



Complete Summary

GUIDELINE TITLE

NKF-K/DOQI clinical practice guidelines for peritoneal dialysis adequacy: update 2000.

BIBLIOGRAPHIC SOURCE(S)

NKF-K/DOQI clinical practice guidelines for peritoneal dialysis adequacy: update 2000. Am J Kidney Dis 2001 Jan; 37(1 Suppl 1):S65-S136. [143 references]

COMPLETE SUMMARY CONTENT

SCOPE
METHODOLOGY - including Rating Scheme and Cost Analysis
RECOMMENDATIONS
EVIDENCE SUPPORTING THE RECOMMENDATIONS
BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS
CONTRAINDICATIONS
QUALIFYING STATEMENTS
IMPLEMENTATION OF THE GUIDELINE
INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT
CATEGORIES
IDENTIFYING INFORMATION AND AVAILABILITY

SCOPE

DISEASE/CONDITION(S)

End-stage renal disease (ESRD)

GUIDELINE CATEGORY

Management
Treatment

CLINICAL SPECIALTY

Family Practice
Internal Medicine
Nephrology
Pediatrics

INTENDED USERS

Advanced Practice Nurses
Allied Health Personnel
Clinical Laboratory Personnel
Health Care Providers
Health Plans
Nurses
Patients
Physician Assistants
Physicians

GUIDELINE OBJECTIVE(S)

1. The primary objective of the National Kidney Foundation-Kidney Disease Outcomes Quality Initiative is to improve patient outcomes and survival by providing recommendations for optimal clinical practices, thereby increasing the efficiency of patient care, and positively impacting patient outcomes.
2. To provide evidence-based guidelines on the adequacy of peritoneal dialysis.

TARGET POPULATION

Adult and pediatric patients with end-stage renal disease who receive peritoneal dialysis treatment.

INTERVENTIONS AND PRACTICES CONSIDERED

1. Initiation of Dialysis
 - When to initiate dialysis: urea clearance x time normalized by total body water, the volume of distribution of urea (Kt/V_{urea}) criterion.
 - When to initiate dialysis: normalized protein equivalent of total nitrogen appearance (nPNA) criterion.
2. Measures of Peritoneal Dose
 - Frequency of delivered peritoneal dialysis dose and total solute clearance measurement within six months of initiation.
 - Measures of peritoneal dialysis dose and total solute clearance.
 - Frequency of measurement of Kt/V_{urea} , total creatinine clearance, protein equivalent of nitrogen appearance (PNA), and total creatinine appearance.
 - Assessing residual renal function.
 - Peritoneal dialysis dose troubleshooting.
3. Measurement of Peritoneal Dialysis Dose
 - Reproducibility of measurement.
 - Estimating total body water and body surface area.
 - Timing of measurement.
 - Dialysate and urine collections.
4. Assessment of Nutritional Status Specifically as it Relates to Peritoneal Dialysis
 - Assessment of nutritional status.
 - Determining fat-free, edema-free body mass.
 - Use of the modified Borah Equation to assess nutritional status of pediatric peritoneal dialysis patients.
5. Adequate Dose of Peritoneal Dialysis
 - Weekly dose of continuous ambulatory peritoneal dialysis.

- Weekly dose of nocturnal intermittent peritoneal dialysis and continuous cycling peritoneal dialysis.
 - Peritoneal dialysis dose in subpopulations.
 - Use of empiric and computer modeling of peritoneal dialysis dose.
6. Strategies for Increasing the Likelihood of Achieving the Prescribed Dose of Peritoneal Dialysis
- Identify and correct patient-related failure to achieve prescribed peritoneal dialysis dose.
 - Identify and correct staff-related failure to achieve prescribed peritoneal dialysis dose.

MAJOR OUTCOMES CONSIDERED

Clinical Outcome Measurements for Adequate Peritoneal Dialysis (PD):

1. Peritoneal dialysis patient survival.
2. Peritoneal dialysis technique survival: Patient characteristics and case mix must be factored into survival statistics. Centers should strive to achieve the goal of a 75% 2-year technique survival rate.
3. Hospitalizations: end-stage renal disease-related and end-stage renal disease-unrelated hospitalizations (admissions/year, hospitalized days/year).
4. Patient-based assessment of quality of life. Measures used in peritoneal dialysis patients and reported in the literature include:
 - Medical Outcomes Study Short Form 36 (SF-36)
 - Sickness Impact Profile (SIP)
 - Index of Well Being, Index of Overall Life Satisfaction
 - Index of Psychological Affect
 - General Health Questionnaire
 - Simmons Self Esteem Scale
 - Profile of Mood States
 - Multidimensional Health Locus of Control
 - Modality Specific Stresses Scale
 - General Treatment Stress Scale
 - Global Illness Stress on Self and Others, Global Adjustment to Illness Scale
 - Quality of Life (QL 100 mm) Analogue Scale
 - Dialysis Relationship Quality Scale
 - Social Leisure Activities Index, Social Support Satisfaction Scale
 - General Well Being Index
 - Index of General Affect, Overall Life Satisfaction
 - Katz Activities of Daily Living
 - Time Tradeoff Measures
5. Measurement of school attendance, growth, and developmental progress in pediatric peritoneal dialysis patients.
6. Albumin concentration in peritoneal dialysis patients.
7. Hematocrit in peritoneal dialysis patients. Providers should strive to achieve a hematocrit level of 33% to 36% in 75% of peritoneal dialysis patients.
8. Normalized protein equivalent of nitrogen appearance (nPNA) in peritoneal dialysis patients.

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Hand-searches of Published Literature (Primary Sources)
Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

From the 1997 Guideline

Initial literature searches

With the help of a former senior subject heading specialist from the National Library of Medicine, project staff performed initial searches of four computerized bibliographic databases: The National Library of Medicine's MEDLINE(R), EMBASE, SciSearch(R), and BIOSIS(R) Previews. Staff used free text terms and controlled vocabulary, such as the NLM's Medical Subject Heading (MeSH). Searches were both general in scope for high sensitivity in identification of pertinent literature (for example, a search related to vascular access and end stage renal disease) and specific to preliminary topics selected by the Work Group Chairs for precision (for example, prevention of particular types of complications). In total 5,746 articles were identified by the initial searches.

Work Group Chairs identified the most important papers related to their topic. These papers were retrieved.

Records retrieved from the searches were transferred into topic-specific databases using Reference Manager, a commercial bibliography management software package. Staff used Reference Manager to maintain and track records throughout the process.

Mock guidelines, rationales, and question lists

To enhance both the sensitivity and specificity of the National Kidney Foundation-Kidney Disease Outcomes Quality Initiative literature review, a systematic process was employed at the July 1995 Work Group meeting to define the questions to be addressed in the literature review. The process involved three sequential tasks. First, each Work Group developed a set of "mock guideline" statements that reflected the types of recommendations they would ultimately like to develop. For example, a mock guideline related to peritoneal dialysis adequacy was:

The dose of peritoneal dialysis that is actually delivered should be measured using (method).

Next, each Work Group developed a draft chain of logic or rationale, which delineated the logical sequence of issues and assumptions that would need to be addressed in order to come to a recommendation on each guideline topic.

For example, the draft rationale related to the preceding mock guideline was:

1. _____ and _____ are currently used to measure peritoneal dialysis dose.
2. _____ is more strongly associated with patient morbidity and mortality than is _____.
3. In addition, _____ is a more reproducible measure than _____.
4. In light of these considerations, _____ is the preferred approach for measuring peritoneal dialysis dose.

