

Prediction of End-Stage Renal Disease in Children with Chronic Kidney Disease and Obstructive Uropathy



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Background

- CKD in children: rare, but significant health complications from progressive loss of function.
- Kidney Failure Risk Equation (KFRE) developed to aid clinical decisions in adults.¹
- KFRE accurately estimated short-term risk of end-stage renal disease (ESRD) in children with CKD of different etiologies.²
- Unknown if accurate in children with CKD due to obstructive uropathy (OU)

Objectives

1. Determine accuracy of the KFRE to predict the risk of ESRD in children with OU.
2. Evaluate usefulness of KFRE scores as a decision aid to identify patients likely to progress to ESRD in the OU cohort.

Methods: Study Design and Population

- Retrospective cohort study of children with OU in the CKiD study.
- CKiD: longitudinal, observational cohort of children with mild-to-moderate CKD, recruited from 48 North American Pediatric Nephrology Centers.³
- N=891 in the overall CKiD cohort (baseline visits in 2005-2013)
- Participants undergo yearly follow-up visits/examinations: renal function, CVD, growth, cognition and behavior.

Methods: Exposure and Outcome Measures

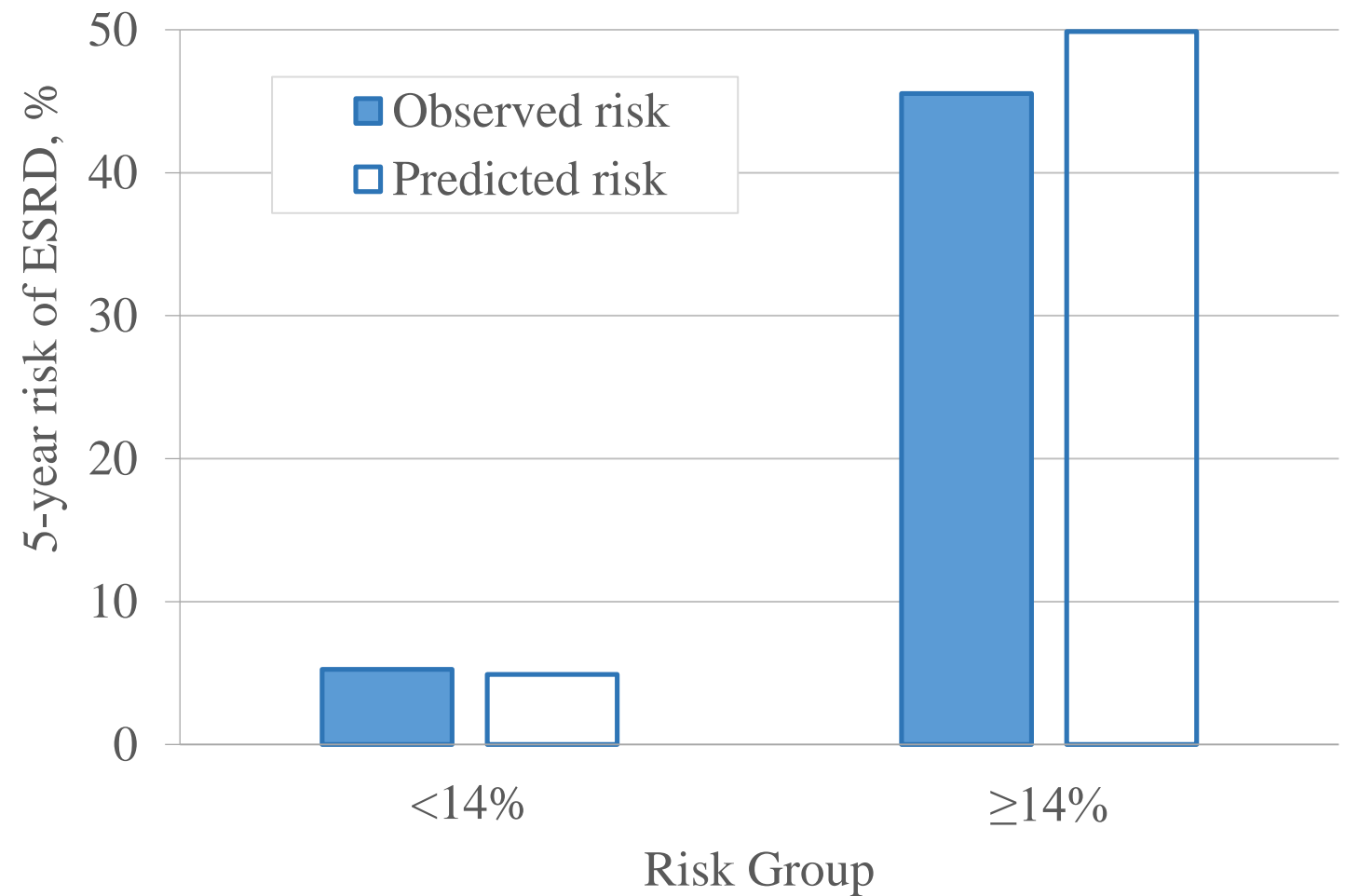
- Outcome: Progression to ESRD (long-term dialysis or transplant) within 5 years.
- Analysis: Calculated 5-year ESRD risk for each patient using baseline data for age, sex, eGFR, and urine albumin/Cr and the published KFRE parameters.⁴
- Estimated model discrimination, calibration, sensitivity, specificity and predictive values.
- Previously, KFRE discriminated the 1-, and 5-year risks of ESRD in overall CKiD cohort, with C statistics of 0.90 and 0.81.²

