Impact of Small Valve Size after TAVR in Women.

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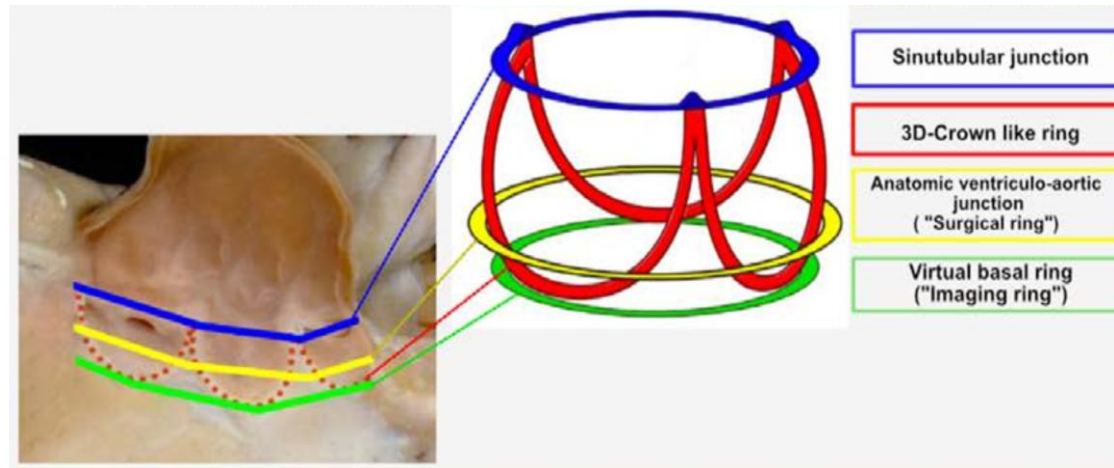Member EAPCI Internatinal Affairs Board
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SOLACI SOCIME '25
MEXICO CITY

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Annulus ≤ 20 mm o
area ≤ 400–430 mm²

- **There is a strong female predominance in patients undergoing aortic valve replacement (AVR).**Poorer outcomes are associated with AVR.
- There is an increased risk of prosthesis-patient mismatch (PPM).
- **Transcatheter aortic valve replacement (TAVR)** appears to be particularly beneficial, demonstrating:
  - Improved hemodynamics
  - Larger effective orifice area (EOA) and indexed EOA
  - Lower peak and mean trans prosthetic gradients.

What is the impact of small valve size after TAVR in women?
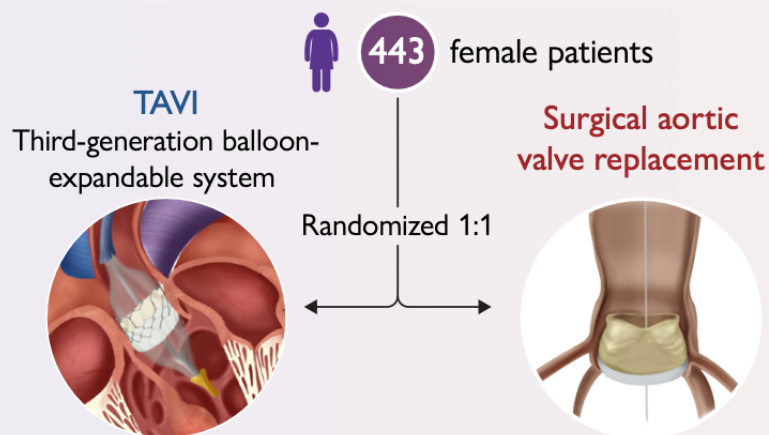
Freitas-Ferraz et al. Circulation 2019

RHEIA TRIAL

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Aim

The **RHEIA trial** compared outcomes with TAVI vs surgery for valve replacement in women all-comers with severe aortic stenosis
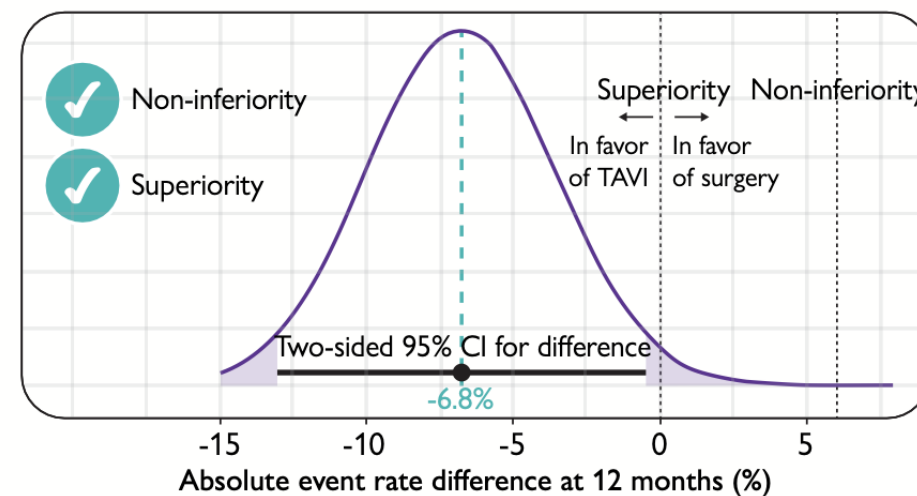
Study population

