What is CKD?

“When bubbles settle on the surface of the urine, they indicate disease of the kidneys, and that the complaint will be protracted.” -- Hippocrates 400 BCE
A decade of efforts to define CKD


KDIGO ‘04 CC: Definition & classification of CKD. *Kidney Int* 2005;67:2089


KDIGO ‘09 CC: Definition & classification of CKD. *Kidney Int* 2010; 80:17

KDIGO CPG on CKD *Kidney Int Suppl* 2013; 3(1)
KDOQI 2002 definition and staging

**Definition**: Kidney damage for ≥3 months, as defined by structural or functional abnormalities of the kidney, with or without decreased GFR or GFR <60 mL/min/1.73m² for ≥3 months, with or without kidney damage.

<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>&gt; 90</td>
</tr>
<tr>
<td>2</td>
<td>Kidney damage with mild ↓ in GFR</td>
<td>60-89</td>
</tr>
<tr>
<td>3</td>
<td>Moderate ↓ in GFR</td>
<td>30-59</td>
</tr>
<tr>
<td>4</td>
<td>Severe ↓ in GFR</td>
<td>15-29</td>
</tr>
<tr>
<td>5</td>
<td>Kidney failure</td>
<td>&lt; 15 (or dialysis)</td>
</tr>
</tbody>
</table>

*Am J Kidney Dis 2002; 39:S1*

**Kidney Disease: Improving Global Outcomes**
Kidney Disease: Improving Global Outcomes

**KDIGO surveys and Controversy Conferences in 2004 and 2006**

Two modifications to account for dialysis and transplantation.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>GFR (ml/min/1.73 m²)</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kidney damage with normal or ↑ GFR</td>
<td>&gt; 90</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Kidney damage with mild ↓ in GFR</td>
<td>60-89</td>
<td>T if kidney transplant</td>
</tr>
<tr>
<td>3</td>
<td>Moderate ↓ in GFR</td>
<td>30-59</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Severe ↓ in GFR</td>
<td>15-29</td>
<td>D if dialysis</td>
</tr>
<tr>
<td>5</td>
<td>Kidney failure</td>
<td>&lt; 15 (or dialysis)</td>
<td></td>
</tr>
</tbody>
</table>

*Kidney Int 2005;67:2089
Kidney Int 2007;72:247*
On the basis of analyses in 45 cohorts that included 1,555,332 participants from general, high-risk, and CKD populations, the conference recommended retaining the current definition for CKD, and to modify the classification by emphasizing clinical diagnosis, adding albuminuria stage, and subdividing stage 3.

*Kidney Int. 2011; 80:17*

**Kidney Disease: Improving Global Outcomes**
Kidney Disease: Improving Global Outcomes

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The CKD guideline team

Kidney Disease: Improving Global Outcomes

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CKD guideline goal

… to clarify the definition and classification system of CKD, and to develop appropriate guidance as to the management and care of people with CKD … foster an extended collaborative research agenda ….
What the guideline covers

- **Target population**: all adults and children identified with CKD who are not on renal replacement therapy.
- **CKD**: any (or unknown) cause.
- **Target audience**: nephrologists, primary care physicians, non-nephrology specialists, clinical chemists and other practitioners caring for adults and children with CKD.
- **Target healthcare settings**: primary, secondary and tertiary care.
What is *not* in the guideline

- Evaluation and management of people receiving renal replacement therapy
- Specific diagnostic approaches to people with AKI, GN or other specific diagnoses
- Treatment of each of the specific causes of CKD
- Management of pregnancy in women with CKD or of pregnant women who develop kidney disease
- Detailed management of complications of CKD
GRADE: an emerging consensus on rating quality of evidence and strength of recommendations

Guidelines are inconsistent in how they rate the quality of evidence and the strength of recommendations. This article explores the advantages of the GRADE system, which is increasingly being adopted by organisations worldwide.