Results: Baseline Characteristics and Outcomes

- N=118 (Primary diagnosis: OU; eGFR<60)
- 84.8% male; median age: 10 years (IQR: 6-14)
- Median eGFR: 42 mL/min/1.73m² (IQR: 32-53)
- Median follow-up time: 4.5 years (IQR: 2.7-7.2)
- **23 patients (19.5%) developed ESRD within 5 years (1 patient within 2 years).**

Results: Model Discrimination & Calibration for the 5-year risk of ESRD

- C statistic (95% CI):
- 0.75 (0.68-0.82)



Results: Sensitivity and Specificity of the KFRE

Predicted Risk Threshold	ESRD by 5 y (n=23)	No ESRD by 5 y (n=95)	Sensitivity/TPR, % (95% CI)	Specificity/ TNR, % (95% CI)	PPV, % (95% CI)	NPV, % (95% CI)	
9%	At/above	23	43	100	54.7	34.9	100
	Below	0	52	(85.0-100)	(44.2-65.0)	(23.5-47.6)	(93.2-100)
20%	At/above	19	32	82.6	66.3	37.2	94.0
	Below	4	63	(61.2-95.1)	(55.9-75.7)	(24.1-51.9)	(85.4-98.4)
30%	At/above	19	24	82.6	74.7	44.2	94.7
	Below	4	71	(61.2-95.1)	(64.8-83.1)	(29.1-60.1)	(86.9-98.5)
40%	At/above	15	21	65.2	77.9	41.7	90.2
	Below	8	74	(42.7-83.6)	(68.2-85.8)	(25.5-59.2)	(81.7-95.7)
50%	At/above	9	18	39.1	81.1	33.3	84.6
	Below	14	77	(19.7-61.5)	(71.7-88.4)	(16.5-54.0)	(75.5-91.3)

TPR, true positive rate; TNR, true negative rate; PPV, positive predictive value; NPV, negative predictive value

Conclusions

- KFRE provided moderate discrimination and accuracy for predicting the 5-year risk of ESRD among children with CKD due to OU.
- A predicted risk threshold of 30% provided 82.6% sensitivity and 74.7% specificity in identifying patients who progressed to ESRD
- Research is ongoing to identify novel markers of progression that may further improve predictive accuracy of ESRD risk.