# Prognostic Role of Routine Stress Testing in Diabetic Patients After PCI: Key Analysis from POST-PCI

**Hoyun Kim, MD**

**Department of Cardiology,**

**Sejong Hospital, Bucheon, Korea**

# Disclosure

- I have nothing to disclose.

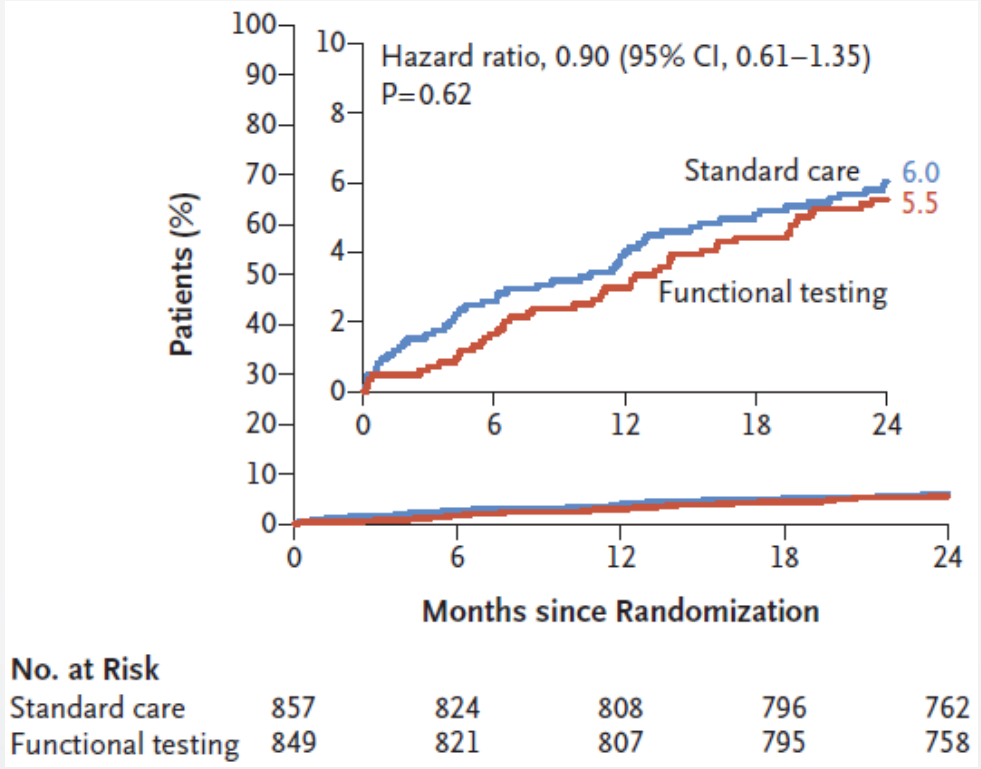
# Follow-up Strategies after PCI
## 2018 ESC Guideline for Myocardial Revascularization

| | COR | LOE |
|---|---|---|
| ➢ Surveillance by non-invasive imaging-based stress testing *may be considered* in high-risk patient subsets 6 months after revascularization | IIb | C |
| ➢ Routine non-invasive imaging-based stress testing *may be considered* 1 year after PCI | IIb | C |

# The POST-PCI trial

- **DESIGN**: a multicenter, pragmatic, randomized trial conducted at 11 sites in South Korea
- **OBJECTIVE**: To compare a follow-up strategy of routine functional testing and standard care alone in patients with high-risk anatomical or clinical characteristics who had undergone PCI
- **Primary Composite Outcome:** a composite of death from any cause, myocardial infarction, or hospitalization for unstable angina) at 2 years
- A total of 1706 patients were randomly assigned to the functional testing group (n = 849) and the standard care group (n = 857)

**Primary Composite Outcome:**
**All-cause Death, MI, or Hospitalization for UA**




**6.0% in Standard care vs. 5.5% in Functional Testing**

Park D-W, et al. NEJM 2022;387:905-15

# Diabetes in Coronary Artery Disease

- Diabetic patients have a more aggressive form of atherosclerosis and more extensive coronary artery disease.

*Circulation 2013;128:1675-1685*
*Circulation 2015;132:923-931*

- Diabetes is a major determinant of adverse clinical events after myocardial revascularization.

*The Lancet Diabetes & Endocrinology 2013;1:317-328*
*Journal of the American College of Cardiology 2019;73:1629-1632*

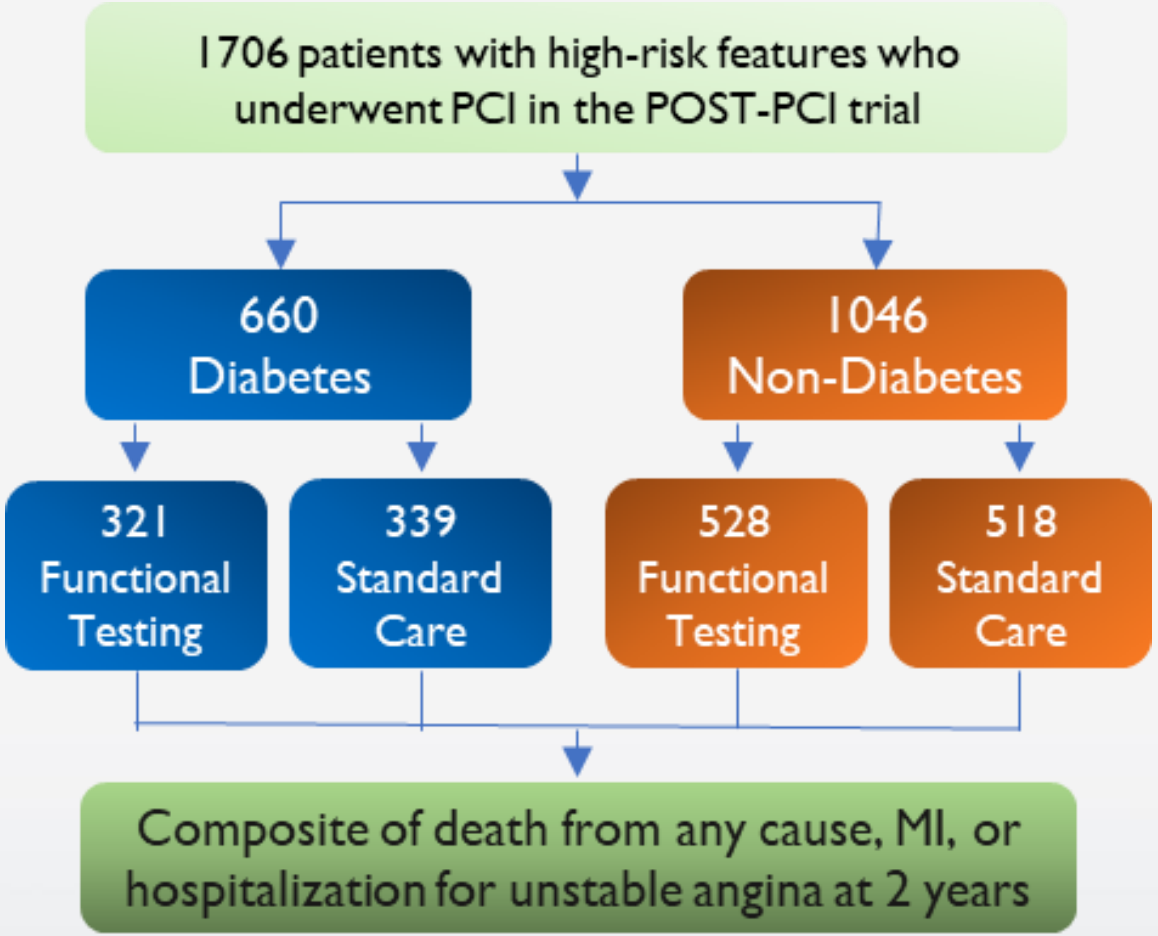
- Percutaneous coronary intervention (PCI) for diabetic patients is often being more complex and anatomically challenging.