Finally, each Work Group worked with staff to develop a question list to be addressed in the literature review. The answers to these questions would fill in each link in the chain of logic, which could then be used to develop the practice recommendations. Specific questions for the example above were:

1. What is the association between total weekly urea clearance x time normalized by total body water, the volume of distribution of urea (Kt/V_{urea}) and patient mortality?
2. What is the association between weekly creatinine clearance and patient mortality?
3. Does knowledge of weekly creatinine clearance provide any additional information regarding expected patient survival than does knowledge of weekly Kt/V_{urea} ?

Detailed literature abstraction forms were then developed to help Work Group members extract the answers to the questions from the literature review. To the Committee's knowledge, this is the first time such an approach has been employed to focus a guideline development literature review effort. In previous guideline development efforts, expert panels have typically developed a list of questions to be addressed in the literature review without explicitly articulating the types of guideline statements they would ultimately like to issue. The result has often been that, after completing the literature review, a guideline development panel has found that it failed to address in the literature review several pertinent issues that needed to be considered to develop particular practice guidelines. By devoting considerable thought at the outset to "mock guideline" statements and the associated chain of logic that would underlie each, we were able to conduct a comprehensive, yet efficient literature review.

Complete supplemental and update searches

After determining that many pertinent papers were not identified during initial computerized searches, the Chair of each Work Group worked with staff to design supplemental computerized searches. These supplemental searches targeted the authors of important papers that had been missed and additional key words. All searches were updated through approximately September 1995. Additional pertinent articles identified by Work Group members and peer reviewers were added through June 1997.

Screening the literature

Work Group members performed the literature review. This entailed screening the literature for pertinence and then conducting a structured review.

The initial computerized searches of the literature identified 5,746 articles. Supplemental and update searches identified 5,065 more articles, and additions

by Work Group members and staff yielded an additional 818 articles for a total of 11,629. To ensure that the detailed literature review process was efficient, a two-step screening process was employed to identify articles that would undergo a structured review.

In the first screen, each Work Group Chair reviewed a list of titles and abstracts obtained from the search of computerized literature databases. The Work Group Chairs were asked to eliminate articles that were clearly not relevant to the questions to be addressed in their Work Group's literature review. Work Group Chairs were instructed not to eliminate articles for any other reason, such as a belief that the journal in which the article was published was not highly regarded. Staff retrieved the full text of articles that passed the first screen.

The full text of articles that passed this first screen were then divided among Work Group members by the Work Group Chair. Work Group members were asked to read these articles and determine whether each was pertinent to the questions being addressed in the literature review or the guideline topic in general. Work Group Chairs typically assigned articles to individual Work Group members based on their expertise. During this pertinence review, two Work Group members reviewed each article and categorized articles as "key," "pertinent, but not key," or "not pertinent." Key articles were articles thought to be particularly important to the development of a particular guideline. Articles identified as either "key" or "pertinent, but not key" by at least one of the two Work Group members were then moved on to the next stage of the process, the structured review.

From the 2000 Update

Rather than conduct an exhaustive search of the articles published since 1996, the Work Group adopted a "top-down" approach, whereby the experts on the Work Groups scanned the literature and selected pertinent articles. These articles were subjected to external review, and the Work Groups selected a final list to undergo structured review.

NUMBER OF SOURCE DOCUMENTS

Summary of the Literature Review for Peritoneal Dialysis (PD) Adequacy from the 1997 Guideline:

Total articles identified (searches, later additions) = 2,735

- First screen: articles retrieved in full text = 908
- Second screen: articles that underwent structured review = 377
- Total articles cited in final reports = 206

Number of Source Documents from the 2000 Update:

The update process for the four original Kidney Disease Outcomes Quality Initiative guidelines focused on a total of 85 articles published since 1996 and considered to be potentially relevant by the Work Group. Of these, 57 were subjected to structured review according to published Disease Outcomes Quality

Initiative methods. The number of source documents for each clinical practice guideline was not delineated.

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

In addition to the structured review of the clinical content of pertinent articles that was performed as part of the Disease Outcomes Quality Initiative Guideline development process, a structured assessment of the methodologic rigor of pertinent articles was performed. In this assessment, four tasks were performed. First, the type of study design used in the study was defined and used to assign the article to a United States Preventive Services Task Force Quality of Evidence Category (see Table 3 in the companion document to the original guideline titled "Methods Used to Evaluate the Quality of Evidence Underlying the National Kidney Foundation-Dialysis Outcomes Quality Initiative Clinical Practice Guidelines: Description, Findings and Implications"*). Second, for each article that underwent a methods review, up to 24 aspects of study design (the exact number depended on the type of study being reviewed) were rated as being fully, partially, or not fulfilled (see Table 4 in the companion document to the original guideline titled "Methods Used to Evaluate the Quality of Evidence Underlying the National Kidney Foundation-Dialysis Outcomes Quality Initiative Clinical Practice Guidelines: Description, Findings and Implications"*). The sum of the scores for those aspects of study design that applied to a given article was then divided by the number of applicable questions, yielding a methods score for the article between 0 and 1. Third, the overall quality of each article that underwent a methods review was rated as excellent, very good, good, fair, or poor based on a global subjective judgment made by the methods reviewer. Finally, based on the results of these ratings, each article was assigned a grade of "a", "b", or "c". An "a" grade was assigned if at least 50% of the answers to the methods review questions that applied to the article (see Table 4 in the companion document to the original guideline titled "Methods Used to Evaluate the Quality of Evidence Underlying the National Kidney Foundation-Dialysis Outcomes Quality Initiative Clinical Practice Guidelines: Description, Findings and Implications"*) were answered "yes". A grade of "b" was assigned when less than 50% of the answers to methods review questions that applied to the article were answered "yes". A "c" grade was assigned to an article when at least one of the following four criteria applied to the article: (1) important demographic and/or prognostic characteristics of the enrolled sample were not described, (2) outcome measurements were not made in a similar fashion in the patient groups being compared, (3) the article received a global subjective quality rating of poor, or (4) the article was a case report. All methods reviews were performed by experienced individuals with masters or doctoral degrees in public health, epidemiology, biostatistics, or a similar discipline.

* See the companion document to the original guideline: Steinberg EP, Eknoyan G, Levin NW, et al. "Methods Used to Evaluate the Quality of Evidence Underlying the National Kidney Foundations-Dialysis Outcomes Quality Initiative Clinical Practice Guidelines: Description, Findings, and Implications." *Am J Kidney Dis*

2000 Jul; 36(1): 1-11. Available from the [American Journal of Kidney Diseases Web site](#).

METHODS USED TO ANALYZE THE EVIDENCE

Systematic Review

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Data Abstraction

Three types of data abstraction forms were used in the review process: (1) a content abstraction form designed for use in abstracting clinical data pertaining to each literature review question; (2) a methods assessment form designed to provide a rough assessment of the methodologic rigor of a paper; and (3) a detailed methods review form designed to assess the methodologic rigor of pivotal or controversial papers.

Staff used the detailed list of questions produced by the Work Groups to develop clinical content abstraction forms for each Work Group. Each detailed question posed by the Work Group was decomposed into subquestions that would capture pertinent data from studies that could vary tremendously in design, content, and presentation of data. Reviewers were asked to summarize any pertinent data from each article that were not addressed by the form and to provide comments on the overall quality of the paper. Renal fellows then pilot-tested the forms using articles identified in the search. Staff conducted conference calls with each topic-specific group of fellows following the pilot-test and reviewed issues and problems with the draft forms. In addition, feedback from Work Group Chairs was incorporated into the draft forms before finalizing them.

Structured review

Articles identified as "key" or "pertinent, but not key," underwent structured review for both clinical content and methodologic rigor. Work Group members reviewed all "key" articles. This ensured that clinical experts reviewed the most important papers, and helped inform Work Group members of the content and quality of the papers. "Pertinent, but not key" articles were reviewed by renal fellows assigned to each Work Group.

