Prognostic Impact of Mildly Impaired Renal Function After Multivessel Revascularization

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A on behalf of the Asan Medical Center–Multivessel Revascularization Registry Investigators

Disclosure

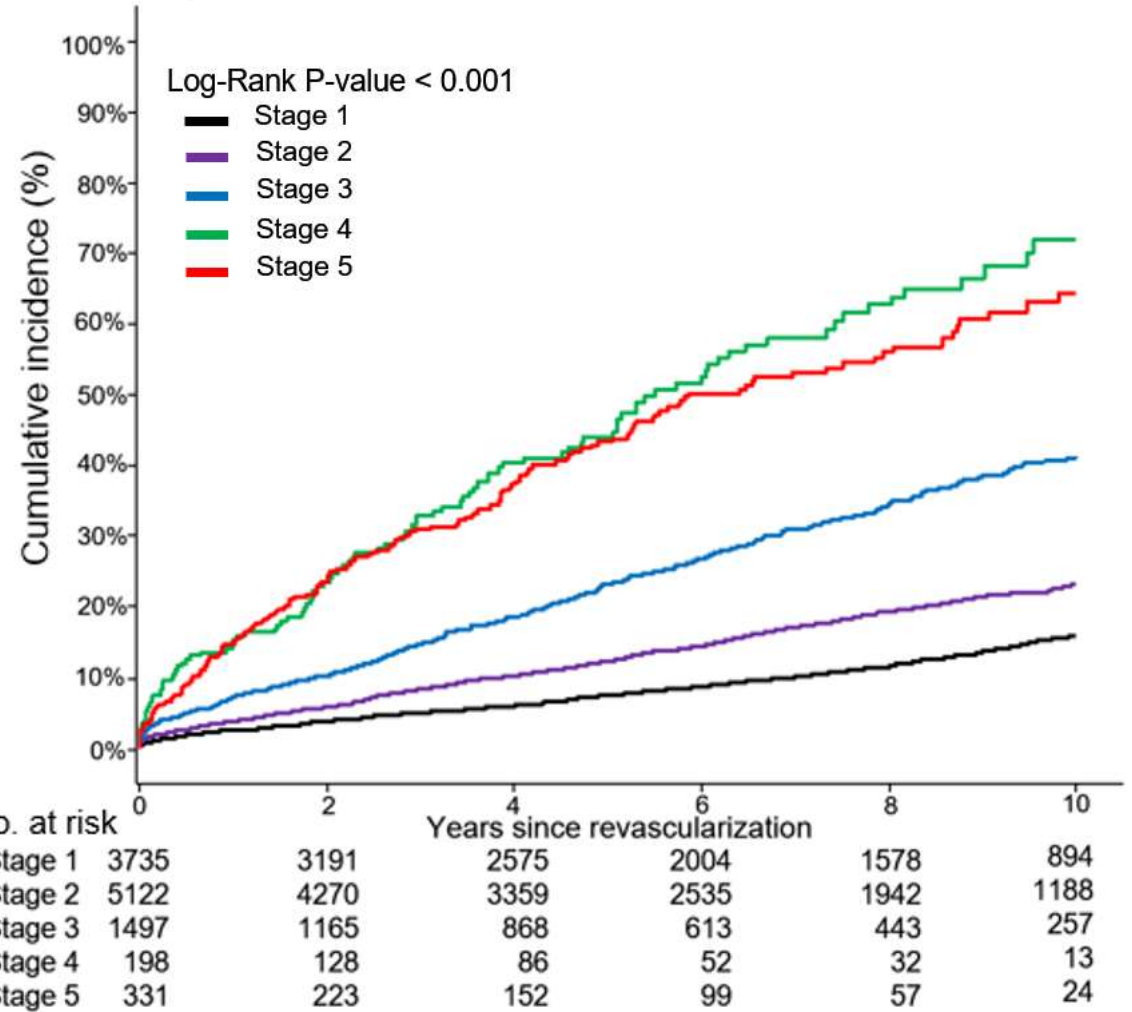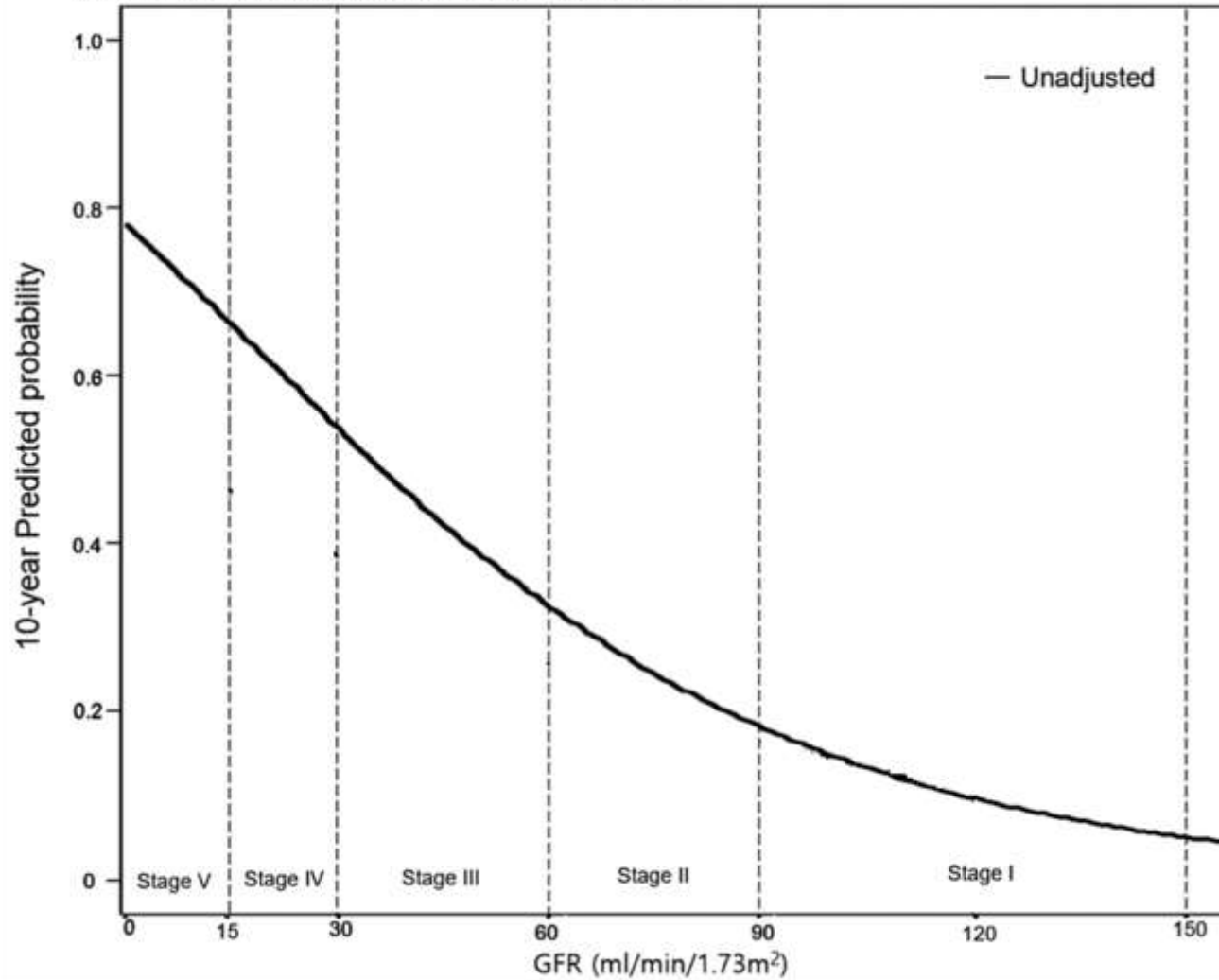- There is nothing to disclose as a conflict of interest