*Circulation: Cardiovascular Interventions 2015;8:e001944*

# Background

- It is still unclear whether diabetic patients who undergo PCI could benefit from routine surveillance stress testing during follow-up.

# Diabetic subgroup analysis of the POST-PCI trial




## *Primary outcome*

- Composite of death from any cause, MI, or hospitalization for unstable angina at 2 years

## *Secondary outcome*

- Individual component of primary outcome
- Any hospitalization for cardiac or noncardiac causes
- Invasive coronary angiography
- Repeat revascularization

# Inclusion and Exclusion Criteria

*__All__ patients enrolled in __the Original POST-PCI trial__ were included in this prespecified subgroup analysis*

## INCLUSION

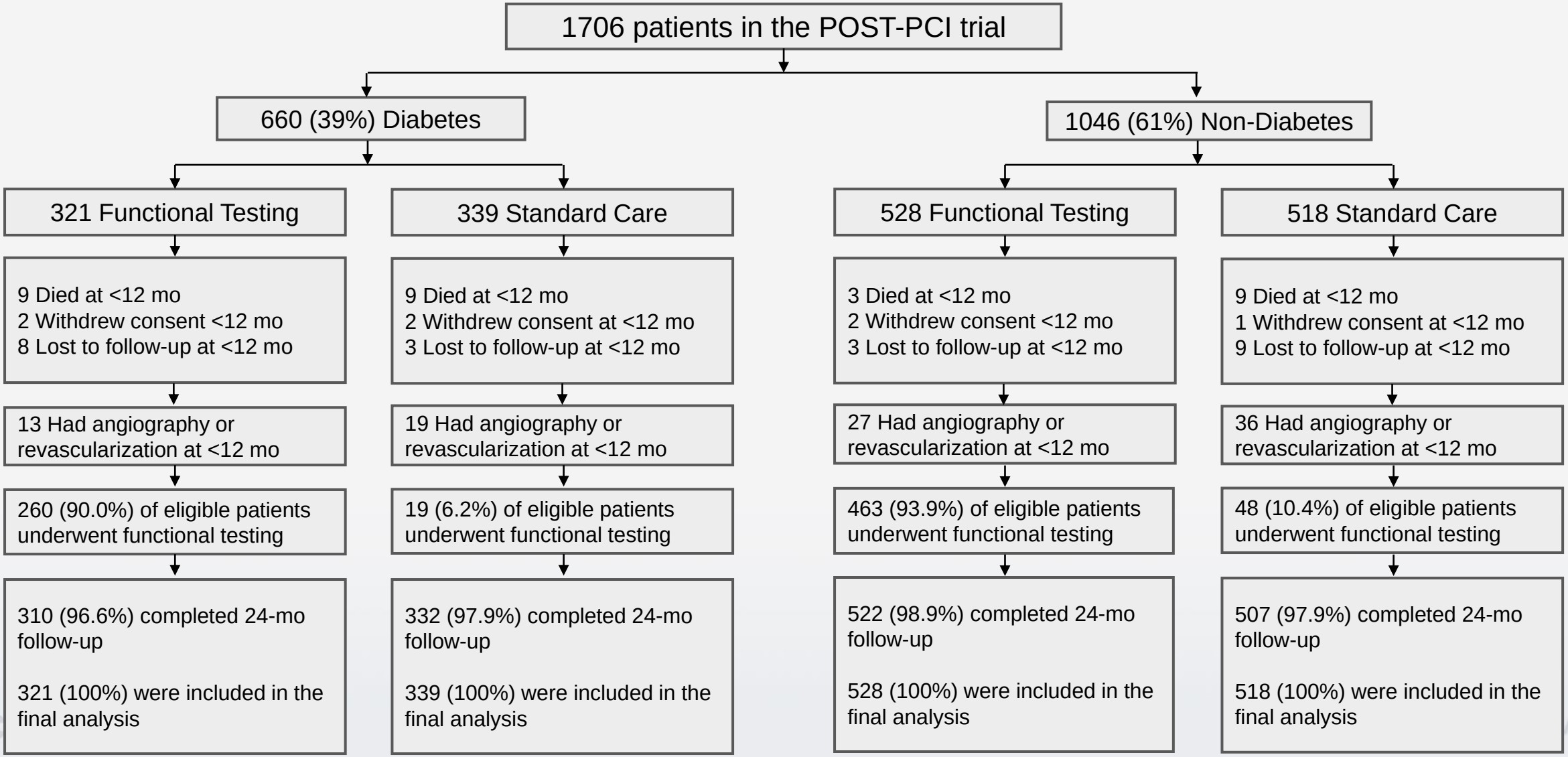
- ≥ 19 years of age.
- Patients who underwent successful PCI with contemporary drug-eluting stents, bioresorbable scaffolds, or drug-coated balloons.
- Patients must have at least one of the following high-risk anatomical or clinical characteristics:
  - Anatomical characteristics: left main lesion, bifurcation lesion, ostial lesion, chronic total occlusion lesion, multivessel disease (≥2 vessels stented), re-stenotic lesion, diffuse long lesion (lesion length ≥30 mm or stent length ≥32 mm), or bypass graft disease.
  - Clinical characteristics: diabetes, chronic renal failure, enzyme positive acute coronary syndrome (e.g., STEMI or NSTEMI).

