

Supplemental Material

Table S1. Definitions of causes of death. Only the underlying cause of death was used.

	ICD-10 (1997-)
Cardiovascular death	I00-I99
Cancer death	C00-C99, D00-D48
Other death	Remaining

ICD = International Statistical Classification of Diseases and Related Health Problems

Table S2. Crude probability of death at 5, 10, 15, and 20 years after surgery according to cause of death by valve type and surgical procedure in 33108 patients who underwent aortic valve replacement in Sweden between 1997 and 2018.

	Cardiovascular death, % (95% CI)	Cancer death, % (95% CI)	Other death, % (95% CI)
5 years after surgery			
Valve type			
Bioprosthesis	11.8% (11.4%-12.2%)	4.2% (4.0%-4.5%)	5.1% (4.8%-5.3%)
Mechanical	6.9% (6.6%-7.2%)	2.9% (2.7%-3.2%)	2.7% (2.5%-2.9%)
Procedure			
Isolated AVR	8.6% (8.2%-8.9%)	3.6% (3.3%-3.8%)	4.2% (4.0%-4.4%)
Combined	12.0% (11.5%-12.4%)	4.0% (3.8%-4.3%)	4.4% (4.1%-4.6%)
10 years after surgery			
Valve type			
Bioprosthesis	27.6% (26.9%-28.2%)	9.3% (8.9%-9.8%)	14.1% (13.6%-14.6%)
Mechanical	16.7% (16.1%-17.4%)	6.5% (6.0%-7.0%)	7.7% (7.2%-8.2%)
Procedure			
Isolated AVR	20.0% (19.4%-20.6%)	7.8% (7.4%-8.3%)	11.4% (10.9%-11.9%)
Combined	27.2% (26.5%-27.9%)	8.7% (8.2%-9.2%)	11.8% (11.3%-12.3%)
15 years after surgery			
Valve type			
Bioprosthesis	41.1% (40.3%-41.9%)	12.5% (11.9%-13.0%)	23.1% (22.3%-23.8%)
Mechanical	26.0% (25.1%-26.9%)	8.8% (8.2%-9.4%)	12.9% (12.2%-13.7%)

Procedure			
Isolated AVR	30.1% (29.3%-31.0%)	10.4% (9.8%-10.9%)	18.5% (17.7%-19.2%)
Combined	40.0% (39.0%-40.9%)	11.6% (11.0%-12.2%)	19.1% (18.3%-19.9%)
20 years after surgery			
Valve type			
Bioprosthesis	50.2% (49.2%-51.2%)	14.6% (13.9%-15.3%)	29.1% (28.1%-30.0%)
Mechanical	32.8% (31.6%-33.9%)	10.3% (9.6%-11.0%)	16.6% (15.7%-17.6%)
Procedure			
Isolated AVR	37.3% (36.2%-38.4%)	12.1% (11.4%-12.8%)	23.3% (22.4%-24.3%)
Combined	48.5% (47.3%-49.6%)	13.5% (12.7%-14.2%)	24.1% (23.1%-25.1%)

CI = confidence interval

Table S3. Observed and expected deaths and standardized mortality ratios with 95% confidence intervals for different causes of deaths according to valve type and surgical procedure in 33108 patients who underwent aortic valve replacement in Sweden between 1997 and 2018.

	All-Cause mortality n = 14 237 (100%)			Cardiovascular death n = 7778 (%)			Cancer death n = 2483 (%)			Other death n = 3976 (%)		
	Observed	Expected	SMR (95% CI)	Observed	Expected	SMR (95% CI)	Observed	Expected	SMR (95% CI)	Observed	Expected	SMR (95% CI)
Valve type												
Bioprosthesis	10232	8205.4	1.25 (1.22-1.27)	5588	3471.3	1.61 (1.57-1.65)	1735	1815.6	0.96 (0.91-1.00)	2909	2918.5	1.00 (0.96-1.03)
Mechanical	4005	2280.3	1.76 (1.70-1.81)	2190	875.5	2.50 (2.40-2.61)	748	657.1	1.14 (1.06-1.22)	1067	747.8	1.43 (1.34-1.52)
Procedure												
Isolated AVR	6648	5253.6	1.27 (1.24-1.30)	3444	2155.9	1.60 (1.55-1.65)	1207	1231.9	0.98 (0.93-1.04)	1997	1865.8	1.07 (1.02-1.12)
Combined	7589	5232.1	1.45 (1.42-1.48)	4334	2190.9	1.98 (1.92-2.04)	1276	1240.7	1.03 (0.97-1.09)	1979	1800.5	1.10 (1.05-1.15)

SMR = standardized mortality ratio, CI = confidence interval.