Pertinent papers with primary or secondary data also underwent a methods review which was performed by staff with training in biostatistics and/or epidemiology. In the end, 1,447 articles, or 13 percent of those identified initially, were subjected to structured review.

Synthesis

The results of the literature review were compiled and synthesized when responses lent themselves to synthesis. Responses to qualitative questions were reported verbatim in tabular format. Quantitative data were presented in tabular format, and aggregated when possible. Since most studies did not report comparable data, aggregation was possible in only a limited number of cases.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Work Groups discussed the available evidence during two meetings and formulated draft guidelines and a rationale for each. In the rationale, the evidentiary basis (specific empirical data or expert opinion) for each recommendation was made explicit. Consensus was not forced. Rather, if divergent opinions emerged, the different viewpoints, and the basis for the divergent opinions, were recorded.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

When all components of the rationale for a guideline are based on published evidence, the guideline has been labeled "Evidence."

When some or all components of a rationale are based on opinion, the guideline has been labeled "Opinion."

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

External Peer Review
Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

As was the case with the initial guidelines, the current guideline updates were subjected to a three stage review process.

Stage One

They were presented first to the National Kidney Foundation-Kidney Disease Outcomes Quality Initiative Steering Committee and revised in response to the comments received.

Stage Two

In the second stage, the Kidney Disease Outcomes Quality Initiative Advisory Board, along with other experts in the field, provided comments. After considering these, the Work Group produced a third draft of the guidelines.

Third Stage

In the final stage, this draft was made available for public review and comment by all interested parties, including end stage renal disease networks, professional and patient associations, dialysis providers, government agencies, product

manufacturers, managed care groups, and individuals. The comments received were reviewed and, where appropriate, incorporated in the final version of the updated guidelines.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Evidentiary Basis For Recommendations:

When all components of the rationale for a guideline are based on published evidence, the guideline has been labeled "Evidence."

When some or all components of a rationale are based on opinion, the guideline has been labeled "Opinion."

1. When to Initiate Dialysis: Urea clearance x time normalized by total body water, the volume of distribution of urea (K_t/V_{urea}) Criterion (Opinion). Unless certain conditions are met, patients should be advised to initiate some form of dialysis when the weekly renal K_t/V_{urea} [the renal component of K_t/V_{urea} ($K_{r,t}/V_{\text{urea}}$)] falls below 2.0. The conditions that may indicate dialysis is not yet necessary even though the weekly $K_{r,t}/V_{\text{urea}}$ is less than 2.0 are:
 1. Stable or increased edema-free body weight. Supportive objective parameters for adequate nutrition include a lean body mass >63%, subjective global assessment score indicative of adequate nutrition (see Guideline 12, "Nutritional Status Assessment," below, and Appendix B, "Detailed Rationale for Guideline 2" in the original guideline document) and a serum albumin concentration in excess of the lower limit for the lab, and stable or rising; and
 2. Nutritional indications for the initiation of renal replacement therapy are detailed in Guideline 27 of the National Kidney Foundation-Kidney Disease Outcomes Quality Initiative "Clinical Practice Guidelines for Nutrition in Chronic Renal Failure" (see the related [National Guideline Clearinghouse Guideline Summary](#) and Guideline 2, "Indications for Renal Replacement Therapy," below); and
 3. Complete absence of clinical signs or symptoms attributable to uremia.

A weekly $K_{r,t}/V_{\text{urea}}$ of 2.0 approximates a kidney urea clearance of 7 mL/min and a renal creatinine clearance that varies between 9 to 14 mL/min/1.73 m². Urea clearance should be normalized to total body water (V) and creatinine clearance should be expressed per 1.73 m² of body surface area. The glomerular filtration rate, which is estimated by the arithmetic mean of the urea and creatinine clearances, will be approximately 10.5 mL/min/1.73 m² when the $K_{r,t}/V_{\text{urea}}$ is about 2.0.

2. Indications for Renal Replacement Therapy (Opinion). In patients with chronic kidney failure (for example, glomerular filtration rate <15 to 20 mL/min) who are not undergoing maintenance dialysis, if protein-energy malnutrition develops or persists despite vigorous attempts to optimize protein and energy intake and there is no apparent cause for malnutrition

other than low nutrient intake, initiation of maintenance dialysis or a renal transplant is recommended.

Note: This is Guideline 27 of the National Kidney Foundation-Kidney Disease Outcomes Quality Initiative "Clinical Practice Guidelines for Nutrition in Chronic Renal Failure." For details, see the related [National Guideline Clearinghouse Guideline Summary](#).

3. Frequency of Delivered Peritoneal Dialysis Dose and Total Solute Clearance Measurement Within Six Months of Initiation (Opinion). The total solute clearance (delivered peritoneal dialysis dose plus residual renal function) should be measured at least twice and possibly three times within the first 6 months after initiation of peritoneal dialysis. For patients initiating dialysis for the first time and/or patients with substantial residual renal function, the first measurement should be performed approximately 2 to 4 weeks after initiation of peritoneal dialysis. For patients transferring from another renal replacement therapy to peritoneal dialysis and/or for patients who do not have substantial residual renal function, the first measurement of delivered dose of peritoneal dialysis should be made by 2 weeks after initiation of peritoneal dialysis. To establish a baseline, at least one and possibly two additional measurements will need to be performed in the subsequent 5 months. The frequency of measurement of residual renal function depends on the peritoneal dialysis prescription of incremental vs. full dose. (See Table II-1, below.)

Table II-1: Peritoneal Dialysis Dose and Total Solute Clearance Measurement Schedule: Initial 6 Months
(X = measurement, Y = additional measurement if "incremental" peritoneal dialysis utilized)

Month	Peritoneal Dialysis Fluid		Peritoneal Equilibration Test	Urine
	K_{pt}/V_{urea}	C_{Crp}		K_{rt}/V_{urea}
1**	X	X	X	X
2***				Y
3***				Y
4***	X	X		X
5***				Y
6***	X	X		X

* For patients who void infrequently (<3 times in 24 hours), collect urine over a 48-hour period.

** If possible, at the end of month 1, but at the end of training if that is more convenient.

*** The measurement interval in months 2 to 6 is flexible. At least one additional measurement is necessary. If the results of the second measurement are similar to those of the first measurement, an adequate baseline is established, obviating the third measurement. If the result of the second measurement is discrepant, a third measurement is necessary to establish a more reliable baseline.

4. Measures of Peritoneal Dialysis Dose and Total Solute Clearance (Opinion). Both total weekly creatinine clearance normalized to 1.73 m² body surface area (BSA) and total weekly Kt/V_{urea} should be used to measure delivered peritoneal dialysis doses.
5. Frequency of Measurement of Kt/V_{urea}, Total Creatinine Clearance (C_{Cr}), Protein Equivalent of Nitrogen Appearance (PNA), and Total Creatinine Appearance (Opinion). After 6 months, total Kt/V_{urea}, total creatinine clearance, and protein equivalent of nitrogen appearance (with all its components), should be measured every 4 months unless the prescription has been changed or there has been a significant change in clinical status. (See Table II-2, below.)

Table II -2: Peritoneal Dialysis Dose and Total Solute Clearance Measurement Schedule After 6 Months
(X = measurement)

Month	Peritoneal Dialysis Fluid		Urine*	
	K _p t/V _{urea}	C _{Cr p}	K _r t/V _{urea}	C
7				
8			X**	X
9				
10	X	X	X	
11				
12			X**	X
13				
14	X	X	X	

* If incremental peritoneal dialysis is still being utilized at this point, the frequency of residual kidney function testing applies as described in Table II-1 of Guideline 3 (above) titled "Frequency of Delivered Peritoneal Dialysis Dose and Total Solute Clearance Measurement within Six Months of Initiation." For patients who void infrequently (<3 times in 24 hours), collect urine over a 48-hour period. Urine testing can cease when the residual kidney function component is a weekly K_rt/V_{urea}<0.1.