Background

- Cardiovascular disease is a major cause of morbidity and mortality in patients with chronic kidney disease (CKD).

- The effects of decreased renal function on cardiovascular disease attributed to

  - coexisting classical cardiovascular risk factors

  (e.g., diabetes, hypertension, smoking, dyslipidemia, and advanced age)

  - non-classical CKD-related risk factors

  (e.g., mineral and bone disease, anemia, inflammation, and oxidative stress)

Background

Death, Spontaneous MI or stroke of overall population

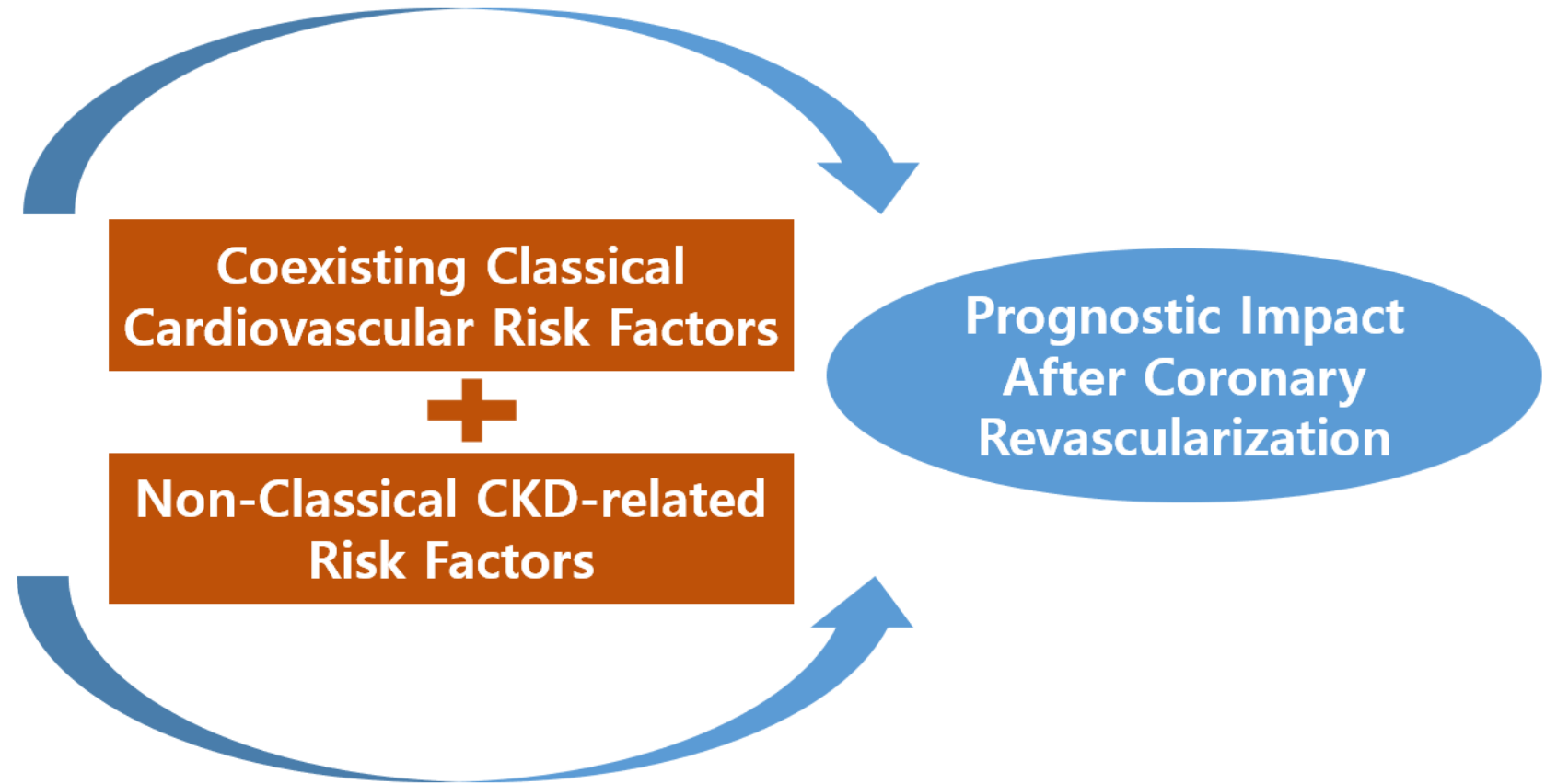MACE according to Renal Function Stage

Background

Objectives

- In this context, we hypothesized that the risk of MACE and the therapeutic benefit of revascularization strategies (ie, CABG or PCI) might differ in patients with mildly decreased renal function compared with those with normal renal function or those with more severe forms of renal dysfunction

