The TAVR Story

The past, present and future…

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Rabin Medical Center,
Petach Tikva, Israel

האיגוד הקרדיולוגי בישראל
ISRAEL HEART SOCIETY

מובילים ביחד התחדשות

כללית מעל 100 שנה הכי טובה למשפחה

מרכז רפואי רבין בילינסון · השרון

IHS Fellow Grand Rounds; September 3rd, 2020

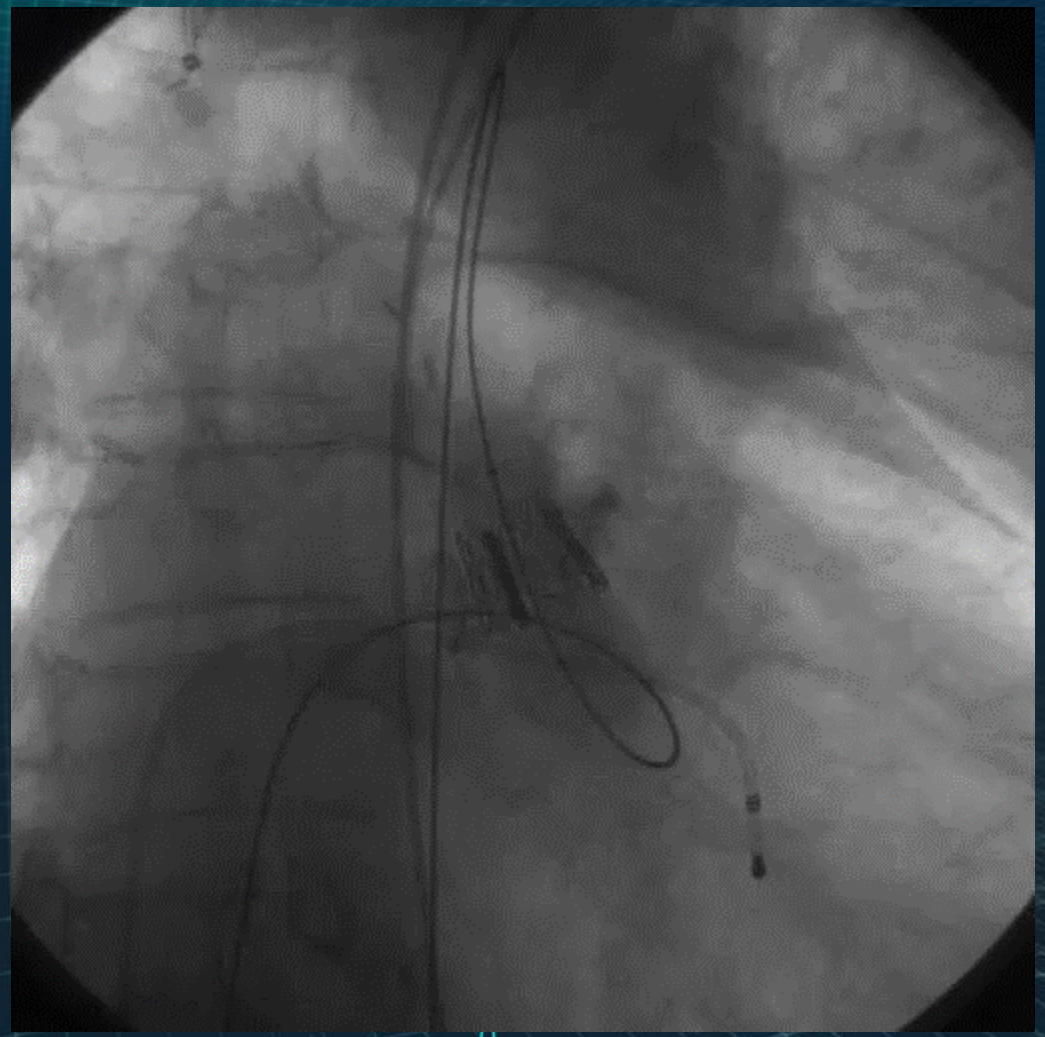
Dr. Alain Cribier - *First-in-Man PIONEER*

April 16, 2002

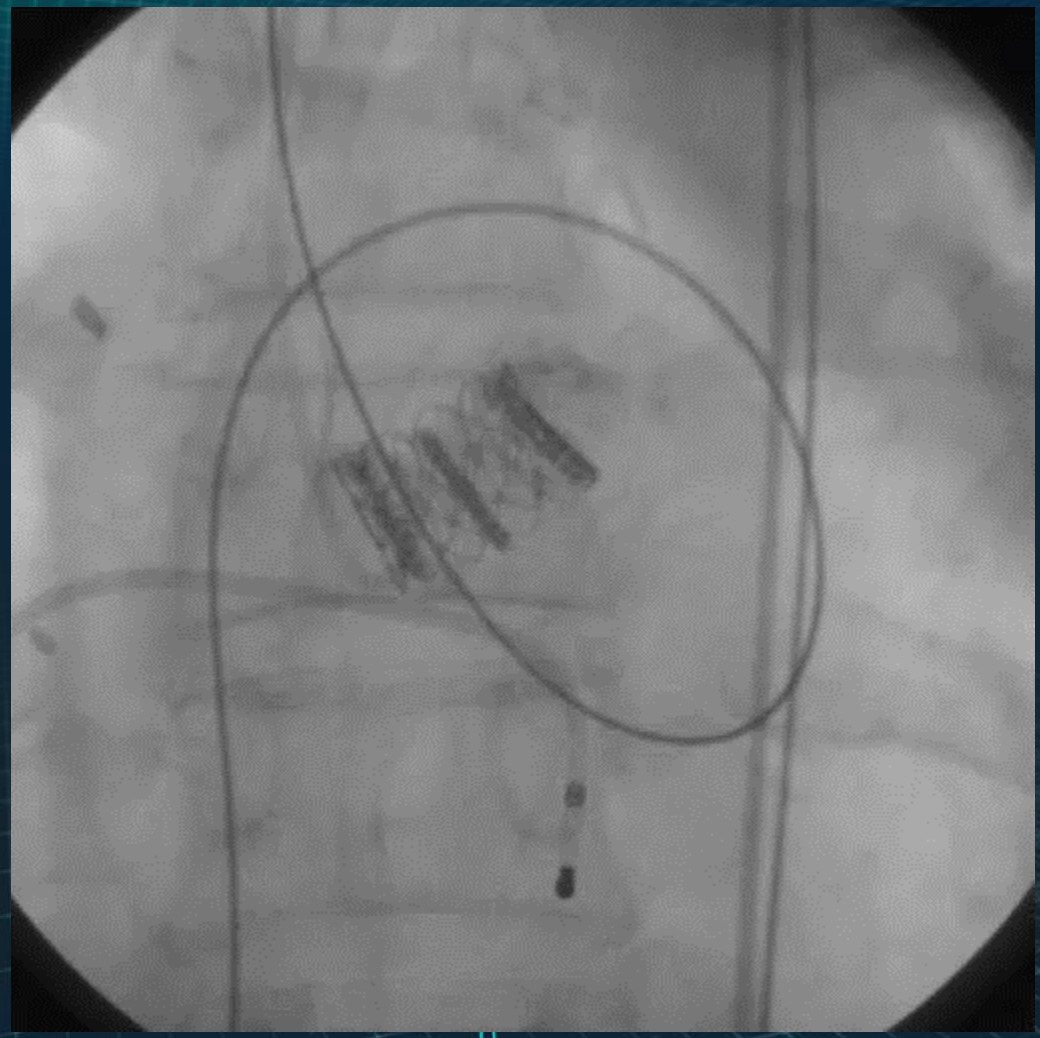
TAVR Odyssey - 2020

The first case

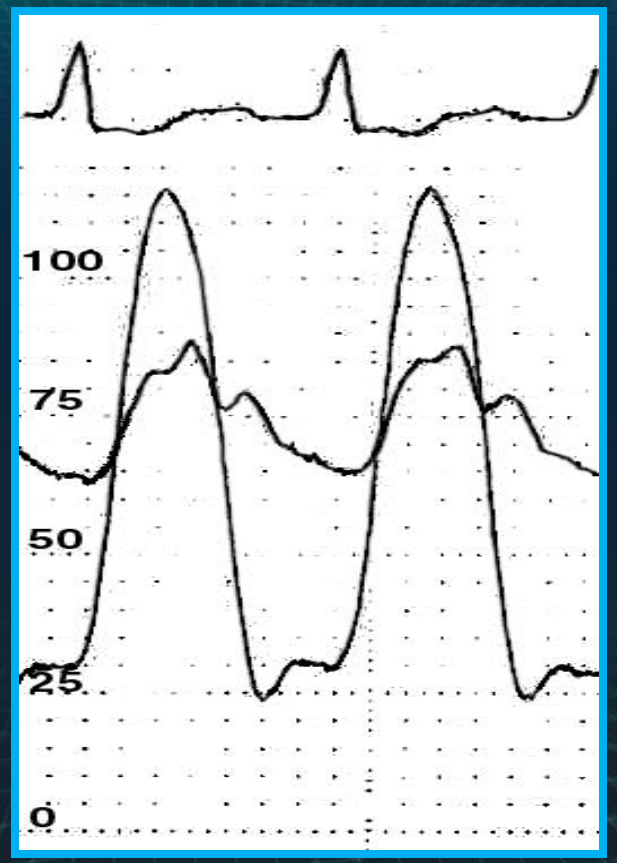
April 16, 2002; FIM-TAVI, Trans-septal

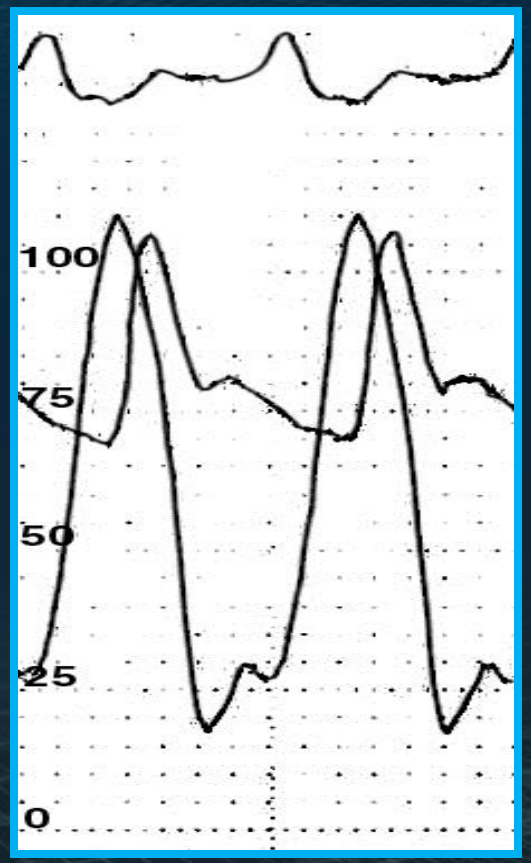


April 16, 2002; FIM-TAVI, Trans-septal



April 16, 2002; FIM-TAVI, Trans-septal





Improvement in trans-vavular gradient!

April 16, 2002; FIM-TAVI, Trans-septal

It worked !

כללית מעל 100 שנה
הכי טובה למשפחה

מרכז רפואי רבין
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Dr. Alain Cribier

First-in-Man PIONEER

Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION
American Heart Association. Learn and Live.

Percutaneous Transcatheter Implantation of an Aortic Valve Prosthesis for Calcific Aortic Stenosis

First Human Case Description

Alain Cribier, MD; Helene Eltchaninoff, MD; Assaf Bash, PhD; Nicolas Borenstein, MD; Christophe Tron, MD; Fabrice Bauer, MD; Genevieve Derumeaux, MD; Frederic Anselme, MD; François Laborde, MD; Martin B. Leon, MD

Conclusions: *Nonsurgical implantation of a prosthetic heart valve can be successfully achieved with immediate and midterm hemodynamic and clinical improvement.*

כללית מעל 100 שנה
הכי טובה למשפחה

April 16, 2002

מרכז רפואי רבין
בילינסון · השרון

TAVR Odyssey - 2020

A niche therapy

TAVR Odyssey - 2020

Key Messages

- **After the landmark FIM case by Alain Cribier, the next several years were spent replicating and refining the TAVR procedure in extreme-risk patients (I-REVIVE/RECAST and REVIVAL feasibility registries in EU and US).**
- **Results were still indicative for high complication rate, due to very sick patients and very crude devices.**

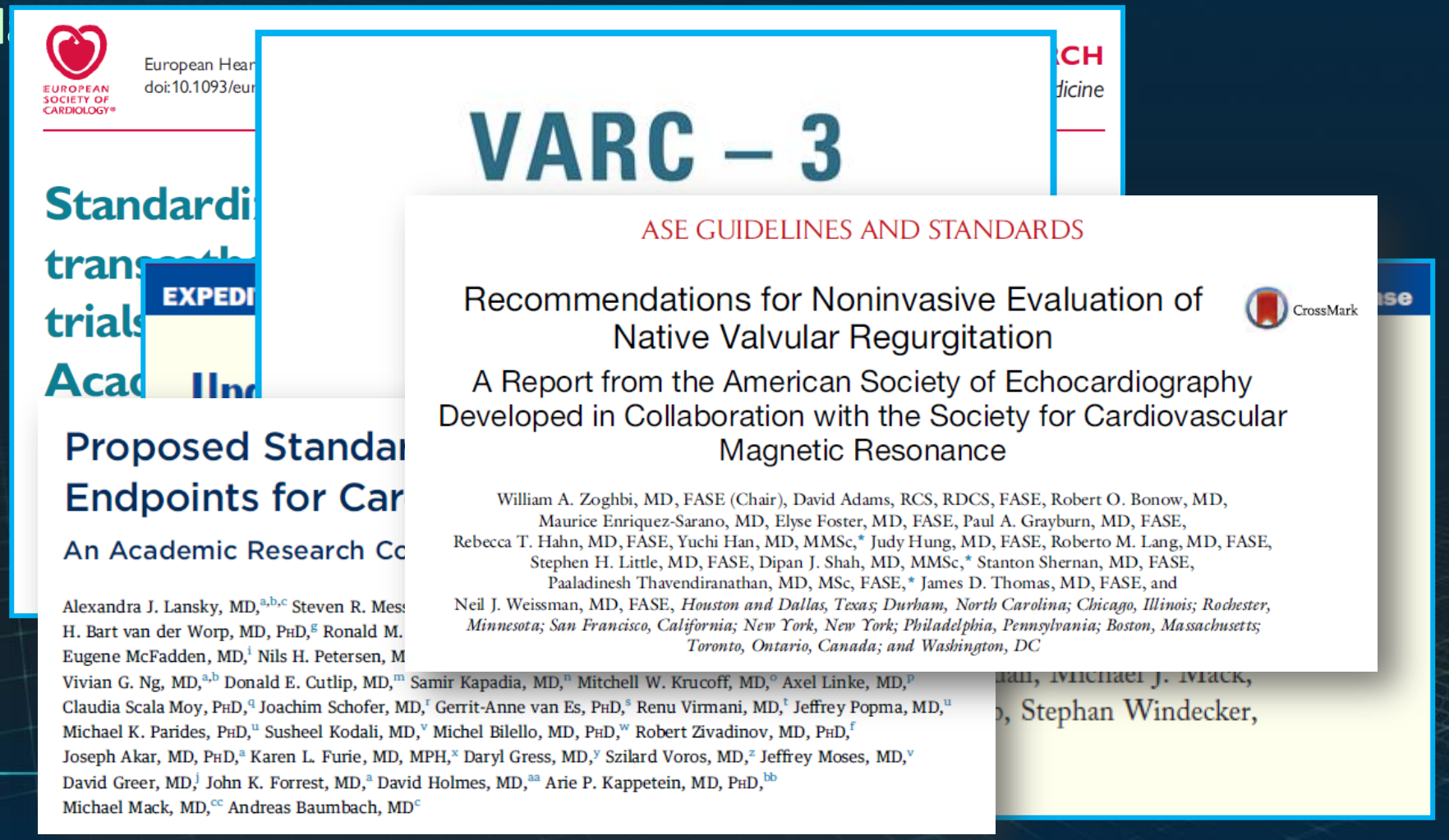
TAVR - The Early Skeptics

- Strokes
- Aortic rupture
- Coronary occlusion
- Mitral valve injury
- Valve instability – embolization
- Para-valvular regurgitation
- Vascular complications (a lot!)
- Valve durability (questionable)
- Other technical challenges

It was uncertain at that period whether this new procedure will cath-up!

TAVR and SAVR Endpoint Guidelines

- In preparation for pivotal FDA studies, a clinical research infrastructure was developed and 2 decisions were made:
  - ✓ TAVR must be valid
  - ✓ Surgical colleagues



כללית מעל 100 שנה
הכי טובה למשפחה

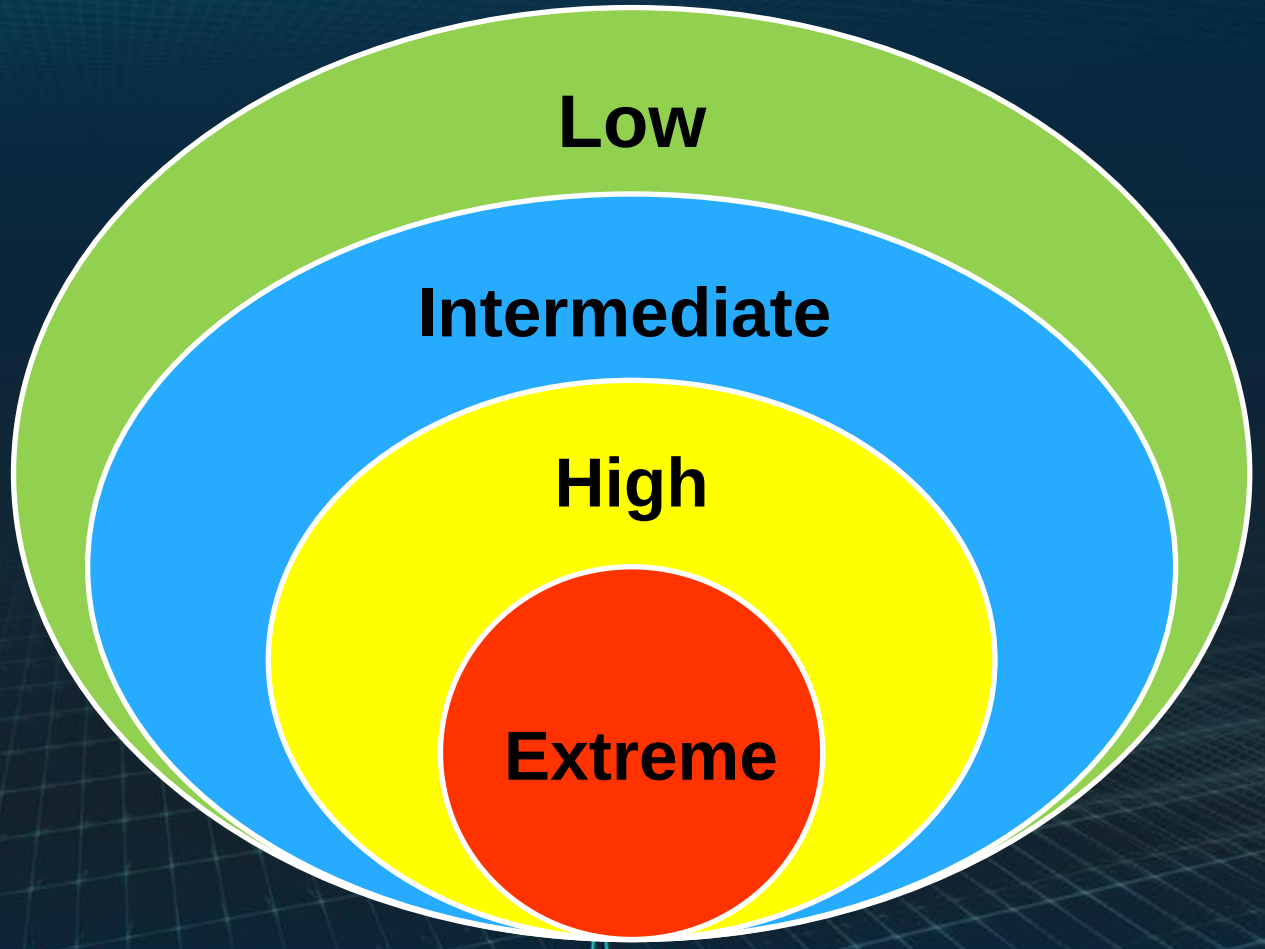
TAVR Odyssey - 2020

Key Messages

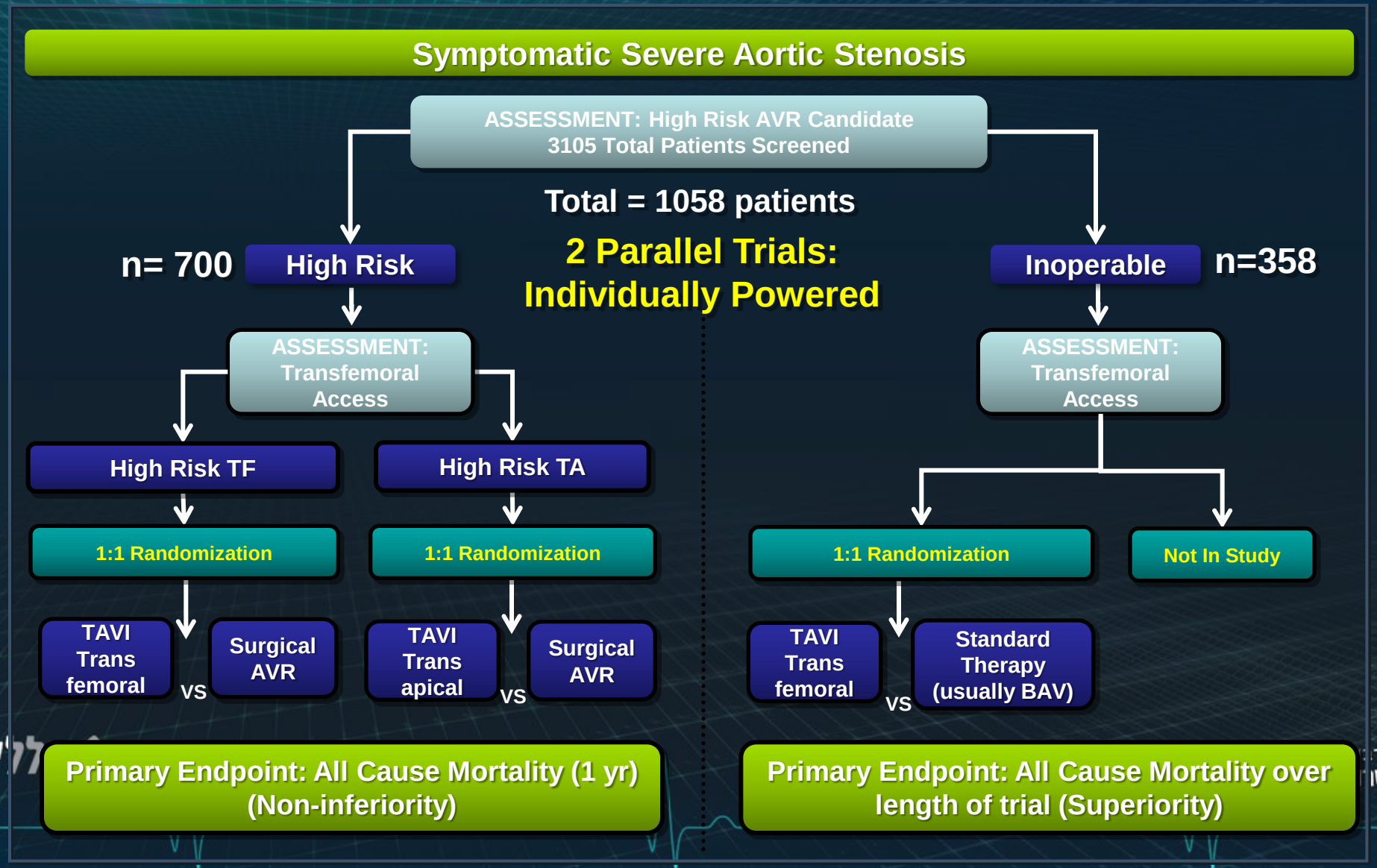
- **The VARC initiative set the stage for PARTNER and MDT CoreValve Pivotal trials, which arguably became the most successful sequence of clinical trials EVER!**
- **The PARTNER trials and the MDT CoreValve studies applied the highest level of clinical trial rigor, including 8 RCTs, to validate the relative safety and efficacy of TAVR vs. control therapies (e.g. medical Rx or surgery) *in de-escalating risk strata over a ten-year period*!**

TAVR Patient Selection for Clinical Trials

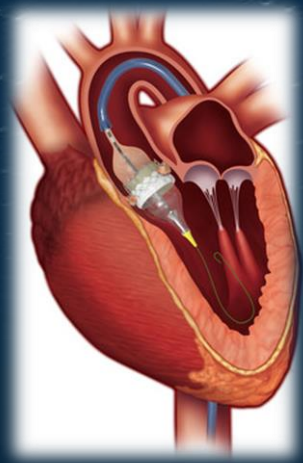
Surgical Risk Stratification

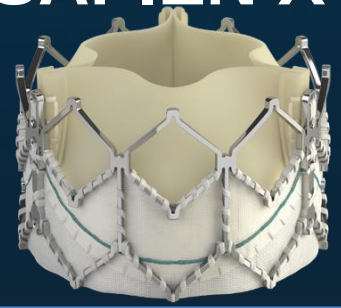


PARTNER Study Design



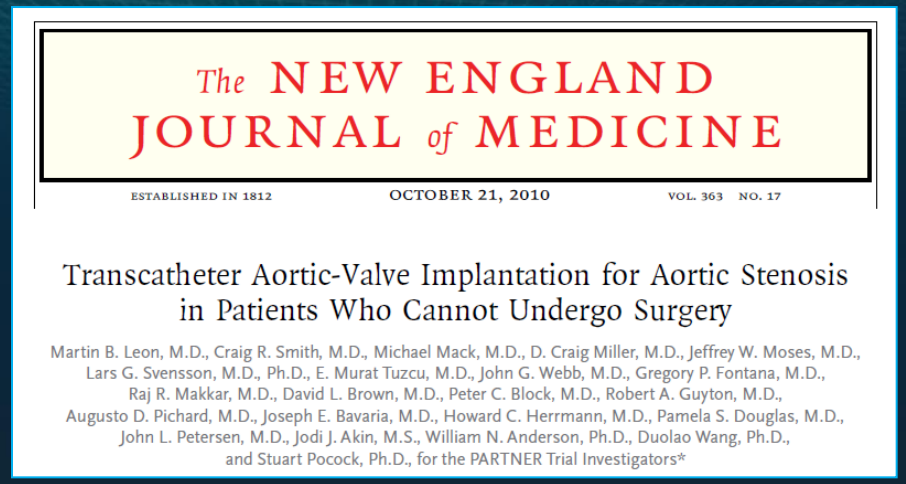
PARTNER SAPIEN Platforms
Device Evolution



	SAPIEN	SAPIEN XT	SAPIEN 3
Valve Technology			
Sheath Compatibility	 22-24F	 16-20F	 14-16F
Available Valve Sizes	 23 mm, 26 mm	 23 mm, 26 mm, 29 mm*, 20 mm	 23 mm, 26 mm, 29 mm

*First Implant Oct 30, 2012

PARTNER Manuscripts in NEJM (October, 2010 – May, 2012)

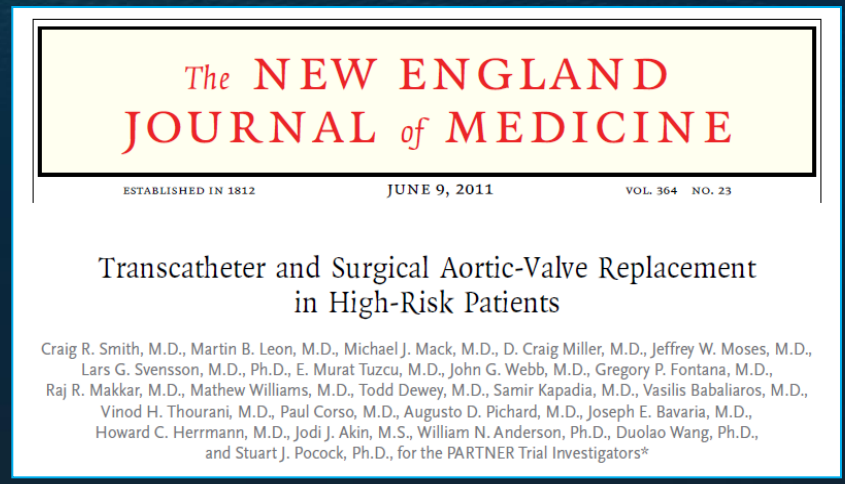


The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 OCTOBER 21, 2010 VOL. 363 NO. 17

Transcatheter Aortic-Valve Implantation for Aortic Stenosis in Patients Who Cannot Undergo Surgery

Martin B. Leon, M.D., Craig R. Smith, M.D., Michael Mack, M.D., D. Craig Miller, M.D., Jeffrey W. Moses, M.D., Lars G. Svensson, M.D., Ph.D., E. Murat Tuzcu, M.D., John G. Webb, M.D., Gregory P. Fontana, M.D., Raj R. Makkar, M.D., David L. Brown, M.D., Peter C. Block, M.D., Robert A. Guyton, M.D., Augusto D. Pichard, M.D., Joseph E. Bavaria, M.D., Howard C. Herrmann, M.D., Pamela S. Douglas, M.D., John L. Petersen, M.D., Jodi J. Akin, M.S., William N. Anderson, Ph.D., Duolao Wang, Ph.D., and Stuart Pocock, Ph.D., for the PARTNER Trial Investigators*

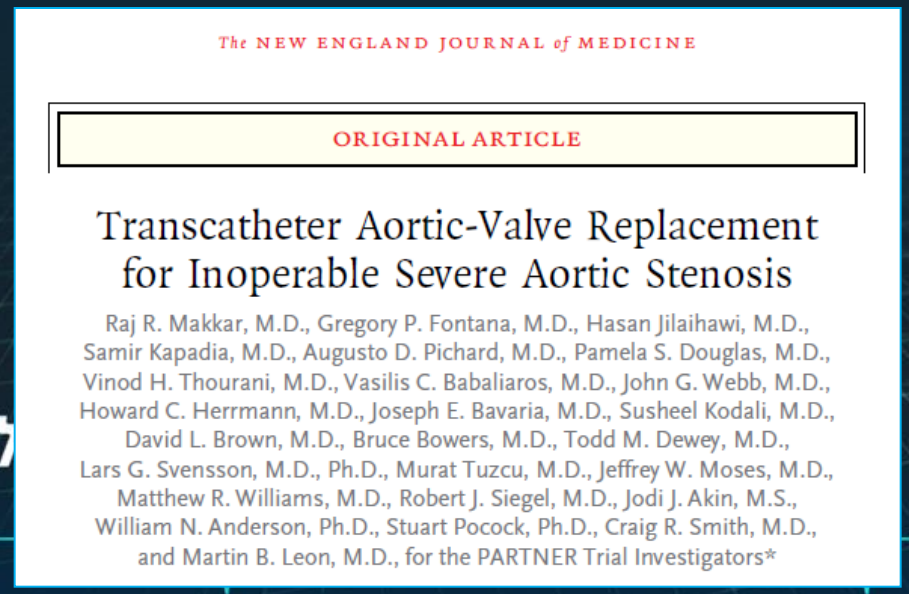


The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JUNE 9, 2011 VOL. 364 NO. 23

Transcatheter and Surgical Aortic-Valve Replacement in High-Risk Patients

Craig R. Smith, M.D., Martin B. Leon, M.D., Michael J. Mack, M.D., D. Craig Miller, M.D., Jeffrey W. Moses, M.D., Lars G. Svensson, M.D., Ph.D., E. Murat Tuzcu, M.D., John G. Webb, M.D., Gregory P. Fontana, M.D., Raj R. Makkar, M.D., Mathew Williams, M.D., Todd Dewey, M.D., Samir Kapadia, M.D., Vasilis Babaliaros, M.D., Vinod H. Thourani, M.D., Paul Corso, M.D., Augusto D. Pichard, M.D., Joseph E. Bavaria, M.D., Howard C. Herrmann, M.D., Jodi J. Akin, M.S., William N. Anderson, Ph.D., Duolao Wang, Ph.D., and Stuart J. Pocock, Ph.D., for the PARTNER Trial Investigators*

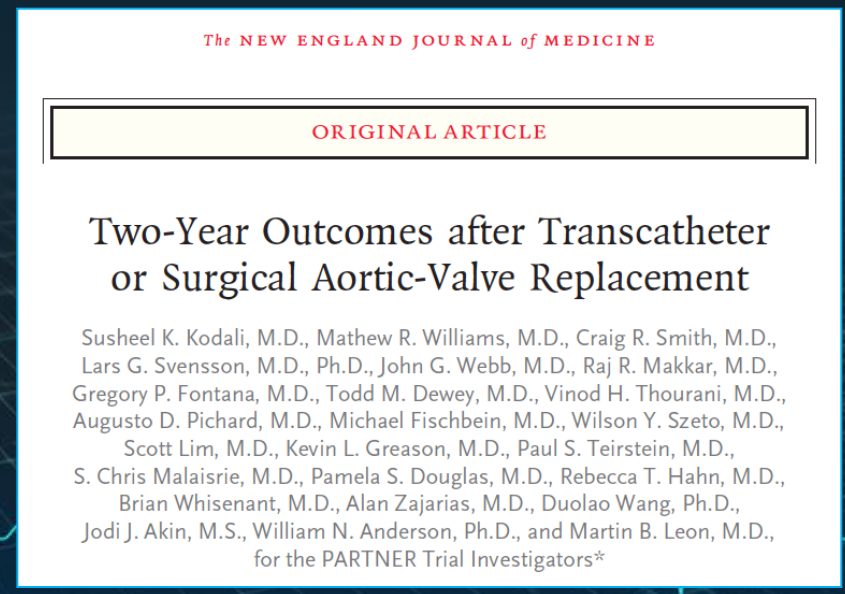


The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Transcatheter Aortic-Valve Replacement for Inoperable Severe Aortic Stenosis

Raj R. Makkar, M.D., Gregory P. Fontana, M.D., Hasan Jilaihawi, M.D., Samir Kapadia, M.D., Augusto D. Pichard, M.D., Pamela S. Douglas, M.D., Vinod H. Thourani, M.D., Vasilis C. Babaliaros, M.D., John G. Webb, M.D., Howard C. Herrmann, M.D., Joseph E. Bavaria, M.D., Susheel Kodali, M.D., David L. Brown, M.D., Bruce Bowers, M.D., Todd M. Dewey, M.D., Lars G. Svensson, M.D., Ph.D., Murat Tuzcu, M.D., Jeffrey W. Moses, M.D., Matthew R. Williams, M.D., Robert J. Siegel, M.D., Jodi J. Akin, M.S., William N. Anderson, Ph.D., Stuart Pocock, Ph.D., Craig R. Smith, M.D., and Martin B. Leon, M.D., for the PARTNER Trial Investigators*



The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Two-Year Outcomes after Transcatheter or Surgical Aortic-Valve Replacement

Susheel K. Kodali, M.D., Mathew R. Williams, M.D., Craig R. Smith, M.D., Lars G. Svensson, M.D., Ph.D., John G. Webb, M.D., Raj R. Makkar, M.D., Gregory P. Fontana, M.D., Todd M. Dewey, M.D., Vinod H. Thourani, M.D., Augusto D. Pichard, M.D., Michael Fischbein, M.D., Wilson Y. Szeto, M.D., Scott Lim, M.D., Kevin L. Greason, M.D., Paul S. Teirstein, M.D., S. Chris Malaisrie, M.D., Pamela S. Douglas, M.D., Rebecca T. Hahn, M.D., Brian Whisenant, M.D., Alan Zajarias, M.D., Duolao Wang, Ph.D., Jodi J. Akin, M.S., William N. Anderson, Ph.D., and Martin B. Leon, M.D., for the PARTNER Trial Investigators*

PARTNER 5-year FU in Lancet (March, 2015)