<table>
<thead>
<tr>
<th>Quality of evidence</th>
<th>High</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Moderate</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>Very low</td>
<td>D</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Strength of recommendation</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>“We recommend“</td>
<td>“We suggest“</td>
</tr>
</tbody>
</table>

Grade 1A ... Grade 2D (8 options); plus “Not Graded“

Guyatt GH, et al. BMJ 2008; 336:924

Kidney Disease: Improving Global Outcomes
Topics

Section 1:
Definition & Classification

Section 2:
Definition, Identification & Prediction of CKD Progression

Section 3:
Management of CKD Progression & Complications

Section 4:
Other Complications

Section 5:
Referral to Specialists & Models of Care

Kidney Disease: Improving Global Outcomes
SECTION 1: Definition and Classification
Audience Response Question 1:

Which of the following would NOT meet the KDIGO definition of CKD ≥3 months of:

1. GFR 65 & urine albumin 60 mg/24h
2. GFR 65 & urine RBCs with IgA on biopsy
3. GFR 65 after kidney transplant
4. GFR 65 after donating a kidney for transplant
5. GFR 45 at age 75 years
1.1 Definition of CKD

1.1.1: CKD is defined as abnormalities of kidney structure or function, present for ≥3 months, with implications for health (Table 2). (Not Graded)

Table 2 | Criteria for CKD (either of the following present for ≥3 months)

<table>
<thead>
<tr>
<th>Markers of Kidney Damage</th>
<th>Decreased GFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albuminuria &gt; 30 mg/day</td>
<td>GFR &lt; 60 mL/min/1.73 m²</td>
</tr>
<tr>
<td>Urine sediment abnormalities (e.g., hematuria, red cell casts etc)</td>
<td></td>
</tr>
<tr>
<td>Electrolyte and other abnormalities due to tubular disorders</td>
<td></td>
</tr>
<tr>
<td>Abnormalities detected by histology</td>
<td></td>
</tr>
<tr>
<td>Structural abnormalities detected by imaging</td>
<td></td>
</tr>
<tr>
<td>History of kidney transplantation</td>
<td></td>
</tr>
</tbody>
</table>
Audience Response Question 2:

Which of the following justifies including GFR <60 mL/min/1.73m$^2$ in defining CKD:

1. increased risk for CVD
2. increased risk of all-cause mortality
3. increased risk of drug dosing errors
4. increased risk of metabolic complications
5. all of the above
Rationale for defining CKD by GFR <60 mL/min/1.73m$^2$


Kidney Disease: Improving Global Outcomes
Rationale for defining CKD by GFR <60 mL/min/1.73m²

All-Cause Mortality; eGFR

Kidney Disease: Improving Global Outcomes
Rationale for defining CKD by GFR <60 mL/min/1.73m$^2$

GFR <60 mL/min/1.73m$^2$ is associated with a higher risk of complications of CKD:

- Drug toxicity
- Metabolic and endocrine complications
- CVD and death
Rationale for defining CKD by ACR <30 mg/g

All-Cause Mortality; ACR

Kidney Disease: Improving Global Outcomes

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1.2 Staging of CKD

1.2.1: We recommend that CKD is classified based on cause, GFR category and albuminuria category (CGA). (1B)

1.2.2: Assign cause of CKD based on presence or absence of systemic disease and the location within the kidney of observed or presumed pathologic-anatomic findings. (Not graded)
### GFR categories

1.2.3: Assign GFR categories as follows [Table 5] (*Not Graded*):

<table>
<thead>
<tr>
<th>GFR category</th>
<th>GFR (ml/min/1.73 m²)</th>
<th>Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>≥ 90</td>
<td>Normal or high</td>
</tr>
<tr>
<td>G2</td>
<td>60–89</td>
<td>Mildly decreased*</td>
</tr>
<tr>
<td>G3a</td>
<td>45–59</td>
<td>Mildly to moderately decreased</td>
</tr>
<tr>
<td>G3b</td>
<td>30–44</td>
<td>Moderately to severely decreased</td>
</tr>
<tr>
<td>G4</td>
<td>15–29</td>
<td>Severely decreased</td>
</tr>
<tr>
<td>G5</td>
<td>&lt;15</td>
<td>Kidney failure</td>
</tr>
</tbody>
</table>

Abbreviations: CKD, chronic kidney disease; GFR, glomerular filtration rate.