Study Design and Patient Population

• **Inclusion criteria**

  - registry-based analysis

  - consecutive patients with multivessel CAD who underwent either isolated CABG

    or PCI with drug-eluting stents between January 1, 2003, and April 30, 2018

The overall population was categorized into 5 groups based on baseline renal status according to eGFR (CKD-EPI)

Study Design and Patient Population
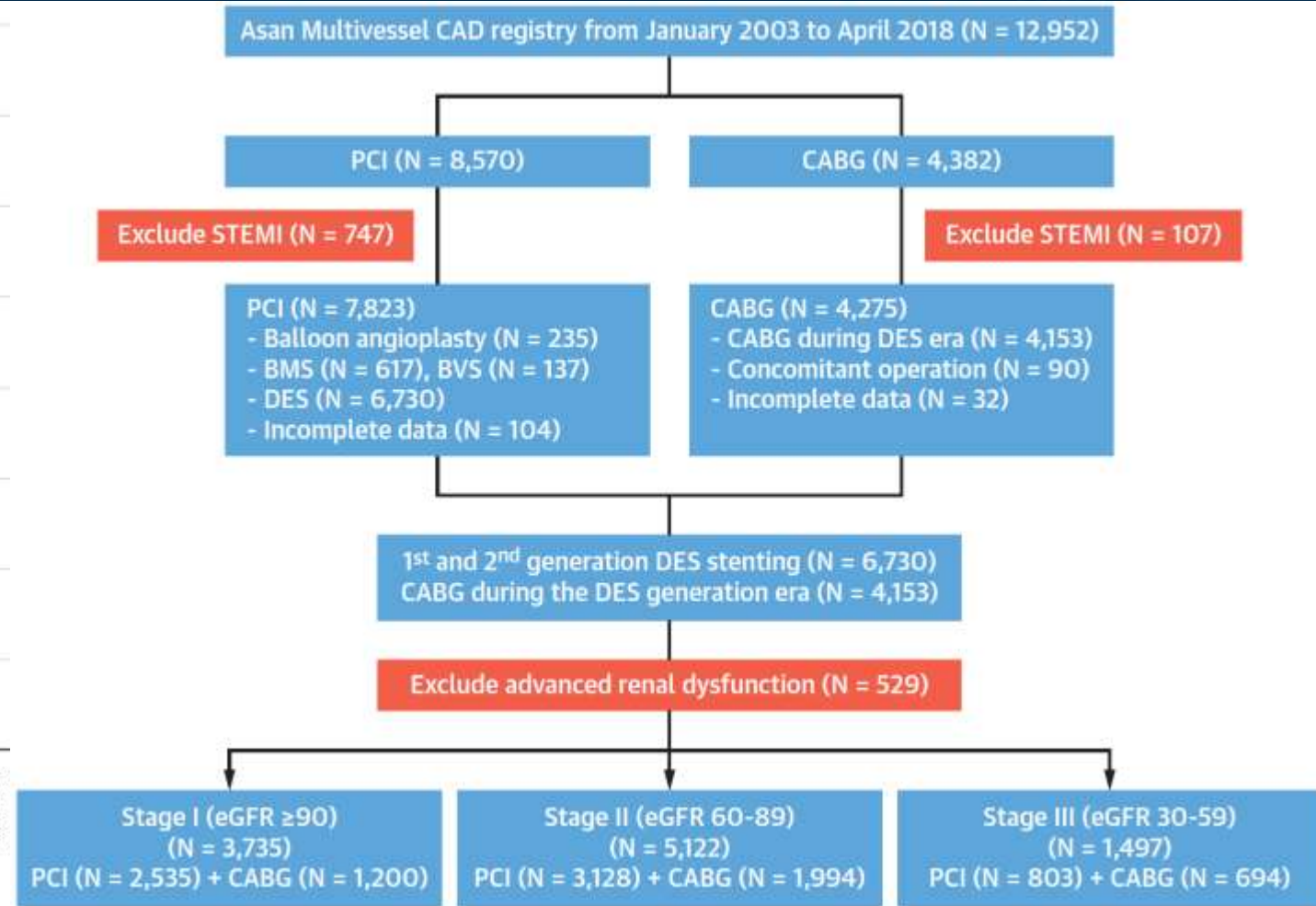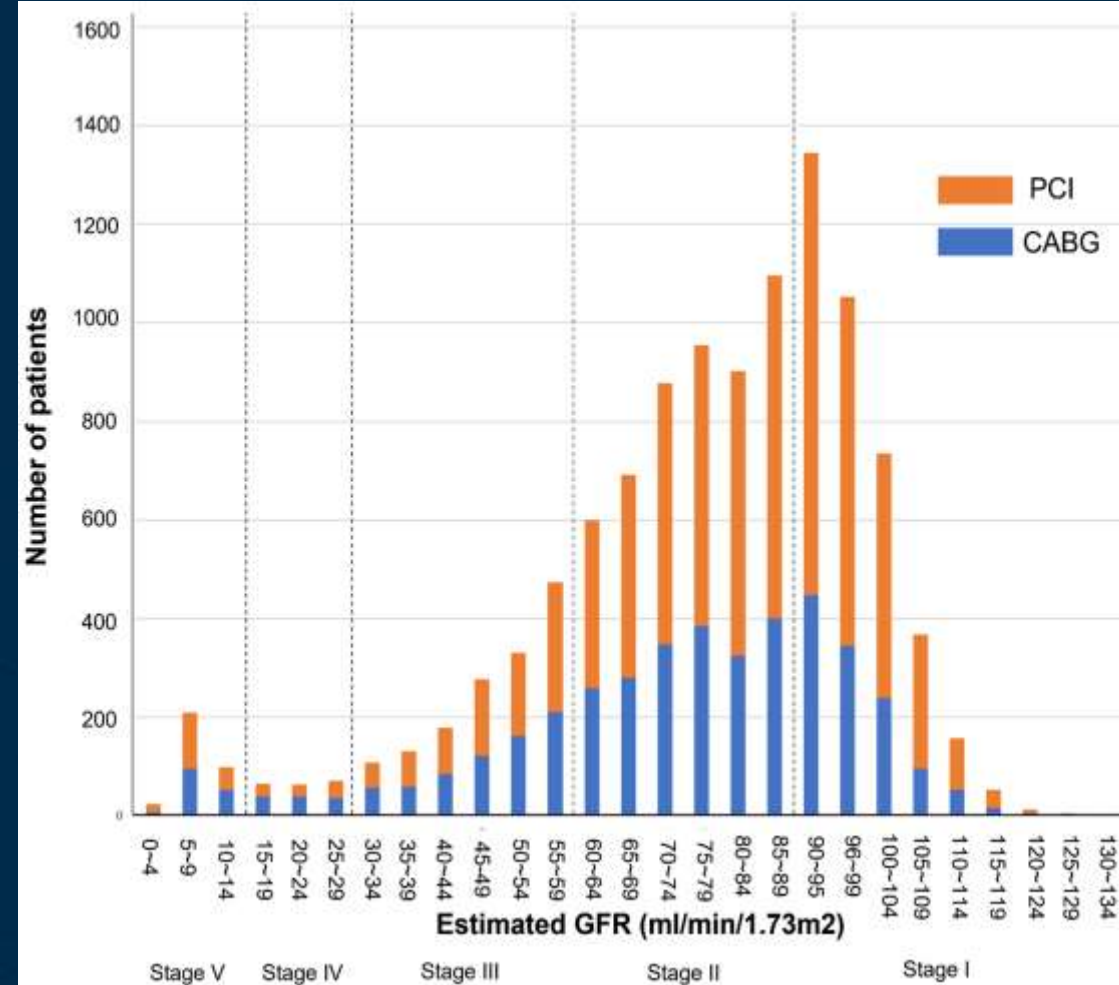
- **Stage I versus Stage II**
- **Stage I versus Stage III**