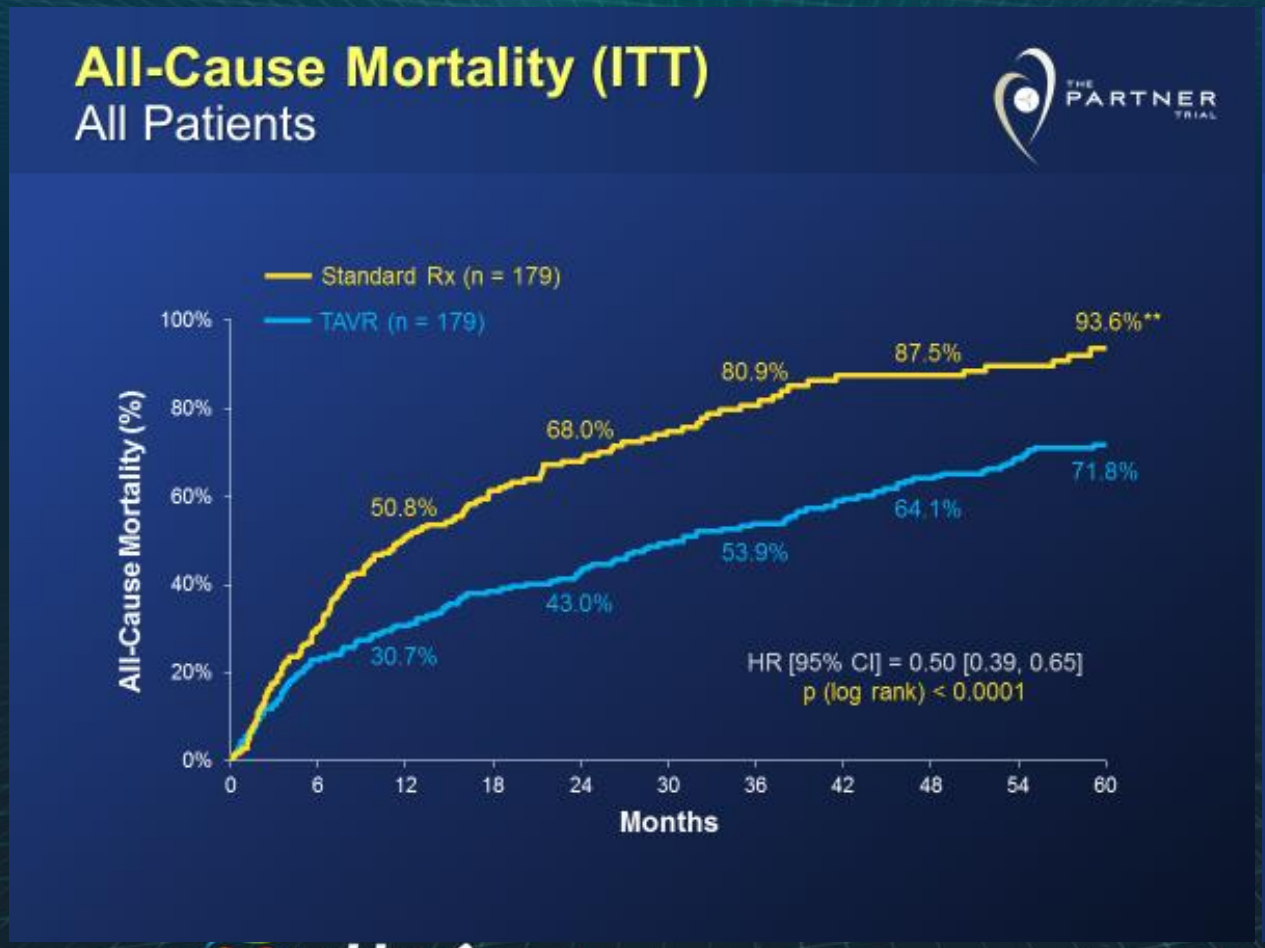
5-year outcomes of transcatheter aortic valve replacement compared with standard treatment for patients with inoperable aortic stenosis (PARTNER 1): a randomised controlled trial

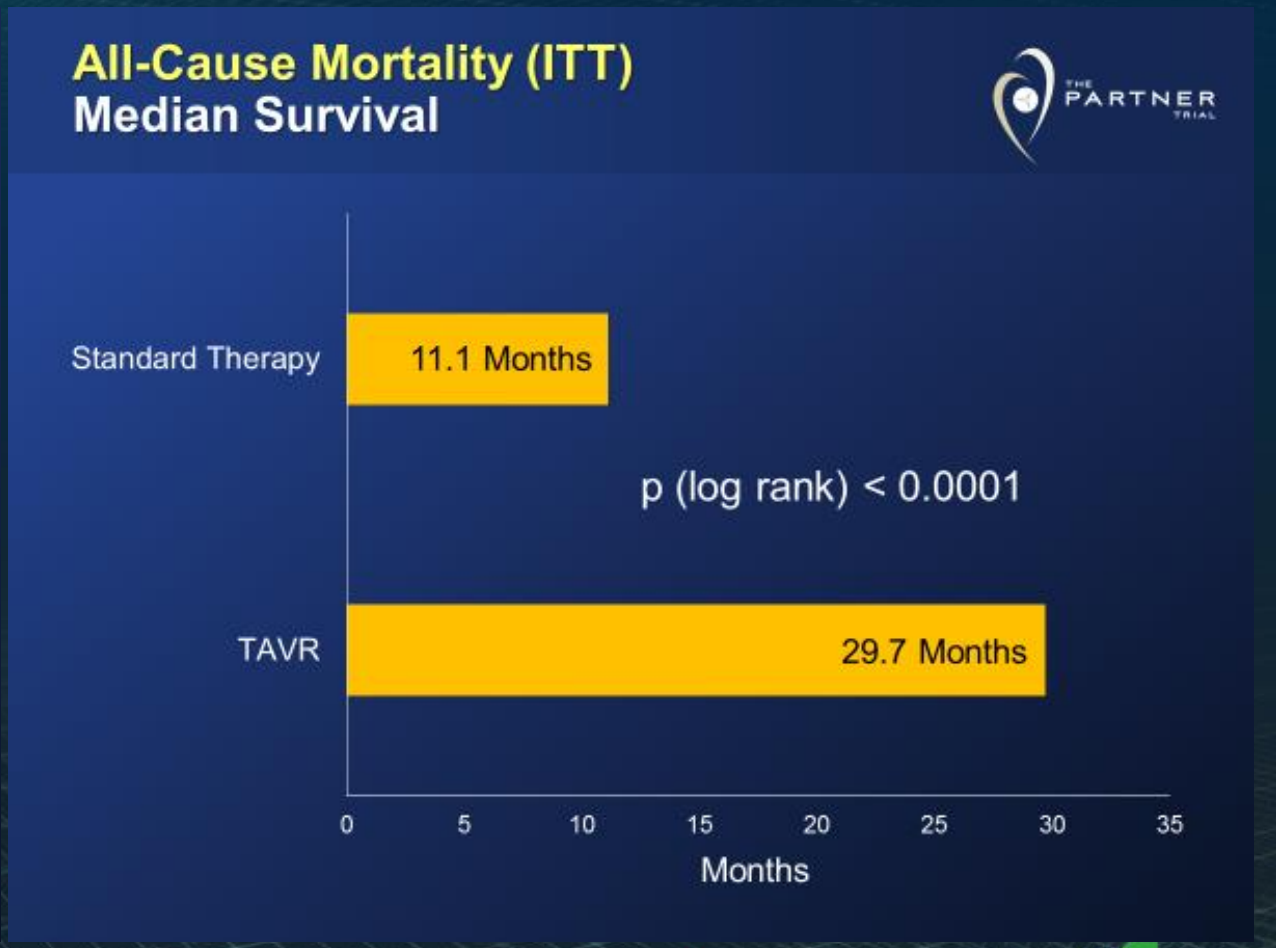
Samir R Kapadia, Martin B Leon, Raj R Makkar, E Murat Tuzcu, Lars G Svensson, Susheel Kodali, John G Webb, Michael J Mack, Pamela S Douglas, Vinod H Thourani, Vasilis C Babaliaros, Howard C Herrmann, Wilson Y Szeto, Augusto D Pichard, Mathew R Williams, Gregory P Fontana, D Craig Miller, William N Anderson, Jodi J Akin, Michael J Davidson†, Craig R Smith, for the PARTNER trial investigators*

5-year outcomes of transcatheter aortic valve replacement or surgical aortic valve replacement for high surgical risk patients with aortic stenosis (PARTNER 1): a randomised controlled trial

Michael J Mack, Martin B Leon, Craig R Smith, D Craig Miller, Jeffrey W Moses, E Murat Tuzcu, John G Webb, Pamela S Douglas, William N Anderson, Eugene H Blackstone, Susheel K Kodali, Raj R Makkar, Gregory P Fontana, Samir Kapadia, Joseph Bavaria, Rebecca T Hahn, Vinod H Thourani, Vasilis Babaliaros, Augusto Pichard, Howard C Herrmann, David L Brown, Mathew Williams, Jodi Akin, Michael J Davidson†, Lars G Svensson, for the PARTNER 1 trial investigators*

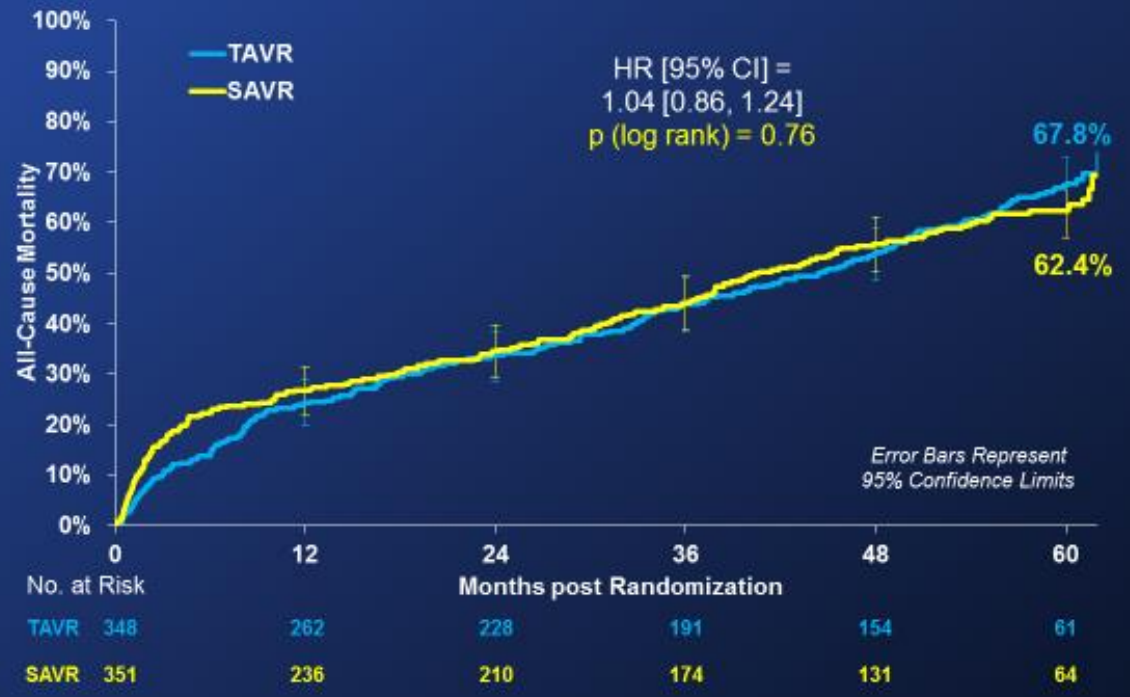
PARTNER 1B Trial – Extreme Risk





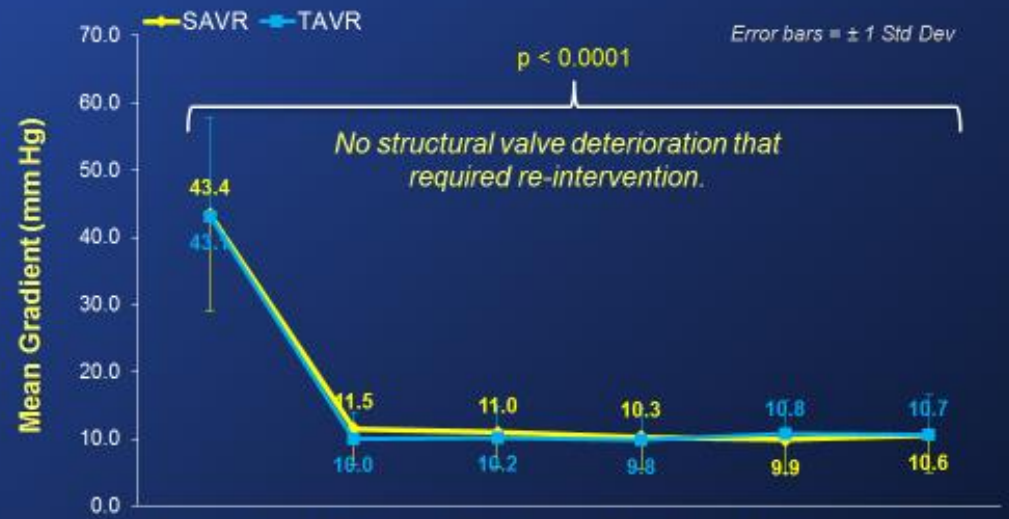
PARTNER 1A Trial – High Risk

All-Cause Mortality (ITT)
All Patients



No. at Risk						
TAVR	348	262	228	191	154	61
SAVR	351	236	210	174	131	64

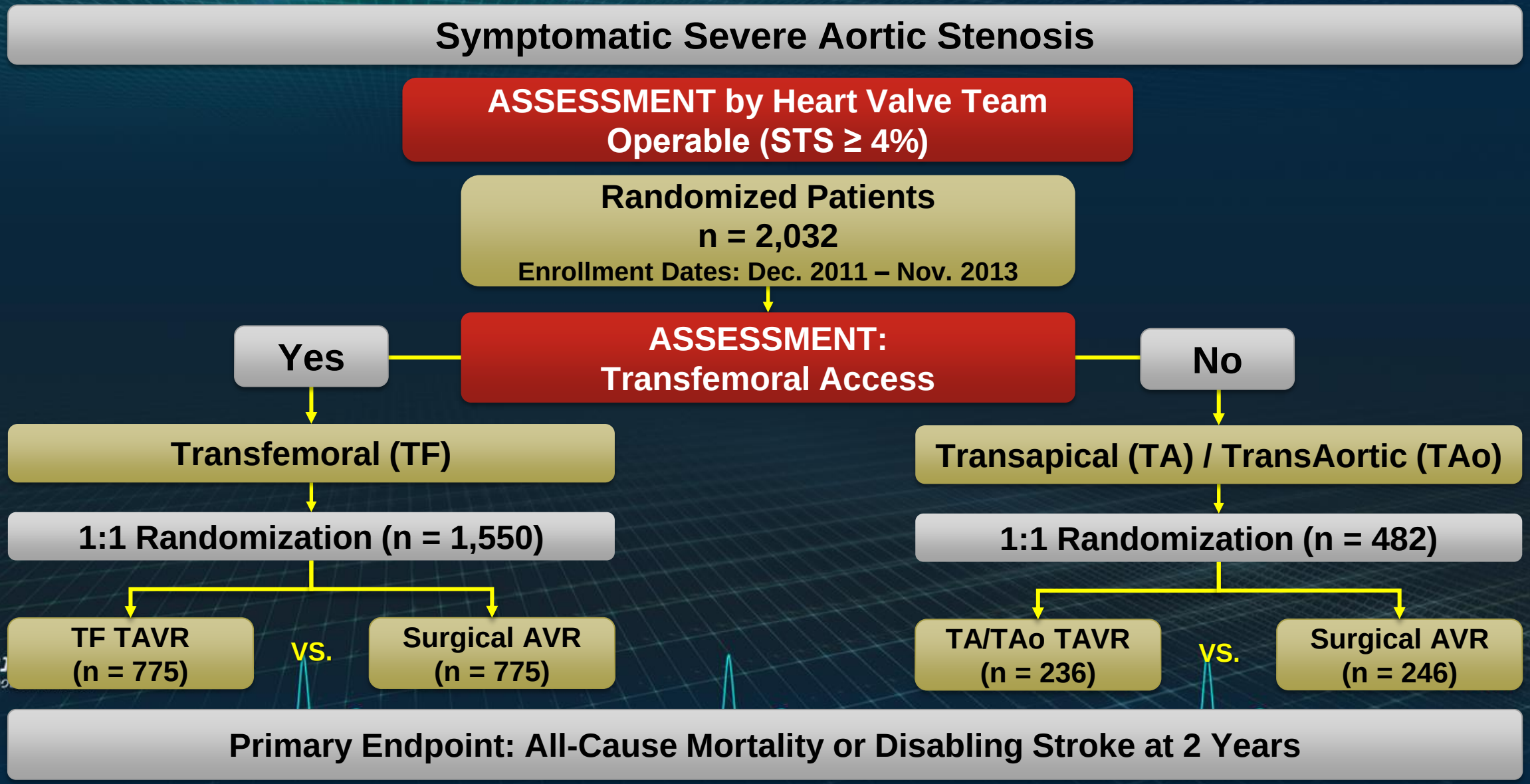
Aortic Valve Mean Gradient



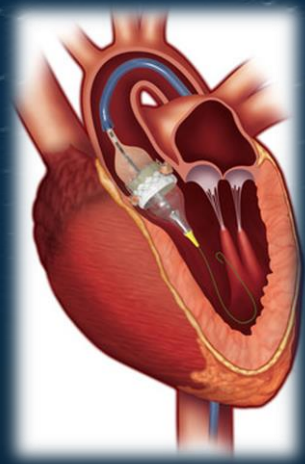
	Baseline	1 Year	2 Year	3 Year	4 Year	5 Year
TAVR	310	219	156	106	79	56
SAVR	299	158	123	86	61	48

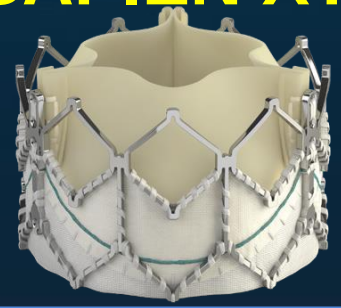
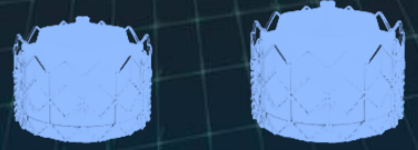
The PARTNER 2A Trial

Study Design



PARTNER SAPIEN Platforms
Device Evolution



	SAPIEN	SAPIEN XT	SAPIEN 3
Valve Technology			
Sheath Compatibility	 22-24F	 16-20F	 14-16F
Available Valve Sizes	 23 mm, 26 mm	 23 mm, 26 mm, 29 mm*	 20 mm, 23 mm, 26 mm, 29 mm

*First Implant Oct 30, 2012

The PARTNER 2A and S3i Trial
The NEJM and Lancet On-line (2016)

The NEW ENGLAND JOURNAL of MEDICINE

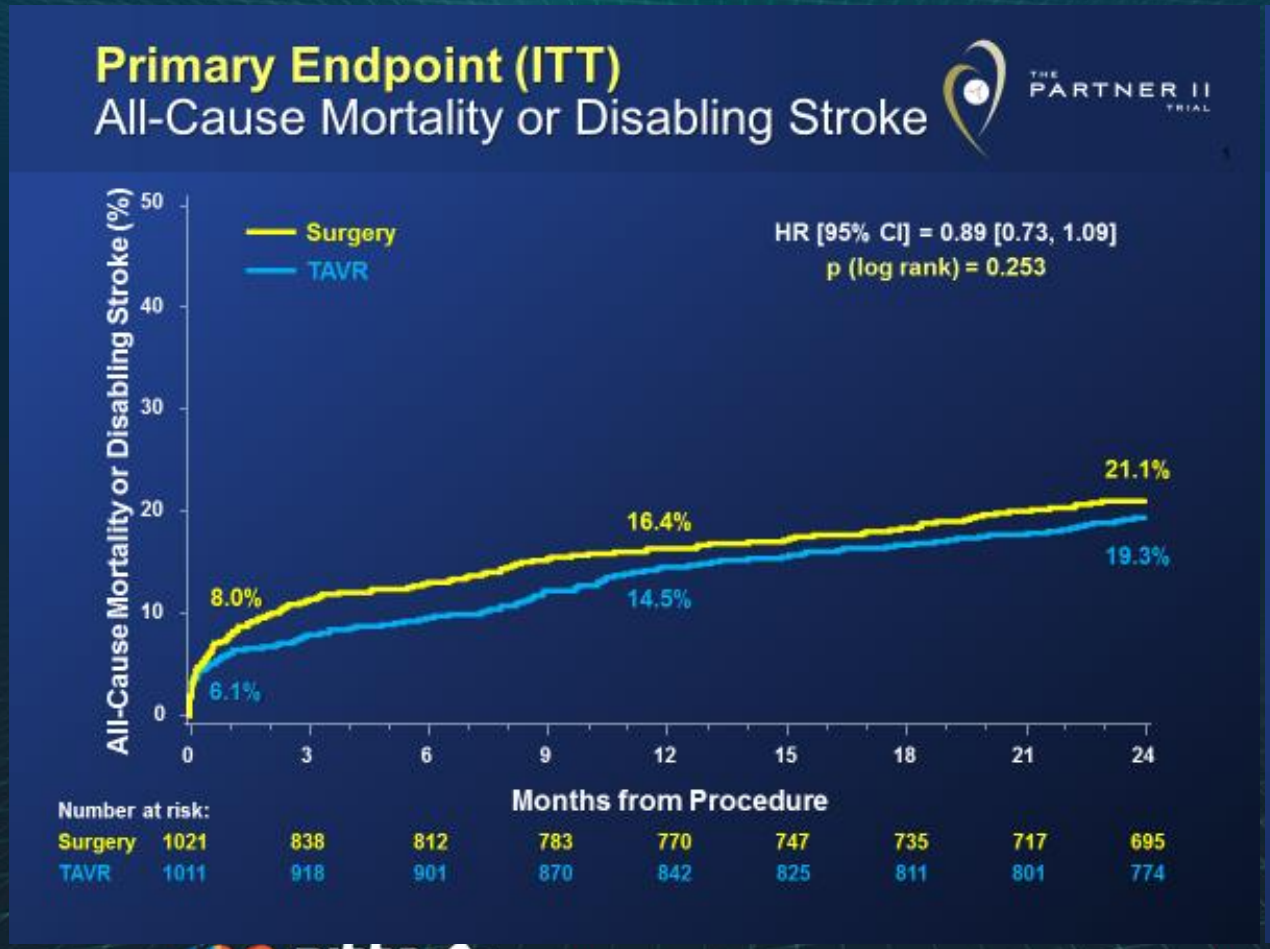
ORIGINAL ARTICLE

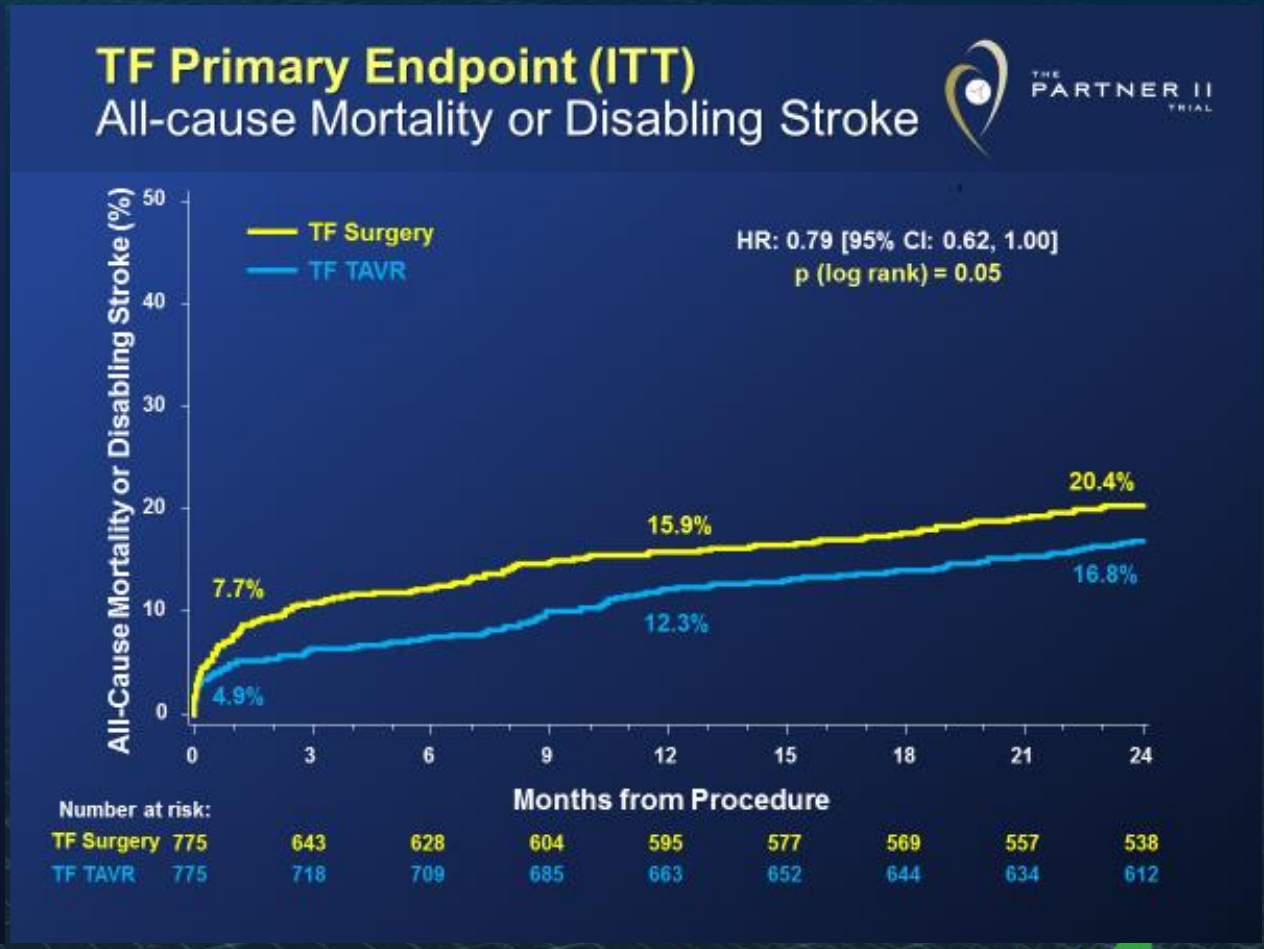
Transcatheter aortic valve replacement versus surgical valve replacement in intermediate-risk patients: a propensity score analysis

Vinod H Thourani, Susheel Kodali, Raj R Makkar, Howard C Herrmann, Mathew Williams, Vasilis Babaliaros, Richard Smalling, Scott Lim, S Chris Malaisrie, Samir Kapadia, Wilson Y Szeto, Kevin L Greason, Dean Kereiakes, Gorav Ailawadi, Brian K Whisenant, Chandan Devireddy, Jonathon Leipsic, Rebecca T Hahn, Philippe Pibarot, Neil J Weissman, Wael A Jaber, David J Cohen, Rakesh Suri, E Murat Tuzcu, Lars G Svensson, John G Webb, Jeffrey W Moses, Michael J Mack, D Craig Miller, Craig R Smith, Maria C Alu, Rupa Parvataneni, Ralph B D'Agostino Jr, Martin B Leon

Alfredo Trento, M.D., David L. Brown, M.D., William F. Fearon, M.D., Philippe Pibarot, D.V.M., Ph.D., Rebecca T. Hahn, M.D., Wael A. Jaber, M.D., William N. Anderson, Ph.D., Maria C. Alu, M.M., and John G. Webb, M.D., for the PARTNER 2 Investigators*

PARTNER 2A Trial – Intermediate Risk





Five-year Outcomes from the PARTNER 2A Trial: Transcatheter vs. Surgical Aortic Valve Replacement in Intermediate-Risk Patients

Vinod H. Thourani, MD

on behalf of The PARTNER Trial Investigators

TCT | San Francisco | September 28, 2019

THE PARTNER II TRIAL

Five-year Outcomes from the PARTNER 2A Trial: Transcatheter vs. Surgical Aortic Valve Replacement in Intermediate-Risk Patients (2020)

The NEW ENGLAND JOURNAL of MEDICINE

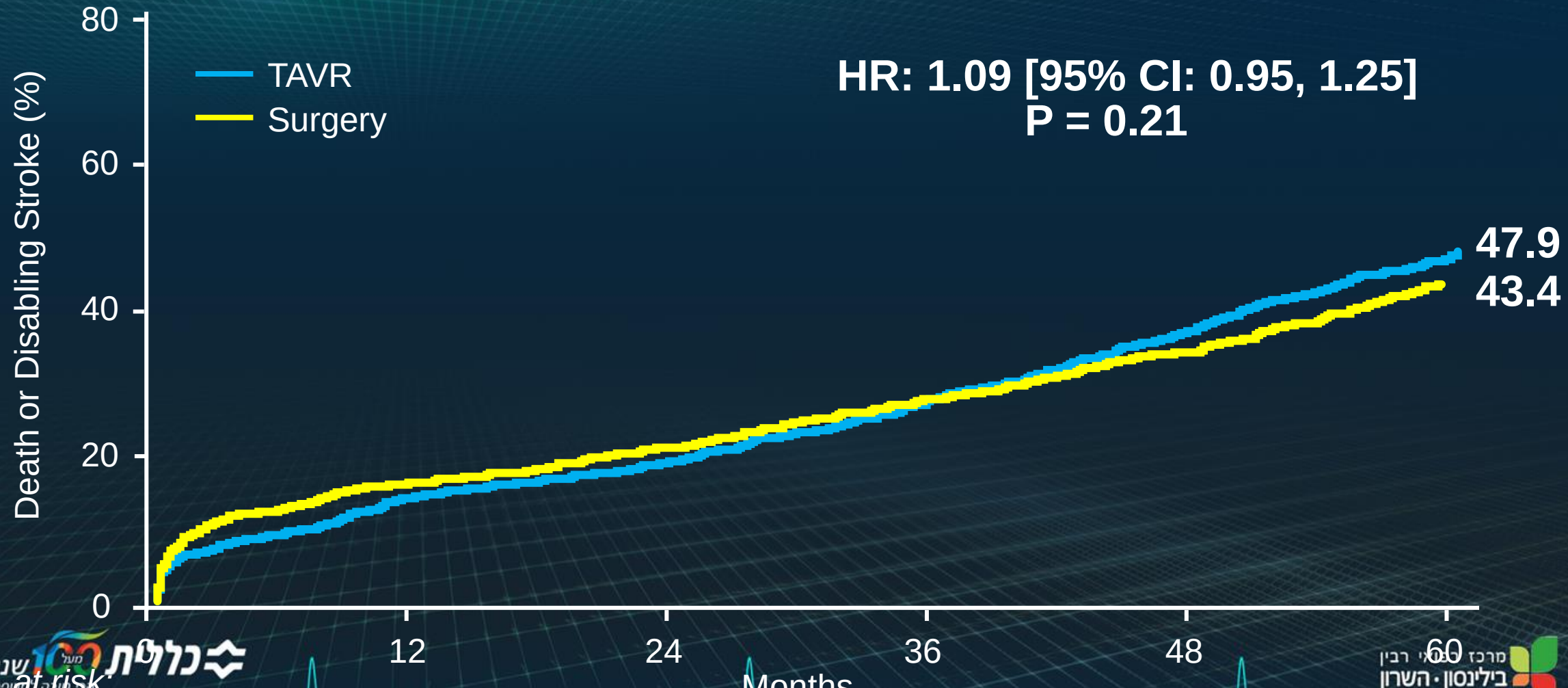
ESTABLISHED IN 1812 FEBRUARY 27, 2020 VOL. 382 NO. 9

Five-Year Outcomes of Transcatheter or Surgical Aortic-Valve Replacement

R.R. Makkar, V.H. Thourani, M.J. Mack, S.K. Kodali, S. Kapadia, J.G. Webb, S.-H. Yoon, A. Trento, L.G. Svensson, H.C. Herrmann, W.Y. Szeto, D.C. Miller, L. Satler, D.J. Cohen, T.M. Dewey, V. Babaliaros, M.R. Williams, D.J. Kereiakes, A. Zajarias, K.L. Greason, B.K. Whisenant, R.W. Hodson, D.L. Brown, W.F. Fearon, M.J. Russo, P. Pibarot, R.T. Hahn, W.A. Jaber, E. Rogers, K. Xu, J. Wheeler, M.C. Alu, C.R. Smith, and M.B. Leon, for the PARTNER 2 Investigators*

Primary Endpoint

ITT Population

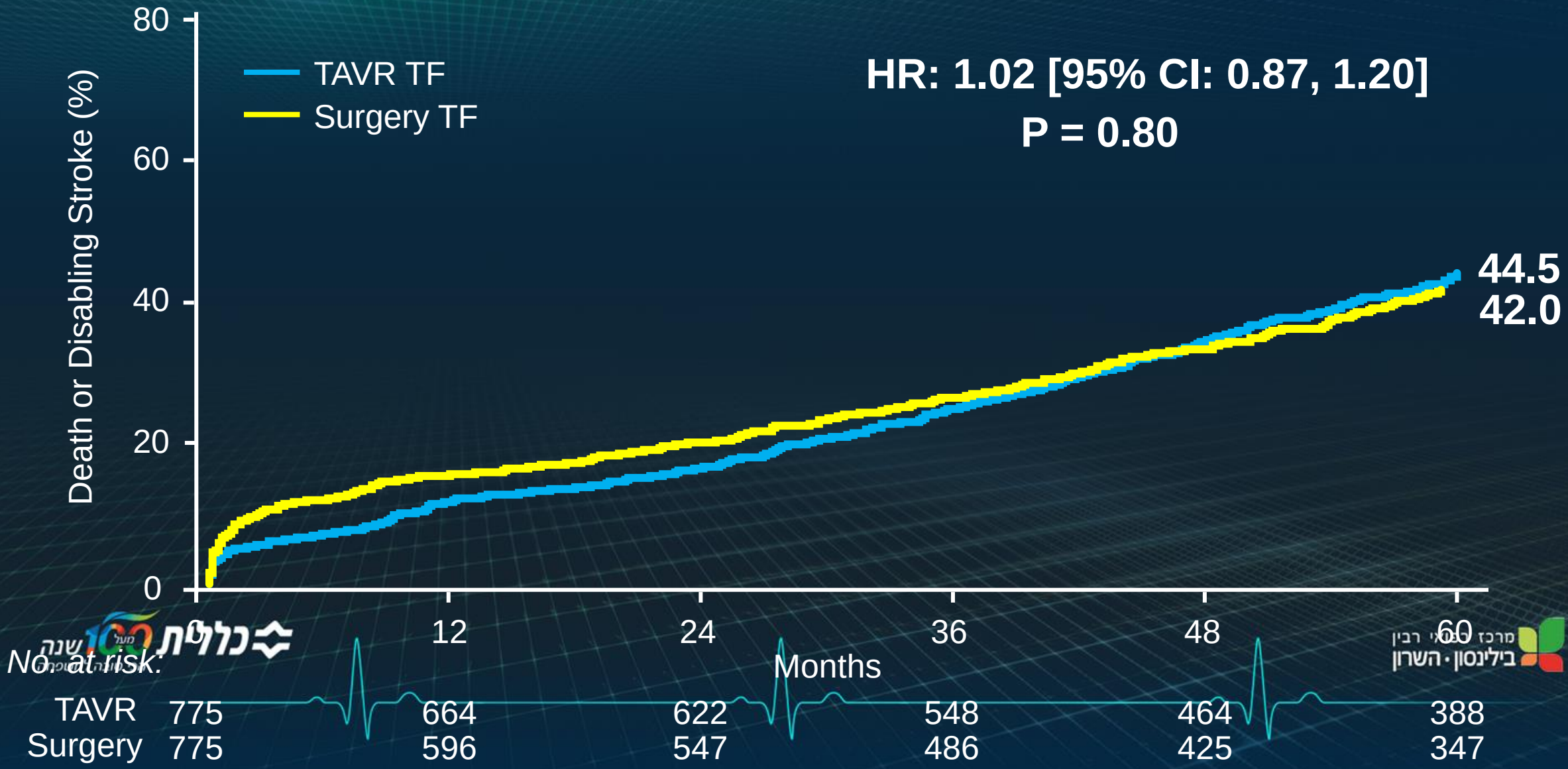


No. at risk:

TAVR	1,011	843	785	687	581	474
Surgery	1,021	771	704	625	547	440

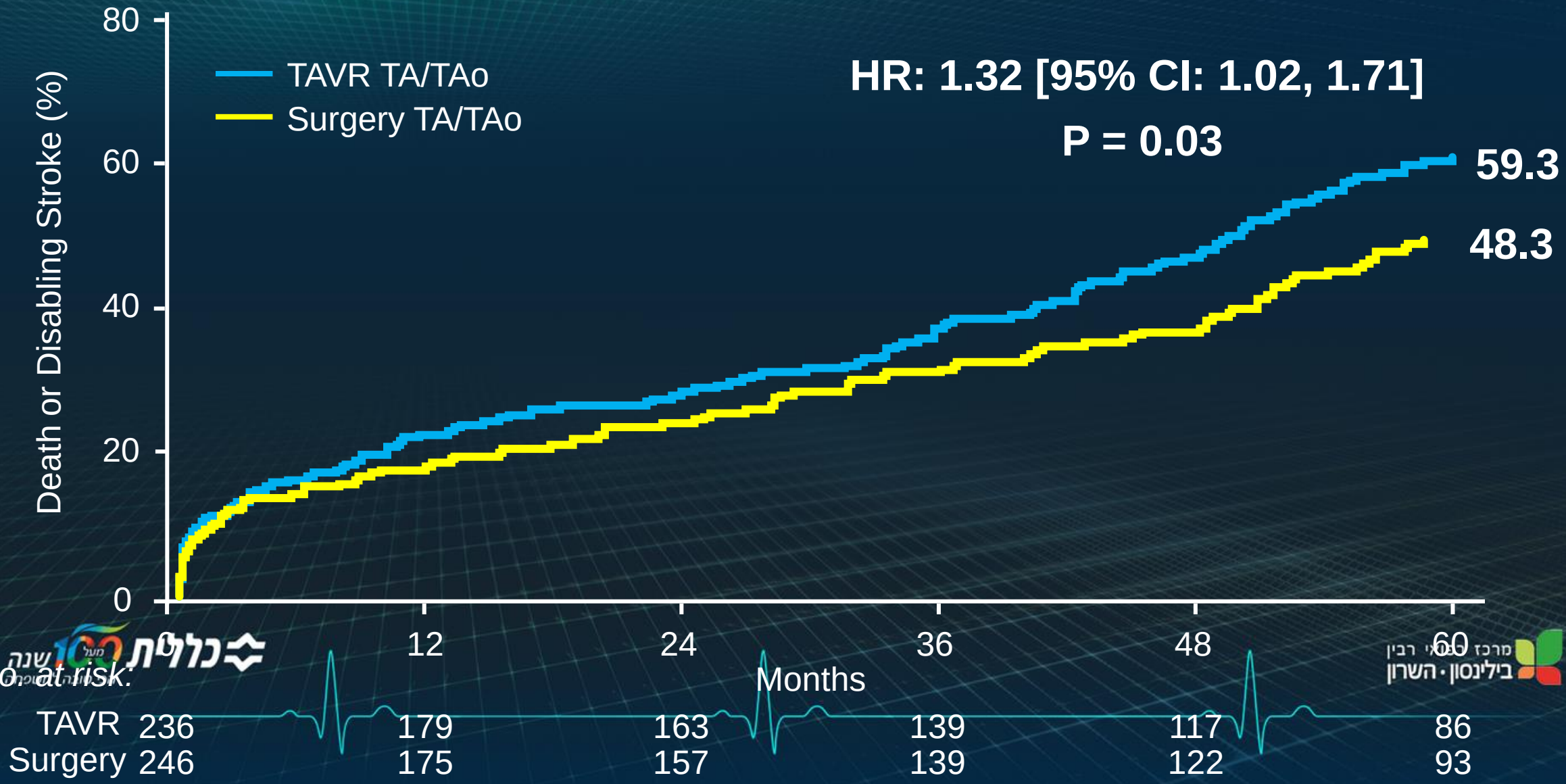
Primary Endpoint

Transfemoral Cohort



Primary Endpoint

Transthoracic Cohort



Aortic Valve Area
VI Population

No. of Echos:	Baseline	30 Days	1 Year	2 Years	3 Years	4 Years	5 Years
TAVR	899	827	695	572	468	365	289
Surgery	861	726	590	490	413	349	259