443 female patients

TAVI
Third-generation balloon-expandable system

Randomized 1:1

Surgical aortic valve replacement

Study sites

48 centres

12 countries in Europe

Primary composite endpoint: death, stroke, rehospitalization

Death, stroke, rehospitalization (%)

— Surgery
— TAVI

HR = 0.55
95% CI = [0.31, 0.96]

15.6%
8.9%

Months since procedure

✓ Non-inferiority
✓ Superiority

Superiority   Non-inferiority
In favor   In favor
of TAVI   of surgery

Two-sided 95% CI for difference
-6.8%

Absolute event rate difference at 12 months (%)

Eltchaninoff, Tchetche et al, EHJ 2025
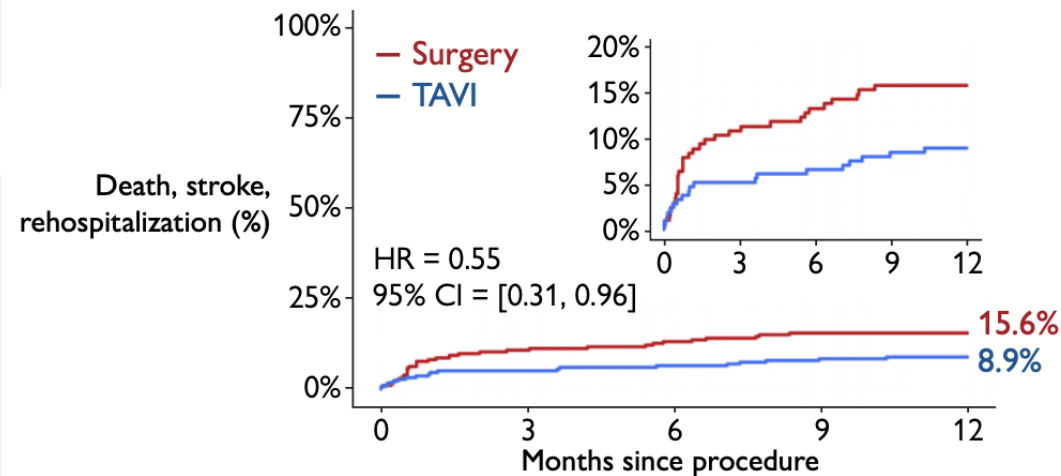
RHEIA trial included **low % of small valves** in TAVR patients & Only **BEV valves**

Valve size implanted	
20 mm– no./total no. (%)	10/215 (4.7%)
23 mm– no./total no. (%)	137/215 (63.7%)
26 mm– no./total no. (%)	58/215 (27.0%)
29 mm– no./total no. (%)	10/215 (4.7%)
Valves used	
Sapien 3– no./total no. (%)	93/215 (43.3%)
Sapien 3 Ultra– no./total no. (%)	122/215 (56.7%)

Eltchaninoff, Tchetche et al, EHJ 2025

Prevalence, predictors, and outcomes of patient prosthesis mismatch in women undergoing TAVI for severe aortic stenosis: Insights from the WIN-TAVI registry

Legend: ■ All TAVI ■ Valve ≤23mm ▦ Balloon expandable THV ▨ Self expanding THV

Patient prosthesis mismatch prevalence (%)
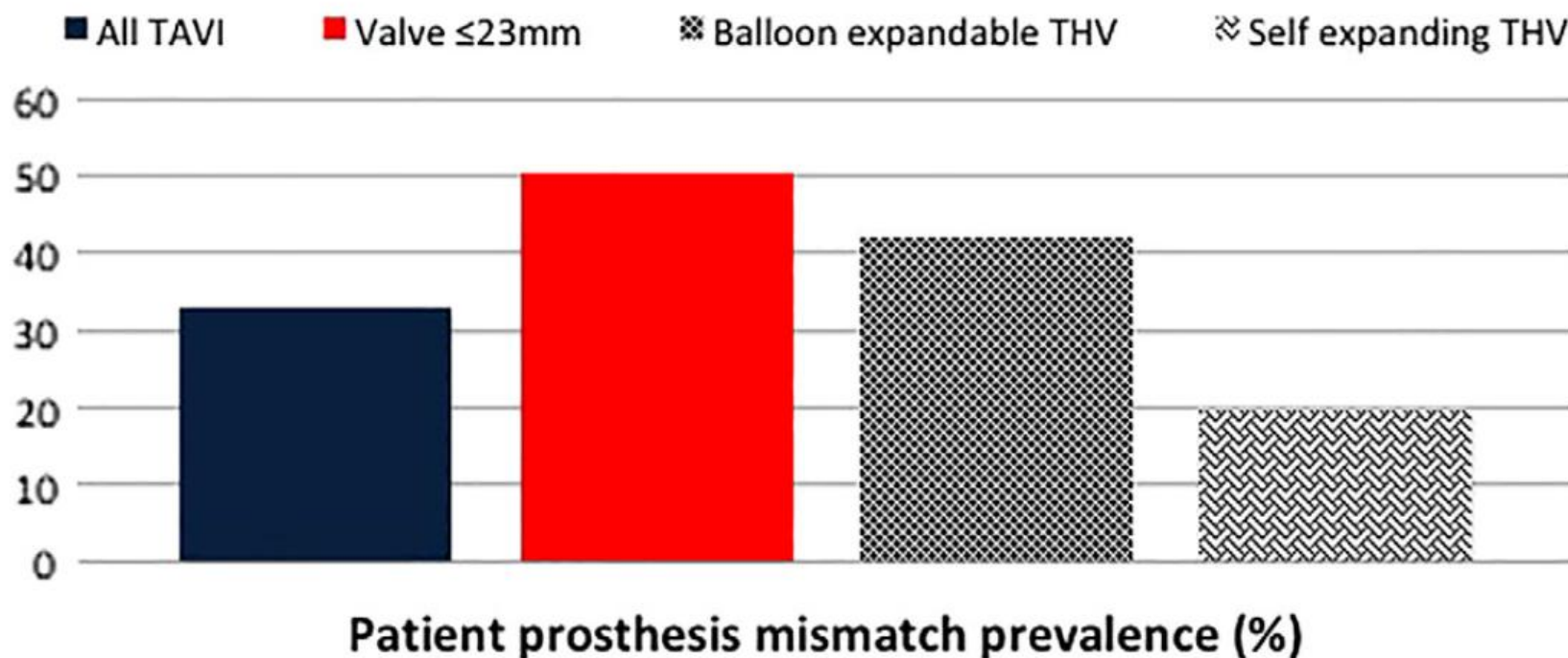
≈**1/3** of female patients included in **WIN Registry** presented **PPM**