** For young children, who have greater difficulty with accurate urine collection than adults, this may be deferred until full urine and dialysate

collections occur every 4 months. (See Guideline 11 titled "Dialysate and Urine Collections," below.)

6. Assessing Residual Kidney Function (Evidence). Residual kidney function, which can provide a significant component of total solute and water removal, should be assessed by measuring the renal component of Kt/V_{urea} ($K_r t/V_{urea}$) and estimating the patient's glomerular filtration rate (GFR) by calculating the mean of urea and creatinine clearance.
7. Peritoneal Dialysis Dose Troubleshooting (Opinion). In adult patients, a daily creatinine excretion in urine and dialysate that differs from the baseline rate (as determined during the first 6 months in Guideline 3, Table II-1 [above]) by >15% should prompt an investigation for noncompliance, improper collection of drained dialysate and/or urine, or altered peritoneal transport function. Compliance should not be assessed by comparing measured to predicted creatinine excretion.
8. Reproducibility of Measurement (Opinion). Accurate measurement of total Kt/V_{urea} and total creatinine clearance requires collection and analysis of urine, dialysate, and serum in a way that yields reproducible and valid results. Dialysate creatinine concentration must be corrected for the presence of glucose in some assays. Peritonitis precludes reliable measurement of delivered peritoneal dialysis dose for up to a month. Compliance with complete collections is mandatory. For patients who void ≥ 3 times per day, a 24-hour urine collection is sufficient. For patients who void less frequently, a 48-hour collection is recommended. For continuous ambulatory peritoneal dialysis patients, the serum sample can be obtained at any convenient time. For nightly intermittent peritoneal dialysis patients, the serum sample should be obtained at the midpoint of the daytime empty period. For continuous cycling peritoneal dialysis patients, the serum sample should be obtained at the midpoint of the daytime dwell.
9. Estimating Total Body Water and Body Surface Area (Opinion). V (total body water) should be estimated by either the Watson or Hume method in adults using actual body weight, and by the Mellitus-Cheek method in children using actual body weight.

Watson Method:

For Men:	$V(\text{liters}) =$	$2.447 + 0.3362 * Wt \text{ (kg)} + 0.1074 * Ht \text{ (cm)} - 0.09516 * \text{Age (years)}$
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For Women:	$V =$	$-2.097 + 0.2466 * Wt + 0.1069 * Ht$
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Hume Method:

For Men:	$V =$	$-14.012934 + 0.296785 * Wt + 0.192786 * Ht$
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For Women:	$V =$	$-35.270121 + 0.183809 * Wt + 0.344547 * Ht$
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Mellitus-Cheek method for children:

For Boys:	$V \text{ (liters)} =$	$-1.927 + 0.465 * Wt \text{ (kg)} + 0.045 * Ht \text{ (cm)}$ when height ≤ 132.7 cm;
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	$V =$	$-21.993 + 0.406 * Wt + 0.209 * Ht,$ when height is ≥ 132.7 cm
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For Girls:	$V =$	$0.076 + 0.507 * Wt + 0.013 * Ht,$ when height is ≤ 110.8 cm;
	$V =$	$-10.313 + 0.252 * Wt + 0.154 * Ht,$ when height is ≥ 110.8 cm

10. Body surface area, BSA, should be estimated by either the DuBois and DuBois method, the Gehan and George method, or the Haycock method using actual body weight.
11. For all formulae, Wt is in kg and Ht is in cm.

DuBois and DuBois method:	$BSA(m^2) = 0.007184 * Wt^{0.425} * Ht^{0.725}$
Gehan and George method:	$BSA(m^2) = 0.0235 * Wt^{0.51456} * Ht^{0.42246}$
Haycock method:	$BSA(m^2) = 0.024265 * Wt^{0.5378} * Ht^{0.3964}$

12. Timing of Measurement (Opinion). Routine measurements of total K_t/V_{urea} and total creatinine clearance should be performed when the patient is clinically stable (for example, stable weight, stable blood urea nitrogen and creatinine concentrations), and at least 4 weeks after resolution of peritonitis.

Following a change in prescription or a major change in clinical status (for example, hospitalization, weight loss), but in the absence of recent peritonitis, measurements of delivered weekly K_t/V_{urea} and total weekly creatinine clearance should be performed within the next 4 weeks and then at 4-month intervals.

13. Dialysate and Urine Collections (Opinion). Two to three total solute removal measurements are required during the first 6 months of peritoneal dialysis. (See Guideline 3 titled "Frequency of Delivered Peritoneal Dialysis Dose and Total Solute Clearance Measurement within Six Months of Initiation," above) After 6 months, if the dialysis prescription is unchanged:
1. Perform both complete dialysate and urine collections every 4 months; and
 2. Perform urine collections every 2 months until the renal weekly K_{rt}/V_{urea} is <0.1 . Thereafter, urine collections are no longer necessary, as the residual kidney function contribution to total K_t/V_{urea} becomes negligible. In young children, urine collections are recommended only with complete dialysate collections. (See Table II-2, above.)
14. Assessment of Nutritional Status (Opinion). Nutritional status of adult peritoneal dialysis patients should be assessed on an ongoing basis in association with K_t/V_{urea} and creatinine clearance measurements using the protein equivalent of nitrogen appearance (PNA) and subjective global assessment (SGA). For pediatric peritoneal dialysis patients, nutritional status should be assessed using the protein equivalent of nitrogen appearance and other standard nutritional assessments. (See Guideline 14, "Use of the Modified Borah Equation to Assess Nutritional Status of Pediatric Peritoneal Dialysis Patients," below, and the National Kidney Foundation-Kidney Disease Outcomes Quality Initiative "Clinical Practice Guidelines for Nutrition in

Chronic Renal Failure" [see the related [National Guideline Clearinghouse Guideline Summary](#)].)

15. Determining Fat-Free, Edema-Free Body Mass (Opinion). Total creatinine appearance should be used to determine fat-free, edema-free body mass.
16. Use of the Modified Borah Equation to Assess Nutritional Status of Pediatric Peritoneal Dialysis Patients (Opinion). Nutritional status of pediatric peritoneal dialysis patients should be assessed at least every 6 months by standard clinical nutritional evaluations and by the modified Borah equation:

$$\text{PNA (g/d)} = [6.49 \times \text{UNA}] + [0.294 \times V] + \text{protein losses (g/day)}$$

where PNA = protein equivalent of nitrogen appearance; UNA = urea nitrogen appearance; and V = volume of distribution. When referring to urea, this is total body water.

