A Randomized Trial to Compare Percutaneous Coronary Intervention between Massachusetts Hospitals With Cardiac Surgery On-Site and Community Hospitals Without Cardiac Surgery On-Site

MASS COMM

Alice K. Jacobs, Sharon-Lise T. Normand, Joseph M. Massaro, Donald E. Cutlip, Joseph P. Carrozza, Anthony D. Marks, Nancy Murphy, Iyah K. Romm, Madeleine Biondolillo, Laura Mauri for the MASS COMM Investigators and Coordinators

Disclosures

- **This study was funded by Massachusetts Hospitals without on-site cardiac surgery.**
- **There are no relevant RWI to disclose.**

Background

- **Emergency coronary artery bypass surgery (CABG) has become a rare event following percutaneous coronary intervention (PCI), with a reported incidence of 0.1-0.4% in contemporary series.**

- **As data supporting primary PCI for patients with ST-segment elevation myocardial infarction (STEMI) have emerged, the need for timely access to the procedure has justified the expansion of emergency PCI to hospitals without on-site cardiac surgery, where reported outcomes have been favorable.**

Background

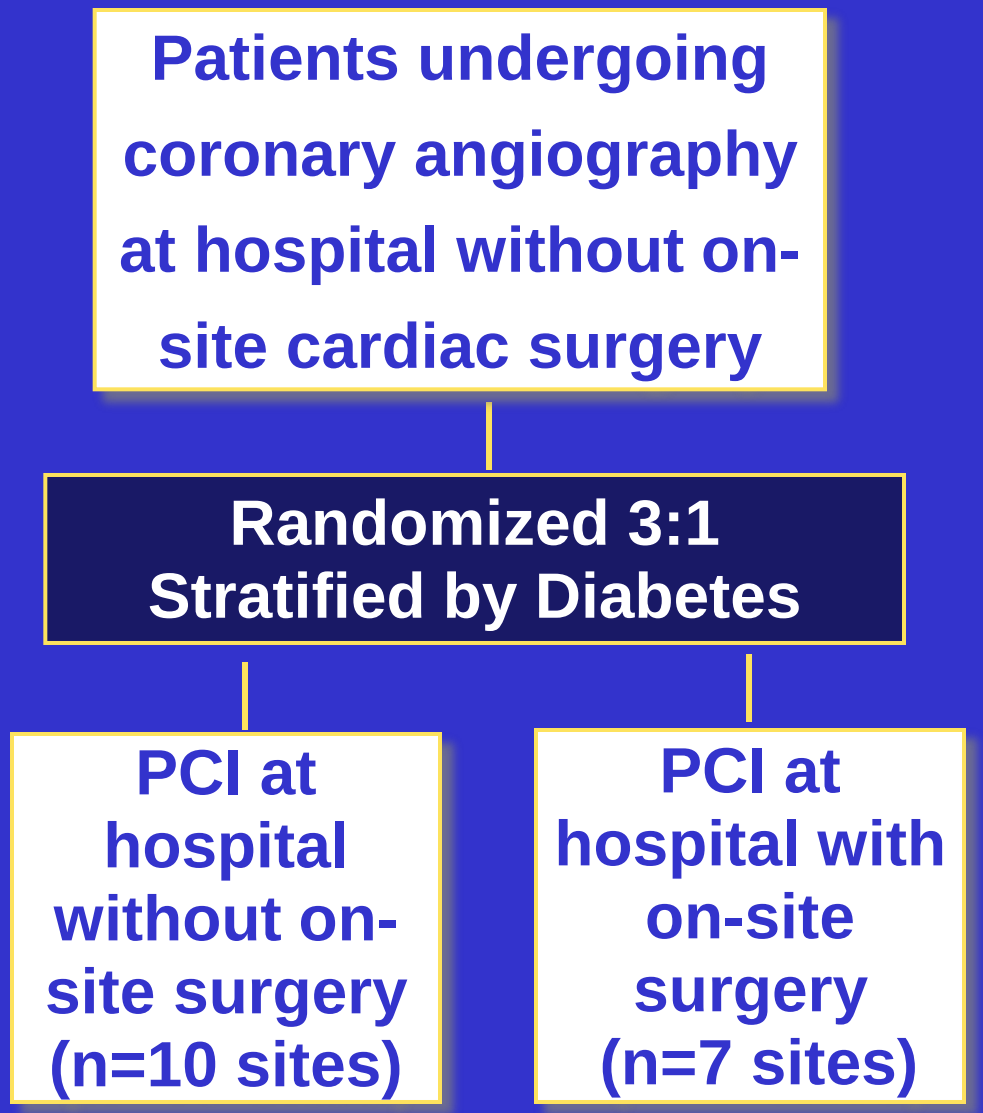
- **Yet, controversy exists over the further expansion of non-emergency PCI to hospitals without on-site cardiac surgery, due to concern over the risk to benefit ratio in a setting where timely access to PCI is less important for optimal cardiovascular outcomes, which is reflected in the Class IIb recommendation in the 2011 PCI guidelines.**

