Baxter

PERITONEAL DIALYSIS

PRESCRIPTION MANAGEMENT GUIDE

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INTRODUCTION

This PD Prescription Management Tool is based on currently available scientific evidence (as of 2015) and clinical practice guideline recommendations from professional societies. It is intended to be used only as a guide and not as a replacement for clinical judgment.

The original clinical practice tool (Peritoneal Dialysis Prescription Management Decision Tree, Baxter Healthcare Corporation, 1997) focused on the peritoneal dialysis prescription in terms of small solute removal to optimize clinical outcomes. These initial recommendations were based largely on observational data from the CANUSA study.[1] Two prospective randomized trials (one from Mexico, the other from Hong Kong), which evaluated the relationship between small solute clearance and clinical outcomes in patients on peritoneal dialysis, have since been published.[2-3] These studies represented a higher level of clinical evidence for use in formulating guidelines for adequacy of peritoneal dialysis. As a result, the National Kidney Foundation (NKF) of the United States (via a sponsored work group for adequacy of peritoneal dialysis) and other national work groups revised clinical practice guidelines. In general, data suggested that the minimal total solute clearance goal may be lowered and guidelines on preservation of residual kidney function (RKF) and maintenance of volume control be added.[4] This tool has been designed to guide an individualized PD prescription that reflects national guidelines and data from recent prospective randomized clinical trials.

When prescribing peritoneal dialysis, one could empirically formulate a patient's peritoneal dialysis prescription — obtain 24-hour collections of peritoneal dialysis effluent drain volume and urine volume — calculate the total solute removal (in terms of Kt/V_{urea}) — and adjust the prescription accordingly, a common approach in clinical practice. Alternatively, one could use prescription aids that would guide in formulating an individual patient's prescription (instilled volume, dwell time and number of exchanges) by predicting what the solute removal would be based on certain parameters (patient's weight, residual kidney clearance, volume of urea distribution (V_{urea}), etc.). These prescription management aids could be in the form of written material (such as this management tool) or computer-assisted programs. In both cases, these are meant to be used as a guide in prescription writing, not as a substitute for an actual determination of the patient's delivered solute removal.

This prescription management tool is for informational purposes only and should not be considered medical advice. It contains sample PD prescriptions for average patients of various cohorts with specified ranges of V_{urea}, peritoneal transport type and residual kidney function. These prescriptions are for initial and subsequent therapy, are provided for informational purposes only and should not be substituted for individual clinical judgement. The clinical tool also includes recommendations for achieving and maintaining euvolemia as well as preservation of residual kidney function. Recommendations about monitoring adequacy of therapy are also reviewed. Included in the Appendix are typical formulas and information used in calculating small solute clearance, patient assessment, types of PD regimens and a summary of other guidelines.

This information is not intended to be the practice of medicine, nor does it replace medical clinical judgment. The information published in this document is for general and educational purposes only. This information is in no way meant to be a substitute for medical treatment and may not be construed as medical advice, diagnosis or treatment.

PD ADEQUEST software is a clinical tool that organizes dialysis therapy data to facilitate clinical decision making and patient care. It is in no way intended to be a substitute for clinical practice or a patient chart.

FUNDAMENTALS OF THE PRESCRIPTION

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GETTING STARTED: PATIENT PATHWAY TO FIRST PRESCRIPTION

This guide was designed to assist clinicians through the process of individualizing a patient's prescription. Sample dialysis prescriptions are based on Volume of Urea Distribution (V_{urea}), Residual Kidney Function (RKF) and Peritoneal Membrane Type. The sample prescriptions are intended as an aid in achieving recommended clearance goals; however, other prescription options may also exist.

If a patient develops any of the following: uremic symptoms, decline in nutritional status and/or decreased measured clearances, consideration should be given to using prescription management software to create a prescription based on patient-specific parameters.

Adequacy and Ultrafiltration Goals

- The minimum delivered weekly Kt/V_{urea} of 1.7 represents peritoneal clearance alone or peritoneal plus renal clearance[4]
- While the Kidney Disease Outcomes Quality Initiative (KDOQI) guidelines do not recommend use of creatinine clearance to assess adequacy, creatinine clearance goals of 45 L/wk in APD patients are advocated by the International Society of Peritoneal Dialysis (ISPD) and other organizations[4–9]
- Euvolemia is critical to improve patient outcomes[4]
- While no recommendation regarding an ultrafiltration (UF) target exists in the United States, other countries recommend an arbitrary UF target of 750–1000 mL/day in anuric patients, based upon improved outcomes in observational studies[7, 8, 10]

Individually tailored prescriptions are essential for good prescription practices. Knowledge of Volume of Urea Distribution, Residual Kidney Function and Peritoneal Membrane Type are fundamental to the PD prescription.[11] **These three parameters are required to appropriately use this Peritoneal Dialysis Prescription Management Guide.** Assessment of these factors is described on the pages that follow.

VOLUME OF DISTRIBUTION OF UREA (V_{UREA})

A simple method for determining the volume of urea distribution is to estimate the patient's total body water (TBW). It is important to note that different equations exist for estimating total body water, and using a different equation may give different values. The anthropometric volume of distribution of urea may be calculated by one of the following formulas based on age, height, weight and gender. These are derived from estimates of total body water in healthy subjects.

WATSON AND WATSON:[12]	**Male TBW** = 2.447 - (0.09156 x age [years]) + (0.1074 x height [cm]) + (0.3362 x weight [kg])
	Female TBW = -2.097 + (0.1069 x height [cm]) + (0.2466 x weight [kg])
HUME-WEYERS:[13]	**Male TBW** = (0.194786 x height [cm]) + (0.296785 x weight [kg]) - 14.012934
	Female TBW = (0.344547 x height [cm]) + (0.183809 x weight [kg]) - 35.270121

The following tables utilize the Watson and Watson formula and were developed and have been calculated for males of three different ages and for females. Only one table is used for females because age has no effect on the equation.[12, 14]

VOLUME OF UREA DISTRIBUTION: 35-YEAR-OLD MALE*

*For every 10-year increase in age, decrease volume by 1L for males.
For every 10-year decrease in age, increase volume by 1L for males.

V < 34 L (small) | 34 L ≤ V < 42 L (medium) | V ≥ 42 L (large)

WEIGHT (KG)	HEIGHT (CM)																
	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200
36	24.1	24.6	25.2	25.7	26.3	26.8	27.3	27.9	28.4	28.9	29.5	30.0	30.6	31.1	31.6	32.2	32.7
38	24.8	25.3	25.9	26.4	26.9	27.5	28.0	28.5	29.1	29.6	30.2	30.7	31.2	31.8	32.3	32.8	33.4
40	25.5	26.0	26.5	27.1	27.6	28.1	28.7	29.2	29.7	30.3	30.8	31.4	31.9	32.4	33.0	33.5	34.0
42	26.1	26.7	27.2	27.7	28.3	28.8	29.3	29.9	30.4	31.0	31.5	32.0	32.6	33.1	33.6	34.2	34.7
44	26.8	27.3	27.9	28.4	28.9	29.5	30.0	30.6	31.1	31.6	32.2	32.7	33.2	33.8	34.3	34.9	35.4
46	27.5	28.0	28.5	29.1	29.6	30.2	30.7	31.2	31.8	32.3	32.8	33.4	33.9	34.5	35.0	35.5	36.1
48	28.1	28.7	29.2	29.8	30.3	30.8	31.4	31.9	32.4	33.0	33.5	34.0	34.6	35.1	35.7	36.2	36.7
50	28.8	29.4	29.9	30.4	31.0	31.5	32.0	32.6	33.1	33.6	34.2	34.7	35.3	35.8	36.3	36.9	37.4
52	29.5	30.0	30.6	31.1	31.6	32.2	32.7	33.2	33.8	34.3	34.9	35.4	35.9	36.5	37.0	37.5	38.1
54	30.2	30.7	31.2	31.8	32.3	32.8	33.4	33.9	34.5	35.0	35.5	36.1	36.6	37.1	37.7	38.2	38.8
56	30.8	31.4	31.9	32.4	33.0	33.5	34.1	34.6	35.1	35.7	36.2	36.7	37.3	37.8	38.3	38.9	39.4
58	31.5	32.0	32.6	33.1	33.7	34.2	34.7	35.3	35.8	36.3	36.9	37.4	37.9	38.5	39.0	39.6	40.1
60	32.2	32.7	33.3	33.8	34.3	34.9	35.4	35.9	36.5	37.0	37.5	38.1	38.6	39.2	39.7	40.2	40.8
62	32.8	33.4	33.9	34.5	35.0	35.5	36.1	36.6	37.1	37.7	38.2	38.8	39.3	39.8	40.4	40.9	41.4
64	33.5	34.1	34.6	35.1	35.7	36.2	36.7	37.3	37.8	38.4	38.9	39.4	40.0	40.5	41.0	41.6	42.1
66	34.2	34.7	35.3	35.8	36.3	36.9	37.4	38.0	38.5	39.0	39.6	40.1	40.6	41.2	41.7	42.2	42.8
68	34.9	35.4	35.9	36.5	37.0	37.6	38.1	38.6	39.2	39.7	40.2	40.8	41.3	41.8	42.4	42.9	43.5
70	35.5	36.1	36.6	37.1	37.7	38.2	38.8	39.3	39.8	40.4	40.9	41.4	42.0	42.5	43.1	43.6	44.1
72	36.2	36.7	37.3	37.8	38.4	38.9	39.4	40.0	40.5	41.0	41.6	42.1	42.7	43.2	43.7	44.3	44.8
74	36.9	37.4	38.0	38.5	39.0	39.6	40.1	40.6	41.2	41.7	42.3	42.8	43.3	43.9	44.4	44.9	45.5
76	37.6	38.1	38.6	39.2	39.7	40.2	40.8	41.3	41.9	42.4	42.9	43.5	44.0	44.5	45.1	45.6	46.1
78	38.2	38.8	39.3	39.8	40.4	40.9	41.5	42.0	42.5	43.1	43.6	44.1	44.7	45.2	45.7	46.3	46.8
80	38.9	39.4	40.0	40.5	41.0	41.6	42.1	42.7	43.2	43.7	44.3	44.8	45.3	45.9	46.4	47.0	47.5
82	39.6	40.1	40.6	41.2	41.7	42.3	42.8	43.3	43.9	44.4	44.9	45.5	46.0	46.6	47.1	47.6	48.2
84	40.2	40.8	41.3	41.9	42.4	42.9	43.5	44.0	44.5	45.1	45.6	46.2	46.7	47.2	47.8	48.3	48.8
86	40.9	41.5	42.0	42.5	43.1	43.6	44.1	44.7	45.2	45.8	46.3	46.8	47.4	47.9	48.4	49.0	49.5
88	41.6	42.1	42.7	43.2	43.7	44.3	44.8	45.3	45.9	46.4	47.0	47.5	48.0	48.6	49.1	49.6	50.2
90	42.3	42.8	43.3	43.9	44.4	44.9	45.5	46.0	46.6	47.1	47.6	48.2	48.7	49.2	49.8	50.3	50.9
92	42.9	43.5	44.0	44.5	45.1	45.6	46.2	46.7	47.2	47.8	48.3	48.8	49.4	49.9	50.5	51.0	51.5
94	43.6	44.1	44.7	45.2	45.8	46.3	46.8	47.4	47.9	48.4	49.0	49.5	50.1	50.6	51.1	51.7	52.2
96	44.3	44.8	45.4	45.9	46.4	47.0	47.5	48.0	48.6	49.1	49.6	50.2	50.7	51.3	51.8	52.3	52.9
98	45.0	45.5	46.0	46.6	47.1	47.6	48.2	48.7	49.2	49.8	50.3	50.9	51.4	51.9	52.5	53.0	53.5
100	45.6	46.2	46.7	47.2	47.8	48.3	48.8	49.4	49.9	50.5	51.0	51.5	52.1	52.6	53.1	53.7	54.2
102	46.3	46.8	47.4	47.9	48.4	49.0	49.5	50.1	50.6	51.1	51.7	52.2	52.7	53.3	53.8	54.4	54.9
104	47.0	47.5	48.0	48.6	49.1	49.7	50.2	50.7	51.3	51.8	52.3	52.9	53.4	54.0	54.5	55.0	55.6
106	47.6	48.2	48.7	49.3	49.8	50.3	50.9	51.4	51.9	52.5	53.0	53.5	54.1	54.6	55.2	55.7	56.2
108	48.3	48.9	49.4	49.9	50.5	51.0	51.5	52.1	52.6	53.1	53.7	54.2	54.8	55.3	55.8	56.4	56.9
110	49.0	49.5	50.1	50.6	51.1	51.7	52.2	52.7	53.3	53.8	54.4	54.9	55.4	56.0	56.5	57.0	57.6
112	49.7	50.2	50.7	51.3	51.8	52.3	52.9	53.4	54.0	54.5	55.0	55.6	56.1	56.6	57.2	57.7	58.3
114	50.3	50.9	51.4	51.9	52.5	53.0	53.6	54.1	54.6	55.2	55.7	56.2	56.8	57.3	57.8	58.4	58.9

V < 34 L (small) | 34 L ≤ V < 42 L (medium) | V ≥ 42 L (large)

VOLUME OF UREA DISTRIBUTION: 55-YEAR-OLD MALE*

*For every 10-year increase in age, decrease volume by 1L for males.
For every 10-year decrease in age, increase volume by 1L for males.