Mean ± SE

TAVR Odyssey - 2020

Standard-of-care

For moderate to intermediate patients

TAVR Odyssey - 2020

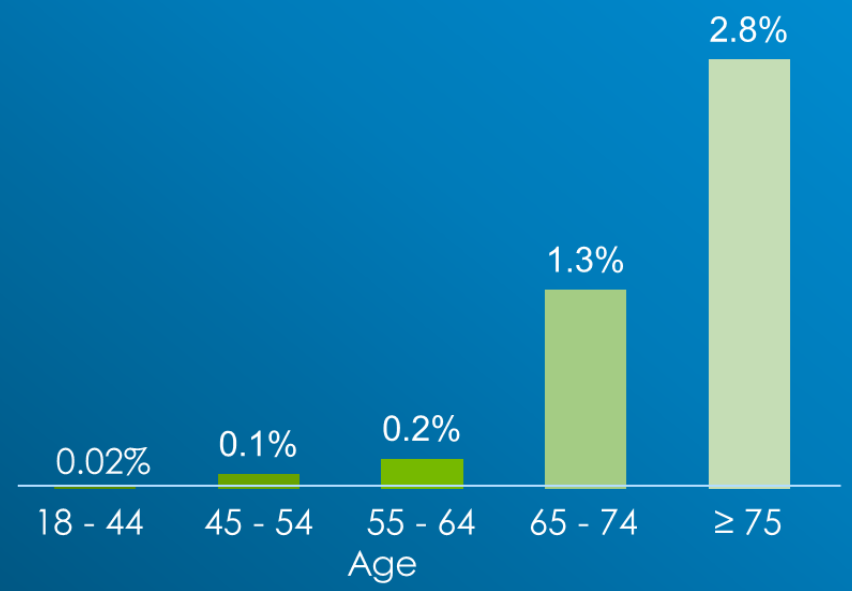
Key Messages

- **TAVR is ‘here to stay’ and will represent a growing proportion of all AVR procedures in the future, in parallel with increased global demographic needs.**
- **The TAVR revolution was was the inevitable result of decades of bold progressive iteration in surgery, cardiac imaging, and transcatheter therapies.**

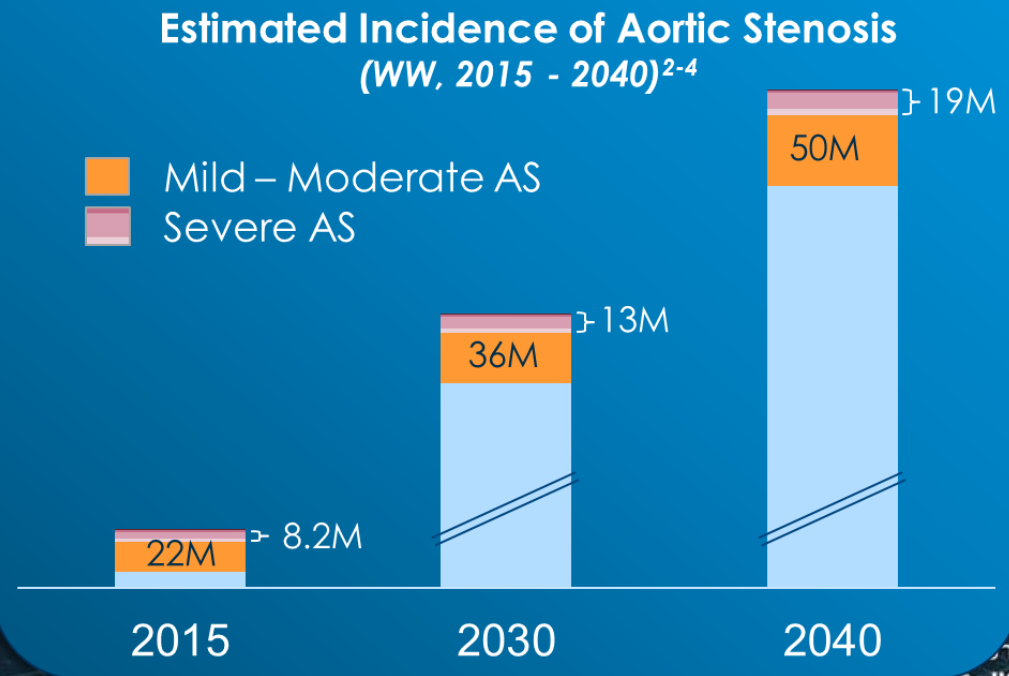
TAVR Odyssey - 2020

AS Incidence Will More Than Double by 2040

Age is an independent determinant of AS

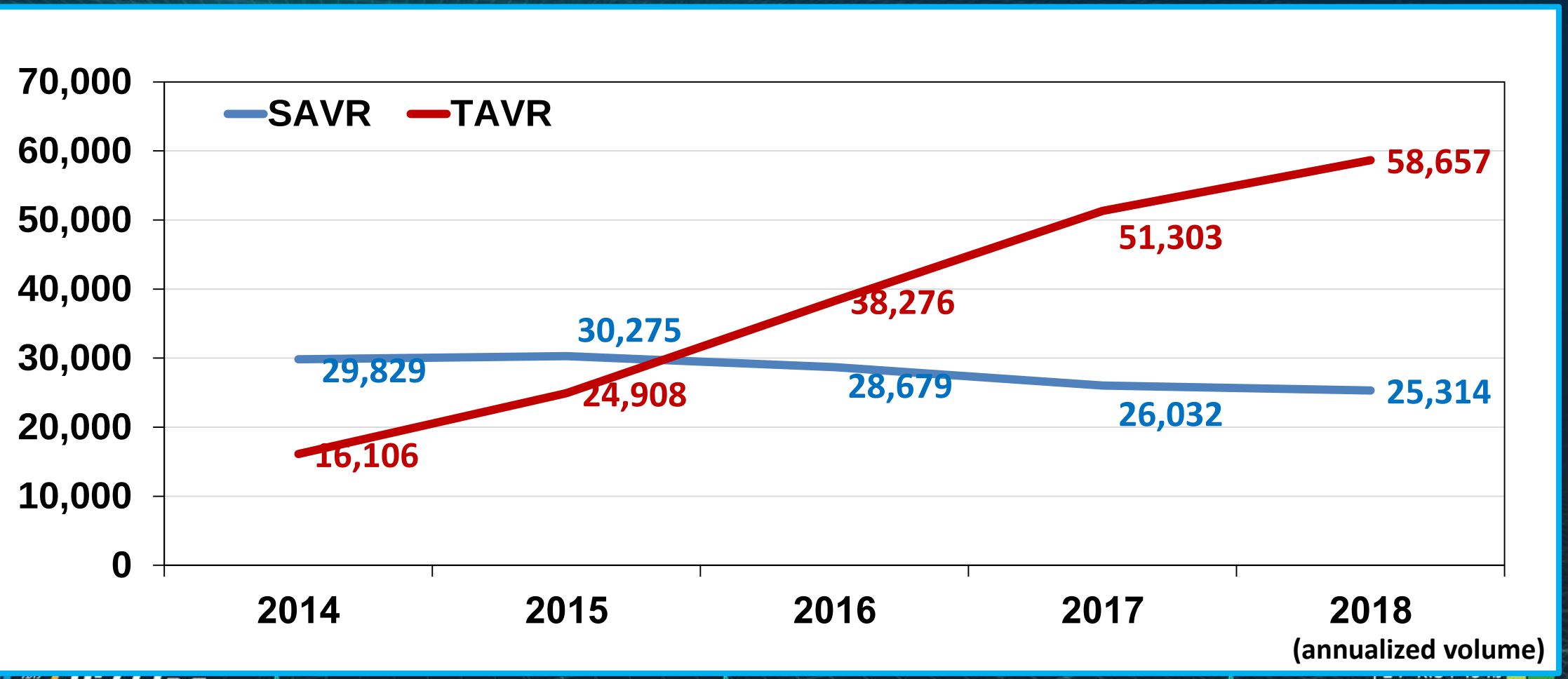


Increased incidence fueled by aging population



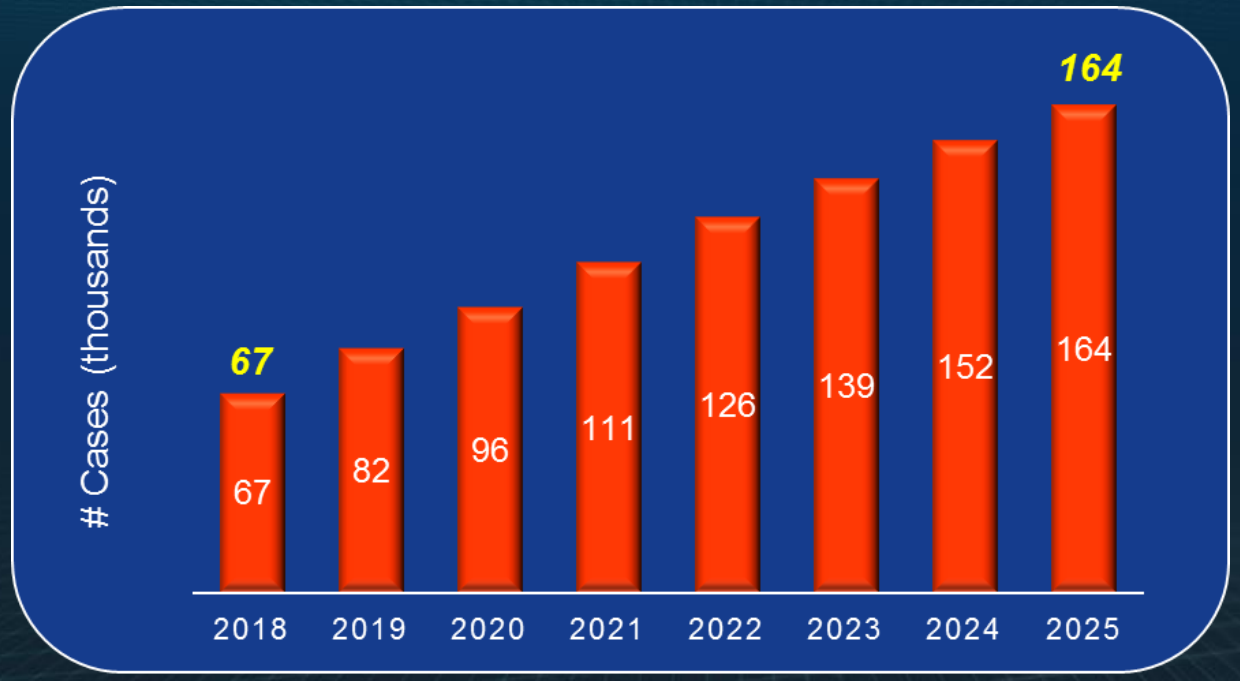
Sources: 1) Nkomo et al *Lancet* 2006; 368:1005-11, 2) Osnabrugge et al JACC 2013; 61(11):1002-1012,
3) Rostagno et al. *World J Cardiol* 2019: 11(2):71-83, 4) United Nations World Population Prospects Accessed 4/1/19;

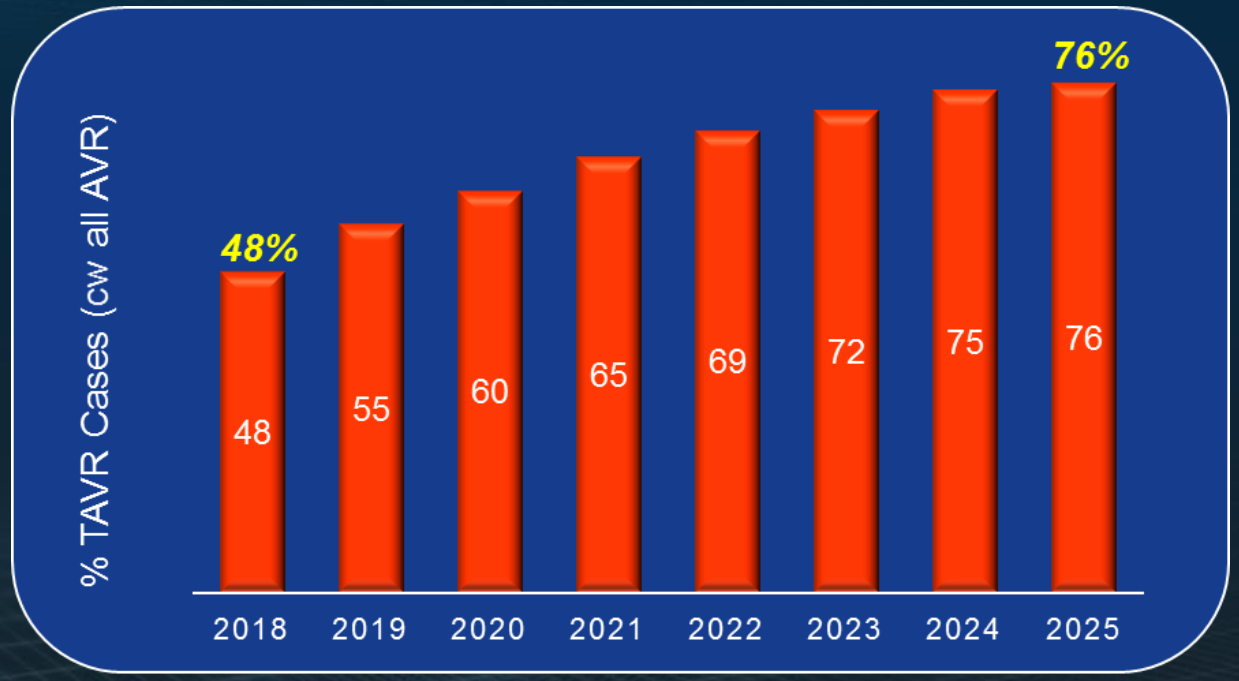
TAVR vs SAVR (isolated)



TVT and STS registries (US only)

Estimated US TAVR Growth





2018 - 2025 the US TAVR Market will Increase 2.5X!

In the US, by 2025, >75% of all AVR will be TAVR!

Current Market Projections

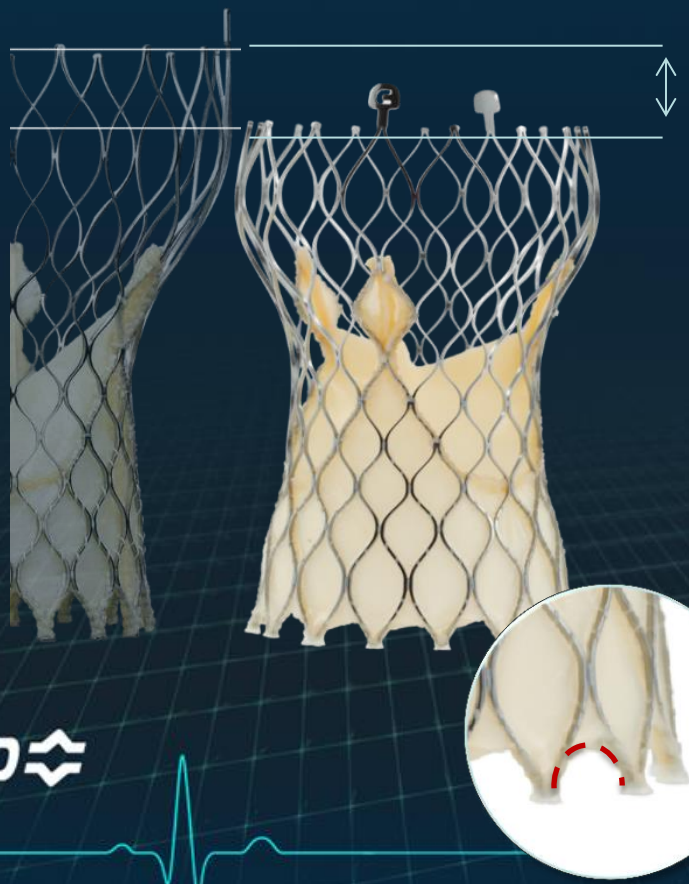
TAVR Odyssey - 2020

The TAVR Makes Progress…

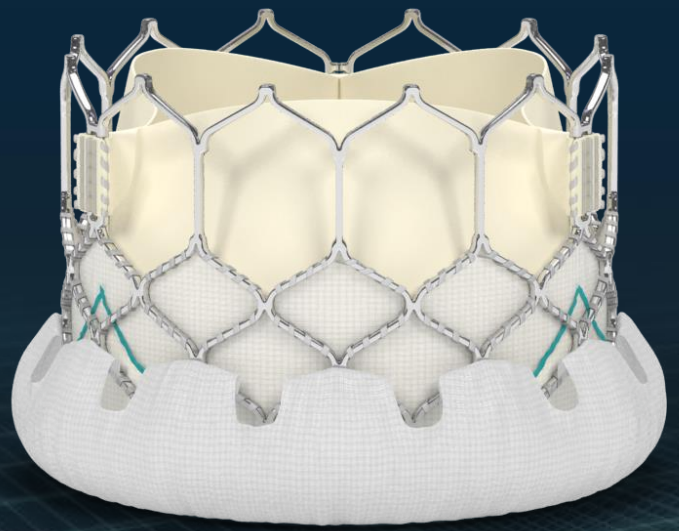
1. Rapid TAVR technology evolution
2. TAVR procedural refinements and simplification
3. Avalanche of TAVR clinical evidence
4. Heart valve team acceptance
5. Dramatic reduction in complications and improved outcomes

Current "Standards" for TAVR

MDT Evolut R (PRO)

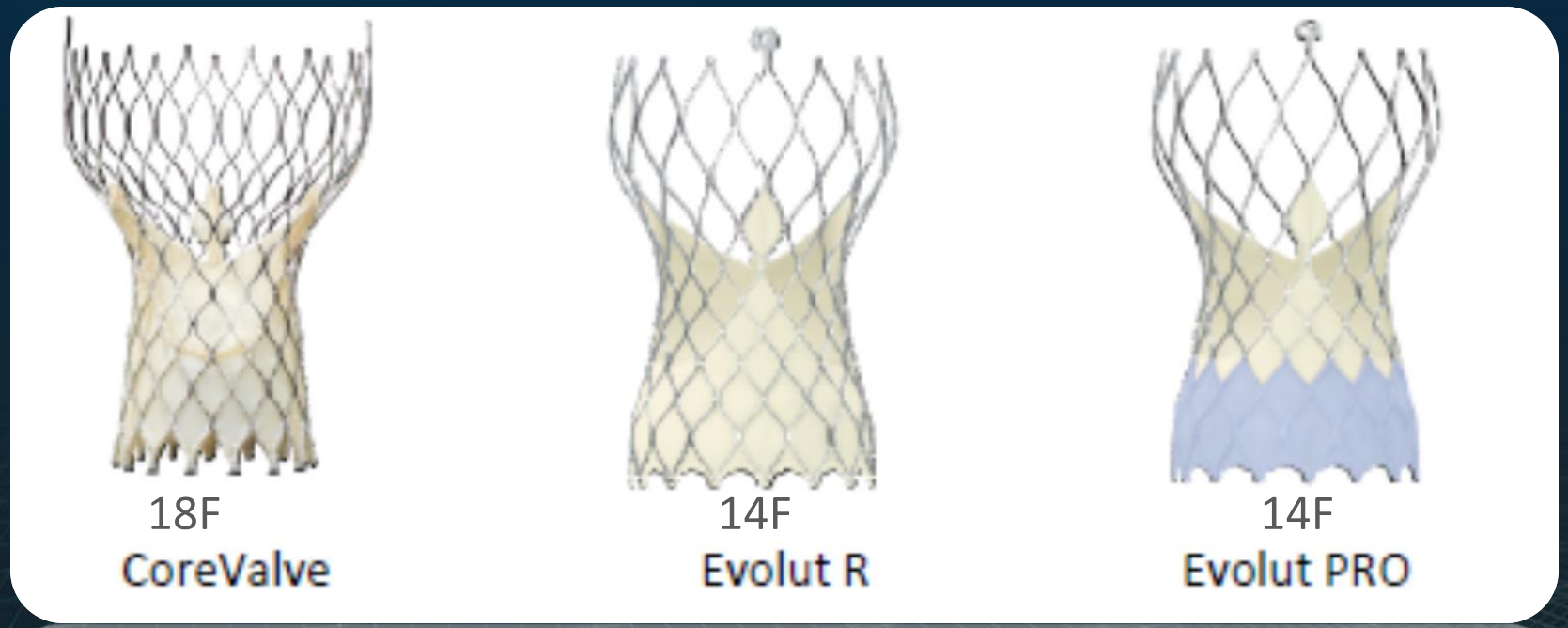


Edwards Sapien 3

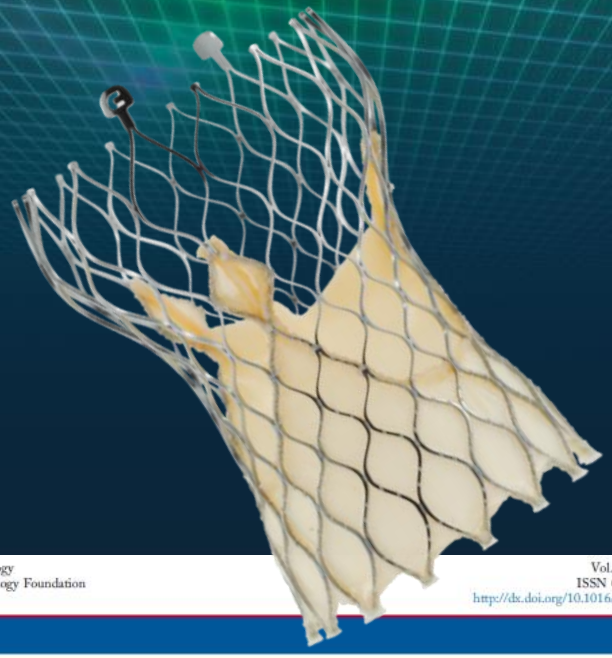


TAVR Odyssey - 2020

The Self-Expandable Pathway…



CoreValve / Evolut R/PRO Related Trial



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Transcatheter Aortic Valve Replacement Using a Self-Expanding Bioprosthesis in Patients With Severe Aortic Stenosis at Extreme Risk for Surgery

Jeffrey J. Popma, MD,* David H. Adams, MD,† Michael J. Reardon, MD,‡ Steven J. Yakubov, MD,§ Neal S. Kleiman, MD,‡ David Heimansohn, MD,‖ James Hermiller, Jr, MD,‖ G. Chad Hughes, MD,¶ J. Kevin Harrison, MD,¶ Joseph Coselli, MD,# Jose Diez, MD,# Ali Kafi, MD,** Theodore Schreiber, MD,** Thomas G. Gleason, MD,†† John Conte, MD,‡‡ Maurice Buchbinder, MD,§§ G. Michael Deeb, MD,‖‖ Blasé Carabello, MD,¶¶ Patrick W. Serruys, MD, PhD,## Sharla Chenoweth, MS,*** Jae K. Oh, MD,††† for the CoreValve United States Clinical Investigators

Boston, Massachusetts; New York, New York; Houston, Texas; Columbus, Ohio; Indianapolis, Indiana; Durham, North Carolina; Detroit and Ann Arbor, Michigan; Pittsburgh, Pennsylvania; Baltimore, Maryland; Palo Alto, California; Rotterdam, the Netherlands; and Minneapolis and Rochester, Minnesota

ORIGINAL ARTICLE

Transcatheter Aortic-Valve Replacement with a Self-Expanding Prosthesis

David H. Adams, M.D., Jeffrey J. Popma, M.D., Michael J. Reardon, M.D., Steven J. Yakubov, M.D., Joseph S. Coselli, M.D., G. Michael Deeb, M.D., Thomas G. Gleason, M.D., Maurice Buchbinder, M.D., James Hermiller, Jr., M.D., Neal S. Kleiman, M.D., Stan Chetcuti, M.D., John Heiser, M.D., William Merhi, D.O., George Zorn, M.D., Peter Tadros, M.D., Newell Robinson, M.D., George Petrossian, M.D., G. Chad Hughes, M.D., J. Kevin Harrison, M.D., John Conte, M.D., Brijeshwar Maini, M.D., Mubashir Mumtaz, M.D., Sharla Chenoweth, M.S., and Jae K. Oh, M.D., for the U.S. CoreValve Clinical Investigators*

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Surgical or Transcatheter Aortic-Valve Replacement in Intermediate-Risk Patients

M.J. Reardon, N.M. Van Mieghem, J.J. Popma, N.S. Kleiman, L. Søndergaard, M. Mumtaz, D.H. Adams, G.M. Deeb, B. Maini, H. Gada, S. Chetcuti, T. Gleason, J. Heiser, R. Lange, W. Merhi, J.K. Oh, P.S. Olsen, N. Piazza, M. Williams, S. Windecker, S.J. Yakubov, E. Grube, R. Makkar, J.S. Lee, J. Conte, E. Vang, H. Nguyen, Y. Chang, A.S. Mugglin, P.W.J.C. Serruys, and A.P. Kappetein, for the SURTAVI Investigators*

CoreValve US Extreme Risk Trial (Cohort - 2014)

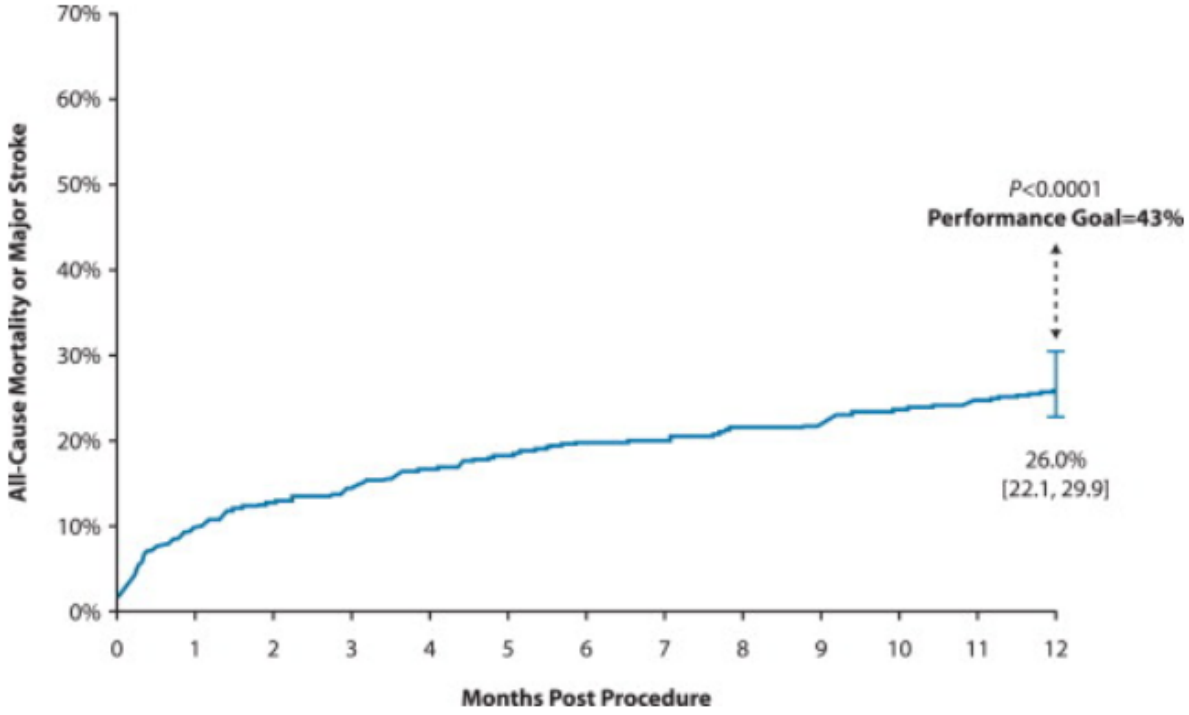


Figure 3

Cumulative Event Curve for All-Cause Mortality or Major Stroke

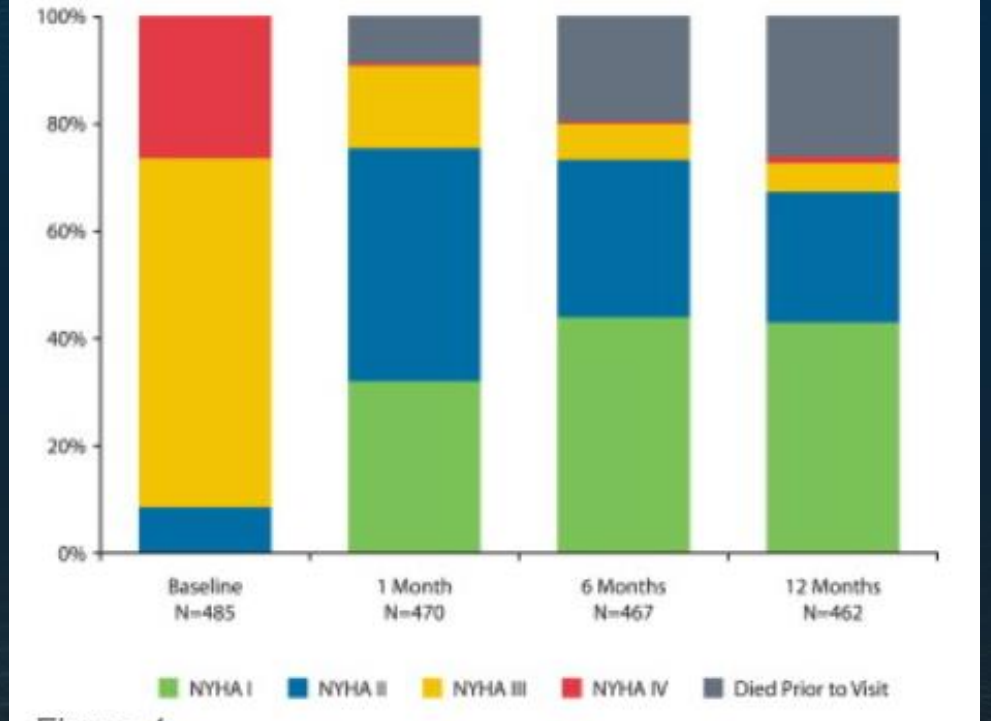
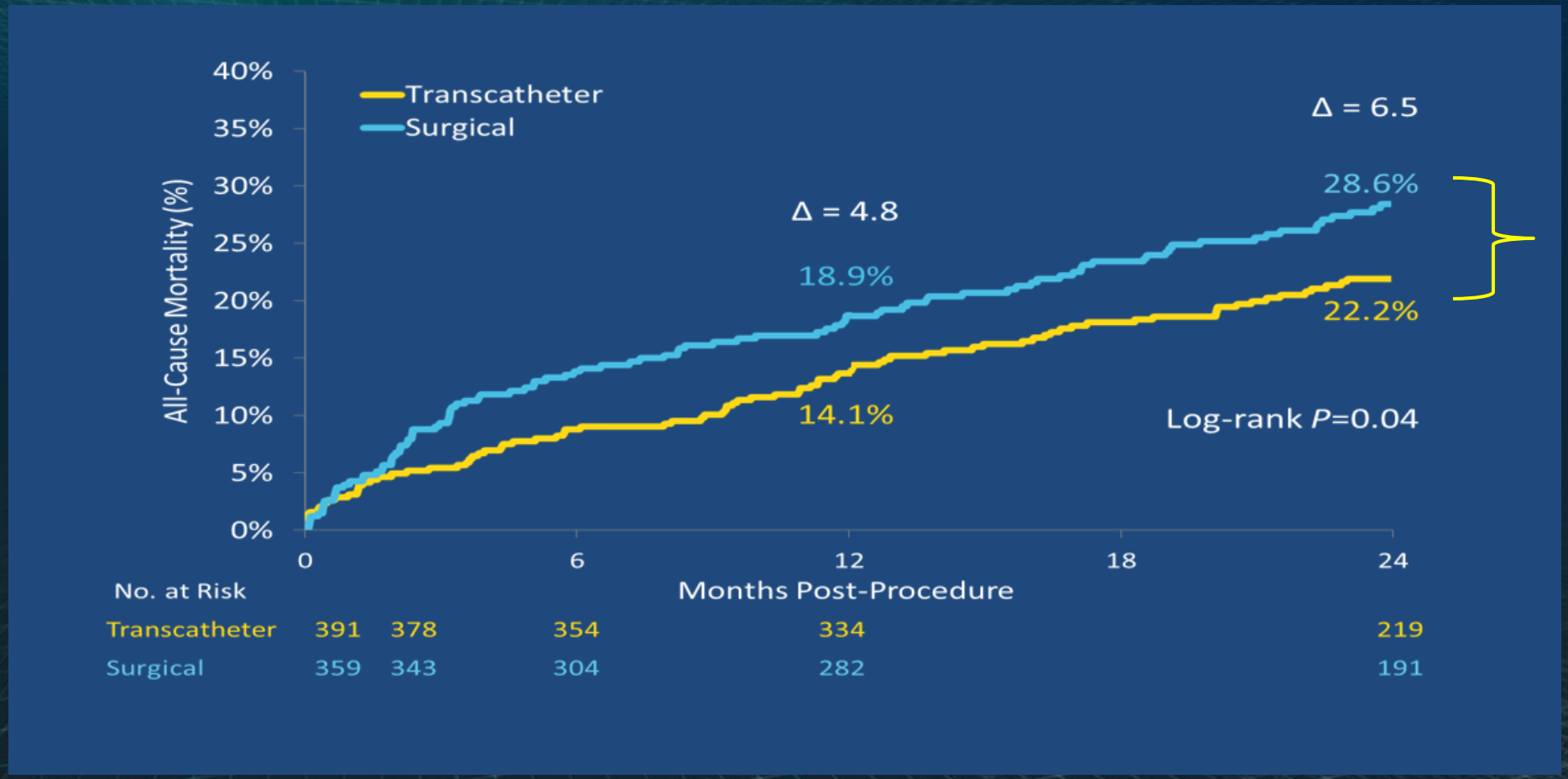


Figure 4

NYHA Classification Over Time

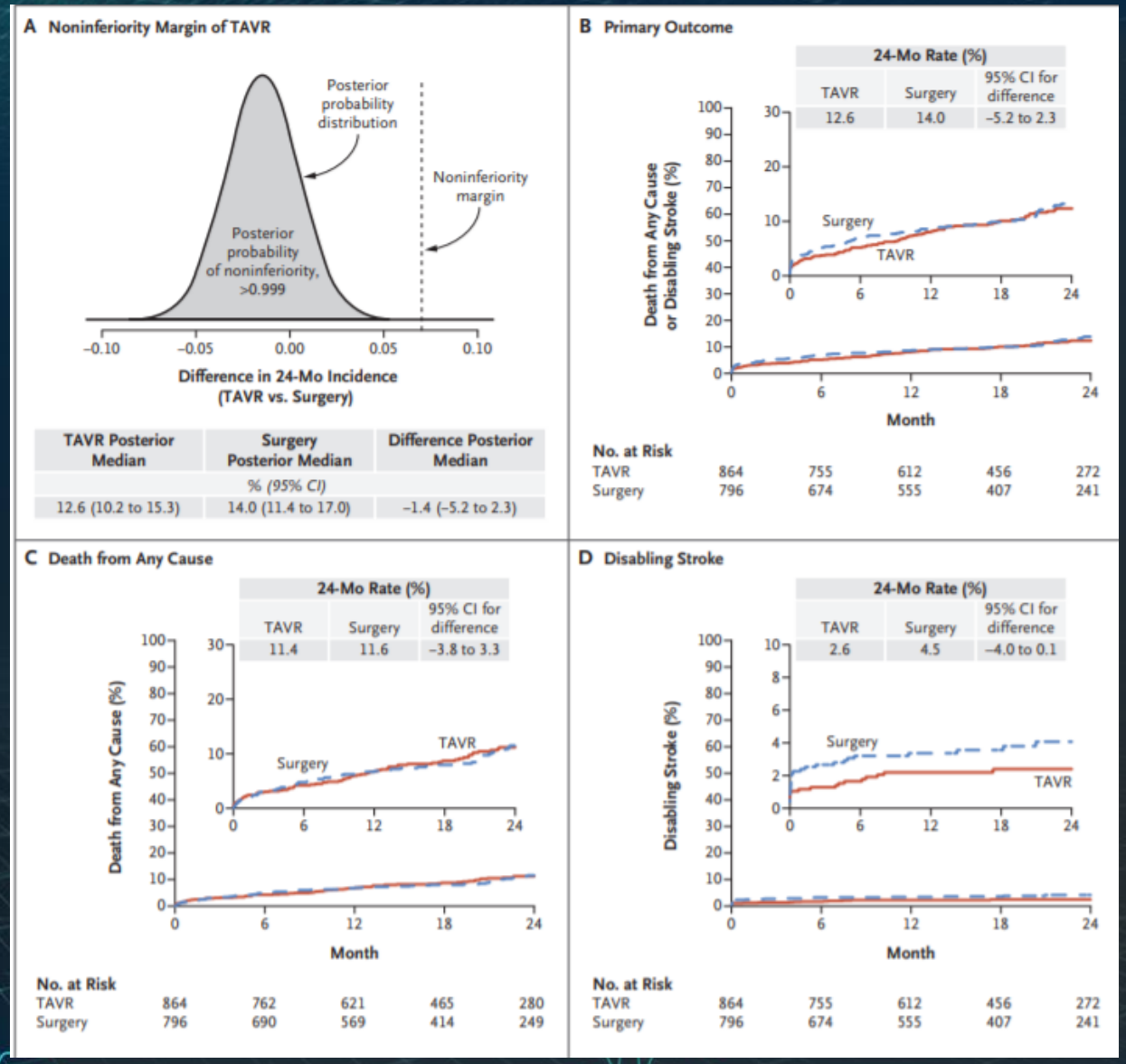
CoreValve US High Risk Trial (2014)



Prognostic advantage!