## EXCLUSION

- Cardiogenic shock at the index admission.
- Patients treated only with bare metal stents or balloon angioplasty without stent implantation at the index procedure.
- Pregnant and/or lactating women.
- Concurrent medical condition with a life expectancy < 1 year.
- Patients who were actively participating in another drug or device investigational study and had not completed the primary endpoint follow-up period.
- Patients who were unable to provide written informed consent or participate in long-term follow-up.

# Enrollment, Randomization, and Follow-up

***Stratified by the presence of Diabetes***



# Baseline Characteristics

| | Overall (n=1706) | Diabetes (n=660) | Non-Diabetes (n=1046) | P Value |
|---|---|---|---|---|
| **Age, yr** | 64.69±10.28 | 66.43±9.53 | 63.59±10.59 | <0.001 |
| **Male sex** | 1356 (79.48) | 505 (76.52) | 851 (81.36) | 0.016 |
| Body-mass index | 24.91±3.09 | 24.96±3.18 | 24.88±3.03 | 0.584 |
| Cardiac risk factors and comorbidities | | | | |
| **Hypertension** | 1178 (69.05) | 513 (77.73) | 665 (63.58) | <0.001 |
| Dyslipidemia | 1487 (87.16) | 584 (88.48) | 903 (86.33) | 0.195 |
| Current smoker | 462 (27.08) | 174 (26.36) | 288 (27.53) | 0.596 |
| Family history of premature CAD | 102 (5.98) | 36 (5.45) | 66 (6.31) | 0.468 |
| Previous myocardial infarction | 113 (6.62) | 43 (6.52) | 70 (6.69) | 0.886 |
| **Previous PCI** | 375 (21.98) | 172 (26.06) | 203 (19.41) | 0.001 |
| Previous CABG | 42 (2.46) | 19 (2.88) | 23 (2.2) | 0.377 |
| **History of cerebrovascular disease** | 109 (6.39) | 52 (7.88) | 57 (5.45) | 0.046 |
| History of peripheral-artery disease | 39 (2.29) | 20 (3.03) | 19 (1.82) | 0.102 |
| **Atrial fibrillation or atrial flutter** | 43 (2.52) | 24 (3.64) | 19 (1.82) | 0.020 |

# Baseline Characteristics

| | Overall (n=1706) | Diabetes (n=660) | Non-Diabetes (n=1046) | P Value |
|---|---|---|---|---|
| Criteria for high risk after PCI | | | | |
| High-risk anatomical characteristics | | | | |
| Left main disease | 359 (21.04) | 148 (22.42) | 211 (20.17) | 0.266 |
| **Bifurcation disease** | 742 (43.49) | 266 (40.3) | 476 (45.51) | 0.035 |
| Ostial lesion | 255 (14.95) | 99 (15) | 156 (14.91) | 0.961 |
| **Chronic total occlusion** | 342 (20.05) | 114 (17.27) | 228 (21.8) | 0.023 |
| **Multivessel disease** | 1191 (69.81) | 482 (73.03) | 709 (67.78) | 0.021 |
| ≥2 vessels stented | 765 (44.84) | 297 (45) | 468 (44.74) | 0.917 |
| Restenotic lesion | 194 (11.37) | 78 (11.82) | 116 (11.09) | 0.644 |
| Diffuse long lesion | 1196 (70.11) | 448 (67.88) | 748 (71.51) | 0.111 |
| Bypass graft disease | 11 (0.64) | 5 (0.76) | 6 (0.57) | 0.759 |
| High-risk clinical characteristics | | | | |
| Diabetes on insulin | 73 (4.28) | 73 (11.06) | 0 (0) | - |
| **Chronic renal failure** | 87 (5.1) | 70 (10.61) | 17 (1.63) | <0.001 |
| Receipt of dialysis | 49 (2.87) | 39 (5.91) | 10 (0.96) | <0.001 |
| Enzyme-positive acute coronary syndrome | 331 (19.4) | 116 (17.58) | 215 (20.55) | 0.130 |
| Clinical indication for index PCI | | | | |
| Stable angina or silent ischemia | 1180 (69.17) | 465 (70.45) | 715 (68.36) | 0.364 |
| Unstable angina | 195 (11.43) | 79 (11.97) | 116 (11.09) | |
| Non-STEMI | 203 (11.9) | 75 (11.36) | 128 (12.24) | |
| STEMI | 128 (7.5) | 41 (6.21) | 87 (8.32) | |

