KAROLINSKA HOSPITAL
DEPARTMENT OF CARDIOLOGY
SWEDEN

ANNUAL STATISTICAL REPORT 2024

SWEDISH ICD & PACEMAKER REGISTRY

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Foreword

We are proud to present the annual report for 2024 regarding CIED usage in Sweden.
We have over the last years focused on longevity of devices, leads and complications as well as the general usage of CIED in Sweden. We have also increased the data collected regarding lead extractions which is rapidly increasing in Sweden and is performed at Akademiska Hospital Uppsala, Karolinska Hospital Stockholm, Skånes Universitetssjukhus Lund and Sahlgrenska Hospital Gothenburg. New for 2024 is the rapid adoption to new pacing methods, CSP. So far we have limited data regarding long- term performance of these system but we will be monitoring this closely.
Complications are shown for each type of implantation for the country, for the region and hospital. There is also an ongoing discussion regarding concentration of therapy to fewer centers to improve outcomes by increasing the numbers of procedures per operator. To aid in this transformation we publish data on number of interventions for all individual implanters. We have seen some changes this year in the concentration of CRT procedures to fewer implanters.
Lead extractions are reported per hospital using the definition by ACC, the removal of a lead with an implant duration of > one year regardless of the method and leads of < than one year if tools are used. All hospitals performing lead extractions are now sending complete data. Lead extractions are in 2024 concentrated by a decision by the National Board of Welfare to four hospitals, Akademiska Sjukhuset Uppsala, Karolinska Sjukhuset in Stockholm, Skånes Universitetssjukhus in Lund and Sahlgrenska Universitetssjukhuset in Göteborg.
The report contains data from all implanting hospitals and > 95-98% of all procedures are reported when validated against the Patient care registry from The National Board of Welfare, Socialstyrelsen, in an annual validation process. There is also an ongoing process of annual auditing at all implanting hospitals.

Fredrik Gadler
Manager Swedish National ICD and Pacemaker Registry

Implant rates

There are 69796 active pacemaker patients in Sweden at the end of 2024. As always there are regional differences with the highest implant rates in Blekinge, 1393 per million and the lowest in the regions of Stockholm and Västmanland; 643 and 672 per million. Both these regions have a lower average age in in population.
The overall implant rate increased somewhat from 731 to 762 new implants per million. The Swedish population has also increased to 10,6 million and the total number of first implants increased in total to 8066 new pacemaker implants.
The number of implanting hospitals is the same as in the previous five years, 41 centers and the number of implants is 22 for the lowest, Visby, and 528 for the highest volume center, Danderyd.

Age and gender distribution of pacemaker treatment

The average age for females receiving pacemaker treatment is 77 years and the same for males, 78 years and eight patients over 100 years of age received primary implants. There is a male predominance with 63% of the new implants going to male patients. There is no change in this distribution compared to previous years.

Pacemakers and leads

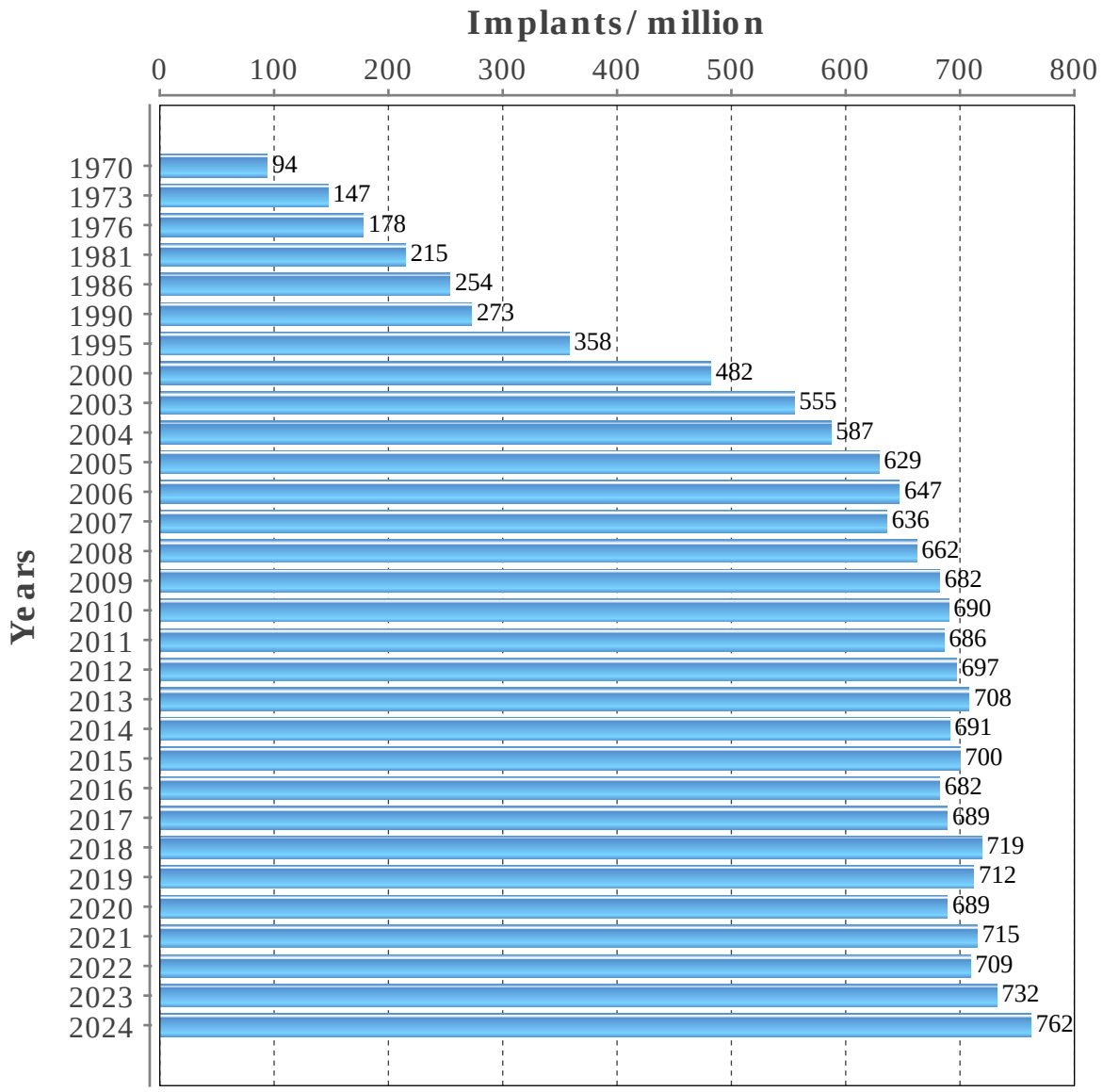
The manufacturer’s shares of the market show only slight redistribution and all regions are bound by tenders for 1-3 years. St Jude Medical is now Abbott and again largest with 40%, and Medtronic with the brand Vitatron is in second place with 26% market share. Boston Scientific has increased its market shares to 14% in brady segment. Biotronik are at a stable 20% of the market share.
Right side pacemaker leads are now solely bipolar. Active fixation is used to 100% in the atrium and 99% in the ventricle. We now have active fixation LV leads and 34% of the LV leads were active fixation and all are quadripolar. Medtronic is the sole manufacturer with active fixation LV-leads. Quadripolar lead technology for CRT has rapidly increased and 95% of the LV leads are now quadripolar, an increase from 65% in 2016.
17888 new leads were implanted all together.
Only a small number of epicardial systems are implanted in small children and patients without venous access and in some CRT patients. Venous access is almost equal between cephalic cut-down technique, 38%, and direct subclavian puncture 20% and 39% axillary punction, often echo guided 7%, has increased as access route. The leadless pacemaker systems are new in clinical use and Medtronic Micras were implanted in 80 patients and Abbott Aveir VR in 17 patients, two Aveir AR and two Aveir DR in 2024.

Pacemakers

All pacemakers implanted have RR capability and DDD-R is the most common subtype, 78%. CRT-P are used in small numbers, 7%, unchanged from previous years. Wireless implants are only 1%.
The rate of MRI safe systems increases rapidly, approximately all of the new systems implanted are MRI safe. The trend from the manufacturers to label older leads together with new pulse generators as MRI safe have made it difficult to keep correct track of the actual percentage.
The most common aethiology for pacemaker treatment is still the “conductive tissue fibrosis” 80% and ischaemic disease is more common in males than females, 6% vs 3%. The usage of the term “conductive tissue fibrosis” is most probably too high and only represents a lack of proper diagnosis when entering registry data.
System upgrade is at a steady state, especially used in brady-paced patients with heart failure and 2017 a total of 221 patients were upgraded from normal brady pacing to CRT compared to 311 in 2024. Since the EHRA recommendation for upgrade has been strengthened and there is now major increase maybe this is an indication that CRT system are more widely used from the beginning in patients prone to develop heart failure from RV pacing.
Data regarding CSP as an upgrade mode will be added to the 2025 report.
The most common symptom is syncope followed closely by dizziness and dyspne. ECG indications are 2024 as before mainly related to sinus node disease with AV conduction disorders being the most common cause for pacemaker implantation. Sinus node disease is slightly more common as an indication in women than in men.
Smaller hospitals tend to use VVI-R pacing more often than larger hospitals for AV-block and SSS.
Generators are used to ERI criteria are fulfilled in 53% of the cases and 2% exhibit premature EOL, technical failure or changed due to recall 3%, Boston Proponent and Abbot Assurity generators being the most common. These generators show an increasing rate of premature depletion. Lead failures are uncommon and survival rates are very good with a 10-year survival of 98%.

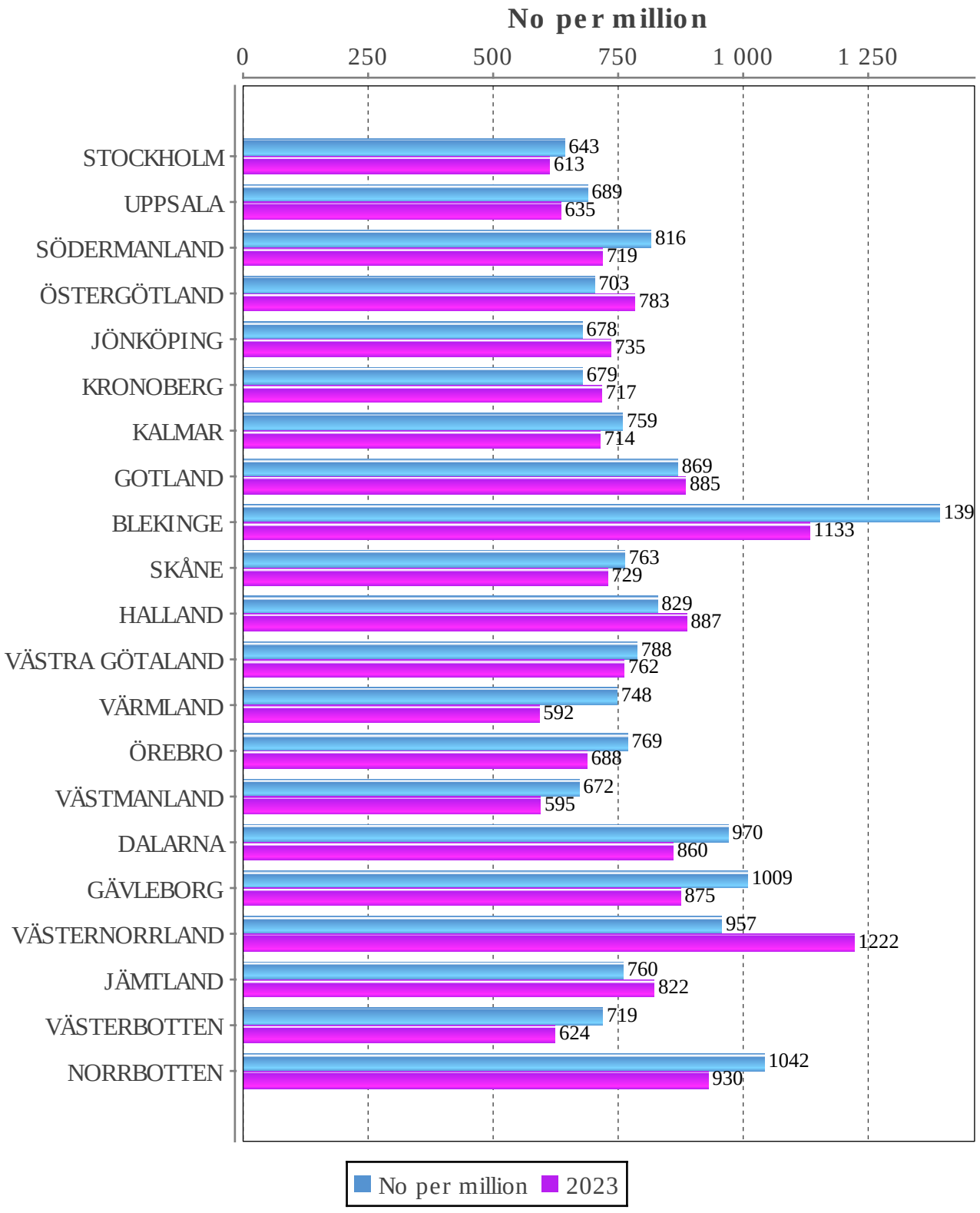
Implanting organization

The number of procedures for each implanter vary to a large extent between hospitals. Recommendations as to minimum number of procedures from EHRA is not routinely followed especially regarding CRT implantation. A recommendation to implant volumes were made by the Swedish Cardiology Societies Arrhythmia Group in 2016 and has so far had little impact on the organization in hospital with low individual implant numbers although some hospitals have concentrated CRT to fewer implanters.


Implants/ million
0
100
200
300
400
500
600
700
800
Years
1970
1973
1976
1981
1986
1990
1995
2000
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
94
147
178
215
254
273
358
482
555
587
629
647
636
662
682
690
686
697
708
691
700
682
689
719
712
689
715
709
732
762

The regions are based on where the patients live, not where they are treated

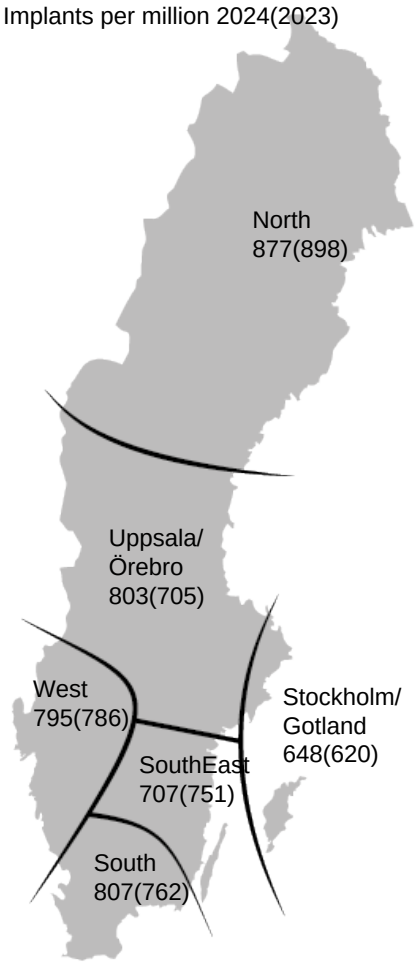
County	Population	No of first	No per million	Active patients
STOCKHOLM	2473307	1590	643	13660
UPPSALA	407912	281	689	2623
SÖDERMANLAND	301542	246	816	2057
ÖSTERGÖTLAND	472446	332	703	3230
JÖNKÖPING	370009	251	678	2268
KRONOBERG	203351	138	679	1246
KALMAR	246352	187	759	1513
GOTLAND	60971	53	869	572
BLEKINGE	157223	219	1393	1478
SKÅNE	1428626	1090	763	9459
HALLAND	345074	286	829	2292
VÄSTRA GÖTALAND	1772821	1397	788	11638
VÄRMLAND	283384	212	748	1899
ÖREBRO	308375	237	769	1817
VÄSTMANLAND	281158	189	672	1649
DALARNA	286546	278	970	2337
GÄVLEBORG	284558	287	1009	2528
VÄSTERNORRLAND	241458	231	957	2358
JÄMTLAND	132839	101	760	1104
VÄSTERBOTTEN	281138	202	719	1857
NORRBOTTEN	248620	259	1042	2211
Total	10587710	8066	762	69796


No per million
0
250
500
750
1 000
1 250
STOCKHOLM
643
613
UPPSALA
689
635
SÖDERMANLAND
816
719
ÖSTERGÖTLAND
703
783
JÖNKÖPING
678
735
KRONOBERG
679
717
KALMAR
759
714
GOTLAND
869
885
BLEKINGE
139
1133
SKÅNE
763
729
HALLAND
829
887
VÄSTRA GÖTALAND
788
762
VÄRMLAND
748
592
ÖREBRO
769
688
VÄSTMANLAND
672
595
DALARNA
970
860
GÄVLEBORG
1009
875
VÄSTERNORRLAND
957
1222
JÄMTLAND
760
822
VÄSTERBOTTEN
719
624
NORRBOTTEN
1042
930
No per million
2023

STATISTICS – PACEMAKER – IMPLANTS PER REGION

The regions are based on where the patients live, not where they are treated

Region	Population	No of first impl	No per million	Active patients
Stockholm/Gotland	2534278	1643	648	14232
Uppsala/Örebro	2153475	1730	803	14910
South-East Sweden	1088807	770	707	7011
Southern Sweden	1932075	1560	807	13000
Western Sweden	1975020	1571	795	13113
Northern Sweden	904055	793	877	7530
Total	10587710	8067	762	69796

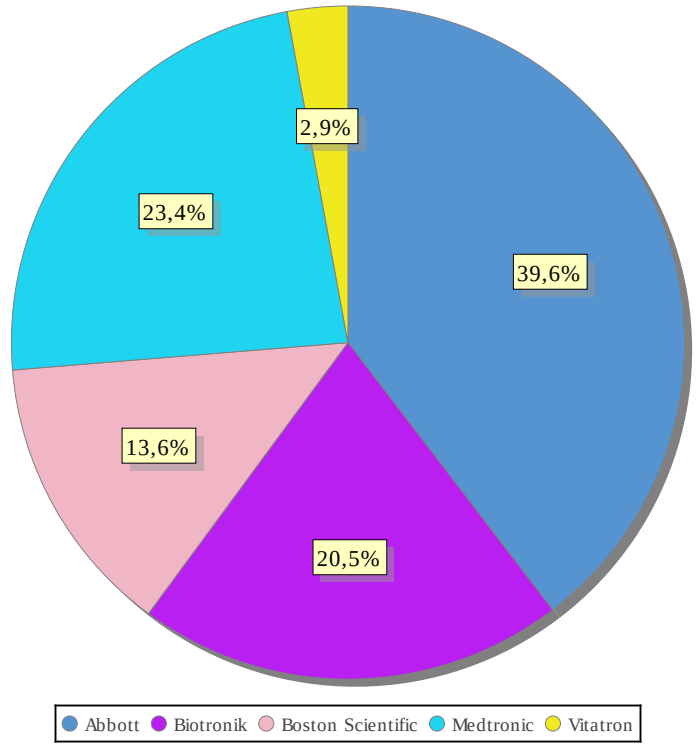


First implants per hospital

Region	Hospital	2024	2023
Northern Sweden	Norrlands Universitetssjukhus	185	168
	Skellefteå lasarett	31	33
	Sollefteå sjukhus	27	16
	Sunderby sjukhus	252	221
	Sundsvalls sjukhus	138	179
	Örnsköldsviks sjukhus	57	89
	Östersunds sjukhus	97	107
Southern Sweden	Blekingesjukhuset	228	189
	Centrallasarettet Växjö	132	139
	Centralsjukhuset Kristianstad	303	213
	Helsingborgs lasarett	216	180
	Länssjukhuset Halmstad	61	70
	Skånes universitetssjukhus, Lund	349	384
	Skånes universitetssjukhus, Malmö	256	289
	Varbergs sjukhus	209	222
South-East Sweden	Linköpings Universitetssjukhus	361	384
	Länssjukhuset Kalmar	140	121
	Länssjukhuset Ryhov	230	258
	Västerviks sjukhus	38	47
Stockholm/Gotland	Danderyds sjukhus	528	442
	Karolinska Universitetssjukhuset	502	459
	St Görans sjukhus	291	320
	Södersjukhuset	342	325
	Visby lasarett	22	21
Uppsala/Örebro	Akademiska sjukhuset	318	296
	Centralsjukhuset Karlstad	180	134
	Centralsjukhuset Västerås	180	149
	Falu lasarett	277	240
	Gävle sjukhus	205	197
	Hudiksvalls sjukhus	70	50
	Mälarsjukhuset	216	202
	Torsby sjukhus	24	19
	Universitetssjukhuset Örebro	243	234
Western Sweden	Alingsås lasarett	52	73
	Drottning Silvias Bus	10	6
	Kungälvs sjukhus	96	123
	Sahlgrenska Universitetssjukhuset	390	387
	Sahlgrenska Universitetssjukhuset /Östra	103	62
	Skaraborgs sjukhus Skövde	235	223
	Södra Älvsborgs sjukhus	254	190
	Trollhättan, NÄL	274	303

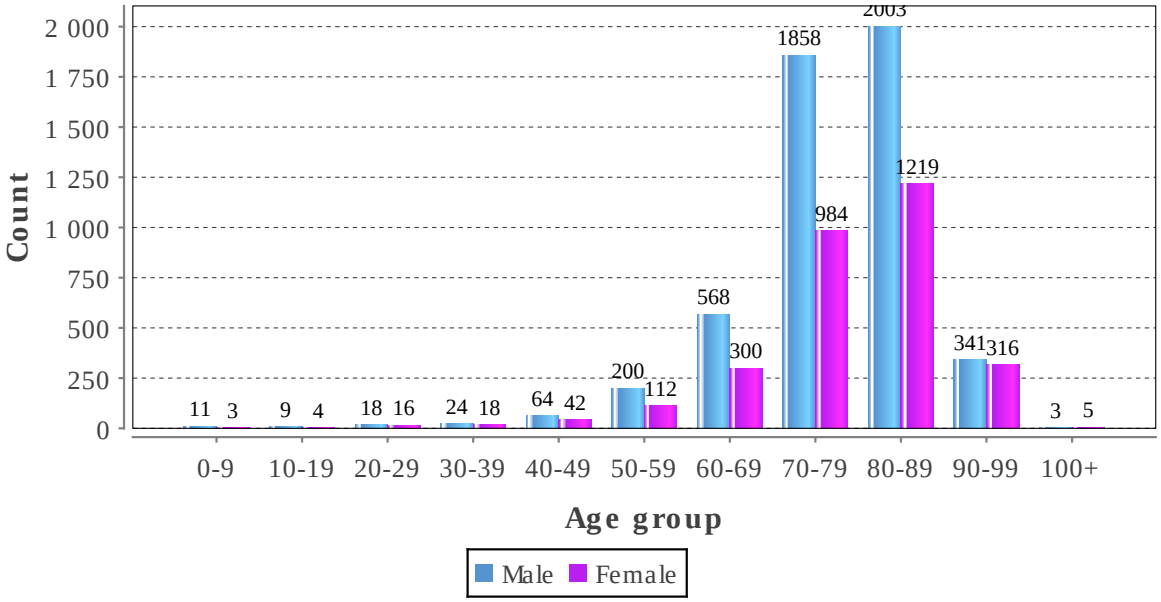
Market share per manufacturer in Sweden. Medtronic and Vitatron regarded as separat companies

Manufacturer	2021 %	2022 %	2023 %	2024 %
Biotronik	18.0	20.9	20.1	20.5
Boston Scientific	10.5	10.9	12.9	13.6
Medtronic	11.1	14.0	20.4	23.4
Sorin/LivaNova	0.1	0.1	0.1	-
Abbott	50.4	47.4	42.4	39.6
Vitatron	9.9	6.7	4.0	2.9