- **MASS COMM was designed in 2006, with the Massachusetts Department of Public Health (MA-DPH), to provide evidence on which to base regulatory policy decisions about performing non-emergency PCI in hospitals without on-site cardiac surgery.**

Aim

- **To determine the short-term safety and 12-month outcomes of PCI (excluding primary PCI for STEMI) performed at hospitals without in comparison to with on-site cardiac surgery in Massachusetts**

MASS COMM Design



Exclusion Criteria

- left ventricular ejection fraction < 20%
- target lesions with:
  - unprotected left main stenosis >50%
  - device other than balloon angioplasty prior to stent
  - saphenous vein graft location
  - vessel serving only viable myocardium

Methods

- ***Design***

  - prospective, multicenter, randomized, controlled non-inferiority trial

- ***Co-Primary End Points***

  - composite of all-cause mortality, myocardial infarction (MI),* repeat coronary revascularization or stroke (MACE) at 30-days (safety) and 12-months (effectiveness)

**Q wave or non-Q-wave; non-Q wave MI defined as CK ≥ twice ULN plus elevated CK-MB or CK-MB ≥ 3 times normal*

Methods

- ***Secondary Outcomes***

  - included all-cause mortality, repeat revascularization, stroke, ischemia-driven target vessel and target lesion revascularization; Academic Research Consortium (ARC) defined definite or probable stent thrombosis; emergency CABG; emergency or urgent PCI; and major vascular complications

- ***Angiographic Subset***

  - random sample of 10% of enrolled patients, CEC blinded to treatment assignment assessed lesion and procedure success, complete revascularization, and the proportion of lesions meeting PCI guidelines Class I or II recommendations for anatomic indications to perform PCI

Statistical Methods

- ***Analysis***

  - primary end points were compared for non-inferiority assessed via the Farrington-Manning test using relative risk non-inferiority margins of 1.5 and 1.3, respectively; P value of less than 0.05 on both end points required to determine non-inferiority overall; all other end points compared for differences

- ***Sample Size***

  - 3,447 evaluable patients to yield 80% to 85% power for the 30-day safety end point (expected MACE 6-7%) and 85% to 88% power for the 12-month effectiveness end point (expected MACE 15-16%) for both arms

Statistical Methods

- ***Analysis***

- Formal non-inferiority testing on an intent-to-treat basis (all randomized patients)

