidneys maintain calcium and phosphorus levels and activate vitamin D. As kidney function declines, complex interactions occur that affect calcium, phosphorus, vitamin D, and the parathyroid gland. Abnormal levels of PTH (measured as intact or iPTH) may be seen. Mineral and bone disorders may result from these interactions. See the specific sections that follow.</td>
</tr>
<tr>
<td><strong>Calcium</strong>&lt;br&gt;Control of calcium and phosphorus levels helps control PTH.</td>
<td>Calcium 8.5-10.2mg/dL&lt;br&gt;Maintain within normal range.&lt;br&gt;Use formula to correct calcium with hypoalbuminemia:&lt;br&gt;Corrected calcium (mg/dL) = total calcium (mg/dL) + 0.8 x [4-serum albumin (g/dL)]</td>
<td>• Dietary calcium recommendations for CKD have yet to be established.&lt;br&gt;• Calcium-based phosphate-binding medications can increase total daily intake and elevate calcium.&lt;br&gt;• Supplementation with active vitamin D increases the risk for hypercalcemia.</td>
</tr>
<tr>
<td>Complication and Its Relevance</td>
<td>Ranges/Goals</td>
<td>Dietary Intervention</td>
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</table>
| **Phosphorus**                          | Phosphorus 2.7-4.6mg/dL Maintain within normal range. Serum phosphorus levels may be "normal" until CKD is advanced. | - If serum phosphorus is elevated, dietary phosphorus restriction may be indicated. The recommended level of restriction has yet to be determined in CKD.  
- Dietary protein restriction decreases phosphorus intake. If further restriction is needed, counsel patients to reduce intake of foods with added phosphorus.  
(Uribarri, 2007)  
- Counsel patients to read ingredient lists for "phos" to identify foods with phosphate additives, as the additives may be absorbed more efficiently than food sources.  
- Limiting whole grains may help if further reduction is needed.  
- Phosphorus binders may be prescribed to lower phosphorus levels. Counsel patients to take binders with meals to help limit absorption of phosphorus from food and beverages. |
| **Parathyroid hormone (PTH)**           | Normal PTH <65pg/mL Measured as iPTH PTH varies by level of kidney function and type of bone disease. | Dietary phosphorus restriction and use of active vitamin D or its analogs may help control PTH levels in CKD. Calcium supplementation may help as well. |

**Additional Information**

Calcium acetate and calcium carbonate are common calcium-containing phosphate binders. Calcium citrate is not recommended as a phosphate binder for CKD patients, because it may increase aluminum absorption. Other binders, used more often in renal replacement therapy, are typically composed of resins (sevelamer carbonate) and earth metals (lanthanum carbonate).

**Additional Information**

PTH is the hormone that regulates serum calcium levels. Low levels of 1,25(OH)₂D, hypocalcemia and hyperphosphatemia stimulate PTH secretion. Its metabolic actions include mobilizing calcium and phosphorus from bone; increasing intestinal absorption and renal tubular reabsorption of calcium; and decreasing renal tubular reabsorption of phosphorus. PTH enhances conversion of 25(OH)D to 1,25(OH)₂D. Consensus guidelines endorse higher PTH therapeutic goal at lower levels of eGFR.
<table>
<thead>
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<th>Ranges*/Goals</th>
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</table>
| **Vitamin D**                 | Vitamin D >30nmol/L  
Measured as 25(OH)D  
Maintain within normal range (Holick, 2007). | • Supplementation may be indicated. Specific requirements in CKD have yet to be determined.  
• Ergocalciferol (vitamin D₂) or cholecalciferol (vitamin D₃) may be used in early CKD to replete Vitamin D.  
• Active vitamin D (calcitriol) or its analogs (doxercalciferol, paricalcitol, or alphacalcidol) may be used as eGFR declines (ibid).  
Monitor for hypercalcemia and/or hyperphosphatemia when using supplements. Active vitamin D increases calcium and phosphorus absorption. |
| **Anemia**                    | Hemoglobin 11-12g/dL  
Without CKD  
Women: 12-16  
Men: 14-17  
Transferrin Saturation (TSAT) >20%  
Ferritin >100ng/mL  
Without CKD  
Women: 18-160  
Men: 18-270 | Both iron supplementation and injectable erythropoiesis-stimulating agents (ESAs) have been used to correct anemia. The risks and benefits of these treatments in CKD are not yet defined.  
**Additional Information**  
Hemoglobin is used to assess anemia in CKD. Uncomplicated anemia of CKD is usually normocytic and normochromic.  
TSAT is a measure of iron saturation. Transferrin transports iron absorbed by the intestines. Ferritin levels reflect iron stores. |
<table>
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<tbody>
<tr>
<td><strong>Cardiovascular Disease (CVD)</strong></td>
<td>Total cholesterol (&lt;200\text{mg/dL})</td>
<td>Decreasing intake of saturated and trans fats (substituting for monounsaturated and polyunsaturated fats), along with physical activity, can help control hyperlipidemia and reduce inflammation.</td>
</tr>
<tr>
<td></td>
<td>LDL cholesterol (&lt;100\text{mg/dL})</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HDL cholesterol (&gt;40\text{mg/dL})</td>
<td><strong>Additional Information</strong> Controlling dyslipidemia may reduce the rate of decline in eGFR. To further decrease risk of developing CVD, pharmacological therapy may be necessary (Fried, 2001).</td>
</tr>
<tr>
<td></td>
<td>Triglycerides (&lt;150\text{mg/dL})</td>
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</table>