Age and gender distribution for new implants, total numbers

Age (years)	Total no	%	Male	Female
0-9	14	0.2	11	3
10-19	13	0.2	9	4
20-29	34	0.4	18	16
30-39	42	0.5	24	18
40-49	106	1.3	64	42
50-59	312	3.8	200	112
60-69	868	10.7	568	300
70-79	2842	35.0	1858	984
80-89	3222	39.7	2003	1219
90-99	657	8.1	341	316
100+	8	0.1	3	5
Average age	77	0.0	77	78
			Total number of implants: 8118	



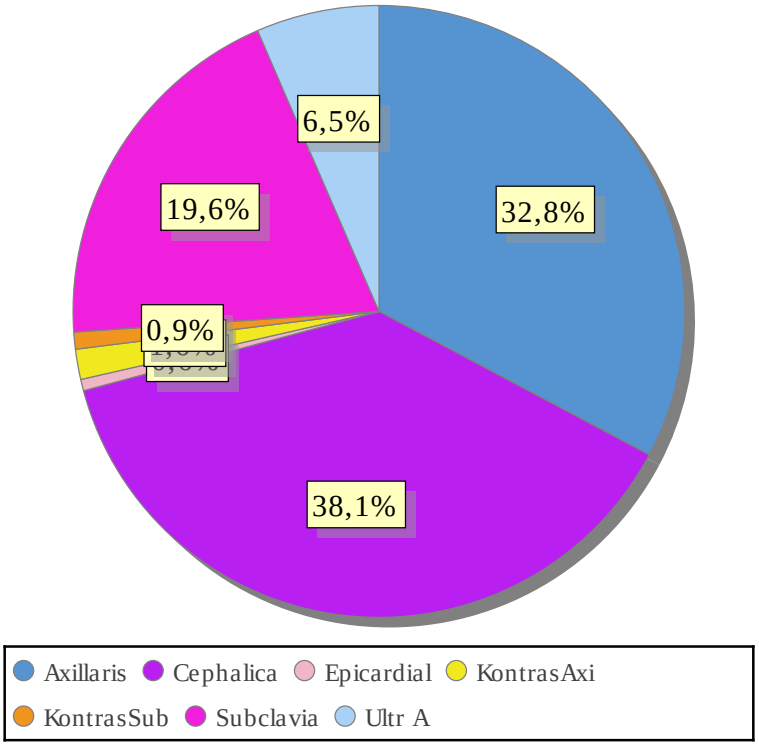
Ratio of new implants versus generator changes

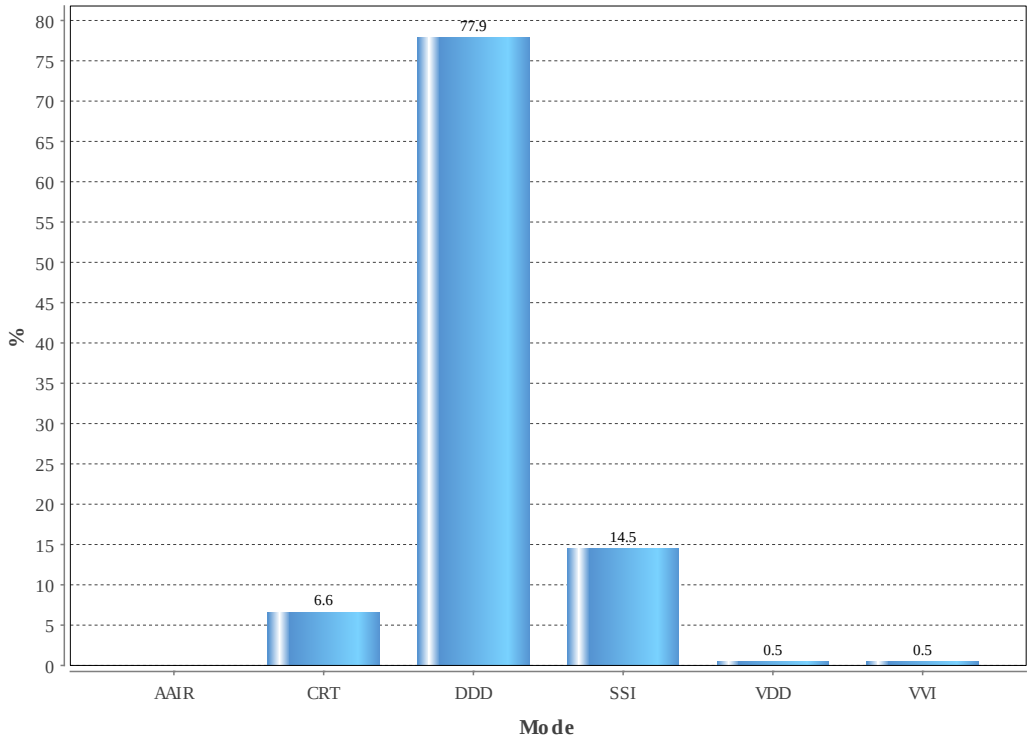
	Total		Male		Female	
	no	**%**	**no**	**%**	**no**	**%**
First implant	8122	71.1	5101	62.8	3021	37.2
Replacement	3298	28.9	1963	59.5	1335	40.5
Total	11420	100.0	7064	61.9	4356	38.1

Lead type distribution for atrial and venticular use for first implants and replacements including all pace leads, pace and ICD systems

	Atrial		Venticular		LV-lead	
	no	**%**	**no**	**%**	**no**	**%**
Bipolar	8026	99.6	8463	99.5	42	3.2
Epicardial	34	0.4	43	0.5	26	2.0
Quadripolar	1	-	-	-	1252	94.8

	Atrial		Venticular		LV-lead	
	no	**%**	**no**	**%**	**no**	**%**
Active fixation	8056	99.9	8433	99.1	453	34.3
Passive fixation	6	0.1	73	0.9	867	65.7
						Total number of leads: 17888


6,5%
19,6%
32,8%
0,9%
38,1%
Axillaris
Cephalica
Epicardial
KontrasAxi
KontrasSub
Subclavia
Ultr A



Wireless implants per subtype

Mode	No
VDDR	40
VVIR	40
Total number of first implants	8122

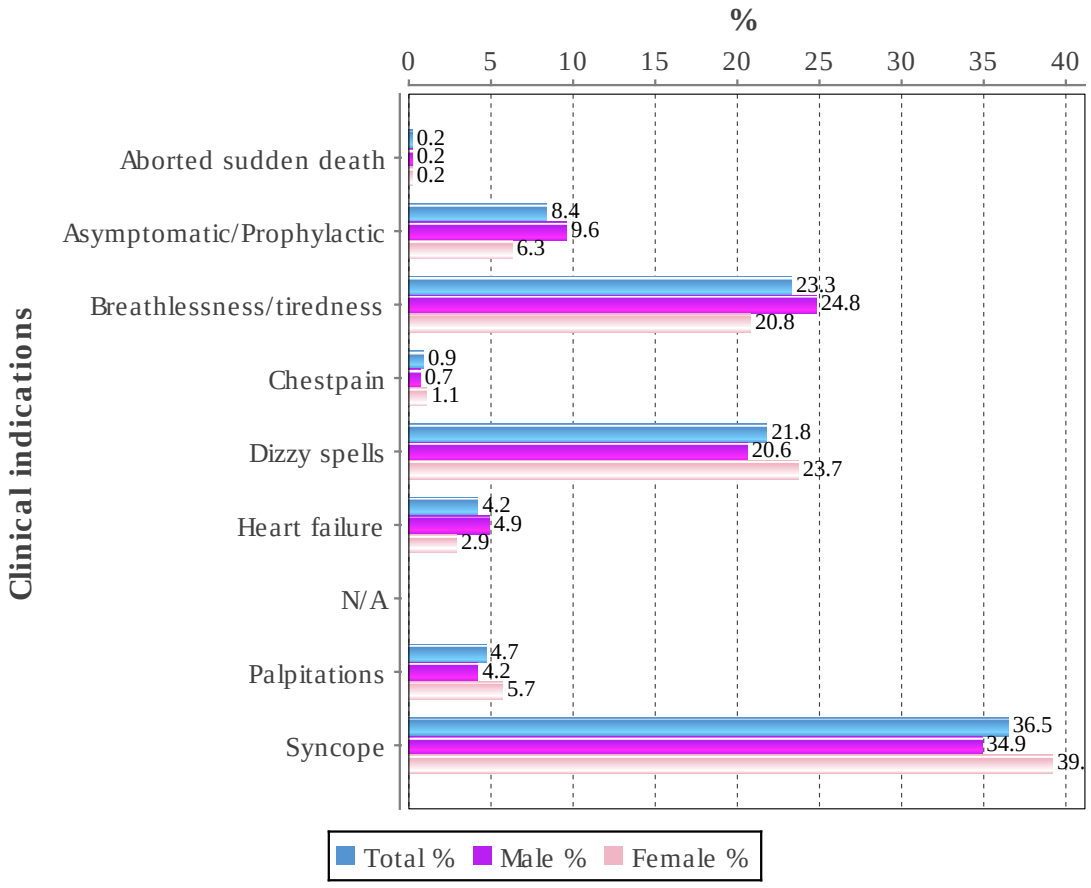
Main aetiology for implanting pacemakers

Aetiology	Total %	Male %	Female %
ARVC	0.0	0.0	0.0
Amyloidos	0.6	0.9	0.1
Borrelios	0.0	0.0	0.0
Cardiomyopathy cytostatic induced	0.0	0.0	0.1
Cardiomyopathy dilated	2.4	2.5	2.3
Cardiomyopathy hypertrophic	0.4	0.4	0.5
Cardiomyopathy ischaemic	0.8	1.0	0.4
Conduction tissue fibrosis	80.1	78.6	82.6
Congenital	0.2	0.3	0.1
Drug induced	0.2	0.2	0.2
Endocarditis	0.1	0.1	0.1
Heart transplantation	0.0	0.0	0.1
High degree RV pacing	0.0	0.0	0.0
His-ablation	1.4	0.9	2.3
Ionizing radiation	0.0	0.0	0.1
Ischaemic	4.6	5.7	2.7
Long QT-syndrome	0.0	0.1	0.0
Myocarditis	0.0	0.1	0.0
N/A	0.0	0.0	0.0
Neurocardiogenic syncope	0.3	0.2	0.5
Other structural heart disease	2.3	2.3	2.3
Post TAVI	1.8	1.9	1.6
Post infarction	0.3	0.3	0.3
RF-ablation, complication	0.3	0.2	0.5
Sarcoidos	0.1	0.0	0.1
Surgical complication	2.6	2.8	2.3
Valvular heart disease	1.2	1.4	0.9

	2024	2023	2022	2021	2020	2019
VVI to VVIR	0	1	1	4	3	3
AAI/AAIR to DDD/DDDR	13	15	11	17	21	21
VVI/VVIR to DDD/DDDR	44	33	34	13	28	35
VVI/VVIR/DDD/DDDR to CRT	311	285	260	267	255	260

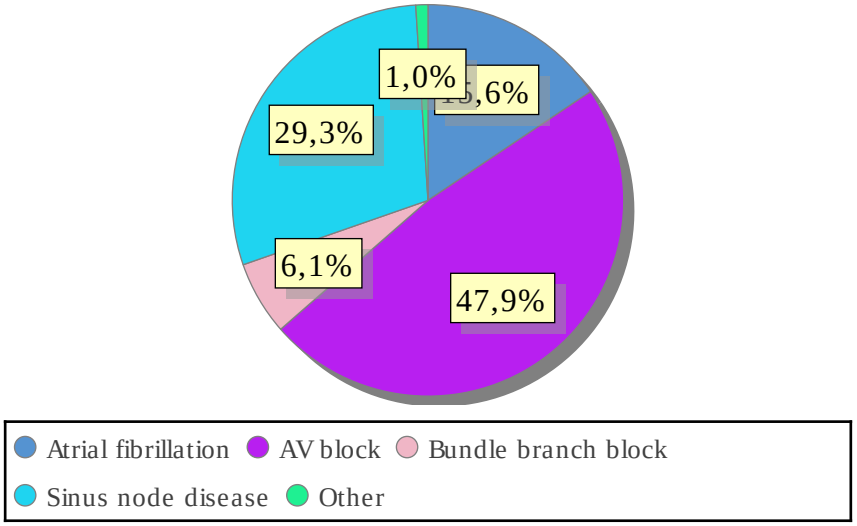
Main symptom for implanting pacemakers

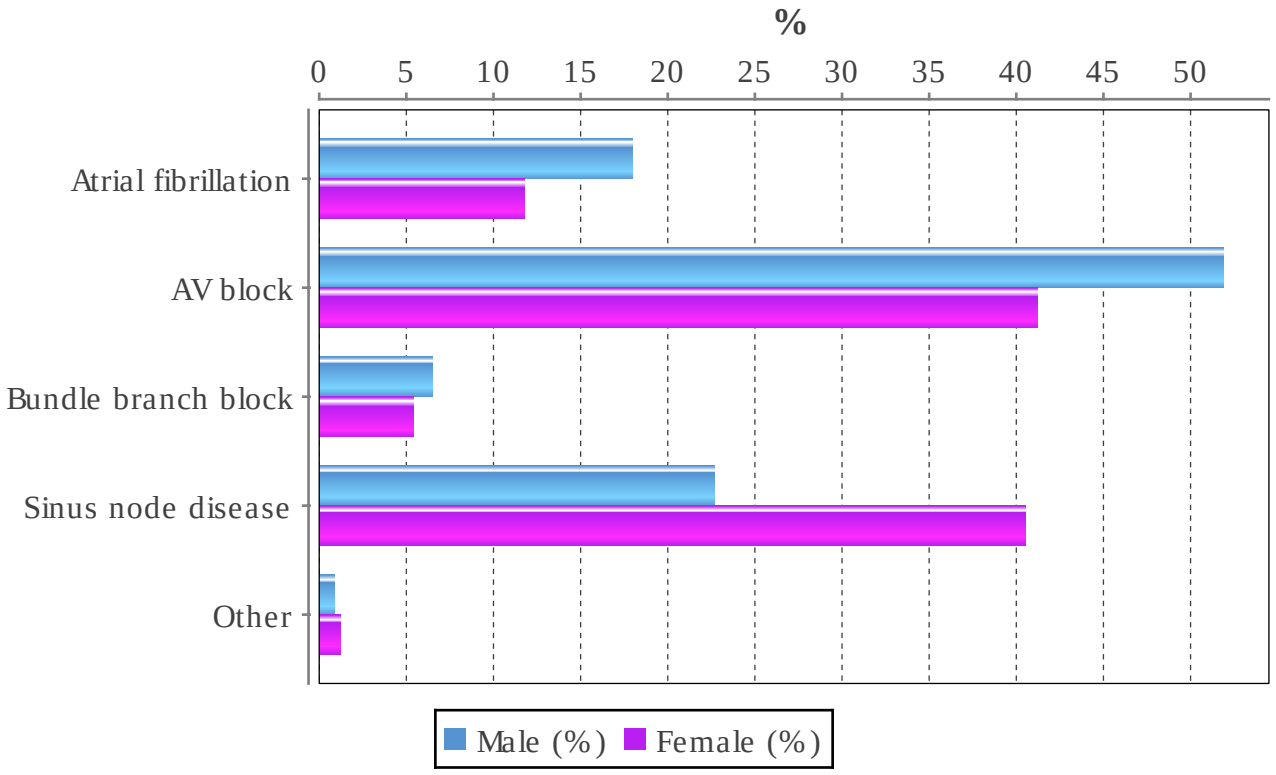
Indication	Total %	Male %	Female %
Aborted sudden death	0.2	0.2	0.2
Asymptomatic/Prophylactic	8.4	9.6	6.3
Breathlessness/tiredness	23.3	24.8	20.8
Chestpain	0.9	0.7	1.1
Dizzy spells	21.8	20.6	23.7
Heart failure	4.2	4.9	2.9
N/A	0.0	0.0	0.0
Palpitations	4.7	4.2	5.7
Syncope	36.5	34.9	39.2



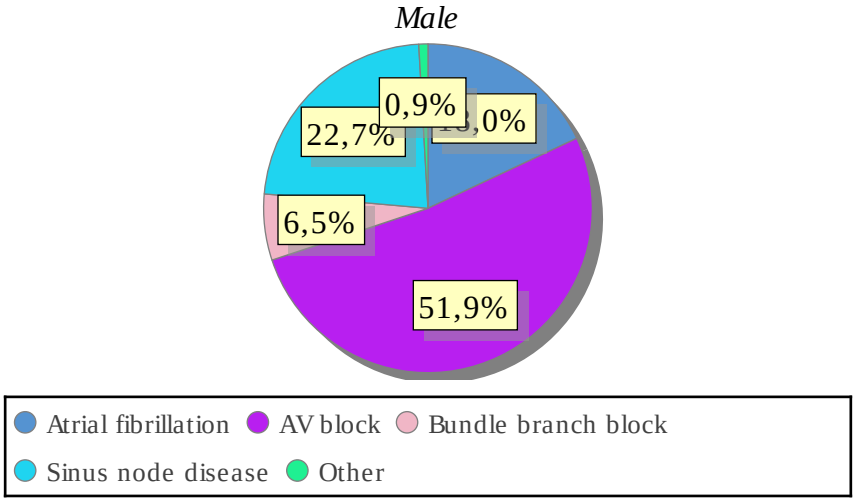
Main ECG indication by gender and for patients < 18 years of age

Indication	No	%	Male (%)	Female (%)	Younger than 18 (%)
Atrial fibrillation	1271	15.6	18.0	11.8	0.0
AV block	3892	47.9	51.9	41.2	73.9
Bundle branch block	497	6.1	6.5	5.4	0.0
Sinus node disease	2378	29.3	22.7	40.5	21.7
Other	84	1.0	0.9	1.2	4.3
					Total number of implants 8122

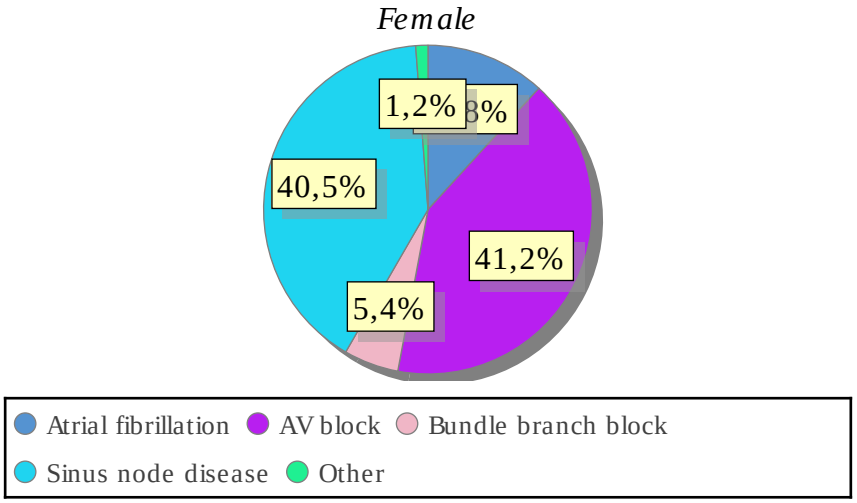




Male



Female



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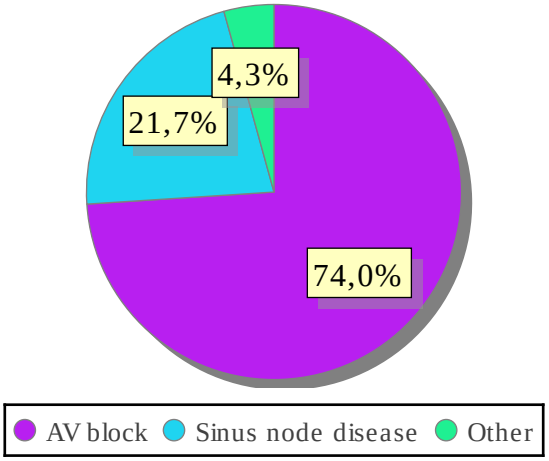


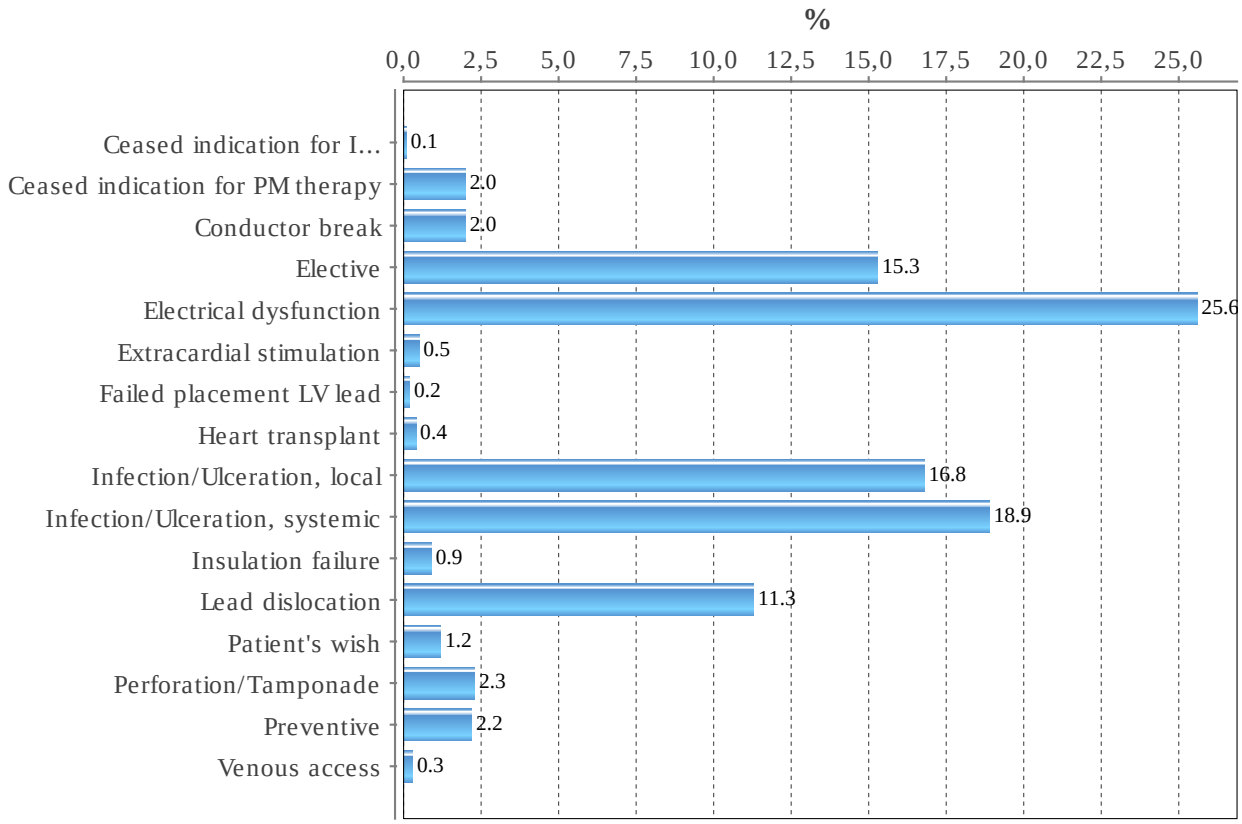
STATISTICS – PACEMAKER – USE OF PACING
MODES FIRST IMPLANT PER HOSPITAL

Use of pacemaker sub type for all indications per hospital (number of new implants / year and hospital))