Panoulas et al, Catheter Cardiovasc Interv. 2021

Main predictors for **PPM** included **BMI** & **small size valve**

Model excluding interaction between valve type and valve size≤23 mm

	OR	95% confidence interval		p-value
BMI	1.077	1.02	1.14	.009
Valve type				
Balloon expandable	Ref			
Self-expanding	0.669	0.32	1.39	.281
Others	1.552	0.70	3.42	.276
Valve ≤23 mm	3.385	1.77	6.46	<.001

Insights from WIN-TAVI Registry

Variable	PPM = 1, N = 82 (32.8%)	PPM = 0, N = 168 (67.2%)	p-value
Type of valve inserted			<.001
Edwards S3	22 (27.5%)	26 (16.0%)	
Edwards XT	17 (21.3%)	28 (17.2%)	
Evolut R	6 (7.5%)	16 (9.8%)	
Corevalve	15 (18.8%)	70 (42.9%)	
Direct flow	10 (12.5%)	5 (3.1%)	
Portico	0 (0.0%)	2 (1.2%)	
Lotus	9 (11.3%)	16 (9.8%)	
ACURATE neo	1 (1.3%)	0 (0.0%)	
Valve type			<.001
Balloon expandable	39 (48.8%)	54 (33.1%)	
Self-expanding	21 (26.3%)	86 (52.8%)	
Others	20 (25.0%)	23 (14.1%)	
Valve size			<.001
20 mm	1 (1.2%)	0 (0.0%)	
23 mm	49 (59.8%)	49 (29.2%)	
25 mm	7 (8.5%)	13 (7.7%)	
26 mm	19 (23.2%)	67 (39.9%)	
27 mm	2 (2.4%)	2 (1.2%)	
29 mm	4 (4.9%)	36 (21.4%)	
31 mm	0 (0.0%)	1 (0.6%)	
Valve ≤23 mm	50 (61.0%)	49 (29.2%)	<.001

Panoulas et al, Catheter Cardiovasc Interv. 2021

PPM was not associated with **clinical outcomes**

	PPM = 1, N = 82 (32.8%)	PPM = 0, N = 168 (67.2%)	*p*-value
30-day outcomes	*No. of events (%)*		
All-cause death	0 (0.0%)	3 (1.8%)	.225
All stroke	0 (0.0%)	2 (1.2%)	.322
Life-threatening bleeding	9 (11.0%)	19 (11.3%)	.948
Acute kidney injury	2 (2.4%)	3 (1.8%)	.728
Coronary artery obstruction	1 (1.2%)	2 (1.2%)	.984
Major vascular complication	9 (11.0%)	14 (8.3%)	.494
Valve-related dysfunction	0 (0.0%)	0 (0.0%)	n.a
VARC2 early safety	21 (25.6%)	43 (25.6%)	.888
1-year outcomes			
Death	4 (4.9%)	14 (8.5%)	.296
Cardiovascular death	2 (2.5%)	12 (7.4%)	.122
Stroke	4 (4.9%)	5 (3.0%)	.480
MACE (death, MI, stroke)	6 (7.3%)	19 (11.5%)	.289
Death or stroke	6 (7.3%)	19 (11.5%)	.289
Arrhythmia or conduction disturbance	16 (19.5%)	36 (21.4%)	.717

Insights from WIN-TAVI Registry

Panoulas et al, Catheter Cardiovasc Interv. 2021

Transcatheter Self-Expandable Valve Implantation for Aortic Stenosis in Small Aortic Annuli

