Supplementary data

Supplementary Table 1. Predicted EOA based on transcatheter heart valve type and size.

	Predicted EOA according to Hahn et al. (9)
SAPIEN XT	
23 mm	1.41 cm²
26 mm	1.74 cm²
29 mm	2.06 cm²
SAPIEN 3 / 3 Ultra	
20 mm	1.22 cm²
23 mm	1.45 cm²
26 mm	1.74 cm²
29 mm	1.89 cm²
CoreValve	
23 mm	1.12 cm²
26 mm	1.74 cm²
29 mm	1.97 cm²
31 mm	2.15 cm²
Evolut R/PRO/PRO Plus	
23 mm	1.09 cm²
26 mm	1.69 cm²
29 mm	1.97 cm²
34 mm	2.6 cm²

EOA: effective orifice area.

Supplementary Table 2. Predicted EOA based on aortic annulus dimensions by preprocedural computed tomography.

	Predicted EOA according to Hahn et al. (9)
SAPIEN 3 / 3 Ultra	
Annulus area	
248 to 384 mm^2	1.41 cm^2
385 to 439 mm^2	1.58 cm^2
440 to 488 mm^2	1.73 cm^2
489 to 537 mm^2	1.79 cm^2
538 to 678 mm^2	1.91 cm^2
CoreValve	
Perimeter derived aortic annulus diameter	
≤22.8 mm	1.71 cm^2
>22.8 to 24.5 mm	1.80 cm^2
>24.5 to 25.9 mm	1.92 cm^2
>25.9 to 27.6 mm	1.94 cm^2
>27.6 to 41.5 mm	2.06 cm^2
Evolut R/PRO/PRO Plus	
Perimeter derived aortic annulus diameter	
≤22.3 mm	1.66 cm^2
>22.3 to 23.2 mm	1.82 cm^2
>23.2 to 24.7 mm	1.98 cm^2
>24.7 to 26.2 mm	1.98 cm^2
>26.2 to 30.2 mm	2.56 cm^2

EOA: effective orifice area.

Supplementary Table 3. Frequency of PPM according to device type.

	All patients (N = 2,463)	Balloon-expandable valve (N = 1,551)	Self-expanding valve (N = 912)	P value
Measured PPM				
Measured EOAi (cm^2/m^2)	0.95 ± 0.29	0.92 ± 0.28	1.0 ± 0.31	<0.001
Moderate or severe measured PPM, n (%)	879 (35.7%)	619 (39.9%)	260 (28.5%)	<0.001
Moderate measured PPM, n (%)	664 (27.0%)	475 (30.6%)	189 (20.7%)	<0.001
Severe measured PPM, n (%)	215 (8.7%)	144 (9.3%)	71 (7.8%)	0.210
Predicted PPM_{THV}				
Predicted $EOAi_{THV}$ (cm^2/m^2)	0.96 ± 0.15	0.92 ± 0.12	1.03 ± 0.18	<0.001
Moderate or severe predicted PPM_{THV}, n (%)	308 (12.5%)	232 (15.0%)	76 (8.3%)	<0.001
Moderate predicted PPM_{THV}, n (%)	279 (11.3%)	232 (15.0%)	47 (5.2%)	<0.001
Severe predicted PPM_{THV}, n (%)	29 (1.2%)	0	29 (3.2%)	<0.001
Predicted PPM_{CT}	**N = 1,570**	**N = 891**	**N = 679**	
Predicted $EOAi_{CT}$ (cm^2/m^2)	0.97 ± 0.15	0.90 ± 0.12	1.05 ± 0.15	<0.001
Moderate or severe predicted PPM_{CT}, n (%)	190 (12.1%)	171 (19.2%)	19 (2.8%)	<0.001
Moderate predicted PPM_{CT}, n (%)	189 (12.0%)	170 (19.1%)	19 (2.8%)	<0.001

Severe predicted PPM_{CT}, n (%)	1 (0.1%)	1 (0.1%)	0	1.00

Values are mean ± SD or n (%).

EOAi = effective orifice area index body surface area; PPM = prosthesis-patient mismatch; PPM_{CT} = PPM defined by predicted EOA derived from pre-procedural computed tomography; PPM_{THV} = PPM defined by predicted EOA for each size and model of implanted transcatheter heart valve.

