

# LM & MVD Revascularization 2023: Guidelines and Beyond

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# Overarching Goals for Revascularization in SIHD

- To improve survival
- To prevent other cardiovascular events
- To improve quality of life

# Revascularization to Improve Survival in SIHD

- Overall cohort
- High risk subgroups
  - Left main disease
  - LV dysfunction
  - 3-vessel disease
  - Proximal LAD disease
  - Extensive ischemia

# Contemporary Revascularization vs. Medicine SIHD Trials

*No difference in mortality*

2007



No difference in death

2009



No difference in death

2012

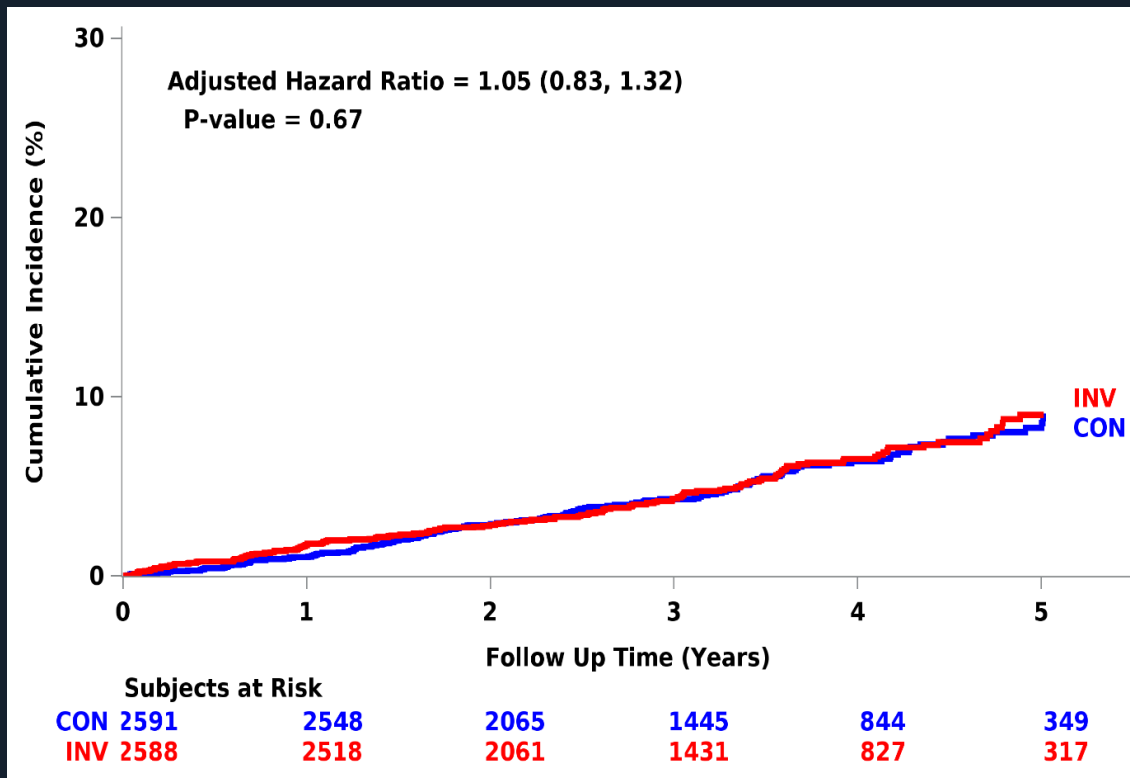
**FAME 2  
Trial**

No difference in death

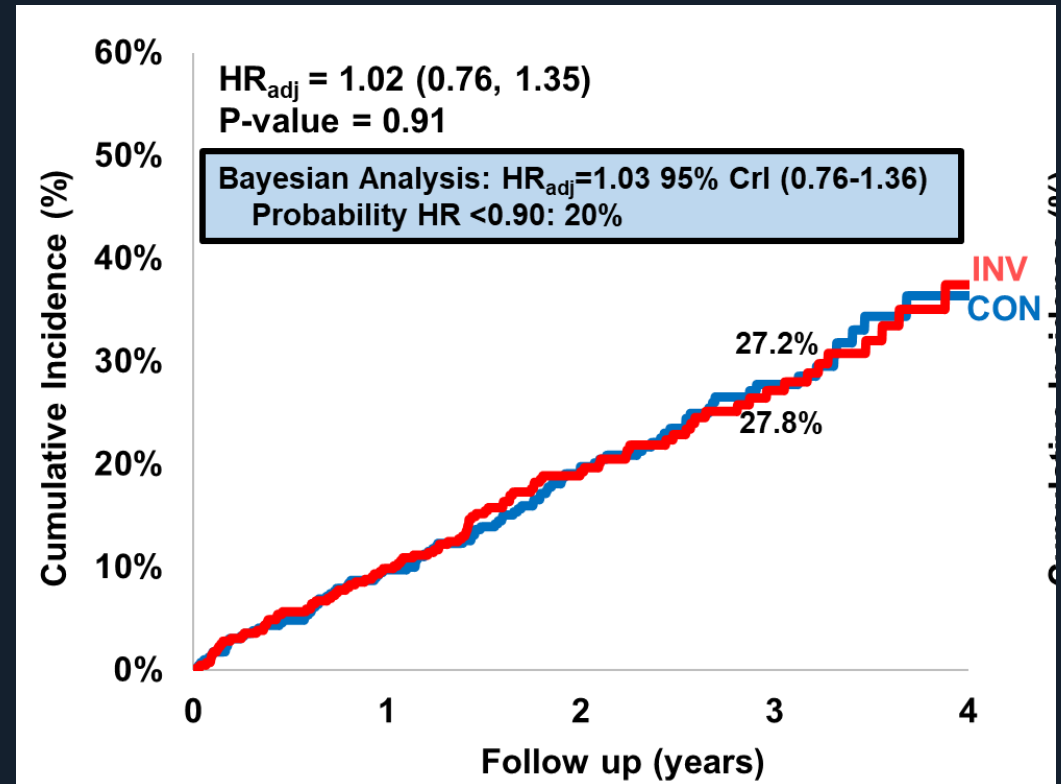