The TAVI-SMALL Registry

TAVI-SMALL Registry

89% female patients

Regazzoli et al. JACC C. Interv. 2020
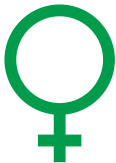
TABLE 1 Baseline Clinical Characteristics

	Overall (N = 859)	EvR (n = 397)	EvPRO (n = 84)	ACU (n = 201)	POR (n = 177)	p Value
Age, yrs	82.4 ± 0.2	82.0 ± 0.4	83.5 ± 0.7	82.7 ± 0.4	82.7 ± 0.5	0.244
Male	87 (10.1)	43 (10.8)	9 (10.7)	21 (10.5)	14 (7.9)	0.747
BMI, kg/m^2	26.6 ± 0.2	26.8 ± 0.4	26.5 ± 0.9	26.6 ± 0.4	26.2 ± 0.4	0.763
BSA, m^2	1.7 ± 0.01	1.7 ± 0.1	1.7 ± 0.1	1.7 ± 0.1	1.7 ± 0.1	0.141
Weight, kg	65.1 ± 0.5	64.7 ± 0.7	63.7 ± 1.4	66.5 ± 1	65 ± 1	0.347
Height, cm	158.3 ± 0.2	158.7 ± 0.3	156.8 ± 0.8	158.7 ± 0.6	157.6 ± 0.5	**0.044**
Hypertension	719 (83.8)	339 (85.4)	68 (81.9)	162 (80.6)	150 (84.8)	0.459
Diabetes mellitus	234 (27.3)	104 (26.2)	20 (24.1)	55 (27.4)	55 (31.1)	0.584
Dyslipidemia	418 (48.8)	202 (51)	40 (48.1)	86 (42.8)	90 (51.1)	0.253
COPD	93 (10.9)	52 (13.1)	3 (3.6)	26 (12.9)	12 (6.8)	**0.015**
Peripheral artery disease or prior PTA	140 (16.3)	72 (18.1)	16 (19.1)	30 (14.9)	22 (12.6)	0.321
Cerebrovascular disease	76 (8.9)	34 (8.6)	8 (9.5)	15 (7.5)	19 (10.8)	0.708
Previous BAV	21 (2.5)	14 (3.5)	1 (1.2)	3 (1.5)	3 (1.7)	0.300
Previous CABG	56 (6.5)	27 (6.8)	4 (4.8)	15 (7.5)	10 (5.7)	0.089
Previous PCI	203 (23.7)	87 (21.9)	12 (14.5)	53 (26.4)	51 (29)	**0.043**
Previous MI	93 (11.3)	42 (11.1)	8 (9.6)	24 (12.9)	19 (10.8)	0.857
Coronary artery disease	318 (37.1)	152 (38.4)	24 (28.6)	80 (39.8)	62 (35.2)	0.285
PM or ICD	87 (10.2)	37 (9.4)	12 (14.5)	19 (9.5)	19 (10.9)	0.538
Atrial fibrillation	200 (23.3)	82 (20.6)	21 (25.0)	47 (23.4)	50 (28.3)	0.249
Angina	140 (19)	79 (20.1)	10 (12.1)	27 (19)	24 (19.8)	0.395
NYHA functional class III or IV	626 (72.9)	294 (74.1)	68 (81.0)	135 (67.2)	129 (72.9)	0.095
STS-PROM, %	5.7 ± 0.2	5.9 ± 0.3	5.5 ± 0.4	5.7 ± 0.3	5.3 ± 0.2	0.337
Hemoglobin, g/dl	11.6 ± 0.1	11.5 ± 0.1	11.4 ± 0.2	11.9 ± 0.1	11.8 ± 0.2	0.064
NT-proBNP, pg/ml	2,842.3 ± 393.6	2,746 ± 571.0	3,655 ± 1,331.0	4,035 ± 1,436.0	2,000 ± 384.0	0.406

SEVs have good hemodynamic performance in patients with SAA →
low post-procedural gradients & large orifice áreas.