CoreValve SURTAVI Trial (2014)

- 1746 AS pts randomization.
- 1660 underwent TAVR or SAVR.
- Mean (±SD) age was 79.8±6.2 yrs.
- All were @intermediate risk (STS, 4.5±1.6%).
- The primary end point was a composite of death from any cause or disabling stroke at 24 months



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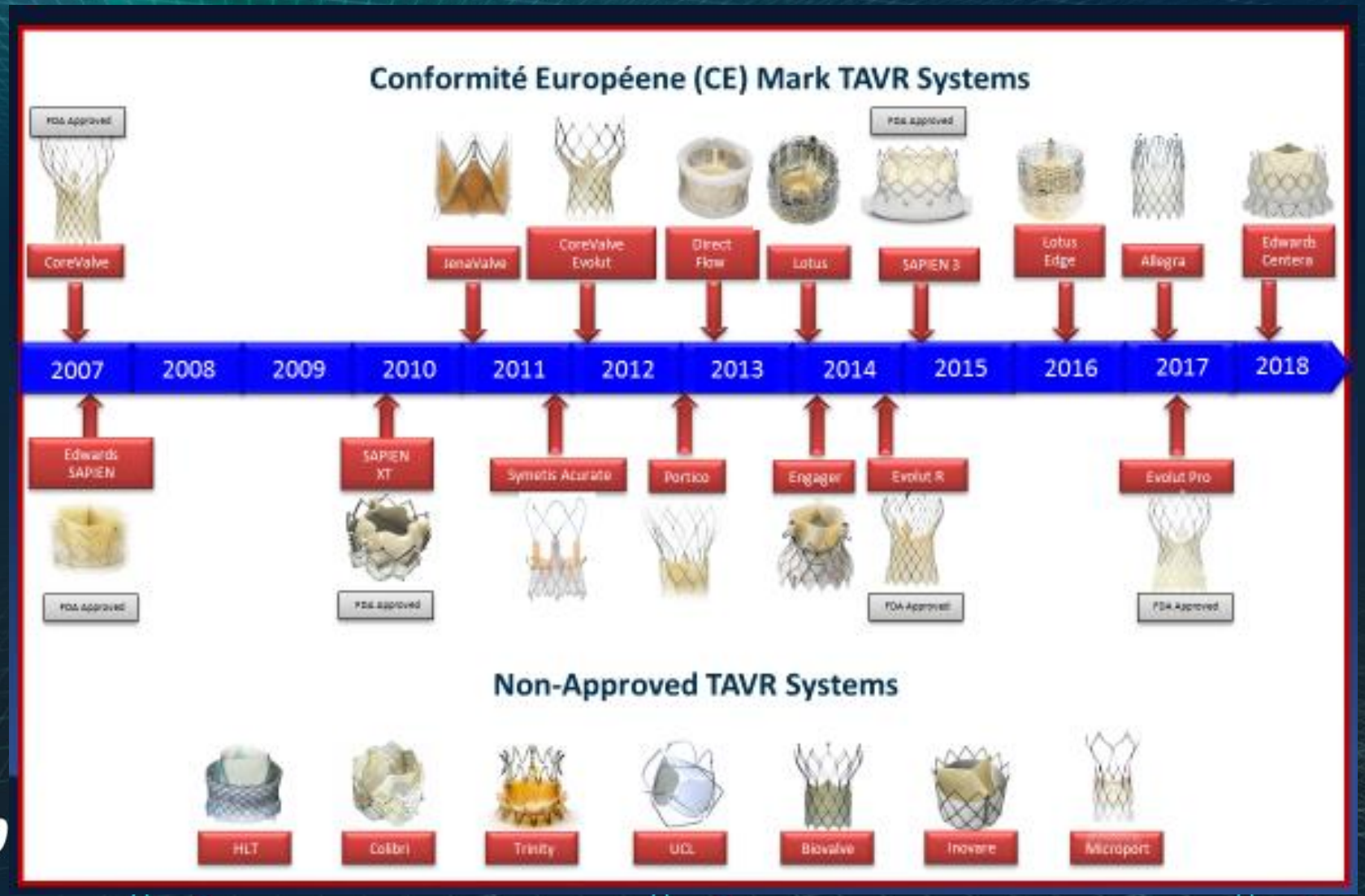
הכי טובה למשפחה

TAVR Technology Evolution



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הכי טובה למשפחה

מרכז רפואי רבין
בילינסון · השרון

TAVR Odyssey - 2020

Accessory Technologies

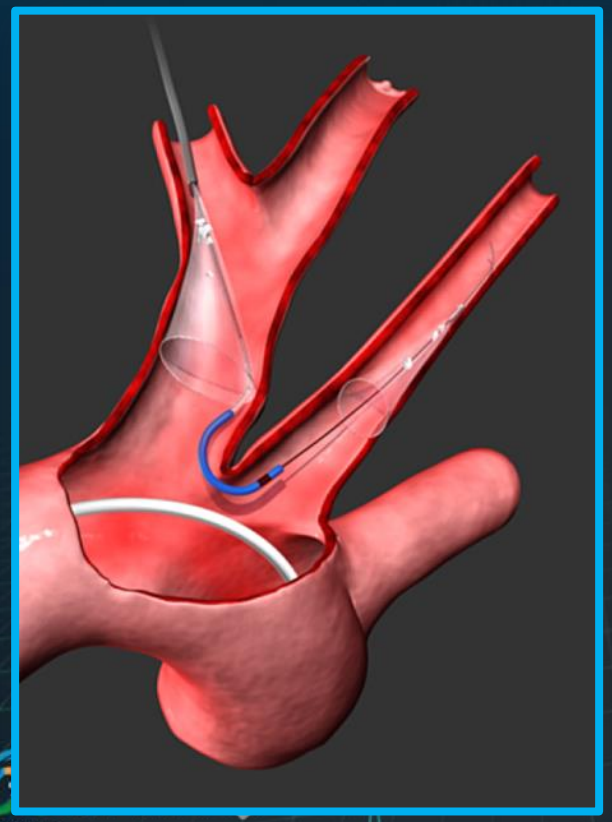
- Cerebral embolic protection devices
- Dedicated pre-shaped guidewires
- Expandable and in-line sheaths
- Large hole closure devices
- Dedicated pacemaker catheters
- Specialized balloons
- Aortic valve remodeling technologies
- Advanced imaging systems

TAVR Odyssey - 2020

Accessory Technologies

Sentinel

Cerebral embolic protection



MANTA

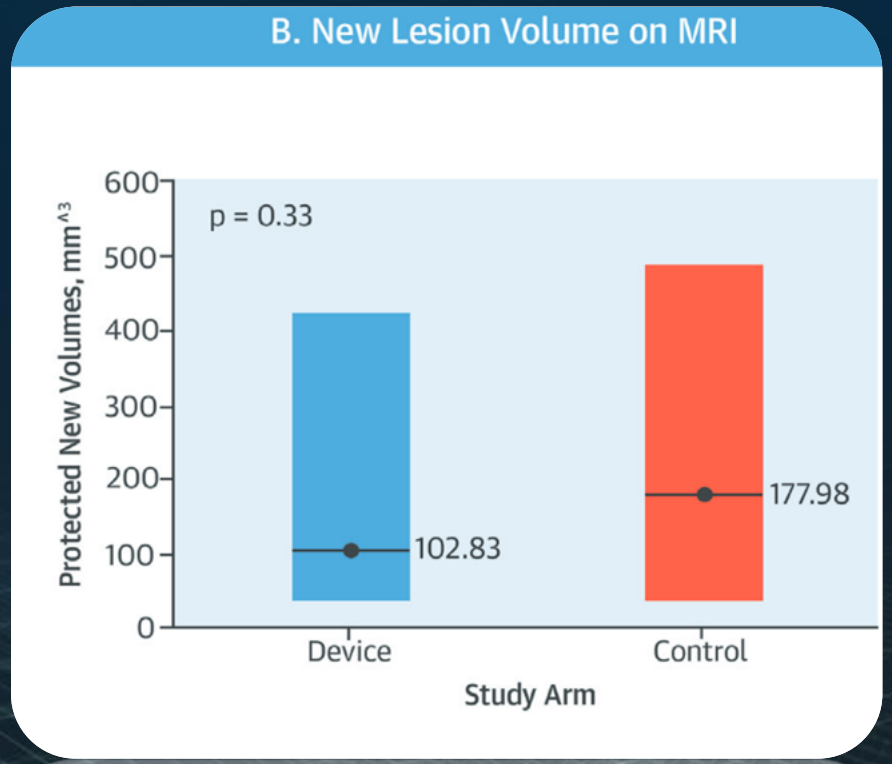
Collagen seal with footplate and footplate (14 and 18 Fr) losure

TAVR Odyssey - 2020

Sentinel Trial (Kapadia S. et al JACC 2017)

TABLE 2 Clinical Outcomes

30-Day Clinical Outcomes	Control Arm	Safety + Device Arm	p Value
Any MACCE*	9.9 (11/111)	7.3 (17/234)	0.40
Death (all cause)	1.8 (2/111)	1.3 (3/234)	0.65
Stroke	9.1 (10/110)	5.6 (13/231)	0.25
Disabling	0.9 (1/109)	0.9 (2/231)	1.00
Nondisabling	8.2 (9/110)	4.8 (11/231)	0.22
AKI (stage 3)	0.0	0.4 (1/231)	1.00
TIA	0.0	0.4 (1/231)	1.00
Major vascular complication	5.9 (7/119)	8.6 (21/244)	0.53
Radial/brachial	NA	0.4 (1/244)	
Femoral	5.9 (119)	8.2 (20/244)	



TAVR Procedural Refinements

The minimalist strategy

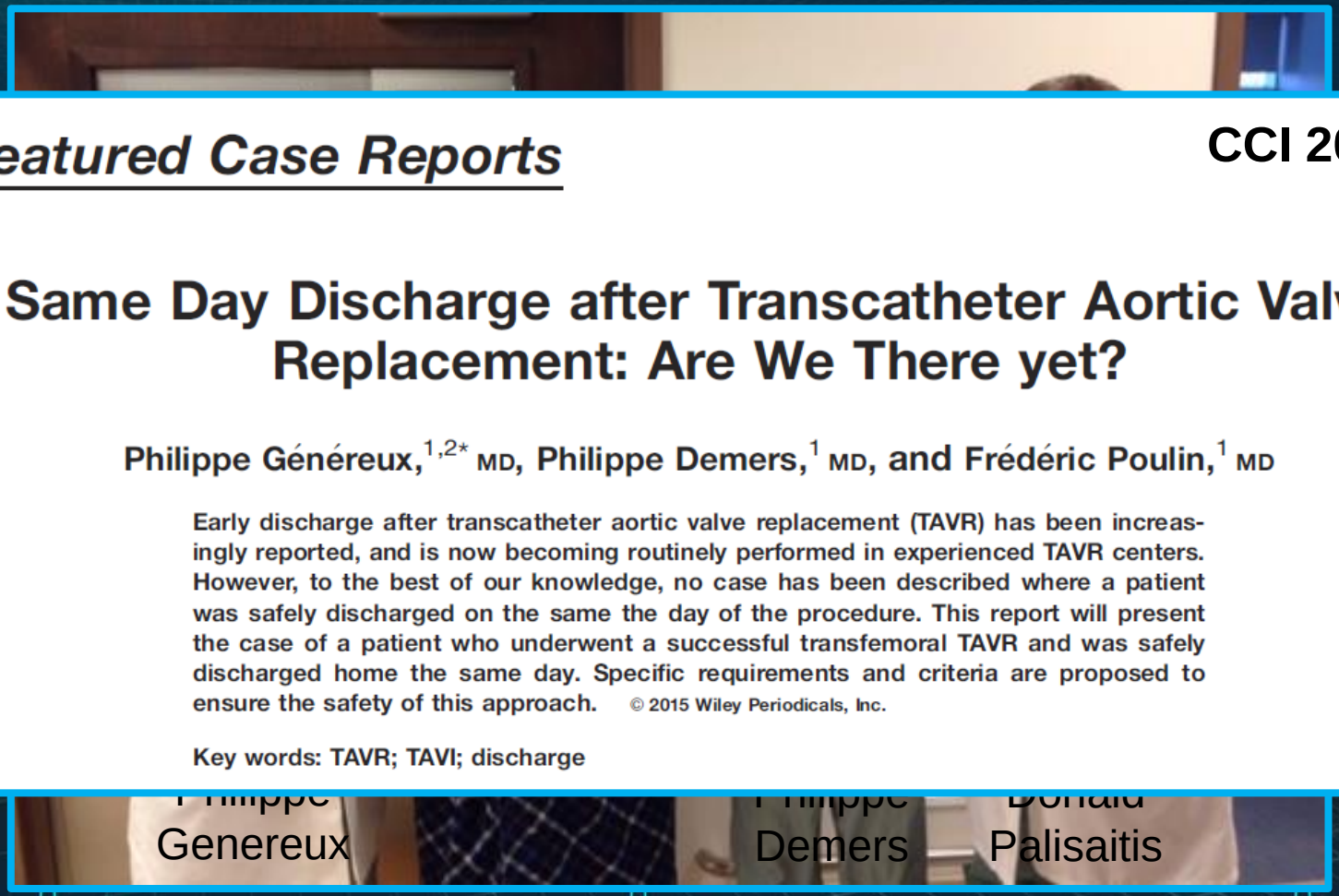
- N
-
-
-
-
-
-

Almost all TAVR cases worldwide are now candidates for some version of “minimalist” procedural strategy!

Median LOS after TAVR is 1-3 days at most medical centers!

“Outpatient” Same-Day TAVR

Sacre-Coeur Hospital; Montreal, CN



CCI 2016

Featured Case Reports

Same Day Discharge after Transcatheter Aortic Valve Replacement: Are We There yet?

Philippe Généreux,[1,2*] MD, Philippe Demers,[1] MD, and Frédéric Poulin,[1] MD

Early discharge after transcatheter aortic valve replacement (TAVR) has been increasingly reported, and is now becoming routinely performed in experienced TAVR centers. However, to the best of our knowledge, no case has been described where a patient was safely discharged on the same the day of the procedure. This report will present the case of a patient who underwent a successful transfemoral TAVR and was safely discharged home the same day. Specific requirements and criteria are proposed to ensure the safety of this approach.

Key words: TAVR; TAVI; discharge

Genereux

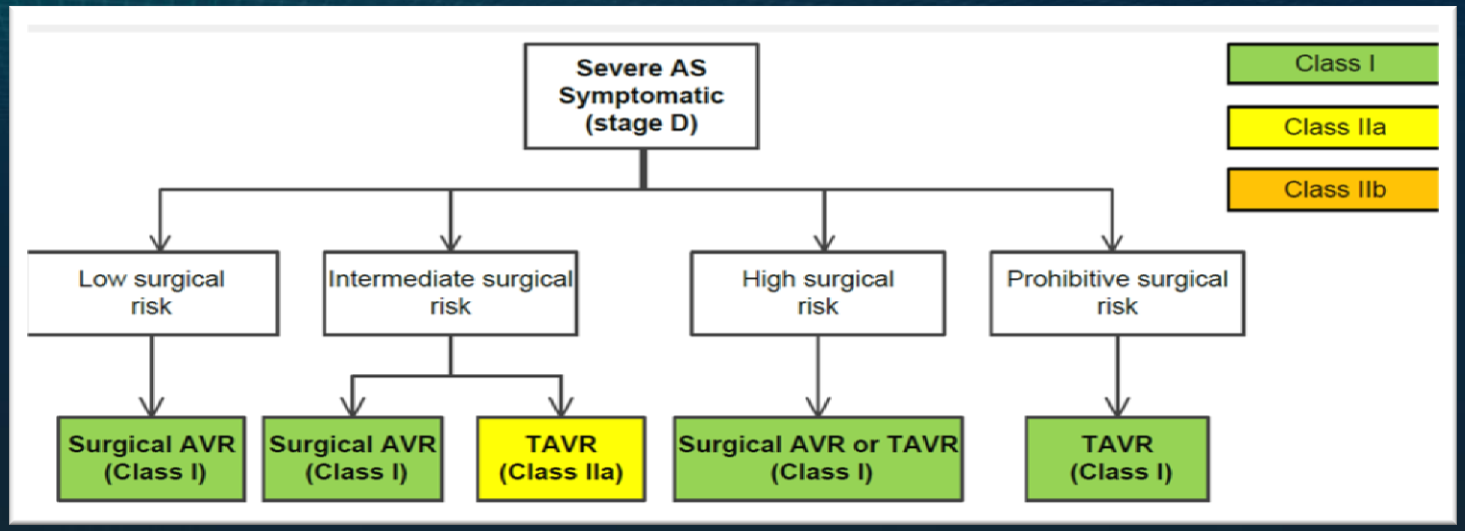
Demers

Palisaitis

Genereux P et al. Catheter Cardiovasc Interv 2016;87:980-2

The ACC/AHA and ESC/EACTS guidelines reflect the success of TAVR trials *in extreme / high / intermediate - risk* patients.

ACC/AHA 2017 Update



ESC/EACTS 2017 Update

The choice for intervention must be based on careful individual evaluation of technical suitability and weighing of risks and benefits of each modality (aspects to be considered are listed in *Table 7*). In addition, the local expertise and outcomes data for the given intervention must be taken into account.	I	C
SAVR is recommended in patients at low surgical risk (STS or EuroSCORE II < 4% or logistic EuroSCORE I < 10%[d] and no other risk factors not included in these scores, such as frailty, porcelain aorta, sequelae of chest radiation).[93]	I	B
TAVI is recommended in patients who are not suitable for SAVR as assessed by the Heart Team.[91,94]	I	B
In patients who are at increased surgical risk (STS or EuroSCORE II ≥ 4% or logistic EuroSCORE I ≥ 10%[d] or other risk factors not included in these scores such as frailty, porcelain aorta, sequelae of chest radiation), the decision between SAVR and TAVI should be made by the Heart Team according to the individual patient characteristics (see *Table 7*), with TAVI being favoured in elderly patients suitable for transfemoral access.[91,94–102]	I	B

Aspects to be considered by the Heart Team for the decision between SAVR and TAVR in patients at increased surgical risk

(2017 ESC/EACTS Guidelines for the management of valvular heart disease)

	Favours TAVI	Favours SAVR
Clinical characteristics		
STS/EuroSCORE II <4% (logistic EuroSCORE I <10%)[a]		+
STS/EuroSCORE II ≥4% (logistic EuroSCORE I ≥10%)[a]	+	
Presence of severe comorbidity (not adequately reflected by scores)	+	
Age <75 years		+
Age ≥75 years	+	
Previous cardiac surgery	+	
Frailty[b]	+	
Restricted mobility and conditions that may affect the rehabilitation process after the procedure	+	
Suspicion of endocarditis		+
Anatomical and technical aspects		
Favourable access for transfemoral TAVI	+	
Unfavourable access (any) for TAVI		+
Sequelae of chest radiation	+	
Porcelain aorta	+	
Presence of intact coronary bypass grafts at risk when sternotomy is performed	+	
Expected patient–prosthesis mismatch	+	
Severe chest deformation or scoliosis	+	
Short distance between coronary ostia and aortic valve annulus		+
Size of aortic valve annulus out of range for TAVI		+
Aortic root morphology unfavourable for TAVI		+
Valve morphology (bicuspid, degree of calcification, calcification pattern) unfavourable for TAVI		+
Presence of thrombi in aorta or LV		+
Cardiac conditions in addition to aortic stenosis that require consideration for concomitant intervention		
Severe CAD requiring revascularization by CABG		+
Severe primary mitral valve disease, which could be treated surgically		+
Severe tricuspid valve disease		+
Aneurysm of the ascending aorta		+
Septal hypertrophy requiring myectomy		+

The HEART TEAM

Who's Missing?

- Valve Cardiologist
- Transcatheter Surgeon
- Structural Interventionalist
- Imaging Expert
- CV Anesthesiologist
- Heart Failure Specialist
- MD Consultants
- Dedicated Coordinator

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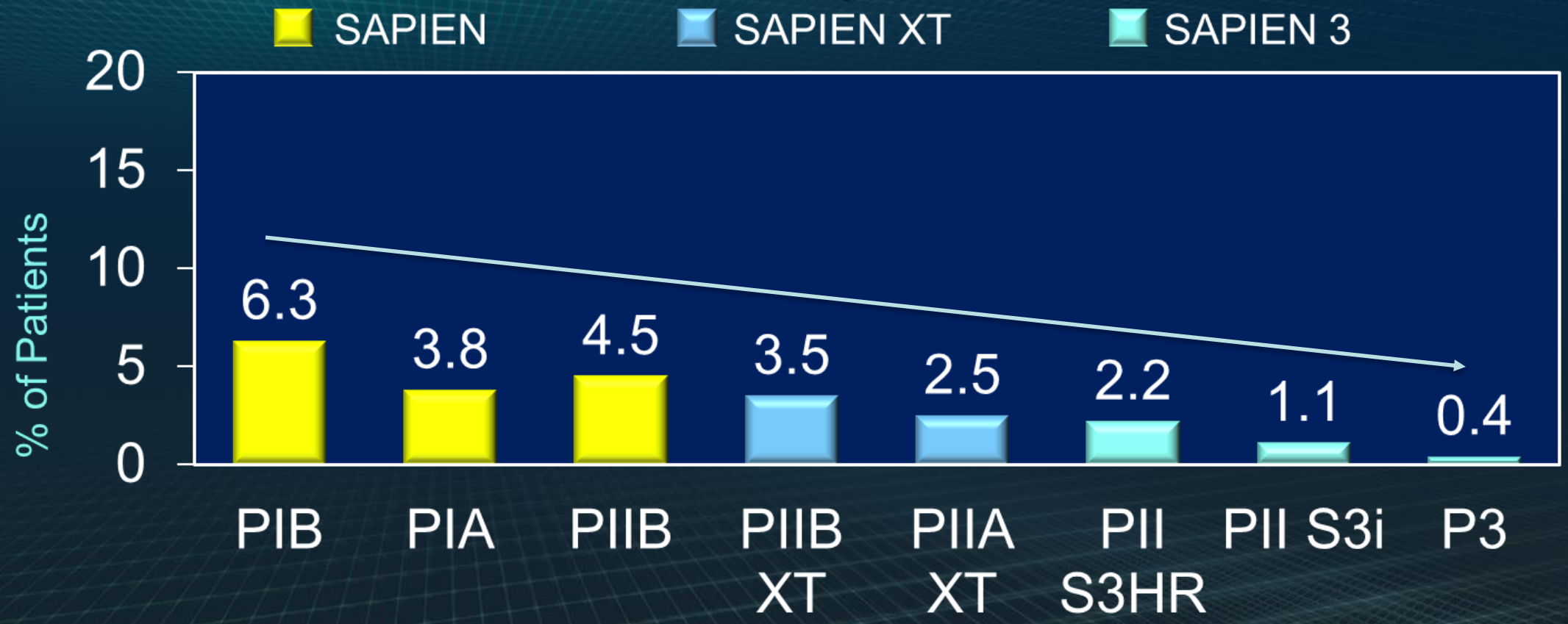
Improved TAVR Clinical Outcomes

TAVR 30-day Mortality



The Importance of Low-Risk Patients

STS Database (141,905 pts)

Contemporary Real-World Outcomes of Surgical Aortic Valve Replacement in 141,905 Low-Risk, Intermediate-Risk, and High-Risk Patients

Vinod H. Thourani, MD, Rakesh M. Suri, MD, DPhil, Rebecca L. Gunter, MD, Shubin Sheng, PhD, Sean M. O'Brien, PhD, Gorav Ailawadi, MD, Wilson Y. Szeto, MD, Todd M. Dewey, MD, Robert A. Guyton, MD, Joseph E. Bavaria, MD, Vasilis Babaliaros, MD, James S. Gammie, MD, Lars Svensson, MD, PhD, Mathew Williams, MD, Vinay Badhwar, MD, and Michael J. Mack, MD

Ann Thorac Surg 2015;99:55-61

The 'holy grail' is the 80% of aortic stenosis patients receiving surgery who are in the low-risk category!

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TAVR Low-Risk RCTs

PARTNER 3 Trial

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Transcatheter Aortic-Valve Replacement with a Balloon-Expandable Valve in Low-Risk Patients

M.J. Mack, M.B. Leon, V.H. Thourani, R. Makkar, S.K. Kodali, M. Russo, S.R. Kapadia, S.C. Malaisrie, D.J. Cohen, P. Pibarot, J. Leipsic, R.T. Hahn, P. Blanke, M.R. Williams, J.M. McCabe, D.L. Brown, V. Babaliaros, S. Goldman, W.Y. Szeto, P. Genereux, A. Pershad, S.J. Pocock, M.C. Alu, J.G. Webb, and C.R. Smith, for the PARTNER 3 Investigators*

EVOLUT Low Risk Trial

The NEW ENGLAND JOURNAL of MEDICINE

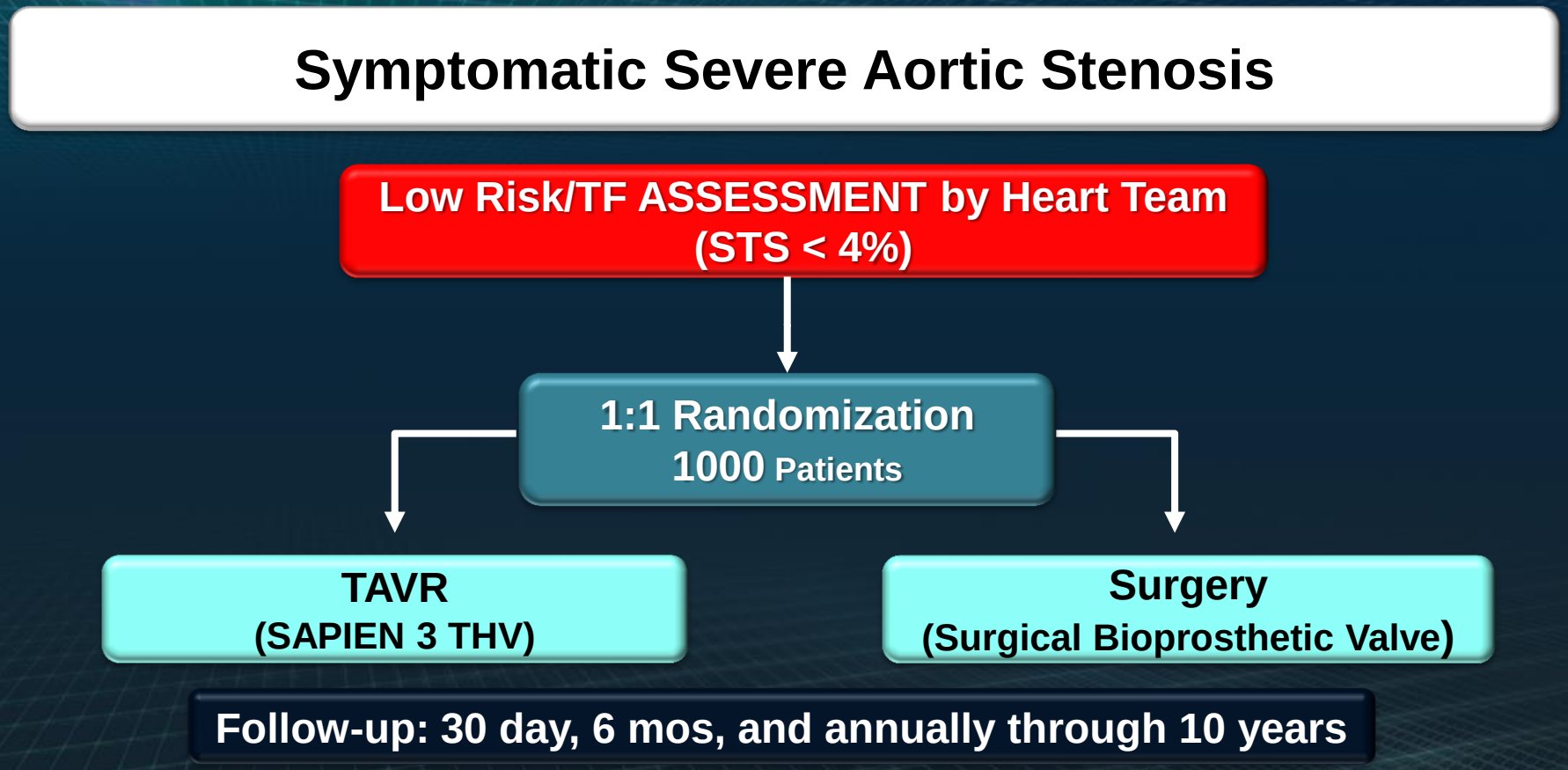
ORIGINAL ARTICLE

Transcatheter Aortic-Valve Replacement with a Self-Expanding Valve in Low-Risk Patients

Jeffrey J. Popma, M.D., G. Michael Deeb, M.D., Steven J. Yakubov, M.D., Mubashir Mum, Tamir Bajwa, M.D., John C. Heiser, Judah Askew, M.D., Paul S. tcuti, M.D., David H. Zorn III, M.D., John K. Forrest ttony Walton, M.D., Nicolo Piaz Robinson, M.D., George F K. Oh, M.D., Michael J. B. Mugglin, Ph.D., and Micha l Investigators*

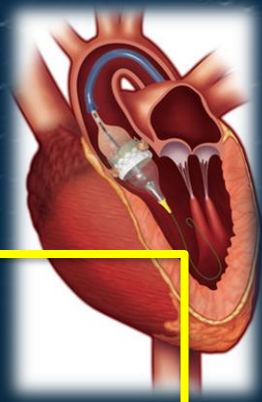
N Engl J Med, May 2019

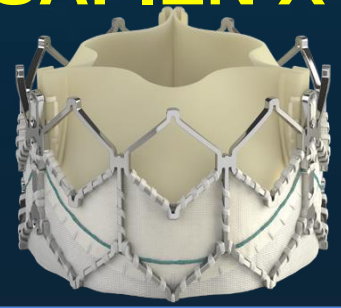
PARTNER 3 Study Design



PRIMARY ENDPOINT:
Composite of all-cause mortality, stroke, or CV re-hospitalization at 1 year post-procedure

PARTNER SAPIEN Platforms
Device Evolution



	SAPIEN	SAPIEN XT	SAPIEN 3
Valve Technology			
Sheath Compatibility	22-24F	16-20F	14-16F
Available Valve Sizes	23 mm, 26 mm	23 mm, 26 mm, 29 mm*	20 mm, 23 mm, 26 mm, 29 mm

*First Implant Oct 30, 2012

Baseline Patient Characteristics

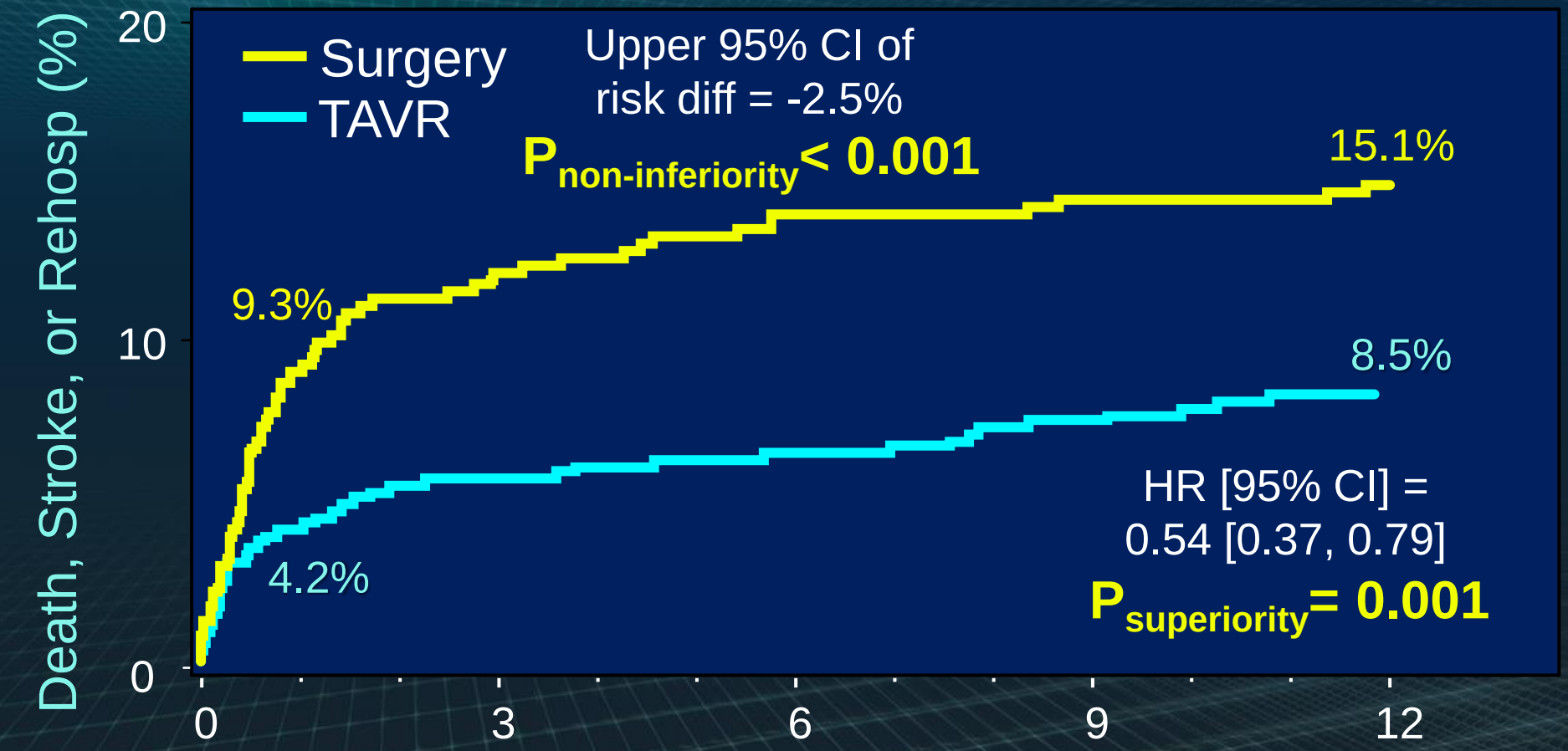
Demographics and Co-Morbidities

% or mean ± SD

Demographics & Vascular Disease	TAVR (N=496)	Surgery (N=454)	Other Co-Morbidities	TAVR (N=496)	Surgery (N=454)
Age (years)	73.3 ± 5.8	73.6 ± 6.1	Diabetes	31.3%	30.2%
Male	67.5%	71.1%	COPD (any)	5.1%	6.2%
BMI – kg/m^2	30.7 ± 5.5	30.3 ± 5.1	Pulmonary Hypertension	4.6%	5.3%
STS Score	1.9 ± 0.7	1.9 ± 0.6	Creatinine > 2mg/dL	0.2%	0.2%
NYHA Class III or IV*	31.3%	23.8%	Frailty (overall; > 2/4+)	0	0
Coronary Disease	27.7%	28.0%	Atrial Fibrillation (h/o)	15.7%	18.8%
Prior CABG	3.0%	1.8%	Permanent Pacemaker	2.4%	2.9%
Prior CVA	3.4%	5.1%	Left Bundle Branch Block	3.0%	3.3%
Peripheral Vascular Disease	6.9%	7.3%	Right Bundle Branch Block	10.3%	13.7%