Study Endpoints & Statistical Analysis

- **Primary Outcome**

  the composite of death, spontaneous myocardial infarction, or stroke

- **Statistical Analysis**

  Propensity-score matching was used to assemble a cohort of patients with similar baseline characteristics.
  (For comparison between PCI and CABG in each renal function group of stage I and stage II, a separate propensity score was also derived.)

Baseline Clinical Characteristics

	Unadjusted Data			Adjusted Data		
	Stage I (n=3735)	Stage II (n=5122)	SD	Stage I (n=2,932)	Stage II (n=2932)	SD
Age, years	58.9 ± 8.8	65.8 ± 9.0	77.5	60.8 ± 8.1	60.9 ± 7.8	1.3
Male	2791 (74.7%)	3830 (74.8%)	0.1	2196 (74.9%)	2239 (76.4%)	3.4
BMI	25.1 ± 3.1	25.0 ± 3.0	2.4	25.1 ± 3.1	25.1 ± 3.0	2.1
Risk factors						
Diabetes mellitus	1250 (33.7%)	1785 (35.0%)	2.8	1003 (34.2%)	1037 (35.4%)	2.4
Hypertension	2127 (57.4%)	3338 (65.4%)	7.9	1785 (60.9%)	1778 (60.6%)	0.5
Hyperlipidemia	1195 (37.1%)	1600 (35.9%)	2.6	922 (36.3%)	899 (35.7%)	1.3
Current smoker	1162 (31.2%)	1210 (23.7%)	16.9	839 (28.6%)	829 (28.3%)	0.8
Previous MI	246 (6.6%)	360 (7.0%)	1.8	195 (6.7%)	200 (6.8%)	0.7
Previous stroke	231 (6.2%)	424 (8.3%)	8.1	196 (6.7%)	195 (6.7%)	0.1
LV EF	58.8 ± 9.0	58.0 ± 10.1	8.9	58.5 ± 9.3	58.3 ± 10.0	2.5
Clinical presentation						
Stable angina	1612 (43.2%)	2246 (43.9%)	5.6	1319 (45.0%)	1318 (45.0%)	1.6
Unstable angina	1350 (36.1%)	1762 (34.4%)		1021 (34.8%)	1031 (35.2%)	
NSTEMI	301 (8.1%)	369 (7.2%)		201 (6.9%)	208 (7.1%)	
Exntet of angiography						
2VD	1561 (41.8%)	1840 (35.9%)	12.3	1144 (39.0%)	1141 (38.9%)	1.7
3VD	1384 (37.1%)	2111 (41.2%)		1164 (39.7%)	1173 (40.0%)	
Revascularization						
PCI	2535 (67.9%)	3128 (61.1%)		1888 (64.4%)	1899 (64.8%)	0.8
CABG	1200 (32.1%)	1994 (38.9%)		1044 (35.6%)	1033 (35.2%)	
Medication at discharge						
DAPT	3262 (89.4%)	4382 (87.6%)	5.8	2555 (89.4%)	2523 (87.7%)	5.2
Statin	2943 (78.8%)	3931 (76.8%)	4.9	2303 (78.6%)	2246 (76.6%)	4.7
Beta-blocker	1955 (52.3%)	2519 (49.9%)	6.3	1479 (50.4%)	1502 (51.2%)	1.6