Hospital	Number	DDD %	VVI %	AAI %	CRT %
Akademiska sjukhuset	315	81.3	13.0	0.0	5.7
Alingsås lasarett	52	75.0	25.0	0.0	0.0
Blekingesjukhuset	228	83.8	11.0	0.9	4.4
Centrallasarettet Växjö	132	83.3	14.4	0.0	2.3
Centralsjukhuset Karlstad	180	86.1	7.8	0.0	6.1
Centralsjukhuset Kristianstad	303	86.1	13.5	0.0	0.3
Centralsjukhuset Västerås	180	71.1	25.6	0.0	3.3
Danderyds sjukhus	528	83.1	9.7	0.0	7.2
Drottning Silvias Bus	10	80.0	20.0	0.0	0.0
Falu lasarett	277	75.5	13.4	0.4	10.8
Gävle sjukhus	205	77.1	19.5	0.0	3.4
Helsingborgs lasarett	216	76.4	17.1	0.0	6.5
Hudiksvalls sjukhus	69	87.0	13.0	0.0	0.0
Karolinska Universitetssjukhuset	497	80.1	10.9	1.0	8.0
Kungälvs sjukhus	96	86.5	12.5	1.0	0.0
Linköpings Universitetssjukhus	361	80.1	12.7	0.6	6.6
Länssjukhuset Halmstad	61	86.9	13.1	0.0	0.0
Länssjukhuset Kalmar	132	67.4	24.2	0.0	8.3
Länssjukhuset Ryhov	230	74.8	24.3	0.9	0.0
Mälarsjukhuset	216	79.6	15.7	0.0	4.6
Norrlands Universitetssjukhus	185	81.6	11.9	0.0	6.5
Sahlgrenska Universitetssjukhuset	361	84.2	9.1	0.0	6.6
Sahlgrenska Universitetssjukhuset /Östra	103	68.9	31.1	0.0	0.0
Skaraborgs sjukhus Skövde	235	70.6	13.6	0.0	15.7
Skellefteå lasarett	31	87.1	12.9	0.0	0.0
Skånes universitetssjukhus, Lund	324	74.4	9.3	1.2	15.1
Skånes universitetssjukhus, Malmö	256	90.2	9.4	0.0	0.4
Sollefteå sjukhus	27	77.8	22.2	0.0	0.0
St Görans sjukhus	291	82.5	13.4	0.3	3.8
Sunderby sjukhus	252	75.0	15.5	0.0	9.5
Sundsvalls sjukhus	138	84.1	8.0	0.0	8.0
Södersjukhuset	342	78.4	16.4	0.0	5.3
Södra Älvsborgs sjukhus	254	72.4	17.7	0.0	9.8
Torsby sjukhus	24	83.3	16.7	0.0	0.0
Trollhättan, NÄL	274	71.9	21.5	0.0	6.6
Universitetssjukhuset Örebro	230	73.5	23.5	0.0	3.0
Varbergs sjukhus	209	78.5	15.3	0.0	6.2
Visby lasarett	22	100.0	0.0	0.0	0.0
Västerviks sjukhus	38	92.1	7.9	0.0	0.0
Örnsköldsviks sjukhus	57	89.5	8.8	0.0	1.8
Östersunds sjukhus	97	78.4	14.4	0.0	7.2

Historical explant indications

Reason	2020 %	2021 %	2022 %	2023 %	2024 %
Preventive	1.7	1.3	2.1	1.8	1.6
Elective	18.1	17.0	20.7	21.3	24.8
Recall/Alert	0.2	0.3	1.9	1.3	2.2
Erosion/Infection, local	2.1	2.3	1.6	1.6	2.8
Erosion/Infection, systemic	3.0	3.1	2.9	2.8	3.1
Patient's wish	0.1	0.2	0.3	0.3	0.2
CRT-P to PM because of discontinued CRT-indication	0.1	0.1	0.0	0.1	0.1
CRT-P to CRT-D	0.3	0.4	0.4	0.3	0.2
ERI	64.5	65.4	61.1	60.8	53.1
Premature EOL	1.6	1.4	0.9	0.9	1.8
Heart transplant	0.1	0.1	0.1	0.1	0.1
Ceased indication for PM therapy	0.3	0.6	0.5	0.4	0.4
PM to CRT-P	4.5	5.0	4.7	5.3	6.4
PM to CRT-D	1.9	1.3	1.3	1.2	1.4
PM to ICD because of arrhythmia	1.1	1.2	0.8	1.0	1.0
Technical failure	0.4	0.5	0.5	0.8	1.0


%
0,0
2,5
5,0
7,5
10,0
12,5
15,0
17,5
20,0
22,5
25,0
Ceased indication for I...
Ceased indication for PM therapy
Conductor break
Elective
Electrical dysfunction
Extracardial stimulation
Failed placement LV lead
Heart transplant
Infection/Ulceration, local
Infection/Ulceration, systemic
Insulation failure
Lead dislocation
Patient's wish
Perforation/Tamponade
Preventive
Venous access
0.1
2.0
2.0
15.3
25.6
0.5
0.2
0.4
16.8
18.9
0.9
11.3
1.2
2.3
2.2
0.3

Implant rates

There are 16500 active ICD patients in Sweden 2024, the number slowly increasing over years and could be an effect of better heart failure management with primary prevention increasing most. The number centers implanting ICD's is 31 and represents roughly 2/3 of the PM implanting centers although 4 centers do <20 implants per year, well below recommendations by ESC and the Swedish national society. The national implant rate is the lower in 2024 than 2023 143 vs 144 per million. Of this 89 per million is primary prevention.
The south region is the only region that have increased the implant rate, all others show stable implant rates. Otherwise implant rates show the same regional differences as in pacemakers with the highest rates in Gävle, 186 and the lowest in the Västra Götaland region with 51 per million.
About 40% of the ICD procedures are replacements but could be expected to go further down with generators now showing increased longevity.
As with PM the regions are bound by ICD purchasing tenders and manufacturers share show only slight variations over previous year. Abbott is the largest with 44% market share, Medtronic second with 34%. Boston Scientific with 14% and Biotronic is smallest with 8% market share.

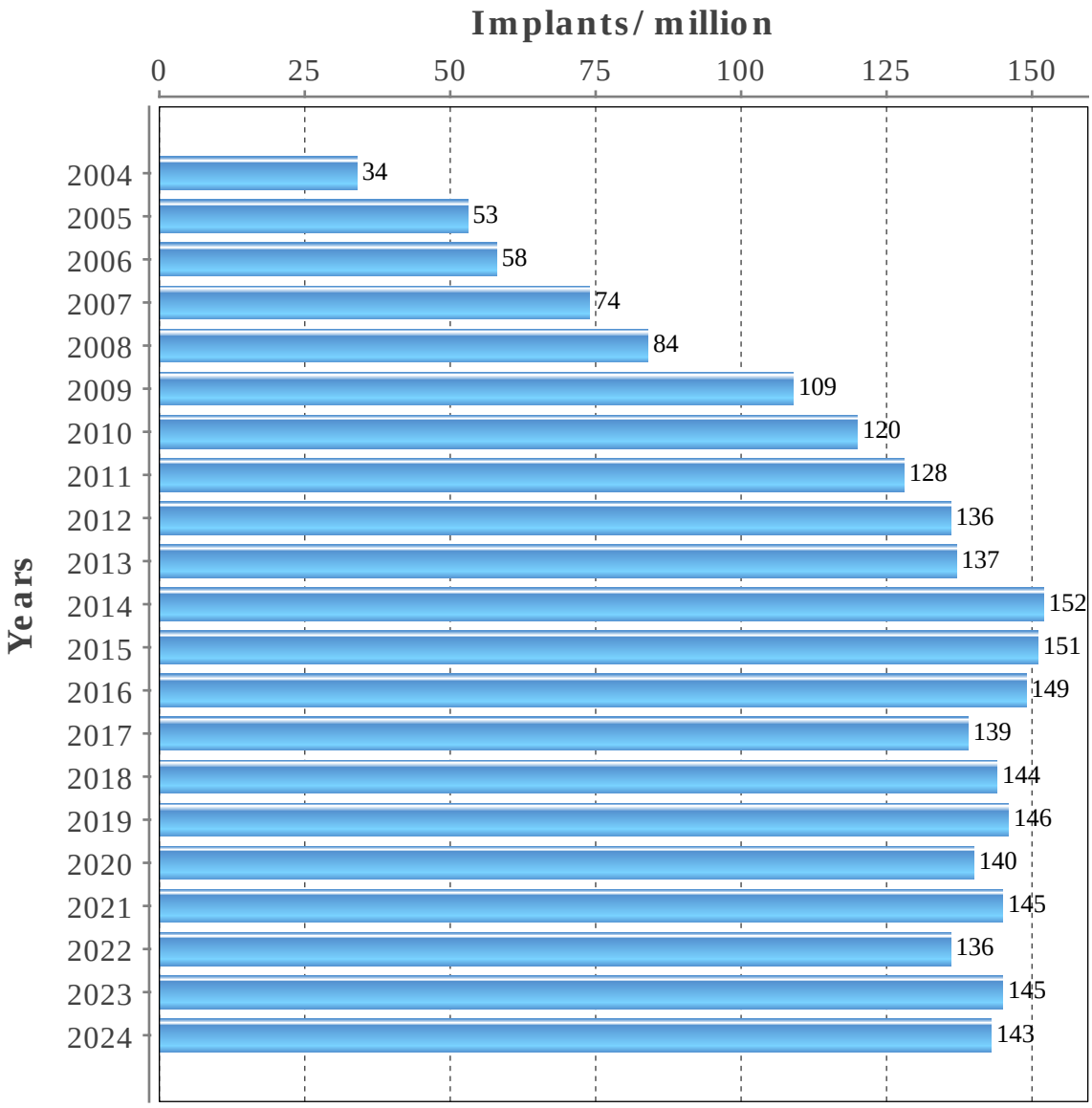
Patients

The average age for ICD implant is stable at 65 years in males and 62 years in females for all types of implants, unchanged from previous years. In the older category 49 patients in the age group 80-89 received a first ICD implants as primary prevention and of these 19 were secondary prevention. Clinical indication for all ICD implants was secondary prevention in 37% and primary in 63%. Aethiology was ischemic heart disease in 42% of all patients but more common in males, 49% vs 31% in females.

Medication at the start of therapy is displayed in tables.

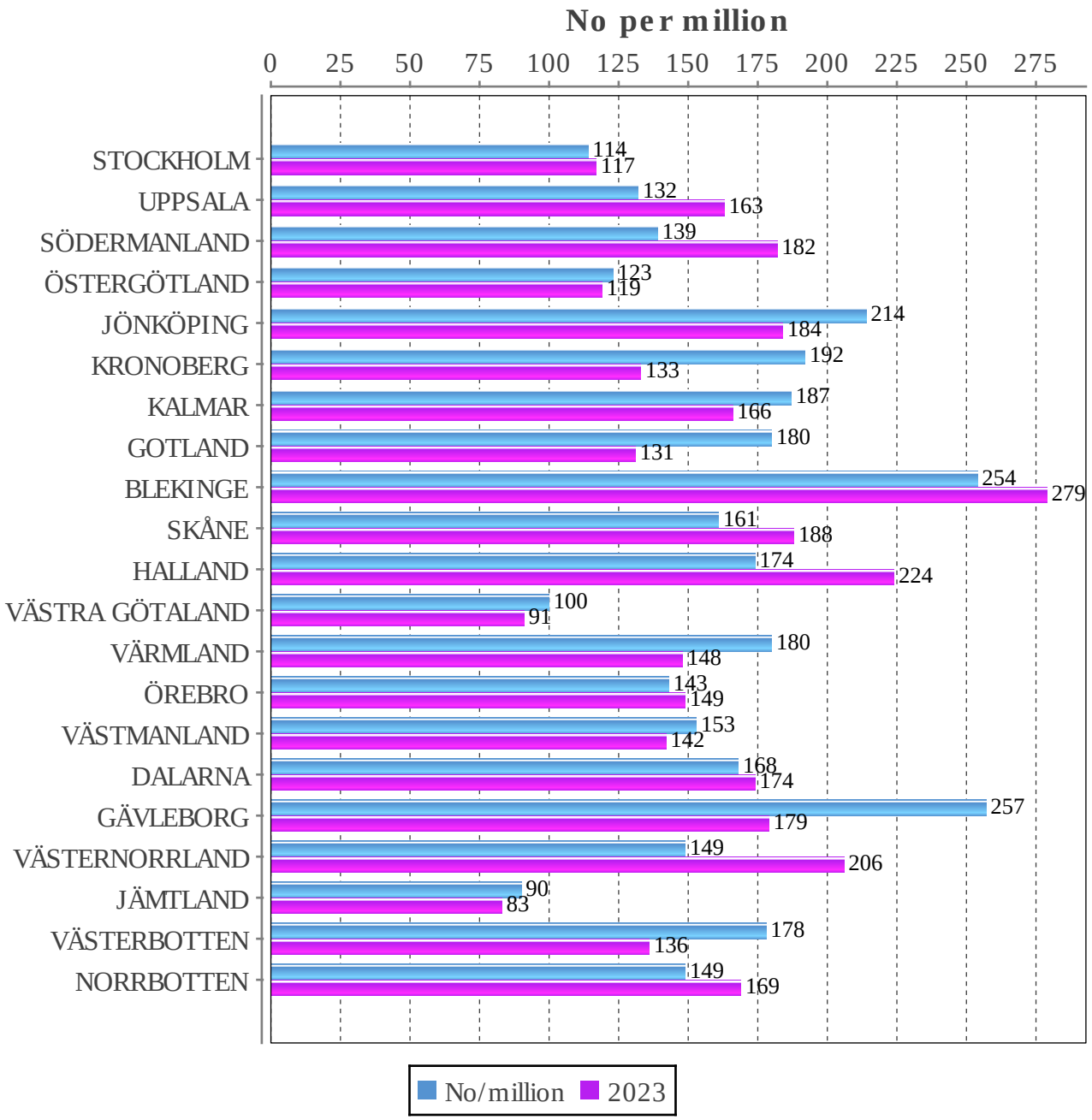
Subtypes and leads

97% of the leads are now single coil and 99% were active fixation. An increase in single coil use from 65%in 2015. Venous axcess for ICD leads is different from PM leads with axillary or cephalic access in 68% of cases and subclavian puncture in only 20% of the cases.


Implants/ million
0
25
50
75
100
125
150
Years
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
34
53
58
74
84
109
120
128
136
137
152
151
149
139
144
146
140
145
136
145
143

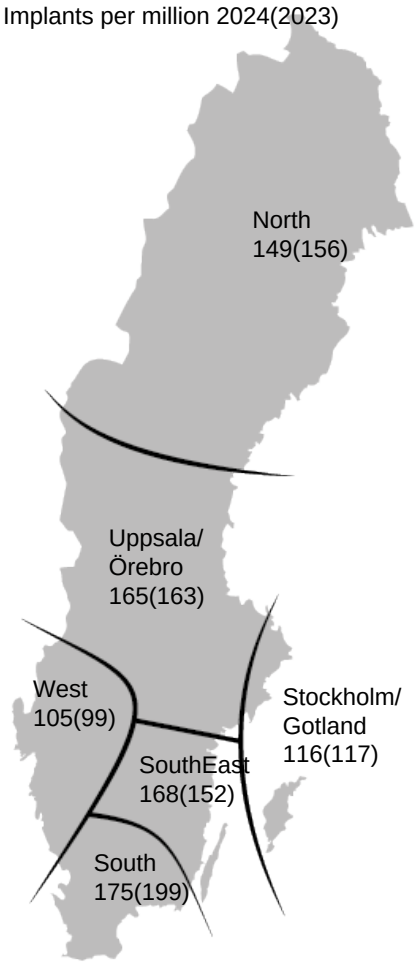
The regions are based on where the patients live, not where they are treated

County	Population	No of first	No/million	Active patients
STOCKHOLM	2473307	282	114	3272
UPPSALA	407912	54	132	684
SÖDERMANLAND	301542	42	139	479
ÖSTERGÖTLAND	472446	58	123	723
JÖNKÖPING	370009	79	214	636
KRONOBERG	203351	39	192	337
KALMAR	246352	46	187	496
GOTLAND	60971	11	180	131
BLEKINGE	157223	40	254	401
SKÅNE	1428626	230	161	2422
HALLAND	345074	60	174	610
VÄSTRA GÖTALAND	1772821	177	100	1926
VÄRMLAND	283384	51	180	456
ÖREBRO	308375	44	143	485
VÄSTMANLAND	281158	43	153	448
DALARNA	286546	48	168	569
GÄVLEBORG	284558	73	257	660
VÄSTERNORRLAND	241458	36	149	499
JÄMTLAND	132839	12	90	227
VÄSTERBOTTEN	281138	50	178	492
NORRBOTTEN	248620	37	149	548
Total	10587710	1512	143	16501


No per million
0
25
50
75
100
125
150
175
200
225
250
275
STOCKHOLM
114
117
UPPSALA
132
163
SÖDERMANLAND
139
182
ÖSTERGÖTLAND
123
119
JÖNKÖPING
214
184
KRONOBERG
192
133
KALMAR
187
166
GOTLAND
180
131
BLEKINGE
254
279
SKÅNE
161
188
HALLAND
174
224
VÄSTRA GÖTALAND
100
91
VÄRMLAND
180
148
ÖREBRO
143
149
VÄSTMANLAND
153
142
DALARNA
168
174
GÄVLEBORG
257
179
VÄSTERNORRLAND
149
206
JÄMTLAND
90
83
VÄSTERBOTTEN
178
136
NORRBOTTEN
149
169
No/million
2023

The regions are based on where the patients live, not where they are treated

Region	Population	No of first impl	No per million	Active patients
Stockholm/Gotland	2534278	293	116	3403
Uppsala/Örebro	2153475	355	165	3781
South-East Sweden	1088807	183	168	1855
Southern Sweden	1932075	338	175	3451
Western Sweden	1975020	208	105	2244
Northern Sweden	904055	135	149	1766
Total	10587710	1512	143	16500

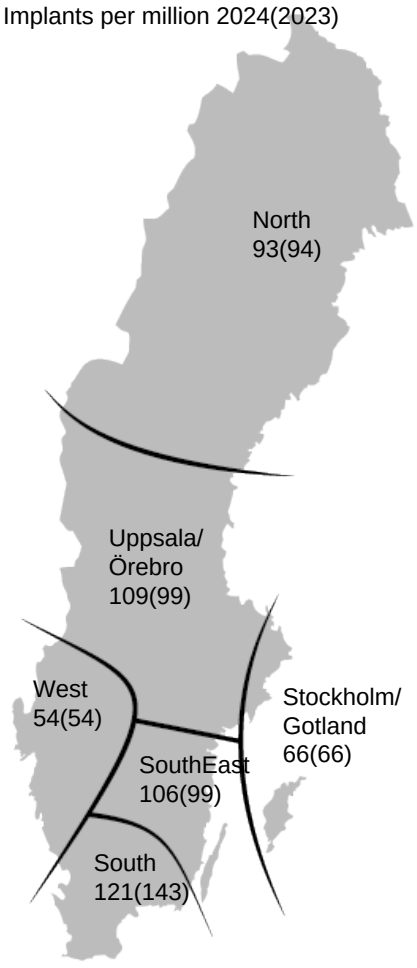


First implants per hospital (inclusive CRT)

Region	Hospital	2024	2023
Northern Sweden	Norrlands Universitetssjukhus	49	41
	Skellefteå lasarett	4	2
	Sollefteå sjukhus	1	0
	Sunderby sjukhus	32	41
	Sundsvalls sjukhus	21	34
	Örnsköldsviks sjukhus	12	14
	Östersunds sjukhus	11	10
Southern Sweden	Blekingesjukhuset	39	43
	Centrallasarettet Växjö	36	22
	Centralsjukhuset Kristianstad	36	38
	Helsingborgs lasarett	25	21
	Skånes universitetssjukhus, Lund	146	180
	Skånes universitetssjukhus, Malmö	43	38
	Varbergs sjukhus	53	79
South-East Sweden	Linköpings Universitetssjukhus	82	72
	Länssjukhuset Kalmar	41	41
	Länssjukhuset Ryhov	57	48
Stockholm/Gotland	Danderyds sjukhus	63	62
	Karolinska Universitetssjukhuset	147	134
	St Görans sjukhus	47	40
	Södersjukhuset	51	69
	Visby lasarett	2	4
Uppsala/Örebro	Akademiska sjukhuset	61	63
	Centralsjukhuset Karlstad	52	39
	Centralsjukhuset Västerås	41	35
	Falu lasarett	47	50
	Gävle sjukhus	57	40
	Hudiksvalls sjukhus	12	11
	Mälarsjukhuset	36	52
	Universitetssjukhuset Örebro	42	51
Western Sweden	Sahlgrenska Universitetssjukhuset	85	62
	Skaraborgs sjukhus Skövde	28	23
	Södra Älvsborgs sjukhus	30	40
	Trollhättan, NÄL	40	37

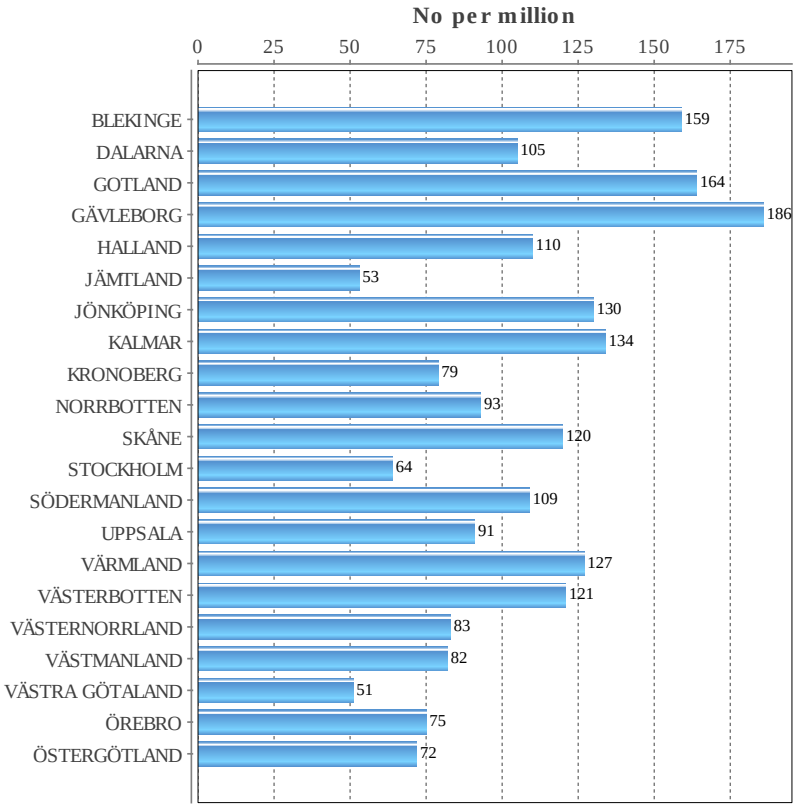
The regions are based on where the patients live, not where they are treated

Region	Population	No of first impl	No per million	Active patients
Stockholm/Gotland	2534278	168	66	1903
Uppsala/Örebro	2153475	235	109	2283
South-East Sweden	1088807	115	106	1143
Southern Sweden	1932075	234	121	2143
Western Sweden	1975020	107	54	1132
Northern Sweden	904055	84	93	1022
Total	10587710	943	89	9626