Supplementary Table 4. Baseline and procedural characteristics according to measured and predicted PPM.

	All patient	Measured PPM				Predicted PPM_{THV}			
	(N = 2,463)	None (N = 1,584)	Moderate (N = 664)	Severe (N = 215)	P value	None (N = 2,155)	Moderate (N = 279)	Severe (N = 29)	P value
Age, year	81.8 ± 6.4	81.9 ± 6.3	81.8 ± 6.5	81.1 ± 7.0	0.224	81.9 ± 6.4	80.8 ± 6.8	82.0 ± 5.5	0.019
Female, n (%)	1154 (46.9%)	749 (47.3%)	304 (45.8%)	101 (47.0%)	0.808	984 (45.7%)	149 (53.4%)	21 (72.4%)	0.001
Body mass index, kg/m^2	26.7 ± 5.3	26.3 ± 5.1	27.0 ± 5.4	28.1 ± 5.8	<0.001	26.5 ± 5.3	28.0 ± 5.5	27.0 ± 2.5	<0.001
Body mass index ≥30 kg/m^2, n (%)	561 (22.8%)	381 (24.1%)	130 (19.6%)	50 (23.3%)	0.069	515 (23.9%)	44 (15.8%)	2 (6.9%)	0.001
Body surface area, m^2	1.86 ± 0.25	1.83 ± 0.24	1.89 ± 0.24	1.95 ± 0.26	<0.001	1.84 ± 0.24	1.95 ± 0.27	1.85 ± 0.13	<0.001
STS PROM, %	5.02 ± 3.86	5.02 ± 3.96	5.03 ± 3.62	5.01 ± 3.86	0.995	5.07 ± 3.90	4.51 ± 3.48	6.21 ± 3.98	0.018
NYHA III or IV, n (%)	1536 (62.4%)	972 (61.4%)	433 (65.3%)	131 (60.9%)	0.191	1356 (63.0%)	157 (56.3%)	23 (79.3%)	0.016
TAVI for degenerative prosthesis, n (%)	129 (5.2%)	63 (4.0%)	42 (6.3%)	24 (11.2%)	<0.001	83 (3.9%)	29 (10.4%)	17 (58.6%)	<0.001
Concomitant diseases									

Hypertension, n (%)	2164 (87.9%)	1384 (87.4%)	588 (88.6%)	192 (89.3%)	0.586	1880 (87.2%)	258 (92.5%)	26 (89.7%)	0.040
Diabetes mellitus, n (%)	672 (27.3%)	415 (26.2%)	198 (29.8%)	59 (27.4%)	0.213	579 (26.9%)	87 (31.2%)	6 (20.7%)	0.227
Renal failure (eGFR <60 mL/min/1.73 m^2), n (%)	1599 (64.9%)	1032 (65.2%)	435 (65.5%)	132 (61.4%)	0.515	1425 (66.2%)	151 (54.1%)	23 (79.3%)	<0.001
Coronary artery disease, n (%)	1393 (56.6%)	881 (55.6%)	381 (57.4%)	131 (60.9%)	0.298	1210 (56.1%)	164 (58.8%)	19 (65.5%)	0.437
Previous history									
Atrial fibrillation, n (%)	806 (32.7%)	480 (30.3%)	251 (37.8%)	75 (34.9%)	0.002	714 (33.1%)	83 (29.7%)	9 (31.0%)	0.516
Peripheral artery disease, n (%)	309 (12.5%)	198 (12.5%)	76 (11.4%)	35 (16.3%)	0.177	274 (12.7%)	31 (11.1%)	4 (13.8%)	0.733
Echocardiography									
Indexed aortic valve area, cm^2/m^2	0.28 ± 0.44	0.29 ± 0.54	0.27 ± 0.10	0.26 ± 0.08	0.366	0.27 ± 0.09	0.35 ± 1.29	0.28 ± 0.09	0.031
Mean aortic valve gradient, mmHg	40.1 ± 16.6	40.2 ± 16.9	40.1 ± 16.6	39.1 ± 15.1	0.654	40.1 ± 16.8	40.0 ± 16.0	39.9 ± 15.6	0.991
LVEF, %	55.0 ± 13.7	55.9 ± 13.4	53.7 ± 14.0	52.0 ± 14.3	<0.001	54.6 ± 13.8	57.3 ± 12.5	56.5 ± 10.8	0.011
Aortic regurgitation moderate or severe, n (%)	251 (10.2%)	153 (9.7%)	74 (11.2%)	24 (11.2%)	0.498	218 (10.1%)	27 (9.7%)	6 (20.7%)	0.167
Mitral regurgitation moderate or severe, n (%)	429 (20.1%)	253 (18.3%)	127 (21.9%)	49 (27.2%)	0.008	384 (20.3%)	37 (16.4%)	8 (32.0%)	0.126