Table S4. Observed and expected deaths and standardized mortality ratios with 95% confidence intervals for cardiovascular cause of deaths according to sex and age groups in patients who underwent aortic valve replacement in Sweden between 1997 and 2018.

Age groups	Men n = 20967 (63%)			Women n = 12141 (37%)		
	Observed	Expected	SMR (95% CI)	Observed	Expected	SMR (95% CI)
20-24	0	0.01	-	0	0.00	-
25-29	1	0.03	37.4 (5.3-266)	0	0.00	-
30-34	1	0.06	17.7 (2.5-126)	2	0.01	258 (64.4-1030)
35-39	9	0.17	52.4 (27.3-101)	1	0.02	47.5 (6.7-337)
40-44	13	0.61	21.4 (12.4-36.8)	0	0.06	-
45-49	21	1.88	11.2 (7.3-17.1)	7	0.19	36.6 (17.5-76.9)
50-54	40	5.51	7.3 (5.3-9.9)	12	0.53	22.6 (12.8-39.8)
55-59	101	16.25	6.2 (5.1-7.6)	27	1.76	15.4 (10.5-22.4)
60-64	170	43.72	3.9 (3.3-4.5)	58	5.79	10.0 (7.7-12.9)
65-69	324	102.09	3.2 (2.8-3.5)	128	17.47	7.3 (6.2-8.7)
70-74	583	217.07	2.7 (2.5-2.9)	252	54.43	4.6 (4.1-5.2)
75-79	908	437.20	2.1 (1.9-2.2)	496	179.80	2.8 (2.5-3.0)
80-84	1069	690.64	1.5 (1.5-1.6)	840	436.62	1.9 (1.8-2.1)
85+	1236	1022.74	1.2 (1.1-1.3)	1479	1112.10	1.3 (1.3-1.4)

SMR = standardized mortality ratio, CI = confidence interval

Table S5. Observed and expected deaths and standardized mortality ratios with 95% confidence intervals for different causes of deaths according to sex and age groups in patients who underwent aortic valve replacement in Sweden between 1997 and 2018. Patients who died within 90 days of surgery were excluded.

	All-Cause mortality n=13060 (100%)			Cardiovascular death n=6764 (52%)			Cancer death n=2464 (19%)			Other death n=3829 (29%)		
	Observed	Expected	SMR (95% CI)	Observed	Expected	SMR (95% CI)	Observed	Expected	SMR (95%CI)	Observed	Expected	SMR (95%CI)
Total population	13060	10481.6	1.25 (1.22-1.27)	6764	4345.1	1.56 (1.52-1.59)	2467	2471.5	1.00 (0.96-1.04)	3829	3665.0	1.04 (1.01-1.08)
Sex												
Men	7715	6227.9	1.24 (1.21-1.27)	3892	2536.9	1.53 (1.49-1.58)	1625	1635.2	0.99 (0.95-1.04)	2198	2055.8	1.07 (1.03-1.11)
Women	5345	4253.8	1.26 (1.22-1.29)	2872	1808.2	1.59 (1.53-1.65)	842	836.3	1.01 (0.94-1.08)	1631	1609.2	1.01 (0.97-1.06)
Age groups												
20-24	0	0.25	-	0	0.01	-	0	0.02	-	0	0.22	-
25-29	3	0.54	5.59 (1.80-17.3)	1	0.03	32.59 (4.59-231)	0	0.05	-	2	0.46	4.39 (1.10-17.5)
30-34	5	0.90	5.55 (2.31-13.3)	1	0.06	15.57 (2.19-111)	0	0.12	-	4	0.71	5.61 (2.11-14.9)
35-39	17	1.7	9.92 (6.17-15.9)	7	0.2	36.3 (17.3-76.2)	2	0.3	5.82 (1.46-23.3)	8	1.2	6.79 (3.40-13.6)
40-44	17	3.9	4.36 (2.71-7.02)	9	0.7	13.52 (7.03-26.0)	2	0.9	2.11 (0.53-8.43)	6	2.3	2.63 (1.18-5.85)
45-49	37	9.4	3.93 (2.85-5.42)	14	2.1	6.75 (4.00-11.4)	7	2.6	2.66 (1.27-5.57)	16	4.7	3.39 (2.08-5.54)
50-54	64	24.1	2.66 (2.08-3.39)	28	6.0	4.64 (3.20-6.72)	10	7.9	1.27 (0.68-2.36)	26	10.2	2.55 (1.74-3.74)
55-59	174	64.7	2.69 (2.32-3.12)	91	18.0	5.06 (4.12-6.21)	36	24.3	1.48 (1.07-2.06)	47	22.4	2.10 (1.57-2.79)
60-64	365	169.1	2.16 (1.95-2.39)	173	49.5	3.50 (3.01-4.06)	96	68.8	1.40 (1.14-1.71)	96	50.8	1.89 (1.55-2.31)