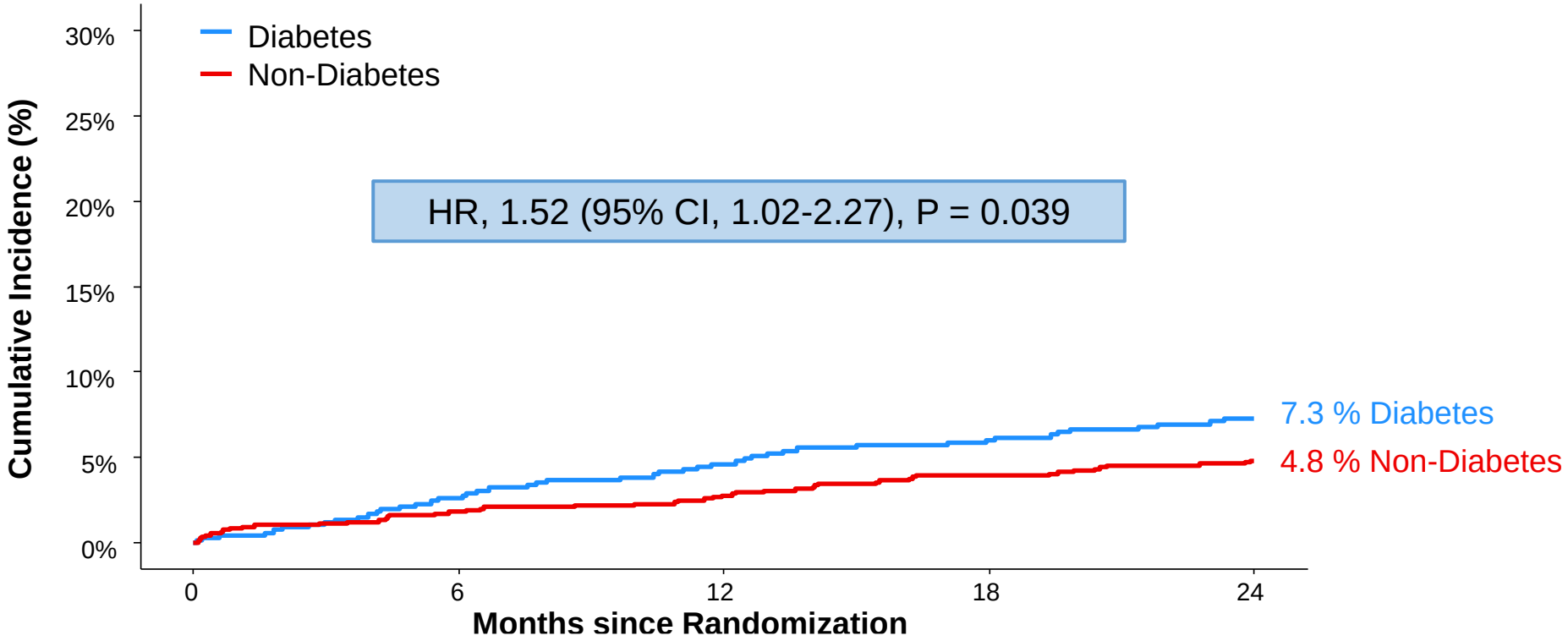
# Procedural Characteristics

| | Overall (n=1706) | Diabetes (n=660) | Non-Diabetes (n=1046) | P Value |
|---|---|---|---|---|
| Procedural characteristics | | | | |
| **Total no. of diseased lesions per patient** | 2.24±1.16 | 2.35±1.21 | 2.16±1.12 | 0.002 |
| Total no. of treated lesions per patient | 1.45±0.68 | 1.46±0.67 | 1.45±0.69 | 0.553 |
| Total no. of stents per patient | 1.95±1.15 | 1.93±1.11 | 1.97±1.18 | 0.743 |
| Total stent length per patient — mm | 57.11±33.84 | 55.94±32.49 | 57.85±34.66 | 0.364 |
| Use of drug-eluting stents — no. (%) | 1645 (96.42) | 640 (96.97) | 1005 (96.08) | 0.335 |
| Use of bioabsorbable scaffold — no. (%) | 16 (0.94) | 2 (0.3) | 14 (1.34) | 0.031 |
| Use of drug-coated balloon — no. (%) | 105 (6.15) | 42 (6.36) | 63 (6.02) | 0.776 |
| Intravascular ultrasound guidance — no. (%) | 1269 (74.38) | 490 (74.24) | 779 (74.47) | 0.915 |
| Fractional flow reserve assessed — no. (%) | 609 (35.7) | 236 (35.76) | 373 (35.66) | 0.967 |

# Primary Composite Outcome

***A composite of Death from any cause, MI, or hospitalization for unstable angina at 2 years***

***Diabetes vs. Non-Diabetes***




No.at Risk

| | | | | | |
|---|---|---|---|---|---|
| Diabetes | 660 | 631 | 615 | 604 | 575 |
| Non-Diabetes | 1046 | 1016 | 1002 | 988 | 945 |

# Primary and Secondary Outcomes

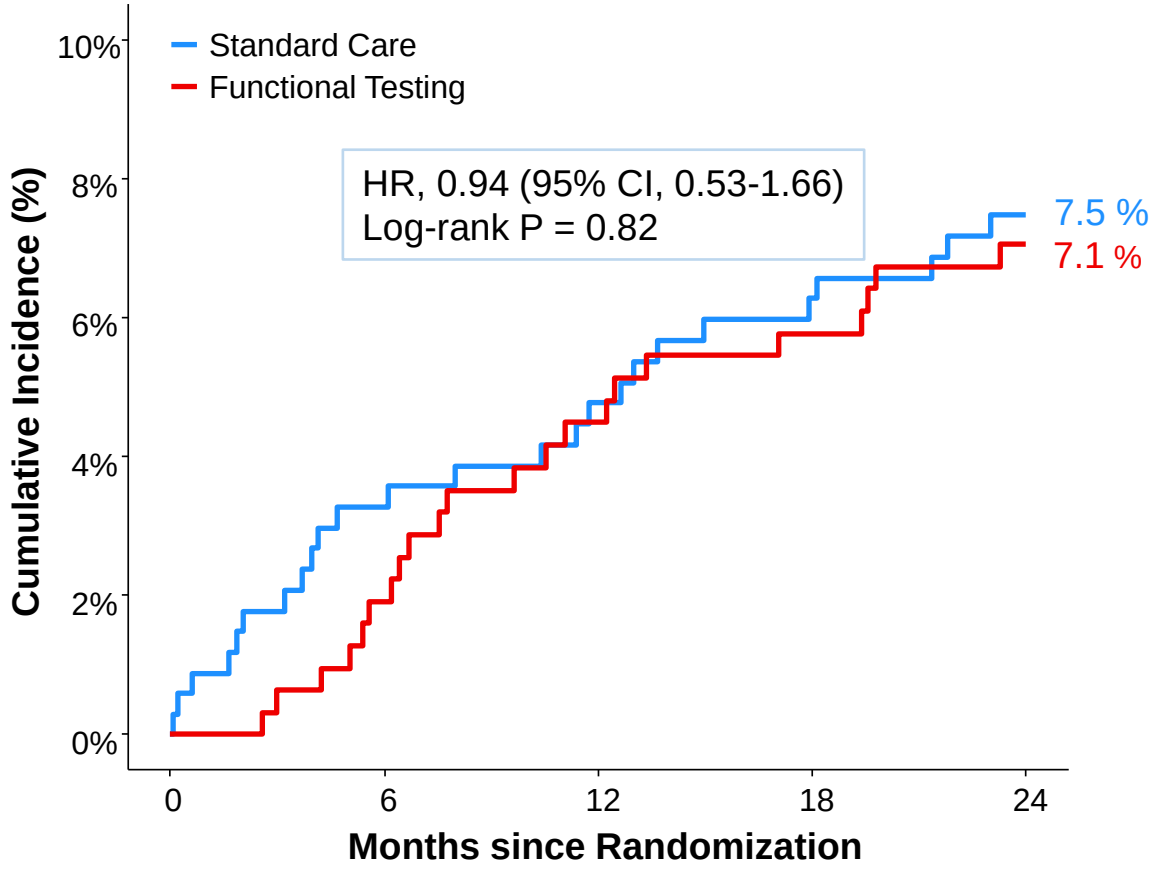
***Diabetic and Non-Diabetic patients***