*p = 0.01

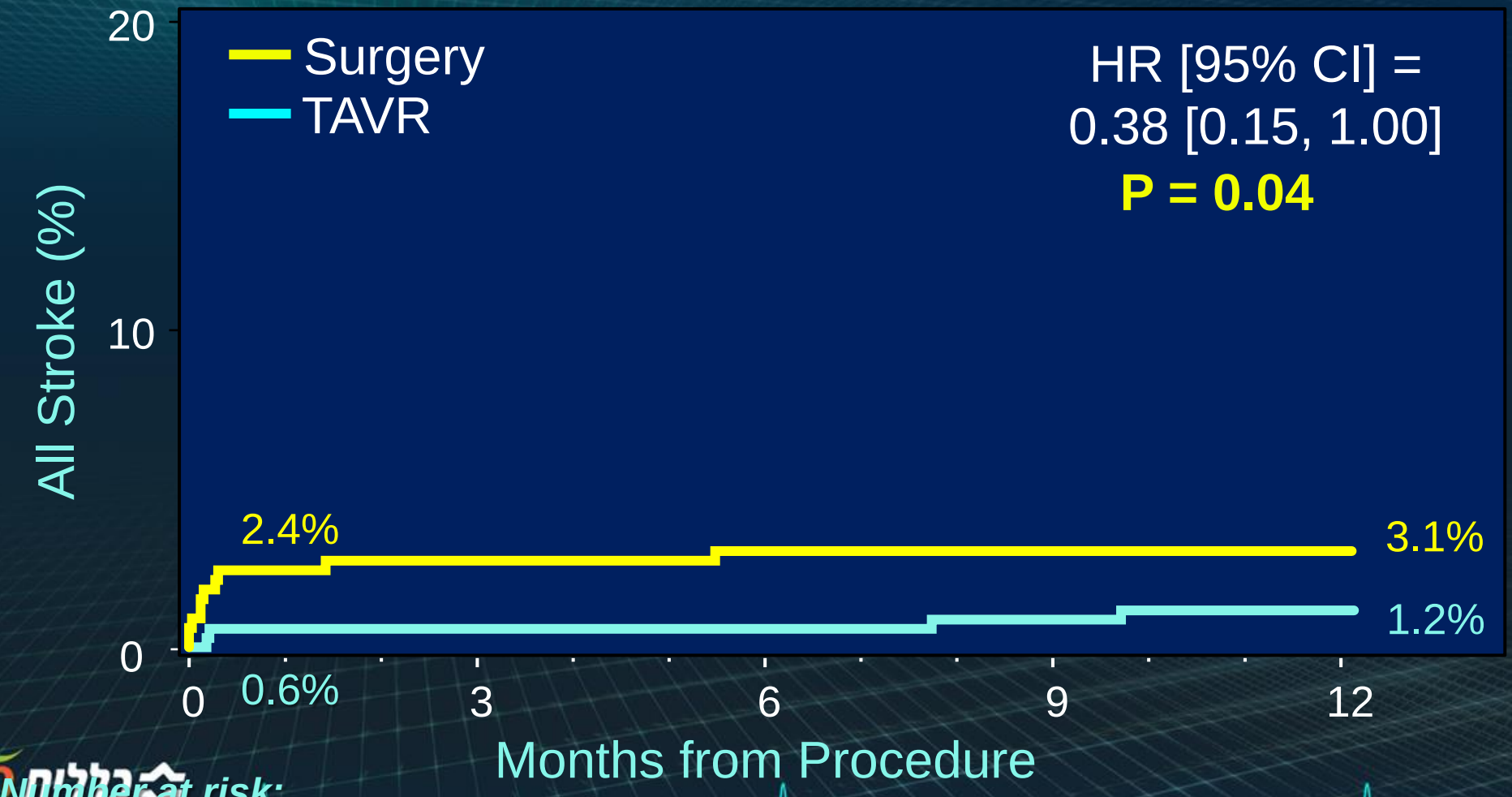
Primary Endpoint



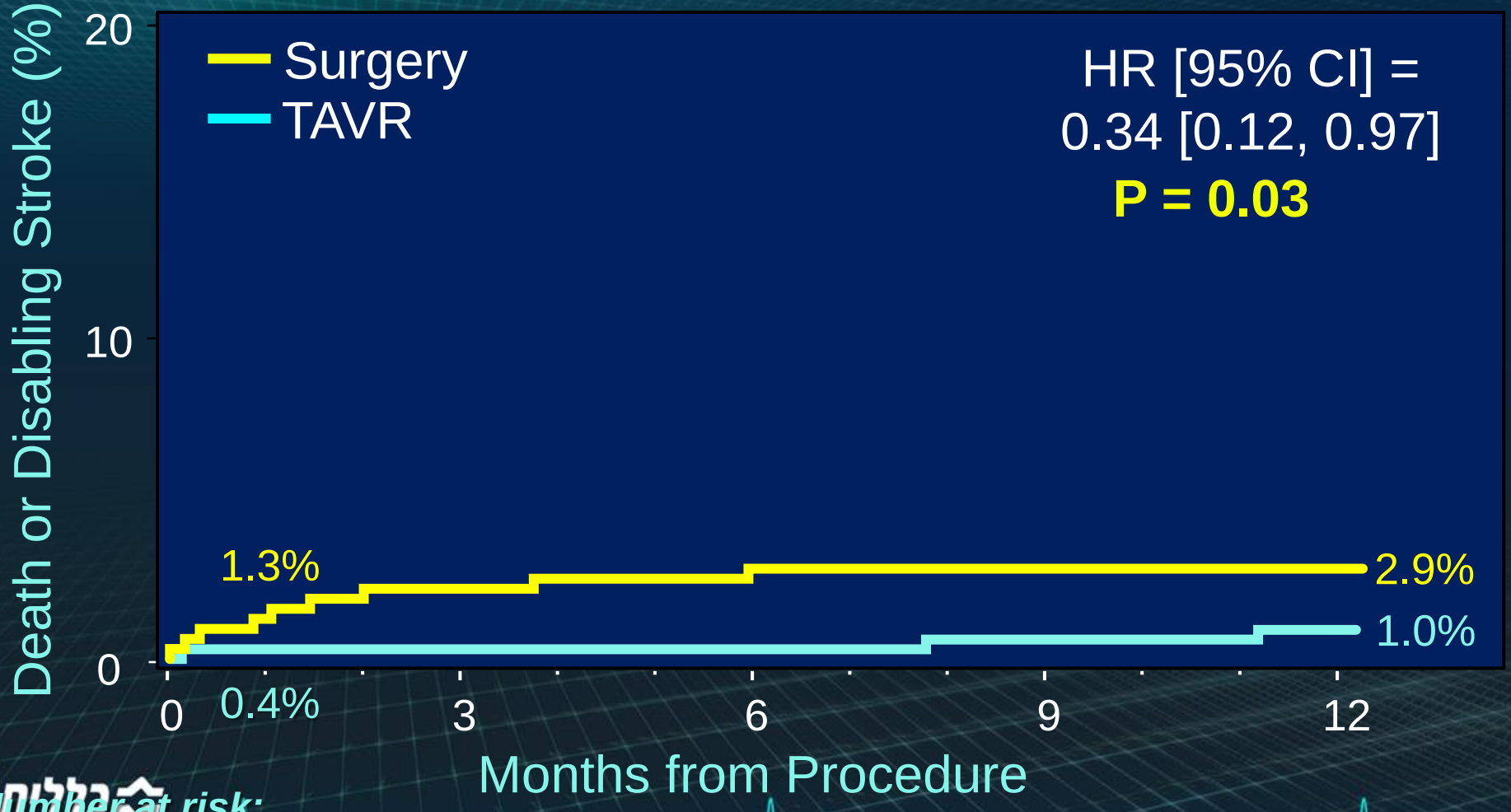
Number at risk:

Surgery	**454**	**408**	**390**	**381**	**377**	**374**
TAVR	**496**	**475**	**467**	**462**	**456**	**451**

All Stroke


Surgery
TAVR
HR [95% CI] =
0.38 [0.15, 1.00]
P = 0.04
All Stroke (%)
20
10
0
2.4%
3.1%
1.2%
0.6%
0
3
6
9
12
Months from Procedure
Number at risk:
Surgery 454 435 427 423 421 417
TAVR 496 491 491 489 487 484

Death or Disabling Stroke



The Low-Risk Patient TAVR Journey

Clinical Care Pathway

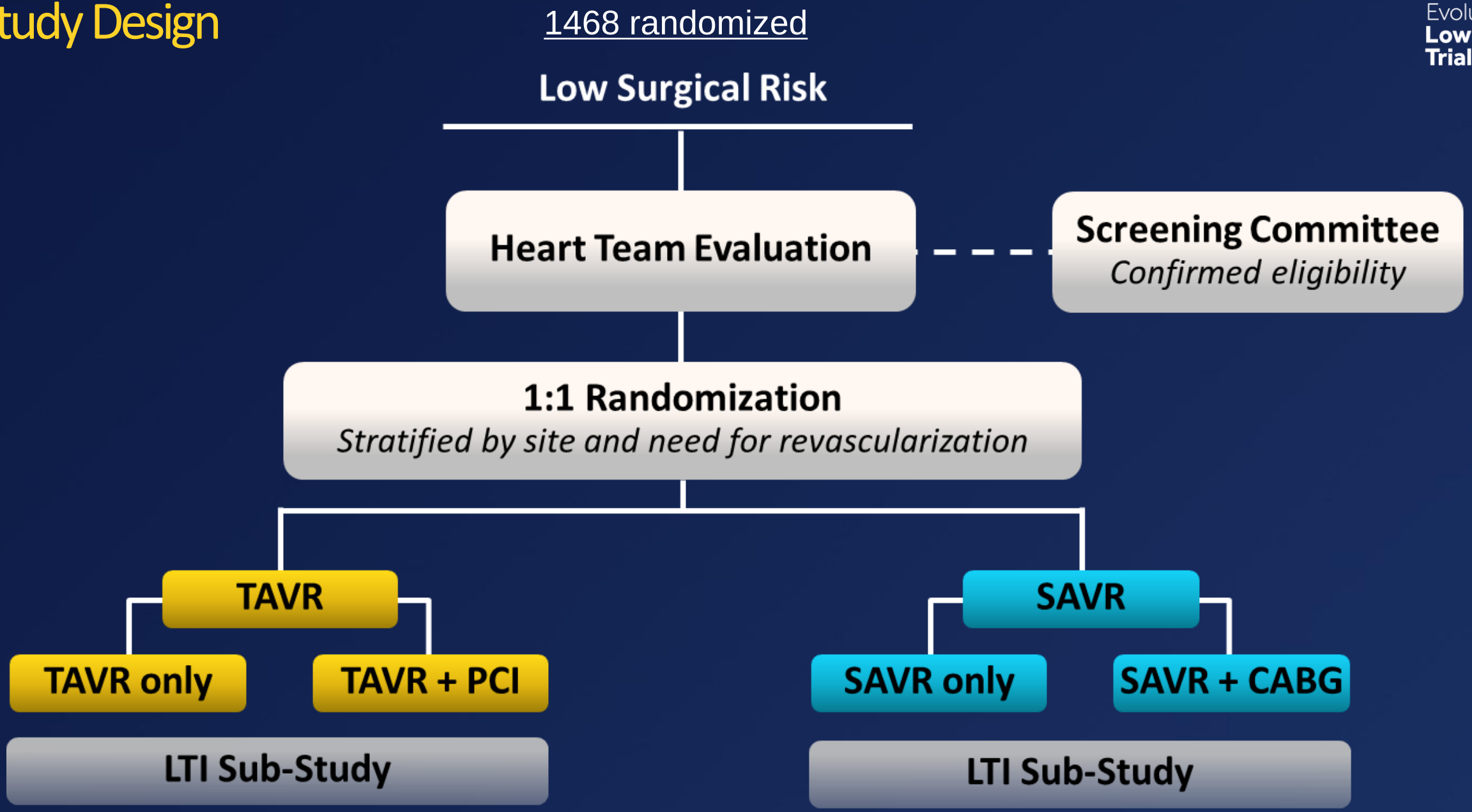
- Same-day admission
- 3/4 pts no general anesthesia (sedated, awake)
- Femoral artery puncture
- No chest wall incision or CPB
- < 1 hour procedure
- 3/4 pts no ICU – Tx to floor
- Discharge @1-2 days; 96% pts to home or self-care

Clinical Outcomes

- Rare procedural complications
- @ 30 days: mortality 0.4% and zero serious strokes!
- Less pain, bleeding, AKI and post-procedure arrhythmias
- Improved early recovery – QoL and increased activities
- @ 1 year: mortality 1% and serious strokes 0.2%

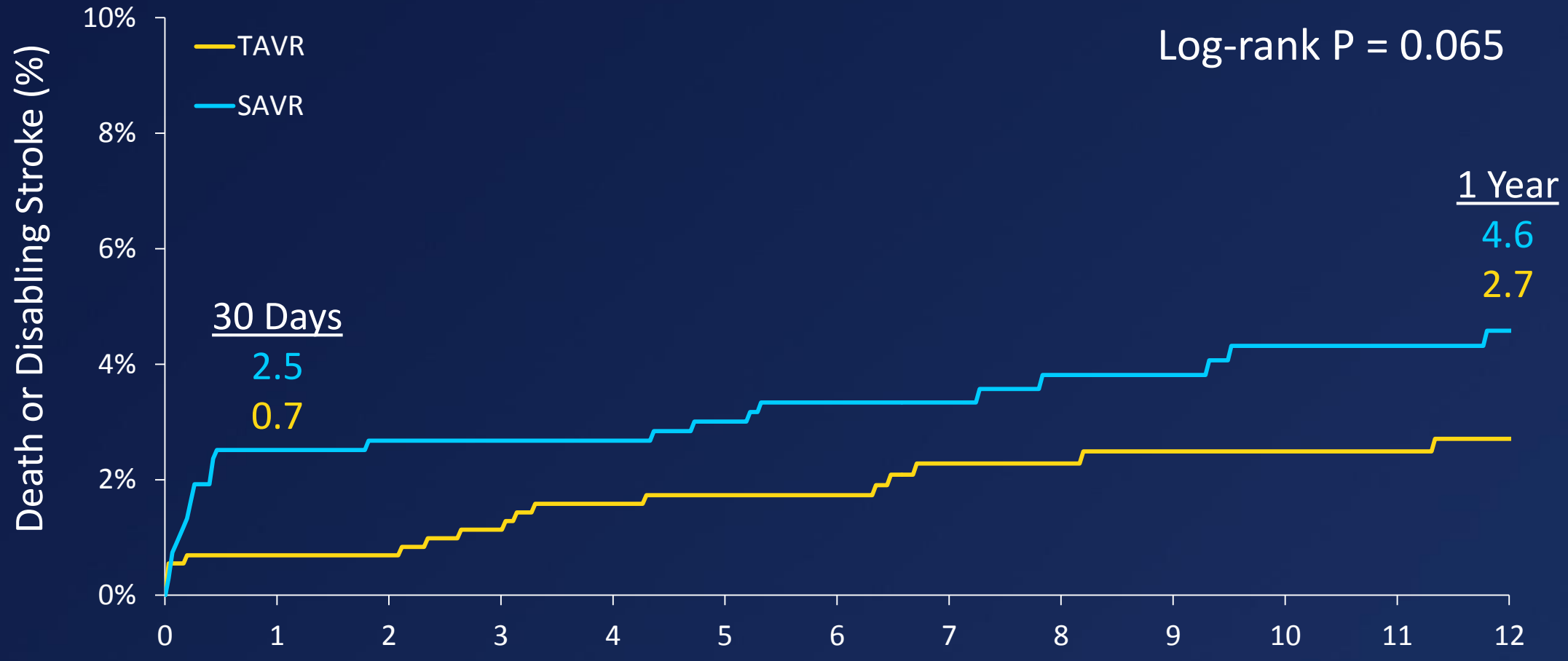
Study Design

Evolut™ Low Risk Trial



K-M All-Cause Mortality or Disabling Stroke at 1 Year

Evolut™ Low Risk Trial

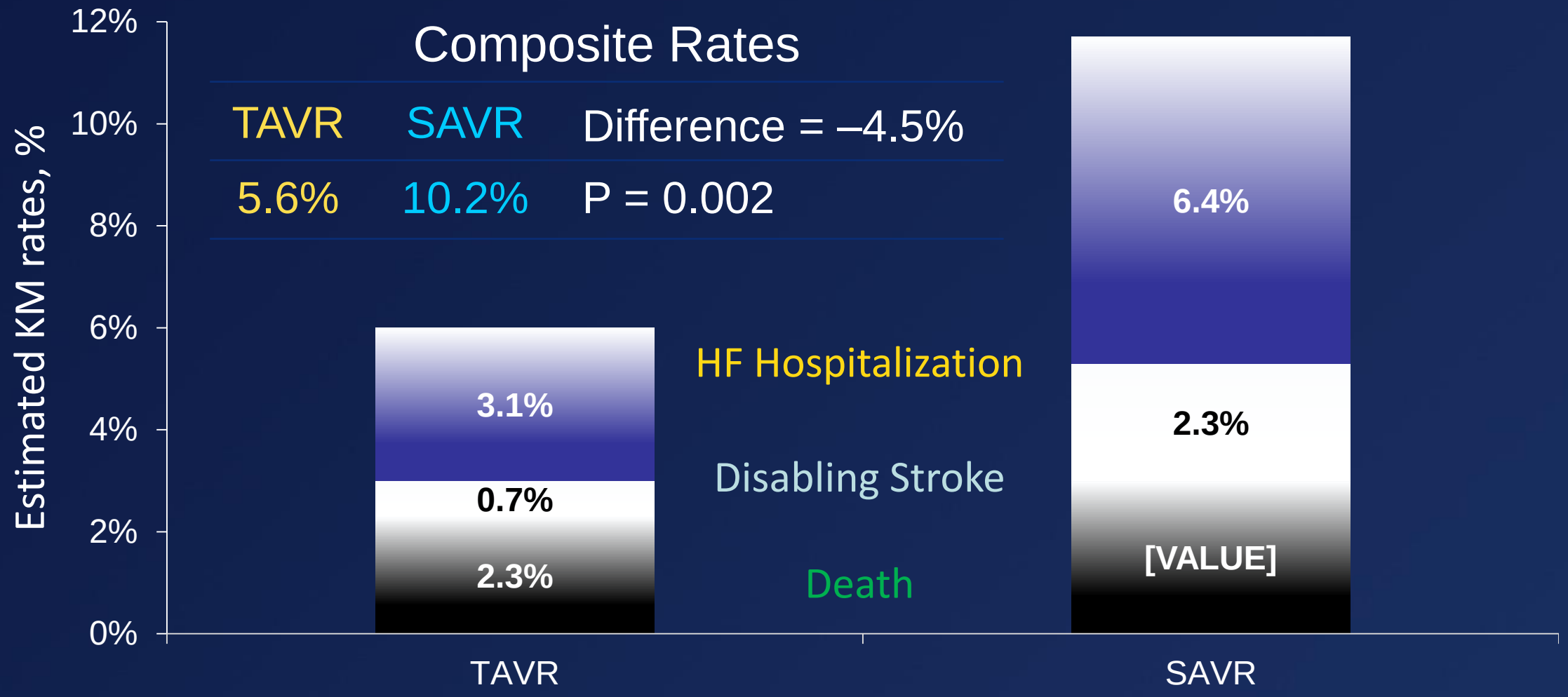


No. at risk					
TAVR	725	718	648		435
SAVR	678	656	576		366

Clinical Implications

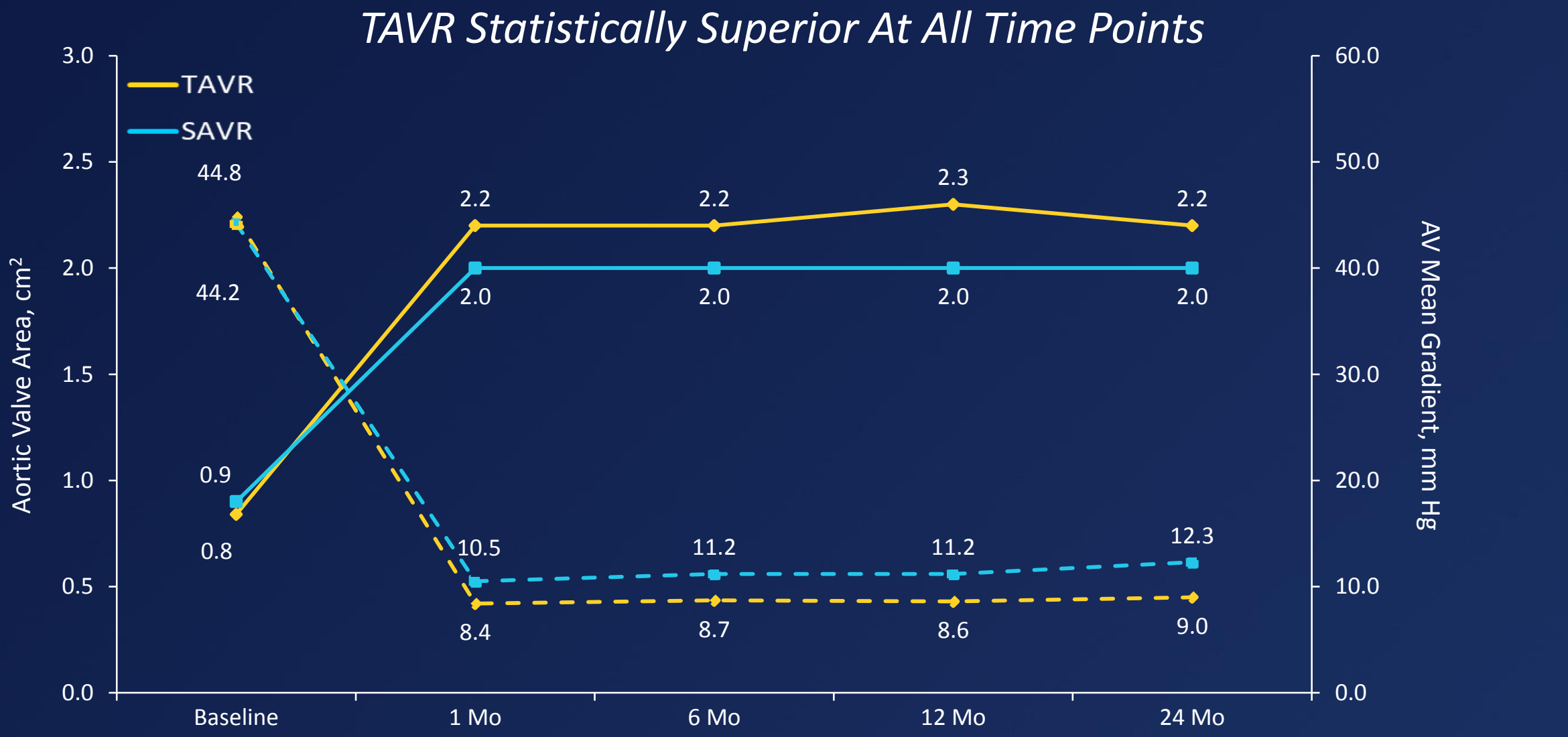
Death, Disabling Stroke and Heart Failure Hospitalizations to 1 Year

Evolut™ Low Risk Trial



Valve Hemodynamics

Evolut™ Low Risk Trial



Implanted population. Core lab assessments.

The Low-Risk TAVR Trials

An AS Treatment Paradigm Shift

"This is an historic moment, and all of us here should remember it as such."

Eugene Braunwald, ACC 2019

Updated Meta-analysis of 7 TAVR vs. Surgery RCTs

ESC European Society of Cardiology

European Heart Journal (2019) **0**, 1–11
doi:10.1093/eurheartj/ehz275

FASTTRACK CLINICAL RESEARCH
TAVI

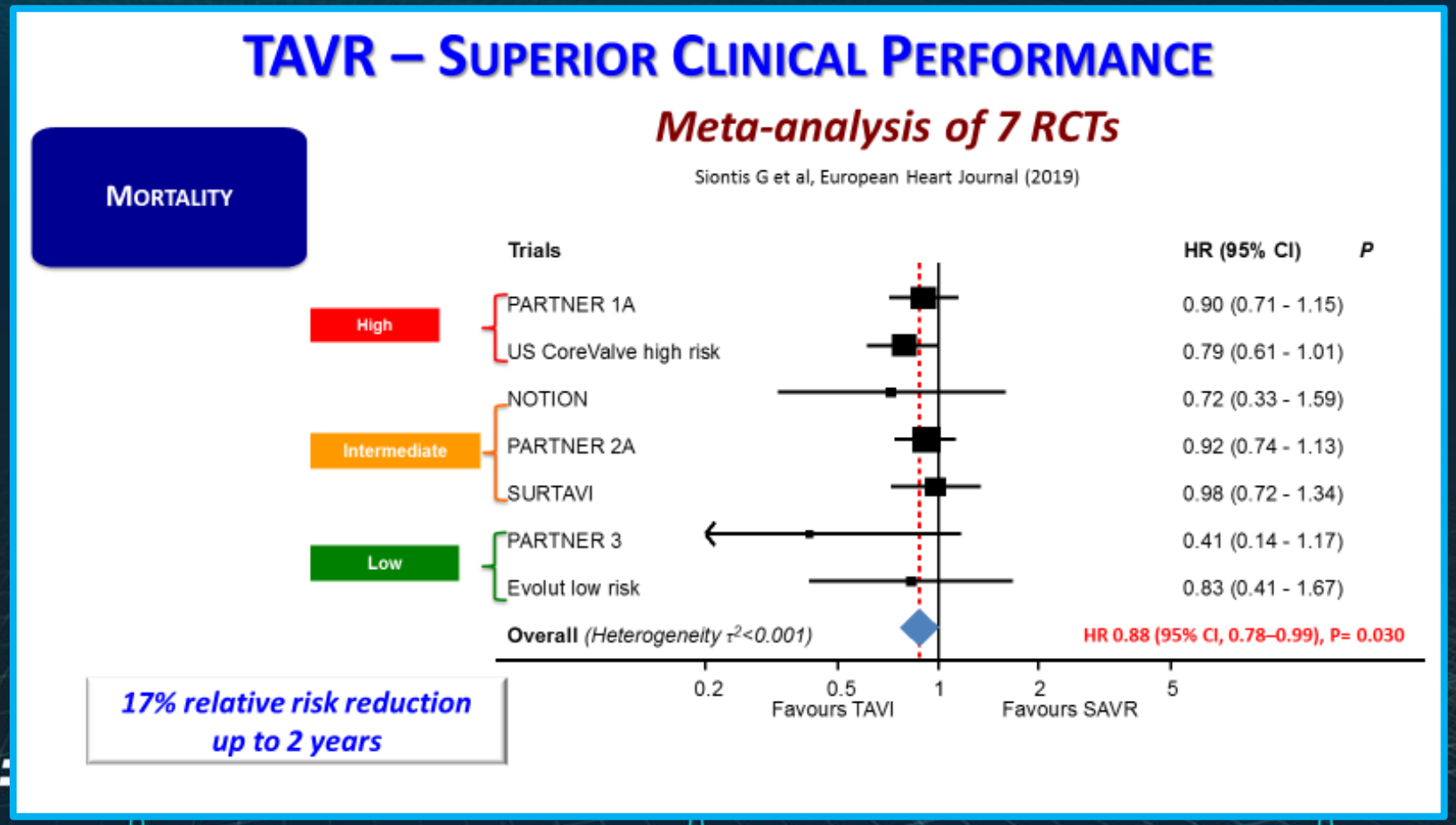
Transcatheter aortic valve implantation vs. surgical aortic valve replacement for treatment of symptomatic severe aortic stenosis: an updated meta-analysis

George C.M. Siontis[1†], Pavel Overtchouk[1†], Thomas J. Cahill[2†], Thomas Modine[3], Bernard Prendergast[4], Fabien Praz[1], Thomas Pilgrim[1], Tatjana Petrinic[5], Adriani Nikolakopoulou[6], Georgia Salanti[6], Lars Søndergaard[7], Subodh Verma[8], Peter Jüni[9], and Stephan Windecker[1*]

Siontis GCM et al. European Heart Journal 2019

Updated Meta-analysis of 7 TAVR vs. Surgery RCTs

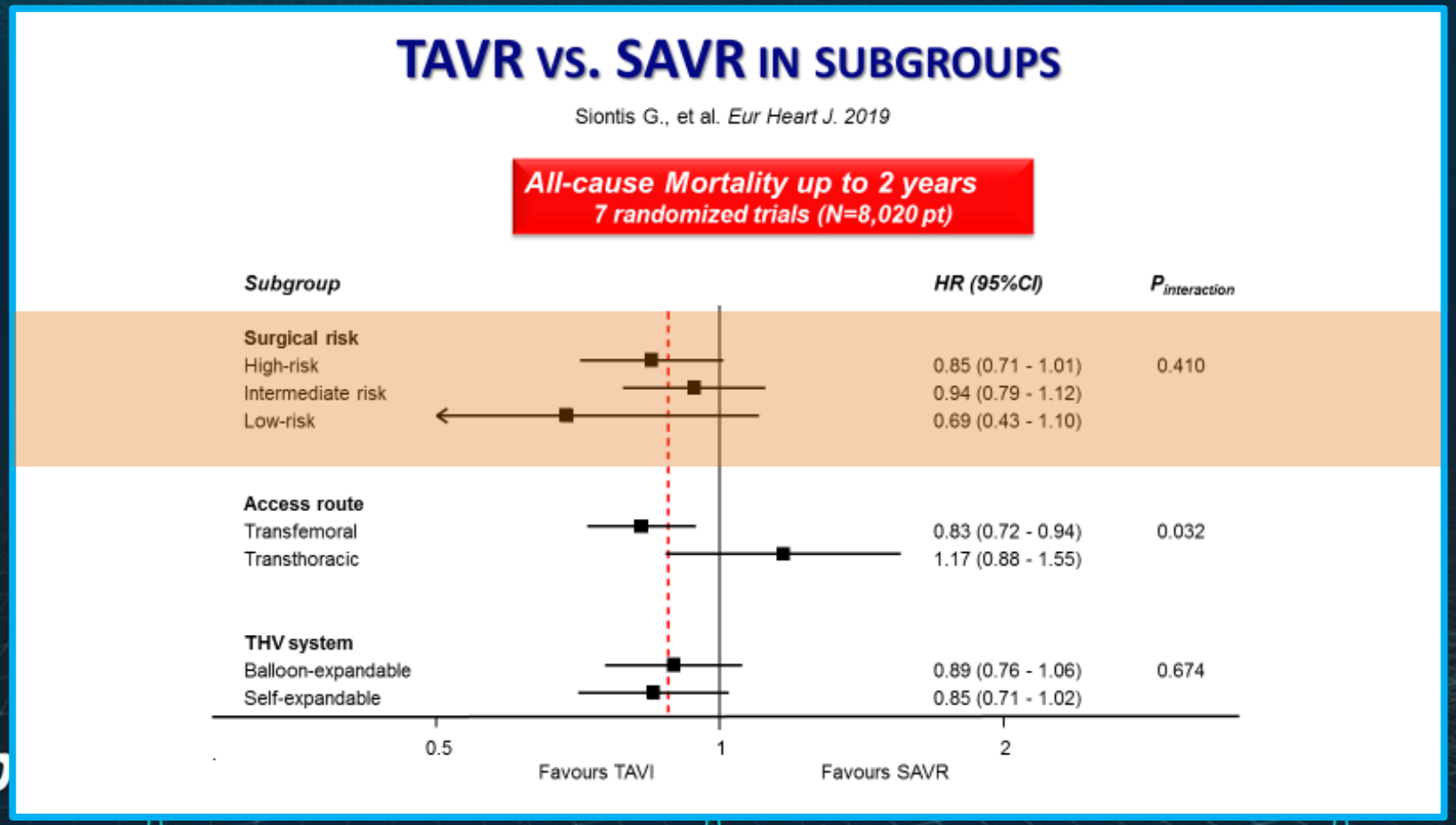
Mortality



Siontis GCM et al. European Heart Journal 2019

Updated Meta-analysis of 7 TAVR vs. Surgery RCTs

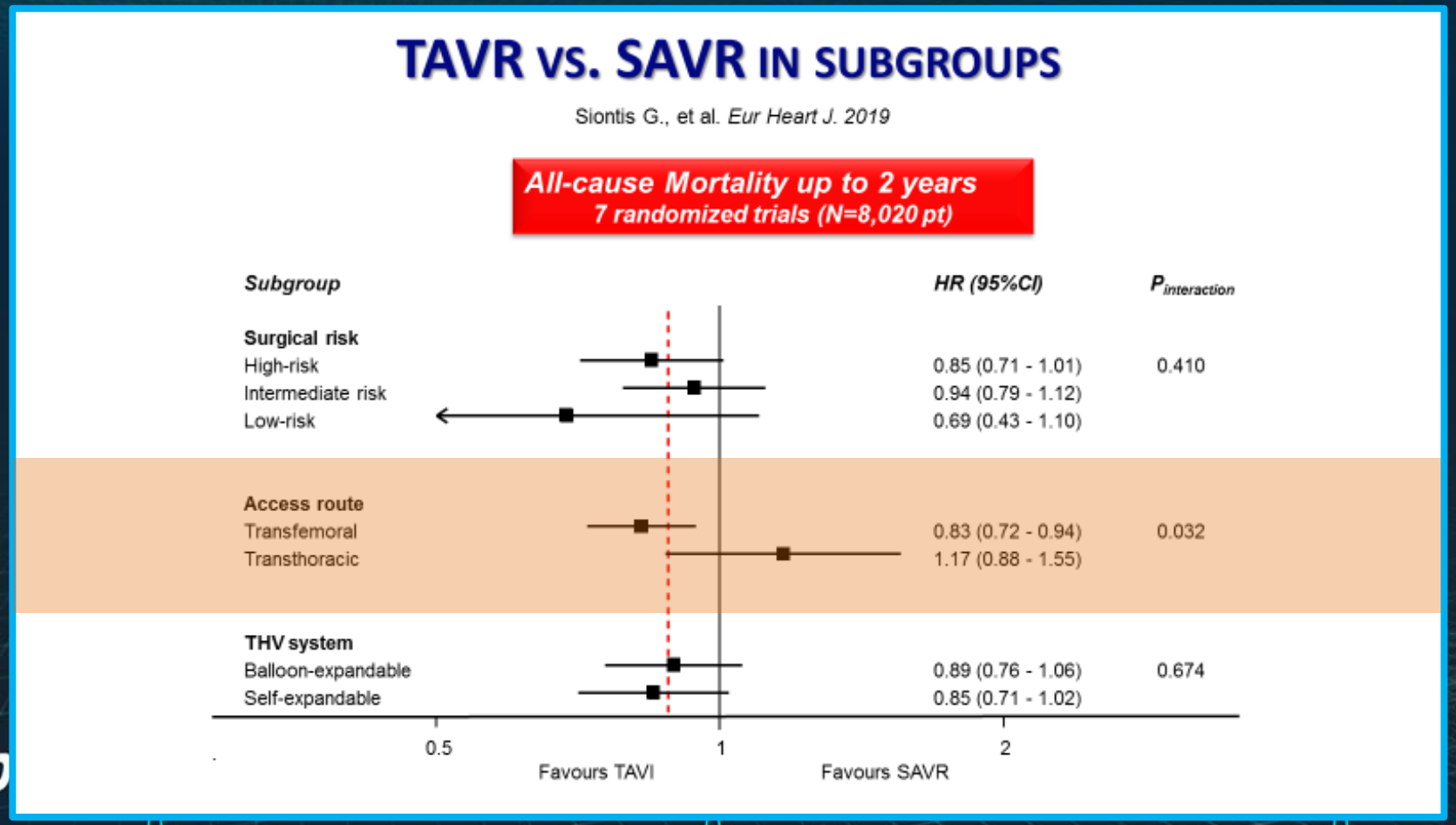
Mortality Subgroups



Siontis GCM et al. European Heart Journal 2019

Updated Meta-analysis of 7 TAVR vs. Surgery RCTs

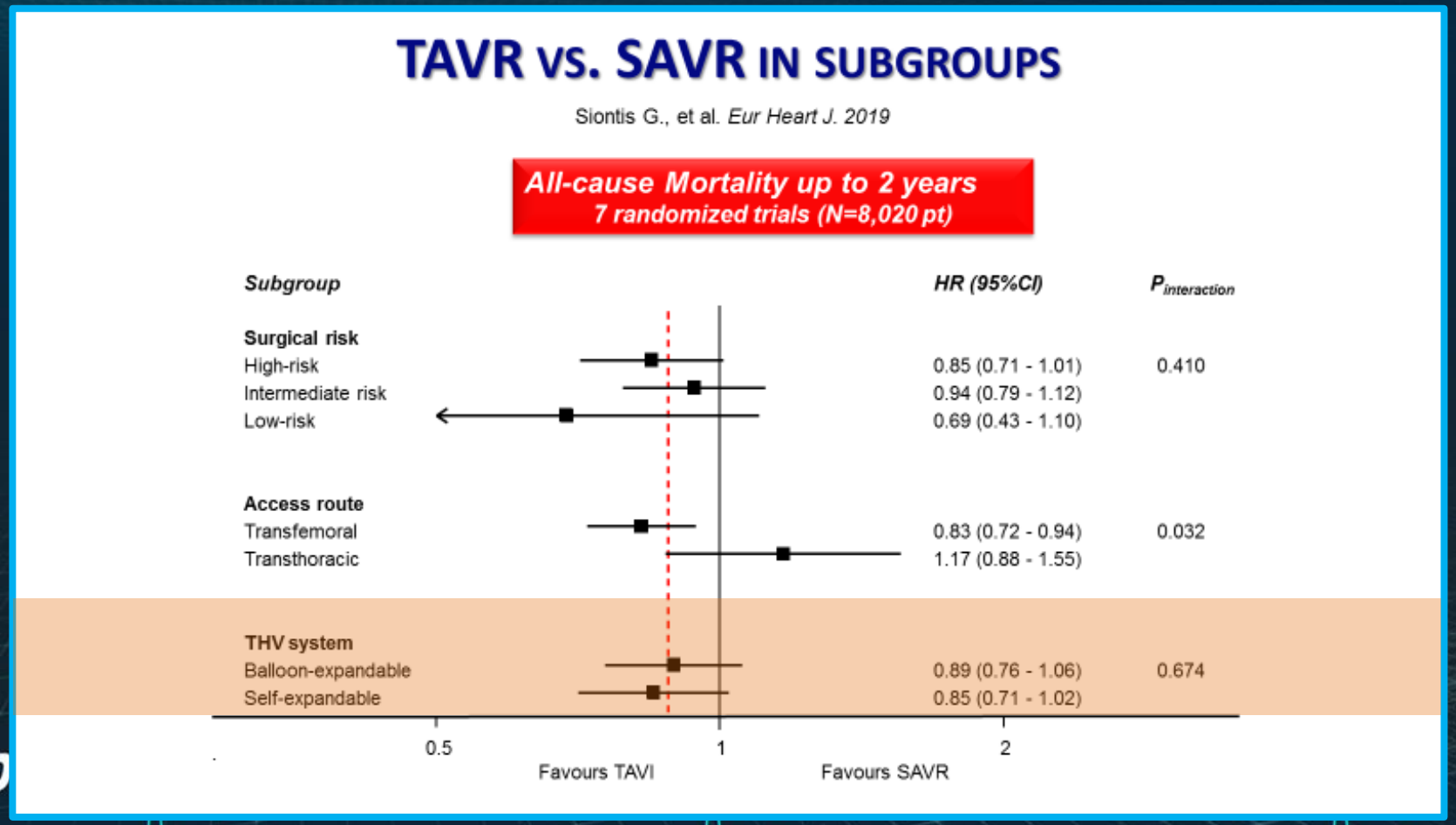
Mortality Subgroups



Siontis GCM et al. European Heart Journal 2019

Updated Meta-analysis of 7 TAVR vs. Surgery RCTs

Mortality Subgroups



Siontis GCM et al. European Heart Journal 2019

Updated Meta-analysis of 7 TAVR vs. Surgery RCTs

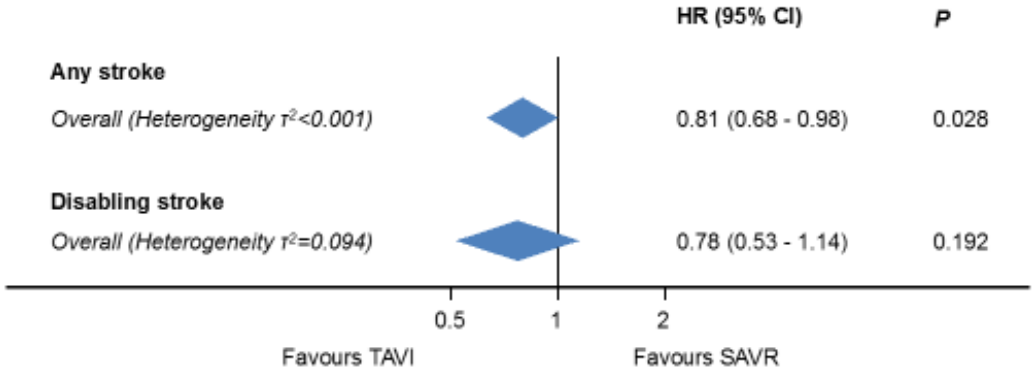
Stroke

TAVR – Superior Clinical Performance

Stroke

Meta-analysis of 7 RCTs

Siontis G et al, European Heart Journal (2019)