*Relative to young adult level

In the absence of evidence of kidney damage, neither GFR category G1 nor G2 fulfill the criteria for CKD.

*Kidney Disease: Improving Global Outcomes*
Rationale for GFR categories


*Kidney Disease: Improving Global Outcomes*
Summary of Relative Risks from Continuous Meta-Analysis

All-Cause Mortality

Cardiovascular Mortality

End Stage Renal Disease

Acute Kidney Injury

Progressive CKD


*Kidney Disease: Improving Global Outcomes*
### Summary of Relative Risks from Categorical Meta-Analysis

(dipstick included [-, ±, +, ≥++])

#### Kidney Failure (ESRD)

<table>
<thead>
<tr>
<th>eGFR</th>
<th>ACR &lt;10</th>
<th>ACR 10-29</th>
<th>ACR 30-299</th>
<th>ACR ≥300</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 105</td>
<td>Ref</td>
<td>Ref</td>
<td>7.8</td>
<td>18</td>
</tr>
<tr>
<td>90-105</td>
<td>Ref</td>
<td>Ref</td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>75-90</td>
<td>Ref</td>
<td>Ref</td>
<td>3.8</td>
<td>48</td>
</tr>
<tr>
<td>60-75</td>
<td>Ref</td>
<td>Ref</td>
<td>7.4</td>
<td>67</td>
</tr>
<tr>
<td>45-60</td>
<td>5.2</td>
<td>22</td>
<td>40</td>
<td>147</td>
</tr>
<tr>
<td>30-45</td>
<td>56</td>
<td>74</td>
<td>294</td>
<td>763</td>
</tr>
<tr>
<td>15-30</td>
<td>433</td>
<td>1044</td>
<td>1056</td>
<td>2286</td>
</tr>
</tbody>
</table>

#### Acute Kidney Injury (AKI)

<table>
<thead>
<tr>
<th>eGFR</th>
<th>ACR &lt;10</th>
<th>ACR 10-29</th>
<th>ACR 30-299</th>
<th>ACR ≥300</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 105</td>
<td>Ref</td>
<td>Ref</td>
<td>2.7</td>
<td>8.4</td>
</tr>
<tr>
<td>90-105</td>
<td>Ref</td>
<td>Ref</td>
<td>2.4</td>
<td>5.8</td>
</tr>
<tr>
<td>75-90</td>
<td>Ref</td>
<td>Ref</td>
<td>2.5</td>
<td>4.1</td>
</tr>
<tr>
<td>60-75</td>
<td>Ref</td>
<td>Ref</td>
<td>3.3</td>
<td>6.4</td>
</tr>
<tr>
<td>45-60</td>
<td>2.2</td>
<td>4.9</td>
<td>6.4</td>
<td>5.9</td>
</tr>
<tr>
<td>30-45</td>
<td>7.3</td>
<td>10</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>15-30</td>
<td>17</td>
<td>17</td>
<td>21</td>
<td>29</td>
</tr>
</tbody>
</table>

#### Progressive CKD

<table>
<thead>
<tr>
<th>eGFR</th>
<th>ACR &lt;10</th>
<th>ACR 10-29</th>
<th>ACR 30-299</th>
<th>ACR ≥300</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 105</td>
<td>Ref</td>
<td>Ref</td>
<td>0.4</td>
<td>3.0</td>
</tr>
<tr>
<td>90-105</td>
<td>Ref</td>
<td>Ref</td>
<td>0.9</td>
<td>3.3</td>
</tr>
<tr>
<td>75-90</td>
<td>Ref</td>
<td>Ref</td>
<td>1.9</td>
<td>5.0</td>
</tr>
<tr>
<td>60-75</td>
<td>Ref</td>
<td>Ref</td>
<td>3.2</td>
<td>8.1</td>
</tr>
<tr>
<td>45-60</td>
<td>3.1</td>
<td>4.0</td>
<td>9.4</td>
<td>57</td>
</tr>
<tr>
<td>30-45</td>
<td>3.0</td>
<td>19</td>
<td>15</td>
<td>22</td>
</tr>
<tr>
<td>15-30</td>
<td>4.0</td>
<td>12</td>
<td>21</td>
<td>7.7</td>
</tr>
</tbody>
</table>