| | Diabetes (n=660) | Non-Diabetes (n=1046) | Hazard Ratio (95% CI) | P Value |
|---|---|---|---|---|
| Primary composite outcome | 47 (7.3) | 50 (4.8) | 1.52 (1.02–2.27) | 0.039 |
| **Death from any cause** | 28 (4.3) | 23 (2.2) | 1.97 (1.13–3.42) | 0.016 |
| Myocardial infarction | 8 (1.3) | 6 (0.6) | 2.17 (0.75–6.24) | 0.153 |
| Hospitalization for unstable angina | 11 (1.7) | 22 (2.2) | 0.81 (0.39–1.67) | 0.56 |
| Secondary outcomes | | | | |
| **Death or myocardial infarction** | 36 (5.6) | 29 (2.8) | 2.01 (1.23–3.28) | 0.005 |
| **Hospitalization** | | | | |
| Any reason | 187 (29.3) | 214 (20.9) | 1.49 (1.22–1.81) | <0.001 |
| Cardiac reason | 87 (13.8) | 145 (14.2) | 0.97 (0.75–1.27) | 0.832 |
| Noncardiac reason | 100 (10.0) | 69 (6.7) | 2.45 (1.80–3.32) | <0.001 |
| *Invasive coronary angiography* | 63 (10.0) | 115 (11.3) | 0.89 (0.65–1.21) | 0.445 |
| Showing restenosis or obstructive CAD | 44 | 70 | | |
| Showing no restenosis or obstructive CAD | 19 | 45 | | |
| *Repeat revascularization* | 45 (6.5) | 73 (7.2) | 0.91 (0.62–1.34) | 0.631 |
| Target-lesion revascularization | 24 (3.8) | 36 (3.5) | 1.09 (0.65–1.82) | 0.753 |
| Nontarget-lesion revascularization | 17 (2.7) | 37 (3.6) | 0.74 (0.42–1.32) | 0.311 |

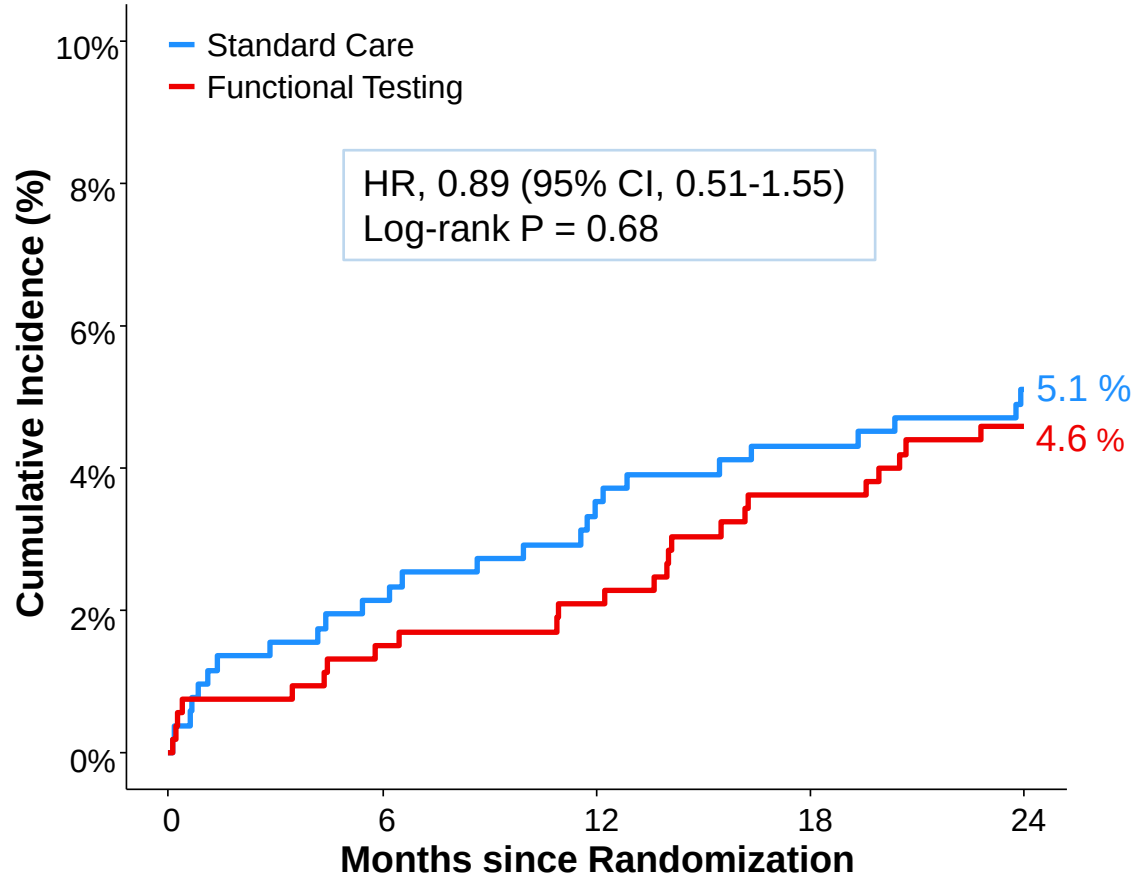
# Primary Composite Outcome

***Stratified by Diabetes status and Randomization Group***

**P for interaction = 0.91**




| No.at Risk | | | | | |
|---|---|---|---|---|---|
| Standard Care | 339 | 324 | 318 | 311 | 293 |
| Functional Testing | 321 | 307 | 297 | 293 | 282 |




| No.at Risk | | | | | |
|---|---|---|---|---|---|
| | 518 | 500 | 490 | 485 | 469 |
| | 528 | 516 | 512 | 503 | 476 |

# Primary and Secondary Outcomes

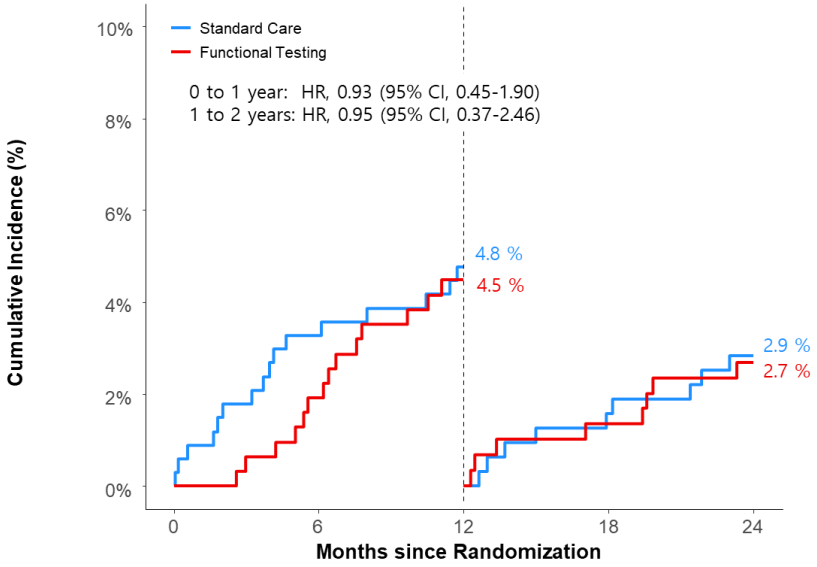
***Stratified by Diabetes status and Randomization Group***