V < 34 L (small) | 34 L ≤ V < 42 L (medium) | V ≥ 42 L (large)

WEIGHT (KG)	HEIGHT (CM)																
	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200
36	22.2	22.7	23.3	23.8	24.4	24.9	25.4	26.0	26.5	27.0	27.6	28.1	28.6	29.2	29.7	30.3	30.8
38	22.9	23.4	24.0	24.5	25.0	25.6	26.1	26.6	27.2	27.7	28.2	28.8	29.3	29.9	30.4	30.9	31.5
40	23.5	24.1	24.6	25.2	25.7	26.2	26.8	27.3	27.8	28.4	28.9	29.5	30.0	30.5	31.1	31.6	32.1
42	24.2	24.8	25.3	25.8	26.4	26.9	27.4	28.0	28.5	29.1	29.6	30.1	30.7	31.2	31.7	32.3	32.8
44	24.9	25.4	26.0	26.5	27.0	27.6	28.1	28.7	29.2	29.7	30.3	30.8	31.3	31.9	32.4	32.9	33.5
46	25.6	26.1	26.6	27.2	27.7	28.3	28.8	29.3	29.9	30.4	30.9	31.5	32.0	32.5	33.1	33.6	34.2
48	26.2	26.8	27.3	27.8	28.4	28.9	29.5	30.0	30.5	31.1	31.6	32.1	32.7	33.2	33.8	34.3	34.8
50	26.9	27.4	28.0	28.5	29.1	29.6	30.1	30.7	31.2	31.7	32.3	32.8	33.4	33.9	34.4	35.0	35.5
52	27.6	28.1	28.7	29.2	29.7	30.3	30.8	31.3	31.9	32.4	33.0	33.5	34.0	34.6	35.1	35.6	36.2
54	28.3	28.8	29.3	29.9	30.4	30.9	31.5	32.0	32.6	33.1	33.6	34.2	34.7	35.2	35.8	36.3	36.8
56	28.9	29.5	30.0	30.5	31.1	31.6	32.2	32.7	33.2	33.8	34.3	34.8	35.4	35.9	36.4	37.0	37.5
58	29.6	30.1	30.7	31.2	31.7	32.3	32.8	33.4	33.9	34.4	35.0	35.5	36.0	36.6	37.1	37.7	38.2
60	30.3	30.8	31.3	31.9	32.4	33.0	33.5	34.0	34.6	35.1	35.6	36.2	36.7	37.3	37.8	38.3	38.9
62	30.9	31.5	32.0	32.6	33.1	33.6	34.2	34.7	35.2	35.8	36.3	36.9	37.4	37.9	38.5	39.0	39.5
64	31.6	32.2	32.7	33.2	33.8	34.3	34.8	35.4	35.9	36.5	37.0	37.5	38.1	38.6	39.1	39.7	40.2
66	32.3	32.8	33.4	33.9	34.4	35.0	35.5	36.0	36.6	37.1	37.7	38.2	38.7	39.3	39.8	40.3	40.9
68	33.0	33.5	34.0	34.6	35.1	35.6	36.2	36.7	37.3	37.8	38.3	38.9	39.4	39.9	40.5	41.0	41.6
70	33.6	34.2	34.7	35.2	35.8	36.3	36.9	37.4	37.9	38.5	39.0	39.5	40.1	40.6	41.2	41.7	42.2
72	34.3	34.8	35.4	35.9	36.5	37.0	37.5	38.1	38.6	39.1	39.7	40.2	40.8	41.3	41.8	42.4	42.9
74	35.0	35.5	36.1	36.6	37.1	37.7	38.2	38.7	39.3	39.8	40.4	40.9	41.4	42.0	42.5	43.0	43.6
76	35.7	36.2	36.7	37.3	37.8	38.3	38.9	39.4	39.9	40.5	41.0	41.6	42.1	42.6	43.2	43.7	44.2
78	36.3	36.9	37.4	37.9	38.5	39.0	39.5	40.1	40.6	41.2	41.7	42.2	42.8	43.3	43.8	44.4	44.9
80	37.0	37.5	38.1	38.6	39.1	39.7	40.2	40.8	41.3	41.8	42.4	42.9	43.4	44.0	44.5	45.1	45.6
82	37.7	38.2	38.7	39.3	39.8	40.4	40.9	41.4	42.0	42.5	43.0	43.6	44.1	44.7	45.2	45.7	46.3
84	38.3	38.9	39.4	40.0	40.5	41.0	41.6	42.1	42.6	43.2	43.7	44.2	44.8	45.3	45.9	46.4	46.9
86	39.0	39.6	40.1	40.6	41.2	41.7	42.2	42.8	43.3	43.8	44.4	44.9	45.5	46.0	46.5	47.1	47.6
88	39.7	40.2	40.8	41.3	41.8	42.4	42.9	43.4	44.0	44.5	45.1	45.6	46.1	46.7	47.2	47.7	48.3
90	40.4	40.9	41.4	42.0	42.5	43.0	43.6	44.1	44.7	45.2	45.7	46.3	46.8	47.3	47.9	48.4	49.0
92	41.0	41.6	42.1	42.6	43.2	43.7	44.3	44.8	45.3	45.9	46.4	46.9	47.5	48.0	48.5	49.1	49.6
94	41.7	42.2	42.8	43.3	43.9	44.4	44.9	45.5	46.0	46.5	47.1	47.6	48.1	48.7	49.2	49.8	50.3
96	42.4	42.9	43.5	44.0	44.5	45.1	45.6	46.1	46.7	47.2	47.7	48.3	48.8	49.4	49.9	50.4	51.0
98	43.0	43.6	44.1	44.7	45.2	45.7	46.3	46.8	47.3	47.9	48.4	49.0	49.5	50.0	50.6	51.1	51.6
100	43.7	44.3	44.8	45.3	45.9	46.4	46.9	47.5	48.0	48.6	49.1	49.6	50.2	50.7	51.2	51.8	52.3
102	44.4	44.9	45.5	46.0	46.5	47.1	47.6	48.2	48.7	49.2	49.8	50.3	50.8	51.4	51.9	52.4	53.0
104	45.1	45.6	46.1	46.7	47.2	47.8	48.3	48.8	49.4	49.9	50.4	51.0	51.5	52.0	52.6	53.1	53.7
106	45.7	46.3	46.8	47.3	47.9	48.4	49.0	49.5	50.0	50.6	51.1	51.6	52.2	52.7	53.3	53.8	54.3
108	46.4	46.9	47.5	48.0	48.6	49.1	49.6	50.2	50.7	51.2	51.8	52.3	52.9	53.4	53.9	54.5	55.0
110	47.1	47.6	48.2	48.7	49.2	49.8	50.3	50.8	51.4	51.9	52.5	53.0	53.5	54.1	54.6	55.1	55.7
112	47.8	48.3	48.8	49.4	49.9	50.4	51.0	51.5	52.1	52.6	53.1	53.7	54.2	54.7	55.3	55.8	56.3
114	48.4	49.0	49.5	50.0	50.6	51.1	51.7	52.2	52.7	53.3	53.8	54.3	54.9	55.4	55.9	56.5	57.0

V < 34 L (small) | 34 L ≤ V < 42 L (medium) | V ≥ 42 L (large)

VOLUME OF UREA DISTRIBUTION: 75-YEAR-OLD MALE*

*For every 10-year increase in age, decrease volume by 1L for males.
For every 10-year decrease in age, increase volume by 1L for males.

V < 34 L (small) | 34 L ≤ V < 42 L (medium) | V ≥ 42 L (large)

WEIGHT (KG)	HEIGHT (CM)																
	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200
36	20.3	20.8	21.4	21.9	22.4	23.0	23.5	24.1	24.6	25.1	25.7	26.2	26.7	27.3	27.8	28.4	28.9
38	21.0	21.5	22.0	22.6	23.1	23.7	24.2	24.7	25.3	25.8	26.3	26.9	27.4	28.0	28.5	29.0	29.6
40	21.6	22.2	22.7	23.3	23.8	24.3	24.9	25.4	25.9	26.5	27.0	27.6	28.1	28.6	29.2	29.7	30.2
42	22.3	22.9	23.4	23.9	24.5	25.0	25.5	26.1	26.6	27.2	27.7	28.2	28.8	29.3	29.8	30.4	30.9
44	23.0	23.5	24.1	24.6	25.1	25.7	26.2	26.7	27.3	27.8	28.4	28.9	29.4	30.0	30.5	31.0	31.6
46	23.7	24.2	24.7	25.3	25.8	26.3	26.9	27.4	28.0	28.5	29.0	29.6	30.1	30.6	31.2	31.7	32.3
48	24.3	24.9	25.4	25.9	26.5	27.0	27.6	28.1	28.6	29.2	29.7	30.2	30.8	31.3	31.9	32.4	32.9
50	25.0	25.5	26.1	26.6	27.2	27.7	28.2	28.8	29.3	29.8	30.4	30.9	31.5	32.0	32.5	33.1	33.6
52	25.7	26.2	26.8	27.3	27.8	28.4	28.9	29.4	30.0	30.5	31.1	31.6	32.1	32.7	33.2	33.7	34.3
54	26.4	26.9	27.4	28.0	28.5	29.0	29.6	30.1	30.6	31.2	31.7	32.3	32.8	33.3	33.9	34.4	34.9
56	27.0	27.6	28.1	28.6	29.2	29.7	30.2	30.8	31.3	31.9	32.4	32.9	33.5	34.0	34.5	35.1	35.6
58	27.7	28.2	28.8	29.3	29.8	30.4	30.9	31.5	32.0	32.5	33.1	33.6	34.1	34.7	35.2	35.8	36.3
60	28.4	28.9	29.4	30.0	30.5	31.1	31.6	32.1	32.7	33.2	33.7	34.3	34.8	35.4	35.9	36.4	37.0
62	29.0	29.6	30.1	30.7	31.2	31.7	32.3	32.8	33.3	33.9	34.4	34.9	35.5	36.0	36.6	37.1	37.6
64	29.7	30.3	30.8	31.3	31.9	32.4	32.9	33.5	34.0	34.5	35.1	35.6	36.2	36.7	37.2	37.8	38.3
66	30.4	30.9	31.5	32.0	32.5	33.1	33.6	34.1	34.7	35.2	35.8	36.3	36.8	37.4	37.9	38.4	39.0
68	31.1	31.6	32.1	32.7	33.2	33.7	34.3	34.8	35.4	35.9	36.4	37.0	37.5	38.0	38.6	39.1	39.7
70	31.7	32.3	32.8	33.3	33.9	34.4	35.0	35.5	36.0	36.6	37.1	37.6	38.2	38.7	39.3	39.8	40.3
72	32.4	32.9	33.5	34.0	34.6	35.1	35.6	36.2	36.7	37.2	37.8	38.3	38.8	39.4	39.9	40.5	41.0
74	33.1	33.6	34.2	34.7	35.2	35.8	36.3	36.8	37.4	37.9	38.4	39.0	39.5	40.1	40.6	41.1	41.7
76	33.7	34.3	34.8	35.4	35.9	36.4	37.0	37.5	38.0	38.6	39.1	39.7	40.2	40.7	41.3	41.8	42.3
78	34.4	35.0	35.5	36.0	36.6	37.1	37.6	38.2	38.7	39.3	39.8	40.3	40.9	41.4	41.9	42.5	43.0
80	35.1	35.6	36.2	36.7	37.2	37.8	38.3	38.9	39.4	39.9	40.5	41.0	41.5	42.1	42.6	43.1	43.7
82	35.8	36.3	36.8	37.4	37.9	38.5	39.0	39.5	40.1	40.6	41.1	41.7	42.2	42.7	43.3	43.8	44.4
84	36.4	37.0	37.5	38.0	38.6	39.1	39.7	40.2	40.7	41.3	41.8	42.3	42.9	43.4	44.0	44.5	45.0
86	37.1	37.6	38.2	38.7	39.3	39.8	40.3	40.9	41.4	41.9	42.5	43.0	43.6	44.1	44.6	45.2	45.7
88	37.8	38.3	38.9	39.4	39.9	40.5	41.0	41.5	42.1	42.6	43.2	43.7	44.2	44.8	45.3	45.8	46.4
90	38.5	39.0	39.5	40.1	40.6	41.1	41.7	42.2	42.8	43.3	43.8	44.4	44.9	45.4	46.0	46.5	47.0
92	39.1	39.7	40.2	40.7	41.3	41.8	42.4	42.9	43.4	44.0	44.5	45.0	45.6	46.1	46.6	47.2	47.7
94	39.8	40.3	40.9	41.4	41.9	42.5	43.0	43.6	44.1	44.6	45.2	45.7	46.2	46.8	47.3	47.9	48.4
96	40.5	41.0	41.5	42.1	42.6	43.2	43.7	44.2	44.8	45.3	45.8	46.4	46.9	47.5	48.0	48.5	49.1
98	41.1	41.7	42.2	42.8	43.3	43.8	44.4	44.9	45.4	46.0	46.5	47.1	47.6	48.1	48.7	49.2	49.7
100	41.8	42.4	42.9	43.4	44.0	44.5	45.0	45.6	46.1	46.7	47.2	47.7	48.3	48.8	49.3	49.9	50.4
102	42.5	43.0	43.6	44.1	44.6	45.2	45.7	46.2	46.8	47.3	47.9	48.4	48.9	49.5	50.0	50.5	51.1
104	43.2	43.7	44.2	44.8	45.3	45.8	46.4	46.9	47.5	48.0	48.5	49.1	49.6	50.1	50.7	51.2	51.8
106	43.8	44.4	44.9	45.4	46.0	46.5	47.1	47.6	48.1	48.7	49.2	49.7	50.3	50.8	51.4	51.9	52.4
108	44.5	45.0	45.6	46.1	46.7	47.2	47.7	48.3	48.8	49.3	49.9	50.4	51.0	51.5	52.0	52.6	53.1
110	45.2	45.7	46.3	46.8	47.3	47.9	48.4	48.9	49.5	50.0	50.6	51.1	51.6	52.2	52.7	53.2	53.8
112	45.9	46.4	46.9	47.5	48.0	48.5	49.1	49.6	50.1	50.7	51.2	51.8	52.3	52.8	53.4	53.9	54.4
114	46.5	47.1	47.6	48.1	48.7	49.2	49.7	50.3	50.8	51.4	51.9	52.4	53.0	53.5	54.0	54.6	55.1

V < 34 L (small) | 34 L ≤ V < 42 L (medium) | V ≥ 42 L (large)

VOLUME OF UREA DISTRIBUTION: FEMALE

V < 34 L (small) | 34 L ≤ V < 42 L (medium) | V ≥ 42 L (large)