# ISCHEMIA and ISCHEMIA-CKD trials

## *No difference in mortality*

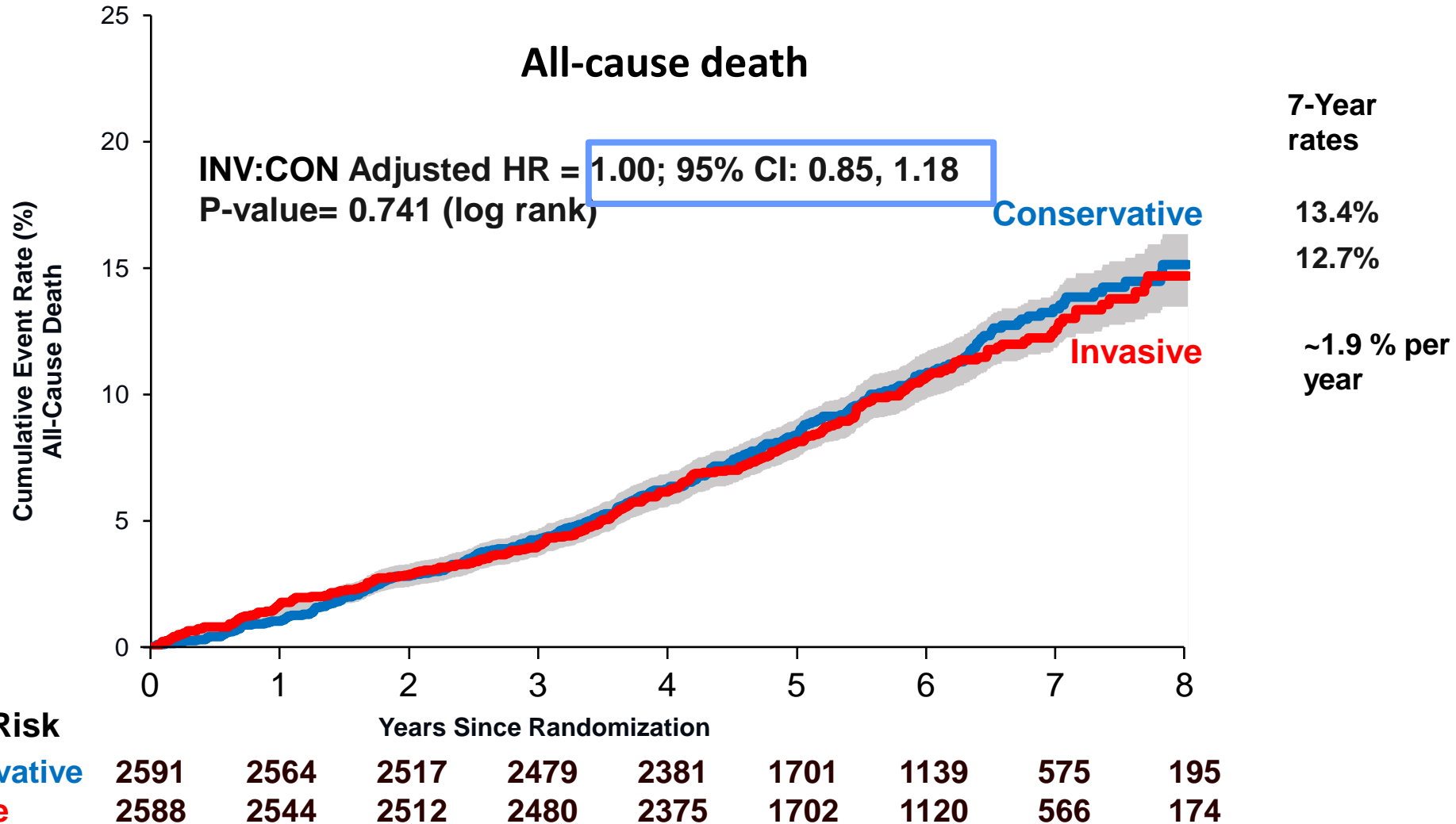
### ISCHEMIA



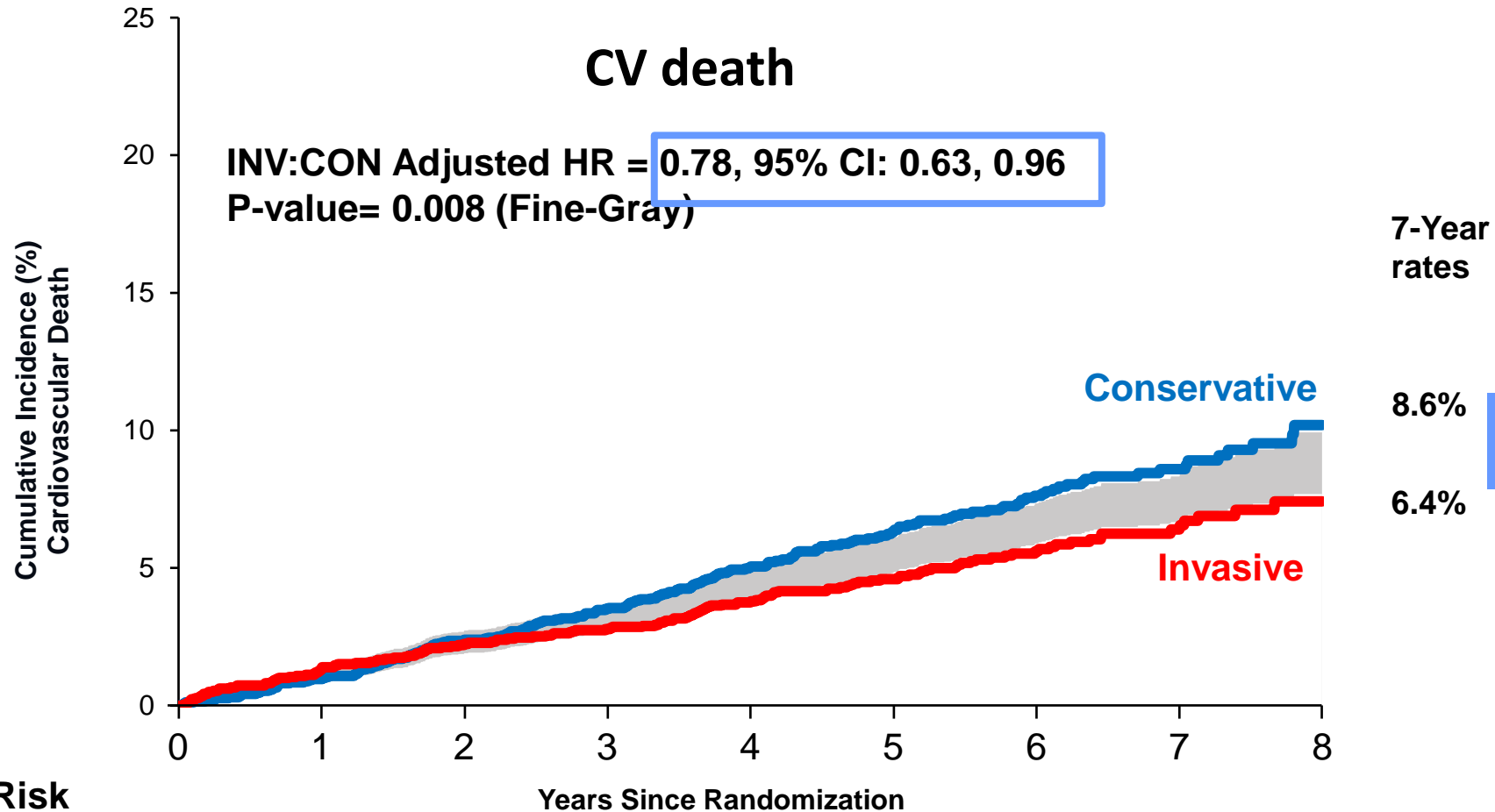
### ISCHEMIA-CKD



# ISCHEMIA EXTEND: All-cause death



# ISCHEMIA EXTEND: CV death

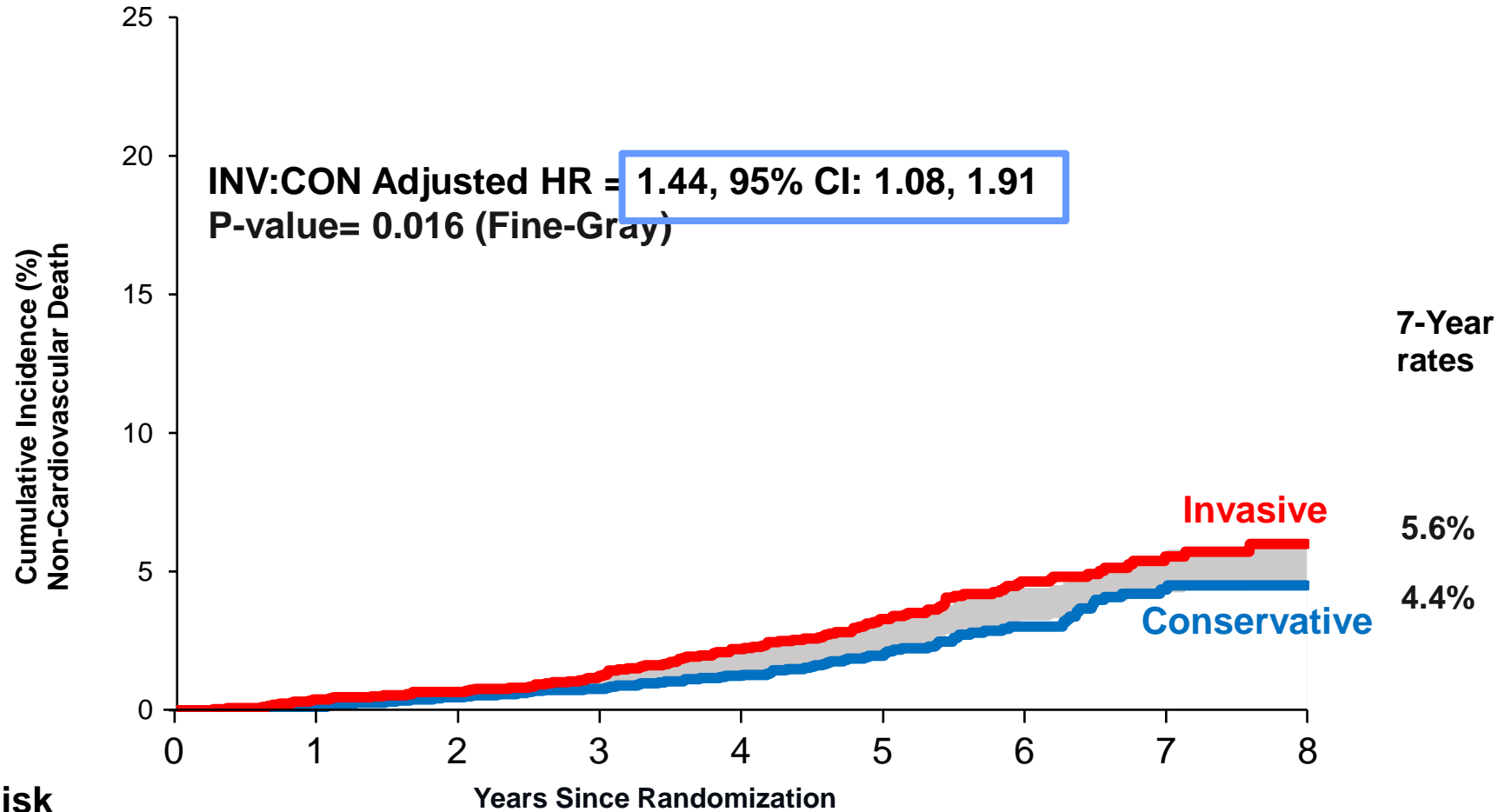


**No. at Risk**

Conservative	2591	2564	2516	2477	2378	1699	1137	575	195
Invasive	2588	2544	2509	2476	2373	1697	1116	564	174



# ISCHEMIA EXTEND: Non CV death



## No. at Risk

Conservative	2591	2564	2516	2477	2378	1699	1137	575	195
Invasive	2588	2544	2509	2476	2373	1697	1116	564	174

# Revascularization to Improve Survival in SIHD

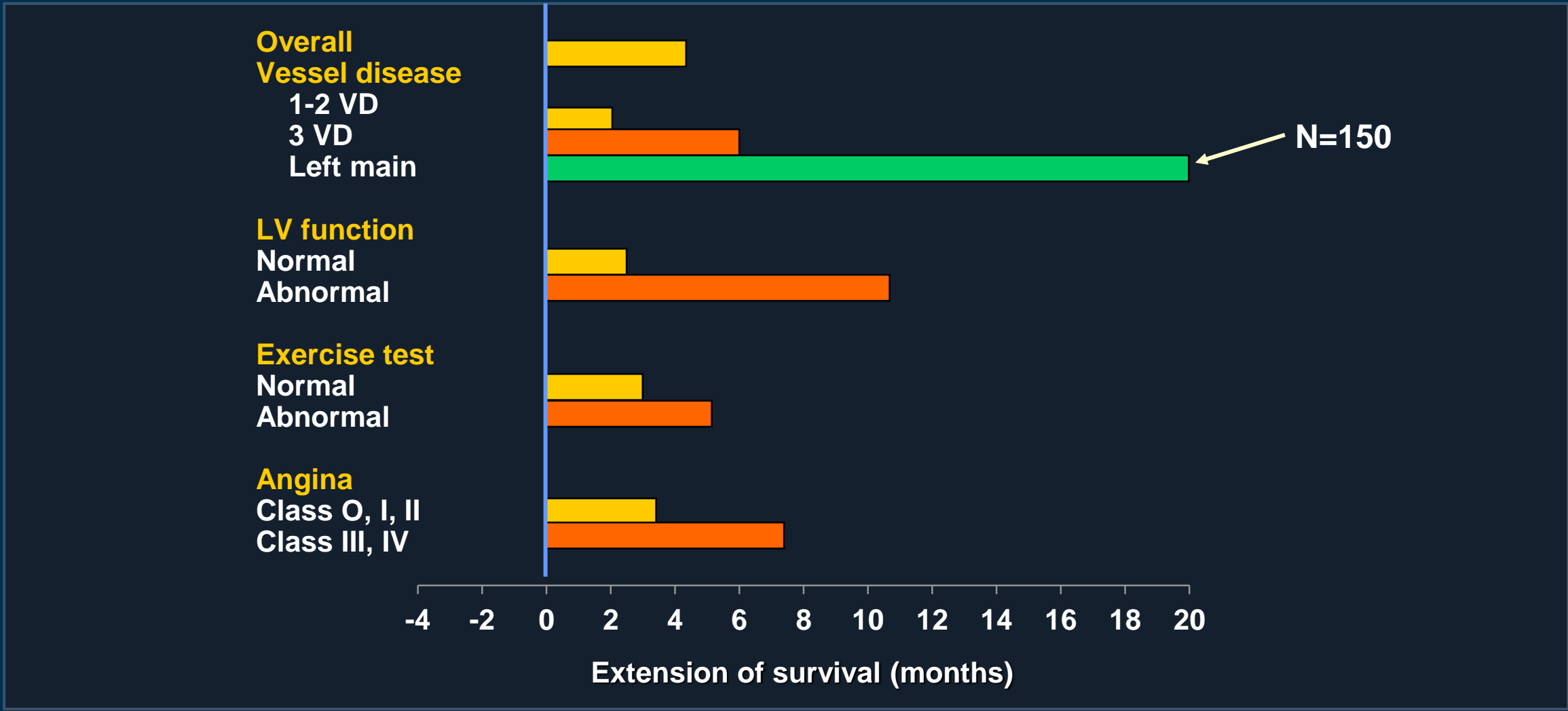
- Overall cohort
  - *Similar survival compared with MT*
  - *Small reduction (0.3%/year) in cardiac death*
- High risk subgroups
  - Left main disease
  - LV dysfunction
  - 3-vessel disease
  - Proximal LAD disease
  - Extensive ischemia

# Revascularization to Improve Survival in SIHD

- Overall cohort
- High risk subgroups
  - Left main disease
  - LV dysfunction
  - 3-vessel disease
  - Proximal LAD disease
  - Extensive ischemia

# Extension of Survival in Left Main Disease with Revascularization

## CABG vs. No CABG trials-1980s



# Revascularization to Improve Survival in High Risk Subgroups

- Overall cohort
- High risk subgroups
  - Left main disease. *Revasc vs. Med: Survival benefit of CABG (older trials-150 patients)*
  - LV dysfunction
  - 3-vessel disease
  - Proximal LAD disease
  - Extensive ischemia