| | Diabetes | | | | Non-Diabetes | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Functional Testing (n=321)** | **Standard Care (n=339)** | **Hazard Ratio (95% CI)** | **P Value** | **Functional Testing (n=528)** | **Standard Care (n=518)** | **Hazard Ratio (95% CI)** | **P Value** | **P for Interaction** |
| Primary composite outcome | 22 (7.1) | 25 (7.5) | 0.94 (0.53–1.66) | 0.818 | 24 (4.6) | 26 (5.1) | 0.89 (0.51–1.55) | 0.684 | 0.906 |
| Death from any cause | 14 (4.5) | 14 (4.2) | 1.07 (0.51–2.24) | 0.86 | 9 (1.7) | 14 (2.8) | 0.62 (0.27–1.43) | 0.264 | 0.34 |
| Myocardial infarction | 2 (0.7) | 6 (1.9) | 0.36 (0.07–1.76) | 0.21 | 2 (0.4) | 4 (0.8) | 0.48 (0.09–2.62) | 0.397 | 0.80 |
| Hospitalization for unstable angina | 6 (2.0) | 5 (1.5) | 1.28 (0.39–4.19) | 0.684 | 13 (2.5) | 9 (1.8) | 1.40 (0.60–3.27) | 0.442 | 0.907 |
| Secondary outcomes | | | | | | | | | |
| Death or myocardial infarction | 16 (5.1) | 20 (6.0) | 0.85 (0.44–1.64) | 0.633 | 11 (2.1) | 18 (3.5) | 0.59 (0.28–1.25) | 0.166 | 0.467 |
| Hospitalization | | | | | | | | | |
| Any reason | 101 (32.8) | 86 (26.1) | 1.30 (0.97–1.73) | 0.076 | 110 (21.1) | 104 (20.7) | 1.01 (0.77–1.32) | 0.939 | 0.213 |
| Cardiac reason | 46 (15.0) | 41 (12.6) | 1.19 (0.78–1.81) | 0.427 | 76 (14.6) | 69 (13.8) | 1.06 (0.76–1.46) | 0.743 | 0.67 |
| Noncardiac reason | 55 (18.0) | 45 (13.7) | 1.35 (0.91–2.01) | 0.134 | 34 (6.5) | 35 (7.0) | 0.93 (0.58–1.50) | 0.775 | 0.238 |
| *Invasive coronary angiography* | 38 (12.6) | 25 (7.7) | | | 63 (12.1) | 52 (10.4) | | | |
| Showing restenosis or obstructive CAD | 28 (73.7) | 16 (64.0) | | | 41 (65.1) | 29 (55.8) | | | |
| Showing no restenosis or obstructive CAD | 10 (26.3) | 9 (36.0) | | | 22 (34.9) | 23 (44.2) | | | |
| *Repeat revascularization* | 24 (8.0) | 17 (5.2) | | | 42 (8.1) | 31 (6.2) | | | |
| Target-lesion revascularization | 13 (4.3) | 11 (3.4) | | | 21 (4.1) | 15 (3.0) | | | |
| Nontarget-lesion revascularization | 11 (3.7) | 6 (1.8) | | | 21 (4.1) | 16 (3.2) | | | |

# Landmark Analysis

## *In Diabetic Patients*

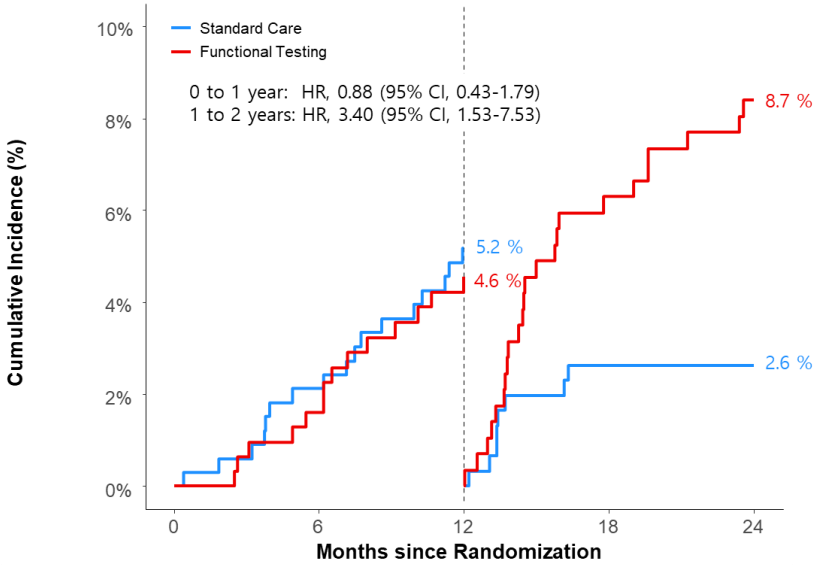
### Primary Composite Outcome




No.at Risk

| | | | | | |
|---|---|---|---|---|---|
| Standard Care | 339 | 324 | 318 | 311 | 293 |
| Functional Testing | 321 | 307 | 297 | 293 | 282 |

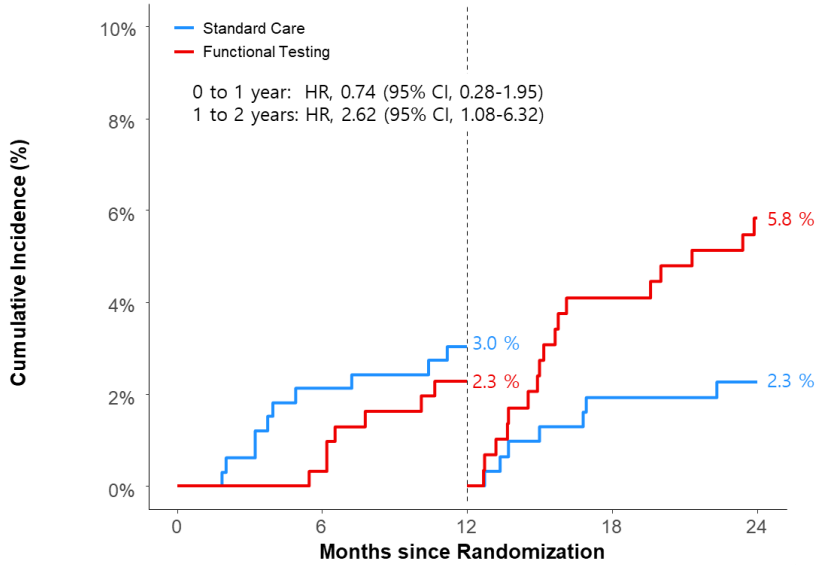
### Invasive Coronary Angiography




No.at Risk

| | | | | | |
|---|---|---|---|---|---|
| Standard Care | 339 | 322 | 308 | 295 | 282 |
| Functional Testing | 321 | 303 | 288 | 268 | 253 |

