

# Chronic Kidney Disease and the Risk of Readmission and Progression to End-Stage Renal Disease in 519,387 Patients Undergoing Coronary Artery Bypass Grafting

**Objective:** Chronic kidney disease (CKD) is a well-established risk factor for operative outcomes after coronary artery bypass grafting (CABG). However, the influence of CKD on post-CABG readmissions, resource utilization, and need for dialysis with progression to end-stage renal disease (ESRD) is not defined. We hypothesize that patients with higher CKD stage have worse operative outcomes, increased readmissions and resource utilization, and a greater need for dialysis with progression to ESRD.

**Methods:** The 2016-2018 Nationwide Readmissions Database was queried for patients to identify 519,387 patients who underwent isolated CABG. Patients were stratified into four groups: no CKD (NCKD; 83%; n=429,711), CKD stages 1 to 3 (CKD 1-3; 12%; n=64,481), CKD stages 4 to 5 (CKD 4-5; 2%; n=8,286), and ESRD (3%, n=16,909) based on ICD 10 classification. New onset dialysis was determined in readmitted patients by ICD procedure code for dialysis or new diagnosis of ESRD. Multivariate logistic regression was used to assess risk factors for in-hospital mortality and 90-day readmission.

**Results:** Operative mortality, hospital readmission, and cost progressively increased with worsening CKD stage (Table). Patients with ESRD had higher rates of in-hospital mortality (7.2%) than the CKD 4-5 (4.7%), CKD 1-3 (3%), and NCKD groups (1.5%) ( $P<0.001$ ). Median hospitalization costs were also higher for patients with ESRD (\$59,616) compared to the CKD 4-5 (\$54,175), CKD 1-3 (\$45,277), and NCKD (\$38,626) groups ( $P<0.001$ ). ESRD patients had higher rates of 90-day readmission (40%) than CKD 4-5 (33%), CKD 1-3 (24%), and NCKD (16%) ( $P<0.001$ ). CKD stage  $>3$  was an independent predictor of operative mortality (OR 1.56, 95% CI 1.40-1.73;  $p<0.001$ ) and 90-day readmission (OR 1.66, 95% CI 1.56-1.76;  $p<0.001$ ). At 30 days post-discharge, new onset dialysis was highest in readmitted CKD 4-5 patients (8.9%; n=1,495) compared to CKD 1-3 (1.4%; n=8,623), or NCKD (0.3%, n=38,885). At 90 days post discharge, the need for dialysis increased to 11.1% (n=1,916) in CKD 4-5 readmitted patients but remained stable for CKD 1-3 (1.4%; n=10,907) and NCKD (0.3%; n=50,200).

**Conclusions:** CKD stage is an important predictor for mortality, new onset dialysis, readmission, and cost following CABG. Patients with CKD 4-5 are readmitted 2.5 times more frequently than NCKD patients and 35 times more likely to require dialysis within 90 days of discharge. A targeted approach including close nephrology follow-up and readmission prevention efforts may reduce costly readmissions and improve outcomes following CABG in CKD patients.

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Characteristic	NCKD (n=387,054)	CKD 1-3 (n=57,095)	CKD 4-5 (n=7,050)	ESRD (n=14,307)	P value
In-hospital mortality, n/N (%)	6,588/429,543 (1.5%)	1,915/64,474 (3.0%)	388/8,285 (4.7%)	1,214/16,902 (7.2%)	<0.001
Length of Stay, median (IQR)	7 (5-11)	10 (7-15)	13 (9-19)	13 (8-21)	<0.001
30-day Readmissions, %	10	15.1	21.2	26.7	<0.001
90-day Readmissions, %	15.8	23.5	33.1	40.2	<0.001
Index Hospitalization Cost, median (IQR)	38,626 (29,718- 51,966)	45,277 (34,038- 62,645)	54,175 (39,980- 74,339)	59,616 (42,719- 85,120)	<0.001
Disposition, %					<0.001
Home Health Care	42.3	41.8	38.4	37.4	
Routine	42.2	29.3	25.5	24.9	
SNF or ICF	15	28	34.5	36	
Short-term Hospital	0.4	0.7	1.3	1.3	
Died on Readmission, n/N (%)	1,483/78,561 (1.9%)	462/16,840 (2.7%)	112/2,967 (3.8%)	277/7,208 (3.8%)	<0.001
Readmission Length of Stay, median (IQR)	3 (2-6)	4 (2-7)	4 (2-8)	4 (2-8)	<0.001
Readmission Cost, median (IQR)	8,747 (5,034- 16,386)	9,111 (5,326- 17,431)	10,063 (5,713- 19,399)	11,077 (6,272- 21,198)	<0.001
Elective Readmission, n/N (%)	12,497/78,474 (15.9%)	2,157/16,805 (12.8%)	312/2,966 (10.5%)	566/7,200 (7.9%)	<0.001