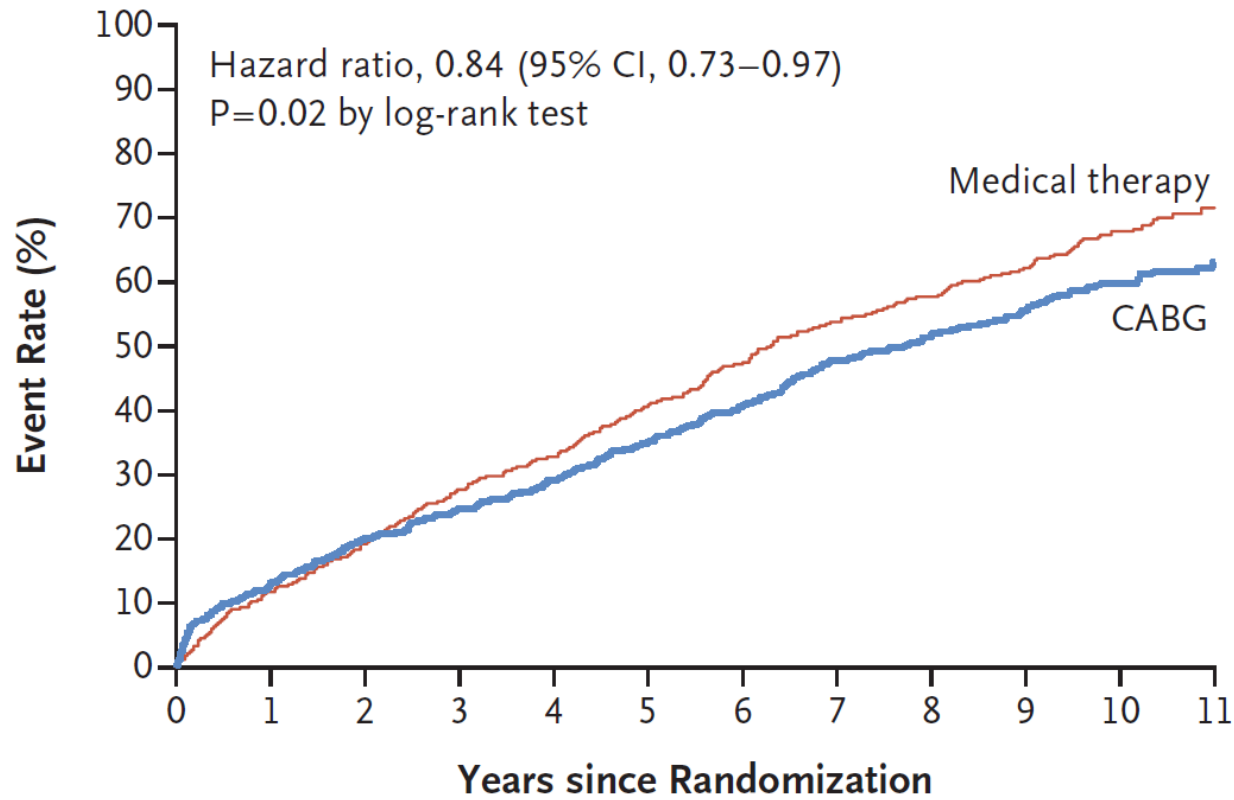
# Revascularization to Improve Survival in SIHD

- Overall cohort
- High risk subgroups
  - Left main disease
  - LV dysfunction
  - 3-vessel disease
  - Proximal LAD disease
  - Extensive ischemia

# Extension of Survival in LV Dysfunction with Revascularization

## *STICHES trial*

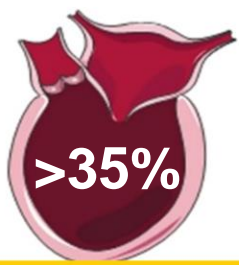
### A Death from Any Cause (Primary Outcome)



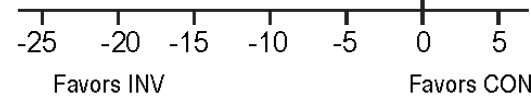
**NNT = 14**

# ISCHEMIA: Heart failure/LVSD

398 (7.7%) participants with HF/LVD



Event	4-year Cumulative Incidence (95% CI)		Difference in Event Rate, INV - CON (95% CI)	Interaction P-value
	INV	CON		
<b>Primary endpoint</b>				
No history of HF/LVD	13.0% (11.5%, 14.6%)	14.6% (13.0%, 16.2%)	-1.6% (-3.8%, 0.7%)	0.055
History of HF/LVD	17.2% (11.6%, 23.8%)	29.3% (21.2%, 38.0%)	-12.1% (-22.6%, -1.6%)	
<b>CV death or MI</b>				
No history of HF/LVD	11.4% (10.0%, 12.9%)	13.1% (11.5%, 14.7%)	-1.6% (-3.8%, 0.5%)	0.061
History of HF/LVD	14.6% (9.4%, 20.9%)	25.9% (18.2%, 34.3%)	-11.4% (-21.4%, -1.4%)	
<b>All-cause death</b>				
No history of HF/LVD	6.2% (5.1%, 7.5%)	5.9% (4.8%, 7.1%)	0.3% (-1.3%, 2.0%)	0.406
History of HF/LVD	10.2% (5.8%, 15.9%)	13.3% (7.9%, 20.0%)	-3.1% (-11.1%, 4.8%)	
<b>CV death</b>				
No history of HF/LVD	3.8% (3.0%, 4.9%)	4.5% (3.5%, 5.5%)	-0.6% (-2.0%, 0.8%)	0.154
History of HF/LVD	6.7% (3.4%, 11.6%)	12.7% (7.5%, 19.5%)	-6.0% (-13.3%, 1.3%)	
<b>MI (Primary Definition)</b>				
No history of HF/LVD	8.8% (7.6%, 10.2%)	9.7% (8.4%, 11.1%)	-0.9% (-2.8%, 1.0%)	0.244
History of HF/LVD	10.5% (6.2%, 16.2%)	16.5% (10.5%, 23.8%)	-6.0% (-14.4%, 2.4%)	
<b>UA hospitalization</b>				
No history of HF/LVD	0.6% (0.4%, 1.1%)	1.5% (1.0%, 2.1%)	-0.8% (-1.5%, -0.2%)	0.864
History of HF/LVD	0.5% (0.0%, 2.4%)	1.1% (0.2%, 3.7%)	-0.7% (-2.5%, 1.2%)	
<b>Hospitalization for HF</b>				
No history of HF/LVD	2.0% (1.4%, 2.8%)	0.6% (0.3%, 1.1%)	1.4% (0.6%, 2.1%)	0.550
History of HF/LVD	4.4% (1.9%, 8.6%)	4.5% (1.9%, 8.7%)	-0.1% (-4.8%, 4.6%)	
<b>Death or HF hospitalization</b>				
No history of HF/LVD	7.5% (6.3%, 8.9%)	6.2% (5.1%, 7.5%)	1.3% (-0.4%, 3.1%)	0.293
History of HF/LVD	13.3% (8.3%, 19.6%)	16.8% (10.7%, 24.1%)	-3.5% (-12.3%, 5.3%)	
<b>HF death</b>				
No history of HF/LVD	0.3% (0.1%, 0.7%)	0.0% (0.0%, 0.3%)	0.3% (-0.0%, 0.6%)	0.401
History of HF/LVD	0.7% (0.1%, 3.8%)	1.8% (0.3%, 6.2%)	-1.0% (-4.1%, 2.0%)	