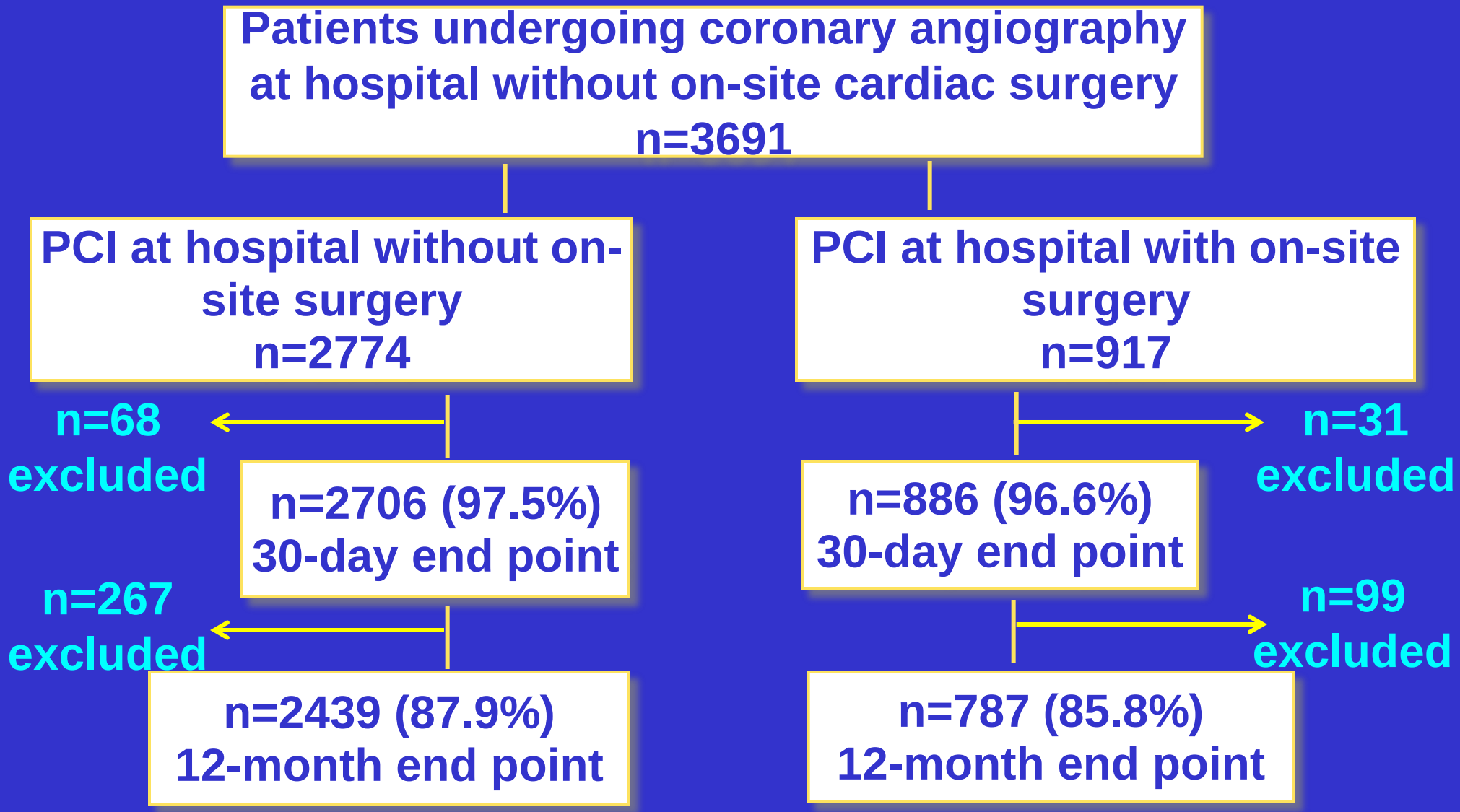
- Patients missing the 12-month follow-up visit -> 99% of records successfully linked to mortality data from state vital statistic records

- Multiple imputation used for patients with remaining missing information regarding MACE

Hospital and Operator Requirements for Participation in MASS COMM

- ***Hospitals without on-site cardiac surgery***
  - **Approval from MA-DPH**
  - **Formal PCI development program**
  - **Participation in MA-DPH special project for primary PCI**
  - **Signed Collaboration Agreement with on-site surgery hospital (24/7 back-up, patient arrival within 60 minutes)**
  - **Perform minimum 300 diagnostic procedures in each of previous 2 years; 36 primary PCI procedures/year**
- ***All Operators***
  - **Perform minimum 75 PCI procedures/year**
  - **ABIM Interventional Cardiology Board Certification**