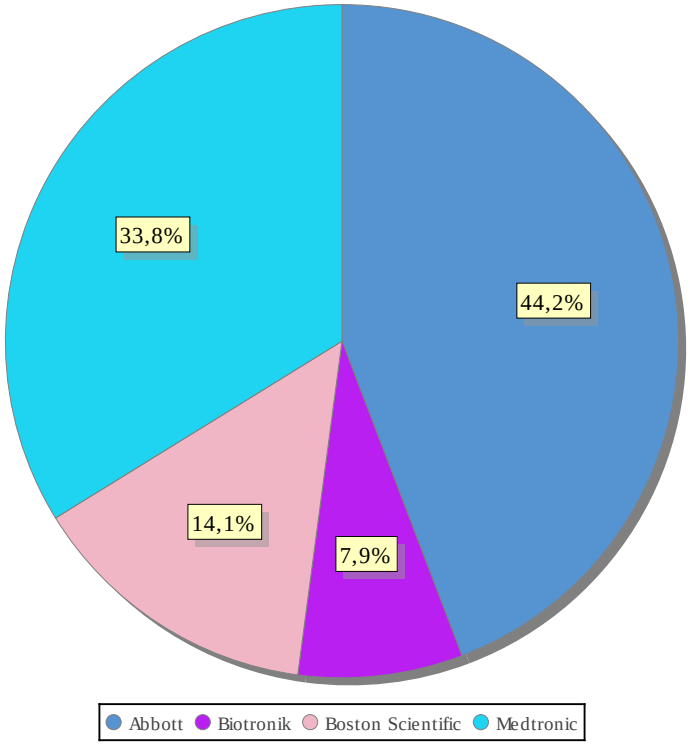
The regions are based on where the patients live, not where they are treated

County	Population	No of first	No/million
BLEKINGE	157223	25	159
DALARNA	286546	30	105
GOTLAND	60971	10	164
GÄVLEBORG	284558	53	186
HALLAND	345074	38	110
JÄMTLAND	132839	7	53
JÖNKÖPING	370009	48	130
KALMAR	246352	33	134
KRONOBERG	203351	16	79
NORRBOTTEN	248620	23	93
SKÅNE	1428626	172	120
STOCKHOLM	2473307	158	64
SÖDERMANLAND	301542	33	109
UPPSALA	407912	37	91
VÄRMLAND	283384	36	127
VÄSTERBOTTEN	281138	34	121
VÄSTERNORRLAND	241458	20	83
VÄSTMANLAND	281158	23	82
VÄSTRA GÖTALAND	1772821	90	51
ÖREBRO	308375	23	75
ÖSTERGÖTLAND	472446	34	72
Total	10587710	943	89



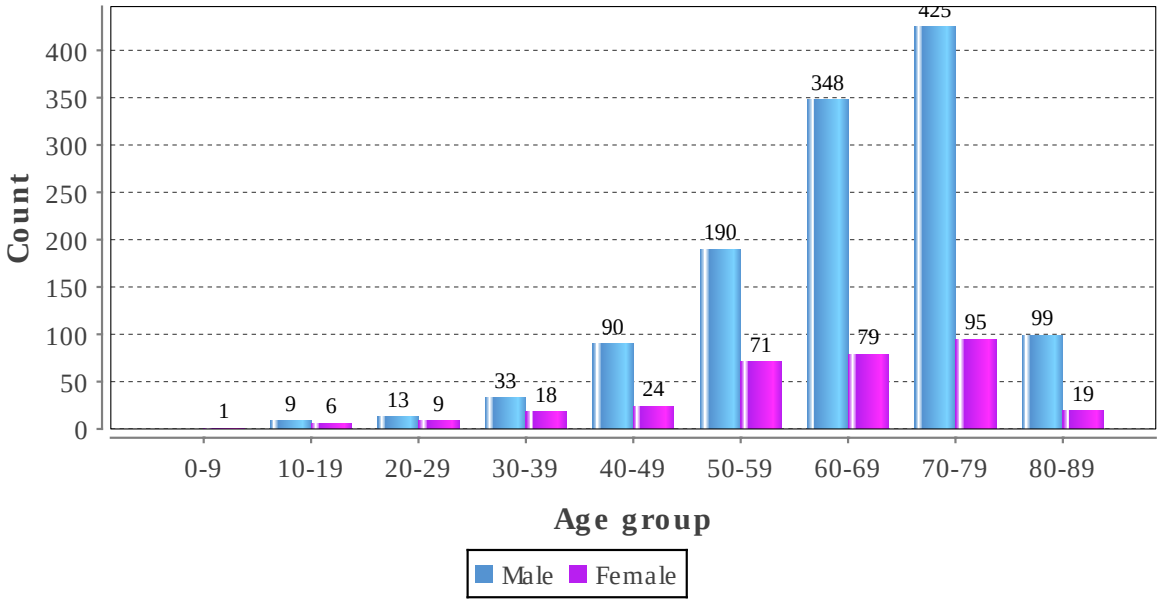
Market share per manufacturer in Sweden

Manufacturer	2021 %	2022 %	2023 %	2024 %
Biotronik	4.7	5.4	6.5	7.9
Boston Scientific	10.2	12.6	14.9	14.1
Medtronic	32.9	33.4	32.5	33.8
Abbott	52.2	48.5	43.4	44.2



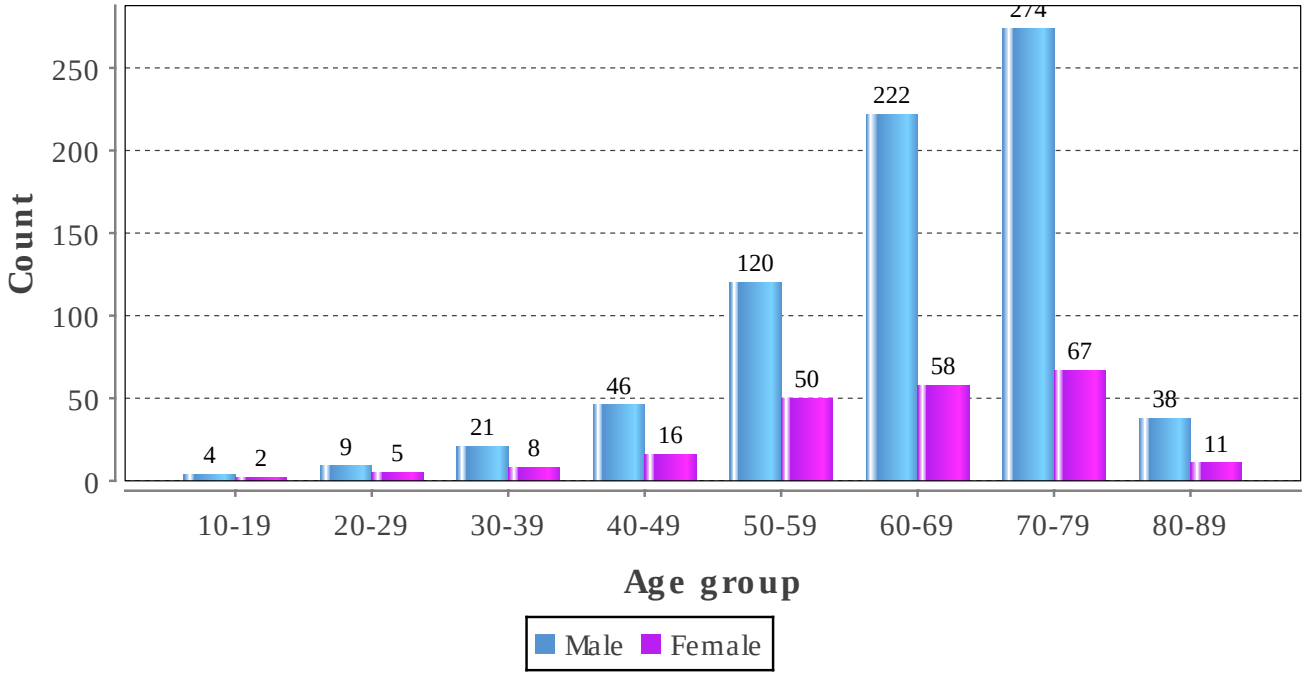
Age and gender distribution for new implants, total numbers

Age (years)	Total no	%	Male	Female
0-9	1	0.1	0	1
10-19	15	1.0	9	6
20-29	22	1.4	13	9
30-39	51	3.3	33	18
40-49	114	7.5	90	24
50-59	261	17.1	190	71
60-69	427	27.9	348	79
70-79	520	34.0	425	95
80-89	118	7.7	99	19
Average age	64	-	65	61
				Total number of implants: 1529

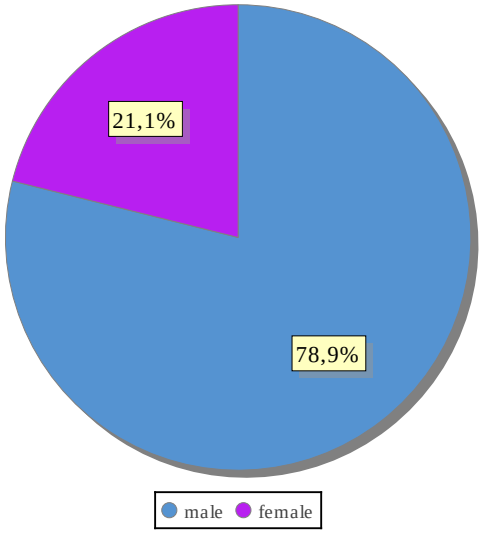


Primary prevention divided by gender and age.

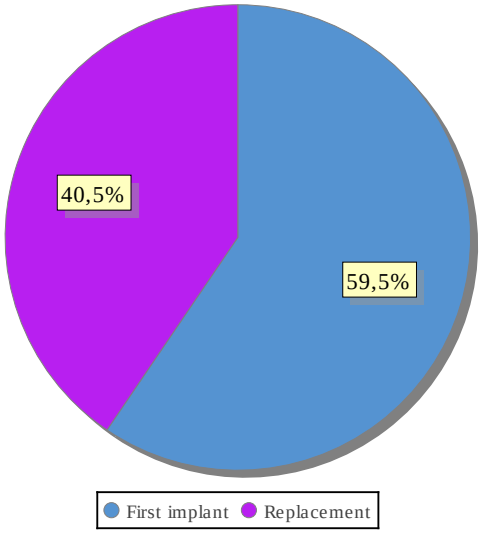
Age (years)	Total no	%	Male	Female
10-19	6	0.6	4	2
20-29	14	1.5	9	5
30-39	29	3.0	21	8
40-49	62	6.5	46	16
50-59	170	17.9	120	50
60-69	280	29.4	222	58
70-79	341	35.9	274	67
80-89	49	5.2	38	11
Average age	64	-	65	62
				Total number of implants: 951



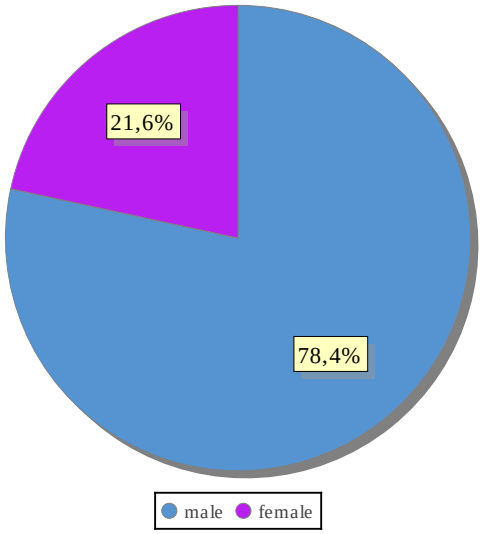
First implant



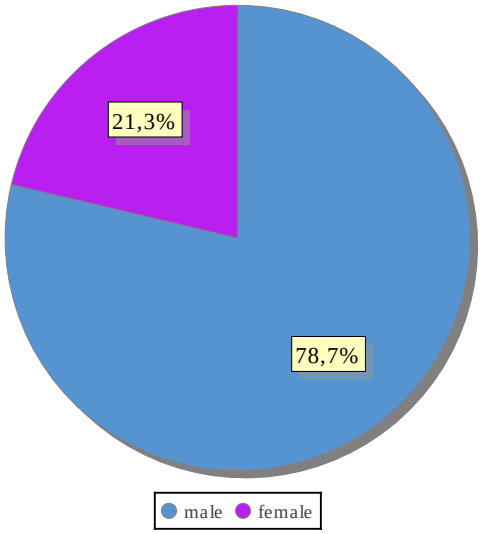
Replacement ratio



Replacement

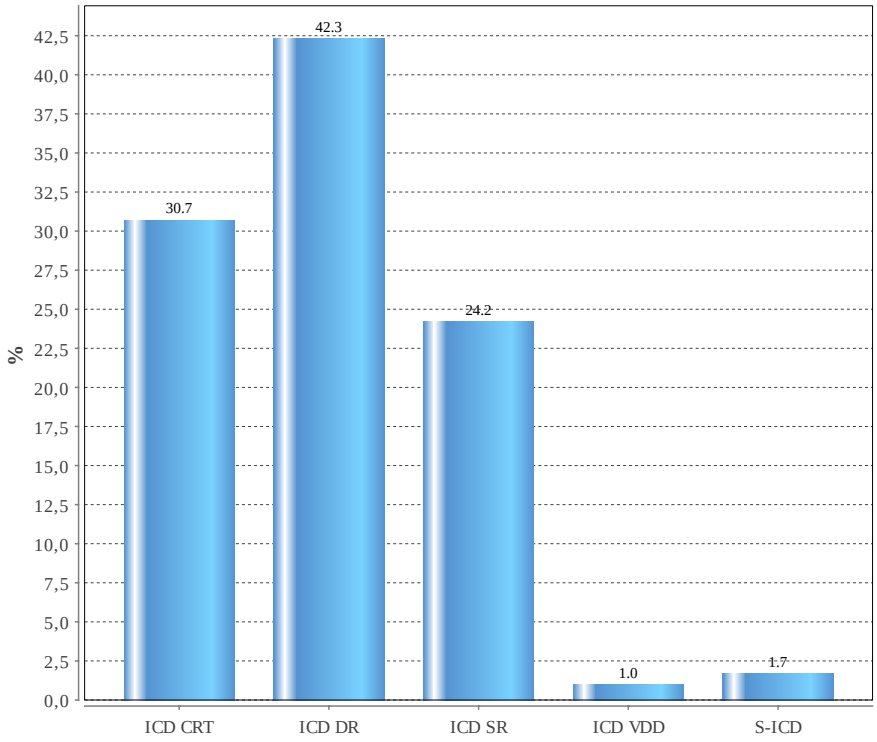


All implant



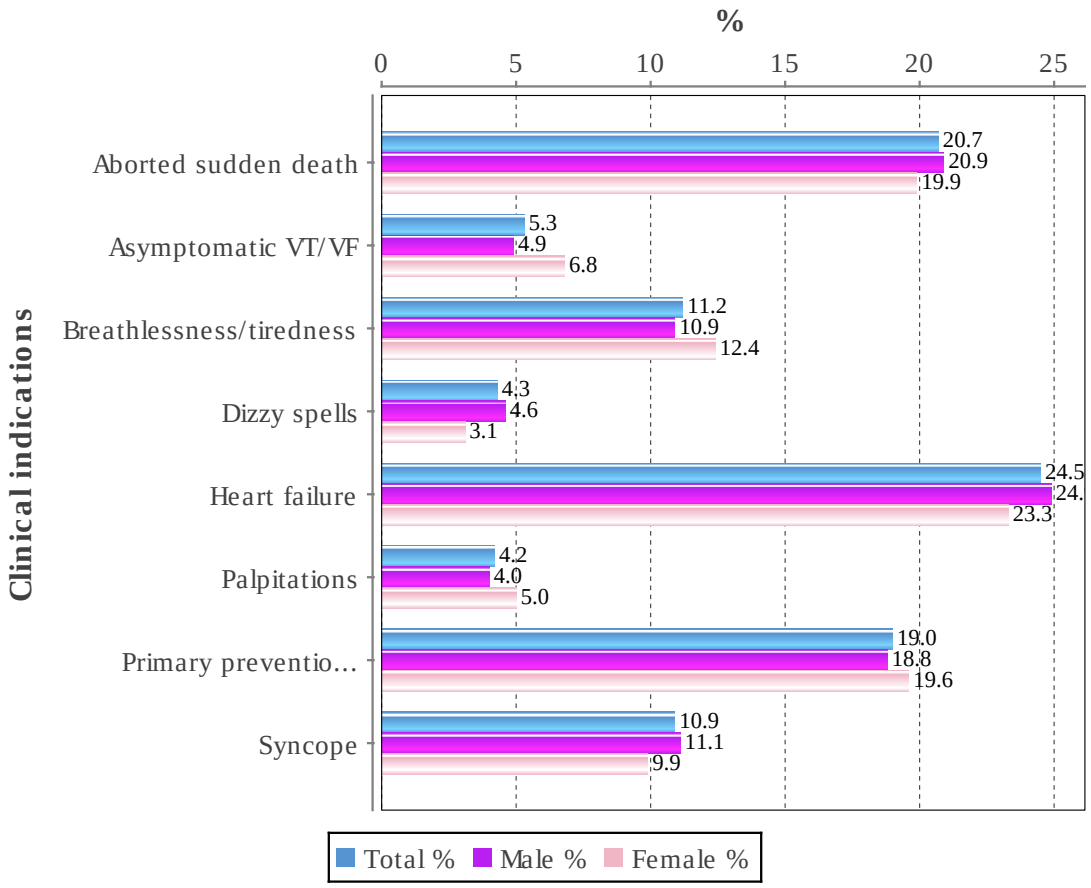
ICD subtype for new implants

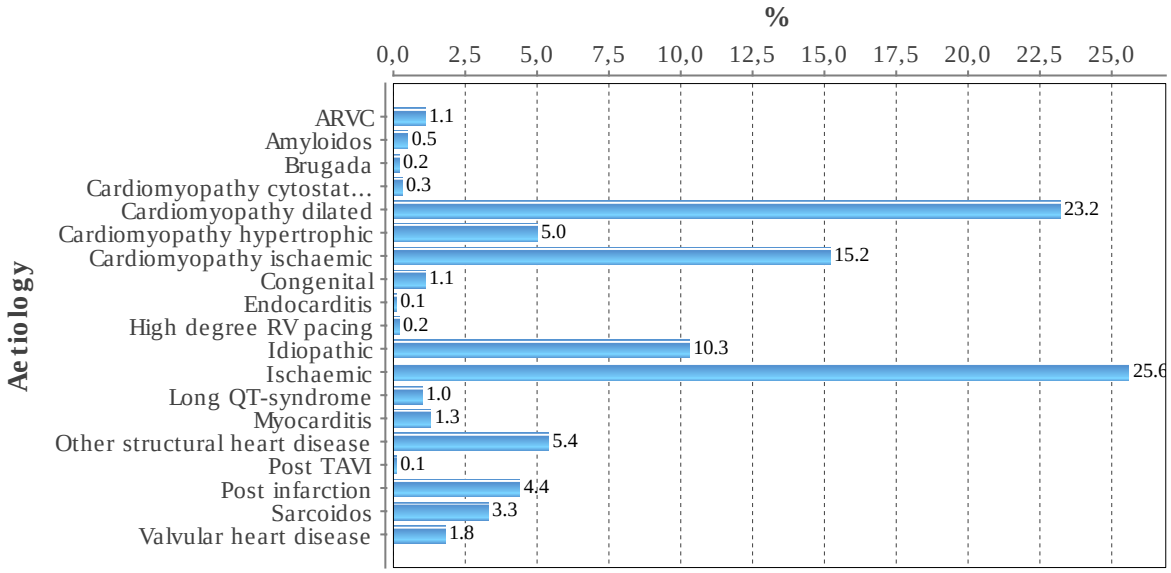
Mode	%	No
ICD CRT	30.7	470
ICD DR	42.3	647
ICD SR	24.2	370
ICD VDD	1.0	16
S-ICD	1.7	26

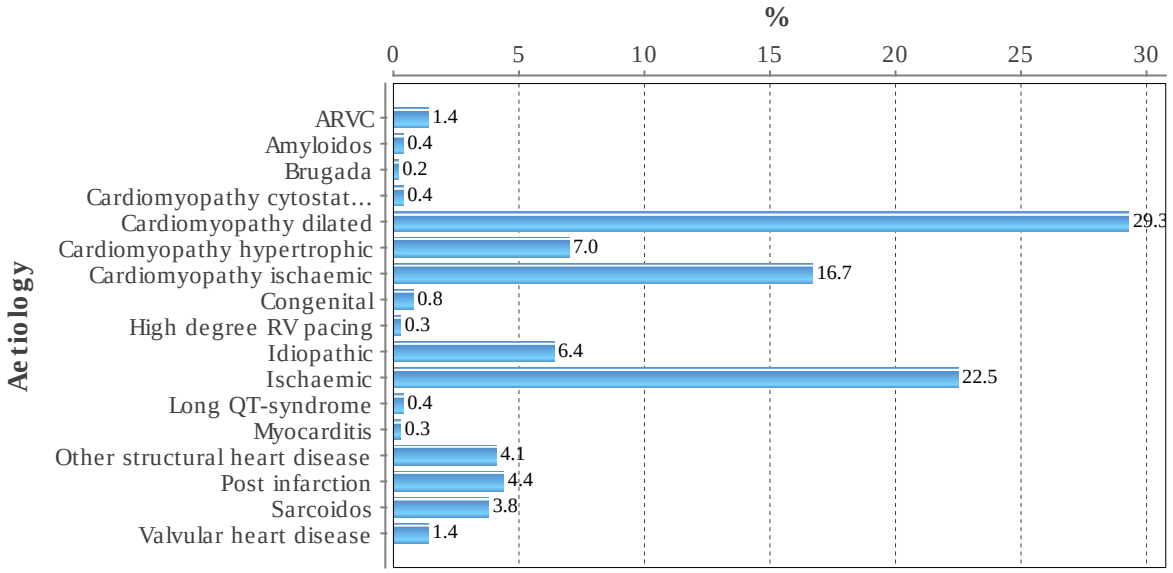


Main symptom for implanting ICDs

Indication	Total %	Male %	Female %
Aborted sudden death	20.7	20.9	19.9
Asymptomatic VT/VF	5.3	4.9	6.8
Breathlessness/tiredness	11.2	10.9	12.4
Dizzy spells	4.3	4.6	3.1
Heart failure	24.5	24.9	23.3
Palpitations	4.2	4.0	5.0
Primary prevention, asymptomatic	19.0	18.8	19.6
Syncope	10.9	11.1	9.9