*Kidney Disease: Improving Global Outcomes*
### Albuminuria categories

1.2.4: Assign albuminuria* categories as follows (Not Graded):

<table>
<thead>
<tr>
<th>Category</th>
<th>AER (mg/d)</th>
<th>Approximately Equivalent ACR (mg/mmol)</th>
<th>Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>&lt;30</td>
<td>&lt;3</td>
<td>Normal to mildly increased</td>
</tr>
<tr>
<td>A2</td>
<td>30-299</td>
<td>3-29</td>
<td>Moderately increased*</td>
</tr>
<tr>
<td>A3</td>
<td>≥300</td>
<td>&gt;30</td>
<td>Severely increased**</td>
</tr>
</tbody>
</table>

*note that where albuminuria measurement is not available, urine reagent strip results can be substituted.

*Kidney Disease: Improving Global Outcomes*

<table>
<thead>
<tr>
<th>GFR Categories, Description and Range (mL/min/1.73 m²)</th>
<th>Persistent Albuminuria Categories, Description and Range</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A1: normal to mildly increased &lt;30 mg/g &lt;3 mg/mmol</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A2: moderately increased 30-299 mg/g 3-29 mg/mmol</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A3: severely increased  ≥300 mg/g ≥30 mg/mmol</td>
<td></td>
</tr>
<tr>
<td>G1 normal or high &gt;90</td>
<td>55.6</td>
<td>0.4</td>
</tr>
<tr>
<td>G2 mildly decreased 60-89</td>
<td>32.9</td>
<td>0.3</td>
</tr>
<tr>
<td>G3a mildly to moderately decreased 45-59</td>
<td>3.6</td>
<td>0.2</td>
</tr>
<tr>
<td>G3b moderately to severely decreased 30-44</td>
<td>1.0</td>
<td>0.2</td>
</tr>
<tr>
<td>G4 severely decreased 15-29</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>G5 kidney failure &lt;15</td>
<td>0.0</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>93.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100.0</td>
</tr>
</tbody>
</table>
1.3 Predicting prognosis of CKD

1.3.1: In predicting risk for outcome of CKD, identify the following variables:

1) cause of CKD;
2) GFR category;
3) albuminuria category;
4) other risk factors and comorbid conditions. (Not Graded)
## Prognosis of CKD by GFR and Albuminuria Categories: KDIGO 2012

<table>
<thead>
<tr>
<th>GFR Categories, Description and Range (mL/min/1.73 m²)</th>
<th>Albuminuria Categories, Description and Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1 normal or high</td>
<td>A1 normal to mildly increased</td>
</tr>
<tr>
<td></td>
<td>A2 moderately increased</td>
</tr>
<tr>
<td></td>
<td>A3 severely increased</td>
</tr>
<tr>
<td>G2 mildly decreased</td>
<td>&lt;30 mg/g</td>
</tr>
<tr>
<td></td>
<td>&lt;3 mg/mmol</td>
</tr>
<tr>
<td>G3a mildly to moderately decreased</td>
<td>30-299 mg/g</td>
</tr>
<tr>
<td></td>
<td>3-29 mg/mmol</td>
</tr>
<tr>
<td>G3b moderately to severely decreased</td>
<td>≥300 mg/g</td>
</tr>
<tr>
<td></td>
<td>≥30 mg/mmol</td>
</tr>
<tr>
<td>G4 severely decreased</td>
<td>15-29</td>
</tr>
<tr>
<td>G5 kidney failure</td>
<td>&lt;15</td>
</tr>
</tbody>
</table>

KDIGO 2012
1.4 Evaluation of CKD: chronicity

1.4.1: Evaluation of Chronicity

1.4.1.1: In people with GFR <60 mL/min/1.73m$^2$ or markers of kidney damage, review past history and previous measurements to determine duration (Not Graded).