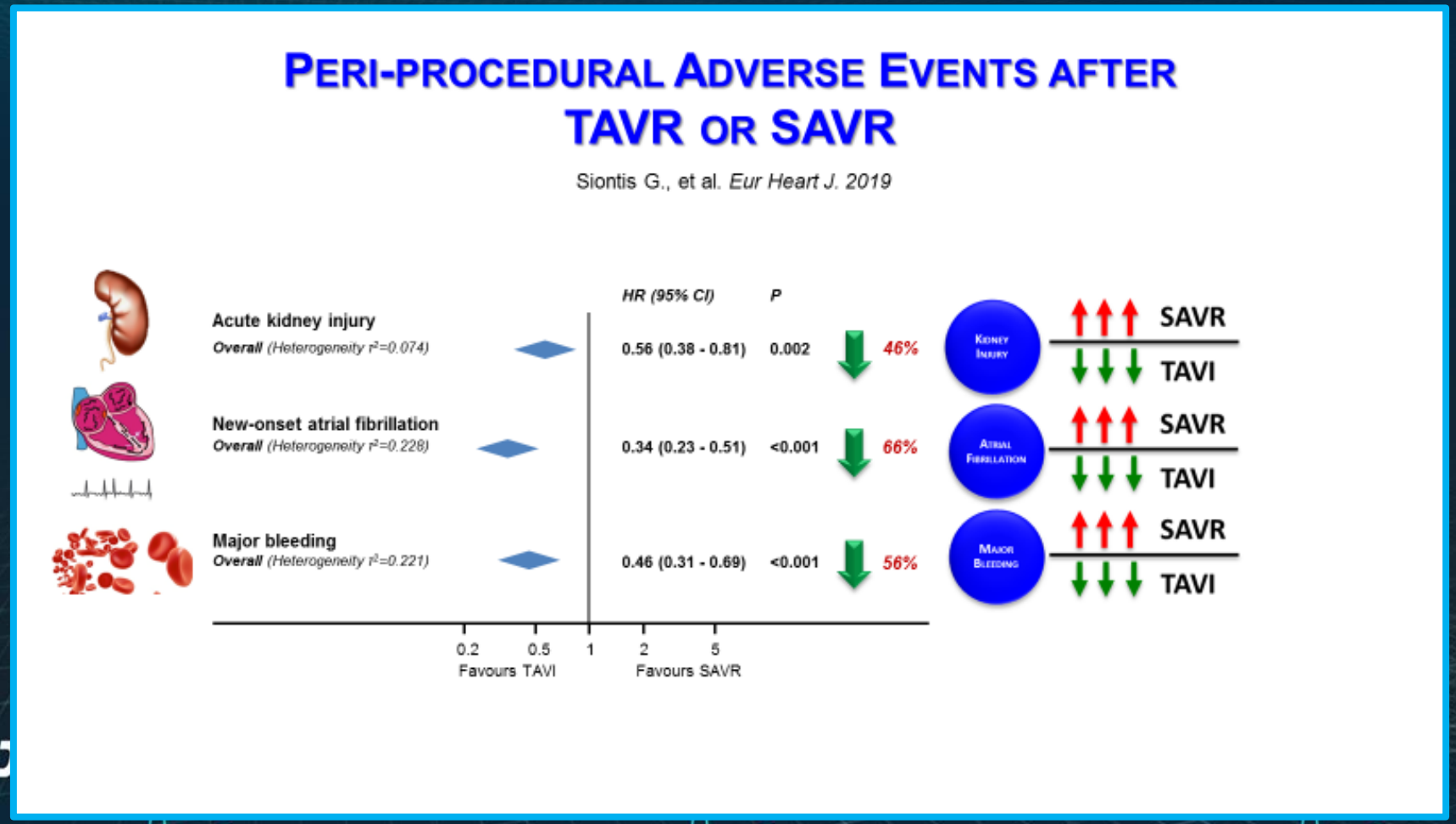


19% relative risk reduction up to 2 years

Siontis GCM et al. European Heart Journal 2019

Updated Meta-analysis of 7 TAVR vs. Surgery RCTs

Secondary Endpoints



Siontis GCM et al. European Heart Journal 2019

Meta-analysis of 9 TAVR vs. Surgery in Low AS Patients

- Nine studies (n=6,124) were included.
- TAVI was associated with a numerically, but not statistically, significant reduced mortality at 30 days (1.45% vs 2.1%, p=0.05), and similar mortality at one year (5.1% vs 5.0%, p=0.74) and a median of two years (10.8% vs 9.8%, p=0.15).
- In terms of periprocedural complications, TAVI was associated with reduced risk for stroke, bleeding and renal failure and an increase in vascular complications and pacemaker implantation.

EuroIntervention 2019

Meta-analysis of transcatheter aortic valve implantation versus surgical aortic valve replacement in patients at low surgical risk

Guy Witberg[1,2*], MD; Uri Landes[1,2], MD; Adi Lador[1,2], MD; Dafna Yahav[2,3], MD; Ran Kornowski[1,2], MD

1. Department of Cardiology, Rabin Medical Center, Petach-Tikva, Israel; 2. Sackler Faculty of Medicine, Tel-Aviv University, Tel-Aviv, Israel; 3. Infectious Diseases Unit, Rabin Medical Center, Petach-Tikva, Israel

This paper also includes supplementary data published online at: https://eurointervention.pcronline.com/doi/10.4244/EIJ-D-19-00663

KEYWORDS

- aortic stenosis
- risk stratification
- TAVI

Abstract

Aims: Although transcatheter aortic valve implantation (TAVI) is officially indicated for severe aortic stenosis (AS) patients at intermediate or higher surgical risk, the procedure is now increasingly being performed in patients who are at low surgical risk. Data on the benefit of TAVI in this patient population are limited. We therefore aimed to perform an updated meta-analysis of all published randomised controlled trials (RCTs) and propensity score-matched studies comparing TAVI versus surgical aortic valve replacement (SAVR) in patients at low surgical risk.

Methods and results: We conducted a systematic review and meta-analysis of RCTs and observational studies with propensity score matching (PSM) of TAVI versus SAVR in patients who are at low surgical risk (mean STS score <4% and/or logistic EuroSCORE <10%). The primary outcome was mortality (examined at 30 days, one year and the longest available follow-up). The secondary outcomes included procedural complications. Nine studies (n=6,124) were included. TAVI was associated with a numerically, but not statistically, significant reduced mortality at 30 days (1.45% vs 2.1%, p=0.05), and similar mortality at one year (5.1% vs 5.0%, p=0.74) and a median of two years (10.8% vs 9.8%, p=0.15). For both time points, there was significant heterogeneity between RCT/PSM studies, with the former suggesting survival advantage for TAVI and the latter for SAVR. In terms of periprocedural complications, TAVI was associated with reduced risk for stroke, bleeding and renal failure and an increase in vascular complications and pacemaker implantation.

Conclusions: In patients who are at low surgical risk, TAVI seems to be associated with equivalent mortality up to a median follow-up of two years compared to SAVR. More data are required before TAVI can be routinely considered as an alternative to SAVR in low-risk patients.

After the Low-Risk Trials

An AS Treatment Paradigm Shift

Who do we offer TAVR?

Who do we offer surgery?

TAVR Odyssey - 2020

Key Messages

- **The favorable outcomes of TAVR in the low-risk trials have established consistency across the entire surgical risk spectrum suggesting that surgical risk estimation should no longer be the basis to guide choices between TAVR and surgery.**
- **There will be a shift from a surgery-first to a TAVR-first strategy for most AS patients. The Heart Team will weigh clinical and anatomic characteristics to identify the best treatment option for individual patients with transfemoral TAVR replacing surgery as the default therapy in most cases!**

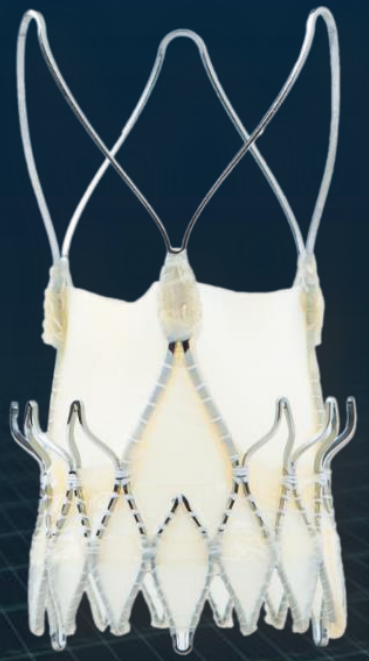
TAVR Odyssey - 2020

Key Messages

- **IMPORTANT CAVEAT: the low-risk clinical trial findings apply only to the patient populations studied! Specifically doesn't apply to 'younger' (< 65 yo) patients, unfavorable TAVR anatomy (non-TF access, some patterns of calcification, high-risk of CA obstruction), complex concomitant CAD requiring treatment, severe LV dysfunction, CKD, and multi-valve disease.**

"Next in Line" for TAVR

LOTUS (Edge) **ACURATE neo** **PORTICO**



כללית מעל 100 שנה
הכי טובה למשפחה

מרכז רפואי רבין
בילינסון · השרון

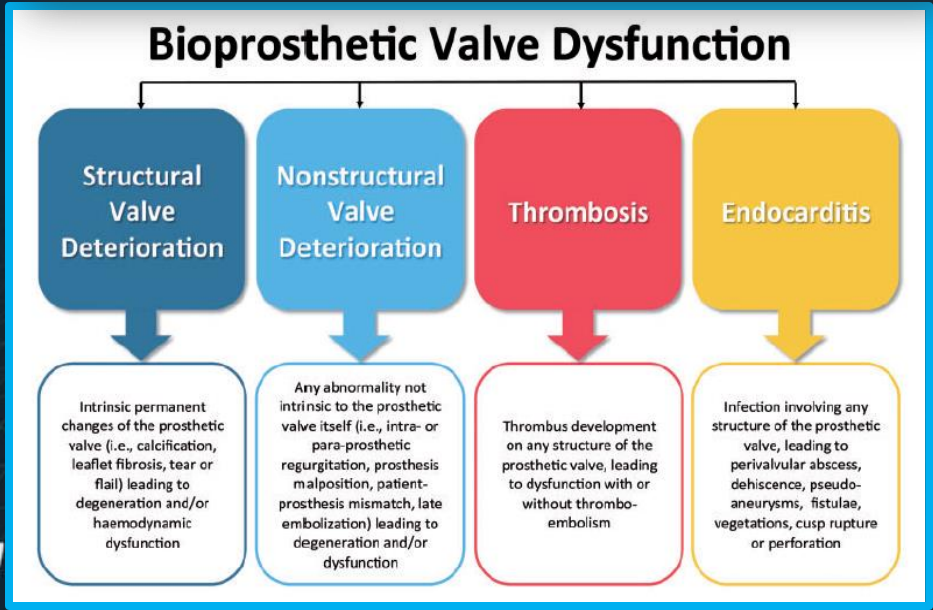
TAVR Odyssey - 2020

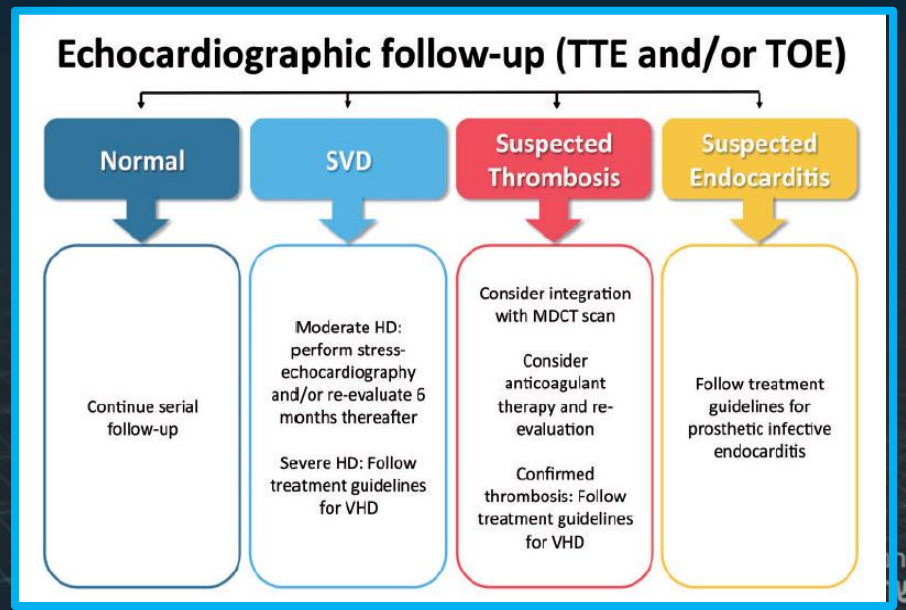
Valve Durability Issues

Standardized definitions of structural deterioration and valve failure in assessing long-term durability of transcatheter and surgical aortic bioprosthetic valves: a consensus statement from the European Association of Percutaneous Cardiovascular Interventions (EAPCI) endorsed by the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS)

Davide Capodanno[1*†], Anna S. Petronio[2†], Bernard Prendergast[3], Helene Eltchaninoff[4], Alec Vahanian[5], Thomas Modine[6], Patrizio Lancellotti[7], Lars Sondergaard[8], Peter F. Ludman[9], Corrado Tamburino[1], Nicolò Piazza[10], Jane Hancock[3], Julinda Mehilli[11], Robert A. Byrne[12], Andreas Baumbach[13], Arie Pieter Kappetein[14], Stephan Windecker[15], Jeroen Bax[16], and Michael Haude[17]

New EU guidance with standardized definitions and endpoints to assess bioprosthetic aortic valve deterioration and failure





Capodanno D et al. Europ Heart J 2017

Incidence, Predictors, and Outcome of Structural Valve Deterioration in Transcatheter versus Surgical Aortic Valve Replacement: 5 Year Follow-up from the PARTNER 2 Trials – Intermediate risk

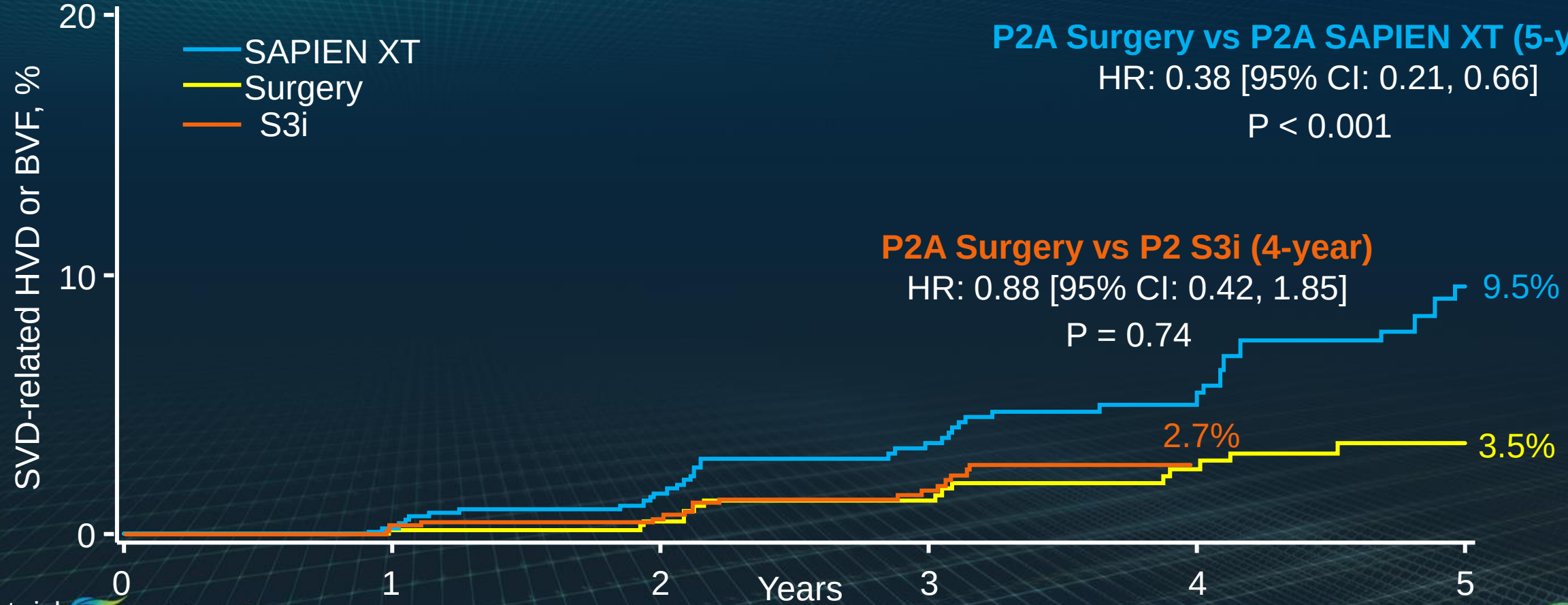
Philippe Pibarot, DMV, PhD & Rebecca Hahn, MD
on behalf of The PARTNER Trial Investigators

London Valves | London | November 18, 2019

THE PARTNER II TRIAL

SVD-related HVD or BVF (Overall SVD)

P2A Surgery, P2A SAPIEN XT, & P2 S3i

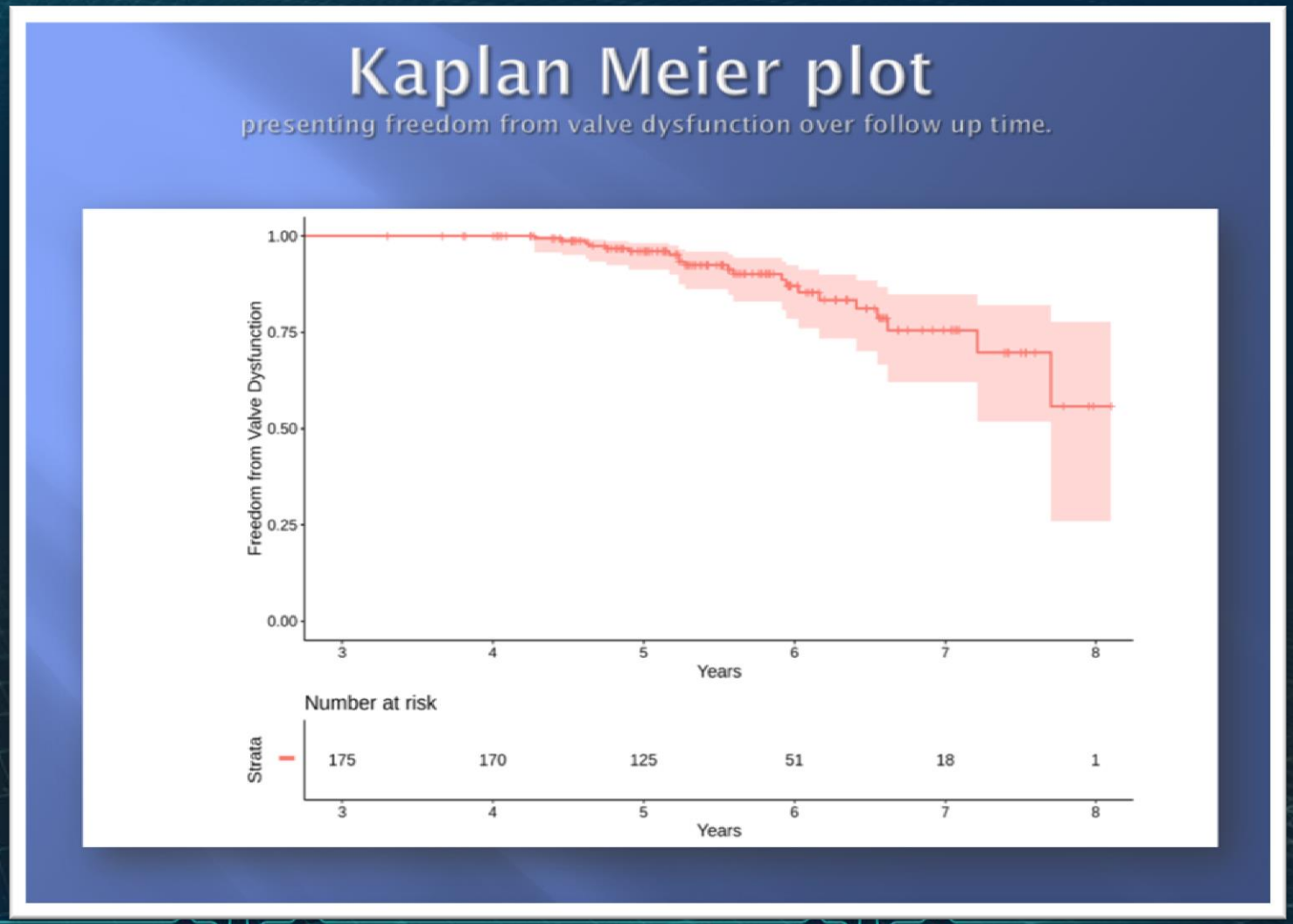


No.at risk:						
Surgery	664	625	538	449	346	265
SAPIEN XT	776	735	623	506	369	298
S3IR	890	826	698	562	265	

SVD-related HVD or BVF (Overall SVD)

Israeli 3 Sites Registry (Orvin K. et al Am J Cardiol 2019)

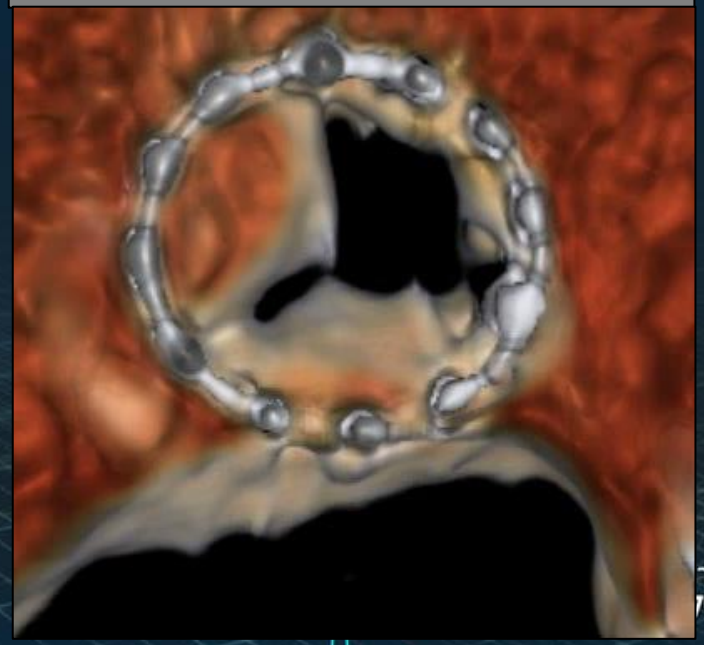
- In 184 patients (40.9%) who survived 5 years, prostheses displayed sustained hemodynamic performance, with average peak and mean aortic valve gradients of 16.2 ± 8.9 and 9.2 ± 6.6 mm Hg.
- Late structural valve deterioration was found in 22 (12.3%) patients. Of these, 16 (8.9%) experienced valve deterioration and 6 (3.3%) experienced valve failure.
- Among the 6 patients with bioprosthetic valve failure, only 3 underwent re-interventions.



Subclinical Leaflet Thrombosis characterized by hypo-attenuated leaflet thickening (HALT) and reduced leaflet motion has been frequently observed in transcatheter and surgical aortic bioprosthetic valves.

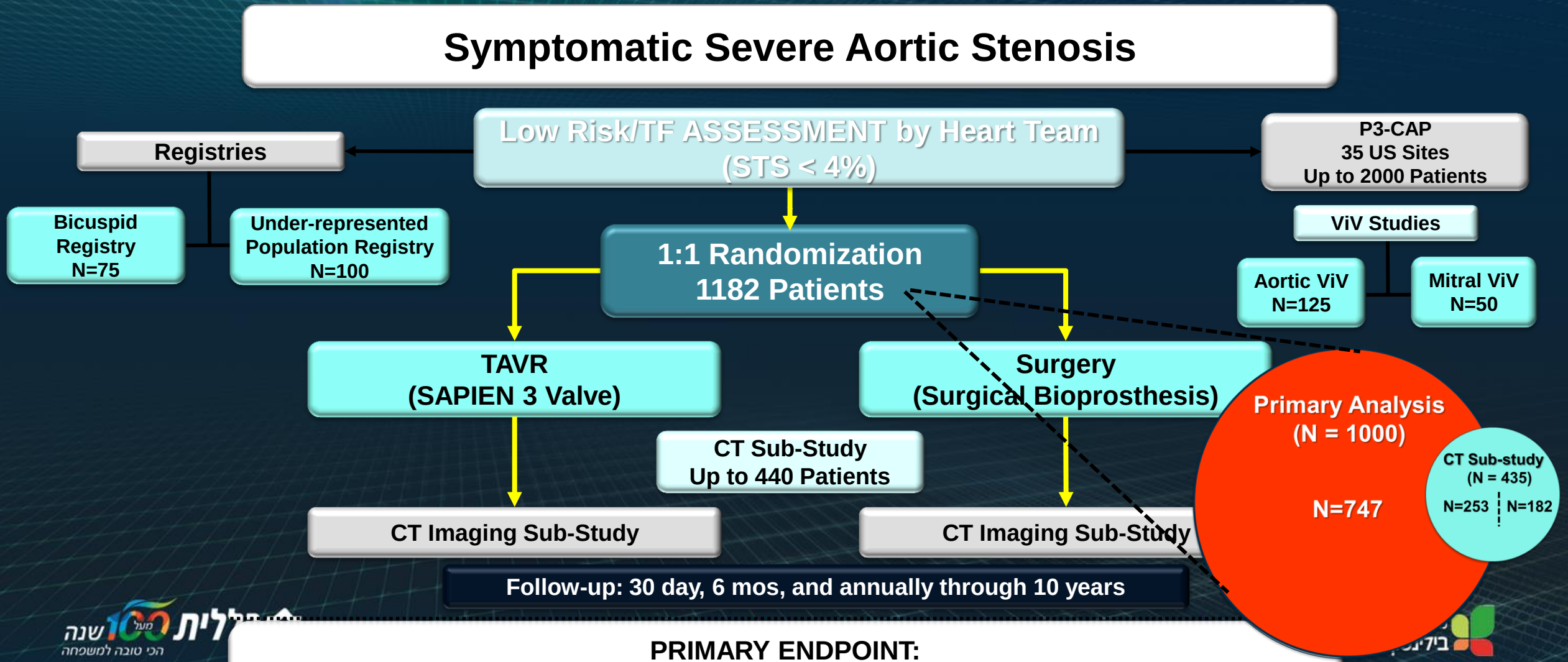
Hypoattenuating leaflet thickening (HALT)

Reduced leaflet motion



Makkar R. et al. NEJM 2015

PARTNER 3 Trial Study Design



PRIMARY ENDPOINT:

Composite of all-cause mortality, stroke, and CV re-hospitalization at 1 year post-procedure.

30-day HALT and Clinical Events

All Patients with Evaluable CTs – TAVR & SAVR

Clinical Events (n)	Day 7-30		Day 31-365	
	HALT at 30 Days (N=35)	No HALT at 30 Days (N=311)	HALT at 30 Days (N=35)	No HALT at 30 Days (N=311)
Death	0	0	0	4
Heart Failure	0	1	1	6
Angina	0	0	0	9
Myocardial Infarction	0	0	0	3
Clinical Valve Thrombosis*	0	0	3	1
Stroke	1	0	0	1
TIA	0	1	1	2
Retinal Artery Embolism	0	0	1	1

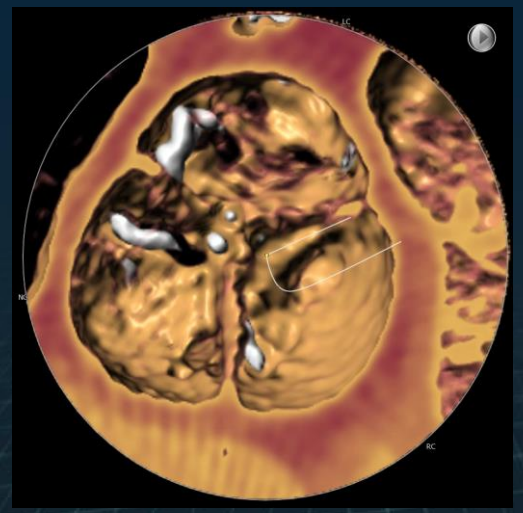
*Defined according to VARC2 definition

BAV Classification

CTA System

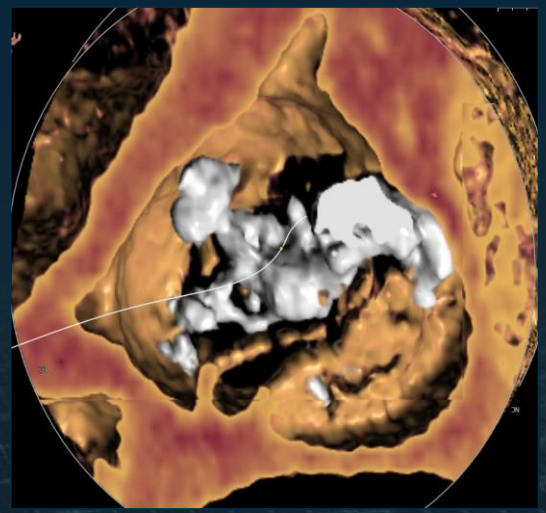
(from 14 centers in North America, Europe and Asia)

Tricommissural



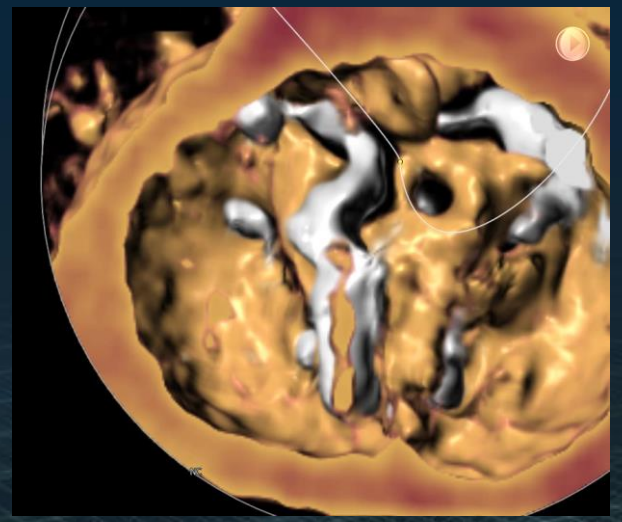
3 commissures
V-like orifice
"functional or acquired"

Bicommissural
Raphe-type



2 commissures, 1 raphe
Slit-like orifice

Bicommissural
Non Raphe-type

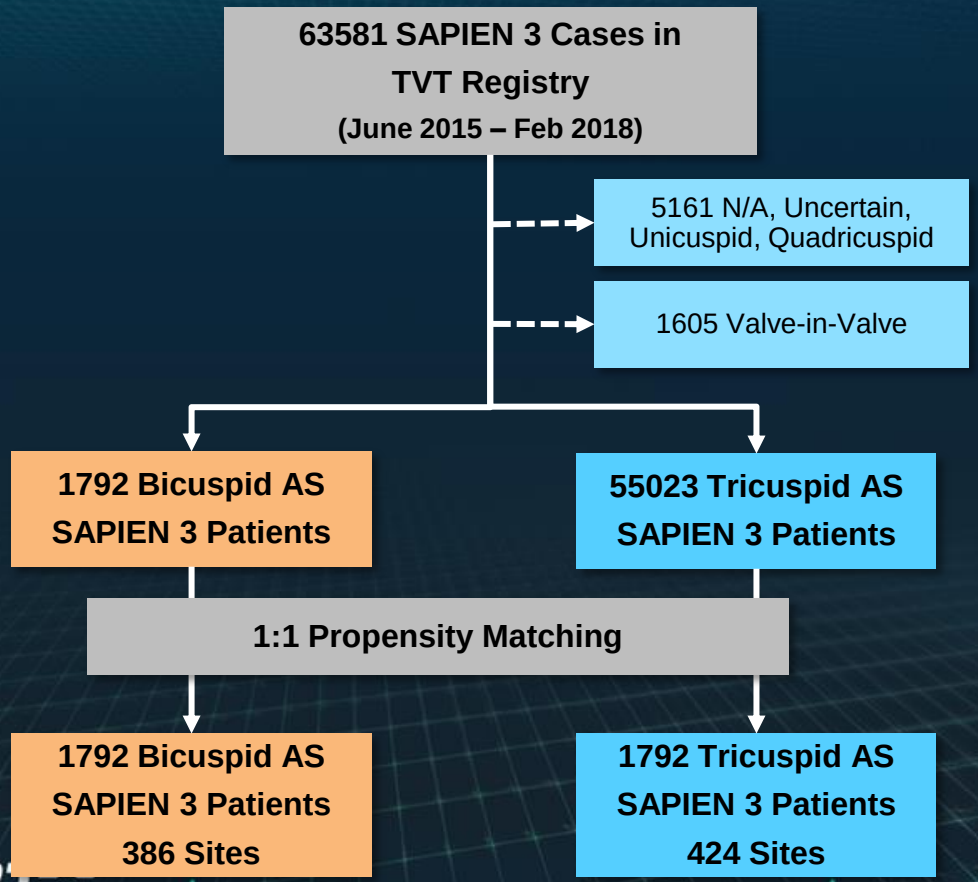


2 commissures, no raphe
Slit-like orifice

Jilaihawi H. JACC Imaging 2016

Bicuspid vs. Tricuspid TAVR Outcomes

A Propensity-Matched Analysis from the TVT Registry



Propensity Matched Analysis

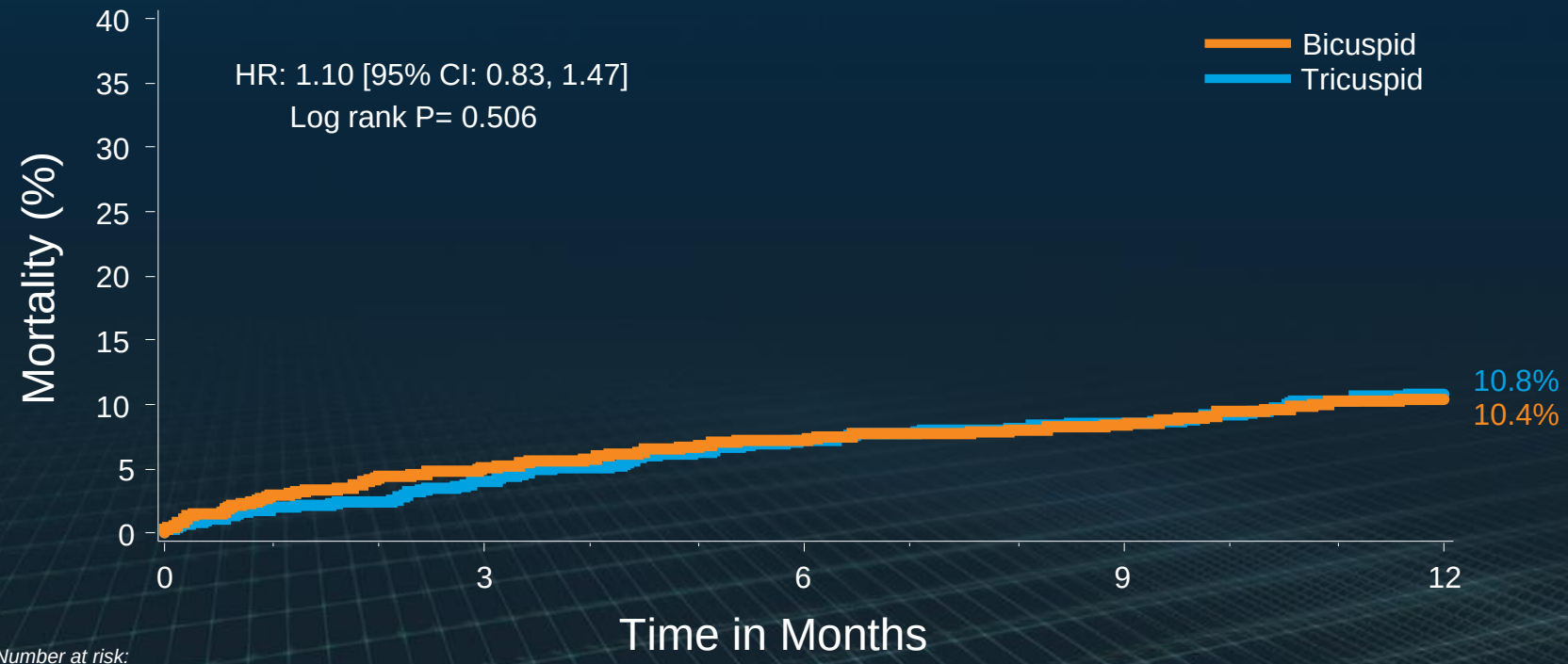
- **1:1 subject selection**
- **24 baseline covariates**
  - Missing values: imputed using Markov Chain Monte Carlo method
- **Logistic regression model**