65-69	713	389.5	1.83 (1.70-1.97)	345	119.5	2.89 (2.60-3.21)	185	160.9	1.15 (1.00-1.33)	183	109.0	1.68 (1.45-1.94)
70-74	1371	822.1	1.67 (1.58-1.76)	649	271.3	2.39 (2.21-2.58)	358	322.7	1.11 (1.00-1.23)	364	228.1	1.60 (1.44-1.77)
75-79	2134	1668.6	1.28 (1.23-1.33)	1093	616.5	1.77 (1.67-1.88)	518	549.5	0.94 (0.86-1.03)	523	502.6	1.04 (0.96-1.13)
80-84	3313	2742.6	1.21 (1.17-1.25)	1697	1126.7	1.51 (1.44-1.58)	681	686.9	0.99 (0.92-1.07)	935	928.9	1.01 (0.94-1.07)
85+	4847	4584.2	1.06 (1.03-1.09)	2656	2134.5	1.24 (1.20-1.29)	572	646.4	0.88 (0.82-0.96)	1619	1803.3	0.90 (0.86-0.94)

SMR = standardized mortality ratio, CI = confidence interval

Figure S1. Number of operations per year in Sweden from 1997 to 2018.

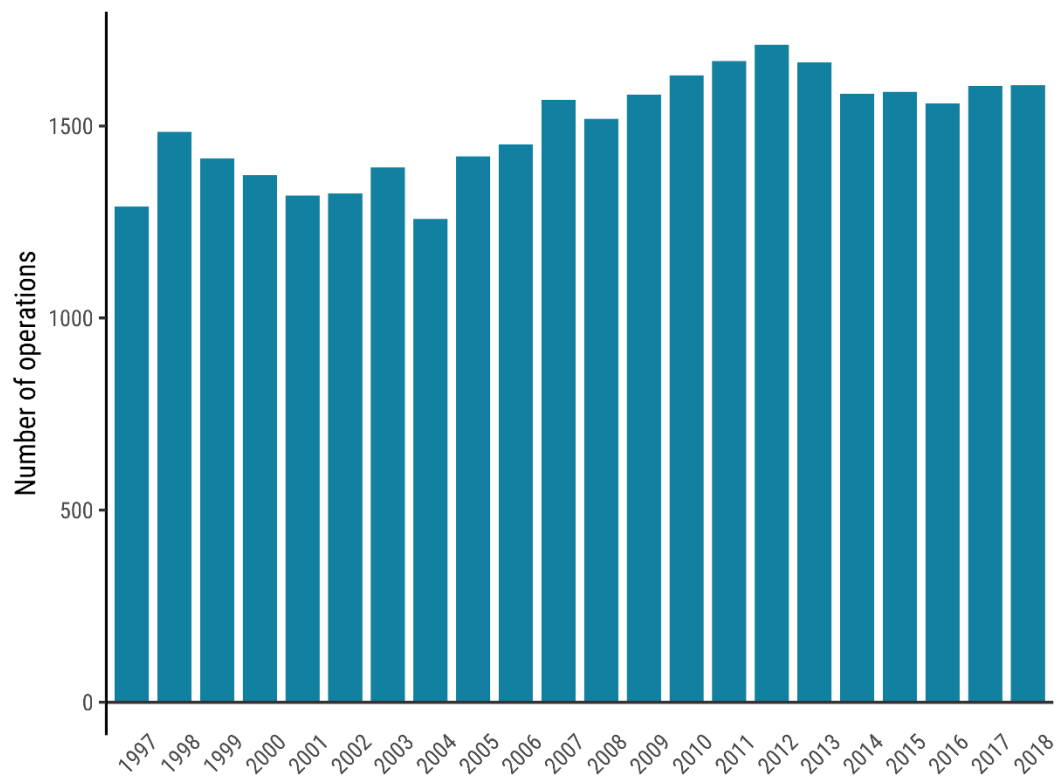
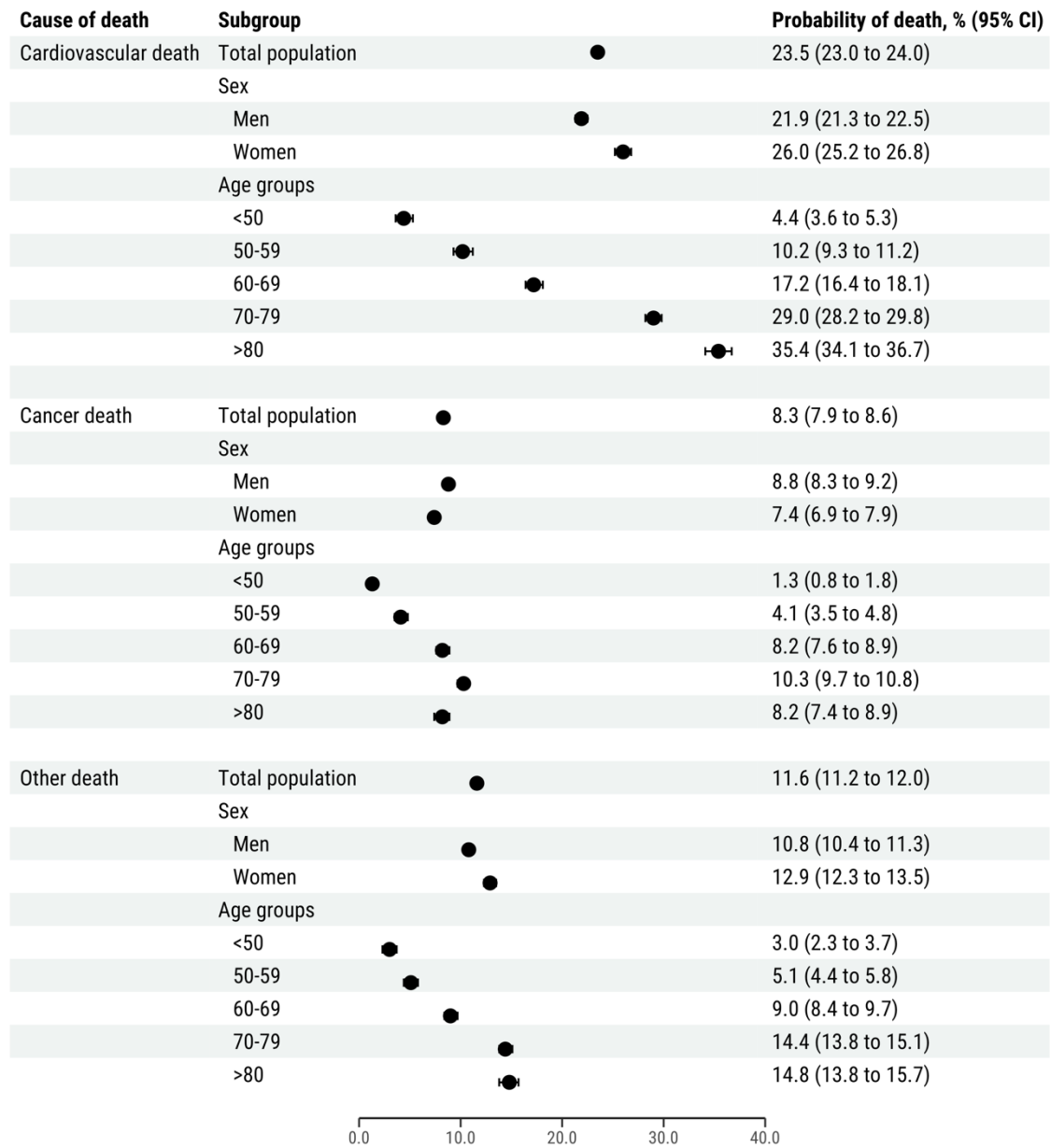
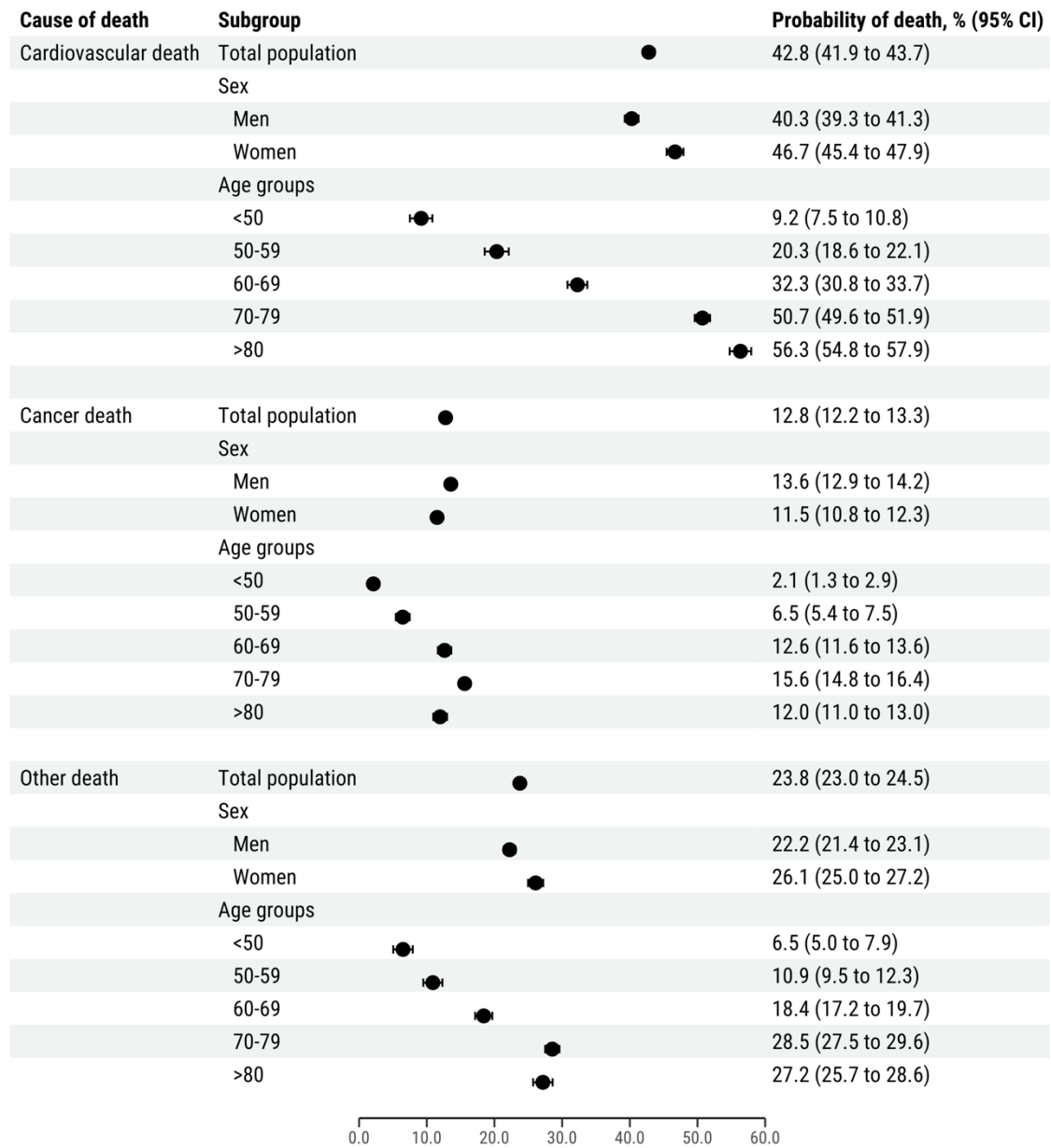