# Revascularization to Improve Survival in SIHD

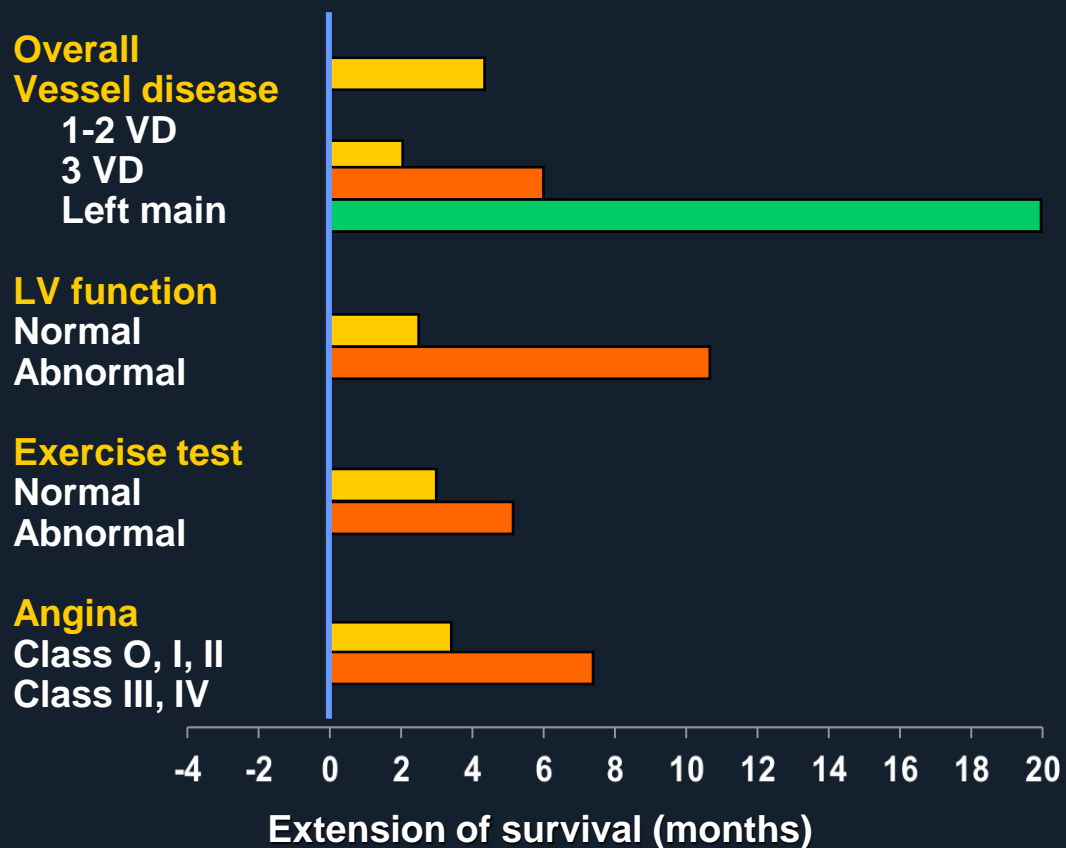
- Overall cohort
- High risk subgroups
  - Left main disease
  - LV dysfunction
    - *CABG vs. Med: Mortality benefit of CABG (STICHES)*
    - *CABG vs. PCI: Need RCT*
  - 3-vessel disease
  - Proximal LAD disease
  - Extensive ischemia

# Revascularization to Improve Survival in SIHD

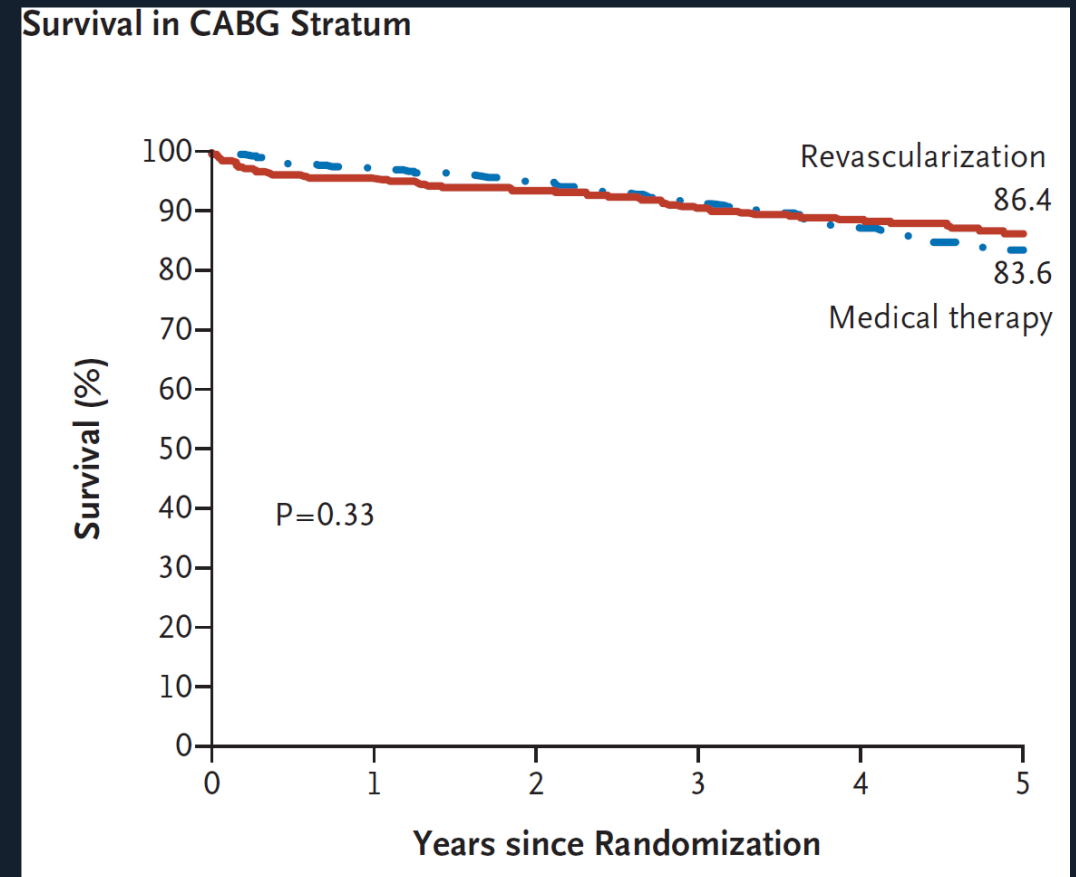
- Overall cohort
- High risk subgroups
  - Left main disease
  - LV dysfunction
  - **3-vessel disease**
  - Proximal LAD disease
  - Extensive ischemia

# Extension of Survival with 3-vessel disease with Revascularization 1980s to Present

## 1980s (CABG vs. No CABG)



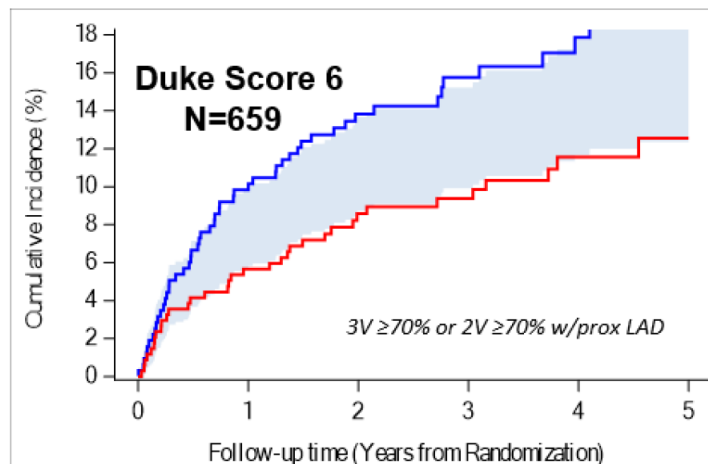
## 2009 (BARI-2 D: CABG vs. Med)



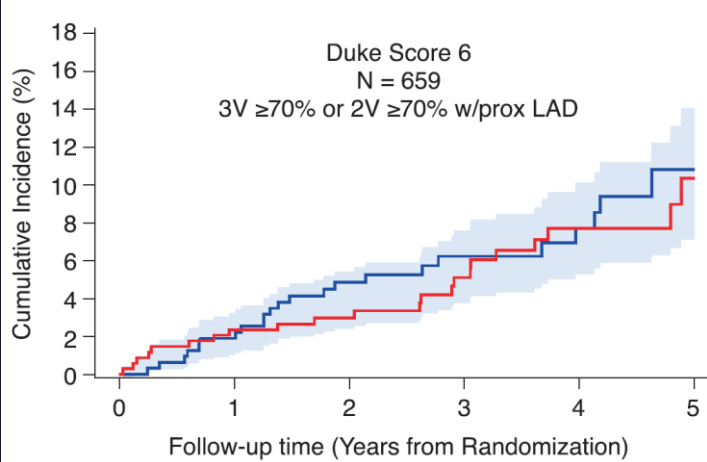
# ISCHEMIA: Potential Reduction in CV death/MI in High Anatomic Risk

