Data Standard	**Weekly Urea Kt/V for Peritoneal Dialysis or (PD wKt/V) Urea**
Alternate Name(s)	
Description	The weekly urea Kt/V for peritoneal dialysis is a dimensionless measure of the adequacy of small molecule removal provided by one week of PD treatments and residual kidney function, where K is the urea clearance, t is the treatment time (one week), and V is the urea distribution volume for the patient.
Rationale	Because peritoneal dialysis is performed with variable frequency and prescription, peritoneal dialysis adequacy has historically been measured in terms of a weekly clearance. While weekly creatinine clearance has been used as a PD adequacy measure, the weekly urea clearance offers the advantage that it can be compared to the standard weekly Kt/V for hemodialysis.
Data Source(s)	• Patient-level data • Lab results
Required Data Elements	• Collection time (min) for PD fluid • Collection volume (ml) for PD fluid • Urea concentration of collected PD fluid (mg/dL) • Collection time (min) for urine • Collection volume (ml) for urine • Urea concentration of collected urine (mg/dL) • Plasma urea concentration (mg/dL) • Estimated dry weight (kg) – for urea distribution volume estimation • Height (cm) – for urea distribution volume estimation • Sex (M/F) – for urea distribution volume estimation • Age (years) – for urea distribution volume estimation using Watson formula
Calculation Method	1. **Total weekly urea clearance (L) = weekly PD urea clearance + weekly urine urea clearance**, where: $\text{Weekly Urine Urea Clearance (L/week)} = \frac{10{,}080\ (\text{min/wk}) \times \text{urine urea concentration (mg/dL)} \times \text{urine timed collection volume (ml)}}{\text{plasma urea concentration (mg/dL)} \times \text{urine timed collection time (min)} \times 1000\ \text{ml/L}}$ $\text{Weekly PD Urea Clearance (L/week)} = \frac{10{,}080\ (\text{min/wk}) \times \text{PD urea concentration (mg/dL)} \times \text{PD timed collection volume (ml)}}{\text{plasma urea concentration (mg/dL)} \times \text{PD timed collection time (min)} \times 1000\ \text{ml/L}}$

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2. Urea distribution volume, estimated using total body water estimate:
<table>
<tr><th></th><th>Male Total Body Water (L)</th><th>Female Total Body Water (L)</th></tr>
<tr><td>Watson[1]</td><td>V = 0.1074 x height (cm)
+ 0.3362 x weight (kg)
- 0.09156 x age (yr)
+ 2.447</td><td>V = 0.1069 x height (cm)
+ 0.2466 x weight kg)
- 2.097</td></tr>
<tr><td>Hume-Weyers[2]</td><td>V = 0.194786 x height (cm)
+ 0.296785 x weight (kg)
- 14.012934</td><td>V = 0.34454 x height (cm)
+ 0.183809 x weight (kg)
- 35.270121</td></tr>
</table>
The Watson equation has been reported to overestimate the urea distribution volume by 10-15%. Based on the results of Noori et al., researchers may choose to multiply the Watson volume by 84%-88% for different patient subgroups.[3]

3. Total weekly Kt/V = Total weekly urea clearance (L) / Urea distribution volume
Urea volume estimate of total body water using the Hume & Weyers or Watson anthropometric equation
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<tr><td>Exclusions</td><td>Pediatric patients should be excluded from the approach described here.</td></tr>
<tr><td>Additional Desirable Data Elements for Collection</td><td>Method of urea distribution volume (or total body water volume) estimation</td></tr>
<tr><td>Notes</td><td>

In the absence of a urine collection, the urine urea clearance is assumed to be zero.
Because of potential loss of residual kidney function after initiating dialysis, it is recommended that the urine collection date be within 6 months of the dialysate collection date for inclusion in the total weekly urea clearance. However, researchers may choose to alter this restriction to within the last 3 months or some other timeframe.
Both methods of estimating the total body water require correction for large limb amputation. For example, consecutive amputations of a foot, a lower leg, and an upper leg were reported to reduce body water by 1.8%, 5.3%, and 11.6%, respectively, while correction for a single above-the-knee amputation from an intact leg was reported as 18.5%.[4] For a bilateral amputee, the pre-amputation height should be used to estimate the pre-amputation volume, and then the appropriate reduction should be applied.
For the purposes of research, the individual data elements and the calculated Kt/V PD should be collected.

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<tr><td>Example Measure Calculation</td><td>65-year-old man
PD fluid collection: volume 12,000 ml, urea concentration 50 mg/dL, time 1440 min
Urine collection: volume 500 ml, urea concentration 600 mg/dL, time 1440 min
Plasma urea concentration: 60 mg/dL</td></tr>
</table>

	Weekly PD urea clearance (L) = $\frac{10{,}080 \text{ min/wk} \times 50 \text{ mg/dL} \times 12{,}000 \text{ ml}}{60 \text{ mg/dL} \times 1440 \text{ min} \times 1000 \text{ ml/L}}$ = 70 L/week **Weekly urine urea clearance (L)** = $\frac{10{,}080 \text{ min/wk} \times 600 \text{ mg/dL} \times 500 \text{ ml}}{60 \text{ mg/dL} \times 1440 \text{ min} \times 1000 \text{ ml/L}}$ = 35 L/week

	Watson[1]	**Hume-Weyers**[2]
Male Total Body Water (L)	V = 0.1074 x 170 (cm) + 0.3362 x 80 (kg) - 0.09156 x 65 (yr) + 2.447 = 39.2 L	V = 0.194786 x 170 (cm) + 0.296785 x 80 (kg) - 14.012934 = 42.8 L
Total Weekly Kt/V	(70 + 35) / 39.2 = 2.7	(70 + 35) / 42.8 = 2.5

Acronyms	PD: Peritoneal Dialysis

References

1. Hume R and Weyers E. Relationship between total body water and surface area in normal and obese subjects Clin Path 1971. 24(3):234-238.
2. Watson PE, Watson ID, Batt RD. Total body water volumes for adult males and females estimated from simple anthropometric measurements Am J Clin Nutr 1980.33:27-39.
3. Noori N, Wald R, Sharma Parpia A, Goldstein MB. Volume estimates in chronic hemodialysis patients by the Watson equation and bioimpedance spectroscopy and the impact on the Kt/V urea calculation. Can J Kidney Health Dis. 2018; 5:2054358117750156.
4. Tzamaloukas AH, MurataGH: Estimating urea volume in amputees on peritoneal dialysis by modified anthropometric formulas. Adv Perit Dial 1996.12:61–65.