Improved Acute Kidney Injury (AKI) Staging Criteria for Predicting Hospital Mortality Across Demographic Strata

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ACUTE KIDNEY INJURY RESEARCH

BACKGROUND

- Several approaches for staging AKI have been described (RIFLE, AKIN and KDIGO), and the insensitivity of the RIFL criteria for staging AKI in elderly patients has recently been noted (Chao et al.)
- We have developed a simplified AKI Staging approach (Wang et al), using absolute changes in [sCr] similar to that described by Chertow et al, and applied this analysis to age-, race- and gender-stratified models.

OBJECTIVES

- To optimize AKI staging strategies across demographic strata, with inpatient survival as the primary endpoint

METHODS

- *Design:* All adult inpatients, administrative and lab data from Oct 2009 thru Sept 2010 at the University of Alabama in Birmingham.
- *Selection of Subjects (Exclusions):*
  – Prisoners, patients admitted to the psychiatry service or labor and delivery service
  – Bedded outpatients and patients transferred from other hospitals
  – End-stage renal diease or previous kidney transplant
  – patients with <2 inpatient sCr values, and sCr values obtained after hospital day 21
- 19,249 patients met inclusion criteria (15,096 unique patients).
- *Baseline and Maximum Change in sCr (ΔsCr)*: the baseline sCr (mg/dL) was defined as the lowest of the first three measured sCr values for that admission. ΔsCr was defined as the maximum change in sCr compared to baseline sCr.
- *Analysis:*
  - Kaplan Meier (KM) survival curves, stratifed by demographic factors.
  - Results were confirmed with multivariable regression models for time-to-event (death, discharge or inpatient day 21 post-admission, using the University Hospital Consortium Global expected mortality index (not shown).
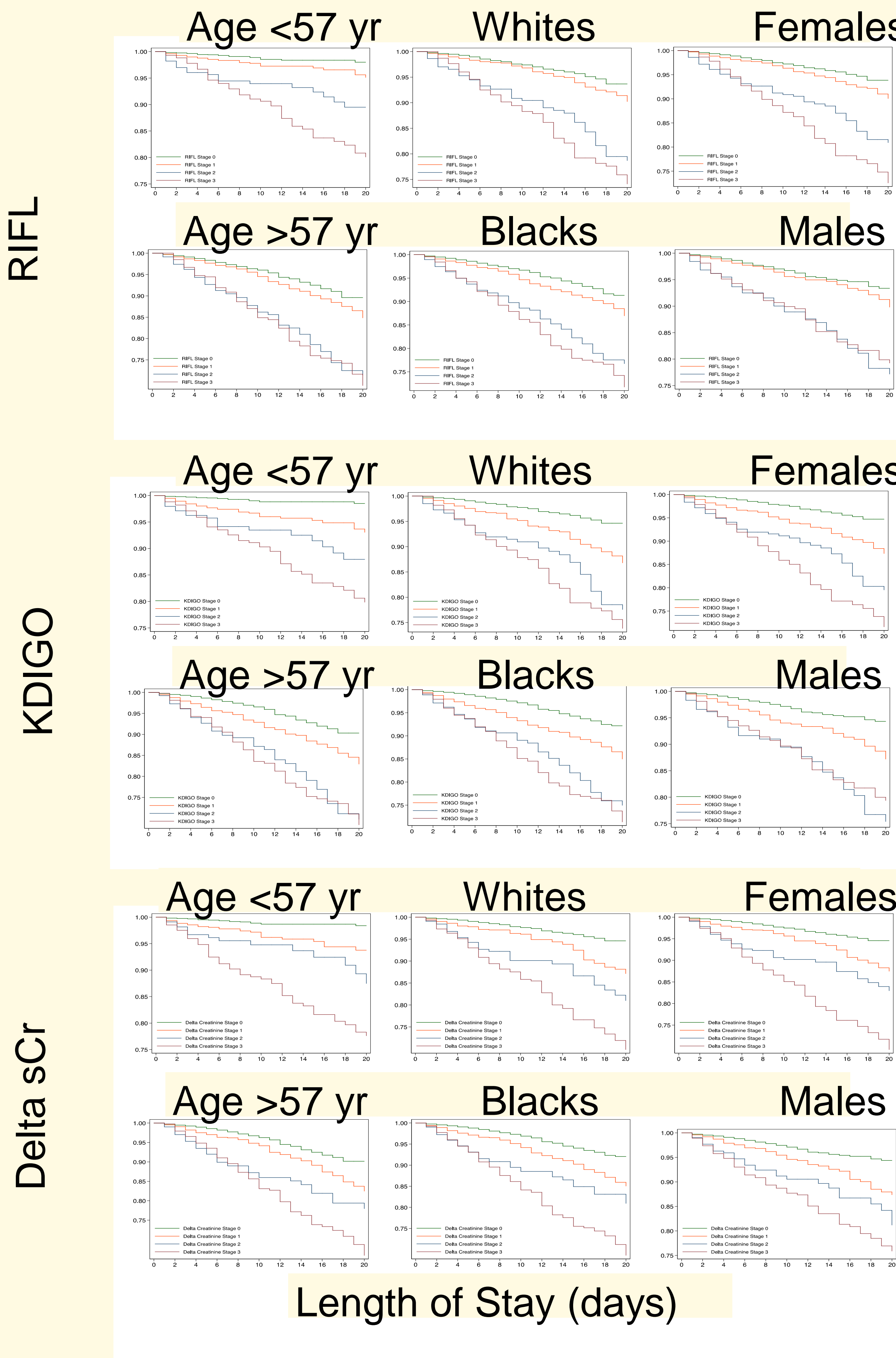
AKI STAGING SYSTEMS