Patient Randomization and Follow-up



Baseline Characteristics

	No On-Site Surgery (n 2774)	*On-Site Surgery (n=917)*
Age, years	64.7±11.8	64.2±11.8
Female Sex (%)	31.8	33.6
Caucasian (%)	91.1	92.9
Diabetes (%)	31.7	32.2
Current or Former Smoker (%)	60.0	60.5
Heart Failure (%)	8.1	7.1
Stroke (%)	2.8	3.5
PVD (%)	10.4	10.4

Baseline Characteristics

	No On-Site Surgery (n 2774)	*On-Site Surgery (n=917)*
Prior PCI (%)	29.0	27.3
Prior CABG (%)	5.4	7.0
Prior MI (%)*	24.1	20.2
Indication for PCI (%)		
NSTEMI	19.0	17.1
Unstable Angina	44.8	46.8
Stable Angina	27.0	28.1
LVEF (%)	55.4±10.3	56.0±9.7

*P=0.015

Angiographic Characteristics – Site Reported

	No On-Site Surgery (n=2774 patients, 4053 lesions)	*On-Site Surgery (n=917 patients, 1294 lesions)*
# vessels treated	1.17±0.40	1.17±0.41
# lesions treated	1.47±0.77	1.43±0.70
Ref. vessel diameter (mm)*	2.99±0.56	2.92±0.49
Lesion length (mm)	15.12±8.73	14.84±7.95
Pre % stenosis	85.66±11.03	85.22±10.84
Final % stenosis**	2.46±12.04	1.51±9.68

mean±SD; *P<0.001, **P=0.005

Procedural Characteristics – Site Reported

	No On-Site Surgery (n=2774 patients, 4053 lesions)	*On-Site Surgery (n=917 patients, 1294 lesions)*
Pre-TIMI 3 flow (%)*	83.3	87.9
Final TIMI 3 flow (%)	98.8	98.6
Type of stent (%)*		
Bare Metal	32.6	24.6
Drug-eluting	63.7	69.3
Both	2.2	1.5
Staged Procedure (%)	0.61	0.22

*P<0.001

MACE at 30-Days (Safety)

	No On-Site Surgery (n=2774)	*On-Site Surgery (n=917)*	*Relative Risk 95% CI*	*P Value*
MACE (%)	**9.5**	**9.4**	**1.00 (1.22)**	**<0.001**
Components of 30-day endpoint (%)				
Death	**0.7**	**0.3**	**1.96 (0.58-6.64)**	**0.44**
Myocardial Infarction	**6.5**	**6.5**	**1.01 (0.76-1.35)**	**1.00**
Repeat Revascularization	**2.7**	**3.5**	**0.77 (0.51-1.17)**	**0.25**
Stroke	**0.4**	**0.1**	**3.93 (0.51-30.21)**	**0.21**

MACE at 12-Months (Effectiveness)

	No On-Site Surgery (n=2774)	*On-Site Surgery (n=917)*	*Relative Risk 95% CI*	*P Value*
MACE (%)	**17.3**	**17.8**	**0.98 (1.13)**	**<0.001**
Components of 12-month endpoint (%)				
Death	**2.3**	**2.4**	**0.95 (0.57-1.60)**	**0.89**
Myocardial Infarction	**8.6**	**7.8**	**1.10 (0.84-1.45)**	**0.55**
Repeat Revascularization	**8.5**	**9.9**	**0.86 (0.67-1.11)**	**0.24**
Stroke	**1.0**	**0.8**	**1.24 (0.51-3.04)**	**0.83**