WEIGHT (KG)	HEIGHT (CM)																
	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200
36	19.6	20.1	20.7	21.2	21.7	22.3	22.8	23.4	23.9	24.4	25.0	25.5	26.0	26.6	27.1	27.6	28.2
38	20.1	20.6	21.2	21.7	22.2	22.8	23.3	23.8	24.4	24.9	25.4	26.0	26.5	27.1	27.6	28.1	28.7
40	20.6	21.1	21.7	22.2	22.7	23.3	23.8	24.3	24.9	25.4	25.9	26.5	27.0	27.5	28.1	28.6	29.1
42	21.1	21.6	22.2	22.7	23.2	23.8	24.3	24.8	25.4	25.9	26.4	27.0	27.5	28.0	28.6	29.1	29.6
44	21.6	22.1	22.7	23.2	23.7	24.3	24.8	25.3	25.9	26.4	26.9	27.5	28.0	28.5	29.1	29.6	30.1
46	22.1	22.6	23.1	23.7	24.2	24.7	25.3	25.8	26.4	26.9	27.4	28.0	28.5	29.0	29.6	30.1	30.6
48	22.6	23.1	23.6	24.2	24.7	25.2	25.8	26.3	26.8	27.4	27.9	28.4	29.0	29.5	30.1	30.6	31.1
50	23.1	23.6	24.1	24.7	25.2	25.7	26.3	26.8	27.3	27.9	28.4	28.9	29.5	30.0	30.5	31.1	31.6
52	23.6	24.1	24.6	25.2	25.7	26.2	26.8	27.3	27.8	28.4	28.9	29.4	30.0	30.5	31.0	31.6	32.1
54	24.0	24.6	25.1	25.7	26.2	26.7	27.3	27.8	28.3	28.9	29.4	29.9	30.5	31.0	31.5	32.1	32.6
56	24.5	25.1	25.6	26.1	26.7	27.2	27.7	28.3	28.8	29.4	29.9	30.4	31.0	31.5	32.0	32.6	33.1
58	25.0	25.6	26.1	26.6	27.2	27.7	28.2	28.8	29.3	29.8	30.4	30.9	31.4	32.0	32.5	33.1	33.6
60	25.5	26.1	26.6	27.1	27.7	28.2	28.7	29.3	29.8	30.3	30.9	31.4	31.9	32.5	33.0	33.5	34.1
62	26.0	26.6	27.1	27.6	28.2	28.7	29.2	29.8	30.3	30.8	31.4	31.9	32.4	33.0	33.5	34.0	34.6
64	26.5	27.0	27.6	28.1	28.7	29.2	29.7	30.3	30.8	31.3	31.9	32.4	32.9	33.5	34.0	34.5	35.1
66	27.0	27.5	28.1	28.6	29.1	29.7	30.2	30.7	31.3	31.8	32.4	32.9	33.4	34.0	34.5	35.0	35.6
68	27.5	28.0	28.6	29.1	29.6	30.2	30.7	31.2	31.8	32.3	32.8	33.4	33.9	34.4	35.0	35.5	36.1
70	28.0	28.5	29.1	29.6	30.1	30.7	31.2	31.7	32.3	32.8	33.3	33.9	34.4	34.9	35.5	36.0	36.5
72	28.5	29.0	29.6	30.1	30.6	31.2	31.7	32.2	32.8	33.3	33.8	34.4	34.9	35.4	36.0	36.5	37.0
74	29.0	29.5	30.0	30.6	31.1	31.7	32.2	32.7	33.3	33.8	34.3	34.9	35.4	35.9	36.5	37.0	37.5
76	29.5	30.0	30.5	31.1	31.6	32.1	32.7	33.2	33.7	34.3	34.8	35.4	35.9	36.4	37.0	37.5	38.0
78	30.0	30.5	31.0	31.6	32.1	32.6	33.2	33.7	34.2	34.8	35.3	35.8	36.4	36.9	37.4	38.0	38.5
80	30.5	31.0	31.5	32.1	32.6	33.1	33.7	34.2	34.7	35.3	35.8	36.3	36.9	37.4	37.9	38.5	39.0
82	31.0	31.5	32.0	32.6	33.1	33.6	34.2	34.7	35.2	35.8	36.3	36.8	37.4	37.9	38.4	39.0	39.5
84	31.4	32.0	32.5	33.0	33.6	34.1	34.7	35.2	35.7	36.3	36.8	37.3	37.9	38.4	38.9	39.5	40.0
86	31.9	32.5	33.0	33.5	34.1	34.6	35.1	35.7	36.2	36.7	37.3	37.8	38.4	38.9	39.4	40.0	40.5
88	32.4	33.0	33.5	34.0	34.6	35.1	35.6	36.2	36.7	37.2	37.8	38.3	38.8	39.4	39.9	40.4	41.0
90	32.9	33.5	34.0	34.5	35.1	35.6	36.1	36.7	37.2	37.7	38.3	38.8	39.3	39.9	40.4	40.9	41.5
92	33.4	34.0	34.5	35.0	35.6	36.1	36.6	37.2	37.7	38.2	38.8	39.3	39.8	40.4	40.9	41.4	42.0
94	33.9	34.4	35.0	35.5	36.0	36.6	37.1	37.7	38.2	38.7	39.3	39.8	40.3	40.9	41.4	41.9	42.5
96	34.4	34.9	35.5	36.0	36.5	37.1	37.6	38.1	38.7	39.2	39.7	40.3	40.8	41.4	41.9	42.4	43.0
98	34.9	35.4	36.0	36.5	37.0	37.6	38.1	38.6	39.2	39.7	40.2	40.8	41.3	41.8	42.4	42.9	43.4
100	35.4	35.9	36.5	37.0	37.5	38.1	38.6	39.1	39.7	40.2	40.7	41.3	41.8	42.3	42.9	43.4	43.9
102	35.9	36.4	37.0	37.5	38.0	38.6	39.1	39.6	40.2	40.7	41.2	41.8	42.3	42.8	43.4	43.9	44.4
104	36.4	36.9	37.4	38.0	38.5	39.0	39.6	40.1	40.7	41.2	41.7	42.3	42.8	43.3	43.9	44.4	44.9
106	36.9	37.4	37.9	38.5	39.0	39.5	40.1	40.6	41.1	41.7	42.2	42.8	43.3	43.8	44.4	44.9	45.4
108	37.4	37.9	38.4	39.0	39.5	40.0	40.6	41.1	41.6	42.2	42.7	43.2	43.8	44.3	44.8	45.4	45.9
110	37.9	38.4	38.9	39.5	40.0	40.5	41.1	41.6	42.1	42.7	43.2	43.7	44.3	44.8	45.3	45.9	46.4
112	38.4	38.9	39.4	40.0	40.5	41.0	41.6	42.1	42.6	43.2	43.7	44.2	44.8	45.3	45.8	46.4	46.9
114	38.8	39.4	39.9	40.4	41.0	41.5	42.1	42.6	43.1	43.7	44.2	44.7	45.3	45.8	46.3	46.9	47.4

V < 34 L (small) | 34 L ≤ V < 42 L (medium) | V ≥ 42 L (large)

RESIDUAL KIDNEY FUNCTION

Residual kidney function contributes significantly to small solute, middle molecule clearances and adequacy of dialysis.[15] Preservation of residual kidney function is associated with better survival.[4,22] When the CANUSA data was reanalyzed, it became evident that it was kidney clearance and urinary volume that predicted survival in PD and not peritoneal clearance. Each 250-mL increase in daily urine volume was associated with a 36% lower relative risk (RR) of death, and every 0.5 mL/min/1.73m^2 increment in residual GFR decreased the risk of mortality by 12%.[16]

Benefits of RKF include:

- Enhanced total solute clearance[15]
- Removal of sodium and water, facilitating easier volume management[17]
- Middle molecule clearance including beta-2-microglobulin[15]
- Improved phosphate control[18]
- Improved blood pressure control[19]
- Lower prevalence of left ventricular hypertrophy (LVH)[20]
- Better nutritional status[21]
- Unrecognized systemic metabolic effects[15]

It is important to monitor patients for loss of RKF and make adjustments to prescription if necessary.

Residual creatinine clearance overestimates the glomerular filtration rate (GFR) because of tubular secretion of creatinine. Conversely, urea clearance (C_{urea}) underestimates GFR because of tubular urea reabsorption. Therefore, when calculating the weekly creatinine clearance (C_{cr}), it is recommended that the average of the two be used. When calculating the renal contribution to Kt/V_{urea}, the more conservative approach of using the actual urea clearance is recommended.[11]

CREATININE CLEARANCE ML/MIN[23] =

$$\frac{\text{Urine Creatinine Concentration (mg/dL) x Volume of 24-Hr Urine (mL/day)}}{\text{Plasma Creatinine Concentration (mg/dL) x 1440 (min/day)}}$$

UREA CLEARANCE ML/MIN[23] =

$$\frac{\text{Urine Urea Nitrogen Concentration (mg/dL) x Volume of 24-Hr Urine (mL/day)}}{\text{Plasma Urea Nitrogen Concentration (mg/dL) x 1440 (min/day)}}$$

RESIDUAL GFR ML/MIN[11] =

$$\frac{\text{Residual } C_{Cr} \text{ (mL/min)} + \text{Residual } C_{urea} \text{ (mL/min)}}{2}$$

Estimated GFR measurements by either the Modification of Diet in Renal Disease (MDRD) or the Cockroft-Gault formulas are useful adjuncts for assessing the contribution of RKF in patients on dialysis. However, both formulas lack accuracy in precise determination.[24]

PERITONEAL MEMBRANE TYPE

Peritoneal Membrane Type is important to consider when individualizing patient prescriptions. The Peritoneal Equilibration Test (PET) is used to define the membrane transport characteristics. Four different membrane types are identified based upon the 4-hour equilibration between dialysate (D) and plasma (P) creatinine and glucose, as shown below.[25]

Standardized PET Procedure[25]

- In preparation for PET, an overnight dwell of 3-12 hours is required[25,26]
- Drain pretest exchange completely
- Infuse 2.5% dextrose solution 2L bag
- Dialysis samples are taken after 0, 2 and 4 hours and analyzed for creatinine and glucose*/**
- A serum sample is taken after 2 hours and analyzed for creatinine and glucose*
- After a 4-hour dwell time, the dialysate is drained and total volume measured
- Based on results, the patient's D/P for creatinine and D/D0 for glucose are calculated

The patient's 4-hour D/P will classify the patient as a high, high-average, low-average or low transporter.

* Prescription management software may require serum and peritoneal dialysate urea measurement.
** If nonenzymatic method (i.e., picric acid assay) is used for analysis of creatinine, be sure to use correction factor to accurately estimate creatinine value.

PET CALCULATIONS[25]

D/P CREATININE =

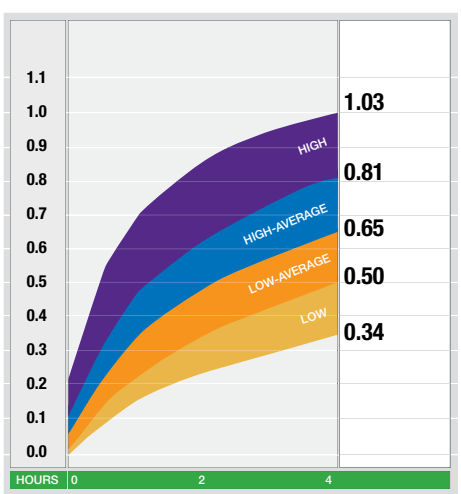
$$\frac{\text{***Corrected Dialysate Creatinine Concentration at 0-hr, 2-hr, 4-hr Dwell}}{\text{Plasma Creatinine Concentration at 2-hr Dwell}}$$

D/D_0 GLUCOSE =

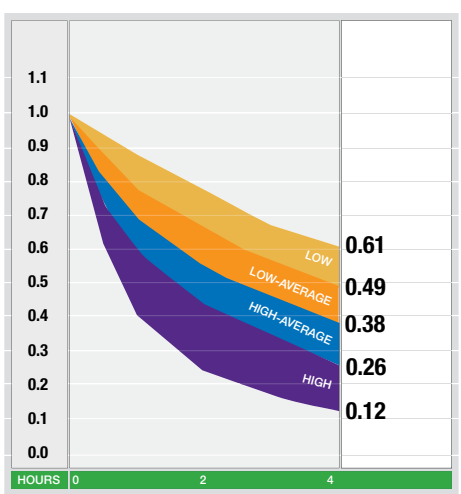
$$\frac{\text{Dialysate Glucose Concentration at 2-hr and 4-hr Dwell}}{\text{Dialysate Glucose Concentration at 0-hr Dwell}}$$

*** A correction is required as glucose interferes with nonenzymatic methods (i.e., picric acid assay) for creatinine measurement.

D/P Creatinine



D/D_0 Glucose



Membrane Transport Type	4-hour D/P Creatinine
HIGH	0.82 - 1.03
HIGH-AVERAGE	0.65 - 0.81
LOW-AVERAGE	0.50 - 0.64
LOW	0.34 - 0.49

If discordance in D/P creatinine and D/D_0 glucose is noted, it is recommended to repeat the PET. Clinical assessment must be taken into account if results remain discordant.[25]

Permission to use chart: Twardowski ZJ, Clinical Value of Standardized Equilibration Test in CAPD Patients, Current Concepts of CAPD, Blood Purif 1989;7:95-108.

THE STANDARD PERITONEAL EQUILIBRATION TEST[25]

- Solute removal can be enhanced with adjustment in dwell time
- The PET should be performed 4–8 weeks after initiating peritoneal dialysis[4]
- The PET should be deferred at least 4 weeks after resolution of a peritonitis episode[4]

MEMBRANE TRANSPORT TYPE	SOLUTE TRANSPORT	UF IN 4 HOURS
HIGH	Fast+	Poor
HIGH-AVERAGE	Moderately Fast	Fair
LOW-AVERAGE	Moderately Slow	Good to Very Good
LOW	Slow	Very Good

\+ At 4 hours, shortened dwell times enhance solute removal in patients with high transport/equilibration ratios.

THE MODIFIED PET (4.25%)

- The 4.25% PET provides information about ultrafiltration and allows assessment of free water transport (aquaporin function)[27, 28]
- There is good correlation between respective D/P creatinine and D/P urea results obtained with either the 4.25% PET and the 2.5% PET[28]
- This PET utilizes a 4.25% dextrose solution instead of a 2.5% and is procedurally similar to the standard PET[28]
- Additional testing of peritoneal fluid and serum sodium is required
- Some experts have recommended that clinicians perform the 4.25% PET instead of a 2.5% PET to guide prescriptions[28]; **however, current prescription software has not been validated for a 4.25% PET. PD ADEQUEST software will do PET simulations for tests done with fill volumes outside of 1.5L, 2.5L and 3.0L or dextrose 1.5% or 4.25%**
- The 4.25% PET is a useful aid in evaluation of ultrafiltration failure[27, 28]

Please note: It is recommended that you use 2.5% dextrose, as the software is validated with 2.5% dextrose.[29] If at a later date you need to work a patient up for UF failure, you can perform a 4.25% PET and compare to the 2.5% PET. Data has shown that D/P creatinine with 2.5% correlates with 4.25% PET. There is an expected difference in drain volumes between the two tests.[28]

THE PROCESS TO DEVELOP AN INITIAL PRESCRIPTION

2

"...individualizing the prescription may help long-term PD therapy management."