Tricuspid regurgitation moderate or severe, n (%)	237 (12.2%)	139 (11.2%)	74 (14.1%)	24 (14.0%)	0.176	207 (12.1%)	24 (12.0%)	6 (25.0%)	0.158
Procedural characteristics and outcomes									
General anesthesia, n (%)	422 (17.1%)	271 (17.1%)	114 (17.2%)	37 (17.2%)	0.999	366 (17.0%)	50 (17.9%)	6 (20.7%)	0.813
Femoral main access site, n (%)	2306 (93.6%)	1479 (93.4%)	626 (94.3%)	201 (93.5%)	0.722	2020 (93.7%)	259 (92.8%)	27 (93.1%)	0.839
Valve type, n (%)					<0.001				<0.001
Balloon-expandable	1551 (63.0%)	932 (58.8%)	475 (71.5%)	144 (67.0%)	<0.001	1319 (61.2%)	232 (83.2%)	0	<0.001
Self-expanding	912 (37.0%)	652 (41.2%)	189 (28.5%)	71 (33.0%)	<0.001	836 (38.8%)	47 (16.8%)	29 (100.0%)	<0.001
Device generation, n (%)					<0.001				<0.001
Early-generation devices	604 (24.5%)	429 (27.1%)	127 (19.1%)	48 (22.3%)	<0.001	558 (25.9%)	41 (14.7%)	5 (17.2%)	<0.001
Newer-generation devices	1859 (75.5%)	1155 (72.9%)	537 (80.9%)	167 (77.7%)	<0.001	1597 (74.1%)	238 (85.3%)	24 (82.8%)	<0.001
Valve size, mm	26.6 ± 2.3	26.8 ± 2.2	26.3 ± 2.4	25.9 ± 2.6	<0.001	27.0 ± 2.1	23.9 ± 1.6	23.0 ± 0.0	<0.001
Valve size ≤23 mm, n (%)	424 (17.2%)	200 (12.6%)	153 (23.0%)	71 (33.0%)	<0.001	194 (9.0%)	201 (72.0%)	29 (100%)	<0.001

Values are mean ± SD or n (%). Early-generation devices includes Medtronic CoreValve and SAPIEN XT. Newer-generation includes SAPIEN 3/SAPIEN 3 Ultra and Evolut R/PRO/PRO Plus.

eGFR = estimated glomerular filtration rate; LVEF = left ventricular ejection fraction; NYHA = New York Heart Association; STS-PROM = society of thoracic surgeons predicted risk of mortality; TAVR = transcatheter aortic valve replacement. Other abbreviations as in Table 1.

Supplementary Table 5. Post-TAVR valve haemodynamics.

	Measured PPM				Predicted PPM_{THV}			
	None (N = 1,584)	**Moderate (N = 664)**	**Severe (N = 215)**	**P value**	**None (N = 2,155)**	**Moderate (N = 279)**	**Severe (N = 29)**	**P value**
Prosthetic mean gradient, mmHg	9.1 ± 4.0	11.5 ± 4.4	13.4 ± 6.4	<0.001	9.7 ± 4.3	13.4 ± 5.4	13.6 ± 6.7	<0.001
High residual gradient (mean gradient ≥20 mmHg), n (%)	17 (1.1%)	34 (5.2%)	31 (14.6%)	<0.001	46 (2.1%)	33 (12.0%)	3 (10.3%)	<0.001
Measured EOAi, cm^2/m^2	1.09 ± 0.26	0.74 ± 0.07	0.54 ± 0.09	<0.001	0.96 ± 0.29	0.82 ± 0.29	0.75 ± 0.19	<0.001
Moderate or severe aortic regurgitation, n (%)	64 (4.1%)	24 (3.6%)	9 (4.2%)	0.875	90 (4.2%)	7 (2.6%)	0	0.236
Left ventricular ejection fraction, (%)	57.1 ± 12.9	54.1 ± 13.5	52.4 ± 15.8	<0.001	55.7 ± 13.4	57.2 ± 14.1	56.6 ± 9.2	0.380
Left ventricular ejection fraction <50%, n (%)	186 (21.7%)	113 (30.7%)	39 (33.1%)	<0.001	303 (26.0%)	30 (18.5%)	5 (27.8%)	0.116
Stroke volume index, mL/m^2	40.0 ± 11.7	32.3 ± 8.3	29.8 ± 10.8	<0.001	36.9 ± 11.5	37.7 ± 12.0	35.2 ± 9.0	0.382
Left ventricular ejection fraction and stroke volume index were evaluated by transthoracic echocardiography at discharge. Abbreviations as in Table 1.								