17. Weekly Dose of Continuous Ambulatory Peritoneal Dialysis (Evidence). For continuous ambulatory peritoneal dialysis, the delivered peritoneal dialysis dose should be a total Kt/V_{urea} of at least 2.0 per week and a total creatinine clearance (C_{Cr}) of at least 60 L/week/1.73 m² for high and high-average transporters, and 50 L/wk/1.73 m² in low and low-average transporters.
18. Weekly Dose of Nightly Intermittent Peritoneal Dialysis and Continuous Cycling Peritoneal Dialysis (Opinion). For nightly intermittent peritoneal dialysis, the weekly delivered peritoneal dialysis dose should be a total Kt/V_{urea} of at least 2.2 and a weekly total creatinine clearance of at least 66 L/1.73 m². For continuous cycling peritoneal dialysis, the weekly delivered peritoneal dialysis dose should be a total Kt/V_{urea} of at least 2.1 and a weekly total creatinine clearance of at least 63 L/1.73 m².
19. Peritoneal Dialysis Dose in Subpopulations (Opinion). There is no adequate basis for recommending any change in the target doses discussed in Guideline 15, "Weekly Doses of Continuous Ambulatory Peritoneal Dialysis," and 16, "Weekly Dose of Nightly Intermittent Peritoneal Dialysis and Continuous Cycling Peritoneal Dialysis," for various patient subpopulations (for example, patients with diabetes or who are elderly), with the exception of the malnourished patient, whose target dose is increased by the ratio of the $V_{\text{desired}}/V_{\text{actual}}$ for Kt/V_{urea} . For creatinine clearance, the target dose in a malnourished patient is increased by the ratio body surface area_{desired}/body surface area_{actual}. Transport status is not considered a subpopulation in the context of this guideline.
20. Use of Empiric and Computer Modeling of Peritoneal Dialysis Dose (Evidence). Both empiric and computer modeling methods can be used to estimate adequate doses of peritoneal dialysis. Specific prescriptions are described below.
 - A. General Evaluation of the Patient with Kidney Failure
 1. Explain all options (transplant, hemodialysis, and peritoneal dialysis) to patients/parents/caregivers in a non-biased manner.
 2. Review medical condition/comorbidities to determine if contraindications, relative or absolute, exist for any modality.

(See Guidelines 29 through 32, below, for recommendations regarding suitable patients for peritoneal dialysis.)

3. If no medical contraindications exist and the patient is a candidate for self therapy, allow patient to choose a modality.
4. Place the chronic dialysis access (peritoneal dialysis or hemodialysis). The Vascular Access Work Group recommends that vascular accesses be placed in patients on peritoneal dialysis (see the related [National Guideline Clearinghouse Guideline Summary](#) for the National Kidney Foundation-Kidney Disease Outcomes Quality Initiative "Clinical Practice Guidelines for Vascular Access"). The Peritoneal Dialysis Adequacy Work Group feels that this decision should be made on an individual patient basis, but their position does not necessarily disagree with the recommendations of the Vascular Access Work Group.
5. If dialysis is needed at the time of presentation, place the temporary hemodialysis access, or after placing the peritoneal dialysis catheter, initiate therapy as suggested below.

B. Initiation of Peritoneal Dialysis

1. If possible, wait 10 days to 2 weeks after catheter placement to start peritoneal dialysis.
2. If peritoneal dialysis must be started in less than 10 days following catheter placement, do low-volume, supine dialysis.
3. Obtain baseline 24-hour urine collection for urea and creatinine clearance. (See Guideline 6, "Assessing Residual Renal Function, above") These collections are for solute clearance calculations, assessment of creatinine generation, and protein equivalent of nitrogen appearance determinations.
4. Note patient's weight and the presence or absence of edema.
5. At initiation of dialysis, explain to patient/parents/caregivers that the patient's prescription will be individualized. Specifically, state that their instilled volume almost certainly will need to increase over time. For patients who choose Automated Peritoneal Dialysis (APD), one or more daytime dwells will be needed in approximately 85% of patients. Patients should know from the start of peritoneal dialysis that their total solute clearance will be monitored and that, if their residual renal function or peritoneal transport changes over time, their prescription may need to change as well.

C. Initial Dialysis Prescription for Adults

Initial dialysis can be prescribed empirically based on patient's weight, amount of residual renal function, and lifestyle constraints. These empiric recommendations should be implemented prior to peritoneal equilibration testing. Peritoneal dialysis may be initiated incrementally, or as full therapy, depending on residual kidney function at the time of initiation (see Guideline 1, "When to Initiate Dialysis K_t/V_{urea} Criterion," above). For example, if $K_r t/V_{urea}$ is 1.8 per week, only 0.2 $K_p t/V_{urea}$ is needed per week. Assuming complete urea equilibration (serum to dialysate) at 6 hours, a single 2-L overnight exchange would contribute 14 L per week. If V is 40 L, this contributes a $K_p t/V_{urea}$ of 14/40 or 0.35 per week. Any ultrafiltrate would add further to total solute removal. That, plus the $K_r t/V_{urea}$ of 1.8, brings the $K_r t/V_{urea}$ to at least 2.15, satisfying the target requirement. This approach uses basic

principles of dialysis prescription development. Thus, the dose of $K_{pr}t/V_{urea}$ depends on the K_{rt}/V_{urea} as the Work Group has emphasized throughout these guidelines. Keeping in mind that the weekly $K_{pr}t/V_{urea}$ goal is 2.0, the following more intense empiric approach is reasonable:

1. Patients with an estimated underlying glomerular filtration rate >2 mL/min:
 - a. If patient's lifestyle choice is continuous ambulatory peritoneal dialysis:
 - body surface area <1.7 m² --> 4 x 2.0 L exchanges/day;
 - body surface area 1.7 to 2.0 m² --> 4 x 2.5 L exchanges/day;
 - body surface area >2.0 m² --> 4 x 3.0 L exchanges/day;
 - b. If patient's lifestyle choice is continuous cycling peritoneal dialysis:
 - body surface area <1.7 m² --> 4 x 2.0 L (9 hours/night) + 2.0 L/day;
 - body surface area 1.7 to 2.0 m² --> 4 x 2.5 L (9 hours/night) + 2.0 L/day;
 - body surface area >2.0 m² --> 4 x 3.0 L (9 hours/night) + 3.0 L/day;
 - c. If patient's lifestyle choice is nightly intermittent peritoneal dialysis:

Specific attention to certain details will be required. Nightly intermittent peritoneal dialysis (nightly intermittent peritoneal dialysis) is not a therapy that is typically used at the initiation of dialysis. It has been reserved for high or rapid transporters. However, in patients with significant residual kidney function (and ability to diurese), they may initially do well on nightly exchanges only (dry day) because of the supplemental clearance provided by the patient's residual kidney function.
2. Patients with an estimated underlying glomerular filtration rate ≤ 2 mL/min:
 - a. If patient's lifestyle choice is continuous ambulatory peritoneal dialysis:
 - body surface area <1.7 m² --> 4 x 2.5 L/day;
 - body surface area 1.7 to 2.0 m² --> 4 x 3.0 L/day;
 - body surface area >2.0 m² --> 4 x 3.0 L/day (Consider use of a simplified nocturnal exchange device to achieve optimal dwell times and to augment clearance.)
 - b. If patient's lifestyle choice is continuous cycling peritoneal dialysis:
 - body surface area <1.7 m² --> 4 x 2.5 L (9 hours/night) + 2.0 L/day;
 - body surface area 1.7 to 2.0 m² --> 4 x 3.0 L (9 hours/night) + 2.5 L/day;
 - body surface area >2.0 m² --> 4 x 3.0 L (10 hours/night) + 2 x 3.0 L/day (Consider combined

hemodialysis / peritoneal dialysis or transfer to hemodialysis if clinical situation suggests need);

- c. If patient's lifestyle choice is nightly intermittent peritoneal dialysis:

Many of the issues discussed above for patients with an estimated underlying glomerular filtration rate >2 mL/min still apply to urine volume. Namely, if residual kidney function provides enough diuresis, nightly intermittent peritoneal dialysis may provide enough solute removal for a while. This should be tested early on. If during training, it is noted that a patient has very low drain volumes with no apparent mechanical problem or leak, a peritoneal equilibration test should be done to determine if the patient is a rapid transporter. If so, nightly intermittent peritoneal dialysis can be prescribed using kinetic modeling.

D. Initial Dialysis Prescription for Children

In view of the close, age-independent relationship between peritoneal surface area and body surface area, the use of body surface area as a normalization factor for the prescribed exchange volume in children is preferred. An instilled volume of at least 1100 mL/m^2 is recommended for most pediatric patients, although individual tolerance must be considered.