- If duration is >3 months, CKD is confirmed. Follow recommendations for CKD.
- If duration is not >3 months or unclear, CKD is not confirmed. Patients may have CKD or acute kidney diseases (including AKI) or both and tests should be repeated accordingly.
1.4.2: Evaluation of Cause

1.4.2.1: Evaluate the clinical context, including personal and family history, social and environmental factors, medications, physical examination, laboratory measures, imaging, and pathologic diagnosis to determine the causes of kidney disease.

(Not Graded)
Audience Response Question 3:

Which does KDIGO recommend for defining & classifying CKD:

1. measure GFR with plasma or urine clearance of an inert tracer (inulin, iohexol, etc.) whenever possible
2. use a cystatin C rather than a Cr formula for eGFR
3. use the “CKD-EPI” formula for eGFR
4. use the best available formula for estimating GFR with serum Cr

Kidney Disease: Improving Global Outcomes
1.4 Evaluation of CKD: GFR

1.4.3.1: We recommend using serum creatinine and a GFR estimating equation for initial assessment. (1A)

1.4.3.2: We suggest using additional tests (such as cystatin C or a clearance measurement) for confirmatory testing in specific circumstances when eGFR based on serum creatinine is less accurate. (2B)

1.4.3.3: We recommend that clinicians (1B):

• use a GFR estimating equation to derive GFR from serum creatinine (eGFR_{\text{creat}}) rather than relying on the serum creatinine concentration alone

• understand clinical settings in which eGFR_{\text{creat}} is less accurate.

Kidney Disease: Improving Global Outcomes
1.4.3.5: We suggest measuring cystatin C in adults with eGFR\textsubscript{creat} 45-59 who do not have other markers of kidney damage if confirmation of CKD is required. (2C)

- If eGFR\textsubscript{cys} / eGFR\textsubscript{creat-cys} is also <60 mL/min/1.73 m\textsuperscript{2}, the diagnosis of CKD is confirmed

- If eGFR\textsubscript{cys} / eGFR\textsubscript{creat-cys} is >60 mL/min/1.73 m\textsuperscript{2}, the diagnosis of CKD is not confirmed
Performance of the CKD-EPI and MDRD study equations


*Kidney Disease: Improving Global Outcomes*
1.4.3.8: We suggest measuring GFR using exogenous filtration markers under circumstances where more accurate ascertainment of GFR will impact on treatment decisions (e.g. acceptance for kidney donation, dose adaptation of toxic drugs). (2B)
1.4 Evaluation of CKD: albuminuria

1.4.4.1: We suggest using the following measurements for initial testing of proteinuria (in descending order of preference, in all cases an early morning urine sample is preferred) (2B):

1) urine albumin-to-creatinine ratio (ACR);
2) urine protein-to-creatinine ratio (PCR);
3) reagent strip urinalysis for total protein with automated reading;
4) reagent strip urinalysis for total protein with manual reading.
1.4 Evaluation of CKD: albuminuria

1.4.4.2: We recommend that clinical laboratories report ACR and PCR in untimed urine samples in addition to albumin concentration or proteinuria concentrations rather than the concentrations alone. \((1B)\)

1.4.4.2.1: The term microalbuminuria should no longer be used by laboratories. \((Not Graded)\)
SECTION 2:
Definition, Identification and Prediction of CKD Progression
2.1 Definition and identification of CKD progression

2.1.1: Assess GFR and albuminuria at least annually in people with CKD. Assess GFR and albuminuria more often for individuals at higher risk of progression, and/or where measurement will impact therapeutic decisions. (Not Graded)
Guide to frequency of monitoring (number of times per year) by GFR and albuminuria category