	Events, n		4-y event rate, %		Difference (95% CI), %	Interaction P value
	Invasive strategy	Conservative strategy	Invasive strategy	Conservative strategy		
Cardiovascular death or myocardial infarction						0.33
1-Vessel CAD $\geq 50\%$	3	4	3.3 (0.9 to 8.6)	8.7 (2.5 to 19.9)	-5.4 (-14.9 to 4.2)	
1-Vessel CAD $\geq 70\%$ or 2-vessel $\geq 50\%$	26	25	8.8 (5.7 to 12.8)	8.7 (5.6 to 12.5)	0.2 (-4.7 to 5.1)	
2-Vessel CAD $\geq 70\%$ or 3-vessel $\geq 50\%$ or 70% proximal LAD	38	48	10.2 (7.2 to 13.9)	12.8 (9.5 to 16.7)	-2.6 (-7.5 to 2.3)	
3-Vessel CAD $\geq 70\%$ or 2-vessel $\geq 70\%$ including proximal LAD	34	50	11.6 (8.1 to 15.7)	17.9 (13.4 to 22.8)	-6.3 (-12.4 to -0.2)	

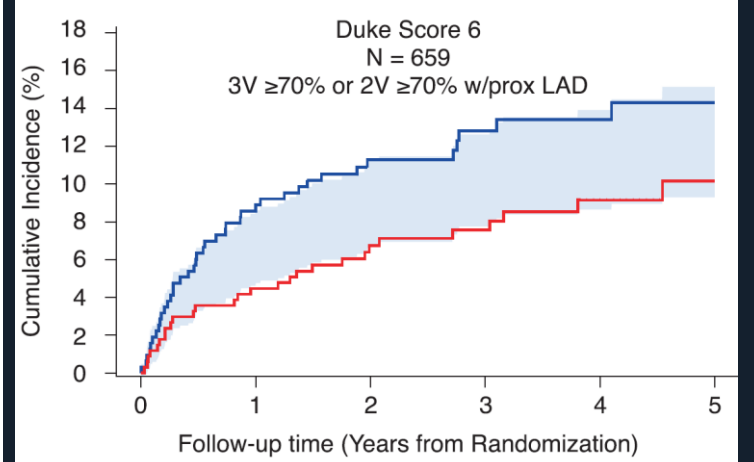
**CV Death or MI**



**All-Cause Mortality**



**Myocardial Infarction**



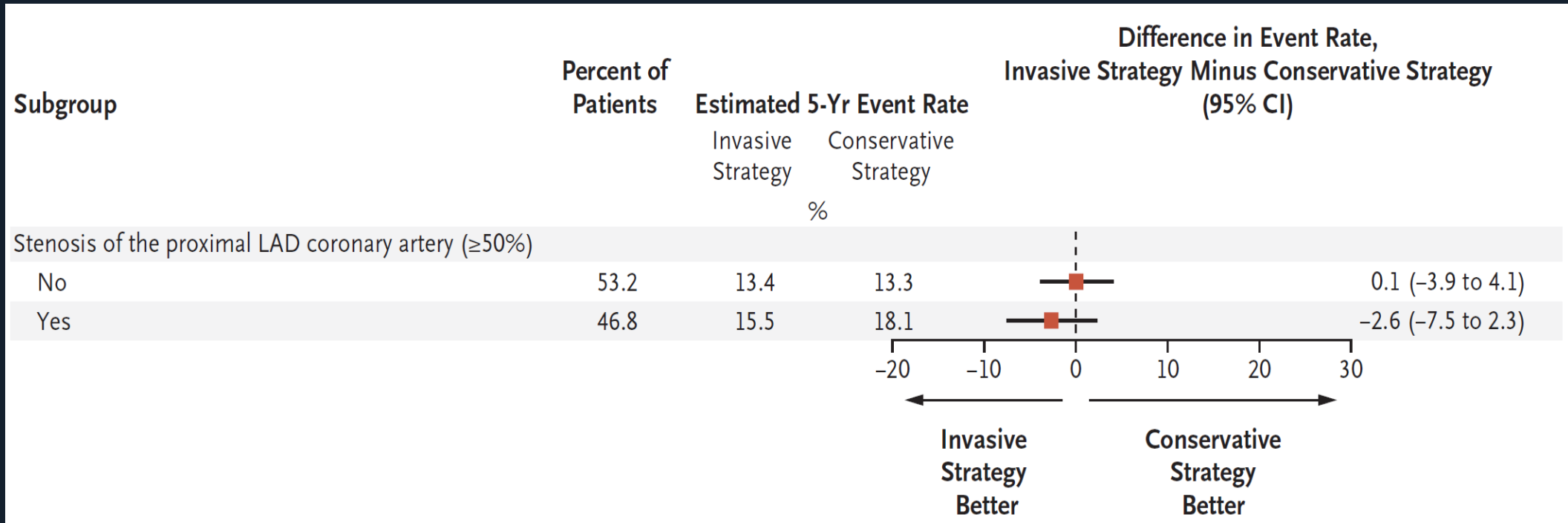
# Revascularization to Improve Survival in SIHD

- Overall cohort
- High risk subgroups
  - Left main disease
  - LV dysfunction
  - 3-vessel disease
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  - Extensive ischemia

# Extension of Survival with Proximal LAD with Revascularization

## ISCHEMIA: Invasive vs. Conservative

No heterogeneity of treatment effect based on proximal LAD stenosis status for the primary endpoint



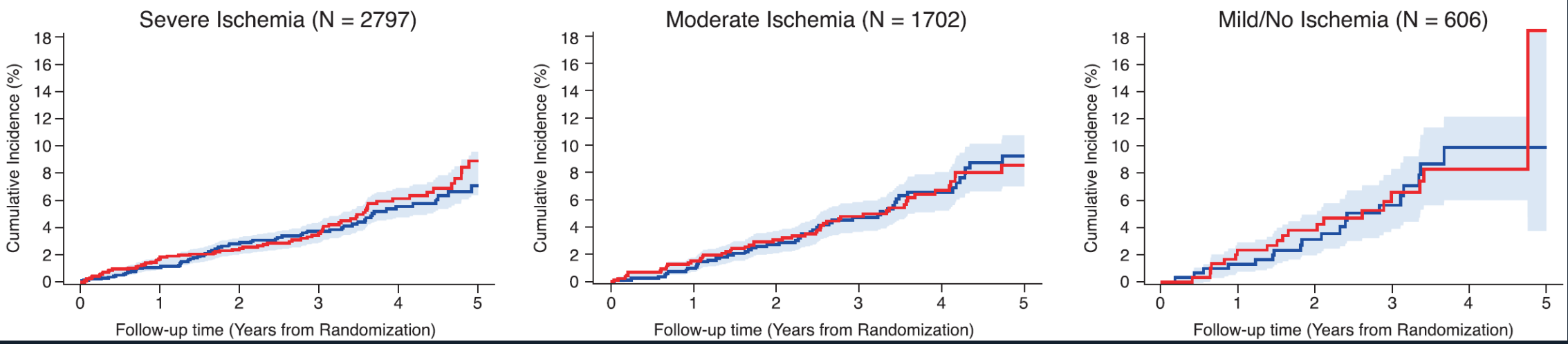
# Revascularization to Improve Survival in SIHD

- Overall cohort
- High risk subgroups
  - Left main disease
  - LV dysfunction
  - 3-vessel disease
  - Proximal LAD disease
  - Extensive ischemia