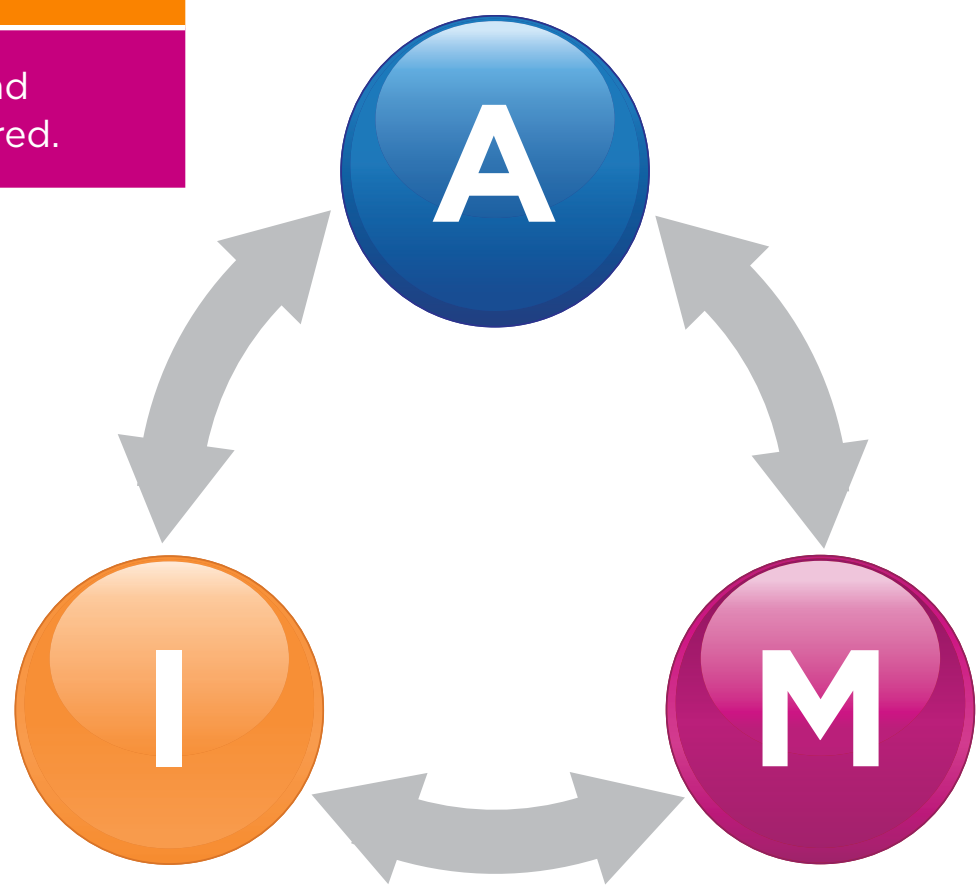
"The challenge to the individual practitioner is to make prescription management an integral part of everyday patient management."

Ad Hoc Committee on PD Adequacy[30]

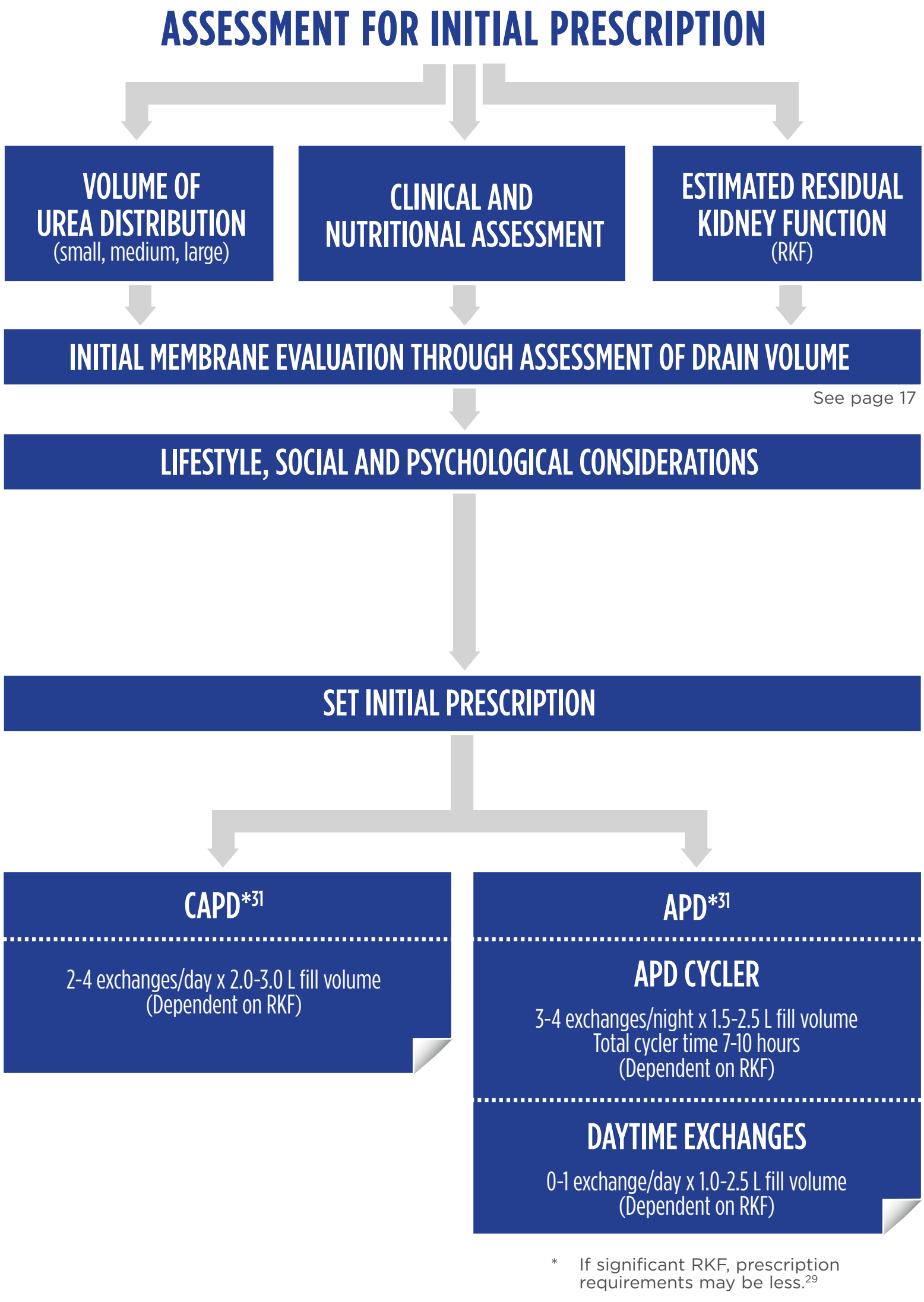
OVERVIEW OF THE PRESCRIPTION MANAGEMENT PROCESS

The key to Prescription Management is to AIM for Adquacy

A	**Assess** for initial prescription.
I	**Individualize** the prescription based on V_{urea}, RKF, Peritoneal Membrane Type.
M	**Monitor** the patient regularly and adjust the prescription as required.



ASSESSMENT FOR INITIAL PRESCRIPTION



See page 17

* If significant RKF, prescription requirements may be less.[29]

PRELIMINARY ASSESSMENT OF DRAIN VOLUME

Careful assessment of patient parameters during the training period is essential. Volume of urea distribution and residual kidney function can easily be determined; however, accurate assessment of peritoneal transport type is more difficult due to inflammatory changes that may occur during the first month.* Therefore, during training, careful assessment of drain volumes following a 4-hour dwell using 2.5% dextrose and 2.0 L fill volume can help in estimating transport properties.[4]

Unless a preliminary PET is performed, the initial prescription should be based on assumptions of average membrane type. Initial membrane assessment and ultrafiltration response to dextrose: Use 2.5% dextrose, 2.0 L fill volume and at **4 hours**, assess drain volume to crudely estimate membrane transport type.[32]

MEMBRANE TRANSPORT TYPE	DRAIN VOLUME*
HIGH	1580-2084 mL
HIGH-AVERAGE	2085-2367 mL
LOW-AVERAGE	2369-2650 mL
LOW	2651-3326 mL

* Mean for all transport types is 2368 mL

Note: In diabetic patients with high serum glucose levels (>300 mg/dL), the results of the drain volume are not useful for patient categorization and inconsistent with creatinine values.[32]

SUGGESTED TIMETABLE FOR INITIAL AND SUBSEQUENT CLEARANCE MEASUREMENTS[4]

The following table is meant as a guide for assessing adequacy of the PD prescription based upon KDOQI recommendations. Depending on patient status, more frequent monitoring may be necessary with subsequent prescription adjustment.

The PET may be repeated if any or all of the following occur:

- Unexplained decrease in drain volume
- Persistent fluid overload/increase in BP
- Decrease in peritoneal solute clearance
- Increased need for hypertonic exchanges despite fluid/sodium restriction
- Unexplained uremic symptoms

* Recommend modified PET with 4.25% dextrose as follow-up

MEASUREMENT	FREQUENCY
Peritoneal Kt/V_{urea}	Baseline within first month, then every 4 months (or as needed if clinical change warrants)
Renal Kt/V_{urea} (only if urine volume is >100 mL/day and residual kidney clearance is being considered as part of the patient's total weekly solute clearance goal)	Baseline at first month, then every 2 months (or sooner if clinical change warrants)
PET	Baseline at 4–8 weeks (then as needed if clinical change warrants)*

INDIVIDUALIZING THE THERAPY

3

INDIVIDUALIZING THE THERAPY

PD therapy should be based upon patient lifestyle choices, Kt/V_{urea} (peritoneal and renal) and clinical status. The following pages provide suggested means to achieve clearance and UF targets through sample PD prescriptions based on individual patient membrane transport type, volume of urea distribution and RKF.

Achieving Minimum Recommended Small Solute Clearances[30]

- The proposed prescriptions will not achieve minimum delivered weekly dialysis clearance goals (Kt/V_{urea} or creatinine clearance*) for all patients. **The peritoneal and kidney clearances must be monitored regularly and the dialysis prescription adjusted using the principles outlined to try to achieve goals. If adequate dialysis cannot be achieved with reasonable alteration in prescription, transfer to HD may be necessary**
- Patients with higher V_{urea} may require a larger fill volume per exchange to enhance clearances (and UF)
- Patients with higher D/P_{Cr}, in general, require an increased number of exchanges
- Anuric APD patients often require an extra daytime exchange to achieve minimum delivered weekly Kt/V_{urea} goal and maintain an ideal dry weight. This exchange can either be performed manually or by connecting to the cycler

* Creatinine clearance used in countries outside of the U.S.[6-9]

	L (D/P < 0.5)	LA (D/P 0.5-0.65)	HA (D/P 0.65-0.81)	H (D/P > 0.81)
Small (V_{urea} < 34L)				
Medium (34L ≤ V_{urea} < 42L)				
Large (V_{urea} ≥ 41L)				

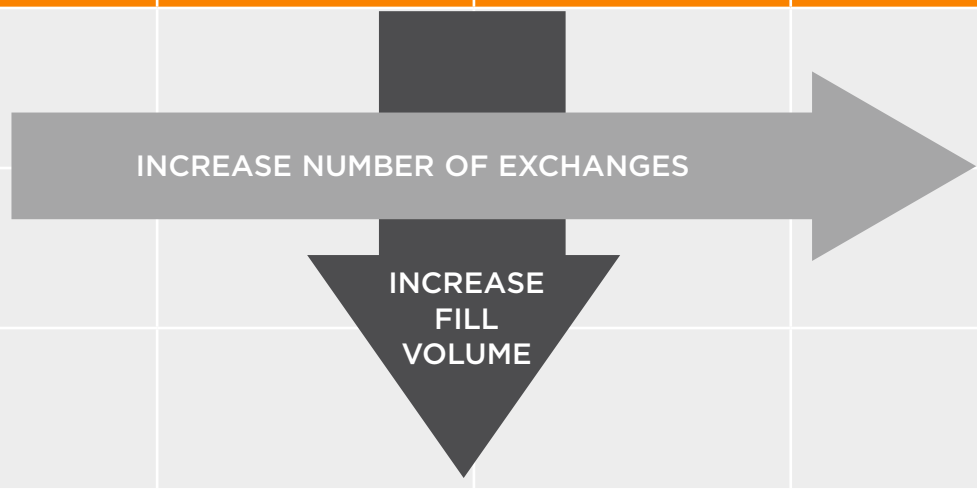


Figure illustrates the need to augment the number of exchanges as D/P creatinine increases and to increase fill volume with increase in V_{urea}.

Achieving Ultrafiltration Targets

- It is critical to maintain euvolemia in dialysis patients without damaging RKF by too rapid ultrafiltration
- While no recommendation regarding UF target exists in the United States, other countries suggest a UF of 750-1000 mL/day in observational studies[6–10]
- Shortening dwell times can result in increased ultrafiltration, especially in patients with high transport characteristics
- Higher glucose concentrations can be used in order to achieve the desired UF target. Clinicians need to be cognizant of the potential negative consequences of glucose exposure on metabolic control and long-term peritoneal membrane function[33]
- In high average and high transporters, EXTRANEAL (icodextrin) PD Solution may be preferred to improve (compared to 4.25% dextrose) UF (and clearance) in the long dwell[34]
- While there is no prospective randomized trial determining what UF targets should be, all work groups suggest that normalization of blood pressure and maintenance of euvolemia are important[4–9]

THERAPY OPTIMIZATION[4]

These sample prescriptions are provided for informational purposes to achieve a minimum Kt/V_{urea} of 1.7. However, some patients may not meet the stated clearances. If measured clearance is less than predicted, it is recommended to ensure that the 24-hour dialysate and urine collections were done properly prior to instituting a change in prescriptions. Listed below are general guidelines to increase clearance if desired goals are not achieved.

CAPD

- Increase fill volume[35, 36]
- For patients without residual kidney function, large V_{urea} and/or high transport type, a fifth exchange may be required (monitor for compliance and quality of life)[4]
- If a sixth exchange is required, consider APD therapy with daytime exchanges

APD

- Increase fill volume[35, 36]
- Increase duration on cycler therapy (time and/or nighttime exchange number)[4]
- Add a daytime exchange[4]
- APD patients with significant RKF may not require a long day dwell[4]
- Anuric APD patients require “wet” days[4]
- High-transport patients usually require EXTRANEAL (icodextrin) PD Solution or two short daytime exchanges to sustain UF[31]

Please see Indications and Important Risk Information, including Boxed Warning for EXTRANEAL (icodextrin) PD Solution on page 43. See www.baxterpi.com for Full Prescribing Information.

