Determining the number of urine samples needed to diagnose or exclude albuminuria

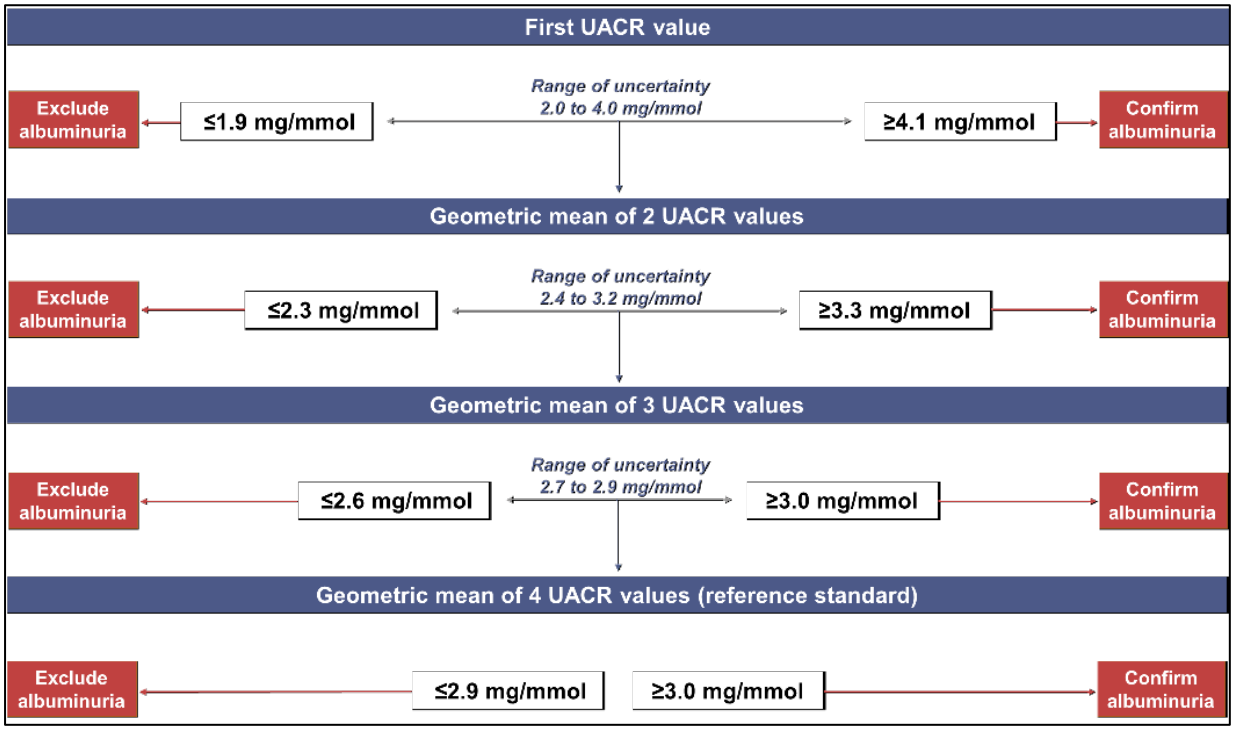
Urinary albumin excretion is a powerful predictor of cardiorenal events, but has high test-test variability. In clinical settings, this is usually addressed by basing diagnoses on at least two samples. However, this suggests that two samples might also be necessary to confidently exclude albuminuria. Furthermore, since the science behind the precise number of samples is not strong, it is possible that more samples might sometimes be necessary.

One of the challenges in determining the appropriate number of samples is that there are very few studies that have quantified variability in the most widely used measurement of albumin excretion – the urinary albumin:creatinine ratio (UACR). Doing so allows the development of tools that can be used to guide clinical practice in regard to diagnosing albuminuria and determining how likely it is that any observed change in UACR over time reflects a true change.

In the Progression of Diabetic Complications (PREDICT) cohort study, 826 Australians with type 2 diabetes (mean age 66+/-9y, 65% men) provided four random spot UACR samples within a 28-day period. Using the geometric mean of the four samples as the reference standard, the ability of means based on one, two and three samples to predict the four-sample classification into albuminuria or no albuminuria was determined (1).

This analysis was used to produce a decision tree, which, depending on the level of UACR, determines whether or not further samples are required to confidently classify an individual. When the first-sample value or the geometric mean of two or three samples lies within the uncertain range, a further sample is required for accurate classification.

Decision tree showing the number of urine collections required for UACR classification, according to UACR values.



Albuminuria diagnosed based on KDIGO guidelines as ≥3.0 mg/mmol (2).

The decision tree is based on the geometric mean, rather than the simple arithmetic mean, of the UACR. Geometric mean can be calculated on many online calculators, such as this one. The data are derived from people with type 2 diabetes, so may not be directly applicable to type 1 diabetes.

Further tools to estimate the likelihood of observed changes in UACR reflecting true changes are available here.

References

1. Rasaratnam N. et al. How many urine samples are required for diagnosis and monitoring of diabetic kidney disease? Diabetes Research and Clinical Practice. Volume 186, Supplement 1, April 2022, 109656.
2. Rossing P et al. Executive summary of the KDIGO 2022 Clinical Practice Guideline for Diabetes Management in Chronic Kidney Disease: an update based on rapidly emerging new evidence. Kidney International (2022) 102, 990–999.

Summary

Determining the number of urine samples needed to diagnose or exclude albuminuria

Determining the number of urine samples needed to diagnose or exclude albuminuria is not straightforward, because of the test-test variability in albumin excretion. A new clinical tool provides an evidence-based, practical approach.