Secondary End Points

	No On-Site Surgery (n 2774)	*On-Site Surgery (n=917)*	*Relative Risk 95% CI*	*P Value*
Target-lesion revascularization (%)+				
At 30 days	**1.3**	**1.4**	**0.98 (0.51-1.88)**	**1.00**
At 12 months	**4.9**	**5.0**	**1.00 (0.70-1.43)**	**1.00**
Target-vessel revascularization (%)+				
At 30 days	**1.5**	**1.5**	**1.03 (0.56-1.92)**	**1.00**
At 12 months	**5.6**	**5.4**	**1.05 (0.75-1.48)**	**0.86**
Stent thrombosis (%)				
At 30 days	**0.6**	**0.8**	**0.75 (0.31-1.81)**	**0.48**
At 12 months	**1.1**	**2.1**	**0.55 (0.30-1.02)**	**0.07**
Major vascular complications at 30 days	**1.5**	**1.5**	**1.04 (0.56-1.92)**	**1.00**

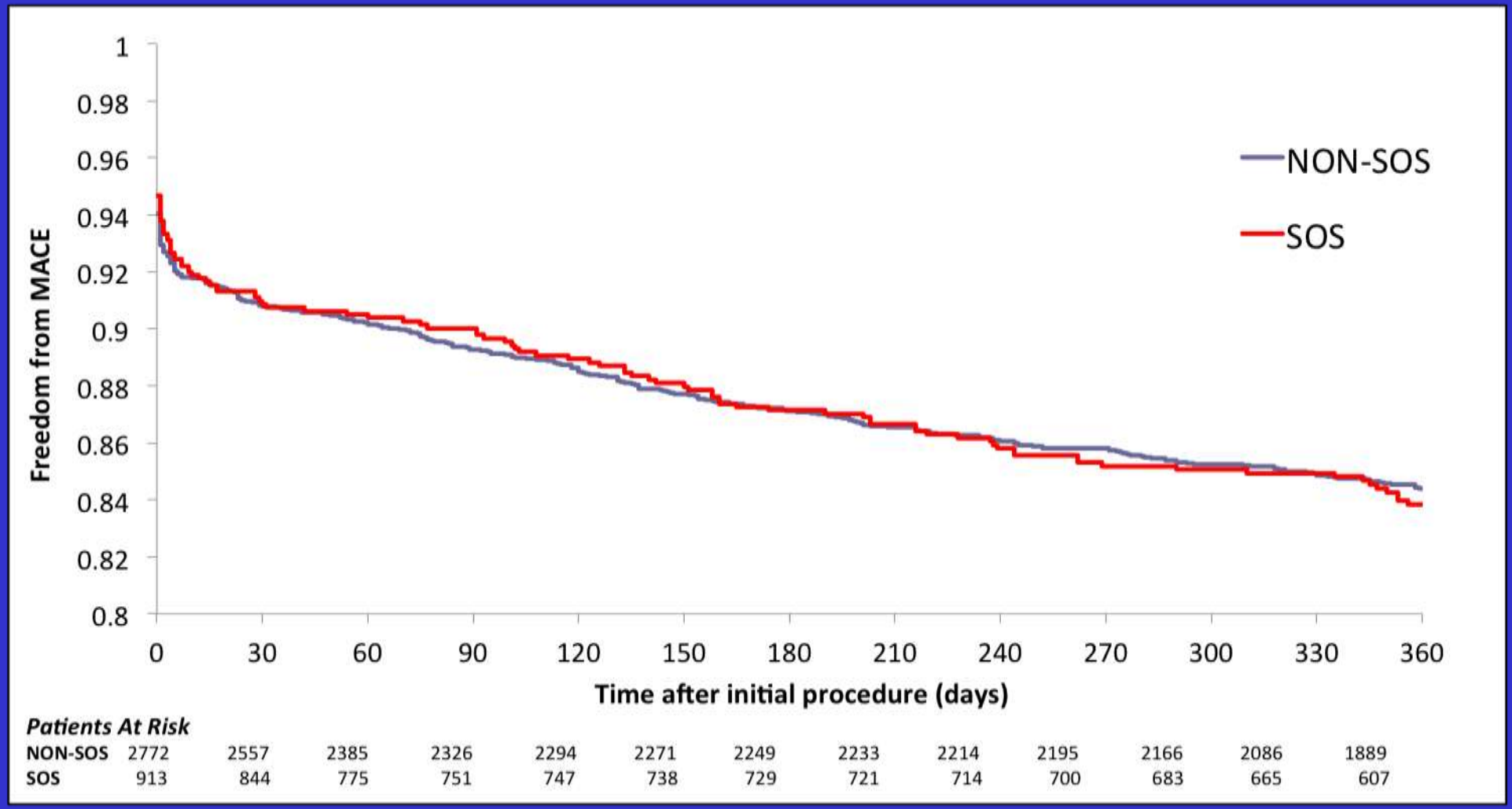
+Ischemia-driven

Procedural Characteristics in the Angiographic Cohort*

	No On-Site Surgery (n=289 patients, 392 lesions)	*On-Site Surgery (n=87 patients, 106 lesions)*	*Relative Risk 95% CI*	*P Value*
Lesion success (%)	95.6	97.1	0.98 (0.95-1.02)	0.59
Procedural success (%)	81.3	74.7	1.09 (0.95-1.24)	0.22
Complete revascularization (%)	60.2	59.8	1.01 (0.83-1.23)	1.00
Met indication criteria for PCI (%)	94.1	91.5	1.03 (0.97-1.10)	0.37

*Adjudicated by CEC blinded to treatment group

Kaplan-Meier Curves for Freedom from MACE within 12-Months Post PCI Procedure



Summary

In patients treated with non-emergency PCI performed in hospitals without in comparison to with on-site cardiac surgery in Massachusetts:

- **PCI was non-inferior with respect to MACE at 30-days (safety).**
- **PCI was non-inferior with respect to MACE at 12-months (effectiveness).**
- **There were no significant differences in all-cause mortality, MI, repeat revascularization, or stroke at 30-days or 12-months.**

Limitations

- **While data were available in 97% of subjects at 30- days, data were not available for the 12-month follow-up visit in 13% of subjects.**