*Normal ranges may vary.*
The CHC-CKD Pilot

Helping Community Health Centers Improve CKD Diagnosis and Management
Why Community Health Centers?

- Non-profit, community-based
- 1150 Health Centers
- 18 million people with limited access to health care
- 70% live below poverty line; 40% uninsured, 45% Medicare/Medicaid
- 66% racial/ethnic minorities
- Primary care throughout lifespan
- Health Disparities Collaboratives
- Partner for QIO’s
350,000 DM Patients Followed in Health Center Registries
Objectives

- Help CHCs adopt system changes
  - Improve screening, detection, and management of CKD
  - Identify best practices for dissemination

- Develop a cooperative model
  - CHCs design, implement, and monitor performance improvements
  - NKDEP provides technical assistance
Performance Measures

- Improve screening of patients with DM
  - eGFR and UACR
- Improve management of CKD
  - BP control
  - ACE inhibitors and ARBs
- Improve screening for complications
  - Anemia, malnutrition, metabolic bone disease, lipid disorders
- Improve CKD education: 4 key concepts
...how much of what nephrologists do could be done just as safely and effectively in primary care, and how much of an overlap is there between nephrology, diabetes, cardiology and the care of older people? (NICE, 2008)

www.nice.org.uk/cg073
# Nephrology Referral

<table>
<thead>
<tr>
<th>NAME</th>
<th>DATE OF BIRTH</th>
<th>FACILITY/PRACTICE AND RECORD NUMBER</th>
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</tbody>
</table>

## Reason for Referral

- [ ] **Kidney Disease**
- [ ] **Renal Transplantation**
- [ ] **Other**

### For Diabetics

- Year of Diagnosis
- Recent A1C
- Recent HbA1C
- Other

### Complications

- Retinopathy
- Neuritis
- PVD
- Other

### Albuminuria

- Not Present
- If Present, Since
- Most Recent UAC

### Hematuria

- Not Present
- If Present, Since

### Urine Sediment

- [ ] eGFR
- Most Recent
- Month/Year

### Blood Pressure

- At Last Visit
- Usual Range

### Additional Evaluation

- **ANA**
- **RF**
- **CRP**
- **C4**
- **HbA1c**
- **Anti-CCP**
- **SpeP**
- **UPEP**
- **Renal US**
- Other

### Family History

- Kidney Disease
- [ ] Yes
- [ ] No
- If Yes, How Related

### Current Medications (or attach list)

- [ ] YES
- [ ] NO
- [ ] Don't Know

### Knowledge

- Does the Patient Know He/She Has Kidney Disease?
- [ ] Yes
- [ ] No
- [ ] Don't Know
- Does the Patient Know the Severity?
- [ ] Yes
- [ ] No
- [ ] Don't Know
- Is the Patient Aware That He/She May Need Dialysis?
- [ ] Yes
- [ ] No
- [ ] Don't Know

### Additional Information

- For more information about why these data are important to share with the nephrologist, visit: [www.nkdep.nih.gov](http://www.nkdep.nih.gov)

- Referred By
- Contact Telephone
- Date
- Email
Lessons Learned

- CKD is part of primary care
- Changing patterns of care requires changing “the system” (CCM)
- Improvement in care results from changes implemented by physicians and non-physician health professionals
- Implemented through diabetes care delivery system; not specialty clinic based
- Surveillance and prevention are part of multisystem chronic disease control
- Emphasis on ensuring that patient received care from competent and interested individual, not referral
Incident Rates of ESRD due to Diabetes 1980-2008

per million population, by age, gender, race, & ethnicity
Improving the care of people with CKD requires changing clinical practice in settings where high risk populations are served.

Providers change their practice based on scientific evidence and the expectations of their patients.

Improving care of patients prior to referral to subspecialty care is necessary to provide better subspecialty care.

Achievement of this goal includes facilitating a redefinition of the primary care/nephrology relationship.
Improving CKD/Bottom line

- Follow eGFR and UACR
- Control blood pressure
- Talk to the patient about CKD
This information was reviewed by KICC agency representatives. It may not reflect new or future agency activities. For more information, please contact the listed representatives.
WELCOME DIALYSIS PATIENTS AND STAFF!

EMERGENCY EXIT ONLY!

Please KEEP OUT.
This area off-limits for safety reasons.
Thank you!