# Extension of Survival with Revascularization Based on Ischemia Severity

## ISCHEMIA: Invasive vs. Conservative

### All-Cause Mortality





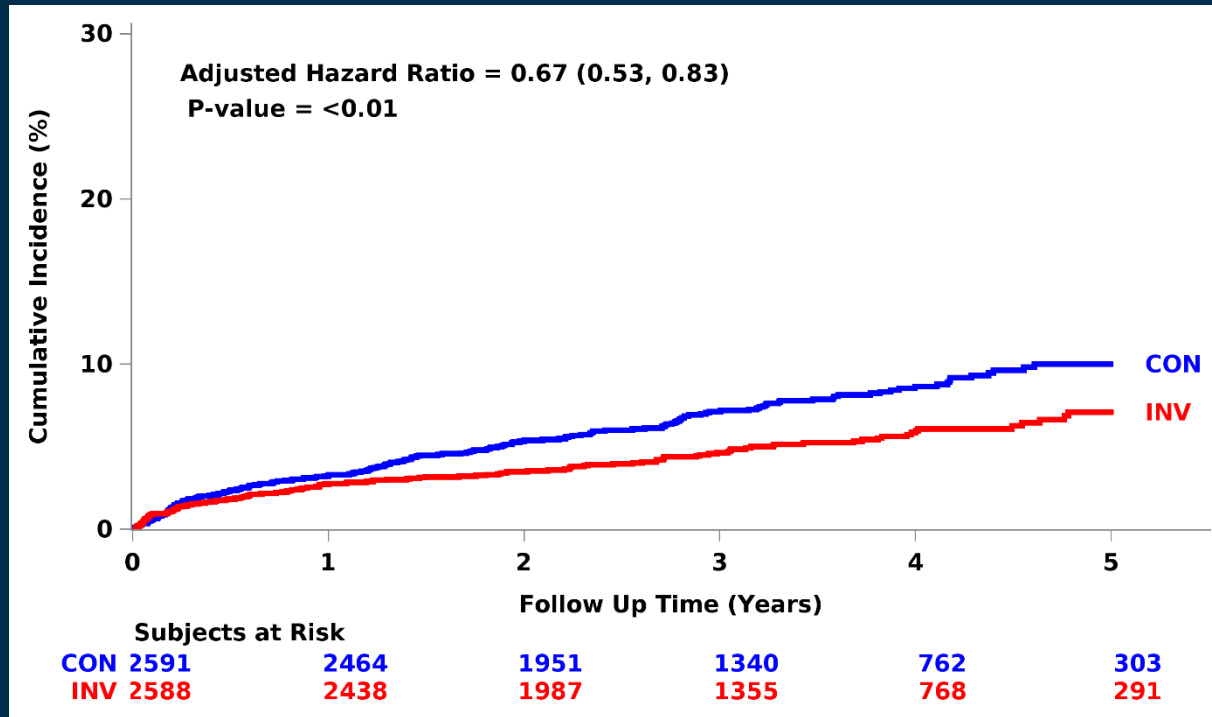
# Overarching Goals for Revascularization in SIHD

- To improve survival
- To prevent other cardiovascular events
- To improve quality of life

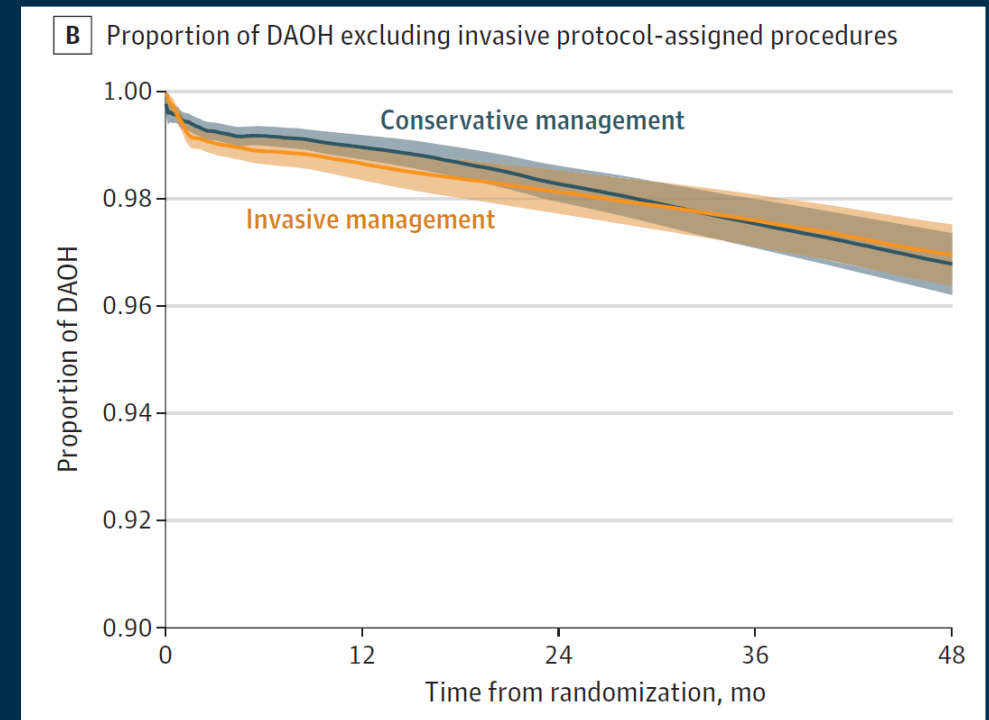
# Revascularization Reduces Spontaneous MI and Lowers CV Stays

## ISCHEMIA: Invasive vs. Conservative

### Spontaneous MI



### DAOH



Lower CV stays (685 vs. 1095; P<0.001)

Maron et al. N Engl J Med. 2020 Apr 9;382(15):1395-1407

White, O'Brien, Alexander, Boden, Bangalore S et al. JAMA Cardiol. 2021;6(9):1023-1031

# Overarching Goals for Revascularization in SIHD

- To improve survival
- To prevent other cardiovascular events
  - *Reduces spontaneous MI, unstable angina and lowers CV stays*
- To improve quality of life

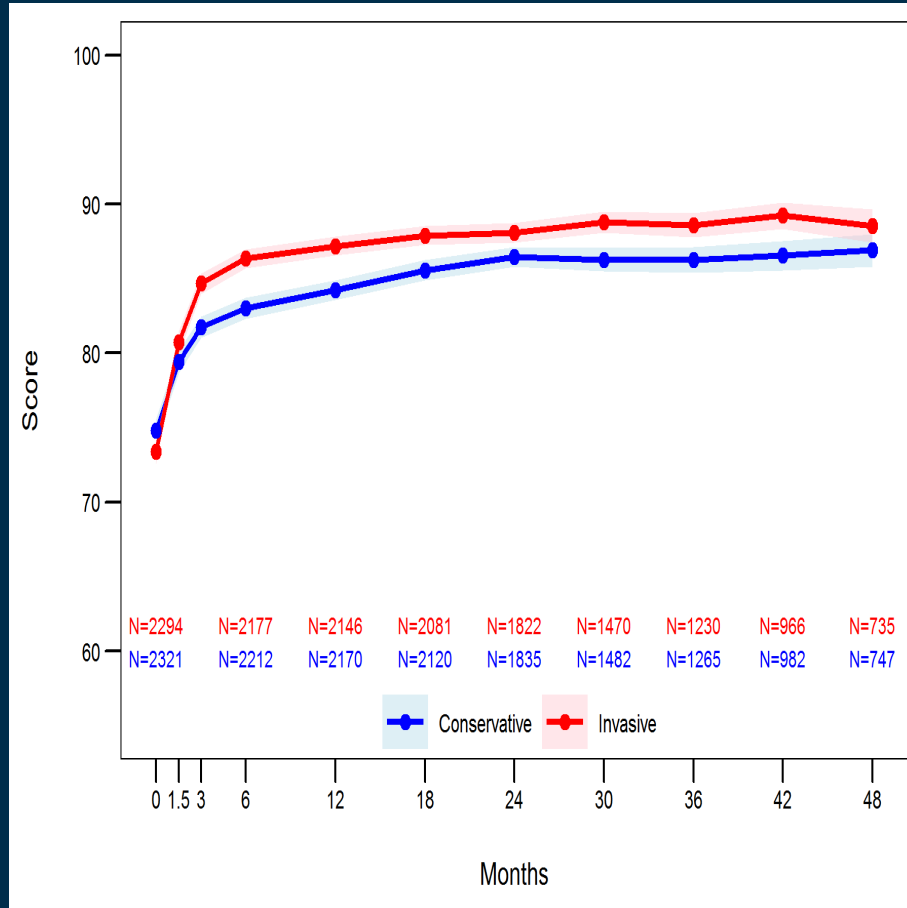
# Overarching Goals for Revascularization in SIHD