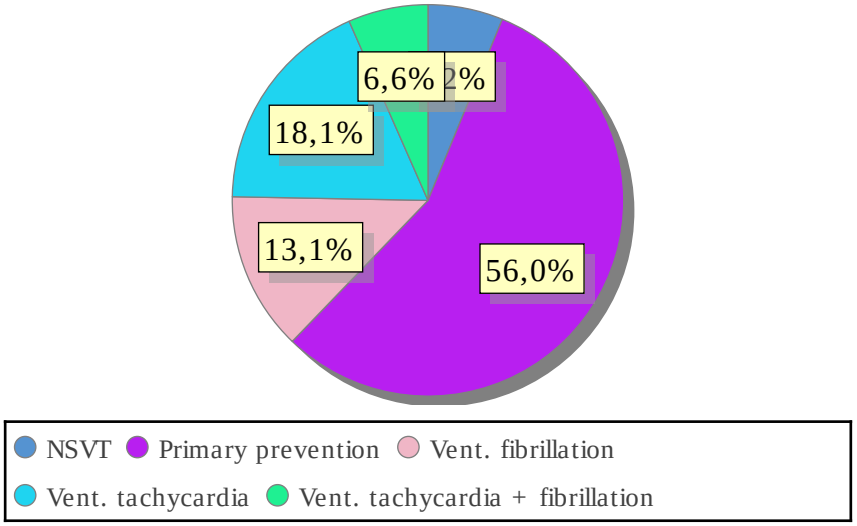


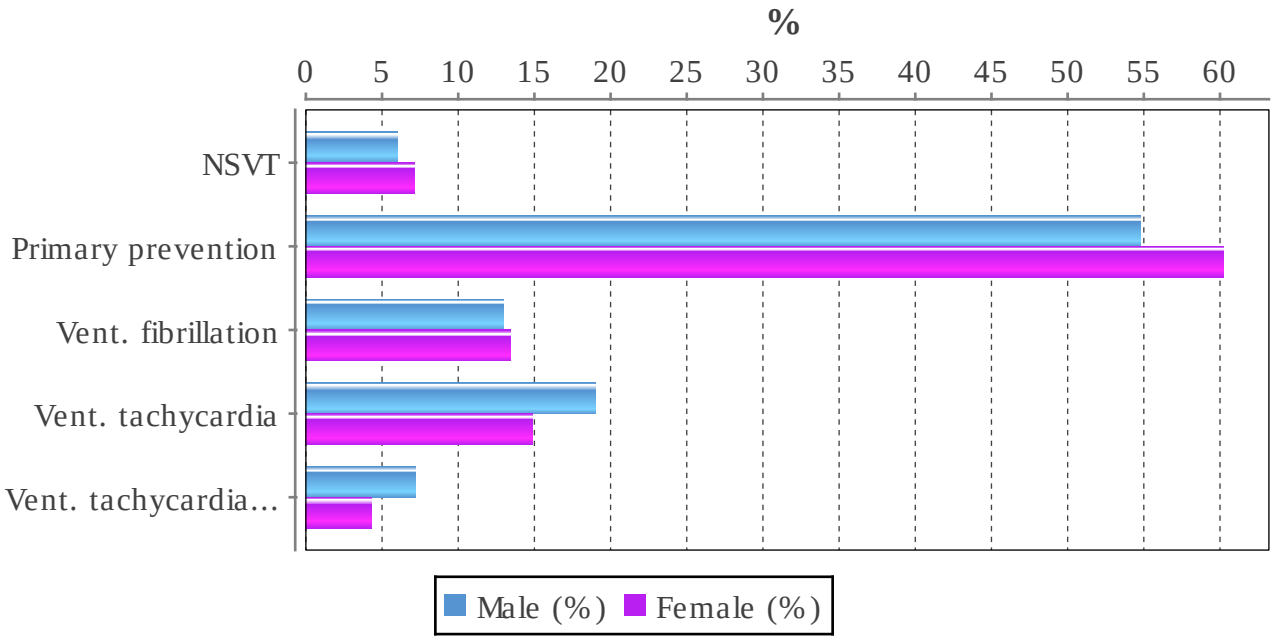

%
0,0
2,5
5,0
7,5
10,0
12,5
15,0
17,5
20,0
22,5
25,0
Aetiology
ARVC
Amyloidos
Brugada
Cardiomyopathy cytostat...
Cardiomyopathy dilated
Cardiomyopathy hypertrophic
Cardiomyopathy ischaemic
Congenital
Endocarditis
High degree RV pacing
Idiopathic
Ischaemic
Long QT-syndrome
Myocarditis
Other structural heart disease
Post TAVI
Post infarction
Sarcoidos
Valvular heart disease
1.1
0.5
0.2
0.3
23.2
5.0
15.2
1.1
0.1
0.2
10.3
25.6
1.0
1.3
5.4
0.1
4.4
3.3
1.8


%
0
5
10
15
20
25
30
Aetiology
ARVC
1.4
Amyloidos
0.4
Brugada
0.2
Cardiomyopathy cytostat...
0.4
Cardiomyopathy dilated
29.3
Cardiomyopathy hypertrophic
7.0
Cardiomyopathy ischaemic
16.7
Congenital
0.8
High degree RV pacing
0.3
Idiopathic
6.4
Ischaemic
22.5
Long QT-syndrome
0.4
Myocarditis
0.3
Other structural heart disease
4.1
Post infarction
4.4
Sarcoidos
3.8
Valvular heart disease
1.4

Documented ECG leading to ICD implant.(NSVT = non sustained VT) by gender and patients < 18 years

Indication	No	Total %	Male (%)	Female (%)	lt 18 (%)
NSVT	95	6.2	6.0	7.1	0.0
Primary prevention	856	56.0	54.8	60.2	18.2
Vent. fibrillation	200	13.1	13.0	13.4	45.5
Vent. tachycardia	277	18.1	19.0	14.9	9.1
Vent. tachycardia + fibrillation	101	6.6	7.2	4.3	27.3
				Total number of implants	1529





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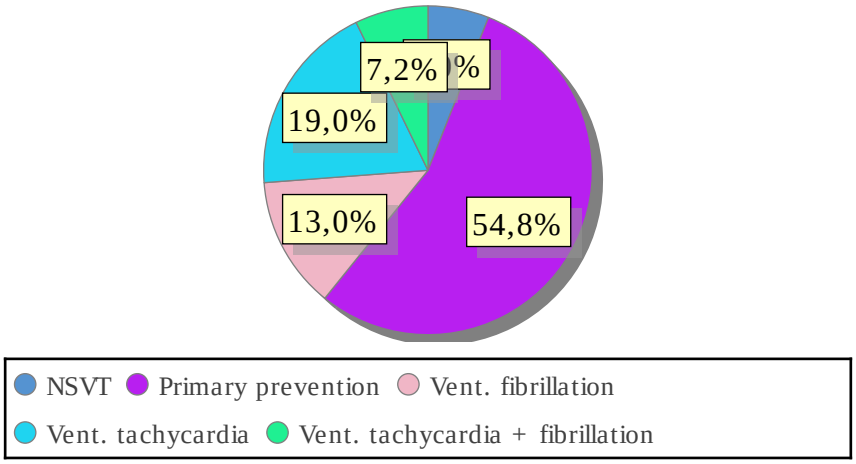
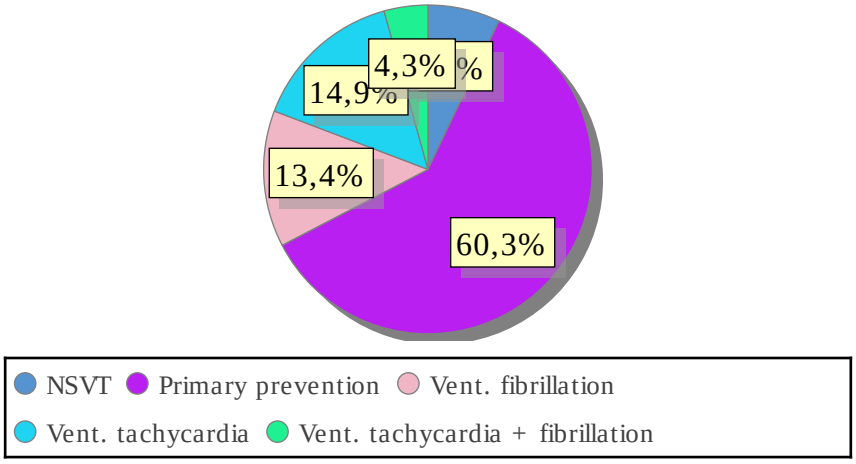


Female



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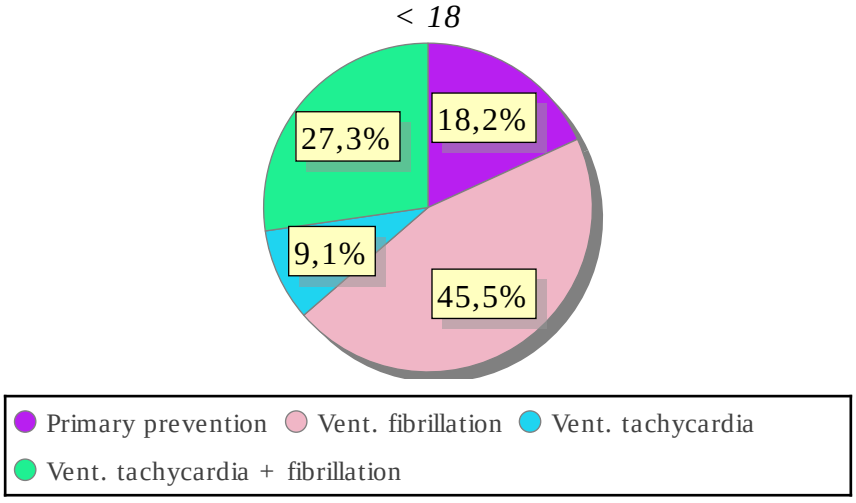
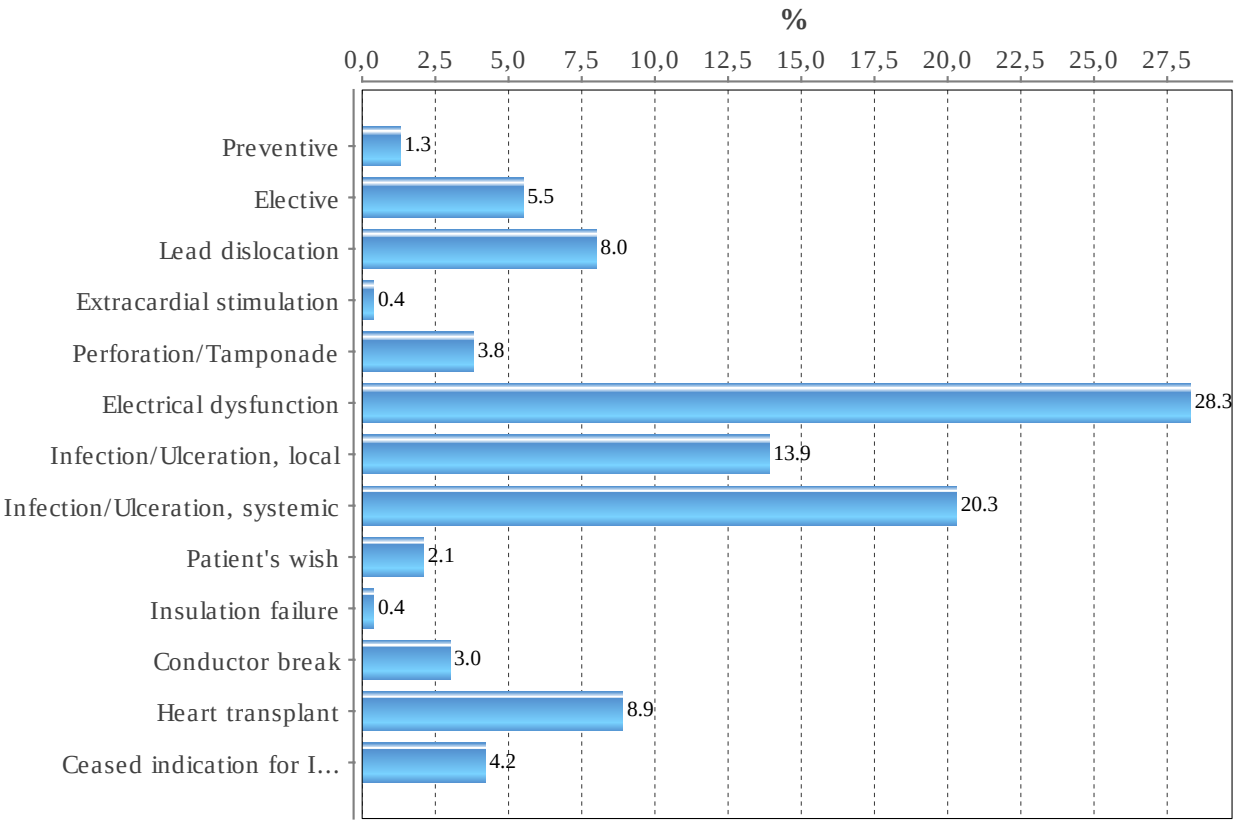


Historical explants indications

Reason	2022 %	2023 %	2024 %
Preventive	1.3	1.4	1.1
Elective	14.1	18.1	19.6
Recall/Alert	0.1	0.1	0.1
Erosion/Infection, local	3.6	3.9	2.6
Erosion/Infection, systemic	4.5	3.2	4.1
Patient's wish	0.6	0.8	0.4
CRT-D to CRT-P	0.5	0.8	0.8
ERI	59.0	55.8	56.6
Premature EOL	1.8	1.1	0.7
Heart transplant	2.0	2.8	1.8
Ceased indication for ICD therapy	1.4	1.9	1.0
ICD to CRT-D	9.5	8.7	9.4
ICD to PM because of ceased indication	0.7	0.3	0.5
Technical failure	0.9	0.8	0.9
CRT-D to ICD because of ceased CRT-indication	0.0	0.2	0.1
ICD to CRT-P because of heart failure	0.0	0.0	0.4

Historical lead explants indications

Reason	2022 %	2023 %	2024 %
Preventive	0.8	1.2	1.3
Elective	4.7	5.5	5.5
Lead dislocation	8.2	7.5	8.0
Perforation/Tamponade	0.8	1.6	3.8
Electrical dysfunction	32.9	32.3	28.3
Infection/Ulceration, local	14.5	14.6	13.9
Infection/Ulceration, systemic	18.4	13.8	20.3
Patient's wish	2.4	0.8	2.1
Insulation failure	0.4	0.8	0.4
Conductor break	2.7	2.8	3.0
Heart transplant	8.2	11.8	8.9
Ceased indication for ICD therapy	5.1	6.7	4.2
Venous access	0.8	0.4	0.0
Extracardial stimulation	0.0	0.4	0.4



Implant rates

Implant rates of CRT system in 2024 were 66 per million CRT-P's and 55 per million CRT-D's. The highest implant rate of CRT in total is found in Dalarna with 238 per million and the lowest in Kronoberg with 50 per million new implants or upgrades.
The distribution between CRT-D and CRT-P systems show only small regional differences.

Patients

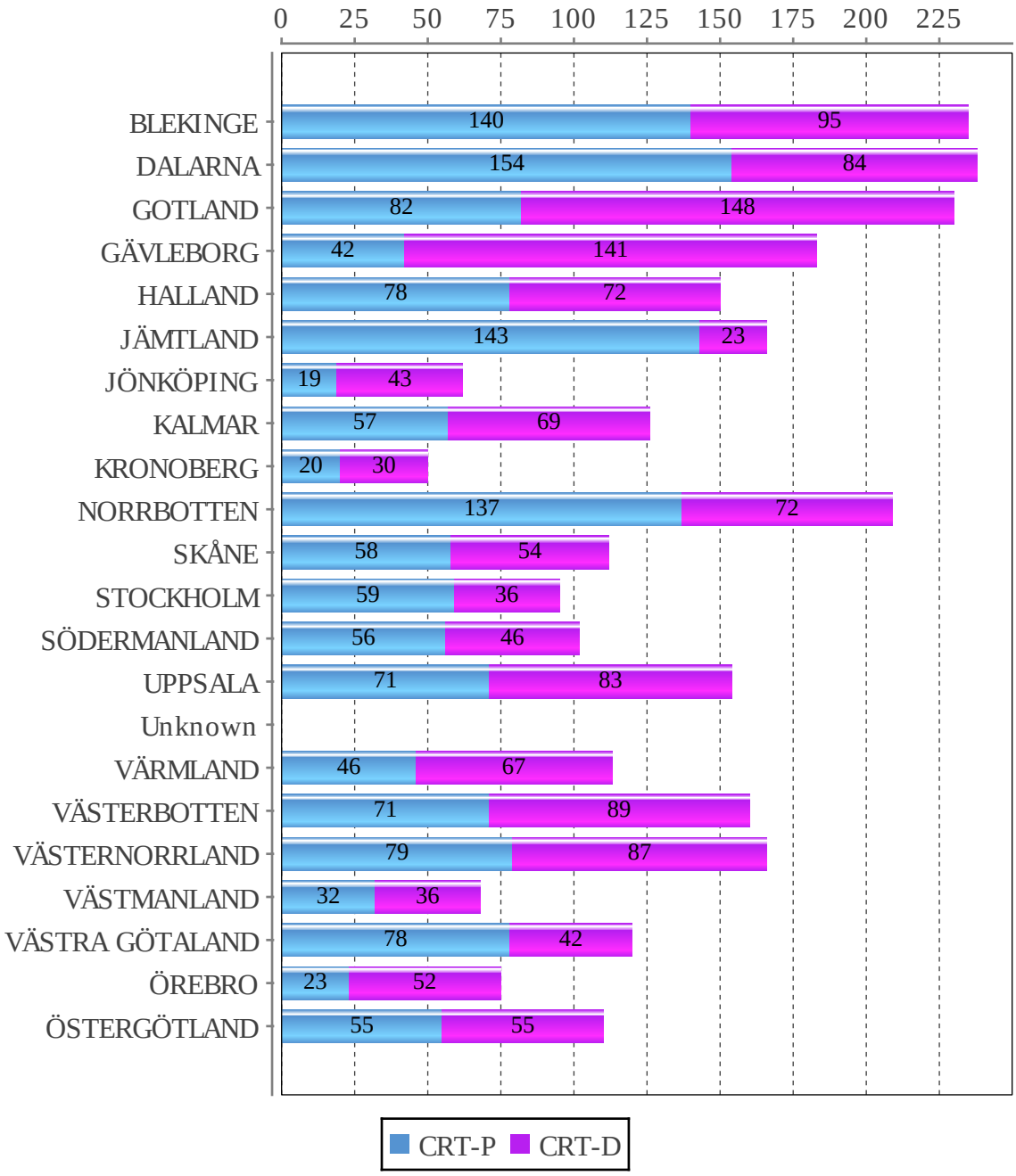
The average age of CRT-P patients at first implant is 76 y and CRT-D patients 67 years with a large male predominance, the same as last year. Medication for patients receiving CRT for the first time is given in tables.

Implanting organisations

The number of centers performing CRT implantations are less than the number doing ICD's 22 vs 32. The number of CRT procedures per implanter range from 1-77 and only a few implanters performing >50 implants. The failure rate at implant is according to the registry 5% but this is most likely an underestimation when compared to the literature.

CRT Historical implant rates per hundred thousand residents

			CRT-P		CRT-D	
Year	**Population**	**No First Impl**	**No**	**Rate**	**No**	**Rate**
2020	10379295	1162	563	5.4	599	5.8
2021	10457147	1236	606	5.8	630	6.0
2022	10520558	1221	652	6.2	569	5.4
2023	10551707	1246	694	6.6	552	5.2
2024	10587700	1281	701	6.6	580	5.5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BLEKINGE
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DALARNA
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GOTLAND
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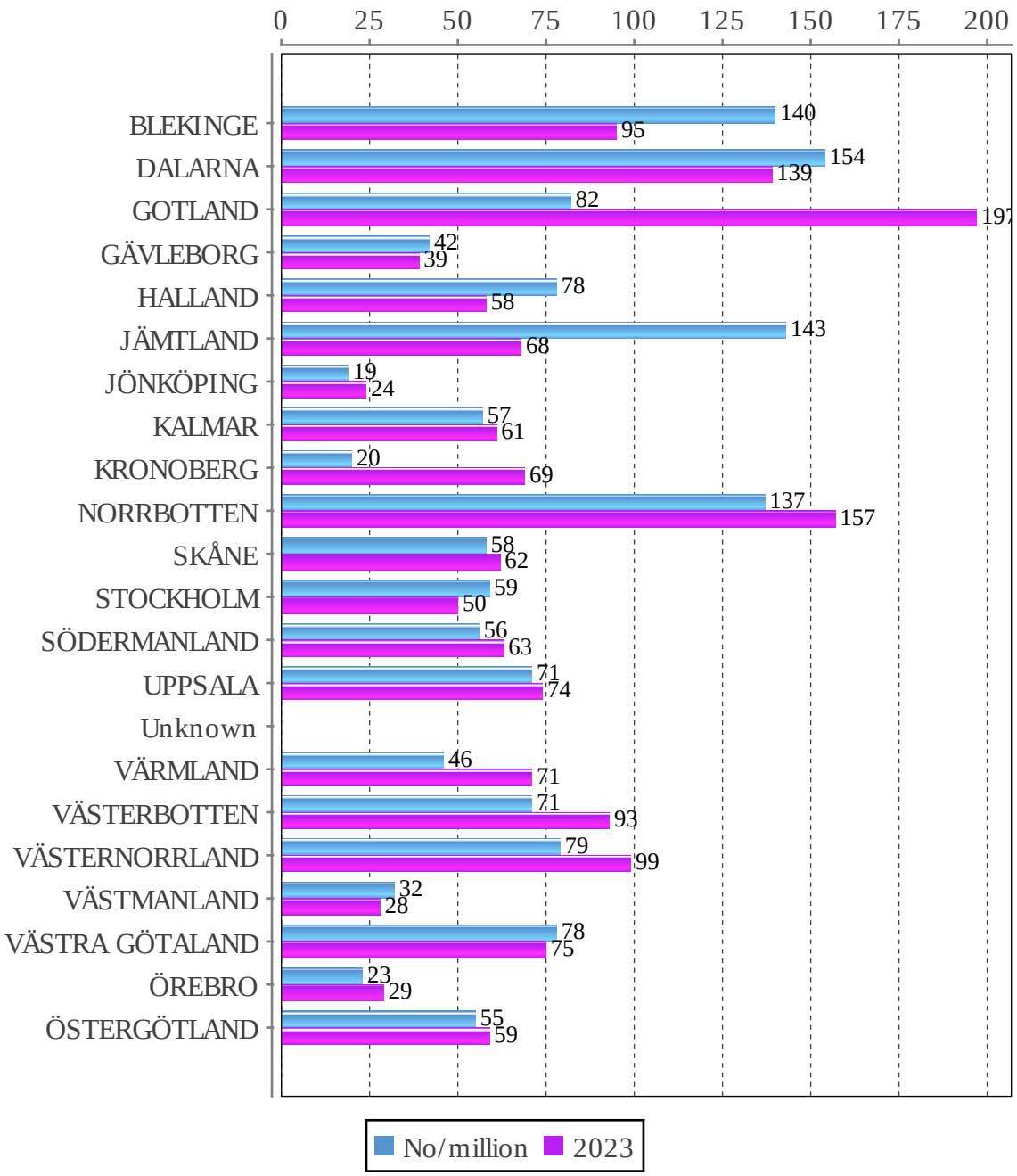
148
GÄVLEBORG
42
141
HALLAND
78
72
JÄMTLAND
143
23
JÖNKÖPING
19
43
KALMAR
57
69
KRONOBERG
20
30
NORRBOTTEN
137
72
SKÅNE
58
54
STOCKHOLM
59
36
SÖDERMANLAND
56
46
UPPSALA
71
83
Unknown
VÄRMLAND
46
67
VÄSTERBOTTEN
71
89
VÄSTERNORRLAND
79
87
VÄSTMANLAND
32
36
VÄSTRA GÖTALAND
78
42
ÖREBRO
23
52
ÖSTERGÖTLAND
55
55
CRT-P
CRT-D