<table>
<thead>
<tr>
<th>Persistent albuminuria categories</th>
<th>Description and range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Normal to mildly increased</td>
</tr>
<tr>
<td>A2</td>
<td>Moderately increased</td>
</tr>
<tr>
<td>A3</td>
<td>Severely increased</td>
</tr>
<tr>
<td>&lt;30 mg/g ≤3 mg/mmol</td>
<td>30–300 mg/g</td>
</tr>
<tr>
<td>3–30 mg/mmol</td>
<td>&gt;300 mg/g</td>
</tr>
<tr>
<td>&gt;30 mg/mmol</td>
<td>&gt;30 mg/mmol</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GFR categories (ml/min/1.73 m²)</th>
<th>Description and range</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>Normal or high</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>G2</td>
<td>Mildly decreased</td>
<td>1 if CKD</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>G3a</td>
<td>Mildly to moderately decreased</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>G3b</td>
<td>Moderately to severely decreased</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>G4</td>
<td>Severely decreased</td>
<td>3</td>
<td>3</td>
<td>4+</td>
</tr>
<tr>
<td>G5</td>
<td>Kidney failure</td>
<td>4+</td>
<td>4+</td>
<td>4+</td>
</tr>
</tbody>
</table>
2.1.3: Define CKD progression based on one of more of the following (Not Graded):

- Decline in GFR category ($\geq 90$ [G1], 60-89 [G2], 45-59 [G3a], 30-44 [G3b], 15-29 [G4], <15 [G5] ml/min/1.73m$^2$). A certain drop in eGFR is defined as a drop in GFR category accompanied by a 25% or greater drop in eGFR from baseline.

- Rapid progression is defined as a sustained decline in eGFR of more than 5 mL/1.73m$^2$/year.

- The confidence in assessing progression is increased with increasing number of serum creatinine measurements and duration of follow-up.
SECTION 3: Management of Progression and Complications of CKD
Audience Response Question 4:

Management of CKD should include all BUT:

1. targeting BP ≤140/90 mm Hg if no proteinuria
2. targeting BP ≤130/80 mm Hg if proteinuria
3. treating hyperuricemia
4. using a statin for increased CVD risk
5. targeting hemoglobin A1c (HbA1c) ~7.0%
Blood Pressure

3.1.1: Individualize BP targets and agents according to age, coexistent cardiovascular disease and other comorbidities, risk of progression of CKD, presence or absence of retinopathy (in CKD patients with diabetes), and tolerance of treatment as described in the KDIGO 2012 Blood Pressure Guideline. (Not Graded).

3.1.4: We recommend that in both diabetic and nondiabetic adults with CKD and urine albumin excretion <30 mg/24 hours (or equivalent*) whose office BP is consistently >140 mm Hg systolic or >90 mm Hg diastolic be treated with BP-lowering drugs to maintain a BP that is consistently ≤140 mm Hg systolic and ≤90 mm Hg diastolic. (1B)
3.1.5: We suggest that in both diabetic and non-diabetic adults with CKD and with urine albumin excretion of ≥30 mg/24 hours (or equivalent*) whose office BP is consistently >130 mm Hg systolic or >80 mm Hg diastolic be treated with BP-lowering drugs to maintain a BP that is consistently ≤130 mm Hg systolic and ≤80 mm Hg diastolic. (2D)
3.1.6: We suggest that an ARB or ACE-I be used in diabetic adults with CKD and urine albumin excretion 30-300 mg/24 hours (or equivalent*). (2D)

3.1.7: We recommend that an ARB or ACE-I be used in both diabetic and non-diabetic adults with CKD and urine albumin excretion >300 mg/24 hours (or equivalent*). (1B)

3.1.8: There is insufficient evidence to recommend combining an ACE-I with ARBs to prevent progression of CKD. (Not Graded)
CDK Risk of AKI

3.1.12: We recommend that all people with CKD are considered to be at increased risk of AKI. (1A)

3.1.12.1: In people with CKD the recommendations detailed in the KDIGO AKI Guideline should be followed for management of those at risk of AKI during inter-current illness, or when undergoing investigation and procedures that are likely to increase the risk of AKI. (Not Graded)

See KDIGO Clinical Practice Guideline for Acute Kidney Injury.

*Kidney Int Suppl* March 2012; Vol. 2 (1)
Protein Intake

3.1.13: We suggest lowering protein intake to 0.8 g/kg/day in adults with diabetes (2C) or without diabetes (2B) and GFR <30 ml/min/1.73m$^2$ (GFR categories G4-G5), with appropriate education.