FIGURE 1 Indexed Effective Orifice Area and Mean Gradient From Baseline to 1 Year
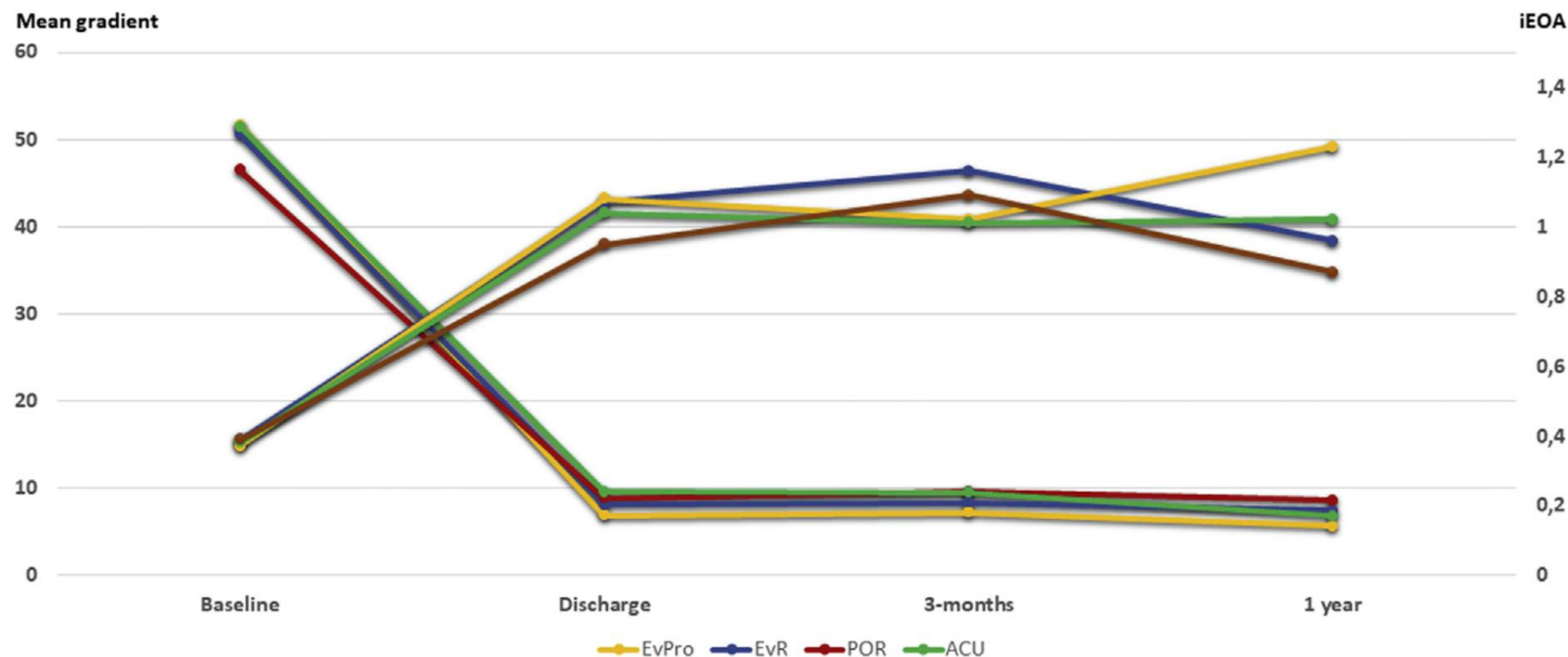
ACU = Acurate; EvPRO = Evolut PRO; EvR = Evolut R; iEOA = indexed effective orifice area; POR = Portico.

The EvR, EvPRO, and ACU seemed to outperform the POR regarding hemodynamic function slightly

Regazzoli et al. JACC C. Interv. 2020

TAVI-SMALL Registry

No significant differences between SEVs interms of **severe PPM** (**overall rate 9.4%**; p = 0.134),

Regazzoli et al. JACC C. Interv. 2020

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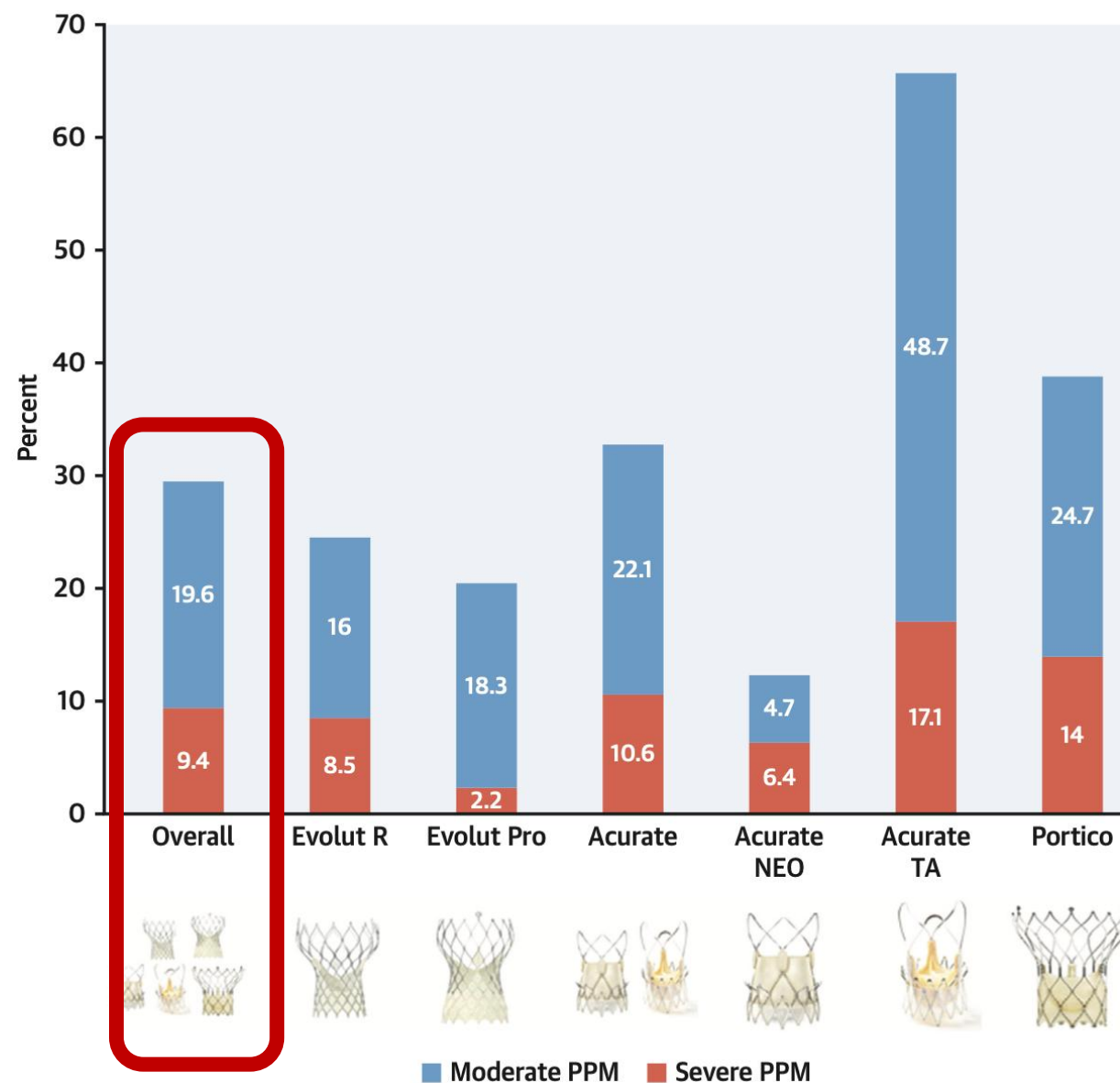
Self-Expanding or Balloon-Expandable TAVR in Patients with a Small Aortic Annulus

