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## Development and validation of Korean equation to predict 24hr urine creatinine excretion: Analysis of KNOW-CKD study

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**Objectives:** Urine creatinine excretion rate (CER) is a standard to determine the accuracy of 24hr urine collection. Anthropometric measures such as muscle mass or Asian ethnicity might affect CER. There was no Korean equation for Urine CER.

**Methods:** For the equation development, 1,860 patients in KNOW-CKD cohort were used. Baseline measurements to the entry of cohort were used. For the external validation, 3 year follow up data of 866 KNOW-CKD patients were used. CER was dependent variable of multivariable linear regression. The predictors were age, sex, weight, waist circumference, diabetes, and hypertension. As internal validations, bias, precision, and accuracy was checked by Bootstrapping methods. Same measures of new equations were compared to western (Ix) equation in the external validation set.

**Results:** Mean age was 53.7 ± 12.1 years old, 60% were men. Mean body mass index was 24.6 kg/m<sup>2</sup>, mean waist circumference was 87.4 ± 9.7 cm. Diabetes were 65.5% and hypertension were 96.0%. Mean estimated glomerular filtration rate was 53.4 ± 31.0 ml/min/1.73m<sup>2</sup>. Mean CER was 1176.2 ± 410.1 mg/day. (In male 1358.0 ± 396.5, in female 898.4 ± 239.6, respectively) Selected predictors were entered in different equations. (equation 1: age, sex, body weight, diabetes; equation 2: age, sex, body weight; equation 3: age, sex) In external validation, equation 2 showed larger bias but similar moderate accuracy compared to equation 1. (mean difference (measured – estimated CER) 29.9 mg/day (95% C.I. 11.3 – 48.5), percent difference 2.61% (95% C.I. 1.01 – 4.20), and P<sub>30</sub> (estimated CER within 30% of measured CER) 83.5% (95% C.I. 81.0% - 85.9%) Performance of equation 2 was comparable to that of Ix equation in external validation set. Equation 2 showed better accuracy than equation 3.

**Conclusions:** The new Korean equation to CER is comparable to Ix equation. Including body weight to prediction equation provided better accuracy

Table 1. Bias, precision, and accuracy of newly developed equation and Ix equation in the internal validation and external validation datasets.

	Difference (mg/day)		Percent difference (%)		Accuracy			RMSE
	Median (95% C.I.)	IQR	Median (95% C.I.)	IQR	P <sub>15</sub> (95% C.I.)	P <sub>20</sub> (95% C.I.)	P <sub>30</sub> (95% C.I.)	
Internal validation (n=1860)								
Equation 1	4.7 (-5.0 – 14.4)	344.5	0.42 (0.47 – 1.30)	31.3	49.5 (47.0 – 51.9)	63.5 (61.1 - 65.9)	80.0 (78.1 – 81.7)	300.2
Equation 2	6.0 (-2.5 – 15.3)	366.2	0.56 (0.23 – 1.36)	32.3	48.7 (46.3 – 51.2)	62.1 (59.8 – 64.4)	79.7 (77.5 – 81.3)	303.1
Equation 3	-5.4 (-16.2 – 6.4)	385.4	-0.61 (-1.59 – 0.38)	36.1	45.6 (43.3 – 47.9)	56.5 (54.1 – 59.0)	75.9 (73.9 – 77.8)	326.5
Ix Equation	-41.1 (-53.2 – -28.8)	366.1	-3.57 (-4.64 – -2.51)	34.3	49.5 (47.0 – 51.9)	63.5 (61.1 – 65.9)	79.9 (78.1 – 81.7)	309.2
External validation (n=894)								
Equation 1	15.9 (-3.3 – 35.2)	304.6	1.46 (-0.31 – 3.24)	28.0	53.5 (50.2 – 56.8)	66.4 (63.2 – 69.6)	83.0 (80.6 – 85.5)	191.4
Equation 2	29.9 (11.3 – 48.5)	304.9	2.61 (1.01 – 4.20)	27.7	53.0 (49.7 – 56.3)	67.1 (64.0 – 70.2)	83.5 (81.0 – 85.9)	191.3
Equation 3	26.1 (5.1 – 47.1)	360.4	2.64 (0.78 – 4.49)	31.4	48.3 (44.9 – 51.6)	59.5 (56.2 – 62.7)	77.5 (74.7 – 80.2)	213.9
Ix Equation	-15.6 (-36.0 – 4.8)	318.9	-1.35 (-3.11 – 0.41)	28.1	55.3 (52.0 – 58.6)	67.2 (64.1 – 70.3)	82.4 (80.0 – 84.9)	191.7

IQR, interquartile range; RMSE, root mean squared error; C.I., confidence interval