Baseline Clinical Characteristics

	Unadjusted Data			Adjusted Data		
	Stage I (n=3735)	StageIII (n=1497)	SD	Stage I (n=836)	StageIII (n=836)	SD
Age, years	58.9 ± 8.8	69.8 ± 8.2	128.2	65.6 ± 6.2	66.7 ± 7.7	2.1
Male	2791 (74.7%)	1007 (67.3%)	16.5	586 (66.1%)	602 (68.0%)	3.8
BMI	25.1 ± 3.1	24.7 ± 3.0	11.8	24.7 ± 3.0	24.8 ± 3.0	2.0
Risk factors						
Diabetes mellitus	1250 (33.7%)	763 (51.1%)	35.9	396 (44.7%)	408 (46.1%)	2.7
Hypertension	2127 (57.4%)	1152 (77.2%)	43.1	638 (72.0%)	644 (72.7%)	1.5
Hyperlipidemia	1195 (37.1%)	476 (35.9%)	2.4	293 (37.2%)	263 (33.8%)	7.3
Current smoker	1162 (31.2%)	244 (16.3%)	35.5	174 (19.6%)	165 (18.6%)	2.6
Previous MI	246 (6.6%)	130 (8.7%)	8.0	67 (7.6%)	66 (7.5%)	0.4
Previous stroke	231 (6.2%)	192 (12.8%)	22.8	97 (1.0%)	95 (10.7%)	0.7
LV EF	58.8 ± 9.0	54.9 ± 12.1	36.8	56.9 ± 10.7	56.6 ± 11.2	2.5
Clinical presentation						
Stable angina	1612 (43.2%)	565 (37.7%)	16.9	364 (41.1%)	374 (42.2%)	2.9
Unstable angina	1350 (36.1%)	537 (35.9%)		312 (35.2%)	301 (34.0%)	
NSTEMI	301 (8.1%)	120 (8.0%)		60 (6.8%)	62 (7.0%)	
Exntet of angiography						
2VD	1561 (41.8%)	456 (30.5%)	27.0	303 (34.2%)	297 (33.5%)	2.9
3VD	1384 (37.1%)	685 (45.8%)		390 (44.0%)	397 (44.8%)	
Revascularization						
PCI	2535 (67.9%)	803 (53.6%)	29.5	512 (57.8%)	509 (57.5%)	0.7
CABG	1200 (32.1%)	694 (46.4%)		374 (42.2%)	377 (42.6%)	
Medication at discharge						
DAPT	3262 (89.4%)	1243 (85.7%)	11.1	763 (88.9%)	749 (86.7%)	6.8
Statin	2943 (78.8%)	1070 (71.5%)	17.0	704 (79.5%)	632 (71.3%)	19.0
Beta-blocker	1955 (52.3%)	645 (43.1%)	18.6	418 (47.2%)	394 (44.5%)	5.4