Figure S2. Crude probability of death at 10 years after surgery according to cause of death by age group and sex in 33108 patients who underwent aortic valve replacement in Sweden between 1997 and 2018.



CI = confidence interval

Figure S3. Crude probability of death at 20 years after surgery according to cause of death by age group and sex in 33108 patients who underwent aortic valve replacement in Sweden between 1997 and 2018.



CI = confidence interval

Figure S4. Crude probability of cause-specific death over time since surgery according to surgical procedure and valve type in 33108 patients who underwent aortic valve replacement in Sweden between 1997 and 2018. The white area shows the probability of being alive.

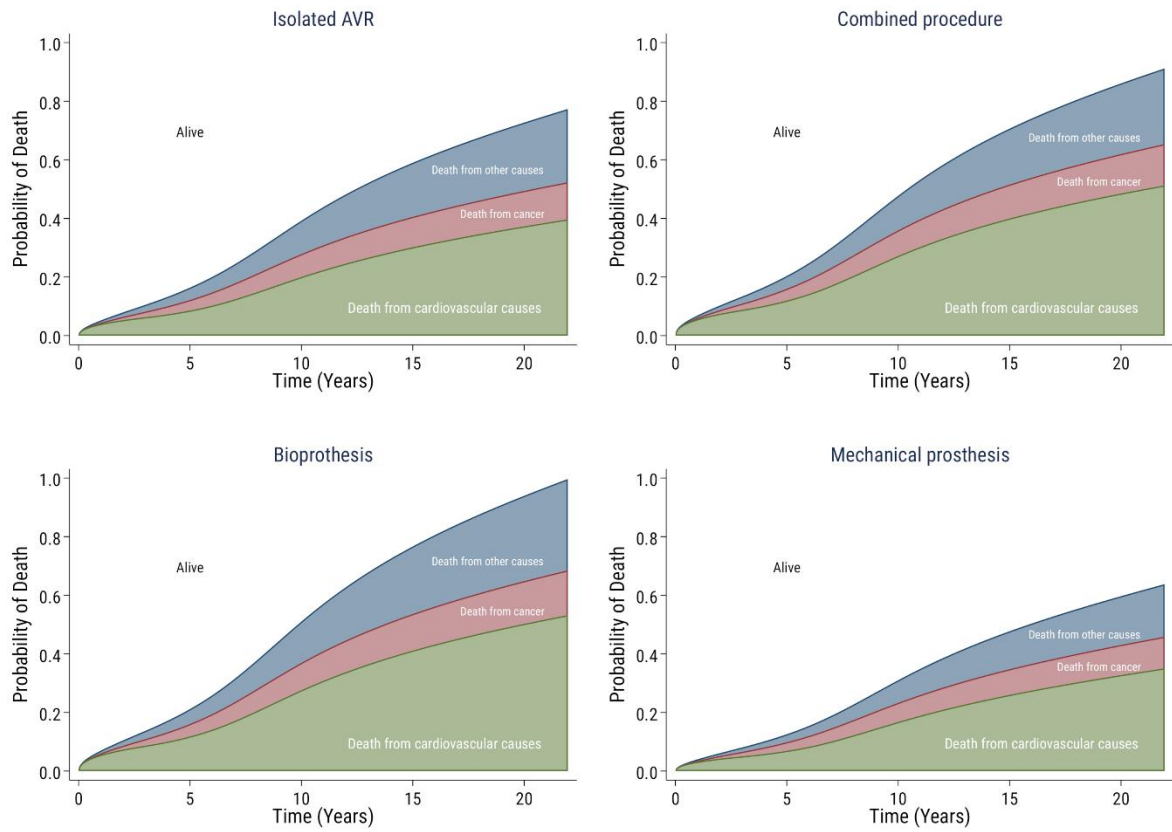
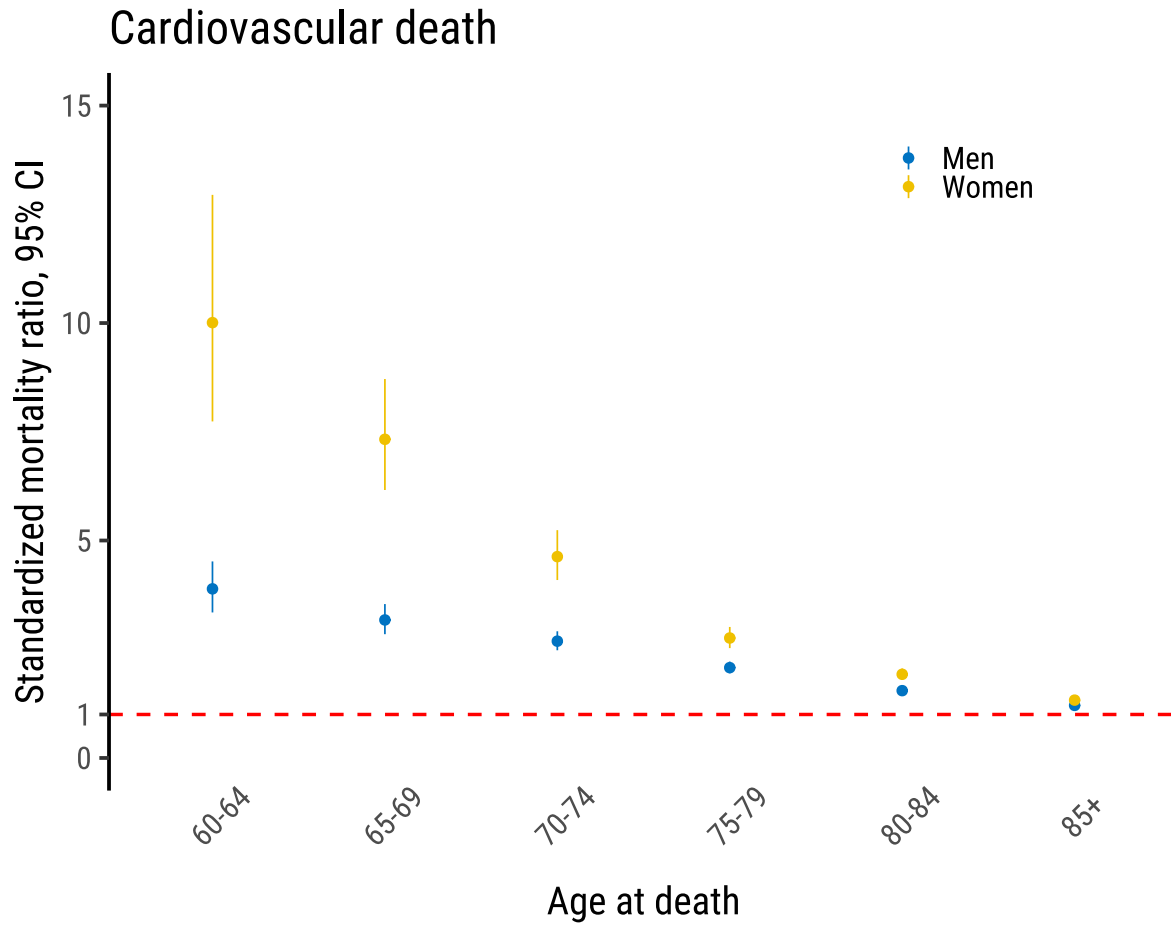


Figure S5. Standardized mortality ratios with 95% confidence intervals for cardiovascular cause of death according to sex and age groups in patients who underwent aortic valve replacement in Sweden between 1997 and 2018.



CI = confidence interval