Supplementary Table 6. Crude hazard ratios for clinical outcomes according to the method for the definition of PPM.

	Measured PPM				Predicted PPM_{THV}			
	Moderate vs. None		Severe vs. None		Moderate vs. None		Severe vs. None	
	Crude HR (95% CI)	P value	Crude HR (95% CI)	P value	Crude HR (95% CI)	P value	Crude HR (95% CI)	P value
At 1 year								
All-cause death, n (%)	1.18 (0.89-1.55)	0.245	1.14 (0.74-1.75)	0.547	0.49 (0.29-0.82)	0.007	0.62 (0.15-2.50)	0.501
Cardiovascular death, n (%)	1.29 (0.92-1.82)	0.138	1.25 (0.73-2.12)	0.413	0.52 (0.27-0.98)	0.044	0.99 (0.24-3.99)	0.986
Structural valve deterioration, n (%)	1.03 (0.49-2.17)	0.930	1.60 (0.61-4.22)	0.339	1.18 (0.46-3.01)	0.736	-	-
Repeat aortic valve intervention, n (%)	1.08 (0.38-3.11)	0.884	2.69 (0.86-8.45)	0.090	2.59 (0.94-7.12)	0.065	-	-
At 5 year								
All-cause death, n (%)	1.18 (0.99-1.41)	0.066	1.01 (0.77-1.33)	0.938	0.64 (0.47-0.88)	0.005	0.59 (0.25-1.43)	0.247
Cardiovascular death, n (%)	1.27 (1.03-1.57)	0.024	1.05 (0.75-1.46)	0.770	0.70 (0.49-1.00)	0.048	0.70 (0.26-1.87)	0.477
Structural valve deterioration, n (%)	1.35 (0.73-2.51)	0.339	2.13 (1.01-4.48)	0.047	1.03 (0.44-2.40)	0.949	-	-
Repeat aortic valve intervention, n (%)	1.09 (0.42-2.81)	0.860	2.44 (0.89-6.72)	0.084	3.03 (1.27-7.21)	0.012	-	-

At 10 year								
All-cause death, n (%)	1.17 (0.99-1.38)	0.061	1.11 (0.86-1.44)	0.409	0.69 (0.52 - 0.90)	0.007	0.57 (0.26 - 1.28)	0.176
Cardiovascular death, n (%)	1.24 (1.02-1.51)	0.029	1.17 (0.87-1.59)	0.304	0.71 (0.52 - 0.98)	0.039	0.67 (0.28 - 1.62)	0.372
Structural valve deterioration, n (%)	1.21 (0.67-2.20)	0.528	2.05 (0.98-4.28)	0.056	1.11 (0.51 - 2.45)	0.789	-	-
Repeat aortic valve intervention, n (%)	1.07 (0.44-2.58)	0.887	2.36 (0.87-6.42)	0.093	3.79 (1.72 - 8.34)	0.001	-	-

Event counts with Kaplan-Meier failure rates (%) counting the first event of each type only per patient. Patients were censored at last valid contact with events assessed and adjudicated. Adjusted hazard ratios and p-values after adjusting for age, gender and STS-PROM.

CI = confidence interval; HR = hazard ratio; PPM = prosthesis-patient mismatch; STS-PROM = society of thoracic surgeons predicted risk of mortality.

Supplementary Table 7. Residual heart failure symptoms according to the method for the definition of PPM.