It should be emphasized that the preceding prescriptive guidelines are general empiric guidelines for patients initiating peritoneal dialysis, generally as first renal replacement therapy. For patients transferring from hemodialysis with minimal residual kidney function, prompt adequacy testing is required. The above empiric recommendations must be individualized and guided by documentation that the delivered dose equals the prescribed dose. Furthermore, the instilled volumes are ones that theoretically will result in a weekly target Kt/V_{urea} of greater than 1.9 for the average patient. Low transporters may be below creatinine targets if residual kidney function is low. Finally, although most patients tolerate instilled volumes of greater than 2.0 L, this needs to be evaluated for each patient.

E. Observations Needed During Training

1. Determine 4-hour drain volumes during training. This is to note if drain volumes are as expected for typical 4-hour dwells with 1.5%, 2.5%, or 4.25% dextrose exchanges. This is not a formal peritoneal equilibration test, but is done to determine if the patient's peritoneal membrane transport characteristics are markedly different from the mean.
2. Monitor for evidence of leakage in the vicinity of the catheter.
3. Complete laboratory studies:
 - a. Delay baseline peritoneal equilibration test (PET) until after training. (See item 18F, "Early Follow-up," below.)
 - b. Perform serum chemistries and complete blood count.

- c. If a computer-assisted kinetic modeling system is available, enter preliminary data to predict if the current prescription will be adequate.

F. Early Follow-up

1. Perform 24-hour dialysate and urine collection for Kt/V_{urea} , creatinine clearance, protein equivalent of nitrogen appearance calculation, creatinine generation, and $D/P_{creatinine}$ and D/P_{urea} values. These should be done 2 to 4 weeks following initiation. (See Table II-1, above, and Guideline 3, "Frequency of Delivered Peritoneal Dialysis Dose and Total Solute Clearance Measurement Within Six Months of Initiation," above.)
2. Perform peritoneal equilibration testing (PET) approximately 1 month following initiation of peritoneal dialysis, an appropriate time physiologically. This baseline peritoneal equilibration testing could be performed at the end of a prolonged (>1 week) training period (see Guideline 3, "Frequency of Delivered Peritoneal Dialysis Dose," above). This peritoneal equilibration testing (1 month) is used as the baseline measure of peritoneal membrane transport characteristics, not to determine total solute clearance. This peritoneal equilibration testing is done to rule out unsuspected problems or deviation from mean transport characteristics. Low transporters will probably require high-dose continuous ambulatory peritoneal dialysis or continuous cycling peritoneal dialysis. High transporters will eventually have ultrafiltration problems (when residual kidney function diuresis fails) and will need short-dwell therapy such as nightly intermittent peritoneal dialysis. Average transporters will have the most flexibility (that is, all options will be feasible).
3. Perform serum chemistries and complete blood count.
4. If a computer-assisted modeling program is available, enter baseline data. Actual data from 24-hour collection can be compared.
5. If clearances are at or above target, continue routine monitoring on a regular basis. Look for changes in 24-hour urine studies and peritoneal equilibration test data. Kinetic modeling can be used to guide future therapy.
6. If clearance is below target at 1 month, a change in prescription may be needed. Compliance issues and collection procedures should be evaluated for abnormalities.

G. Adjusting Dialysis Prescription

If kinetic modeling is not available, unless peritoneal equilibration test has changed, dialysis dose is most effectively increased by increasing the instilled volume, therefore maximizing mass transfer and dwell time. Another option would be to increase the number of exchanges/day while maintaining maximum dwell time, that is, by using a single nighttime exchange to increase to 5 equal dwells/day. To this end, simplified mechanical exchange systems have been developed to perform a nocturnal exchange. If kinetic modeling is available, use these programs to tailor a new prescription to meet adequacy target goals and patient lifestyle issues.

21. Identify and Correct Patient-related Failure to Achieve Prescribed Peritoneal Dialysis Dose (Opinion). Potential patient-related causes of failure to achieve prescribed peritoneal dialysis dose should be investigated and corrected. These include:
 - Failure to comply with the prescription
 - Lack of understanding of the importance of adherence to the full prescription
 - Sampling and collection errors.
22. Identify and Correct Staff-related Failure to Achieve Prescribed Peritoneal Dialysis Dose (Opinion). Potential staff-related causes of failure to achieve prescribed peritoneal dialysis dose should be investigated and corrected. These include:
 - Errors in prescription
 - Inadequate monitoring of delivered dose
 - Inadequate patient education.
23. Measurement of Peritoneal Dialysis Patient Survival (Opinion). Survival of peritoneal dialysis patients should be quantitated serially as an outcome measure.
24. Measurement of Peritoneal Dialysis Technique Survival (Opinion). Peritoneal dialysis technique survival, both dependent and independent of peritonitis, should be quantitated serially in peritoneal dialysis patients as an outcome measure.
25. Measurement of Hospitalizations (Opinion). End-stage renal disease - related and end-stage renal disease -unrelated hospitalizations (admissions/year, hospitalized days/year) in peritoneal dialysis patients should be quantitated as an outcome measure.
26. Measurement of Patient-based Assessment of Quality of Life (Opinion). Patient-based assessment of quality of life (QOL) in peritoneal dialysis patients should be evaluated serially as an outcome measure. A patient-based quality of life instrument should have both generic and disease/treatment-specific measures of health-related quality of life, and should be shown to be valid, reliable, and responsive prior to use. Once such an instrument is available, it should be administered at initiation of dialysis and at intervals determined to be appropriate by its validation studies.
27. Measurement of School Attendance, Growth, and Developmental Progress in Pediatric Peritoneal Dialysis Patients (Opinion). School attendance (in the absence of other comorbidities precluding school attendance), growth, and developmental progress should be measured serially in pediatric peritoneal dialysis patients.
28. Measurement of Albumin Concentration in Peritoneal Dialysis Patients (Opinion). A stable or rising serum albumin concentration that is greater than or equal to the lower limit of normal for each laboratory should be used as an outcome goal.
29. Measurement of Hematocrit in Peritoneal Dialysis Patients. Providers should strive to achieve a hemoglobin level of 11 to 12 g/dL or a hematocrit level of 33% to 36% in 75% of peritoneal dialysis patients.
30. Measurement of Normalized Protein Equivalent of Total Nitrogen Appearance in Peritoneal Dialysis Patients. Providers should strive to achieve a normalized protein equivalent of total nitrogen appearance (nPNA) of greater than or equal to 0.9 g/kg/day in peritoneal dialysis patients.
31. Indications for Peritoneal Dialysis (Opinion). Indications for peritoneal dialysis include:
 - Patients who prefer peritoneal dialysis or will not do hemodialysis (HD)

- Patients who cannot tolerate hemodialysis (for example, some patients with congestive or ischemic heart disease, extensive vascular disease, or in whom vascular access is problematic, including the majority of young children)
 - Patients who prefer home dialysis but have no assistant for hemodialysis, or whose assistant cannot be trained for home hemodialysis.
32. Absolute Contraindications for Peritoneal Dialysis (Opinion). Absolute contraindications for peritoneal dialysis include:
- Documented loss of peritoneal function or extensive abdominal adhesions that limit dialysate flow.
 - In the absence of a suitable assistant, a patient who is physically or mentally incapable of performing peritoneal dialysis.
 - Uncorrectable mechanical defects that prevent effective peritoneal dialysis or increase the risk of infection (for example, surgically irreparable hernia, omphalocele, gastroschisis, diaphragmatic hernia, and bladder extrophy).
33. Relative Contraindications for Peritoneal Dialysis (Opinion). Relative contraindications for peritoneal dialysis include:
- Fresh intra-abdominal foreign bodies (for example, 4-month wait after abdominal vascular prostheses, recent ventricular-peritoneal shunt)
 - Peritoneal leaks
 - Body size limitations
 - Intolerance to peritoneal dialysis volumes necessary to achieve adequate peritoneal dialysis dose
 - Inflammatory or ischemic bowel disease
 - Abdominal wall or skin infection
 - Morbid obesity (in short individuals)
 - Severe malnutrition
 - Frequent episodes of diverticulitis
34. Indications for Switching from Peritoneal Dialysis to Hemodialysis (Opinion). The decision to transfer a peritoneal dialysis patient to hemodialysis should be based on clinical assessment, the patient's ability to reach hemodialysis dose target levels, and the patient's wishes. In particular, these patients should have vascular access addressed as advised by the National Kidney Foundation-Kidney Disease Outcomes Quality Initiative Vascular Access Work Group (see the related [National Guideline Clearinghouse Guideline Summary](#)).