The regions are based on where the patients live, not where they are treated

	Population	No first impl	No/million
BLEKINGE	157223	22	140
DALARNA	286546	44	154
GOTLAND	60971	5	82
GÄVLEBORG	284558	12	42
HALLAND	345074	27	78
JÄMTLAND	132839	19	143
JÖNKÖPING	370009	7	19
KALMAR	246352	14	57
KRONOBERG	203351	4	20
NORRBOTTEN	248620	34	137
SKÅNE	1428626	83	58
STOCKHOLM	2473307	146	59
SÖDERMANLAND	301542	17	56
UPPSALA	407912	29	71
Unknown	0	8	0
VÄRMLAND	283384	13	46
VÄSTERBOTTEN	281138	20	71
VÄSTERNORRLAND	241458	19	79
VÄSTMANLAND	281158	9	32
VÄSTRA GÖTALAND	1772821	139	78
ÖREBRO	308375	7	23
ÖSTERGÖTLAND	472446	26	55
Total	10587710	704	66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HALLAND
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JÄMTLAND
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JÖNKÖPING
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KALMAR
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KRONOBERG
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NORRBOTTEN
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SKÅNE
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62
STOCKHOLM
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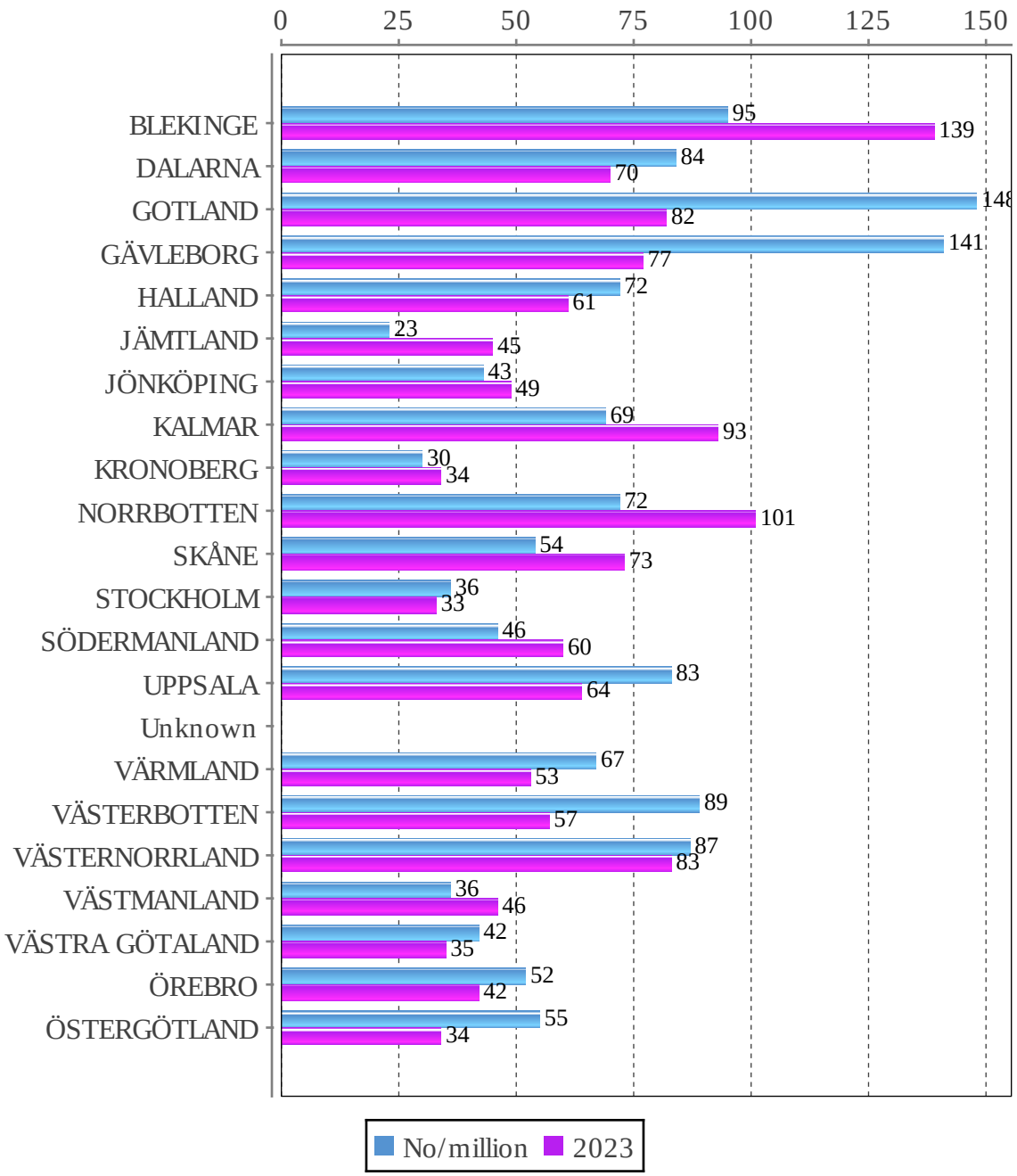
SÖDERMANLAND
56
63
UPPSALA
71
74
Unknown
VÄRMLAND
46
71
VÄSTERBOTTEN
71
93
VÄSTERNORRLAND
79
99
VÄSTMANLAND
32
28
VÄSTRA GÖTALAND
78
75
ÖREBRO
23
29
ÖSTERGÖTLAND
55
59
No/million
2023

STATISTICS – CRT-D – IMPLANTS PER COUNTY

The regions are based on where the patients live, not where they are treated

	Population	No first impl	No/million
BLEKINGE	157223	15	95
DALARNA	286546	24	84
GOTLAND	60971	9	148
GÄVLEBORG	284558	40	141
HALLAND	345074	25	72
JÄMTLAND	132839	3	23
JÖNKÖPING	370009	16	43
KALMAR	246352	17	69
KRONOBERG	203351	6	30
NORRBOTTEN	248620	18	72
SKÅNE	1428626	77	54
STOCKHOLM	2473307	88	36
SÖDERMANLAND	301542	14	46
UPPSALA	407912	34	83
Unknown	0	6	0
VÄRMLAND	283384	19	67
VÄSTERBOTTEN	281138	25	89
VÄSTERNORRLAND	241458	21	87
VÄSTMANLAND	281158	10	36
VÄSTRA GÖTALAND	1772821	74	42
ÖREBRO	308375	16	52
ÖSTERGÖTLAND	472446	26	55
Total	10587710	583	55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DALARNA
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GOTLAND
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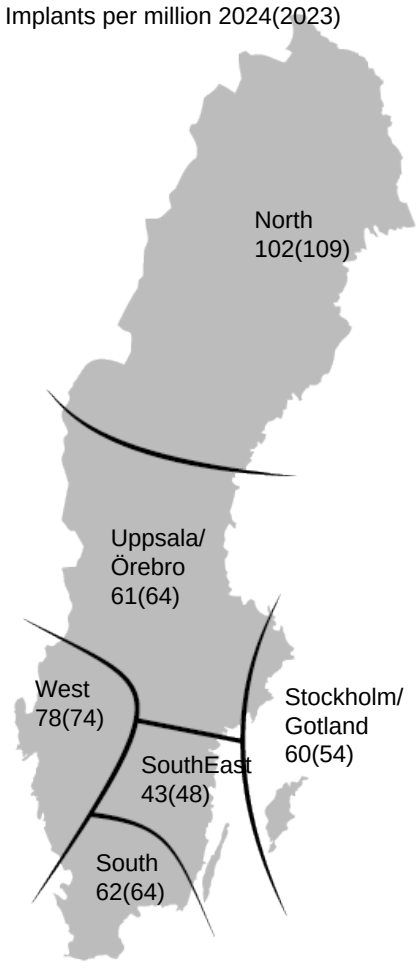
141
77
HALLAND
72
61
JÄMTLAND
23
45
JÖNKÖPING
43
49
KALMAR
69
93
KRONOBERG
30
34
NORRBOTTEN
72
101
SKÅNE
54
73
STOCKHOLM
36
33
SÖDERMANLAND
46
60
UPPSALA
83
64
Unknown
VÄRMLAND
67
53
VÄSTERBOTTEN
89
57
VÄSTERNORRLAND
87
83
VÄSTMANLAND
36
46
VÄSTRA GÖTALAND
42
35
ÖREBRO
52
42
ÖSTERGÖTLAND
55
34
No/million
2023

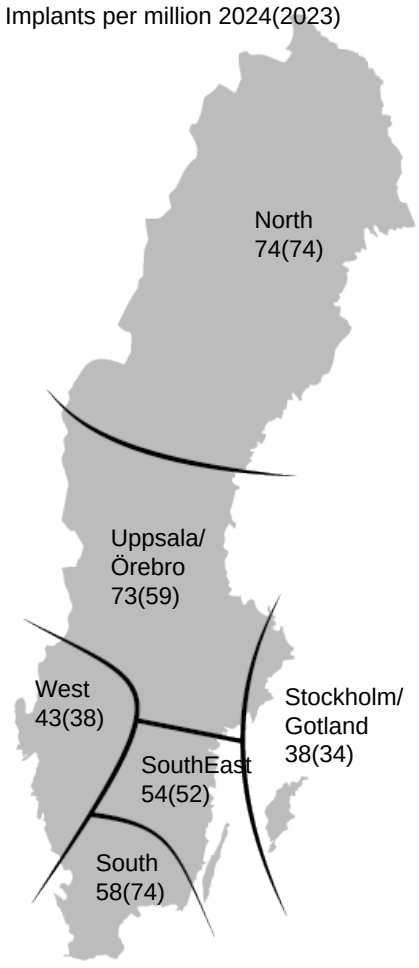
The regions are based on where the patients live, not where they are treated

Region	Population	No of first impl	No per million
Stockholm/Gotland	2534278	151	60
Uppsala/Örebro	2153475	131	61
South-East Sweden	1088807	47	43
Southern Sweden	1932075	120	62
Western Sweden	1975020	155	78
Northern Sweden	904055	92	102
Total	10587710	696	66



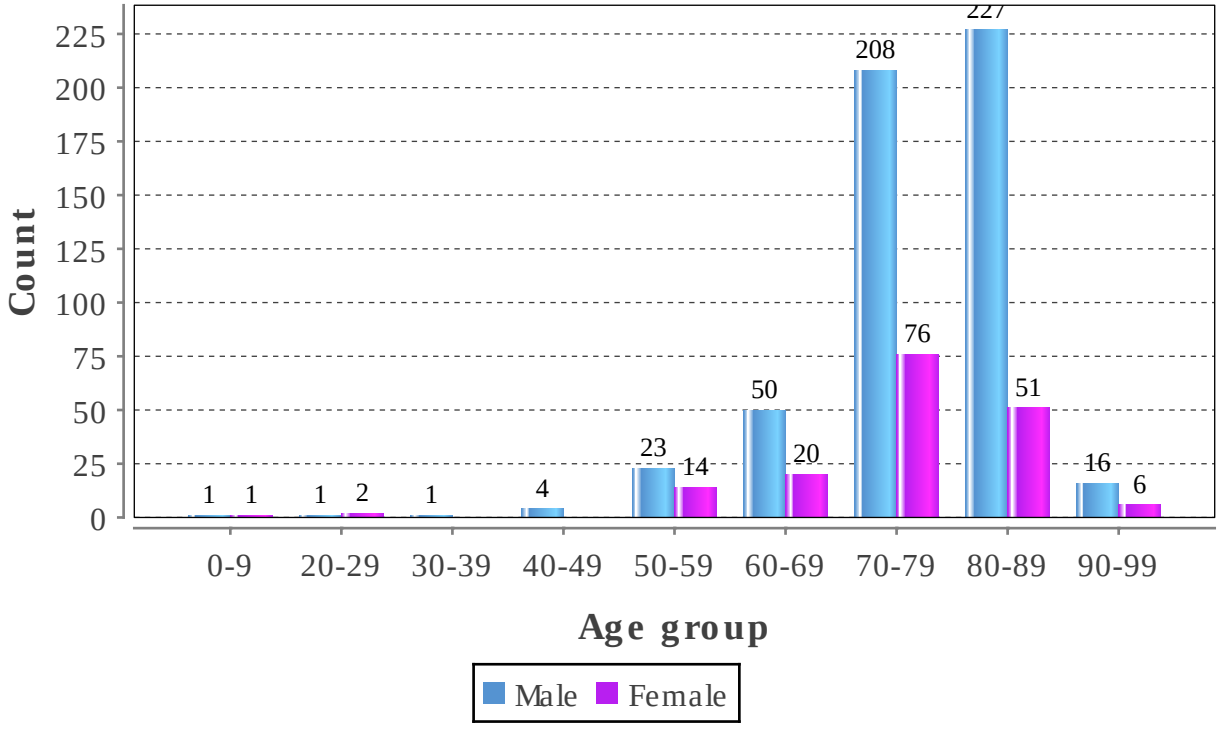
The regions are based on where the patients live, not where they are treated

Region	Population	No of first impl	No per million
Stockholm/Gotland	2534278	97	38
Uppsala/Örebro	2153475	157	73
South-East Sweden	1088807	59	54
Southern Sweden	1932075	113	58
Western Sweden	1975020	85	43
Northern Sweden	904055	67	74
Total	10587710	578	55



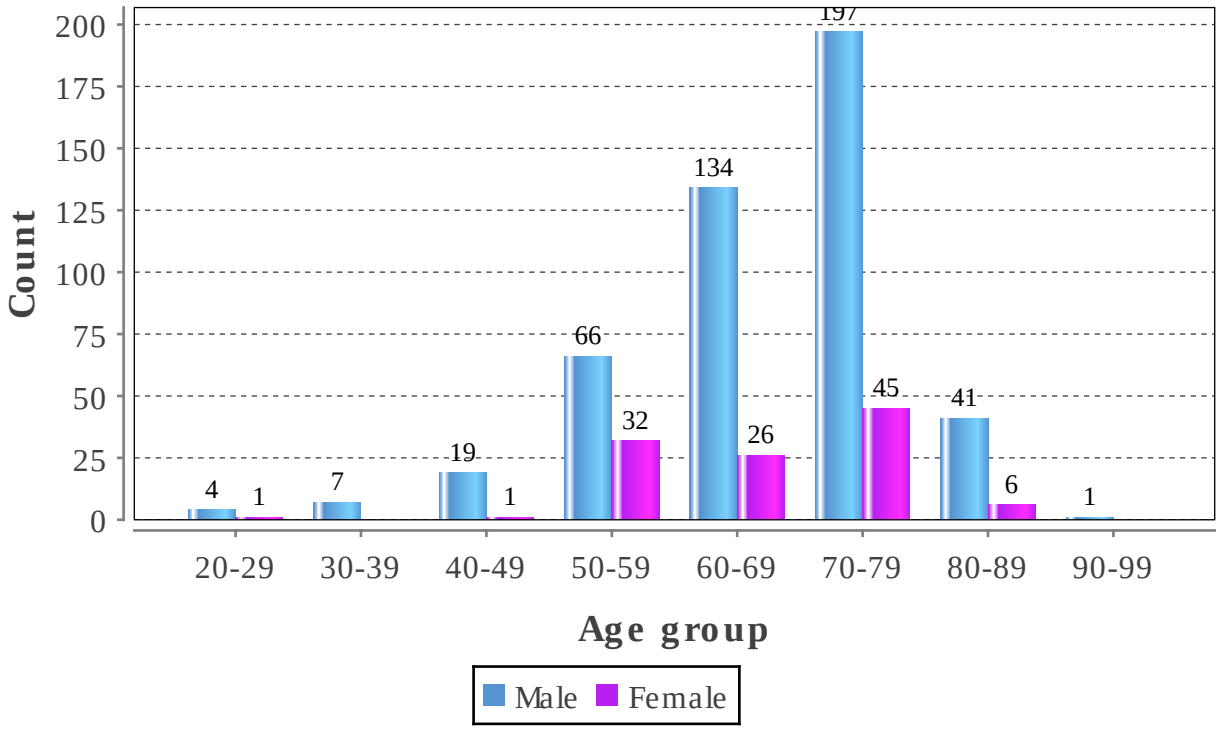
Age and gender distribution for new implants, total numbers

Age (years)	Total no	%	Male	Female
0-9	2	0.3	1	1
20-29	3	0.4	1	2
30-39	1	0.1	1	0
40-49	4	0.6	4	0
50-59	37	5.3	23	14
60-69	70	10.0	50	20
70-79	284	40.5	208	76
80-89	278	39.7	227	51
90-99	22	3.1	16	6
Average age	76	0.0	77	74
				Total number of implants: 701



Age and gender distribution for new implants, total numbers

Age (years)	Total no	%	Male	Female
20-29	5	0.9	4	1
30-39	7	1.2	7	0
40-49	20	3.4	19	1
50-59	98	16.9	66	32
60-69	160	27.6	134	26
70-79	242	41.7	197	45
80-89	47	8.1	41	6
90-99	1	0.2	1	0
Average age	67	0.0	68	66
				Total number of implants: 580



Based on both CRT-P and CRT-D

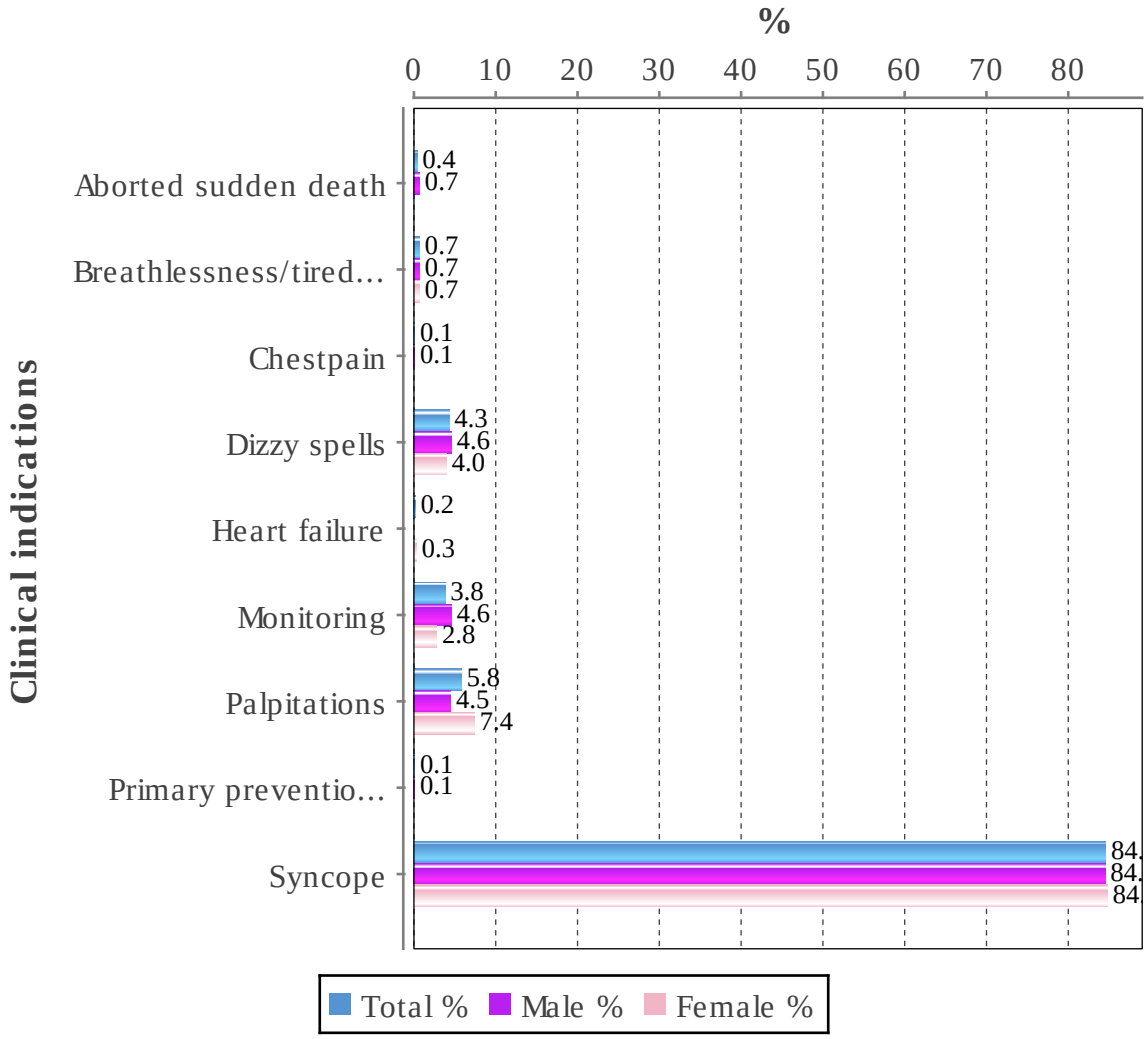
	Total		Male		Female	
	no	**%**	**no**	**%**	**no**	**%**
First implant	1280	55.6	1000	78.1	280	21.9
Replacement	1024	44.4	780	76.2	244	23.8
Total	2304	100.0	1780	77.3	524	22.7

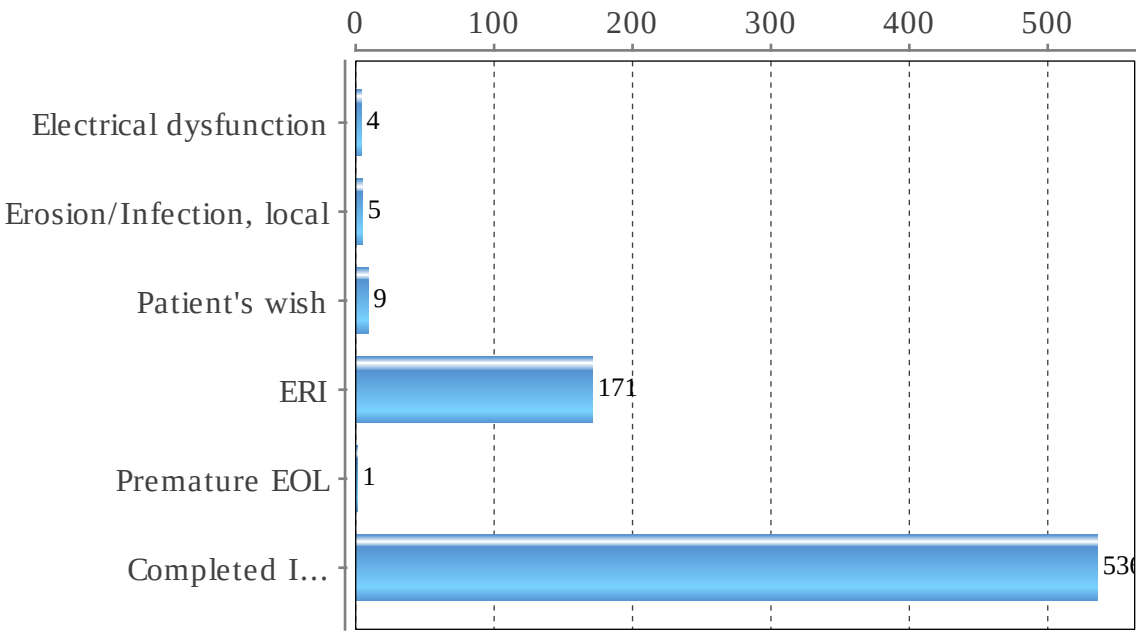
ILR

1268 ILR’s were implanted in Sweden 2024 which is slightly up from 1236 in 2023 with the main indication being dizzy spells 4%, palpitations, 6% and syncope 84%.
At the end of the ILR investigation period 70% of the patients were found to have an PM indication and 7% an ICD indication, the rest showed no pathological rhythm during the FU.
In 8% a new ILR was implanted to extend the monitoring period.

Ratio of new implants versus generator changes

	Total		Male		Female	
	no	**%**	**no**	**%**	**no**	**%**
First implant	1268	96.9	670	52.8	598	47.2
Replacement	40	3.1	15	37.5	25	62.5
Total	1308	100.0	685	52.4	623	47.6


%
0
10
20
30
40
50
60
70
80
Clinical indications
Aborted sudden death
0.4
0.7
Breathlessness/tired...
0.7
0.7
0.7
Chestpain
0.1
0.1
Dizzy spells
4.3
4.6
4.0
Heart failure
0.2
0.3
Monitoring
3.8
4.6
2.8
Palpitations
5.8
4.5
7.4
Primary preventio...
0.1
0.1
Syncope
84.
84.
84.
Total %
Male %
Female %


0
100
200
300
400
500
Electrical dysfunction
4
Erosion/Infection, local
5
Patient's wish
9
ERI
171
Premature EOL
1
Completed I...
536

Investigation after first ILR implant in % of completed ILR investigation

Action	No	%
Pacemaker implant	377	70.3
ICD implant	40	7.5
New ILR implant	45	8.4

Pacing modes

In high degree AV block only 4% of the patients receive VVI-R systems on average the same in all hospitals
The use of VVIR pacing mode in sinus node disease vary from 1-24% when comparing different hospitals.