	Measured PPM							Predicted PPM_{THV}						
	None	Moderate	Severe	Moderate vs. None		Severe vs. None		None	Moderate	Severe	Moderate vs. None		Severe vs. None	
	N=1584	N=664	N=215	RR (95% CI)	P value	RR (95% CI)	P value	N=2155	N=279	N=29	RR (95% CI)	P value	RR (95% CI)	P value
NYHA class III or IV (%) at 1 year	127/1244 (10.2%)	53/517 (10.3%)	18/171 (10.5%)	1.0 (0.74 - 1.36)	0.979	1.03 (0.65 - 1.65)	0.898	173/1683 (10.3%)	21/225 (9.3%)	4/24 (16.7%)	0.91 (0.59 - 1.40)	0.661	1.62 (0.66 - 4.01)	0.296
NYHA class III or IV (%) at 5 years	57/366 (15.6%)	19/131 (14.5%)	6/57 (10.5%)	0.93 (0.58 - 1.50)	0.771	0.68 (0.31 - 1.50)	0.334	72/489 (14.7%)	9/56 (16.1%)	1/9 (11.1%)	1.09 (0.58 - 2.06)	0.787	0.75 (0.12 - 4.86)	0.767
NYHA class III or IV (%) at 10 years	6/34 (17.6%)	2/7 (28.6%)	1/1 (100.0%)	1.62 (0.40 - 6.53)	0.498	5.67 (2.72 - 11.8)	<0.001	8/37 (21.6%)	1/4 (25.0%)	0/1 (0%)	1.16 (0.19 - 7.19)	0.876	-	-

Risk ratios (95% CIs) from robustified Poisson regression are reported, with corresponding P values.
CI = confidence interval; NYHA = New York Heat Association; RR = risk ratio; PPM = prosthesis-patient mismatch; PPMTHV = prosthesis-patient mismatch defined by the normal reference values of effective orifice area for each size and model of implanted transcatheter heart valve.

Supplementary Table 8. Crude hazard ratios for clinical outcomes according to the method for the definition of PPM in a competing risk analysis.