INDIVIDUALIZING THE THERAPY

CLINICAL REVIEW VISIT

EVALUATE THE ADEQUACY OF THE PRESCRIPTION FOR THE PATIENT

CLINICAL ASSESSMENT	LABORATORY ASSESSMENT	MEMBRANE ASSESSMENT	SMALL SOLUTE CLEARANCE	FLUID REMOVAL AND VOLUME STATUS
– Comorbid disease – Nausea, vomiting, fatigue – Nutritional assessment: appetite, signs of protein energy malnutrition – Exit site examination – Quality of Life (social, psychological, professional, vitality, physical performance quality of sleep) – Medication review	Urea Creatinine K, Na, Cl Bicarbonate Hgb Ca-P Albumin Ferritin Lipids Glycemic control	PET – at first review and then as indicated	Kt/V Creatinine Clearance	– Presence of edema – BP and weight – Residual Kidney Function – Salt and Fluid intake – Treatment records (UF and PD solutions used, incl. dextrose%) – Compliance – Check catheter function – Check deliveries records

KT/V ≥ 1.7 ADEQUATE FLUID STATUS

CLINICAL ASSESSMENT SATISFACTORY

CONTINUE SAME TREATMENT PRESCRIPTION

KT/V < 1.7 ADEQUATE FLUID STATUS

CLINICAL ASSESSMENT SUGGESTS INADEQUATE SMALL SOLUTE CLEARANCE (EVEN IF KT/V > 1.7)

ADJUST PRESCRIPTION TO INCREASE SMALL SOLUTE CLEARANCE – SEE GUIDE PAGE 29

KT/V < 1.7 FLUID OVERLOAD

INADEQUATE UF IN LONG DWELLS

USE EXTRANEAL (ICODEXTRIN) PD SOLUTION

SHORTEN DWELL TIME IF DEXTROSE USED

INCREASE DEXTROSE CONCENTRATION

KT/V > 1.7 FLUID OVERLOAD

ASSESS FOR UREMIC SIGNS/SYMPTOMS OR MALNUTRITION

INADEQUATE UF IN SHORT DWELLS

CAPD	APD
– Consider APD – Increase number of exchanges – Increase fill volume	– Shorten dwells – Increase number of cycles – Increase total therapy time – Increase fill volume – Increase dextrose concentration

ASSUMPTIONS ON WHICH MODELING IS BASED

Data from 1,006 randomly selected adult PD patients from 39 U.S. centers were analyzed and used to group patients according to their peritoneal membrane transport characteristics and V_{urea}. Based on four PET classifications and three V_{urea} categories, modeling was performed on PD ADEQUEST software to obtain prescriptions that would meet or exceed minimum adequacy and UF goals.[31]

Clearance goals have been subject to multiple revisions. The sample prescriptions provided in this guide were designed to achieve a minimum weekly delivered Kt/V of 1.7 and to minimize patient burden. The sample prescriptions must not be considered medical advice and are not a substitute for clinical judgement.[31]

Minimal Delivered Weekly Clearance Goal: Kt/V ≥ 1.7[31]

Continuous Therapy: Fluid in peritoneal cavity seven days/week[31]

Ultrafiltration: ≥ 1.0 L/day. Adjustment of dialysis solutions including dextrose and EXTRANEAL (icodextrin) PD Solution to meet the patient's UF requirement is necessary. UF plays an important role in obtaining clearance. Increasing or decreasing UF also impacts clearance[31]

Residual Kidney Function: For patients with ≥ 2 mL/min of RKF, prescriptions are based on kidney urea clearance[31]

CAPD: 8-hour overnight exchange[31]

APD: 9-hour cycler time[31, 37]

A glucose-sparing strategy, using 1.5% and 2.5% dextrose solutions, was applied in modeling. Under these modeling assumptions, use of 4.25% was therefore precluded. However, 4.25% dextrose solutions can be used in situations of fluid overload[31]

Please note: The following tables contain sample prescriptions based on patient categories. These are provided for informational purposes only and should not be considered medical advice nor should they be substituted for individual clinical judgement.

It is important that you obtain a 24-hour urine and dialysate collection so that the delivered dose is at your goal and adjust the prescription accordingly. If one were to model the prescription, there would be many other prescription options you may want to consider.

Important Risk Information: Peritoneal dialysis may affect a patient's protein, water-soluble vitamin, potassium, sodium, chloride, bicarbonate, and magnesium levels and volume status. Monitor electrolytes and blood chemistry periodically.

SUGGESTED PRESCRIPTIONS FOR PATIENTS WITH RESIDUAL KIDNEY UREA CLEARANCE < 2 ML/MIN*[29]

Kinetic modeling was performed using PD ADEQUEST software to create the tables below. Recommended dialysis prescriptions are intended to achieve a desired Kt/V_{urea} of 1.7 and a minimum ultrafiltration of 1000 mL/day. To illustrate that modeling can be designed around additional targeted objectives, use of 4.25% dextrose was omitted in these examples to avoid excessive glucose exposure. Only PD solutions containing dextrose concentrations of 1.5% and 2.5% were used in the modeling process while additional prescriptions were created using EXTRANEAL (icodextrin) PD Solution in the long dwell. An extra daytime exchange (in addition to the last bag fill) was also included in selected situations to help augment clearance and ultrafiltration results for motivated patients as needed. Nine hour overnight treatments periods were considered for the APD prescriptions.

Irrespective of modeling, clinical judgment must always be employed in order to create individualized prescriptions that meet patients' specific urea clearance, ultrafiltration, medical and lifestyle needs.

- 1.5%/2.5% dextrose dialysis solutions
- 2.5% dextrose dialysis solutions
- EXTRANEAL (icodextrin) PD Solution used in the long dwell period

	LOW TRANSPORT			LOW-AVERAGE TRANSPORT			HIGH-AVERAGE TRANSPORT			HIGH TRANSPORT		
		NIGHT	DAY		NIGHT	DAY		NIGHT	DAY		NIGHT	DAY
V1 <34L (SMALL)	APD	5x2L 3x2L 4x2L	2L 2x2L 2L	APD	4x2.5L 4x2L 3x2.5L 4x2L	2L 2x2L 2x2L 2L	APD	5x2L 3x2L	2L 2L	APD	4x2L 3x2L 3x2.5L	2x2L 2L 2.5L
	CAPD	2L 1.5L	3x2L 4x1.5L	CAPD	2L 1.5L	3x2L 4x1.5L	CAPD	2L 1.5L 2L	3x2L 4x1.5L 3x2L	CAPD	2.5L 2L	3x2L 3x2L
V2 34 L ≤ V < 42 L (MEDIUM)	APD	3x3L 4x2.5L	2x2.5L 2x2.5L	APD	3x2.5L 4x3L 4x2.5L 5x2.5L	2x2L 3L 2.5L 2L	APD	4x2L 5x2.5L 5x2L	2x2L 2.5L 2L	APD	4x2.5L 5x2.5L 4x2.5L	2x2.5L 2x2.5L 2.5L
	CAPD	3L 2.5L	3x3L 4x2.5L	CAPD	2.5L	3x2.5L	CAPD	2.5L 2.5L	3x2.5L 3x2.5L	CAPD	3L 2.5L 2.5L	3x3L 4x2.5L 3x2.5L
V3 V ≥ 42 L (LARGE)	APD	3x3L 4x3L	2x3L 2x2.5L	APD	5x2.5L 3x3L 4x3L	2x2.5L 2x3L 2x2.5L	APD	4x2.5L 4x3L	2x2.5L 2x2.5L	APD	4x2.5L 5x2.5L	2x2.5L 2.5L
	CAPD	3L	4x3L	CAPD	3L	4x3L	CAPD	3L 2.5L	4x3L 4x2.5L	CAPD	3L	4x3L

* Lower concentrations of dextrose and/or a fewer number of exchanges than indicated here may be needed to achieve total UF targets and euvolemia in the setting of substantial volume output by the kidneys.

Please see Indications and Important Risk Information, including Boxed Warning for EXTRANEAL (icodextrin) PD Solution on page 43. See www.baxterpi.com for Full Prescribing Information.

SUGGESTED PRESCRIPTIONS FOR PATIENTS WITH RESIDUAL KIDNEY UREA CLEARANCE ≥ 2 ML/MIN*[29]

Kinetic modeling was performed using PD ADEQUEST software to create the tables below. Recommended dialysis prescriptions are intended to achieve a desired Kt/V_{urea} of 1.7 and a minimum ultrafiltration of 1000 mL/day. To illustrate that modeling can be designed around additional targeted objectives, use of 4.25% dextrose was omitted in these examples to avoid excessive glucose exposure. Only PD solutions containing dextrose concentrations of 1.5% and 2.5% were used in the modeling process while additional prescriptions were created using EXTRANEAL (icodextrin) PD Solution in the long dwell. An extra daytime exchange (in addition to the last bag fill) was also included in selected situations to help augment clearance and ultrafiltration results for motivated patients as needed. Nine hour overnight treatments periods were considered for the APD prescriptions.

Irrespective of modeling, clinical judgment must always be employed in order to create individualized prescriptions that meet patients' specific urea clearance, ultrafiltration, medical and lifestyle needs.

- 1.5%/2.5% dextrose dialysis solutions
- 2.5% dextrose dialysis solutions
- EXTRANEAL (icodextrin) PD Solution used in the long dwell period

	LOW TRANSPORT			LOW-AVERAGE TRANSPORT			HIGH-AVERAGE TRANSPORT			HIGH TRANSPORT		
		NIGHT	DAY		NIGHT	DAY		NIGHT	DAY		NIGHT	DAY
V1 <34L (SMALL)	APD	3x1.5L ◪ 3x2L ◪ 4x2L ■	1.5L ◪ 2L ■ dry	APD	4x2L ■ 3x2L ◪	2L ■ 2L ■	APD	3x2L ◪ 5x2L ■ 3x2L ◪	2x2L ■ 2L ■ 2L ■	APD	4x2L ■ 3x2L ■	2x2L ■ 2L ■
	CAPD	1.5L ■	3x1.5L ◪	CAPD	1.5L ■ 2L ■ 2L ■	3x1.5L ■ 3x2L ■ 3x2L ◪	CAPD	2L ■ 2L ■	3x2L ■ 3x2L ◪	CAPD	2.5L ■ 2L ■	3x2.5L ■ 3x2L ◪
V2 34 L ≤ V < 42 L (MEDIUM)	APD	3x2.5L ◪ 5x2L ◪ 4x2.5L ■ 3x2L ■ 4x2L ◪	2.5L ■ 2L ■ 2L ■ 2L ■ 2L ■	APD	3x2.5L ■ 3x2.5L ◪ 3x2L ◪	2L ■ 2x2L ■ 2L ■	APD	3x2L ◪ 5x2L ■ 3x2L ◪	2x2L ■ 2L ■ 2L ■	APD	3x2.5L ■ 3x2L ■	2x2.5L ■ 2L ■
	CAPD	2L ■	3x2L ◪	CAPD	2L ■ 2L	3x2L ■ 3x2L ◪	CAPD	2L ■ 2L	3x2L ■ 3x2L ◪	CAPD	3L ■ 3L ■ 2.5L ■	3x3L ■ 4x3L ◪ 3x2.5L ◪
V3 V ≥ 42 L (LARGE)	APD	4x3L ◪ 3x2L ◪ 4x2.5L ◪	2.5L ■ 2x2L ■ 2.5L ■	APD	3x3L ◪ 4x3L ■ 3x2.5L ◪ 4x2.5L ◪	2x2.5L ■ 2x3L ■ 2x2.5L ■ 2.5L ■	APD	4x2.5L ◪ 5x2.5L 4x2.5L ◪ 5x2.5L ◪ 3x3L ◪	2x2L ■ 2.5L ■ 2.5L ■ 2L ■ 2.5L ■	APD	3x2.5L ■ 4x2.5L ■ 3x3L ■	2x2.5L ■ 2L ■ 2L ■
	CAPD	2.5L ■ 2.5L ■	3x2.5L ◪ 3x2L ■	CAPD	2.5L ■ 2.5L ■	3x2.5L ■ 3x2.5L ◪	CAPD	2.5L ■ 2.5L ■	3x2.5L ■ 3x2.5L ◪	CAPD	3L ■ 2.5L ■ 2.5L ■	3x3L ■ 4x2.5L ■ 3x2.5L ◪

* Lower concentrations of dextrose and/or a fewer number of exchanges than indicated here may be needed to achieve total UF targets and euvolemia in the setting of substantial volume output by the kidneys.

Please see Indications and Important Risk Information, including Boxed Warning for EXTRANEAL (icodextrin) PD Solution on page 43. See www.baxterpi.com for Full Prescribing Information.

MEMBRANE TRANSPORT CHARACTERISTICS AND PREFERRED PD MODALITY[31]

TRANSPORT CHARACTERISTICS	PREFERRED PD MODALITY
HIGH	Standard or High-Dose APD CAPD NIPD (if significant RKF)
HIGH-AVERAGE	Standard or High-Dose APD CAPD
LOW-AVERAGE	CAPD Standard or High-Dose APD
LOW	Standard or High-Dose APD CAPD

MONITORING THE THERAPY LONG TERM

4

Monitoring the Therapy Long Term

- After individualizing the therapy, it is important to monitor the patient's adequacy parameters. Measurements should be done within one month after therapy is stabilized on a newly defined prescription. It is also necessary to carefully monitor the patient's compliance and satisfaction to treatment
- The recommended minimum delivered dose has been derived from the NKF-KDOQI guidelines[4]
  - Weekly $Kt/V_{urea} \geq 1.7$
- Measuring peritoneal Kt/V_{urea} is recommended every four months unless the prescription has been changed or there has been a significant change in clinical status[4]
- Ultrafiltration is another parameter that is important to monitor.[4] While no recommendation regarding ultrafiltration (UF) target exists in the United States, other countries recommend an arbitrary UF target of 750 – 1000 mL/day in anuric patients based upon findings in observational studies[7–10]

RESIDUAL KIDNEY FUNCTION

Residual Kidney Function (RKF) is very important in PD. Maintenance of RKF in PD patients:

- facilitates achievement of clearance guidelines (1 mL/min of GFR adds about 0.25 to the total weekly Kt/V_{urea} for a 70-kg person)[38]
- has consistently been an independant predictor of survival in dialysis patients.[39]

RKF is best measured by the mean of the creatinine clearance and the urea clearance.

Recommendations for Preservation of RKF:

- For patients who need antihypertensive medication, consider use of angiotensin converting-enzyme inhibitors (ACEI) or angiotensin-receptor blockers (ARB) as first-line agents[38, 40]
- For normotensive patients, ACEIs or ARBs may be utilized for renal protection[38, 40]
- Avoid dehydration/hypotensive episodes[41]
- Prevent peritonitis episodes[4]
- Minimize exposure to nephrotoxic agents (e.g., radiographic contrast, sodium phosphate bowel preps[42], nonsteroidal antiinflammatory drugs (NSAIDs), repeated or prolonged use of aminoglycosides)[43, 44]
- Evaluate for urinary tract obstruction (if indicated)[4]
- Avoid hypercalcemia[4]

VOLUME CONTROL

Hypertension in End Stage Renal Disease (ESRD) can be due to extracellular fluid (ECF) volume expansion. Blood pressure control requires optimization of volume status.

Measurement of ECF volume status in ESRD patients currently remains a clinical judgment. A practical approach is to reduce the target "dry" weight gradually until the patient is edema free and normotensive without medication (except for cardioprotective or renoprotective reasons); the process may be limited by postural hypotension, cramps or excess fatigue. Given the proven value of residual kidney function, a falling urine output should prompt one to reconsider target weight reduction. Dyspnea and edema may be due to other causes.