- **While the study inclusion criteria were broad, certain clinical and anatomic subsets were excluded, and thus, the findings in this study should not be extrapolated to these subgroups.**

- **The study was powered to detect non-inferiority regarding the two co-primary composite end points but not the individual components, such as mortality or stroke.**

Conclusions

- **These data suggest that performance of PCI at hospitals without on-site cardiac surgery but with established programs and requisite hospital and operator procedural volume, may be considered an acceptable option for patients presenting to such hospitals for care.**

Acknowledgements

Participating Hospitals

Beth Israel Deaconess Hospital
Boston Iniversity Medical Center
Brigham and Women's Hospital
Brockton Hospital
Good Samaritan Medical Center
Holy Family Hospital
Lahey Clinic
Lawrence General Hospital
Lowell General Hospital
Massachusetts General Hospital
Melrose Wakefield Hospital
Metro West Medical Center
Norwood Hospital
Saints Memorial Medical Center
South Shore Hospital
St. Elizabeth's Medical Center
Tufts Medical Center

Data Safety Monitoring Board

Frederick S. Ling, MD, Chair
David R. Holmes, MD
Harry Dauerman, MD
Jennifer Gassman

Clinical Events Committee

Donald E. Cutlip, MD, Chair
Paul Gordon, MD
John Lopez, MD
Robert Piana, MD

Data Analysis and Linkage

Harvard Clinical Research Institute
Massachusetts Data Analysis Center

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Nonemergency PCI at Hospitals with or without On-Site Cardiac Surgery

Alice K. Jacobs, M.D., Sharon-Lise T. Normand, Ph.D., Joseph M. Massaro, Ph.D., Donald E. Cutlip, M.D., Joseph P. Carrozza, Jr., M.D., Anthony D. Marks, M.D., Nancy Murphy, B.A., Iyah K. Romm, B.S., Madeleine Biondolillo, M.D., and Laura Mauri, M.D., for the MASS COMM Investigators*

MASS COMM Trial published online
Monday, March 11,2013
NEJM.org