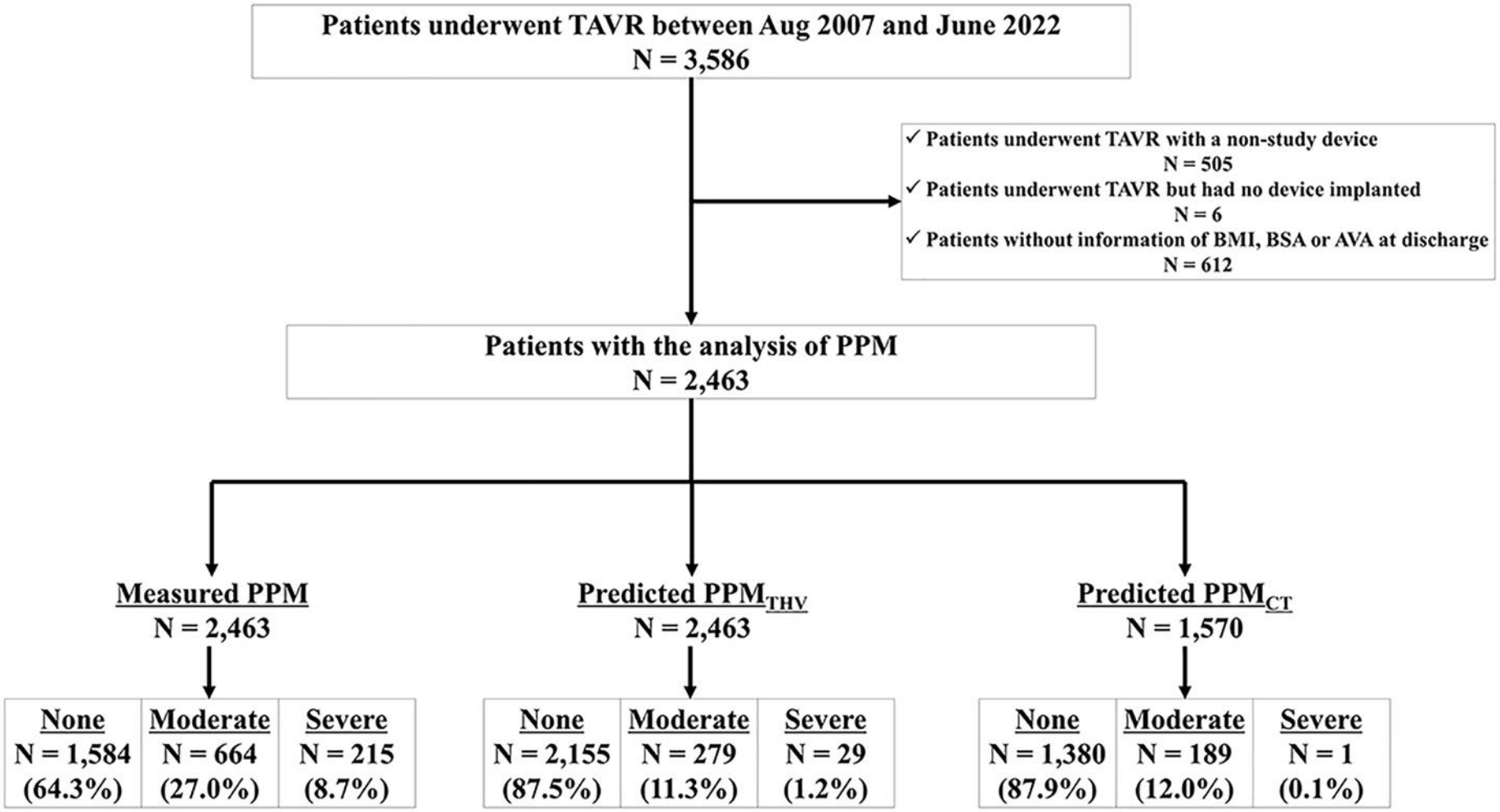
	Measured PPM				Predicted PPM_{THV}			
	Moderate vs. None		Severe vs. None		Moderate vs. None		Severe vs. None	
	Crude sHR (95% CI)	P value	Crude sHR (95% CI)	P value	Crude sHR (95% CI)	P value	Crude sHR (95% CI)	P value
At 1 year								
Cardiovascular death, n (%)	1.29 (0.92-1.81)	0.142	1.25 (0.73-2.11)	0.416	0.52 (0.28-0.99)	0.047	1.01 (0.26-3.95)	0.989
Structural valve deterioration, n (%)	1.02 (0.49-2.15)	0.949	1.60 (0.60-4.22)	0.345	1.21 (0.47-3.10)	0.692	-	-
Repeat aortic valve intervention, n (%)	1.08 (0.37-3.10)	0.891	2.68 (0.85-8.43)	0.091	2.62 (0.95-7.22)	0.062	-	-
At 5 year								
Cardiovascular death, n (%)	1.17 (0.96-1.42)	0.114	1.03 (0.74-1.42)	0.875	0.68 (0.48-0.95)	0.025	0.64 (0.23-1.76)	0.384
Structural valve deterioration, n (%)	1.18 (0.66-2.11)	0.576	1.93 (0.93-4.00)	0.078	1.14 (0.52-2.52)	0.739	-	-
Repeat aortic valve intervention, n (%)	1.21 (0.52-2.83)	0.657	2.35 (0.86-6.42)	0.095	3.29 (1.45-7.49)	0.004	-	-
At 10 year								

Cardiovascular death, n (%)	1.17 (0.98-1.39)	0.082	1.13 (0.86-1.49)	0.376	0.70 (0.52-0.94)	0.018	0.66 (0.28-1.58)	0.354
Structural valve deterioration, n (%)	1.17 (0.68-2.02)	0.577	1.71 (0.83-3.52)	0.144	1.19 (0.57-2.50)	0.639	-	-
Repeat aortic valve intervention, n (%)	1.17 (0.53-2.58)	0.702	2.03 (0.76-5.42)	0.159	3.89 (1.83-8.24)	<0.001	-	-

Competing risk with death, or in case of cardiovascular death with non-cardiovascular death, reported are subdistributions of the hazard ratio (sHR) with confidence intervals (95% CI). Adjusted hazard ratios and p-values after adjusting for age, gender and STS-PROM.

PPM = prosthesis-patient mismatch; PPMTHV = prosthesis-patient mismatch defined by the normal reference values of effective orifice area for each size and model of implanted transcatheter heart valve; STS -PROM = society of thoracic surgeons predicted risk of mortality.

Supplementary Figure 1. Study flowchart.



AVA = aortic valve area; BMI = body mass index; BSA = body surface area. Other abbreviations as Central Illustration.