3.1.14: We suggest avoiding high protein intake (>1.3 g/kg/day) in adults with CKD at risk of progression. (2C)
Glycemic Control

3.1.15: We recommend a target hemoglobin A1c (HbA1c) of ~7.0% (53 mmol/mol) to prevent or delay progression of the microvascular complications of diabetes, including diabetic kidney disease. (1A)

3.1.16: We recommend not treating to an HbA1c target of <7.0% (<53 mmol/mol) in patients at risk of hypoglycemia. (1B)

3.1.17: We suggest that target HbA1c be extended above 7.0% (53 mmol/mol) in individuals with comorbidities or limited life expectancy and risk of hypoglycemia. (2C)
3.1.12: We recommend lowering salt intake to <90 mmol (<2 g) per day of sodium (corresponding to 5 g of sodium chloride) in adults, unless contraindicated. (1C)
3.1.13: There is insufficient evidence to support or refute the use of agents to lower serum uric acid concentrations in people with CKD and either symptomatic or asymptomatic hyperuricemia in order to delay progression of CKD. (Not Graded)
3.1.14: We recommend that people with CKD be encouraged to take exercise (aiming for at least 30 minutes 5 times per week), achieve a healthy weight (BMI 20-25, according to country specific demographics), and stop smoking. (1D)
Anemia

3.2.3: To identify anemia in people with CKD measure Hb concentration (*Not Graded;*)
- when clinically indicated in people with GFR ≥60 ml/min/1.73 m² (GFR categories G1-G2);
- at least annually in people with GFR 30-59 ml/min/1.73 m² (GFR categories G3a-G3b);
- at least twice per year in people with GFR <30 ml/min/1.73 m² (GFR categories G4-G5).

See KDIGO Clinical Practice Guideline for Anemia in CKD.
*Kidney Int Suppl* August 2012; Vol. 2(4)
3.3.1: We recommend measuring serum levels of calcium, phosphate, PTH, and alkaline phosphatase activity at least once in adults with GFR <45 ml/min/1.73 m² (GFR categories G3b-G5) in order to determine baseline values and inform prediction equations if used. (1C)

Acidosis

3.4.1: We suggest that in people with CKD and serum bicarbonate concentrations <22 mmol/l treatment with oral bicarbonate supplementation be given to maintain serum bicarbonate within the normal range, unless contraindicated. (2B)
SECTION 4: Other Complications of CKD
Other Complications of CKD

- Cardiac and vascular disease (CVD)
- Medication dosage
- Patient safety
- Infections
- Hospitalizations
- Caveats for investigating complications
SECTION 5: Referral to Specialists and Models of Care
When to refer to a specialist.

<table>
<thead>
<tr>
<th>GFR Categories (mL/min/1.73m²)</th>
<th>Albuminuria Categories (mg/g)</th>
<th>G1 (high and optimal)</th>
<th>G2 (Mild reduction)</th>
<th>G3a (mild-moderate reduction)</th>
<th>G3b (moderate-severe reduction)</th>
<th>G4 (Severe reduction)</th>
<th>G5 (kidney failure)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albuminuria Categories (mg/g)</td>
<td></td>
<td>≥90</td>
<td>60-89</td>
<td>45-59</td>
<td>30-44</td>
<td>15-29</td>
<td>&lt;15</td>
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<td>A1 (normal to increased)</td>
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<td>monitor</td>
<td>monitor</td>
<td>monitor</td>
<td>monitor</td>
<td>refer*</td>
<td>refer</td>
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<tr>
<td>A2 (moderately increased)</td>
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<td></td>
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<td>monitor</td>
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<tr>
<td>A3 (severely increased)</td>
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</tbody>
</table>

Notes:
- *Refer to a specialist.*
- *Monitor the patient.*

Data source: KDIGO.org
Summary: Key Changes

• Diagnosis and classification:
  – Re-emphasise need for a diagnosis
  – Add albuminuria categories
  – Subdivide GFR category 3

• Define progression & preventive measures
• Interpretation of tests & use of medications
• Models of care
Thank you!