86.7% female patients

SMART trial

Bioprosthetic-Valve Dysfunction through 12 Months

Difference, −32.2 percentage points (95% CI, −38.7 to −25.6); P<0.001 for superiority
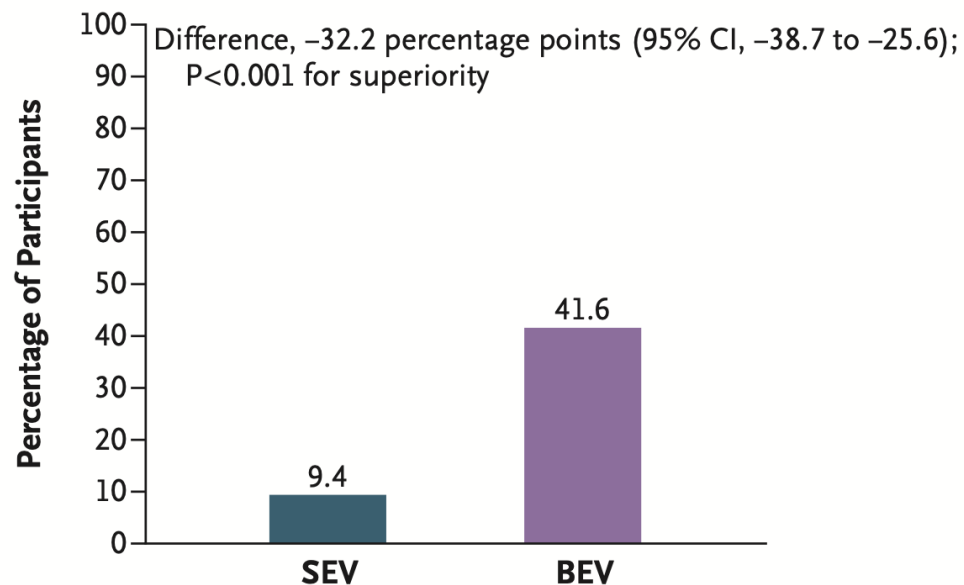
Percentage of Participants — SEV 9.4, BEV 41.6