Lead extraction

The numbers of lead extractions are increasing and there are now 4 centers performing regular assisted lead extraction. Numbers are given as patients/leads: Karolinska 117/223 leads, Lund 80/173, Sahlgrenska 49/97, Uppsala 41/78. The numbers are expected further increase in 2025. The lead dwell time is in the vast majority of cases 1-2 years but 80 leads had >20 years dwell time.
The most common reason is infection. Preventive extraction of leads with problems such as Medtronic Sprint Fidelis and SJM Riata is also performed in a lower number of cases 2024 than before due to decreasing numbers of leads still in use.
Methods and success rate are displayed for those hospitals that have complete reporting.

Complications pacemaker

The total complication rate for pacemaker procedures is 3,7% vs 5.4% in 2016 with lead dislodgement being the most common. Passive atrial leads show the highest dislodgement rate with 3,4% vs 1.6% for active fix atrial leads. LV leads show the same tendency with 1,8% dislodgement for all passive types and 0,8% for the Medtronic screw-in type CS lead.
There is a variation among the operating hospitals with possible underreporting in many cases. Hospitals that have registered <3% in total complication can be regarded as having incomplete registration. This is based on literature regarding pacemaker procedure complications with a common rate of 5-10%.

Complications and gender

Infections are more common during generator changes, 1,0%, than new implants, 0,7% and most common I CRT system changes, 1%.
In PMR female sex is associated with less complications of all types except perforation, pneumothorax and infections after upgrade to CRT. This is difference from the literature that usually have an overrepresentation of females in all types of complications.

Complications ICD

The overall complication rate to ICD treatment is 5,3% and is up slightly from 4,8% in 2023. The most common complication is lead dislodgement 2,5% followed by infection with 0,4%.
The rate between hospitals is also given in tables and as with pacemaker treatment <3% overall complication rate is considered incomplete registration.

Complications CRT

This is presented as a both CRT-D and CRT-P complications. Both are 3-5% and are very low and does not compare well with literature findings of up to 15% complications.
Most common are as with ICD’s and PM’s lead dislodgement 0,7% vs 2,3% for CRT-P and CRT-D. Most commonly it is the sc lead that dislodges.

Procedures

Duration of fluoroscopy and procedure times are given for all types and hospitals in tables. The procedures that have been performed in less than 10 procedures at different sites are marked as not reliable for comparison.
A single chamber device takes 50+-27 minutes to implant, and a dual chamber device 50+-25 min and a CRT system 92+-40 minutes to implant.

Device longevity ICD and PM

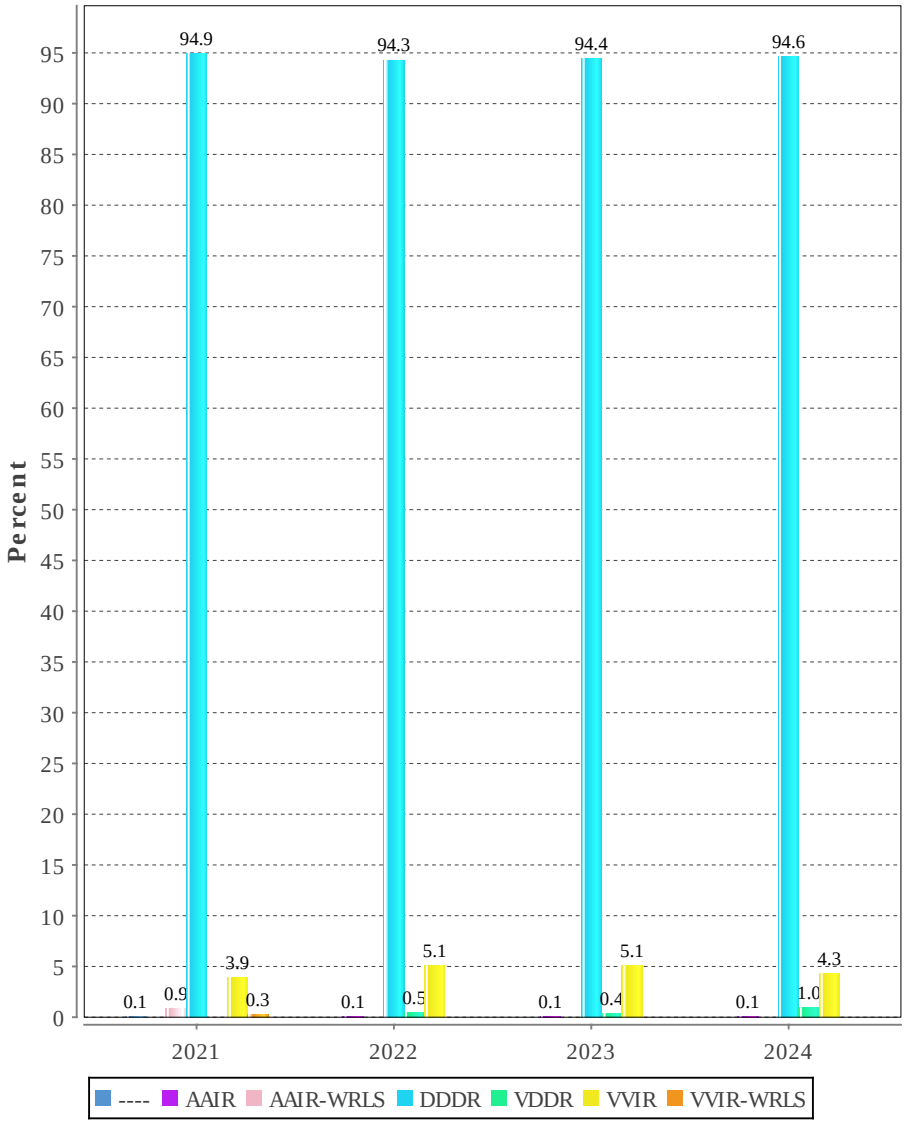
Generators generally have very good longevity with an average for Pacemakers of 99% after 5 years and 57% after 10 years but there are large differences between models and manufacturers. Each model is given in the tables.
Pacemaker right sided lead survival is very good with a survival rate of 98% after 10 years with very little difference between models only Abbot 2088 has a slightly higher failure rate with only 94% 10-year survival. SC leads have lower survival rates with the early models like Medtronic Starfix with 78% 10-year survival. The later models have yet to attain 10-year data.
ICD generator survival is more heterogenous than PM generator survival with larger differences between manufacturers and models and an average of 97% after 5 years and 30% after 10 years.
Abbott Fortify and Unify were identified as problem generators in 2014 in our registry long before the Abbott alert and survival curves are given for each model.
ICD lead survival is also shorter than pacemaker lead survival, 97% after 5 years and 95% after 10 years but still very good as an average.
The Medtronic Sprint Fidelis models were implanted in 903 cases in Sweden and the survival rate is 68% after 10 years and decreased rapidly as expected from previous years but now seems to be steady.
In the Abbott Riata model’s failures are increasing and 10-year survival is now down to 73% at 10 year.
The Biotronik Linox leads also have a decreased longevity compared to the average ICD lead and have an 89% survival at 5 years and a 68% 10-year survival.

Patients

The pacemaker patients have a 5-year survival of 69% and a 10-year survival of 42%.
The ICD patient survival is 67% after 5 years and 45% after 10 years.
The heart failure patients treated with CRT also have the shortest expected survival rate among the PM and ICD patients. CRT-P patients have a 64% 5-year survival and 33% 10-year survival. CRT-D patients 31% 5-year survival and 28% 10-year survival.
One-year mortality is 7% in PM patients, 3% in ICD patients 9% in CRT-P patients and 4% in CRT-D patients.

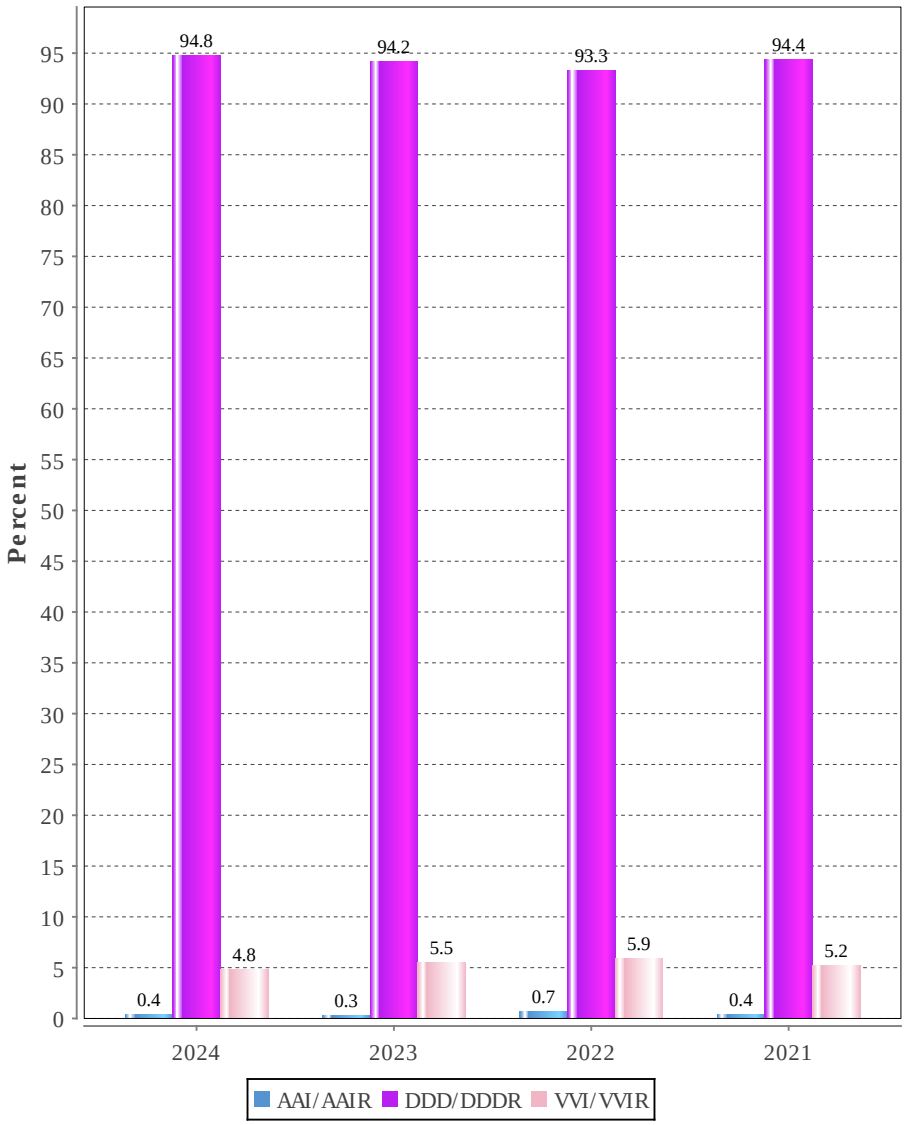
Use of pacing mode for total AV block indication, historical data

Mode %	2021	2022	2023	2024
----	0.1	0.0	0.0	0.0
AAIR	0.0	0.1	0.1	0.1
AAIR-WRLS	0.9	0.0	0.0	0.0
DDDR	94.9	94.3	94.4	94.6
VDDR	0.0	0.5	0.4	1.0
VVIR	3.9	5.1	5.1	4.3
VVIR-WRLS	0.3	0.0	0.0	0.0



Use of pacing mode for Sinus Node Disease, historical data

Mode (%)	2024	2023	2022	2021
AAI/AAIR	0.4	0.3	0.7	0.4
DDD/DDDR	94.8	94.2	93.3	94.4
VVI/VVIR	4.8	5.5	5.9	5.2



Dislocation rate for different lead types in atrial or ventricular placement. Based on all implants implanted 2007 and later and explanted/corrected 2024 or earlier

Type	Right atrium %	Right ventricle %	Left ventricle %	Total %
Fixed screw	1.6	0.9	0.8	1.2
Retractable screw	1.6	0.9	0.8	1.2
Passive	3.4	1.6	1.8	1.3
All	1.6	1.0	1.5	1.2

Extractions per hospital

Hospital	No of patients	No of leads
Akademiska sjukhuset	41	78
Gävle sjukhus	5	8
Karolinska Solna	117	223
Linköpings universitetssjukhus	5	8
Norrlands Universitetssjukhus, Umeå	5	8
Sahlgrenska universitetssjukhuset	49	97
Skånes universitetssjukhus, Lund	80	173
Sunderby sjukhus	5	6
Universitetssjukhuset Örebro	3	6

Extractions per type

Type	Extractions
ICD lead	110
Pacemaker lead	528

Extractions per model (more then 5 extractions)

Manfacturer	Model	Extractions
Abbott	1258T QuickFlex	7
Abbott	1456Q Quartet MRI	7
Abbott	1458Q Quartet MRI	24
Abbott	1488T Tendril SDX	8
Abbott	1788T Tendril ST	6
Abbott	1948 Isoflex MRI	12
Abbott	1999 Optisense	22
Abbott	2088TC Tendril STS MRI 46/52/58 cm	173
Abbott	7122Q Durata	15
Abbott	LDA210Q Optisure DF4	30
Abbott	LPA1200M52cm TendrilMRI	8
Biotronik	Solia S53 MRI	23
Biotronik	Solia S60 MRI	27
Boston Scientific	4470 Fineline II Sterox EZ MRI	15
Boston Scientific	7741 Ingevity MRI	8
Boston Scientific	7742 Ingevity MRI	8
Boston Scientific	7841 Ingevity MRI	7
Medtronic	4076 CapSureFix Novus MRI	58
Medtronic	4796 Attain Stability MRI	6
Medtronic	5076 CapSureFix MRI	13
Medtronic	6935M Sprint Quattro S MRI DF4	23

Extractions per reason

Reason	Extractions
Ceased indication for PM therapy	12
Elective	52
Electrical dysfunction	74
Heart transplant	49
Infection/Ulceration, local	162
Infection/Ulceration, systemic	228
Lead dislocation	22
Patient's wish	11
Preventive	18

*Extraction positions**

Hospital	Femoral	Left superior	N/A	Right superior
Akademiska sjukhuset	0	62	1	15
Gävle sjukhus	0	8	0	0
Karolinska Solna	0	207	0	16
Linköpings universitetssjukhus	0	8	0	0
Norrlands Universitetssjukhus, Umeå	0	8	0	0
Skånes universitetssjukhus, Lund	3	168	0	2
Universitetssjukhuset Örebro	0	6	0	0
*Hospital Sahlgrenska and Sunderby excluded				

*Extraction problems**

Hospital	I	E	O	P	X	D
Akademiska sjukhuset	0	2	0	0	0	0
Gävle sjukhus	0	0	0	0	0	0
Karolinska Solna	0	0	0	0	0	0
Linköpings universitetssjukhus	0	0	0	0	0	0
Norrlands Universitetssjukhus, Umeå	0	0	0	0	0	0
Skånes universitetssjukhus, Lund	0	0	0	0	0	0
Universitetssjukhuset Örebro	0	0	0	0	0	0

(*Hospital Sahlgrenska and Sunderby excluded), I: Insulation break, E: Conductor break, O: Unintentional extraction of another lead, P: Perforation/Tamponade, X: Pneumothorax, D: Death

*Extraction results**

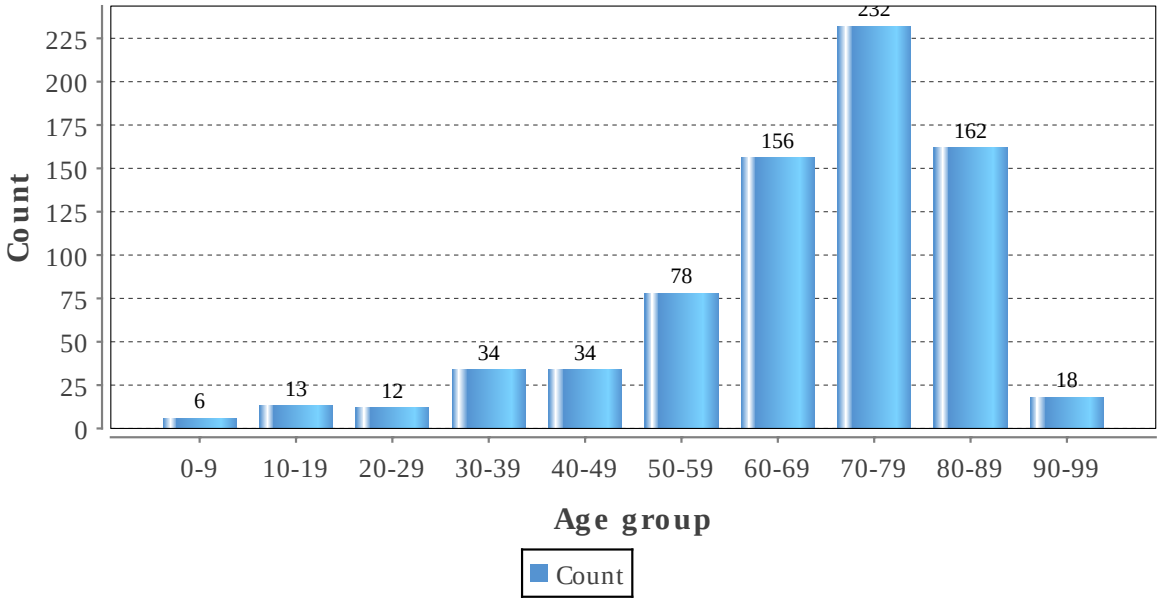
Hospital	Failed	Partially successfull	Successfull
Akademiska sjukhuset	0	2	76
Gävle sjukhus	0	0	8
Karolinska Solna	0	6	217
Linköpings universitetssjukhus	0	0	8
Norrlands Universitetssjukhus, Umeå	0	0	8
Skånes universitetssjukhus, Lund	0	0	173
Universitetssjukhuset Örebro	0	0	6

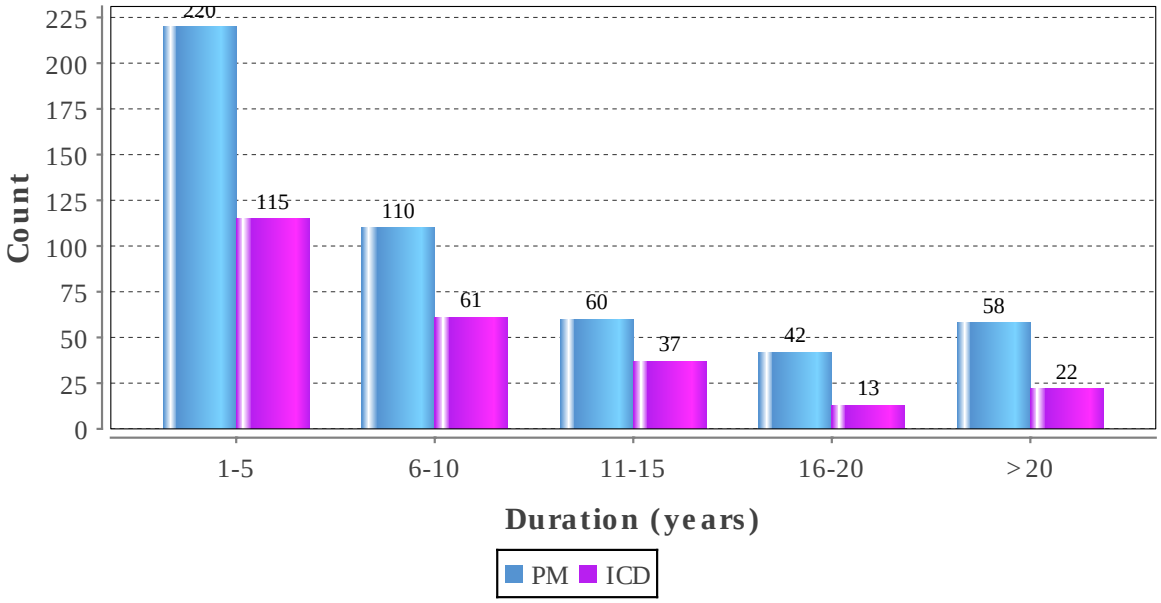
*Hospital Sahlgrenska and Sunderby excluded

*Extraction tools**

Hospital	SS	LS	PS	AM	L	S	PK	EK	AL
Akademiska sjukhuset	16	6	3	46	0	0	0	0	6
Gävle sjukhus	0	0	0	0	0	0	0	0	0
Karolinska Solna	0	52	6	96	0	0	0	0	0
Linköpings universitetssjukhus	6	0	0	0	0	0	0	0	0
Norrlands Universitetssjukhus, Umeå	0	0	0	0	0	0	0	0	0
Skånes universitetssjukhus, Lund	19	5	5	77	0	2	0	0	0
Universitetssjukhuset Örebro	3	0	0	0	0	0	0	0	0

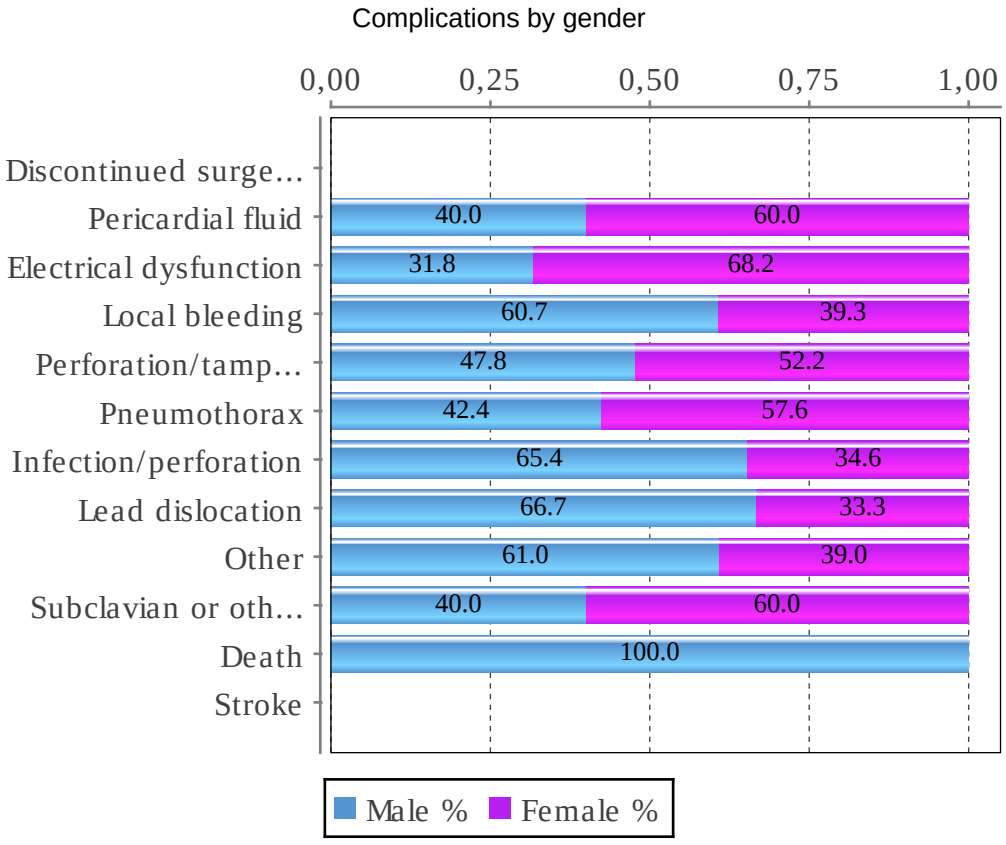
(*Hospital Sahlgrenska and Sunderby excluded), SS: Standard stylet, LS: Locking stylet, PS: Passive sheath, AM: Active mechanical sheath, L: Lasso, S: Snare, PK: Pigtail catheter, EP: EP catheter, AL: Active laser sheath