NON-PERITONEAL APPROACHES INCLUDE:[4]	PERITONEAL APPROACHES TO INCREASE ULTRAFILTRATION UTILIZING:[4]
– Restriction of sodium and water intake – Use of diuretics to increase urine output – Protection of RKF – Enhancement of patient compliance and education – Glycemic control	– PET to modify the dialysis prescription – Shorter dwell time – Increasing fill volume – More hypertonic glucose exchanges and/or – EXTRANEAL (icodextrin) PD Solution for long dwells (for both CAPD and APD)

Target weight in PD can be accomplished by two means: nonperitoneal and peritoneal approaches. A combination of these peritoneal and nonperitoneal approaches should be used to optimize volume status. However, it should be noted that increased utilization of more hypertonic glucose on a sustained basis is less desirable due to concerns about adverse effects both on the peritoneal membrane and on the patients' metabolic status, body weight and cardiovascular risk profiles.

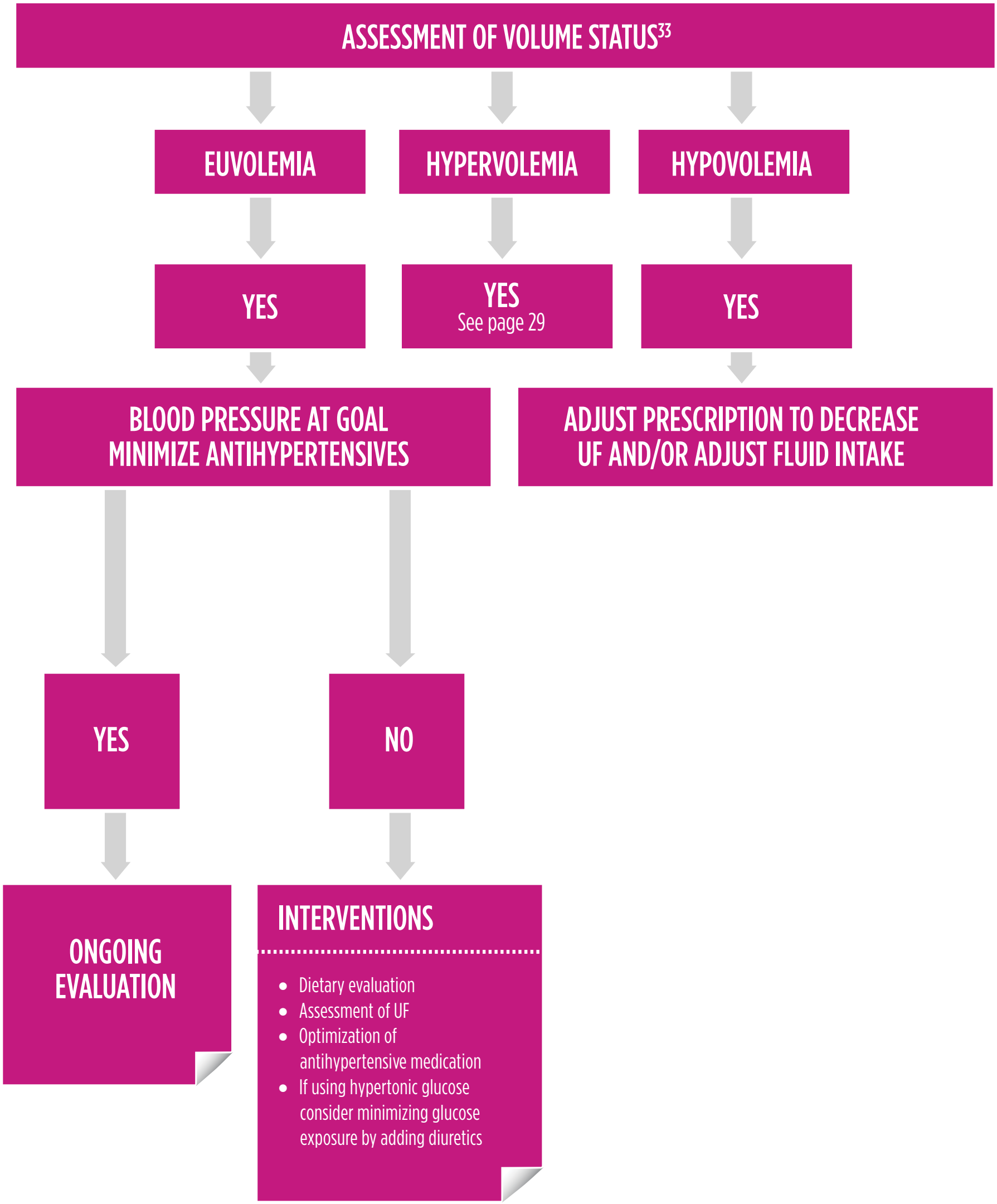
Short, frequent APD cycles can result in hypernatremia as a result of sodium sieving (water removed in excess of sodium). Patients on such therapy should be queried about early morning thirst. Presence of thirst may mandate appropriate adjustment in therapy (e.g., lengthening of APD dwell times).[4]

Given that reduction of blood pressure is of importance, antihypertensive agents should be added if BP cannot be controlled by extracellular volume reduction. For reasons of renoprotection, ACEIs or ARBs should be the initial antihypertensive agent used.

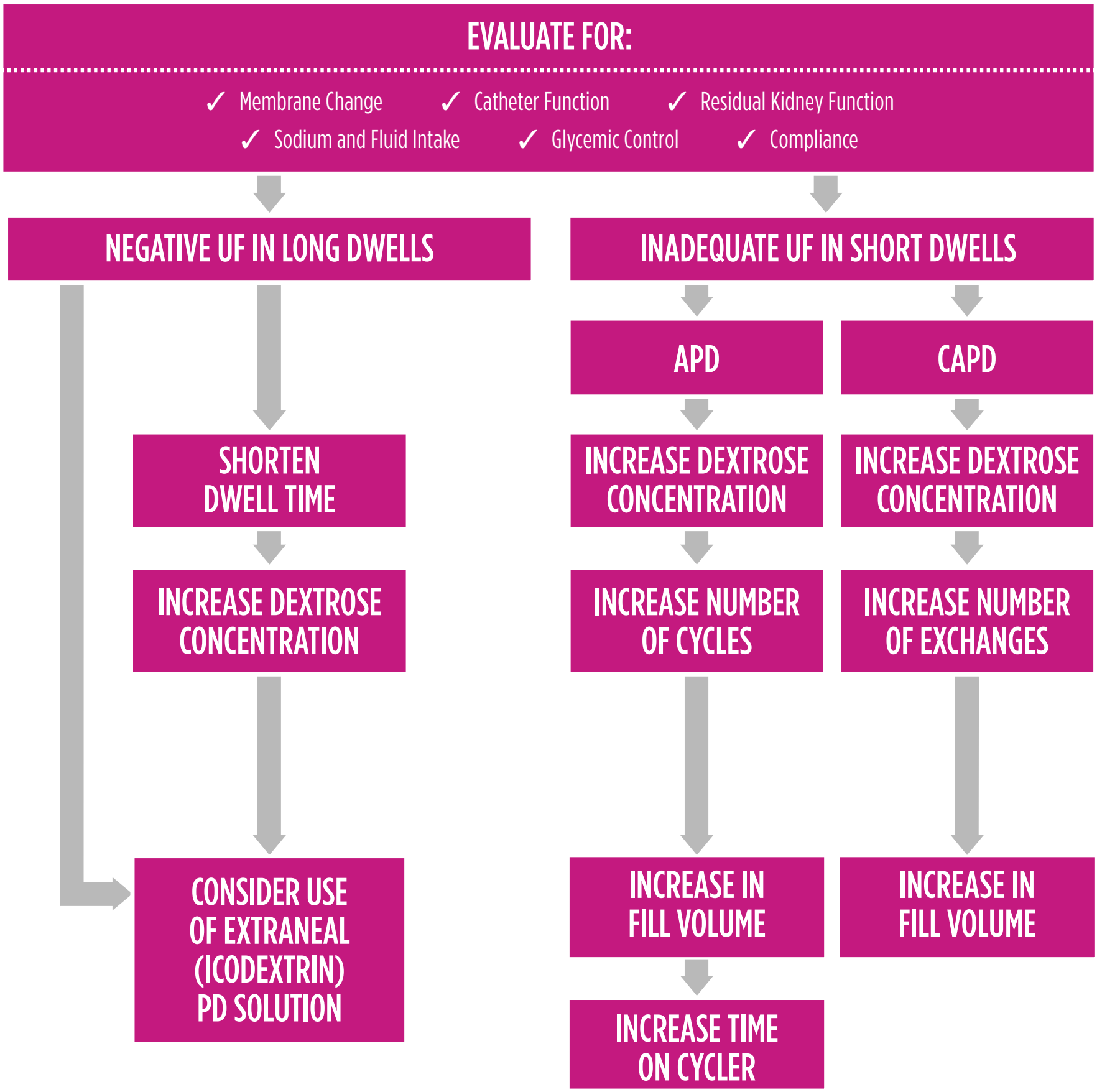
While a total target volume removal of at least 750 – 1000 mL/day in anuric patients is advocated by some regional and international groups, individual clinical patient assessment is imperative to avoid symptomatic ECF volume depletion or loss of RKF.[7, 8]

Interventions, such as use of EXTRANEAL (icodextrin) PD Solution, have been shown to improve ECF volume control and left ventricular (LV) mass. However, it should be noted that there is no high-quality clinical evidence to show that aggressive ECF volume management, LV mass reduction, or even that lowering blood pressure improves patient survival in ESRD patients treated with either peritoneal dialysis or hemodialysis (HD).

ASSESSMENT OF VOLUME STATUS



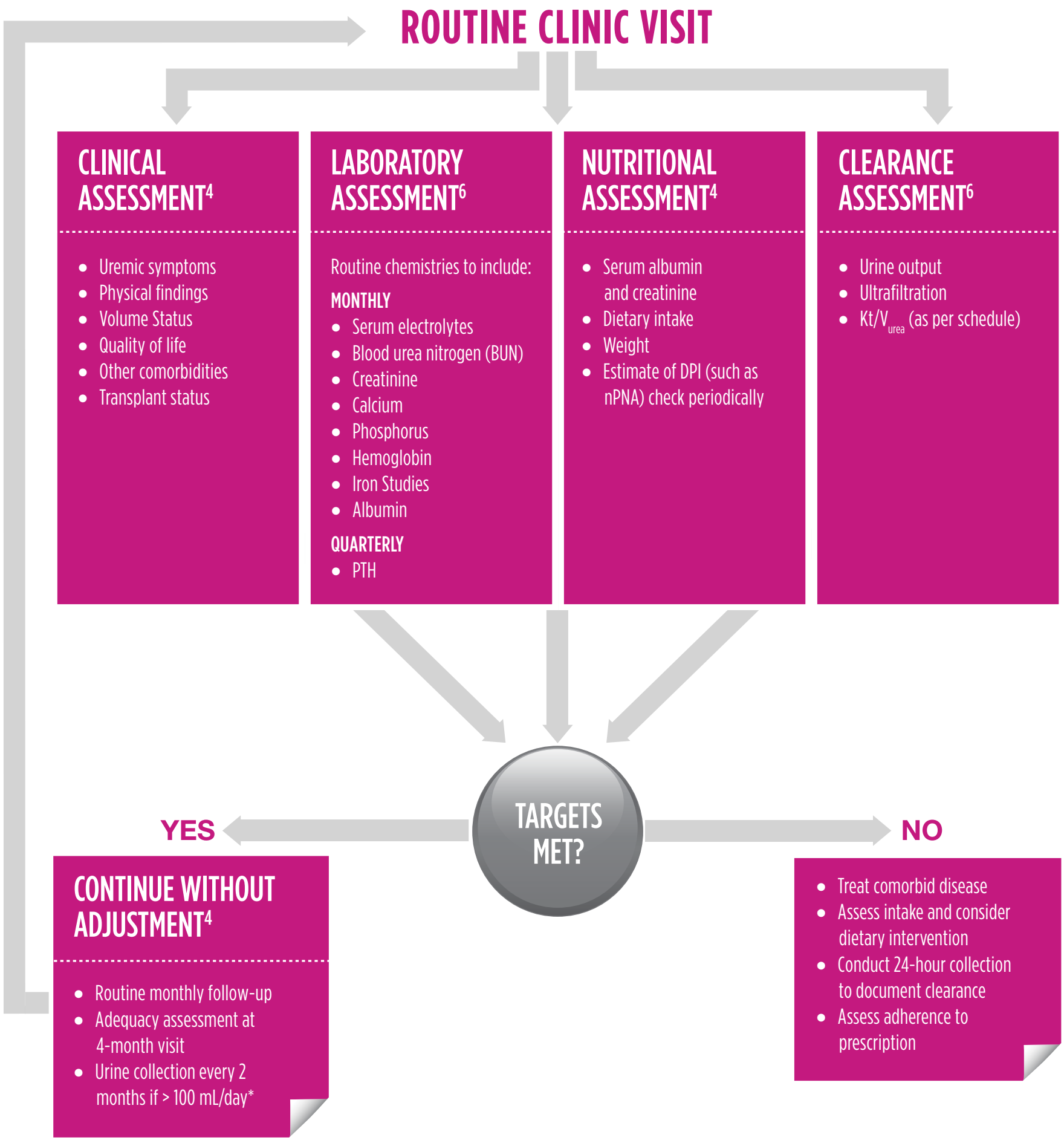
MANAGEMENT OF HYPERVOLEMIA[33]



Selected Important Risk Information: Monitor fluid status to avoid hyper- or hypovolemia and potentially severe consequences including congestive heart failure, volume depletion, and hypovolemic shock. Abnormalities in any of these parameters should be treated promptly under the care of a physician.

Please see Indications and Important Risk Information, including Boxed Warning for EXTRANEAL (icodextrin) PD Solution on page 43. See www.baxterpi.com for Full Prescribing Information.

ROUTINE CLINIC VISIT



At the routine clinic visits, laboratory values, clinical signs and symptoms and patient history should be carefully monitored. Any decline in patient status may warrant a more thorough adequacy assessment involving a 24-hour dialysate and urine collection. If you include RKF in your total Kt/V_{urea} calculation, residual kidney function (urine output is > 100 mL/day (KDOQI)) should be measured every two months. Adjust prescription as necessary.[4]

*If residual kidney clearance is being considered as part of the patient's total weekly solute clearance goal

CAVEATS ABOUT SERUM PHOSPHORUS AND PD[45]

It is well recognized that replacement of renal function by dialysis entails more than just small solute clearance. Normalization of other retained solutes, such as phosphorus, must also be addressed in order to optimize patient outcomes. Removal of phosphorus by PD is dependent on:

- PD exchange dwell time
- Use of continuous PD (24 hours/day)
- Peritoneal transport type
- Serum phosphorus level
- Dietary intake
- Residual kidney function

In contrast to what is known about Kt/V_{urea} (where over the range of solute clearances evaluated, studies have not shown a benefit to increasing dialysis dose), it has been shown that higher phosphorus levels are associated with an increased relative risk of death. Therefore, normalization of serum phosphorus should be a goal of every patient on dialysis.