Herrmann et al, NEJM 2024

Table 1. Characteristics of the Patients at Baseline (As-Treated Population).*

Characteristic	SEV (N=355)	BEV (N=361)
Age — yr	80.1±6.3	80.3±6.1
Body-surface area — m²	1.8±0.2	1.8±0.2
Female sex — no. (%)	312 (87.9)	309 (85.6)
STS-PROM — %	3.3±1.9	3.2±1.7
STS-PROM category — no. (%)		
<3%	182 (51.3)	191 (52.9)
3 to <5%	122 (34.4)	123 (34.1)
≥5%	51 (14.4)	47 (13.0)
NYHA functional class — no. (%)†		
I	4 (1.1)	6 (1.7)
II	197 (55.5)	211 (58.4)
III	150 (42.3)	144 (39.9)
IV	4 (1.1)	0
Diabetes — no. (%)	104 (29.3)	123 (34.1)
Hypertension — no. (%)	293 (82.5)	313 (86.7)
COPD or chronic lung disease — no./total no. (%)	61/339 (18.0)	62/353 (17.6)
Cerebrovascular disease — no./total no. (%)	42/351 (12.0)	41/360 (11.4)
Previous CABG — no./total no. (%)	12/354 (3.4)	18/361 (5.0)
Previous PCI — no./total no. (%)	60/353 (17.0)	84/360 (23.3)
Previous myocardial infarction — no. (%)	19 (5.4)	29 (8.0)
Arrhythmia — no./total no. (%)	83/355 (23.4)	85/360 (23.6)
Atrial fibrillation or flutter — no./total no. (%)	69/349 (19.8)	65/353 (18.4)
History of right bundle-branch block — no. (%)	21 (5.9)	25 (6.9)
Site-reported LVEF at screening — %‡	61.6±7.6	61.2±8.7
Coronary artery disease — no. (%)	125 (35.2)	148 (41.0)
Preexisting pacemaker or defibrillator — no. (%)	30 (8.5)	25 (6.9)
Tricuspid aortic-valve morphology — no. (%)	341 (96.1)	346 (95.8)
Treatment with vitamin K antagonist — no. (%)	16 (4.5)	16 (4.4)
Treatment with direct oral anticoagulant — no. (%)	54 (15.2)	57 (15.8)
Aortic annulus area — mm²	380.9±34.2	382.8±33.9

SMART Trial

A Mean Gradient at 12 Months

Difference, −8.0 (95% CI, −8.9 to −7.1)
P<0.001

Mean Gradient (mm Hg)

SEV (N=298)   BEV (N=301)
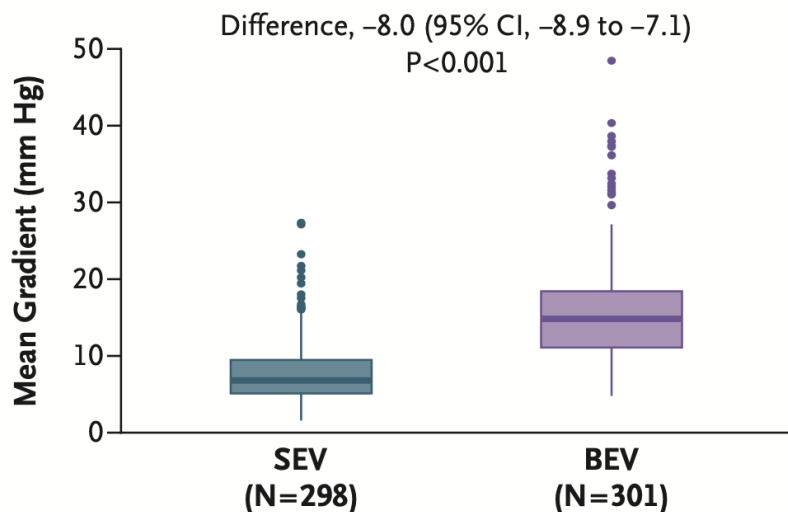
B Effective Orifice Area at 12 Months

Difference, 0.49 (95% CI, 0.42 to 0.56)
P<0.001

Effective Orifice Area (cm²)

SEV (N=267)   BEV (N=266)
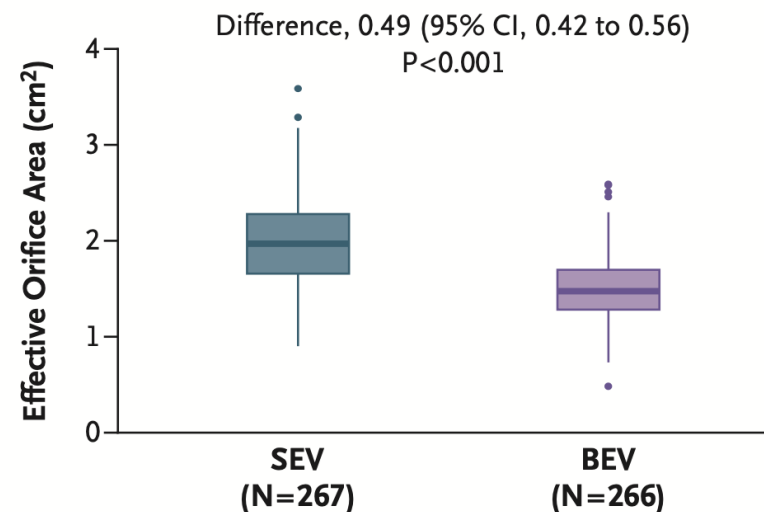
C Hemodynamic Structural Valve Dysfunction through 12 Months

Difference, −29.3 (95% CI, −34.7 to −23.8)
P<0.001

Percentage of Patients

3.5   32.8

SEV (N=350)   BEV (N=365)
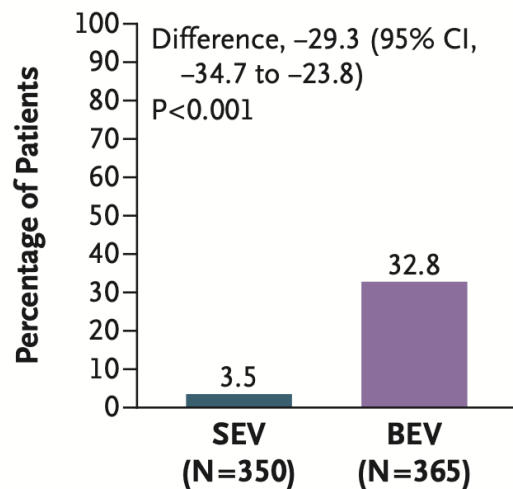
D Bioprosthetic-Valve Dysfunction in Women through 12 Months