Raj Makkar; TCT 2018

Bicuspid vs. Tricuspid TAVR Outcomes

A Propensity-Matched Analysis from the TVT Registry

1-Year All-Cause Mortality

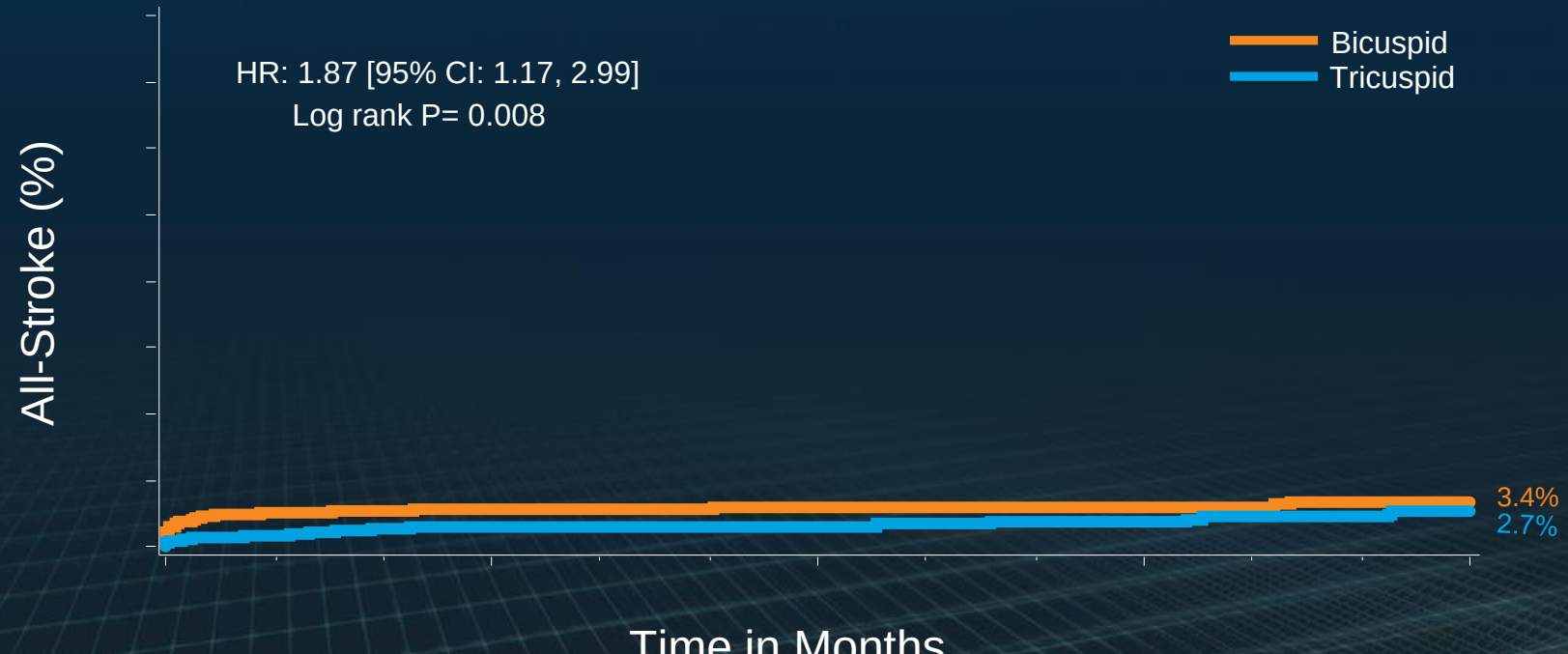


Raj Makkar; TCT 2018

Bicuspid vs. Tricuspid TAVR Outcomes

A Propensity-Matched Analysis from the TVT Registry

1-Year All Strokes

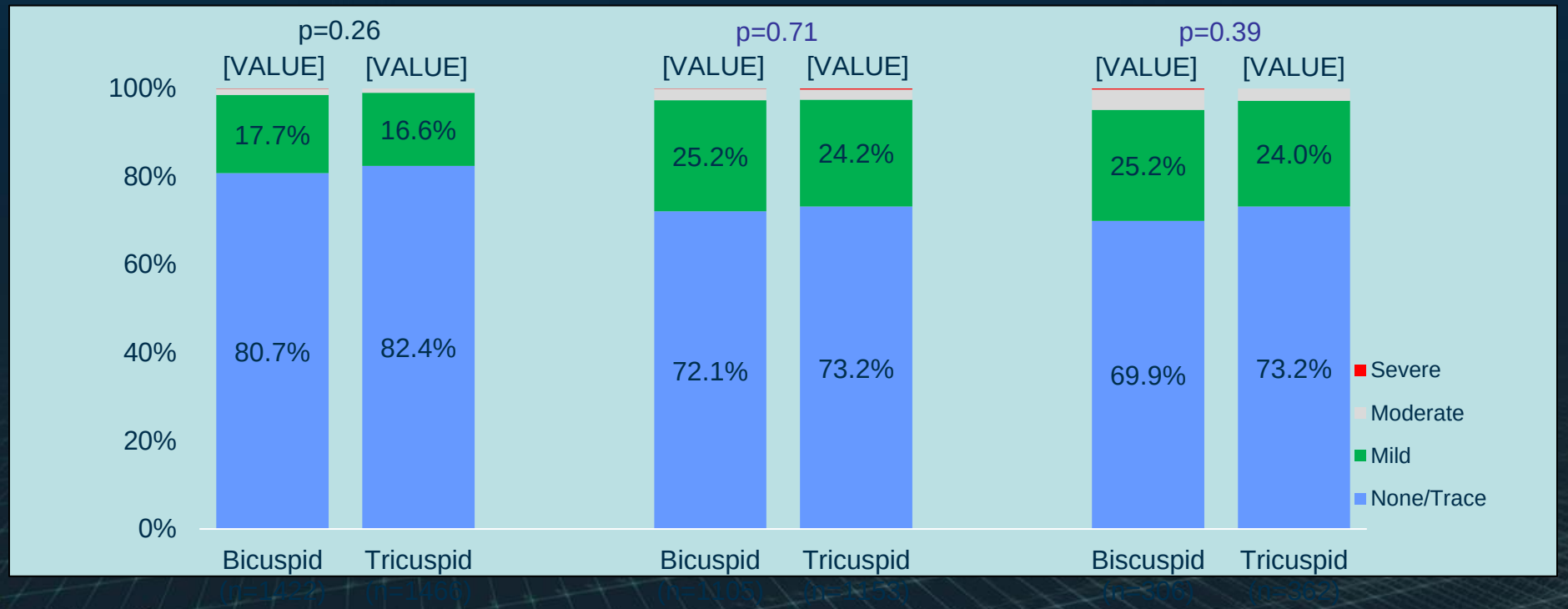


Raj Makkar; TCT 2018

Bicuspid vs. Tricuspid TAVR Outcomes

A Propensity-Matched Analysis from the TVT Registry

Para-Valvular Leak



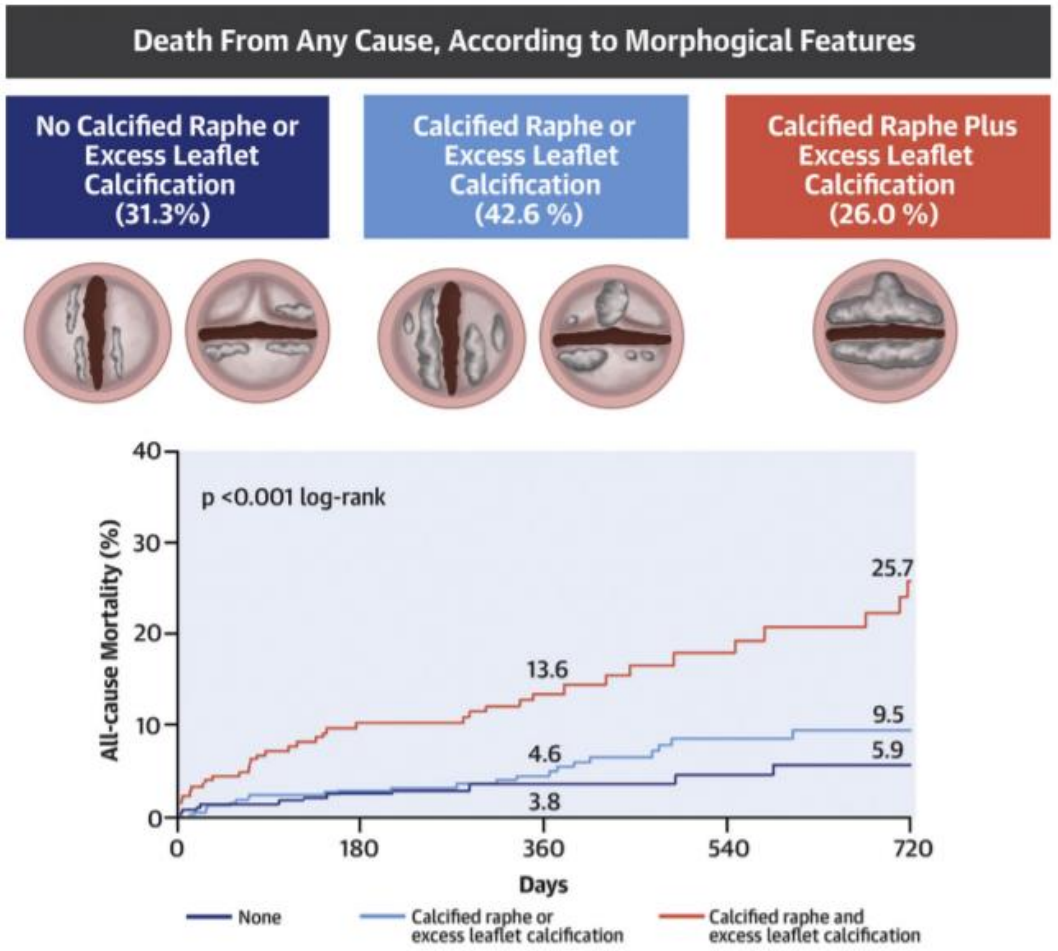
Raj Makkar; TCT 2018

Bicuspid Aortic Valve Morphology and Outcomes After Transcatheter Aortic Valve Replacement

Sung-Han Yoon, MD,[a] Won-Keun Kim, MD,[b] Abhijeet Dhoble, MD,[c] Stephan Milhorini Pio, MD,[d] Vasilis Babaliaros, MD,[e] Hasan Jilaihawi, MD,[f] Thomas Pilgrim, MD,[g] Ole De Backer, MD,[h] Sabine Bleiziffer, MD,[i] Flavien Vincent, MD,[j] Tobias Schmidit, MD,[k] Christian Butter, MD,[l] Norihiko Kamioka, MD,[e] Lena Eschenbach, MD,[m] Matthias Renker, MD,[b] Masahiko Asami, MD,[g] Mohamad Lazkani, MD,[n] Buntaro Fujita, MD,[o,p] Antoinette Birs, MD,[q] Marco Barbanti, MD,[r] Ashish Pershad, MD,[s] Uri Landes, MD,[t] Brad Oldemeyer, MD,[n] Mitusnobu Kitamura, MD,[k] Luke Oakley, MD,[a] Tomoki Ochiai, MD,[a] Tarun Chakravarty, MD,[a] Mamoo Nakamura, MD,[a] Philip Ruile, MD,[u] Florian Deuschl, MD,[v] Daniel Berman, MD,[a] Thomas Modine, MD,[j,w] Stephan Ensminger, MD,[o,p] Ran Kornowski, MD,[t] Rudiger Lange, MD,[m] James M. McCabe, MD,[q] Mathew R. Williams, MD,[f] Brian Whisenant, MD,[x] Victoria Delgado, MD,[d] Stephan Windecker, MD,[g] Eric Van Belle, MD,[j] Lars Sondergaard, MD,[h] Bernard Chevalier, MD,[y] Michael Mack, MD,[z] Jeroen J. Bax, MD,[d] Martin B. Leon, MD,[aa] Raj R. Makkar, MD,[a] for the Bicuspid Aortic Valve Stenosis Transcatheter Aortic Valve Replacement Registry Investigators

Yoon SH et al. J Am Coll Cardiol. 2020

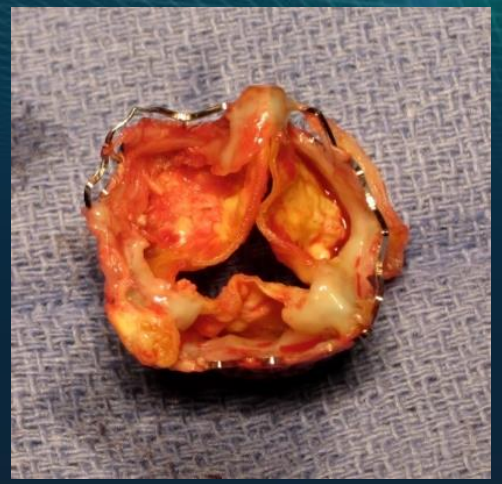
CENTRAL ILLUSTRATION Death From Any Cause According to Morphological Features



Yoon, S.-H. et al. J Am Coll Cardiol. 2020;76(9):1018-30.

(Top) Schematic presentations of various bicuspid aortic valve morphology. Bicuspid aortic valve with no morphological features (calcified raphe or excess leaflet calcification), either, or both of these features. **(Bottom)** All-cause mortality according to the morphological features. Event rates were calculated with the use of Kaplan-Meier methods and were compared with the log-rank test.

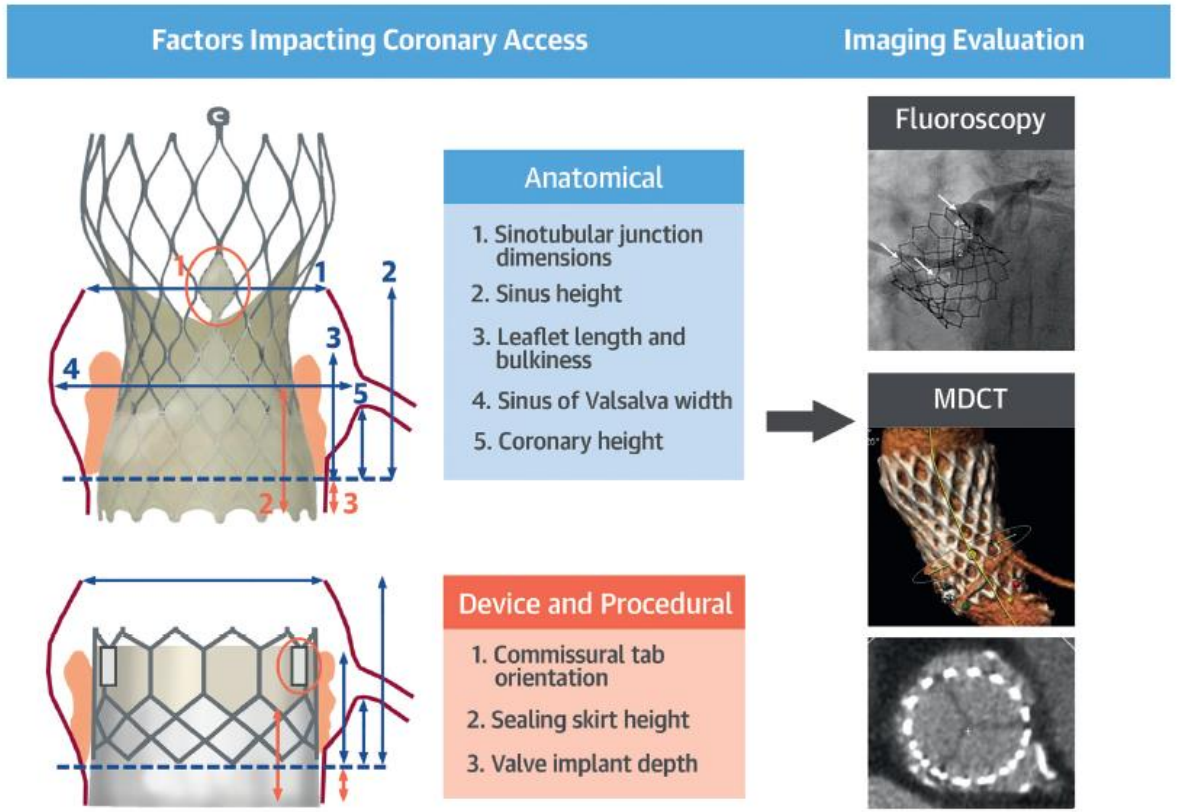
TAVR Failures



Coronary Angiography and Percutaneous Coronary Intervention After Transcatheter Aortic Valve Replacement

Matias B. Yudi, MBBS,[a] Samin K. Sharma, MD,[a] Gilbert H.L. Tang, MD, MSc, MBA,[b] Annapoorna Kini, MD[a]

CENTRAL ILLUSTRATION Coronary Reaccess After TAVR



Yudi, M.B. et al. J Am Coll Cardiol. 2018;71(12):1360-78.

Yudi et al. JACC 2018; 71:1360-78

TAVR Adjunct Pharmacology

Customized Patient-Based Therapy

BEFORE	DURING	AFTER
Acetylsalicylic acid (ASA)	**UNFRACTIONATED HEPARIN:** target ACT ≥300” **Bivalirudin:** BRAVO BivalirRudin and Aortic Valve intervention Outcomes **Low Molecular Weight Heparin**	**ASA + CLOPIDOGREL** **Acetylsalicylic acid (ASA)** ARTE trial **Non anti-VKA Oral Anticoagulant ± ASA:** Atlantis Action GALILEO

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

A Controlled Trial of Rivaroxaban after Transcatheter Aortic-Valve Replacement

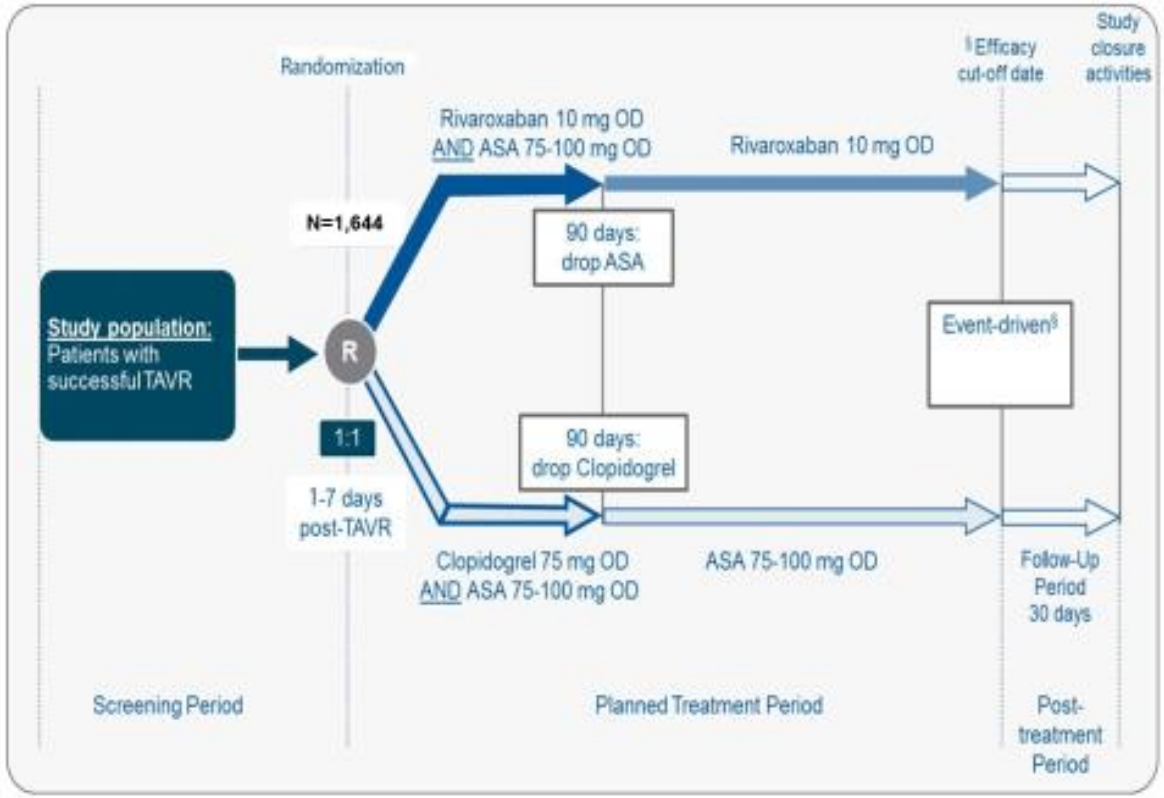
G.D. Dangas, J.G.P. Tijssen, J. Wöhrle, L. Søndergaard, M. Gilard, H. Möllmann, R.R. Makkar, H.C. Herrmann, G. Giustino, S. Baldus, O. De Backer, A.H.C. Guimarães, L. Gullestad, A. Kini, D. von Lewinski, M. Mack, R. Moreno, U. Schäfer, J. Seeger, D. Tchétché, K. Thomitzek, M. Valgimigli, P. Vranckx, R.C. Welsh, P. Wildgoose, A.A. Volkl, A. Zazula, R.G.M. van Amsterdam, R. Mehran, and S. Windecker, for the GALILEO Investigators*

AHA 2019, NEJM 2019

Galileo – Study Design

Study Design

- Open label, international, multicenter, event-driven, randomized, controlled trial comparing a rivaroxaban-based antithrombotic strategy vs. an antiplatelet-based strategy post-successful TAVR
- **Primary efficacy endpoint**: death, stroke, MI, systemic thromboembolism, symptomatic valve thrombosis, or deep venous thrombosis or pulmonary embolism
- **Primary safety endpoint**: VARC-2 major, disabling or life-threatening bleeding

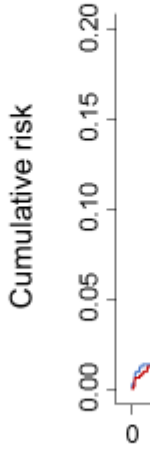


Dangas G et al. NEJM 2019

Galileo – Clinical Outcomes

Primary Efficacy Endpoint (Intention-to-treat)

Time to death, stroke, myocardial infarction, symptomatic valve thrombosis, pulmonary embolism, deep vein



Number at risk

Antiplatelet arm	818
Rivaroxaban arm	826

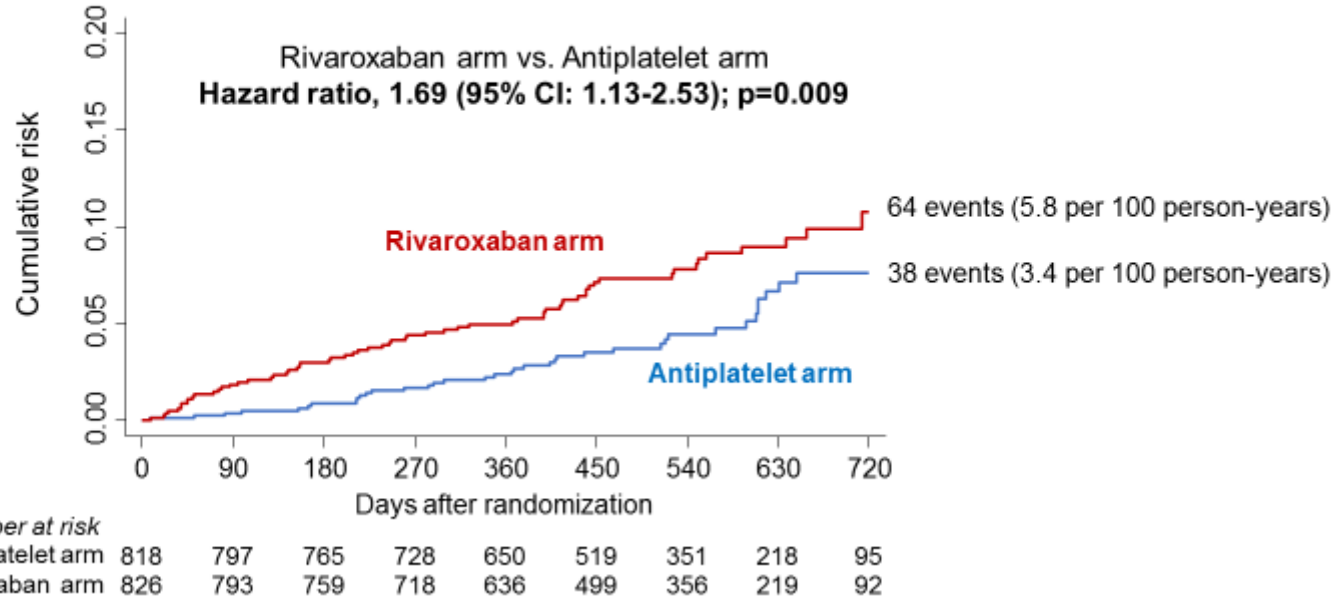
Primary Safety Endpoint (Intention-to-treat)

Time to VARC life-threatening, disabling or major bleeding

Number at risk

Antiplatelet arm	818
Rivaroxaban arm	826

All-Cause Mortality (Intention-to-treat)



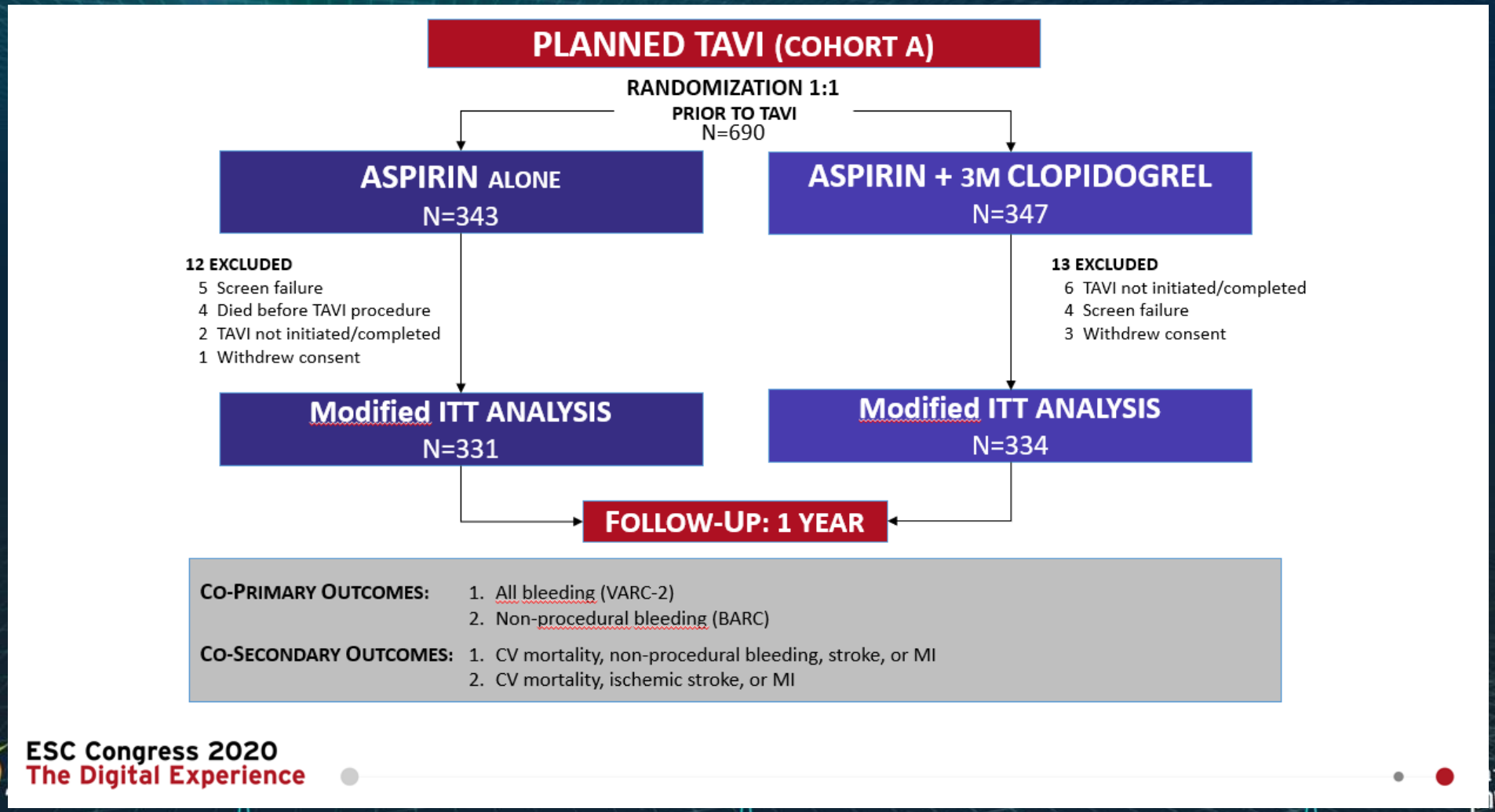
Number at risk

Antiplatelet arm	818	797	765	728	650	519	351	218	95
Rivaroxaban arm	826	793	759	718	636	499	356	219	92

כללית מעל 100 שנה
הכי טובה למשפחה

Dangas G et al. NEJM 2019

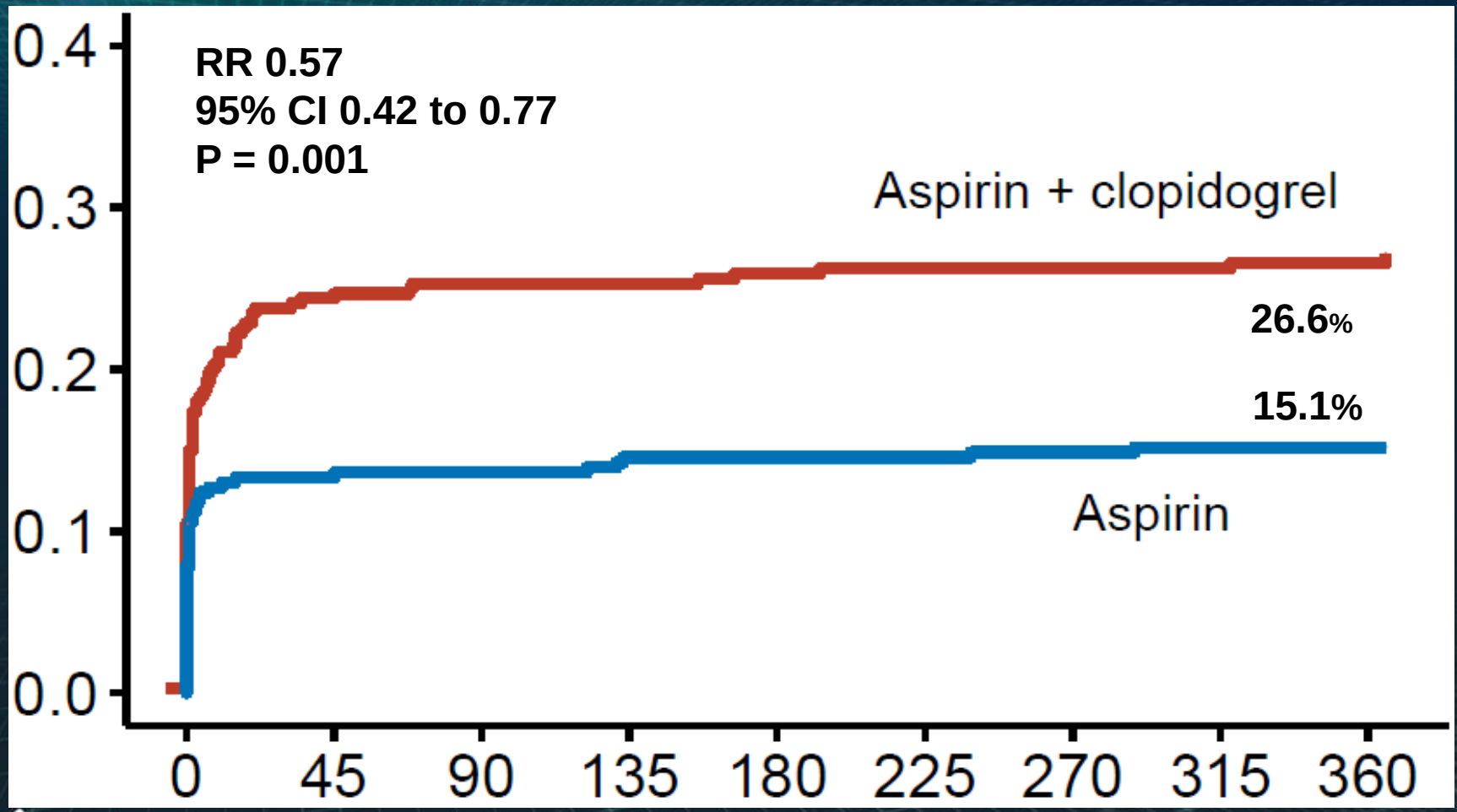
POPULAR TAVI – Clinical Outcomes (cohort A)



Jorn Brouwer, et al. NEJM August 2020

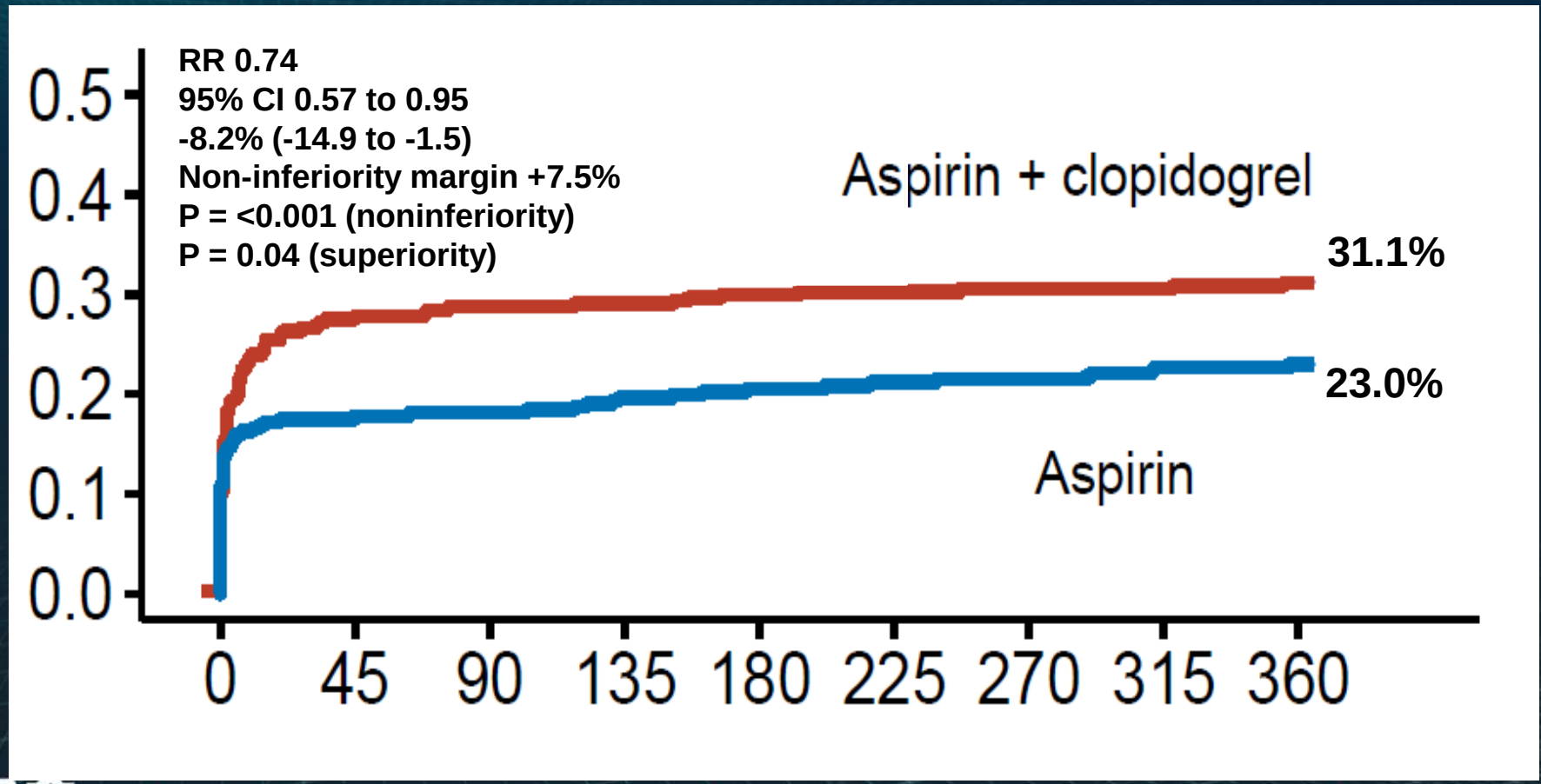
POPULAR TAVI (Cohort A)