Baseline Clinical Characteristics

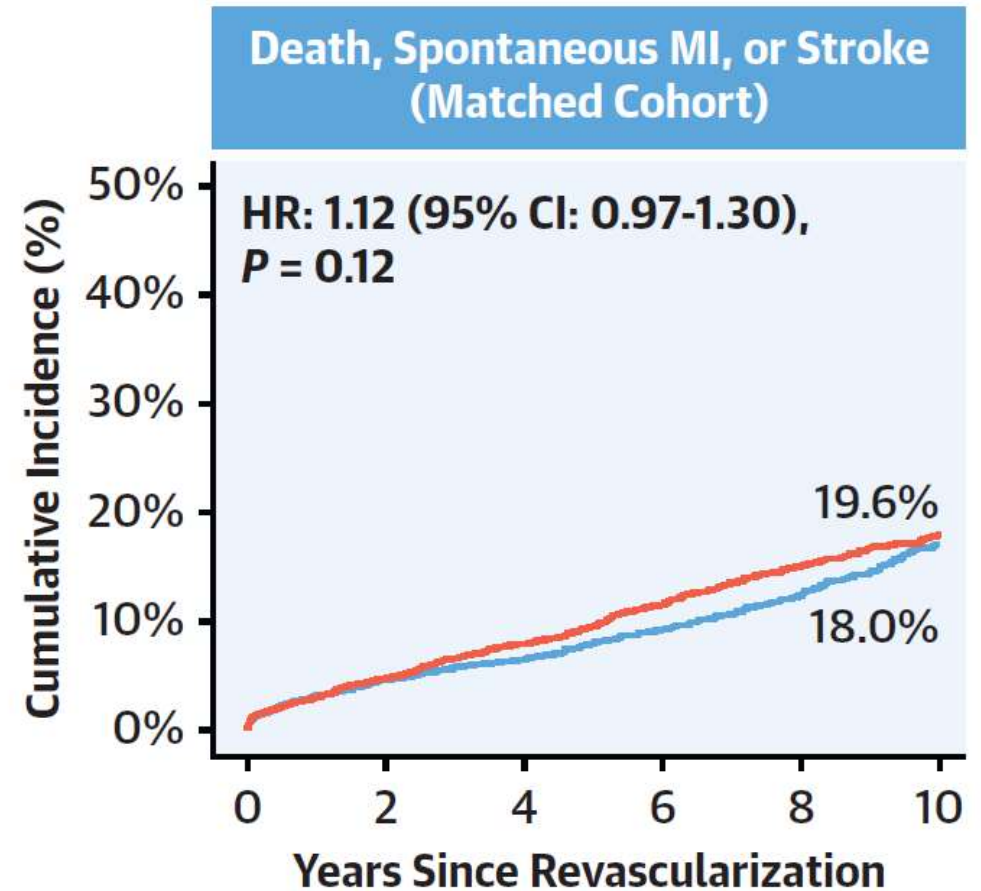| | Unadjusted Data | | | | | | | | |
| | Stage I | | | Stage II | | | Stage III | | |
	PCI (n = 2,535)	CABG (n = 1,200)	P Value	PCI (n = 3,128)	CABG (n = 1,994)	P Value	PCI (n = 803)	CABG (n = 694)	P Value
Age, y	58.9 ± 8.9	58.9 ± 8.5	0.99	66.1 ± 9.3	65.2 ± 8.4	0.001	70.7 ± 8.4	68.7 ± 7.9	<0.001
Male	1,913 (75.5)	878 (73.2)	0.13	2295 (73.4)	1,535 (77.0)	0.004	531 (66.1)	476 (68.6)	0.31
Body mass index, kg/m²	25.2 ± 3.1	24.8 ± 3.1	0.001	25.1 ± 3.0	24.8 ± 3.0	<0.001	24.7 ± 3.0	24.7 ± 2.9	0.80
Diabetes mellitus									
Any diabetes	778 (30.8)	472 (39.7)	<0.001	1,020 (32.7)	765 (38.5)	<0.001	384 (47.9)	379 (54.9)	0.01
Requiring insulin	58 (2.3)	53 (4.4)	<0.001	112 (3.6)	117 (5.9)	<0.001	81 (10.1)	87 (12.5)	0.13
Hypertension	1,421 (56.6)	706 (59.0)	0.16	2,087 (67.1)	1,251 (62.8)	0.002	624 (77.7)	528 (76.1)	0.41
Hyperlipidemia	873 (39.7)	322 (31.5)	<0.001	1,081 (39.3)	519 (30.3)	<0.001	287 (39.8)	189 (31.3)	0.001
Current smoker	817 (32.3)	345 (28.8)	0.03	715 (22.9)	495 (24.9)	0.11	126 (15.7)	118 (17.0)	0.49
Previous MI	152 (6.0)	94 (7.9)	0.03	187 (6.0)	173 (8.7)	<0.001	54 (6.8)	76 (11.0)	0.004
Previous CABG	44 (1.7)	5 (0.4)	0.001	53 (1.7)	8 (0.4)	<0.001	24 (3.0)	10 (1.4)	0.05
Previous PCI	352 (13.9)	184 (15.4)	0.24	500 (16.0)	317 (15.9)	0.95	150 (18.7)	93 (13.4)	0.01
Previous heart failure	40 (1.6)	50 (4.2)	<0.001	79 (2.5)	93 (4.7)	<0.001	42 (5.2)	58 (8.4)	0.02
Previous stroke	817 (32.3)	345 (28.8)	0.03	240 (7.7)	184 (9.2)	0.05	102 (12.7)	90 (13.0)	0.89
Previous dialysis	0 (0)	1 (0.1)	0.32	4 (0.1)	1 (0.1)	0.65	5 (0.6)	3 (0.4)	0.73
Chronic lung disease	29 (1.1)	25 (2.1)	0.03	61 (2.0)	39 (2.0)	0.99	17 (2.1)	16 (2.3)	0.80
Atrial fibrillation	25 (1.0)	16 (1.3)	0.34	77 (2.5)	68 (3.4)	0.05	37 (4.6)	30 (4.3)	0.79
LV ejection fraction									
Mean ejection fraction, %	60.0 ± 7.6	56.7 ± 10.8	<0.001	59.8 ± 8.5	55.5 ± 11.6	<0.001	57.8 ± 10.2	51.8 ± 13.1	<0.001
Extent of angiography									
2-vessel disease	1,388 (54.8)	173 (14.4)	<0.001	1,582 (50.6)	258 (12.9)	<0.001	367 (45.7)	89 (12.8)	<0.001
3-vessel disease	735 (29.0)	649 (54.1)		1,015 (32.5)	1,096 (55.0)		275 (34.3)	410 (59.1)	

Risks of the Primary Composite Outcome (Stage I vs II)

A — Death, Spontaneous MI, or Stroke (Crude)

HR: 1.60 (95% CI: 1.42-1.81), *P* < 0.001

23.3%
15.9%

Cumulative Incidence (%) vs Years Since Revascularization
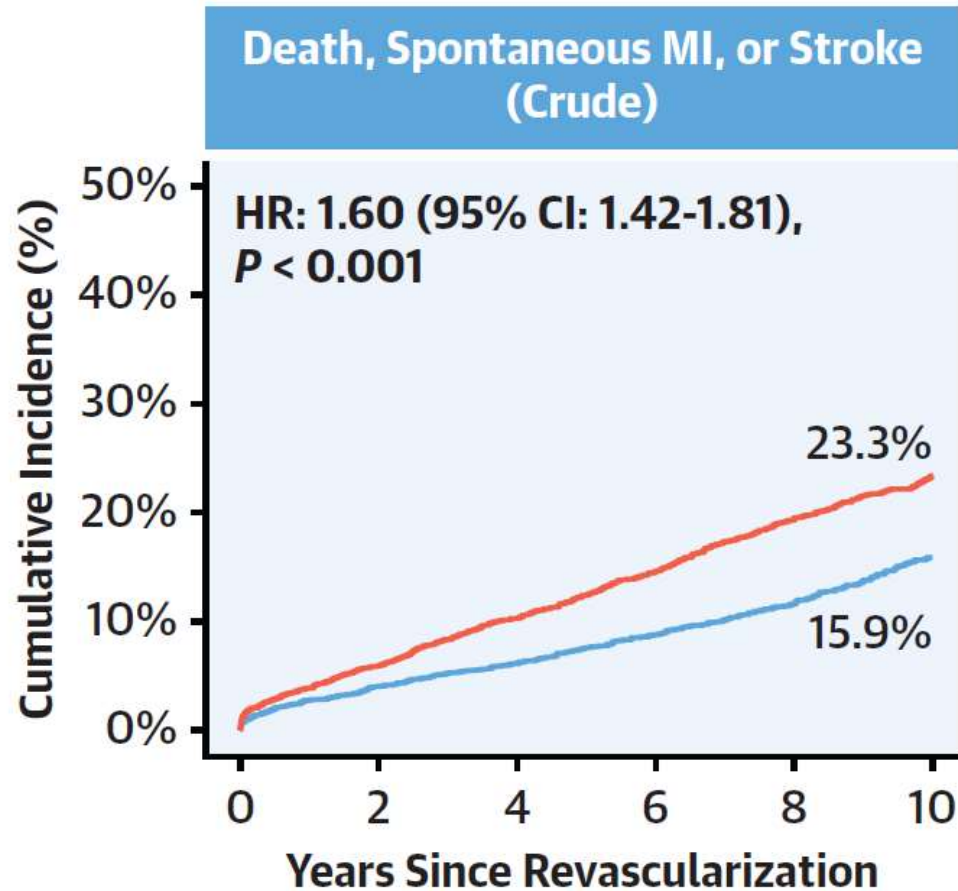
No. at risk