Difference, −33.0 (95% CI, −40.2 to −25.9)
P<0.001

Percentage of Patients

10.2   43.3

SEV (N=307)   BEV (N=313)
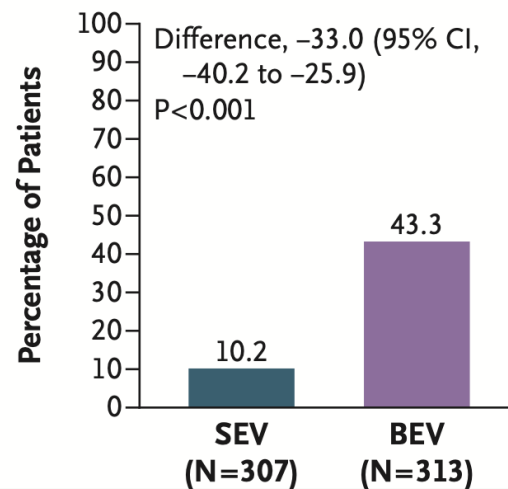
E Moderate or Severe Prosthesis–Patient Mismatch at 30 Days

Difference, −24.1 (95% CI, −30.5 to −17.7)
P<0.001

Percentage of Patients

11.2   35.3

SEV (N=273)   BEV (N=296)

Herrmann et al, NEJM 2024
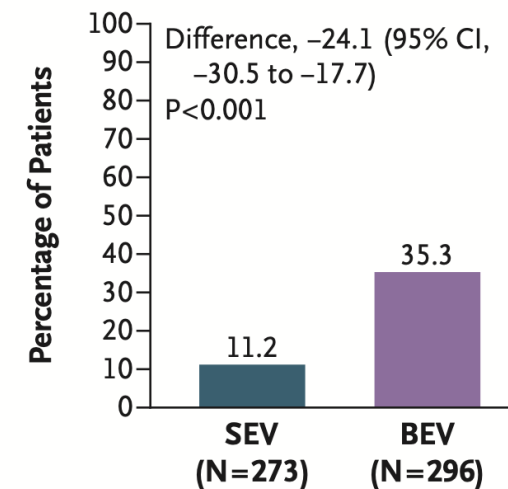
SMART trial

B Subgroup Analysis of Second Coprimary End Point through 12 Months

Subgroup	SEV	BEV	Hazard Ratio for Bioprosthetic-Valve Dysfunction (95% CI)	
	no. of patients with an event/total no. (Kaplan–Meier % at 12 mo)			
Age				
<75 yr	9/60 (19)	32/66 (53)		0.26 (0.13–0.55)
≥75 yr	19/290 (8)	99/299 (39)		0.17 (0.10–0.28)
Sex				
Female	22/307 (8)	112/313 (42)		0.17 (0.11–0.27)
Male	6/43 (16)	19/52 (40)		0.35 (0.14–0.89)
STS-PROM				
<3%	22/181 (14)	68/192 (40)		0.31 (0.19–0.50)
≥3 to <5%	5/118 (5)	51/126 (47)		0.09 (0.04–0.22)
≥5 to <8%	1/37 (3)	10/35 (34)		0.12 (0.02–0.69)
≥8%	0/14	2/12 (33)		0.15 (0.01–3.32)
Left ventricular ejection fraction				
<50%	1/15 (10)	7/22 (46)		0.16 (0.02–1.33)
≥50%	27/333 (9)	123/342 (41)		0.20 (0.13–0.30)
Dialysis owing to renal dysfunction				
Yes	0/5	0/3		—
No	28/344 (10)	131/362 (42)		0.20 (0.13–0.29)
Atrial fibrillation or flutter				
Yes	5/67 (8)	22/67 (42)		0.20 (0.07–0.52)
No	23/277 (10)	104/290 (41)		0.20 (0.13–0.32)
Previous cerebrovascular accident				
Yes	2/23 (10)	7/30 (34)		0.36 (0.08–1.75)
No	26/321 (10)	123/334 (42)		0.19 (0.12–0.29)
Preexisting left bundle-branch block or complete heart block				
Yes	3/27 (13)	8/19 (49)		0.22 (0.06–0.81)
No	25/313 (9)	123/338 (42)		0.19 (0.12–0.29)

SEV Better ← | → BEV Better

Herrmann et al, NEJM 2024

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TAKE HOME MESSAGES

📣 Female anatomy → higher prevalence of SAA

📣 SAA → has a higher risk of PPM

📣 **Supra-annular SEV → better hemodynamic performance** & **lower PPM rates** in women with small annuli

📣 **Mortality and clinical event rates at 1–2 years** are similar in women treated with **small versus larger valves**.

📣 **Careful pre-procedural planning** and consideration of **female-specific anatomical characteristics** are critical for optimal outcomes.