- To improve survival
- To prevent other cardiovascular events
- To improve quality of life

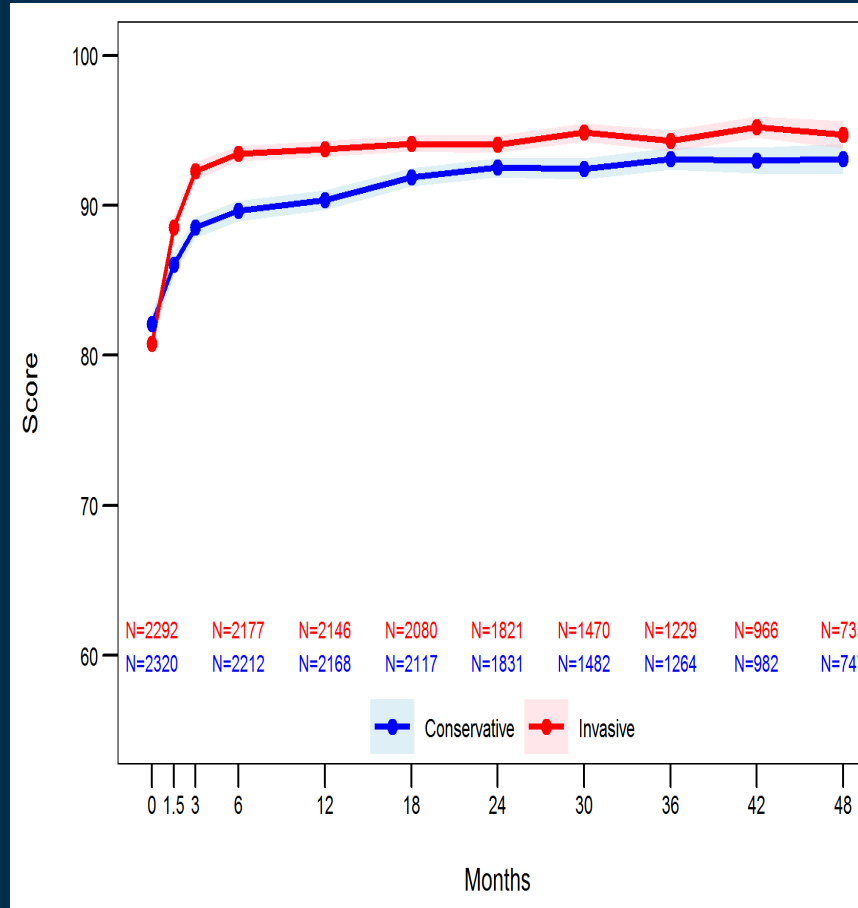
# Durable Improvement in Angina Related QoL

## ISCHEMIA

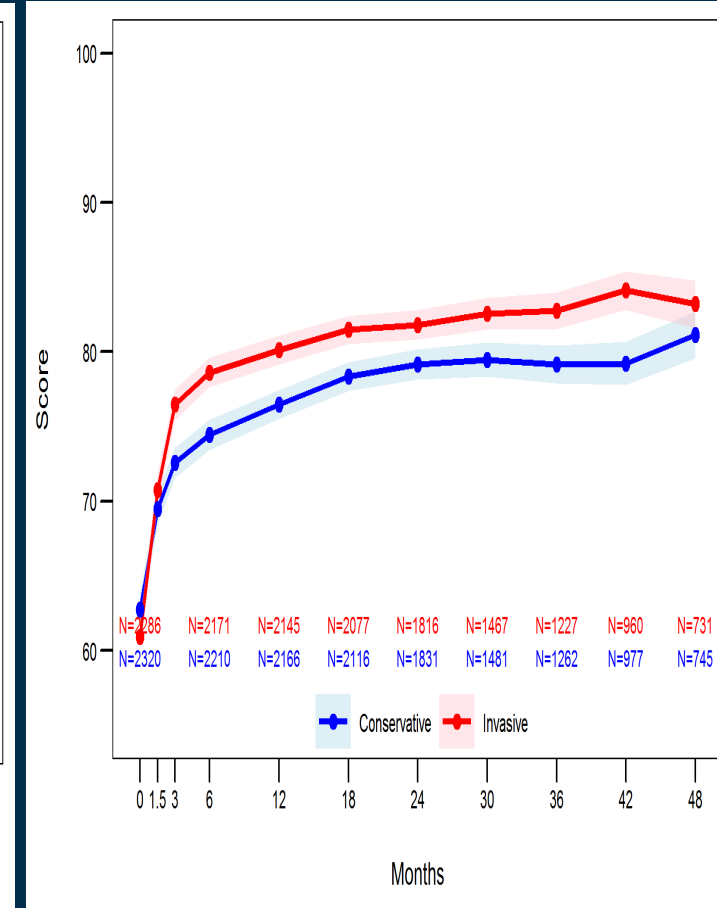
### SAQ Summary Score



### SAQ Angina Frequency



### SAQ Quality of Life



# Overarching Goals for Revascularization in SIHD

- To improve survival
- To prevent other cardiovascular events
- To improve quality of life
  - *Yes, but not in the asymptomatic patients*

# Potential Reasons for Revascularization in SIHD

## *Summary*

- To improve survival
  - *No improvement in survival compared with MT, except in those with LM disease and LV systolic dysfunction*
  - *Small reduction (0.3%/year) in cardiac death*
- To prevent other cardiovascular events
  - *Reduces spontaneous MI, unstable angina and lowers CV stays*
- To improve quality of life
  - *Faster and more durable relief of angina in symptomatic patients*

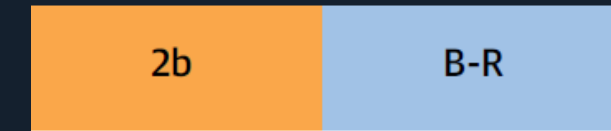
# 2021 ACC/AHA Revascularization Guidelines

## SIHD and Normal EF

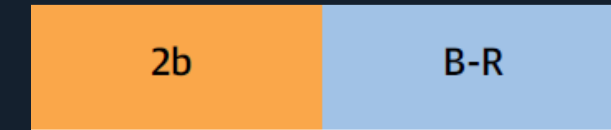
**LM:** CABG is recommended to improve survival



**3V-CAD:** CABG maybe reasonable to improve survival



**3V-CAD:** Usefulness of PCI to improve survival is uncertain



**Prox LAD:** Usefulness of revasc to improve survival is uncertain



**1 or 2VD and no Prox LAD:** Revasc is not recommended to improve survival





# 2021 ACC/AHA Revascularization Guidelines

## *SIHD and Normal EF*

**Multivessel-CAD:** revascularization is reasonable to lower the risk of cardiovascular events such as **spontaneous MI, unplanned urgent revascularizations, or cardiac death**