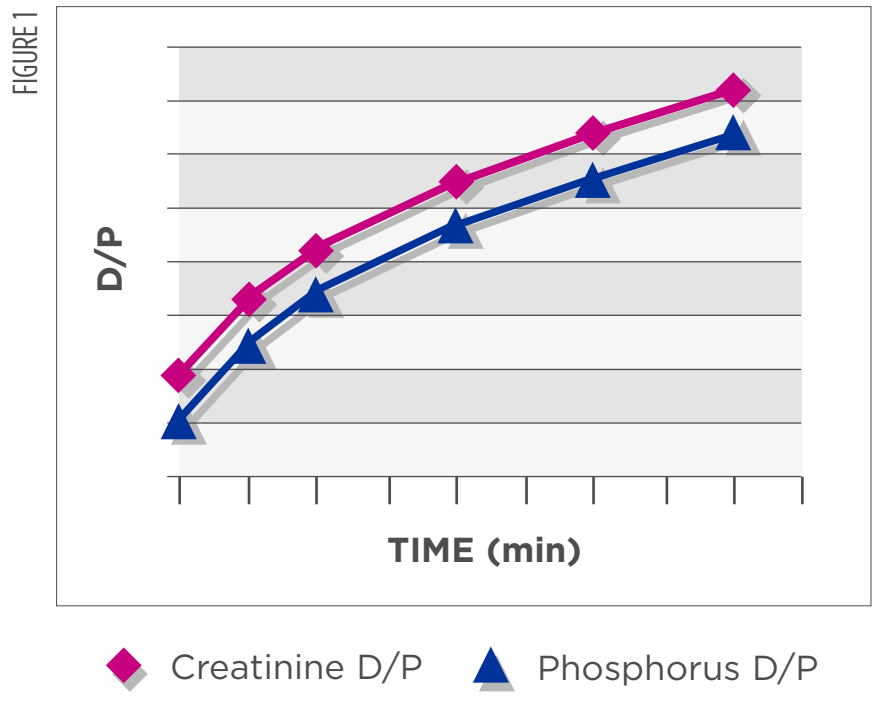
Some caveats about serum phosphorus and the 2006 KDOQI PD guidelines are as follows:

1. Phosphorus is slightly larger than creatinine in size/molecular weight. Therefore, the D/P phosphorus during a typical PD dwell would be parallel to, but just slightly less than, creatinine (FIGURE 1). Prescriptions that would keep the Kt/V_{urea} the same, but would decrease the creatinine clearance (such as switch from CAPD to APD — especially if a low transporter), would likely also decrease phosphorus removal. Although KDOQI no longer recommends monitoring weekly creatinine clearance as a predictor of dialysis dose and survival, one may want to monitor creatinine clearance as a surrogate for phosphorus removal.
2. Serum phosphorus levels are in part related to dietary protein intake. Patients with a high dietary protein intake may have high serum phosphorus. In these patients, even if their weekly total Kt/V_{urea} is > 1.7, an upward adjustment of their dialysis prescription may be needed to "keep up with" protein intake and control serum phosphorus levels.

At the present time, it is important to monitor serum phosphorus, use phosphate binders and be cognizant of the above caveats when supervising the care of a patient on PD.

D/P Ratios for Creatinine and Phosphorus

FIGURE 1



APPENDIX

5

WEEKLY DIALYSIS CLEARANCE

Weekly Dialysis Clearance is calculated using the simple formula:
24-hr D/P* x 24-hr Drained Volume (Liters) x 7[11]

DIALYSIS KT/V_{UREA} =	$\frac{\text{24-hr D/P Urea x 24-hr Drained Volume x 7}}{\text{Volume of Urea Distribution}}$
RENAL KT/V =	$\frac{\text{24-hr U/P** Urea x 24-hr Urine Volume x 7}}{\text{Volume of Urea Distribution}}$

$$*D/P = \frac{\text{Dialysate concentration}}{\text{Plasma concentration}} \qquad **U/P = \frac{\text{Urine concentration}}{\text{Plasma concentration}}$$

CREATININE CLEARANCE (C_{CR})

Creatinine Clearance (C_{Cr}) is normalized to a set standard of 1.73m^2 Body Surface Area (BSA). Please refer to the Body Surface Area chart in the Appendix of this guide to determine BSA.

DIALYSIS C_{CR} L/WEEK =	24-hr D/P Cr x 24-hr Drained Volume x 7 x (1.73m^2 BSA/Patient's BSA)
RENAL C_{CR} L/WEEK =	24-hr U/P Cr x 24-hr Urine Volume x 7 x (1.73m^2 BSA/Patient's BSA)

For those patients with renal function, their residual function is added to the calculated dialysate clearance for a total clearance. For further information about calculating clearance, contact your Baxter Clinical Educator.

ROUTINE PATIENT ASSESSMENT[6]

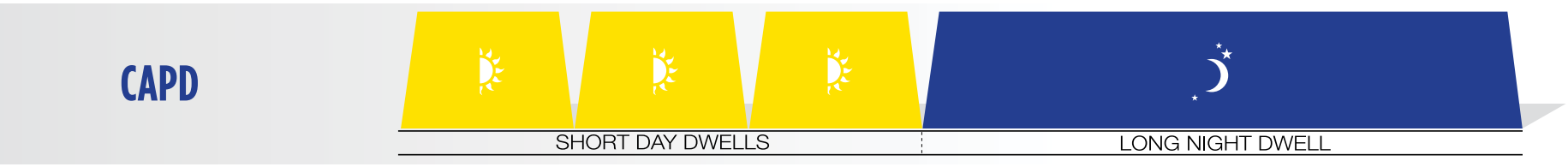
Routine clinical and nutritional assessment for PD patients should include the following:

- Review of home records
- Medication review
- Weight and fluid balance
- Patient's UF response to dextrose/icodextrin
- Appetite and nutritional status
- Uremic symptomatology
- Physical examination
- Blood pressure control and cardiac status
- Exit site and catheter function
- Routine monthly laboratory studies (electrolytes, acid/base balance)
- Calcium/phosphorus balance
- Anemia evaluation
- Iron studies
- Comorbid diseases
- Quality of life (social, psychological, employment, vitality, physical performance)
- Transplant status

APD REGIMENS (EXAMPLES)*

*Number of nocturnal dwells may vary, but it is usually 3-5

CAPD REGIMEN



INTERNATIONAL CLINICAL PRACTICE GUIDELINE RECOMMENDATIONS

	KT/V_{UREA} (PER WEEK) RENAL + PERITONEAL	C_{CR} (PER WEEK) RENAL+ PERITONEAL	UF (PER DAY)
KDOQI (US) 2006[4]	≥ 1.7	X	X
ISPD 2006[6]	≥ 1.7	APD > 45 L/wk	X
Canadian Society of Nephrology 2011[5]	≥ 1.7	X	X
European Best Practice Guidelines 2005[7]	≥ 1.7	APD > 45 L/wk for patients with slow transport status	1.0 L/day in anuric patients
CARI (Australia) 2005[9]	≥ 1.6	High/high-average transport > 60 L/wk Low/low-average transport > 50 L/wk	X
UK Renal Association 2007[8]	≥ 1.7	≥ 50 L/wk	≥ 750 mL/day in anuric patients

X = no recommendation

BODY SURFACE AREA (BSA)

Body Surface Area affects the amount of dialysis a patient requires.
Larger patients require a larger dose of dialysis. Using the table below, determine the patient's BSA (m^2).

BSA < 1.65 | BSA 1.65–1.97 | BSA >1.97

WEIGHT (KG)	HEIGHT (CM)																
	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200
36	1.06	1.09	1.12	1.15	1.19	1.22	1.25	1.28	1.31	1.33	1.36	1.39	1.42	1.45	1.48	1.51	1.53
38	1.08	1.12	1.15	1.18	1.21	1.24	1.27	1.31	1.34	1.37	1.40	1.43	1.45	1.48	1.51	1.54	1.57
40	1.11	1.14	1.17	1.21	1.24	1.27	1.30	1.33	1.37	1.40	1.43	1.46	1.49	1.52	1.55	1.58	1.61
42	1.13	1.17	1.20	1.23	1.27	1.30	1.33	1.36	1.39	1.43	1.46	1.49	1.52	1.55	1.58	1.61	1.64
44	1.15	1.19	1.22	1.26	1.29	1.32	1.36	1.39	1.42	1.45	1.49	1.52	1.55	1.58	1.61	1.64	1.67
46	1.18	1.21	1.25	1.28	1.32	1.35	1.38	1.42	1.45	1.48	1.51	1.55	1.58	1.61	1.64	1.67	1.70
48	1.20	1.23	1.27	1.30	1.34	1.37	1.41	1.44	1.48	1.51	1.54	1.57	1.61	1.64	1.67	1.70	1.73
50	1.22	1.26	1.29	1.33	1.36	1.40	1.43	1.47	1.50	1.53	1.57	1.60	1.63	1.67	1.70	1.73	1.76
52	1.24	1.28	1.31	1.35	1.39	1.42	1.46	1.49	1.53	1.56	1.59	1.63	1.66	1.70	1.73	1.76	1.79
54	1.26	1.30	1.33	1.37	1.41	1.44	1.48	1.52	1.55	1.59	1.62	1.66	1.69	1.72	1.76	1.79	1.82
56	1.28	1.32	1.36	1.39	1.43	1.47	1.50	1.54	1.58	1.61	1.65	1.68	1.72	1.75	1.78	1.82	1.85
58	1.30	1.34	1.38	1.41	1.45	1.49	1.53	1.56	1.60	1.63	1.67	1.71	1.74	1.78	1.81	1.85	1.88
60	1.32	1.36	1.40	1.43	1.47	1.51	1.55	1.59	1.62	1.66	1.69	1.73	1.77	1.80	1.84	1.87	1.91
62	1.34	1.38	1.41	1.45	1.49	1.53	1.57	1.61	1.64	1.68	1.72	1.76	1.79	1.83	1.86	1.90	1.93
64	1.35	1.39	1.43	1.47	1.51	1.55	1.59	1.63	1.67	1.70	1.74	1.78	1.82	1.85	1.89	1.92	1.96
66	1.37	1.41	1.45	1.49	1.53	1.57	1.61	1.65	1.69	1.73	1.77	1.80	1.84	1.88	1.91	1.95	1.99
68	1.39	1.43	1.47	1.51	1.55	1.59	1.63	1.67	1.71	1.75	1.79	1.83	1.86	1.90	1.94	1.97	2.01
70	1.41	1.45	1.49	1.53	1.57	1.61	1.65	1.69	1.73	1.77	1.81	1.85	1.89	1.92	1.96	2.00	2.04
72	1.42	1.47	1.51	1.55	1.59	1.63	1.67	1.71	1.75	1.79	1.83	1.87	1.91	1.95	1.99	2.02	2.06
74	1.44	1.48	1.53	1.57	1.61	1.65	1.69	1.73	1.77	1.81	1.85	1.89	1.93	1.97	2.01	2.05	2.08
76	1.46	1.50	1.54	1.59	1.63	1.67	1.71	1.75	1.79	1.83	1.87	1.91	1.95	1.99	2.03	2.07	2.11
78	1.47	1.52	1.56	1.60	1.65	1.69	1.73	1.77	1.81	1.85	1.89	1.94	1.98	2.01	2.05	2.09	2.13
80	1.49	1.53	1.58	1.62	1.66	1.71	1.75	1.79	1.83	1.87	1.92	1.96	2.00	2.04	2.08	2.12	2.15
82	1.50	1.55	1.59	1.64	1.68	1.72	1.77	1.81	1.85	1.89	1.94	1.98	2.02	2.06	2.10	2.14	2.18
84	1.52	1.56	1.61	1.65	1.70	1.74	1.79	1.83	1.87	1.91	1.96	2.00	2.04	2.08	2.12	2.16	2.20
86	1.53	1.58	1.63	1.67	1.72	1.76	1.80	1.85	1.89	1.93	1.98	2.02	2.06	2.10	2.14	2.18	2.22
88	1.55	1.60	1.64	1.69	1.73	1.78	1.82	1.87	1.91	1.95	1.99	2.04	2.08	2.12	2.16	2.20	2.24
90	1.56	1.61	1.66	1.70	1.75	1.79	1.84	1.88	1.93	1.97	2.01	2.06	2.10	2.14	2.18	2.22	2.27
92	1.58	1.63	1.67	1.72	1.77	1.81	1.86	1.90	1.95	1.99	2.03	2.08	2.12	2.16	2.20	2.25	2.29
94	1.59	1.64	1.69	1.74	1.78	1.83	1.87	1.92	1.96	2.01	2.05	2.09	2.14	2.18	2.22	2.27	2.31
96	1.61	1.66	1.70	1.75	1.80	1.84	1.89	1.94	1.98	2.03	2.07	2.11	2.16	2.20	2.24	2.29	2.33
98	1.62	1.67	1.72	1.77	1.81	1.86	1.91	1.95	2.00	2.04	2.09	2.13	2.18	2.22	2.26	2.31	2.35
100	1.64	1.69	1.73	1.78	1.83	1.88	1.92	1.97	2.02	2.06	2.11	2.15	2.20	2.24	2.28	2.33	2.37
102	1.65	1.70	1.75	1.80	1.84	1.89	1.94	1.99	2.03	2.08	2.12	2.17	2.21	2.26	2.30	2.35	2.39
104	1.66	1.71	1.76	1.81	1.86	1.91	1.96	2.00	2.05	2.10	2.14	2.19	2.23	2.28	2.32	2.37	2.41
106	1.68	1.73	1.78	1.83	1.88	1.92	1.97	2.02	2.07	2.11	2.16	2.20	2.25	2.30	2.34	2.38	2.43
108	1.69	1.74	1.79	1.84	1.89	1.94	1.99	2.03	2.08	2.13	2.18	2.22	2.27	2.31	2.36	2.40	2.45
110	1.70	1.75	1.81	1.86	1.91	1.95	2.00	2.05	2.10	2.15	2.19	2.24	2.29	2.33	2.38	2.42	2.47
112	1.72	1.77	1.82	1.87	1.92	1.97	2.02	2.07	2.11	2.16	2.21	2.26	2.30	2.35	2.40	2.44	2.49
114	1.73	1.78	1.83	1.88	1.93	1.98	2.03	2.08	2.13	2.18	2.23	2.27	2.32	2.37	2.41	2.46	2.50