### Repeat Revascularization



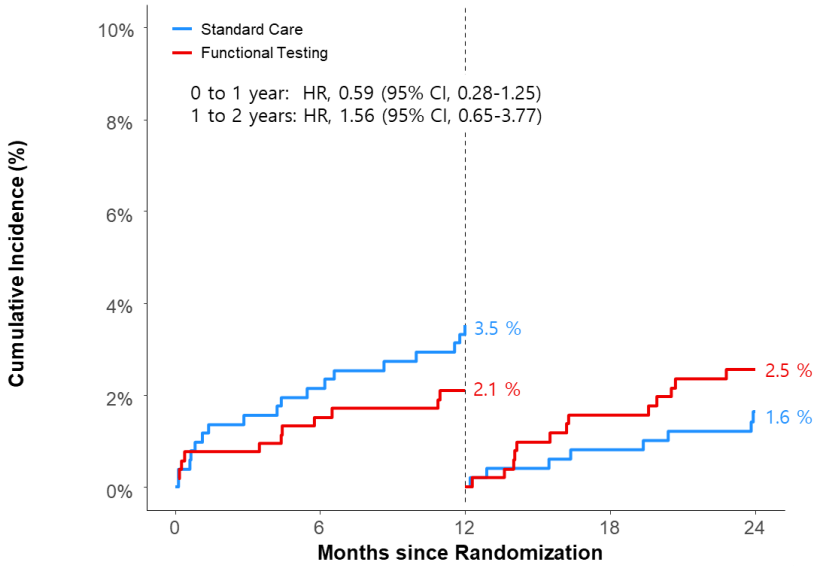

No.at Risk

| | | | | | |
|---|---|---|---|---|---|
| Standard Care | 339 | 322 | 315 | 304 | 288 |
| Functional Testing | 321 | 307 | 295 | 280 | 266 |

# Landmark Analysis

## *In Non-Diabetic Patients*

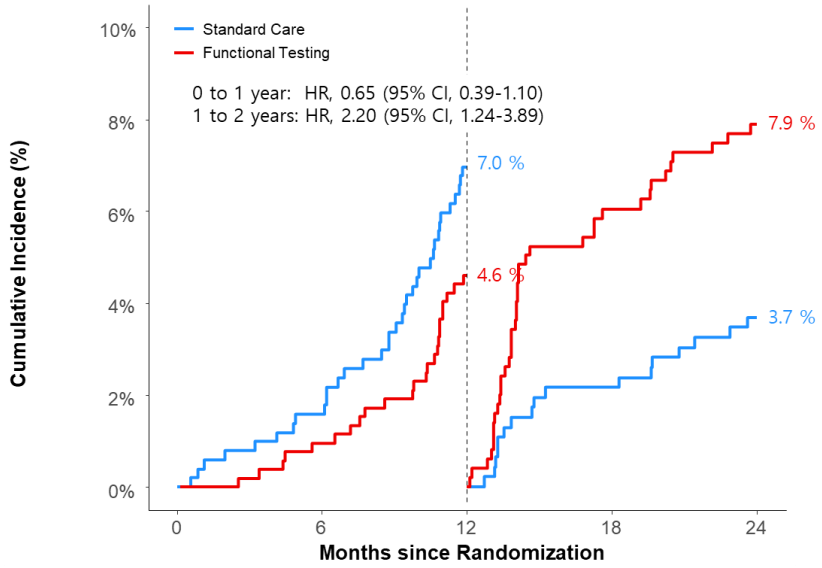
### Primary Composite Outcome




No.at Risk

| | | | | | |
|---|---|---|---|---|---|
| Standard Care | 518 | 500 | 490 | 485 | 469 |
| Functional Testing | 528 | 516 | 512 | 503 | 476 |

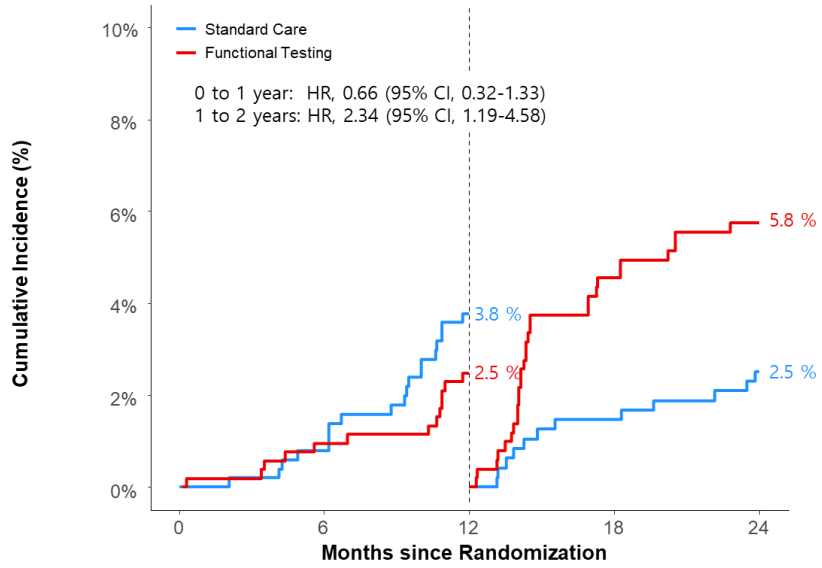
### Invasive Coronary Angiography




No.at Risk

| | | | | | |
|---|---|---|---|---|---|
| Standard Care | 518 | 496 | 464 | 451 | 434 |
| Functional Testing | 528 | 516 | 496 | 462 | 433 |