Stage I	3,735	3,191	2,575	2,004	1,578	894
Stage II	5,122	4,270	3,359	2,535	1,942	1,188
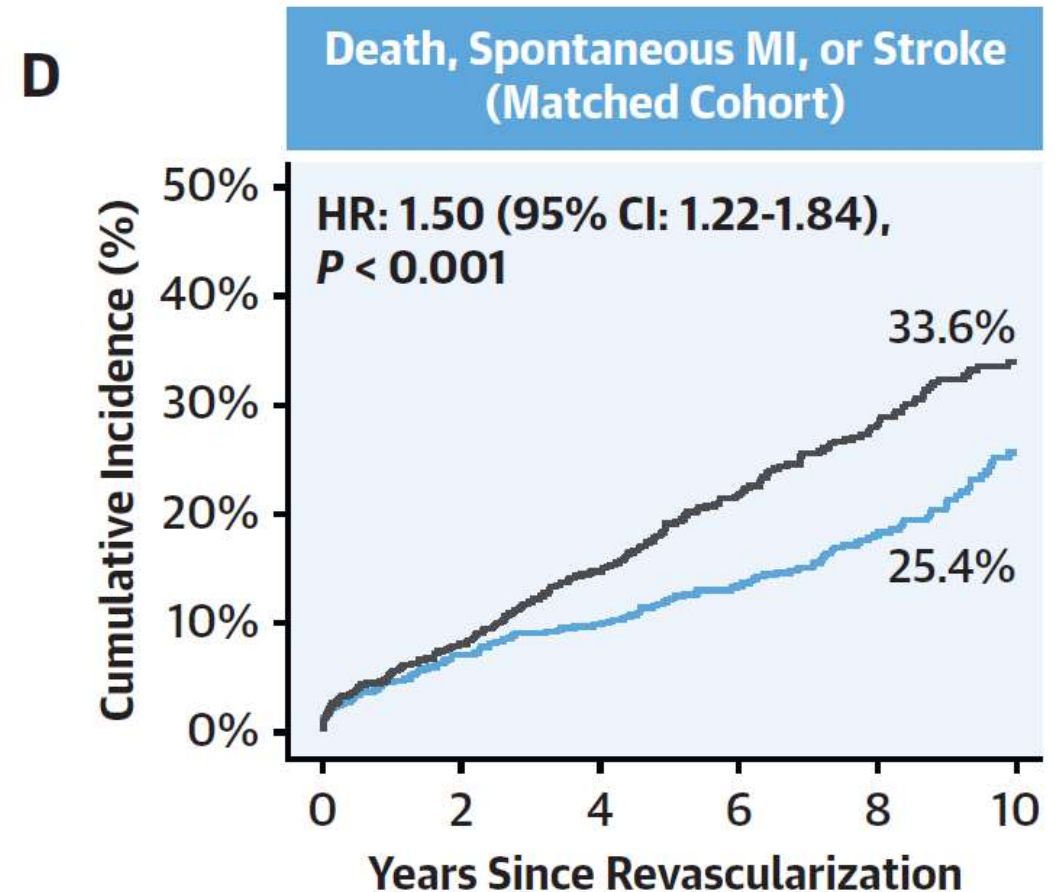
B — Death, Spontaneous MI, or Stroke (Matched Cohort)

HR: 1.12 (95% CI: 0.97-1.30), *P* = 0.12

19.6%
18.0%

Cumulative Incidence (%) vs Years Since Revascularization

No. at risk

Stage I	2,932	2,494	1,999	1,541	1,209	671
Stage II	2,932	2,491	2,016	1,575	1,264	852

Risks of the Primary Composite Outcome (Stage I vs III)