Indications for switching from peritoneal dialysis to hemodialysis include:

- Consistent failure to achieve target Kt/V_{urea} and creatinine clearance when there are no medical, technical, or psycho-social contraindications to hemodialysis
- Inadequate solute transport or fluid removal. High transporters may have poor ultrafiltration and/or excessive protein losses (relative contraindication, obviously discovered after initiation and the first peritoneal equilibration test)
- Unmanageably severe hypertriglyceridemia
- Unacceptably frequent peritonitis or other peritoneal dialysis -related complications
- Development of technical/mechanical problems

- Severe malnutrition resistant to aggressive management (relative)

Patients should be informed of the risks of staying on peritoneal dialysis at a level of adequacy below that recommended by their physician.

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

Evidentiary Basis for Guidelines

The National Kidney Foundation-Kidney Disease Outcomes Quality Initiative guidelines were developed using an evidence-based approach similar to the one used by the Agency for Healthcare Research and Quality (AHRQ) (formerly the Agency for Health Care Policy and Research [AHCPR]). That is, before formulating recommendations, the Work Groups reviewed all published evidence pertinent to the topics being considered, and critically appraised the quality and strength of that evidence. For many issues that the National Kidney Foundation-Kidney Disease Outcomes Quality Initiative Work Groups chose to address, there either was no pertinent literature available, or available evidence was flawed or weak. As a result, in many instances the Work Groups formulated their recommendations based on the opinions of the Work Group members and comments received from the peer reviewers. In all instances, the Work Groups have documented the rationale for their recommendations. That is, they have articulated each link in the chain of logic they used as the evidentiary or opinion-related basis for their recommendation. This approach will help readers of the National Kidney Foundation-Kidney Disease Outcomes Quality Initiative guidelines determine the quantity and quality of evidence underlying each recommendation.

Although some of the National Kidney Foundation-Kidney Disease Outcomes Quality Initiative guidelines are clearly based entirely on evidence or entirely on opinion, many are based in part on evidence and in part on opinion. Such "hybrid" guidelines arise when some (or even most) of the links in the chain of logic underlying a guideline are based on empirical evidence, but some (that is, at least one) are based on opinion. The opinion of the Work Group members can enter the chain of logic that supports a guideline either to fill in a gap in available evidence on some scientific or clinical issue, or in the form of a value judgment regarding what they feel is appropriate clinical practice based on available evidence. Thus, many opinion-based guidelines may have substantial empirical evidence underlying them.

To help readers determine the basis for each guideline, the Work Groups have provided their rationale for each guideline. When all components of the rationale for a guideline are based on published evidence, the guideline has been labeled "Evidence." When some or all components of a rationale are based on opinion, the guideline has been labeled "Opinion."

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

- Delivery of adequate peritoneal dialysis dose in end-stage renal disease patients
- Decreased morbidity and mortality for end-stage renal disease patients receiving peritoneal dialysis
- Improved patient-reported quality of life

Subgroups Most Likely to Benefit:

Indications for Peritoneal Dialysis Include:

- Patients who prefer peritoneal dialysis or will not do hemodialysis;
- Patients who cannot tolerate hemodialysis (for example, some patients with congestive or ischemic heart disease, extensive vascular disease, or in whom vascular access is problematic, including the majority of young children); and
- Patients who prefer home dialysis but have no assistant for hemodialysis, or whose assistant cannot be trained for home hemodialysis.

POTENTIAL HARMS

Complications of peritoneal dialysis: Peritonitis remains the primary cause of transfer from peritoneal dialysis.

CONTRAINDICATIONS

CONTRAINDICATIONS

Absolute Contraindications for Peritoneal Dialysis Include:

1. Documented loss of peritoneal function or extensive abdominal adhesions that limit dialysate flow
2. In the absence of a suitable assistant, a patient who is physically or mentally incapable of performing peritoneal dialysis
3. Uncorrectable mechanical defects that prevent effective peritoneal dialysis or increase the risk of infection (for example, surgically irreparable hernia, omphalocele, gastroschisis, diaphragmatic hernia, and bladder extrophy)

Relative Contraindications for Peritoneal Dialysis Include:

1. Fresh intra-abdominal foreign bodies (for example, 4-month wait after abdominal vascular prostheses, recent ventricular-peritoneal shunt)
2. Peritoneal leaks
3. Body size limitations
4. Intolerance to peritoneal dialysis volumes necessary to achieve adequate peritoneal dialysis dose
5. Inflammatory or ischemic bowel disease
6. Abdominal wall or skin infection

7. Morbid obesity (in short individuals)
8. Severe malnutrition
9. Frequent episodes of diverticulitis

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

From the 1997 Guideline

1. These guidelines are based upon the best information available at the time of publication. They are designed to provide information and assist decision making. They are not intended to define a standard of care, and should not be construed as one. Neither should they be interpreted as prescribing an exclusive course of management. Variations in practice will inevitably and appropriately occur when clinicians take into account the needs of individual patients, available resources, and limitations unique to an institution or type of practice. Every health-care professional making use of these guidelines is responsible for evaluating the appropriateness of applying them in the setting of any particular clinical situation.
2. The guidelines are intended for use by health-care professionals trained to understand variations in the practice of medicine and the necessity for such variation. The guidelines are not intended for punitive use by any oversight official who does not understand the reasons or the necessity for practice variations including variations in societies different from that of the United States.
3. There is a paucity of data on children in the areas covered by these guidelines. Pediatricians were represented on the Work Group, and outside pediatric consultations were obtained. Because some recommendations for adults do not apply to children, additional recommendations are included when appropriate for pediatric patients. For the purpose of these guidelines, a child was considered to be a patient less than 19 years of age.

Clinical judgment suggests that the target doses of peritoneal dialysis for children should meet or exceed the adult standards. However, there are currently no definitive outcome data in pediatric patients to suggest that any measure of dialysis adequacy is predictive of well-being, morbidity, or mortality. There also are no data regarding the real protein needs of children, especially young children, on dialysis. It is the opinion of the Work Group that the nutritional requirements per kilogram of body weight are higher in children than in adults. Therefore, peritoneal dialysis doses in children, and especially small infants who have very high protein intakes, may have to be higher than peritoneal dialysis doses in adults.

4. For hemodialysis and peritoneal dialysis the maximal effective dose is not known. There are insufficient data to address the issue of adequate compared to optimal dialysis. The latter is in part defined as the dialysis dose above which the incremental clinical benefit does not justify the patient burden or financial costs. Nor are there sufficient data to evaluate the relative

importance of renal and peritoneal clearances. The recommendations assume equivalence but this requires further study. The correlation between urea clearance x time normalized by total body water, the volume of distribution of urea (Kt/V_{urea}) and creatinine clearance will vary with residual renal function.