DELTA sCr Cut-Points (mg/dL) or % Change from Baseline				
Criteria/Stage	0	1	2	3
RIFL	<0.5	R: 150% ↑ΔsCr or 25% ↓eGFR	I: 200% ↑ΔsCr or 50% ↓eGFR	F: 300% ↑ΔsCr or 75% eGFR or RRT
KDIGO (AKIN)	<0.3	≥0.3 or 150 - 200% ↑ΔsCr	>200 - 300% ↑ΔsCr	sCr≥4.0 or >300% ↑ΔsCr or RRT
Delta-sCR	<0.3	≥0.3 - 0.8 ↑ΔsCr	≥0.8 - 1.3 ↑ΔsCr	≥1.3 ↑ΔsCr or RRT

ΔsCr, increase to peak sCr above baseline; baseline sCr, lowest of first three inpatient sCr values; RRT, renal replacement therapy

RESULTS

- Defining AKI as KDIGO Stages 1-3, the prevalence of AKI was 23.4%.
- For each KDIGO AKI stage (1, 2 and 3), the median times to peak sCr were 2.0, 3.8 and 2.0 days respectively. For each Delta-Creatinine AKI stage, the median times to peak sCr were 1.7, 2.5 and 3.5 days.

Baseline Characteristics of Hospitalized Adults at UAB		
	AKI (4,116)	No AKI (15,130)
Age at admission, median years (IQR)	58 (47-69)	55 (42-67)*
Males (%)	2,230 (51.9)	7,650 (51.4)
Black Race (%)	1,279 (39.6)	4,962 (33.3)
Baseline eGFR <60 ml/min/1.73 m² (%)	1,555 (36.6)	2,752 (18.5)*
Length of Stay, median days (IQR)	7 (4-13)	4 (2-7)*
Any ICU day during hospitalization (%)	1,824 (41.8)	3.294 (22.1)*
Inpatient Mortality, (%)	470 (10.8)	223 (1.5)
Baseline sCr, mg/dL (±SD)	1.6 (2.0)	1.0 (0.8)
Peak sCr, mg/dL (±SD)	2.4 (2.4)	1.1 (0.8)
Days to peak sCr, median (IQR)	2.7 (1.4-5.6)	1.2 (0.6-2.4)
Hospital mortality, n (%)	482 (10.7%)	210 (1.4%)

The table shows baseline characteristocs for admissions with and without AKI.* p value <0.001, AKI compared to non-AKI. LOS (inpatient days), CKD, age >57 and black race were associated with ↑ risk for AKI

RESULTS: KM Survival Curves

RIFL — Age <57 yr / Whites / Females; Age >57 yr / Blacks / Males

KDIGO — Age <57 yr / Whites / Females; Age >57 yr / Blacks / Males

Delta sCr — Age <57 yr / Whites / Females; Age >57 yr / Blacks / Males

Length of Stay (days)

CONCLUSIONS

RIFL and KDIGO Staging did not distinguish risk of inpatient mortality between Stage 2 and 3 for patients >57 yr, blacks or men. Delta-sCr cut-points performed well for all strata; validation of this approach with other data sets is underway.

REFERENCES

- Chao et al. Kid Int 82:920, 2012
- Wang et al. NDT in press: 2013 doi: 10.1093/ndt/gfs533
- Chertow et al. JASN 16:3365, 2005