All Bleeding



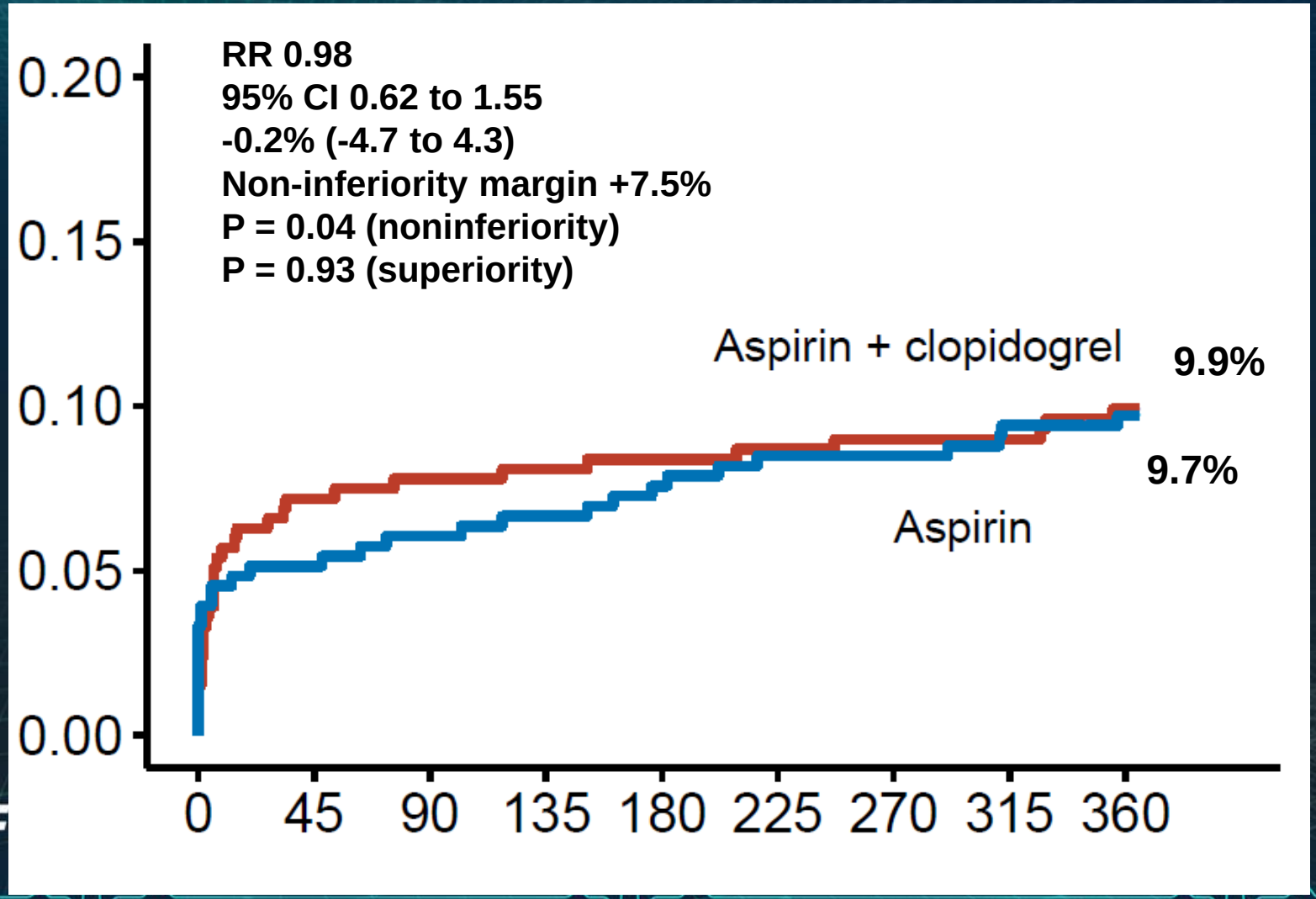
POPULAR TAVI (Cohort A)

CV Mortality, Non-Procedural Bleeding, Stroke, MI

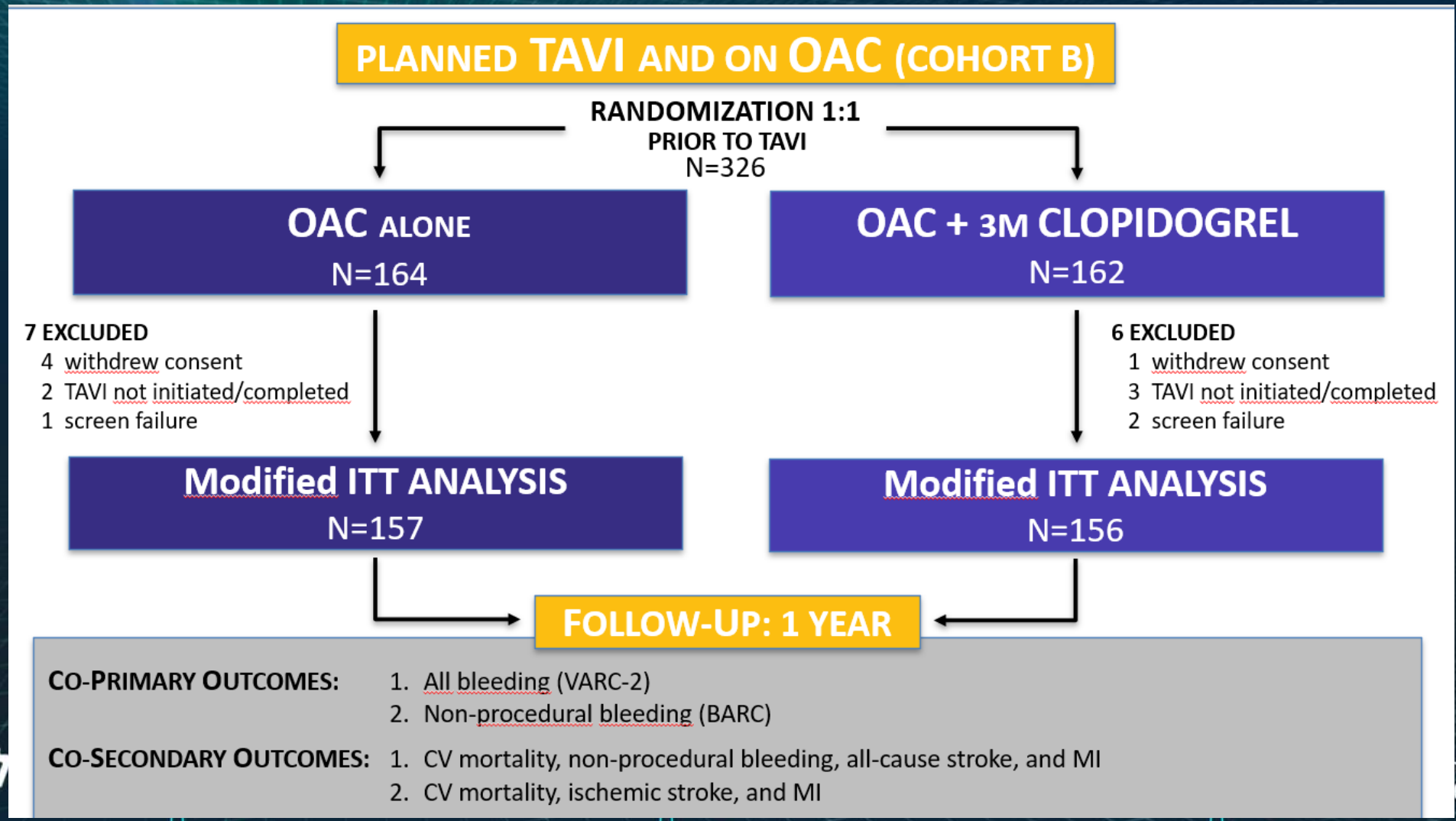


POPULAR TAVI (Cohort A)

CV Mortality, Ischemic Stroke, MI



POPULAR TAVI (Cohort B)



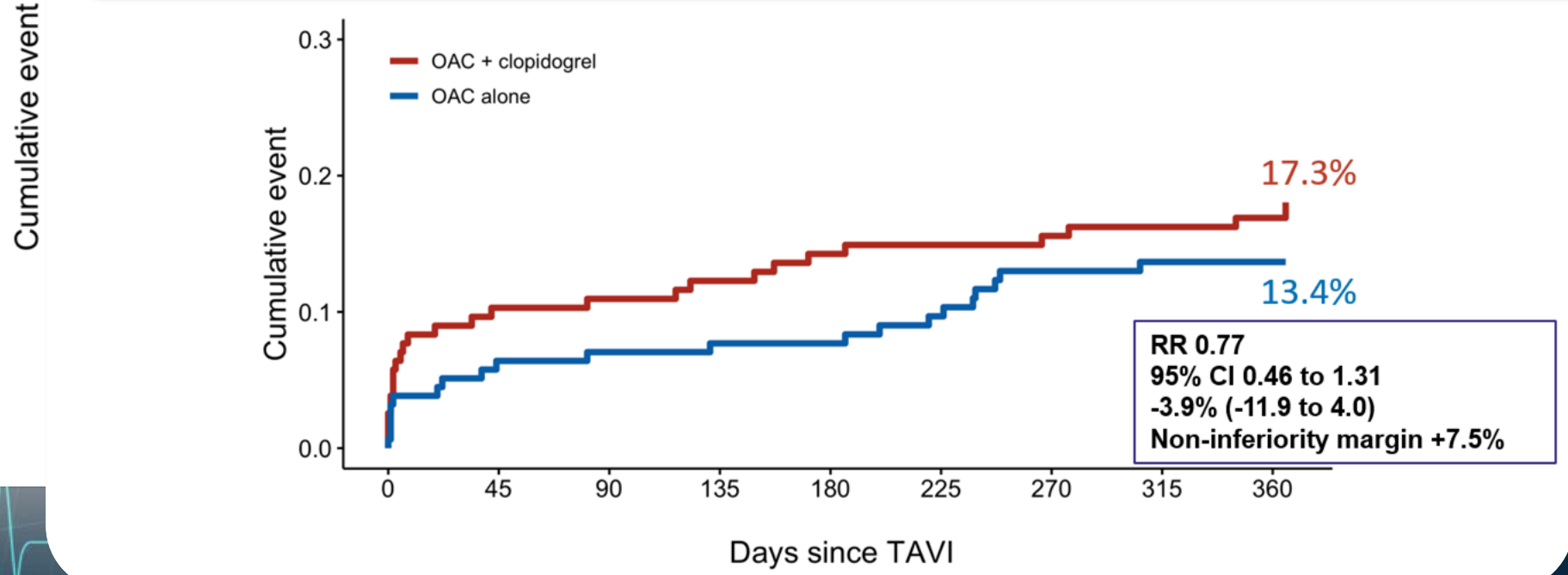
Jorn Brouwer, et al. NEJM April 2020

POPULAR TAVI (Cohort B)

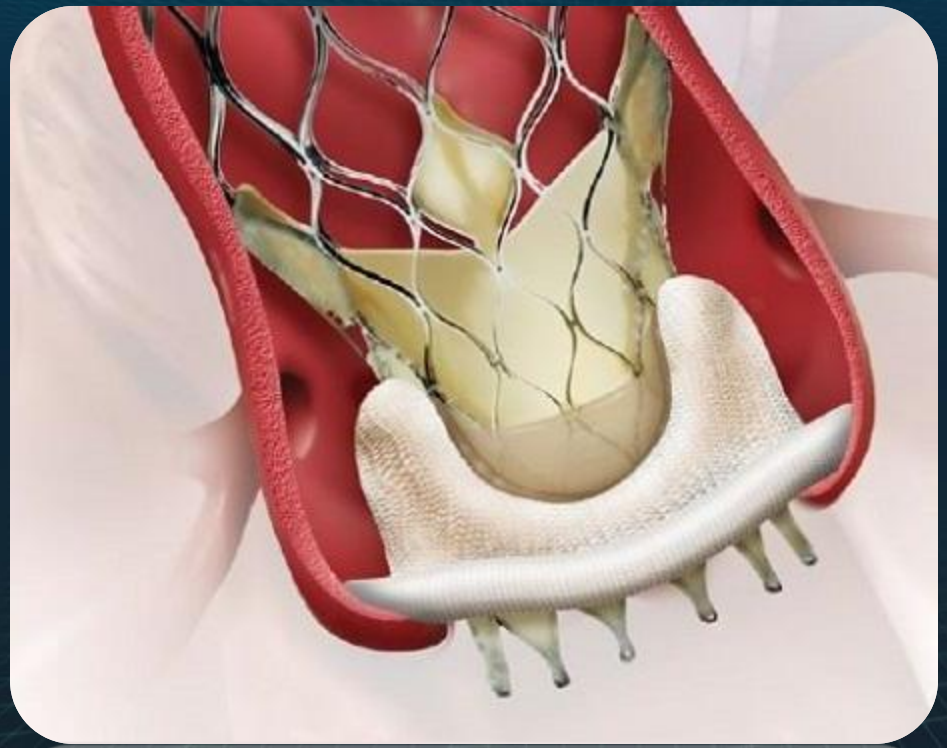
All Bleeding

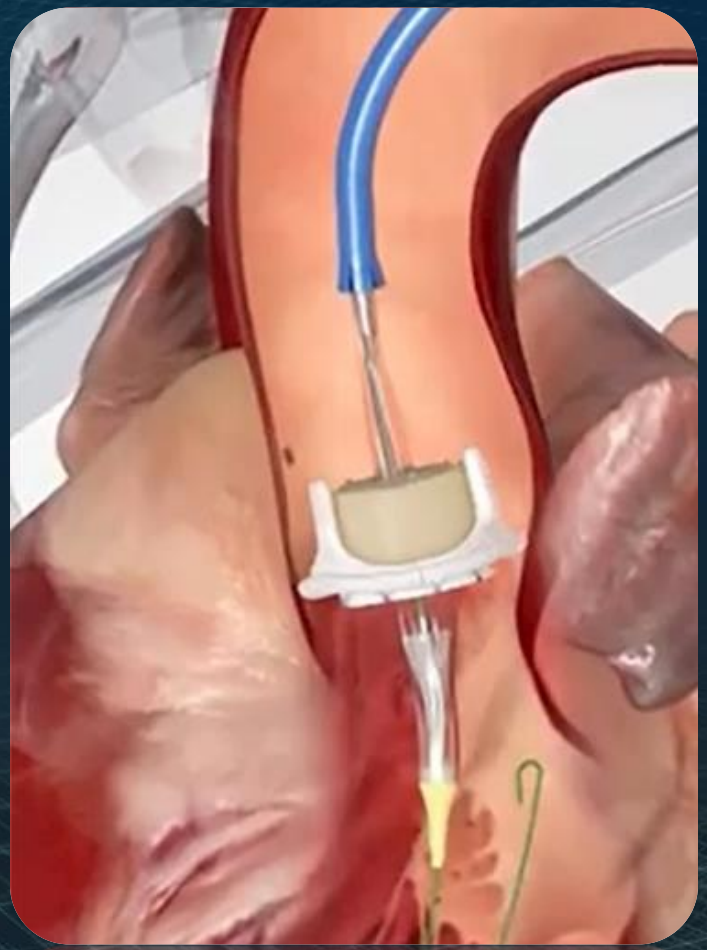
CV Mortality, Non-Procedural Bleeding, Stroke, MI

CV Mortality, Ischemic Stroke, MI



TAVR Valve in Valve Intervention

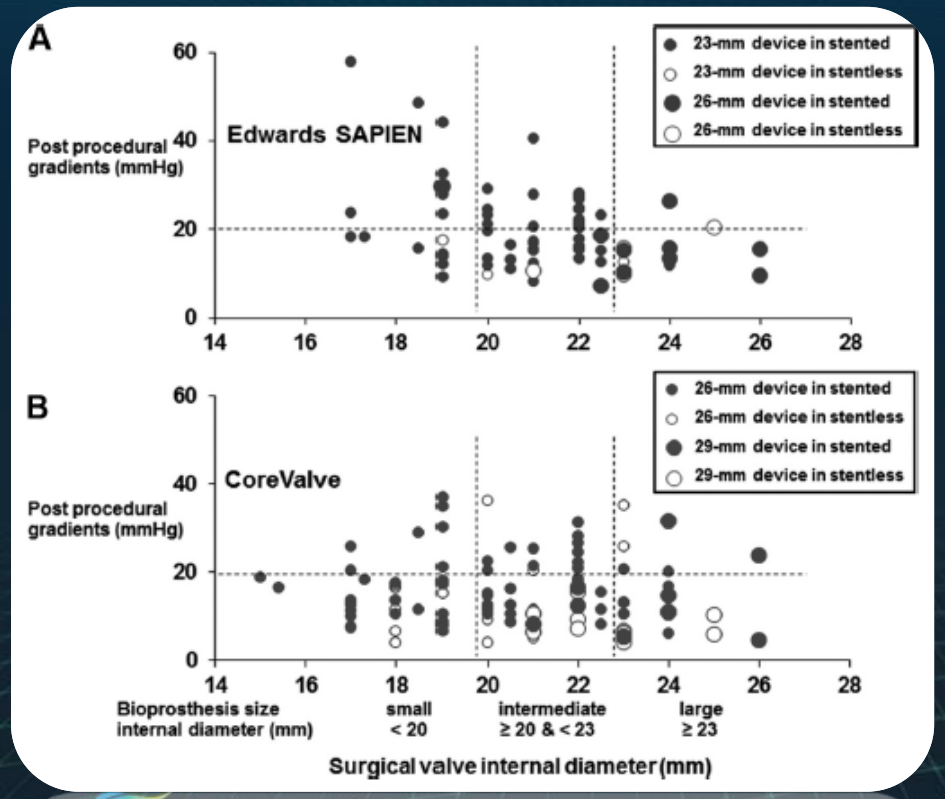


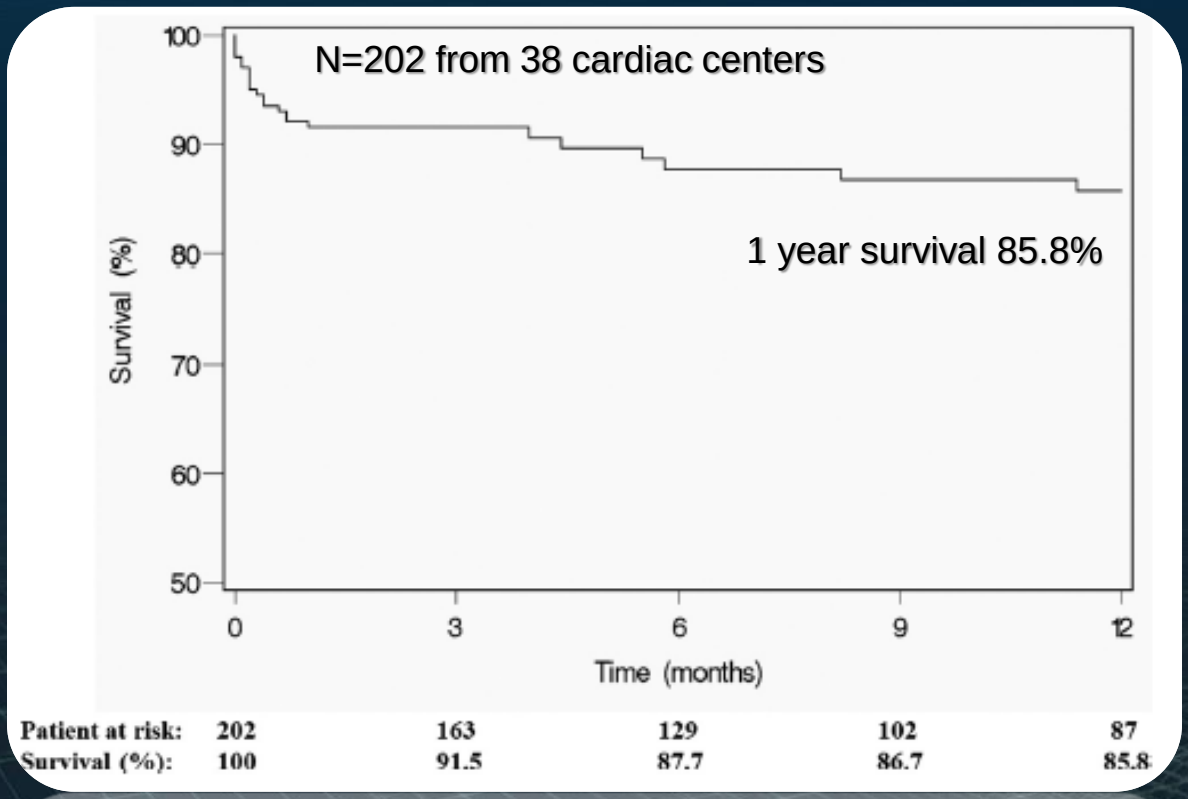


Transcatheter Aortic Valve Replacement for Degenerative Bioprosthetic Surgical Valves

Results From the Global Valve-in-Valve Registry

Danny Dvir, MD; John Webb, MD; Stephen Brecker, MD; Sabine Bleiziffer, MD; David Hildick-Smith, MD; Antonio Colombo, MD; Fleur Descoutures, MD; Christian Hengstenberg, MD; Neil E. Moat, FRCS; Raffi Bekeredjian, MD; Massimo Napodano, MD; Luca Testa, MD, PhD; Thierry Lefevre, MD; Victor Guetta, MD; Henrik Nissen, MD, PhD; José-María Hernández, MD; David Roy, MD; Rui C. Teles, MD; Amit Segev, MD; Nicolas Dumonteil, MD; Claudia Fiorina, MD; Michael Gotzmann, MD; Didier Tchetche, MD; Mohamed Abdel-Wahab, MD; Federico De Marco, MD; Andreas Baumbach, MD; Jean-Claude Laborde, MD; Ran Kornowski, MD





Dvir D, et al. Circulation 2012

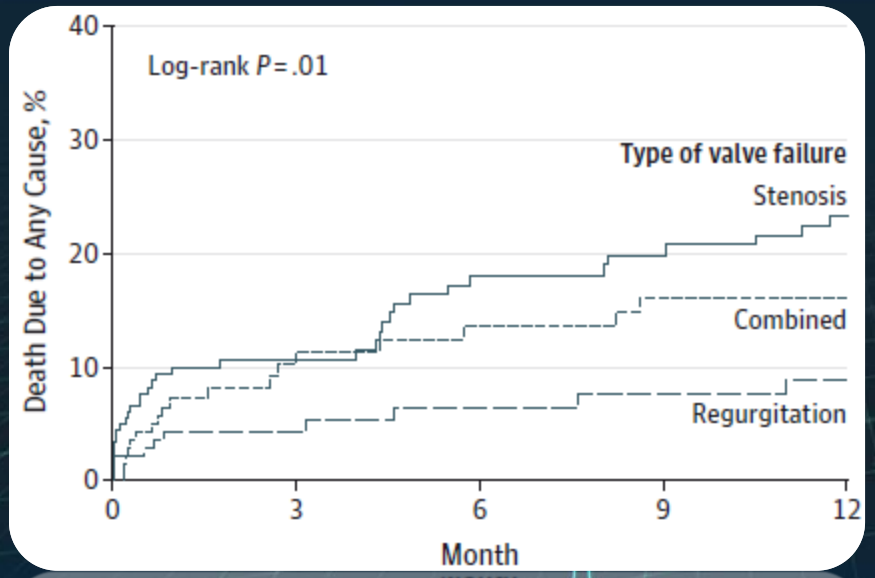
Original Investigation

Transcatheter Aortic Valve Implantation in Failed Bioprosthetic Surgical Valves

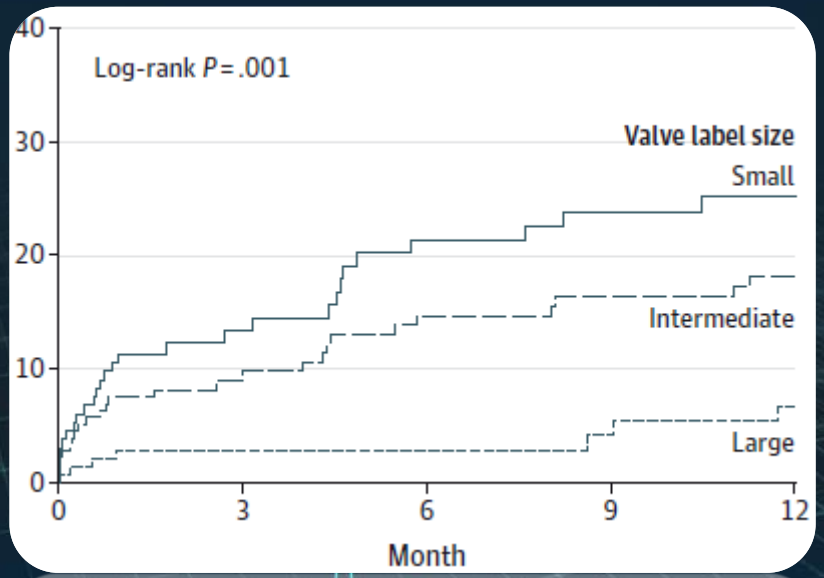
Danny Dvir, MD; John G. Webb, MD; Sabine Bleiziffer, MD; Miralem Pasic, MD, PhD; Ron Waksman, MD; Susheel Kodali, MD; Marco Barbanti, MD; Azeem Latib, MD; Ulrich Schaefer, MD; Josep Rodés-Cabau, MD; Hendrik Treede, MD; Nicolo Piazza, MD, PhD; David Hildick-Smith, MD; Dominique Himbert, MD; Thomas Walther, MD; Christian Hengstenberg, MD; Henrik Nissen, MD, PhD; Raffi Bekeredjian, MD; Patrizia Presbitero, MD; Enrico Ferrari, MD; Amit Segev, MD; Arend de Weger, MD; Stephan Windecker, MD; Neil E. Moat, FRCS; Massimo Napodano, MD; Manuel Wilbring, MD; Alfredo G. Cerillo, MD; Stephen Brecker, MD; Didier Tchetche, MD; Thierry Lefèvre, MD; Federico De Marco, MD; Claudia Fiorina, MD; Anna Sonia Petronio, MD; Rui C. Teles, MD; Luca Testa, MD; Jean-Claude Laborde, MD; Martin B. Leon, MD; Ran Kornowski, MD; for the Valve-in-Valve International Data Registry Investigators

N=459 from 55 cardiac centers

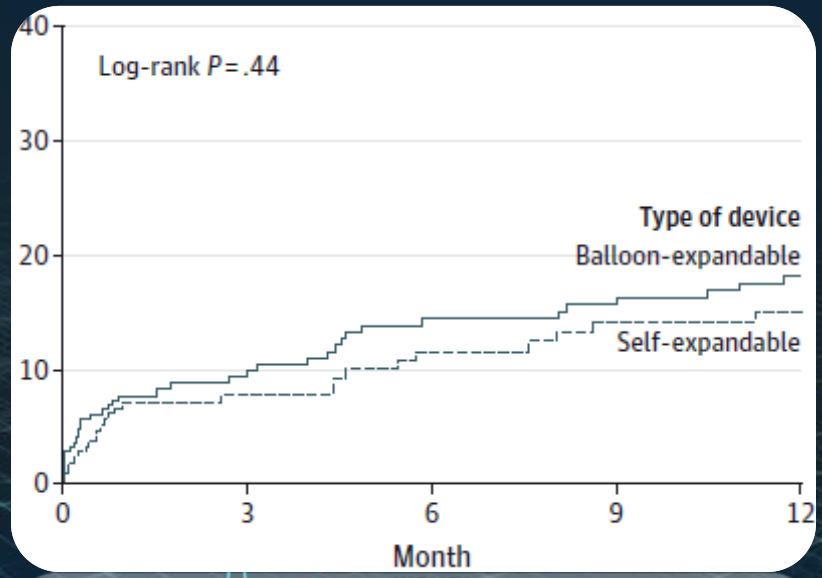
Mechanism of surgical valve failure



Surgical valve label size[a]



Device used during valve-in-valve implantation



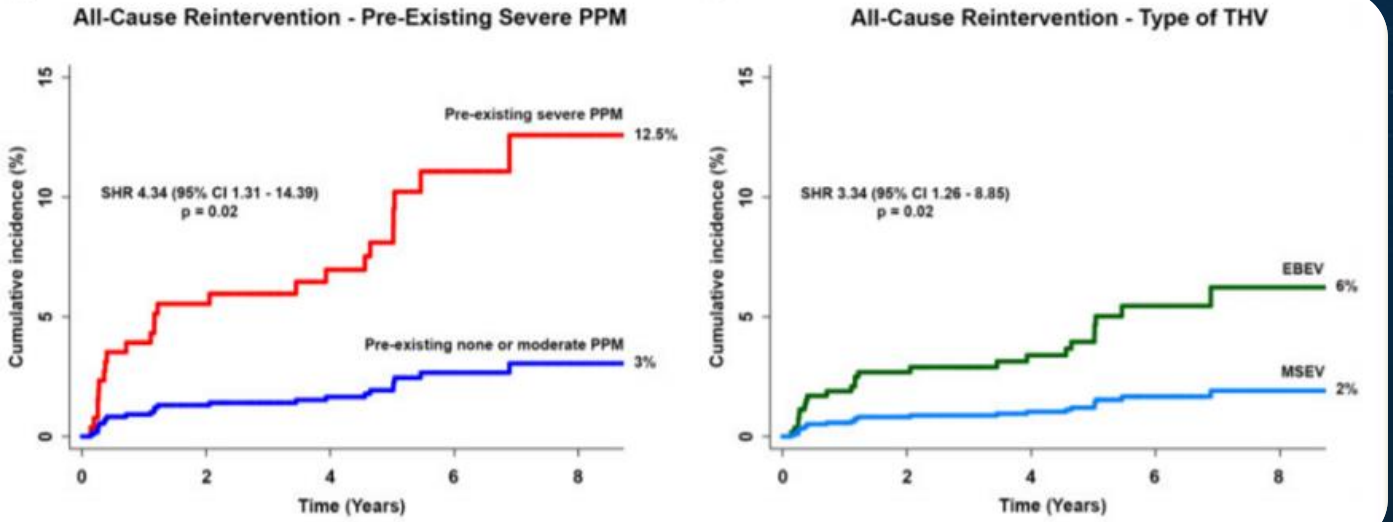
Dvir D,et al. JAMA 2014

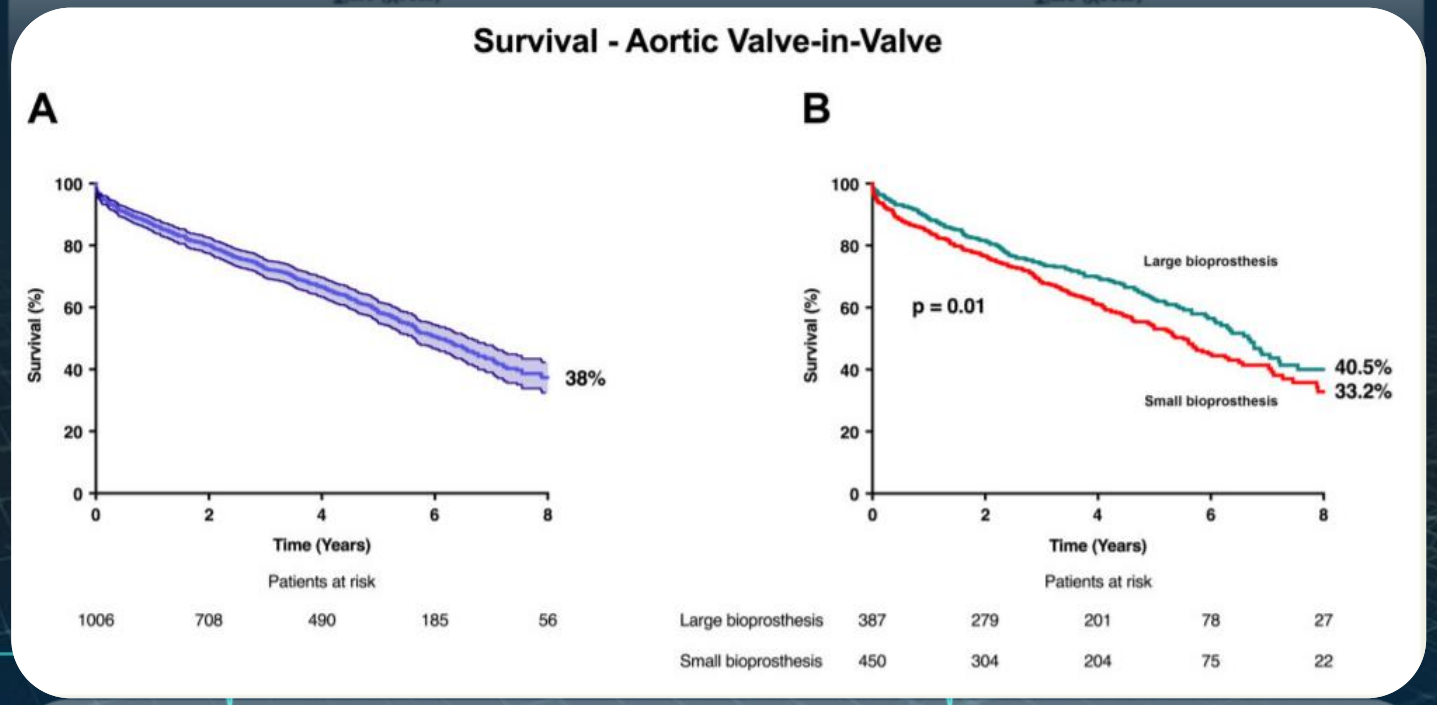
ESC European Society of Cardiology
European Heart Journal (2020) 0, 1–12
doi:10.1093/eurheartj/ehaa544
FASTTRACK CLINICAL RESEARCH

Long-term outcomes after transcatheter aortic valve implantation in failed bioprosthetic valves

Sabine Bleiziffer[1†], Matheus Simonato[2†], John G. Webb[3], Josep Rodés-Cabau[4], Philippe Pibarot[4], Ran Kornowski[5], Stephan Windecker[6], Magdalena Erlebach[7], Alison Duncan[8], Moritz Seiffert[9], Axel Unbehaun[10], Christian Frerker[11], Lars Conzelmann[12], Harindra Wijeysundera[13], Won-Keun Kim[14], Matteo Montorfano[15], Azeem Latib[16], Didier Tchetche[17], Abdelhakim Allali[18], Mohamed Abdel-Wahab[19], Katia Orvin[5], Stefan Stortecky[6], Henrik Nissen[20], Andreas Holzamer[21], Marina Urena[22], Luca Testa[23], Marco Agrifoglio[24], Brian Whisenant[25], Janarthanan Sathananthan[3], Massimo Napodano[26], Antonio Landi[26], Claudia Fiorina[27], Armin Zittermann[1], Verena Veulemans[28], Jan-Malte Sinning[29], Francesco Saia[30], Stephen Brecker[31], Patrizia Presbitero[32], Ole De Backer[33], Lars Søndergaard[33], Giuseppe Bruschi[34], Luis Nombela Franco[35], Anna Sonia Petronio[36], Marco Barbanti[37], Alfredo Cerillo[38], Konstantinos Spargias[39], Joachim Schofer[40], Mauricio Cohen[41], Antonio Muñoz-Garcia[42], Ariel Finkelstein[43], Matti Adam[11], Vicenç Serra[44], Rui Campante Teles[45], Didier Champagnac[46], Alessandro Iadanza[47], Piotr Chodor[48], Holger Eggebrecht[49], Robert Welsh[50], Adriano Caixeta[51], Stefano Salizzoni[52], Antonio Dager[53], Vincent Auffret[54], Asim Cheema[55], Timm Ubben[56], Marco Ancona[15], Tanja Rudolph[1], Jan Gummert[1], Elaine Tseng[57], Stephane Noble[58], Matjaz Bunc[59], David Roberts[60], Malek Kass[61], Anuj Gupta[62], Martin B. Leon[63], and Danny Dvir[64,65*]

Dvir D et al. EHJ 2020





TAVR Odyssey - 2020

- As a new wave of clinical indications for aortic valve therapy are being explored which will further expand the application of transcatheter solutions.
  - ✓ Valve vs. valve comparison
  - ✓ AS + concomitant disease (CAD, MR/TR, AF)
  - ✓ Severe asymptomatic AS
  - ✓ Moderate AS + CHF
  - ✓ High-risk severe AR

TAVR Odyssey – 2020
My Final Comments

- I had the privilege to witness the TAVR evolution over the past 20 years, to study the field, to learn the technique from the pioneers and top experts, to teach others, to help AS patients in need, to explore and research, to contribute a bit and to look for the future with great excitement.
- I feel lucky to be part of this thrilling journey and I recommend the young generation of Israeli cardiologists to “get on board” at the various tremendously important specialties of structural heart diseases and interventions.