- Some individuals have expressed concern that this guideline will run afoul of the Health Care Financing Administration (HCFA)* regulations regarding the initiation of dialysis (for example, form 2728, ESRD Medicare Medical Evidence Report). The leadership of the National Kidney Foundation-Kidney Disease Outcomes Quality Initiative is working with HCFA to ensure that this will not be the case.
- There are no data available in the literature on which to base a recommendation for different adequacy targets for patients with diabetes or for the elderly. However, it must be remembered that malnourished patients may appear to have an adequate Kt/V_{urea} due to calculation of water (V) from the actual or malnourished body weight. If V were calculated from an estimate of desired body weight, the target would reflect that target body weight.

The amount of dialysis required for malnourished patients is not known. While there probably is consensus that such patients need extra dialysis, the requisite increase is unclear and should be studied. Other malnutrition-related questions of interest include: Can aggressive dialysis delivery reverse malnutrition? What V is to be used in malnourished patients?

From the 2000 Update

1. While extensive effort has gone into the guideline development process, and careful attention has been paid to detail and scientific rigor, it is absolutely essential to emphasize that these documents are guidelines, not standards or mandates. Each recommendation in the guidelines is accompanied by a rationale, enabling caregivers of patients with chronic kidney disease to make informed decisions about the proper care plan for each individual patients. Variations in practice are expected and can be appropriate.
2. The optimal timing of blood sampling for subjects on asymmetric peritoneal dialysis (nightly intermittent peritoneal dialysis, continuous cycling peritoneal dialysis) should be determined. The recommendations the guideline developer made are based on pharmacokinetic theory.
3. The amount of dialysis required for malnourished patients is not known. While there probably is consensus that such patients need extra dialysis, the requisite increase is unclear and should be studied. Other nutrition-related questions of interest include: Can aggressive dialysis delivery reverse malnutrition? What volume of distribution (V) is to be used in malnourished patients? Can increasing dialysis dose improve outcomes in a linear manner, or is there a dose above which no benefit is noted, or complications or costs outweigh benefits?

* NGC Editor's note: As of July 1, 2001, the Health Care Financing Administration became the Centers for Medicare and Medicaid Services.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

National Kidney Foundation-Kidney Disease Outcomes Quality Initiative Implementation Planning

Based on broad-based input and careful thought, the National Kidney Foundation-Kidney Disease Outcomes Quality Initiative leadership has decided to undertake three types of activities to promote implementation of its recommendations.

- Translating recommendations into practice. National Kidney Foundation-Kidney Disease Outcomes Quality Initiative will develop core patient and professional education programs and tools to facilitate the adoption of their recommendations.
- Building commitment to reducing practice variations. National Kidney Foundation-Kidney Disease Outcomes Quality Initiative will work with providers and insurers to clarify the need for and the benefits of changes in practice patterns and to encourage the adoption of the guidelines.
- Evaluation. National Kidney Foundation-Kidney Disease Outcomes Quality Initiative will develop performance measures that can be used to assess compliance with the Disease Outcomes Quality Initiative practice guidelines. In addition, the association between compliance with the Disease Outcomes Quality Initiative guidelines and patient outcomes will be evaluated in an effort to validate and improve the guidelines over time.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Living with Illness

IOM DOMAIN

Effectiveness
Patient-centeredness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

NKF-K/DOQI clinical practice guidelines for peritoneal dialysis adequacy: update 2000. Am J Kidney Dis 2001 Jan;37(1 Suppl 1):S65-S136. [143 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1997 (updated 2000)

GUIDELINE DEVELOPER(S)

National Kidney Foundation - Disease Specific Society

SOURCE(S) OF FUNDING

The National Kidney Foundation-Kidney Disease Outcomes Quality Initiative (NKF-K/DOQI) is supported by Amgen, Inc., Founding and Principal Sponsor of K/DOQI and Luitpold Pharmaceuticals. Implementation of the K/DOQI guidelines is supported by Watson Pharmaceuticals, Inc., Nephrology Division (formerly Schein Pharmaceuticals, Inc.).

GUIDELINE COMMITTEE

NKF-K/DOQI (National Kidney Foundation-Kidney Disease Outcomes Quality Initiative) Peritoneal Dialysis Adequacy Work Group

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Peritoneal Dialysis Adequacy Work Group Members: Thomas Golper, MD, Work Group Chair; David Churchill, MD, Work Group Vice-Chair; Peter Blake, MB, FRCPC, FRCPI; John Burkart, MD; Dinesh Chatoth, MBBS; Catherine Firanek, RN, CNN, MBA; Denis Geary, MB, FRCPC; Frank Gotch, MD; Alan Kliger, MD; Steve Korbet, MD; Linda Moore, RD; Karl Nolph, MD; Neil Powe, MD, MPH, MBA; Hermeet Singh, MD; Brendan Teehan, MD; Antonios Tzamaloukas, MD; Bradley Warady, MD

K/DOQI Co-Chairs: Garabed Eknoyan, MD; Nathan W. Levin, MD

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

All Work Group members completed a disclosure statement certifying that any potential conflict of interest would not influence their judgment or actions concerning the National Kidney Foundation Kidney Disease Outcomes Quality Initiative (NKF-K/DOQI).

John Burkart, MD, reported an affiliation with Baxter Healthcare.

Stephen M. Korbet, MD, is currently a member of Baxter's International Ad Hoc Committee on Ultrafiltration Management in Peritoneal Dialysis.

GUIDELINE STATUS

This is the current release of the guideline. It updates a previously issued version of the guideline (Clinical practice guidelines for peritoneal dialysis adequacy. New

York [NY]: National Kidney Foundation; 1997. 213 p. [Dialysis outcomes quality initiative (DOQI)].

GUIDELINE AVAILABILITY

Electronic copies: Available from the [National Kidney Foundation \(NKF\) Web site](#).

Print copies: Available from NKF, 30 East 33rd St., New York, NY 10016. These guidelines are also available on CD-ROM from NKF.

AVAILABILITY OF COMPANION DOCUMENTS

The following are available:

- Golper G. Peritoneal dialysis adequacy. Executive summary. 2001. Available from the [National Kidney Foundation \(NKF\) Web site](#).
- Steinberg EP, Eknoyan G, Levin NW, Eschbach JW, Golper TA, Owen WF, Schwab S. Methods used to evaluate the quality of evidence underlying the National Kidney Foundation-Dialysis Outcomes Quality Initiative clinical practice guidelines: description, findings and implications. *Am J Kidney Dis* 2000 Jul; 36(1): 1-11.
- Eknoyan G, Levin NW, Eschbach JW, Golper TA, Owen WF Jr, Schwab S, Steinberg EP. Continuous quality improvement: DOQI becomes K/DOQI and is updated. National Kidney Foundation's Dialysis Outcomes Quality Initiative. *Am J Kidney Dis* 2001 Jan; 37(1): 179-94. Available from the [NKF Web site](#).

Print copies: Available from NKF, 30 East 33rd St., New York, NY 10016.

PATIENT RESOURCES

The following patient information is available.

- Getting the most from your treatment. What you need to know about peritoneal dialysis. New York (NY): National Kidney Foundation (NKF), 1998.
- Getting the most from your treatment. What you need to know about nutrition and peritoneal dialysis. New York (NY): NKF, 1998.

Print copies: Available from NKF, 30 East 33rd St., New York, NY 10016.

Please note: This patient information is intended to provide health professionals with information to share with their patients to help them better understand their health and their diagnosed disorders. By providing access to this patient information, it is not the intention of NGC to provide specific medical advice for particular patients. Rather we urge patients and their representatives to review this material and then to consult with a licensed health professional for evaluation of treatment options suitable for them as well as for diagnosis and answers to their personal medical questions. This patient information has been derived and prepared from a guideline for health care professionals included on NGC by the authors or publishers of that original guideline. The patient information is not reviewed by NGC to establish whether or not it accurately reflects the original guideline's content.

NGC STATUS

This summary was completed by ECRI on September 1, 2001. The information was verified by the guideline developer as of November 19, 2001.

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