Risks of the Primary Composite Outcome After PCI and CABG
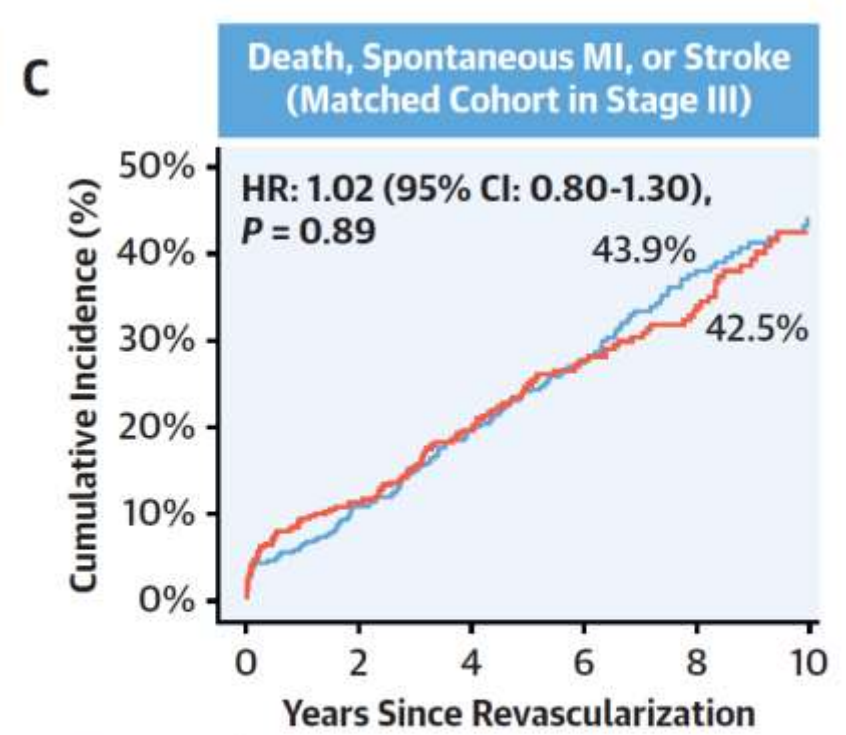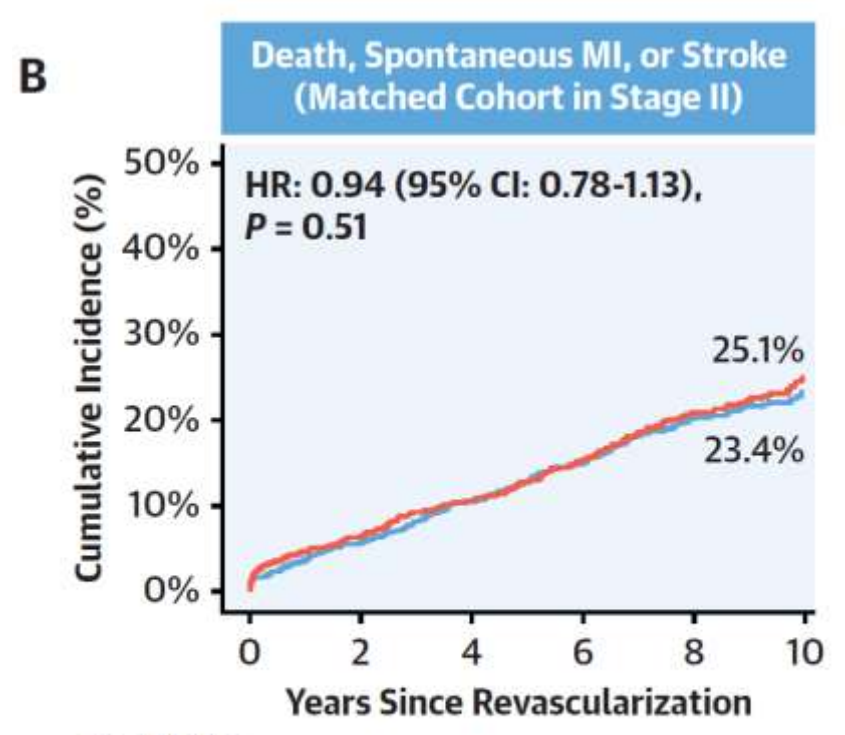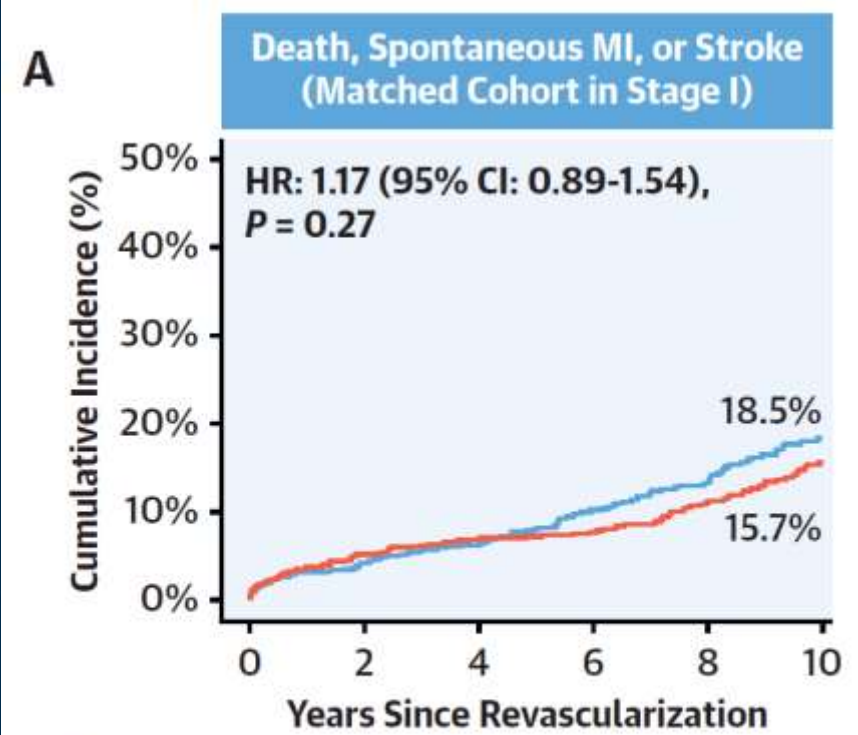
Key Message

- In this large scale, real-world cohort of patients with multivessel CAD,

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Matched Cohort	Adjusted HR (95% CI)
(Overall cohort): Stage II vs Stage I	1.12 (0.97-1.30), p = 0.12 (Ref: Stage I)
(Overall cohort): Stage III vs Stage I	1.50 (1.22-1.84), p < 0.001 (Ref: Stage I)
(Stage I Cohort): PCI vs CABG	1.17 (0.89-1.54), p = 0.27 (Ref: CABG)
(Stage II cohort): PCI vs CABG	0.94 (0.78-1.13), p = 0.51 (Ref: CABG)
(Stage III cohort): PCI vs CABG	1.02 (0.80-1.30), p = 0.89 (Ref: CABG)

0.5   0.7   1.0   1.5   2.0
Decreased Risk   Increased Risk