BSA < 1.65 | BSA 1.65–1.97 | BSA >1.97

PATIENT DAILY RECORDS – CAPD TREATMENT

Patient Daily Records - CAPD Treatment Records

Name: _____ Prescription: _____

	TIMING	SOLUTION	CONCENTRATION	VOLUME
EXCHANGE 1				
EXCHANGE 2				
EXCHANGE 3				
EXCHANGE 4				
EXCHANGE 5				
EXCHANGE 6				

Date: _____ Weight: _____ Blood Pressure: _____ Other: _____

	SOLUTION	CONCENTRATION	VOLUME IN	VOLUME OUT	UF	COMMENTS
EXCHANGE 1						
EXCHANGE 2						
EXCHANGE 3						
EXCHANGE 4						
EXCHANGE 5						
EXCHANGE 6						
TOTAL ULTRAFILTRATION IN 24 HOURS						

PATIENT DAILY RECORDS – APD TREATMENT

Patient Daily Records - APD Treatment Records

Name: _____

Date: _____ Weight: _____ Blood Pressure: _____ Other: _____

SOLUTION	CONCENTRATION	VOLUME	INITIAL DRAIN	1. TOTAL (NIGHT) UF	2. INITIAL DRAIN VOLUME - LAST FILL VOLUME	TOTAL 24H UF: 1+2
1.						
2.						
3.						
4.						
5.						
Last Fill						
COMMENTS						

PERITONEAL DIALYSIS Kt/V_{UREA}

Patient Name: Date: ___/___/___

Patient Collection Data

PATIENT SEX: ☐ M ☐ F

Serum Collection Data	Urine Collection Data	Peritoneal Dialysate Collection Data
Blood Urea Nitrogen (BUN):	24-hour Urine Volume in Liters:	24-hour Total Peritoneal Effluent Volume in Liters:
mg/dl	L	L
	Urine Urea Nitrogen (UUN):	Dialysate Urea Nitrogen (DUN):
	mg/dl	mg/dl

Assessment Data

Patient Weight* To convert lbs to Kg (1 lb = 2.2 Kg)

Kg | lb/2.2 = Kg

To convert ml to L (1000ml = 1 L): ml/1000 = L

Residual Renal Function Calculation

"K" (L/Day Urea Clearance):

$$\frac{\text{URINE UREA NITROGEN (UUN) (mg/dl)} \times \text{24-HOUR URINE VOLUME (L)}}{\text{BLOOD UREA NITROGEN (BUN) (mg/dl)}} = \text{RESIDUAL RENAL UREA CLEARED (L/Day)}$$

"Kt/V" (Weekly Urea Clearance):

$$\text{RESIDUAL RENAL UREA CLEARED (L/Day)} \times \text{DAYS PER WEEK DIALYZED} = \text{RESIDUAL RENAL UREA CLEARED (L/Week)}$$

"Kt/V" (Volume of urea distribution within the body):*

$$\frac{\text{RESIDUAL RENAL UREA CLEARED (L/Week)}}{\text{PATIENT WEIGHT* (kg)} \times \text{0.60 for male or 0.55 for female}} = \text{WEEKLY RESIDUAL RENAL } Kt/V_{urea}$$

ESTIMATED TOTAL BODY WATER (L) (1Kg=1L)

Peritoneal Calculation

"K" (L/Day Urea Clearance):

$$\frac{\text{DIALYSATE UREA NITROGEN (DUN) (mg/dl)} \times \text{24-HOUR TOTAL PERITONEAL EFFLUENT (L)}}{\text{BLOOD UREA NITROGEN (BUN) (mg/dl)}} = \text{PERITONEAL UREA CLEARED (L/Day)}$$

"Kt/V" (Weekly Urea Clearance):

$$\text{PERITONEAL UREA CLEARED (L/Day)} \times \text{DAYS PER WEEK DIALYZED} = \text{PERITONEAL UREA CLEARED (L/Week)}$$

"Kt/V" (Volume of urea distribution within the body):*

$$\frac{\text{PERITONEAL UREA CLEARED (L/Week)}}{\text{PATIENT WEIGHT* (kg)} \times \text{0.60 for male or 0.55 for female}} = \text{WEEKLY PERITONEAL } Kt/V_{urea}$$

ESTIMATED TOTAL BODY WATER (L) (1Kg=1L)

Add Residual Renal Kt/V_{urea} and Peritoneal Kt/V_{urea} to obtain TOTAL Kt/V_{urea}

WEEKLY RESIDUAL RENAL Kt/V_{urea} + WEEKLY PERITONEAL Kt/V_{urea} = **TOTAL Kt/V_{urea}**

* Total Body Water (TBW) calculation is a rough estimation. KDOQI recommends utilizing the Watson or Hume method for determining TBW in adults.
* Use of patients ideal or standard weight (rather than actual weight) should be considered.

WHAT IS PERITONEAL DIALYSIS Kt/V_{UREA}?

Peritoneal Dialysis Kt/V_{urea} is a calculation used to quantify treatment adequacy. The National Kidney Foundation's Kidney Disease Outcomes Quality Initiatives (KDOQI) recommends a **Total Kt/V_{urea}** of at least 1.7 in their 2006 Update. **Total Kt/V_{urea}** indicates the sum of **Residual Renal Kt/V_{urea}** and **Peritoneal Kt/V_{urea}**. Peritoneal Kt/V_{urea} measures clearance data from peritoneal dialysis itself, while Residual Renal Kt/V_{urea} measures how the body's remaining kidney function adds to clearance data. The Kt/V_{urea} calculation requires a 24-hour collection of peritoneal effluent and urine, as well as a serum sample drawn at the completion of 24-hour collections.*

"K" represents urea clearance. **Urea Clearance** is the volume of blood cleared of urea in a given amount of time. Urine and dialysate are collected over a 24-hour period of time, thus urea cleared is expressed as Liters per Day (L/Day). The formulas below express urea clearance for residual renal function ❶ and urea clearance from peritoneal dialysis ❷.

❶ $\dfrac{\text{Urine Urea Nitrogen (UUN mg/dl) x 24-hour Urine Volume in Liters}}{\text{Serum Urea Nitrogen (BUN mg/dl)}} = \text{L/Day Residual Renal Urea Cleared}$

❷ $\dfrac{\text{Dialysate Urea Nitrogen (DUN mg/dl) x 24-hour Total Peritoneal Effluent Volume in Liters}}{\text{Serum Urea Nitrogen (BUN mg/dl)}} = \text{L/Day Peritoneal Urea Cleared}$

"t" represents measurement of time on dialysis. Peritoneal dialysis patients perform therapy daily, in most cases, and KDOQI recommendations are expressed as "weekly." Therefore, L/Day of urea cleared is multiplied by days per week dialyzed giving you L/wk of urea cleared. Again, the equations below are for both residual renal function ❶ and peritoneal dialysis ❷.**

❶ L/Day of residual renal urea cleared x ☐ (days/wk) = L/wk of residual renal urea cleared
❷ L/Day of peritoneal urea cleared x ☐ (days/wk) = L/wk of peritoneal urea cleared

"V" represents the volume of urea distribution within the body and it is currently measured using the patient's total body water (TBW). There are several ways to calculate total body water. KDOQI recommends using the Watson or Hume equations for adults. A rough estimate of total body water can be calculated by multiplying the patient's weight in Kg by 0.6 for males or 0.55 for females. The equation is completed when L/wk of urea cleared is divided by the total body water.

❶ $\dfrac{\text{L/wk of residual renal urea cleared}}{\text{Patient Weight in Kg x (0.60 for male and 0.55 for female) = Estimated Total Body Water in Liters (1Kg = 1L)}} = \text{Residual Renal Kt/Vurea}$

❷ $\dfrac{\text{L/wk of peritoneal urea cleared}}{\text{Patient Weight in Kg x (0.60 for male and 0.55 for female) = Estimated Total Body Water in Liters (1Kg = 1L)}} = \text{Peritoneal Kt/Vurea}$

Total Kt/V_{urea} represents the sum of residual renal Kt/V_{urea} and peritoneal Kt/V_{urea}.
⇒ TOTAL: Residual Renal Kt/V_{urea} + Peritoneal Kt/V_{urea} = Total Kt/V_{urea}

Reviewing Data from Laboratory

1. The Kt/V_{urea} calculation requires a laboratory assay for Urea Nitrogen (not Urea). If the laboratory data reads "Urea," instruct your laboratory to assay for "Urea Nitrogen."
2. In the event that laboratory data includes "corrected" results, always use the "corrected" results when calculating Kt/V_{urea}. This indicates the sample has been corrected for glucose interference.
3. Ensure Urea Nitrogen is expressed as "mg/dl."
4. If your laboratory reports Urine results in "Grams/24Hour," you must know the 24-hour urine volume to convert to mg/dl. Use the following formula for conversion:

$$\frac{\text{Gm/24Hr} \times 100{,}000}{\text{mL (24-hour urine volume)}} = \text{mg/dl}$$

* Residual Renal Function measurement is not required if urine output is less than 100mL in 24-hours or Peritoneal Kt/V_{urea} is greater than or equal to 1.7 per KDOQI 2006 recommendations.

EXTRANEAL (ICODEXTRIN) PD SOLUTION IMPORTANT RISK INFORMATION, REFERENCES & CONTRIBUTORS

6

INDICATION

EXTRANEAL (icodextrin) is indicated for a single daily exchange for the long (8- to 16- hour) dwell during continuous ambulatory peritoneal dialysis (CAPD) or automated peritoneal dialysis (APD) for the management of end-stage renal disease. EXTRANEAL is also indicated to improve (compared to 4.25% dextrose) long-dwell ultrafiltration and clearance of creatinine and urea nitrogen in patients with high average or greater transport characteristics, as defined using the peritoneal equilibration test (PET).

IMPORTANT RISK INFORMATION

WARNING: UNRECOGNIZED HYPOGLYCEMIA RESULTING FROM DRUG-DEVICE INTERACTION

- Only use glucose-specific monitors and test strips to measure blood glucose levels in patients using EXTRANEAL (icodextrin) Peritoneal Dialysis Solution. Blood glucose monitoring devices using glucose dehydrogenase pyrroloquinolinequinone (GDH-PQQ) or glucose-dye-oxidoreductase (GDO)-based methods must not be used. In addition, some blood glucose monitoring systems using glucose dehydrogenase flavin-adenine dinucleotide (GDH-FAD)-based methods must not be used. Use of GDH-PQQ, GDO, and GDH-FAD-based glucose monitors and test strips has resulted in falsely elevated glucose readings (due to the presence of maltose). Falsely elevated glucose readings have led patients or health care providers to withhold treatment of hypoglycemia or to administer insulin inappropriately. Both of these situations have resulted in unrecognized hypoglycemia, which has led to loss of consciousness, coma, permanent neurological damage, and death. Plasma levels of EXTRANEAL (icodextrin) and its metabolites return to baseline within approximately 14 days following cessation of EXTRANEAL (icodextrin) administration. Therefore, falsely elevated glucose levels may be measured up to two weeks following cessation of EXTRANEAL (icodextrin) therapy when GDH-PQQ, GDO, and GDH-FAD-based blood glucose monitors and test strips are used.
- To avoid improper insulin administration, educate all patients to alert health care providers of this interaction particularly in hospital settings.
- The manufacturer(s) of the monitor and test strips should be contacted to determine if icodextrin or maltose causes interference or falsely elevated glucose readings. For a list of toll free numbers for glucose monitor and test strip manufacturers, please contact the Baxter Renal Clinical Help Line 1-888-RENAL-HELP or visit **www.glucosesafety.com**.
- Because of the risk of unrecognized hypoglycemia that could result from a drug-device interaction, EXTRANEAL is available only through a restricted program.

- EXTRANEAL (icodextrin) is contraindicated in patients with a known allergy to cornstarch or icodextrin, in patients with maltose or isomaltose intolerance, in patients with glycogen storage disease, and in patients with severe lactic acidosis.
- EXTRANEAL is intended for intraperitoneal administration only. Not for intravenous injection. Aseptic technique should be used throughout the peritoneal dialysis procedure.
- Encapsulating peritoneal sclerosis (EPS), sometimes fatal, is a complication of peritoneal dialysis therapy and has been reported in patients using EXTRANEAL.
- Serious hypersensitivity reactions to EXTRANEAL have been reported such as toxic epidermal necrolysis, angioedema, serum sickness, erythema multiforme and vasculitis. Anaphylactic or anaphylactoid reactions may occur. If a serious reaction is suspected, discontinue EXTRANEAL immediately and institute appropriate therapeutic countermeasures.
- Overinfusion of peritoneal dialysis solution volume into the peritoneal cavity may be characterized by abdominal distention, feeling of fullness and/or shortness of breath. Drain the peritoneal dialysis solution from the peritoneal cavity to treat overinfusion.
- Patients with insulin-dependent diabetes may require modification of insulin dosage following initiation of treatment with EXTRANEAL. Monitor blood glucose and adjust insulin, if needed.
- Peritoneal dialysis may affect a patient's protein, water-soluble vitamin, potassium, sodium, chloride, bicarbonate, and magnesium levels and volume status. Monitor electrolytes and blood chemistry periodically. Monitor fluid status to avoid hyper- or hypovolemia and potentially severe consequences including congestive heart failure, volume depletion, and hypovolemic shock. Abnormalities in any of these parameters should be treated promptly under the care of a physician.
- In clinical trials, the most frequently reported adverse events occurring in ≥ 10% of patients and more common in EXTRANEAL PD solution patients than in control patients, were peritonitis, upper respiratory infection, hypertension, and rash. The most common treatment-related adverse reaction for EXTRANEAL PD solution patients was skin rash.

Please see www.glucosesafety.com or www.baxterpi.com for Full Prescribing Information.

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CONTRIBUTORS

Alp Akonur, PhD	Baxter Healthcare Corporation Deerfield, Illinois
Peter G. Blake, MB, FRCPC	London Health Sciences Centre London, Ontario, Canada
John M. Burkart, MD	Bowman Gray School of Medicine Winston-Salem, North Carolina
Catherine A. Firanek, BSN, MBA	Baxter Healthcare Corporation Deerfield, Illinois
Maggie Gellens, MD	Baxter Healthcare Corporation Deerfield, Illinois
Thomas A. Golper, MD, FACP	Vanderbilt University Medical Center Nashville, Tennessee
Audrey M. Hutchcraft, MS	Baxter Healthcare Corporation Deerfield, Illinois
Pranay Kathuria, MD, FACP, FASN	University of Oklahoma College of Medicine Tulsa, Oklahoma
James A. Sloand, MD, FACP	Baxter Healthcare Corporation Deerfield, Illinois
Beth M. Trapani, BSN, CNN	Baxter Healthcare Corporation Deerfield, Illinois

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