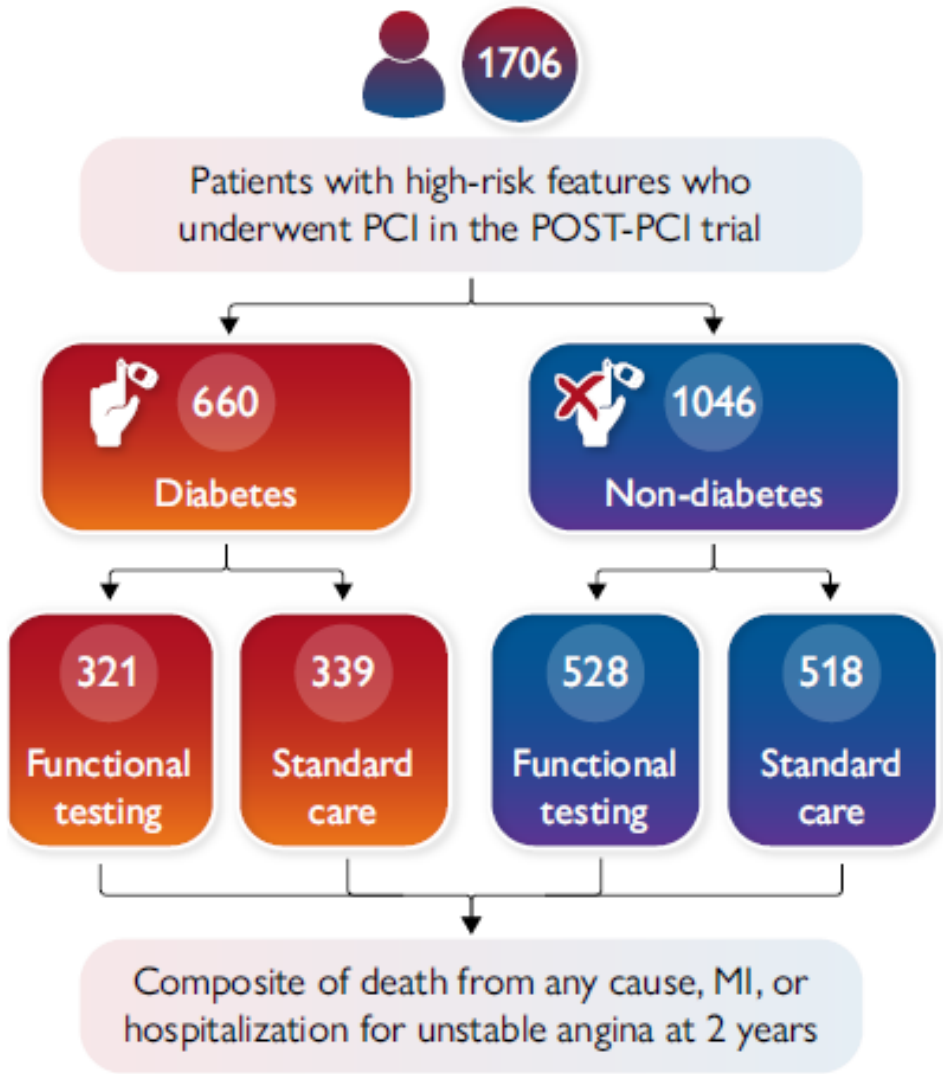
### Repeat Revascularization

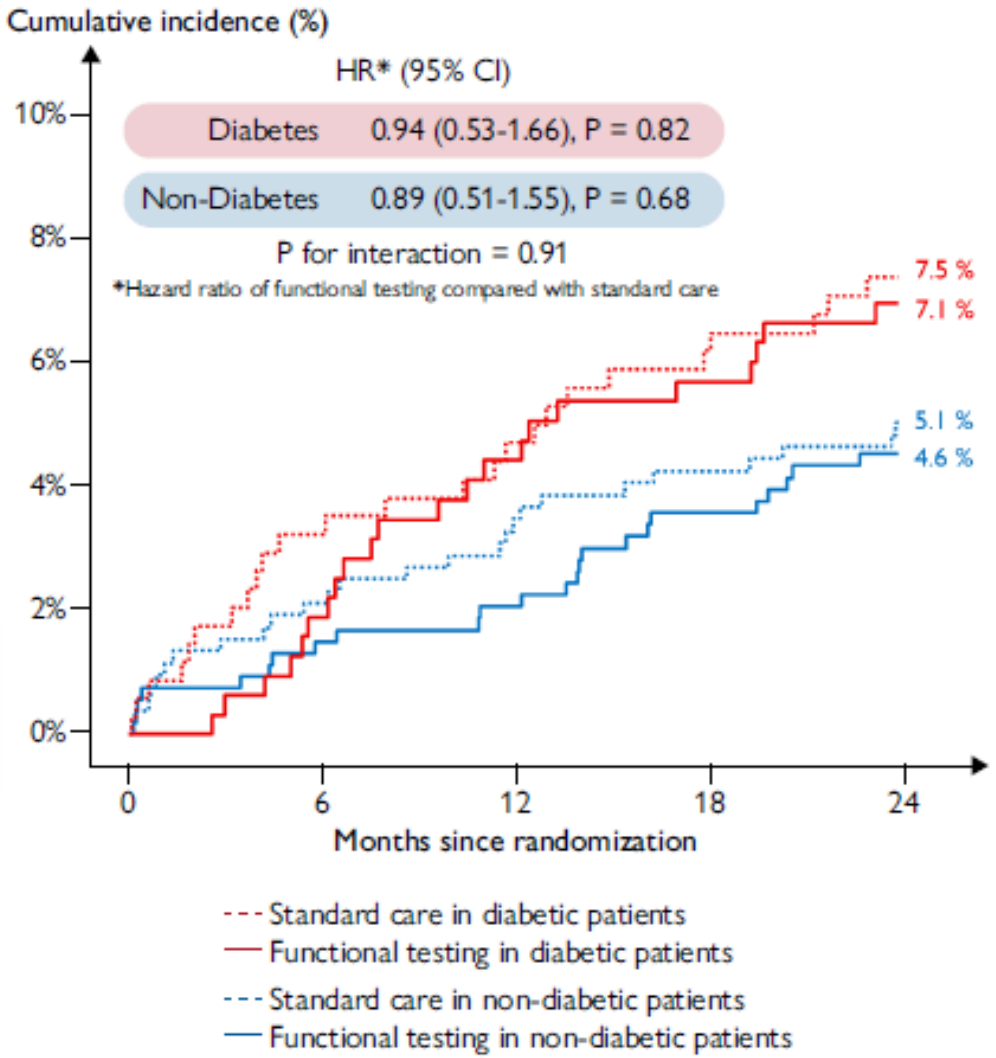



No.at Risk

| | | | | | |
|---|---|---|---|---|---|
| Standard Care | 518 | 500 | 480 | 470 | 453 |
| Functional Testing | 528 | 516 | 507 | 479 | 450 |

# A pre-specified subgroup analysis of the POST-PCI trial






Kim H, et al. European Heart Journal (2023) 00, 1–13

# Conclusion

- Patients with Diabetes had an increased risk of adverse cardiovascular events at 2 years.

- The adverse cardiovascular events rate did not differ between the routine functional-testing group and the standard-care group both in patients with and without diabetes.

- Invasive coronary angiography and repeat revascularization after 1 year occurred more frequently in the functional-testing group, irrespective of diabetes status. However, this additional invasive management did not reduce major adverse cardiovascular events or mortality.