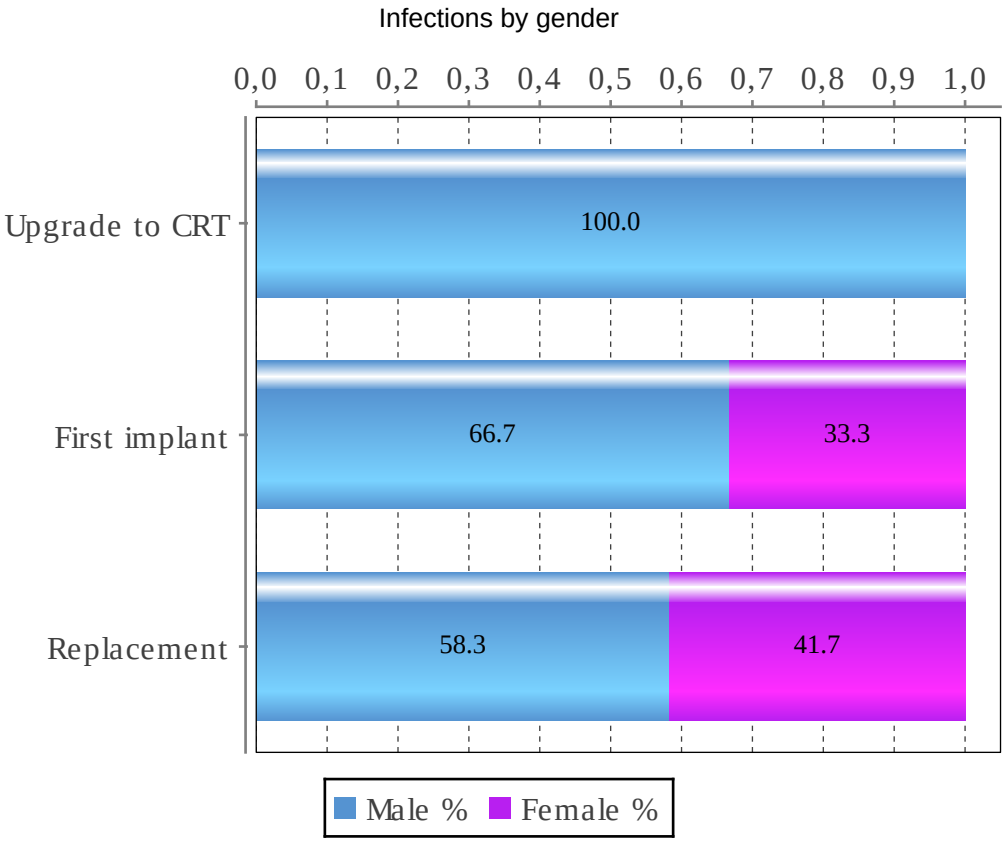

Count
225
200
175
150
125
100
75
50
25
0
6
13
12
34
34
78
156
232
162
18
0-9
10-19
20-29
30-39
40-49
50-59
60-69
70-79
80-89
90-99
Age group
Count


Count
225
200
175
150
125
100
75
50
25
0
220
115
110
61
60
37
42
13
58
22
1-5
6-10
11-15
16-20
>20
Duration (years)
PM
ICD

Registered complications for new implants and for bleeding, infection and other also including replacements

Complication	2023 %	2024 %	Based on
Discontinued surgery due to hemodynamic reasons	0.0	0.0	A
Pericardial fluid	0.1	0.0	A
Electrical dysfunction	0.3	0.3	B
Local bleeding	0.2	0.2	A
Perforation/tamponade	0.3	0.3	B
Pneumothorax	0.5	0.4	B
Infection/perforation	0.3	0.5	A
Lead dislocation	1.4	1.3	B
Other	0.3	0.4	A
Subclavian or other related thrombosis	0.0	0.1	B
Death	0.0	0.0	A
Stroke	0.0	0.0	A
Discontinued surgery due to lack of venous access	0.0	0.0	A
Discontinued surgery due to LV-lead impl. failure	0.1	0.2	A
Total	3.5	3.7	
Based on A=11414 (all implants) alternatively B=8598 (first implants + lead replacement) validated events			





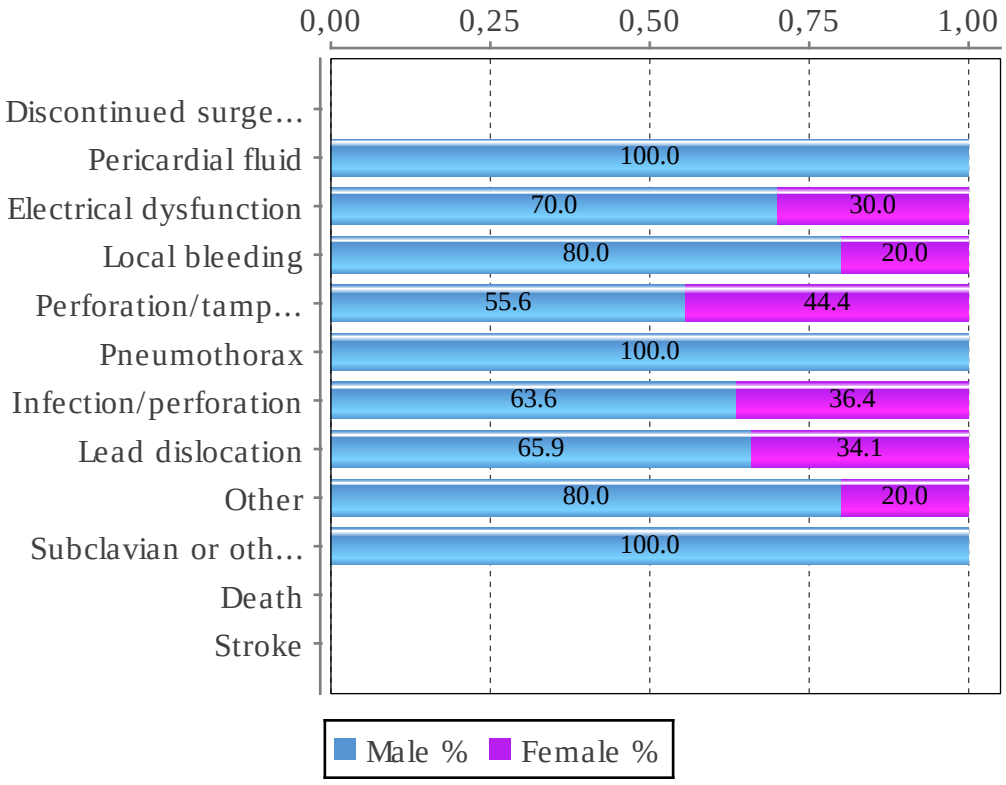
Infections related to all interventions by gender

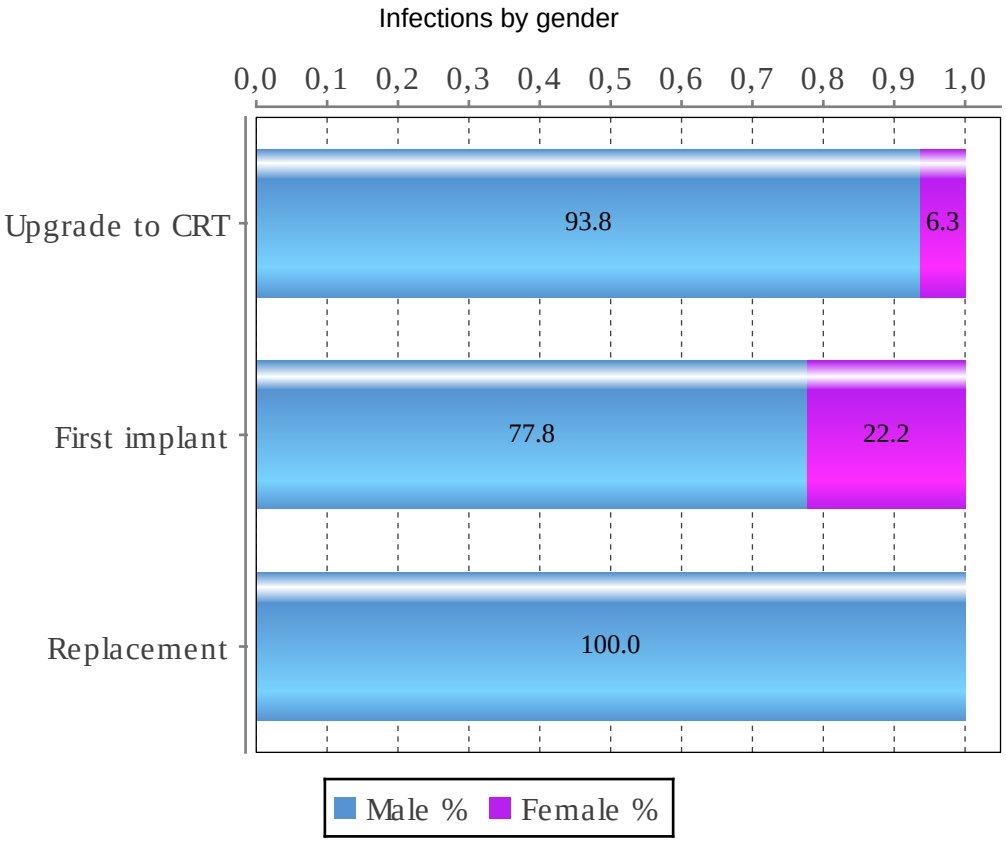
Reason	Male %	Female %
First implant	*0.8*	*0.7*
Replacement	*0.7*	*0.7*
Upgrade to CRT	*0.8*	*0.0*

Registered complications for new implants and for bleeding, infection and other also including replacements

Complication	2023 %	2024 %
Discontinued surgery due to hemodynamic reasons	0.0	0.0
Electrical dysfunction	0.6	0.6
Local bleeding	0.5	0.2
Perforation/tamponade	0.6	0.5
Pneumothorax	0.3	0.2
Infection/perforation	0.5	0.4
Lead dislocation	1.6	2.5
Other	0.5	0.4
Subclavian or other related thrombosis	0.0	0.0
Death	0.0	0.0
Pericardial fluid	0.0	0.0
Stroke	0.0	0.0
Discontinued surgery due to lack of venous access	0.0	0.0
Discontinued surgery due to LV-lead impl. failure	0.2	0.5
Total	4.8	5.3
Based on 2568 (all implants) alternatively 1665 (first implants + lead replacements) validated events		

Complications by gender





Infections related to all interventions by gender

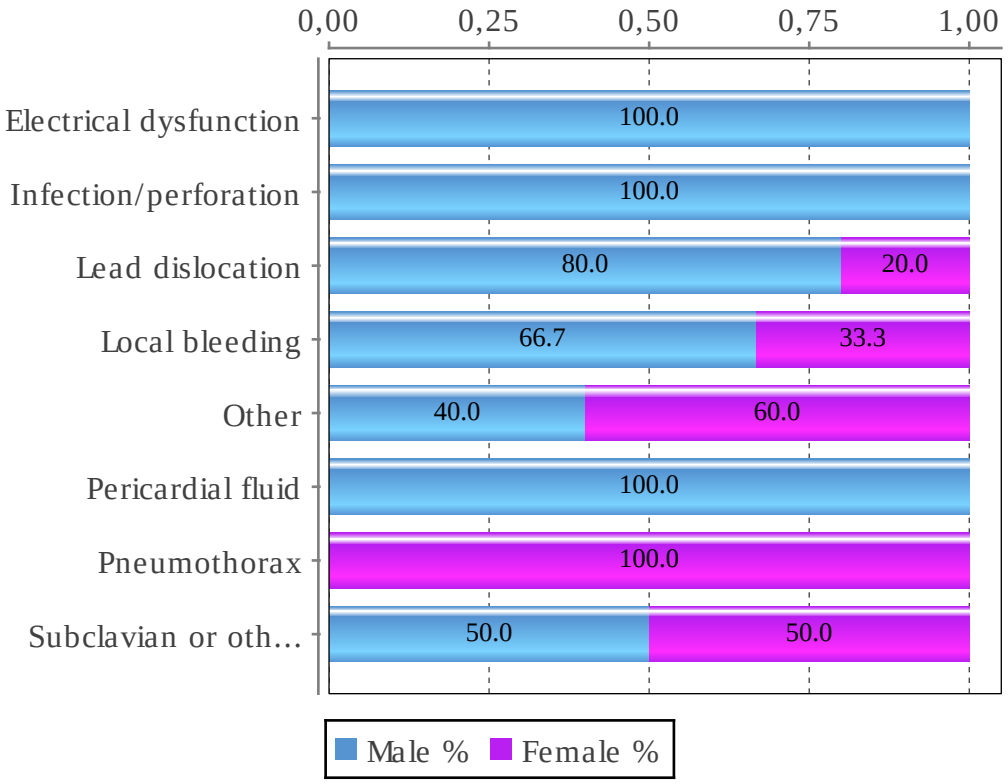
Reason	Male %	Female %
First implant	*1.2*	*1.2*
Replacement	*1.3*	*0.0*
Upgrade to CRT	*2.7*	*0.8*

Registered complications for new implants and for bleeding, infection and other also including replacements.

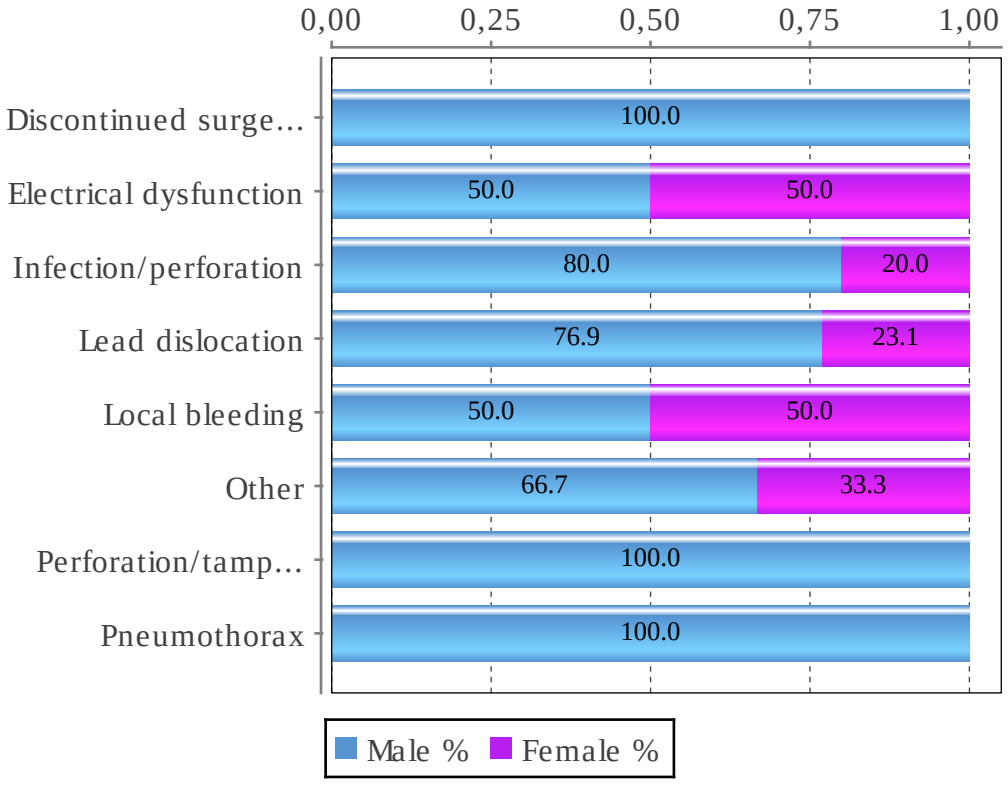
CRT-P Complication	%
Death	-
Discontinued surgery due to LV-lead impl. failure	-
Discontinued surgery due to hemodynamic reasons	-
Discontinued surgery due to lack of venous access	-
Electrical dysfunction	0.1
Infection/perforation	0.3
Lead dislocation	0.7
Local bleeding	0.4
Other	0.7
Perforation/tamponade	-
Pericardial fluid	0.1
Peroperative arrhythmia requiring acute medication	-
Pneumothorax	0.1
Stroke	-
Subclavian or other related thrombosis	0.3
Total	2.9
Total no of implants	700

CRT-D Complication	%
Death	-
Discontinued surgery due to LV-lead impl. failure	0.2
Discontinued surgery due to hemodynamic reasons	-
Discontinued surgery due to lack of venous access	-
Electrical dysfunction	0.3
Infection/perforation	0.9
Lead dislocation	2.3
Local bleeding	0.3
Other	0.5
Perforation/tamponade	0.3
Pericardial fluid	-
Peroperative arrhythmia requiring acute medication	-
Pneumothorax	0.2
Stroke	-
Subclavian or other related thrombosis	-
Total	5.1
Total no of implants	573

CRT-P complications by gender

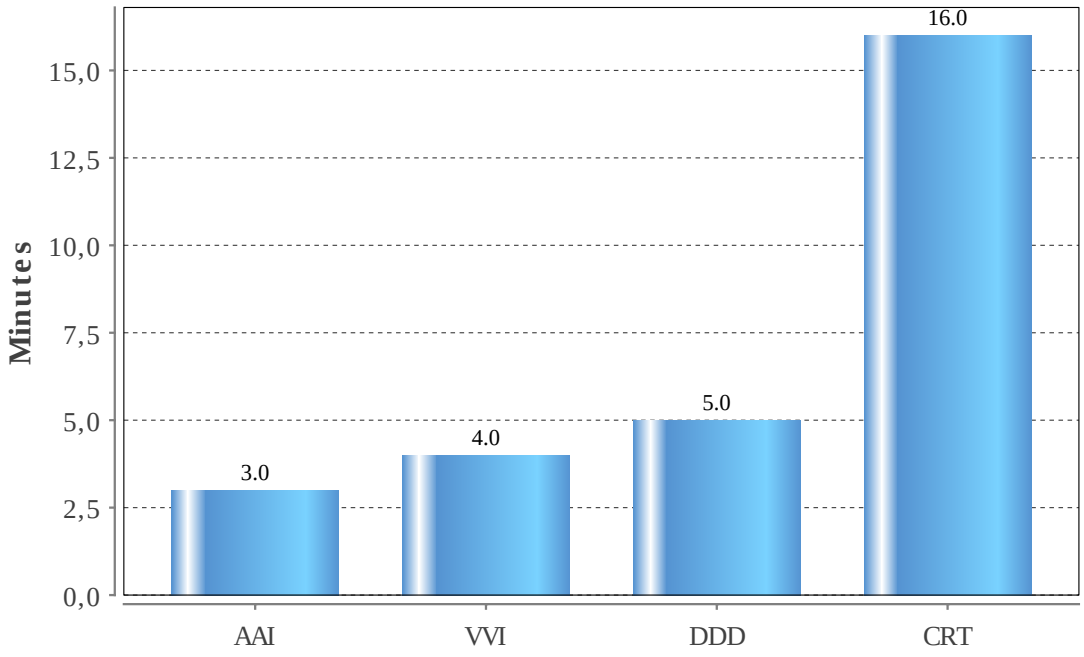


CRT-D complications by gender



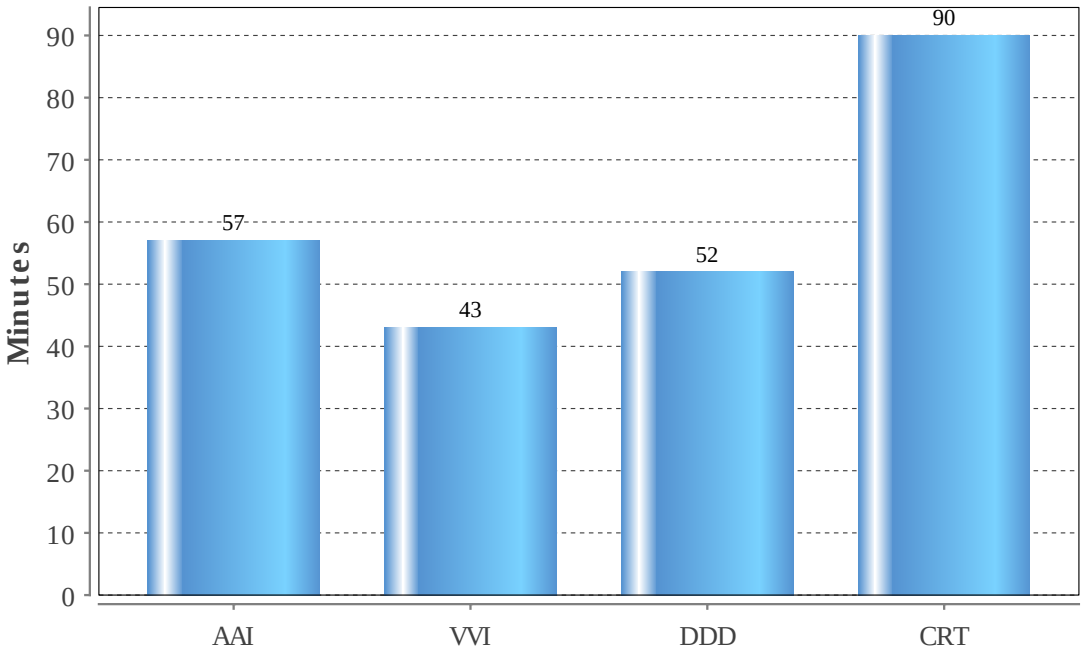
National mean fluoroscopy duration for a new implant of different subtypes

Fluoroscopy time	Average	Standard deviation
AAI	3.0	2.7
VVI	4.0	7.3
DDD	5.0	6.9
CRT	16.0	13.0



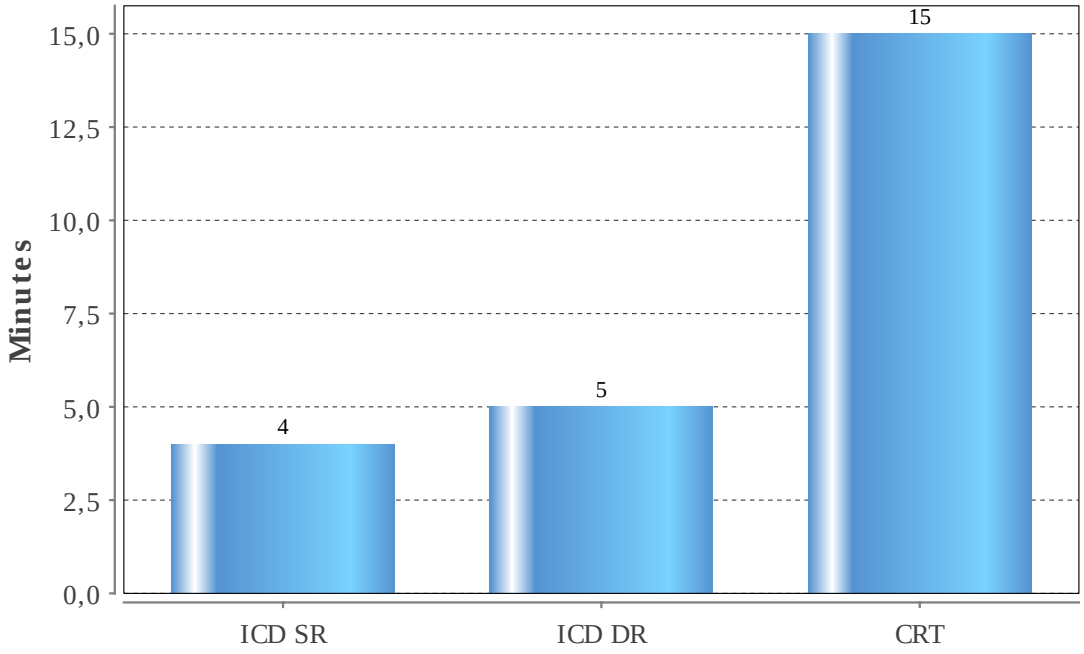
National mean skin to skin duration for a new implant of different subtypes

Knife time	Average	Standard deviation
AAI	57	31.7
VVI	43	25.8
DDD	52	27.0
CRT	90	39.3



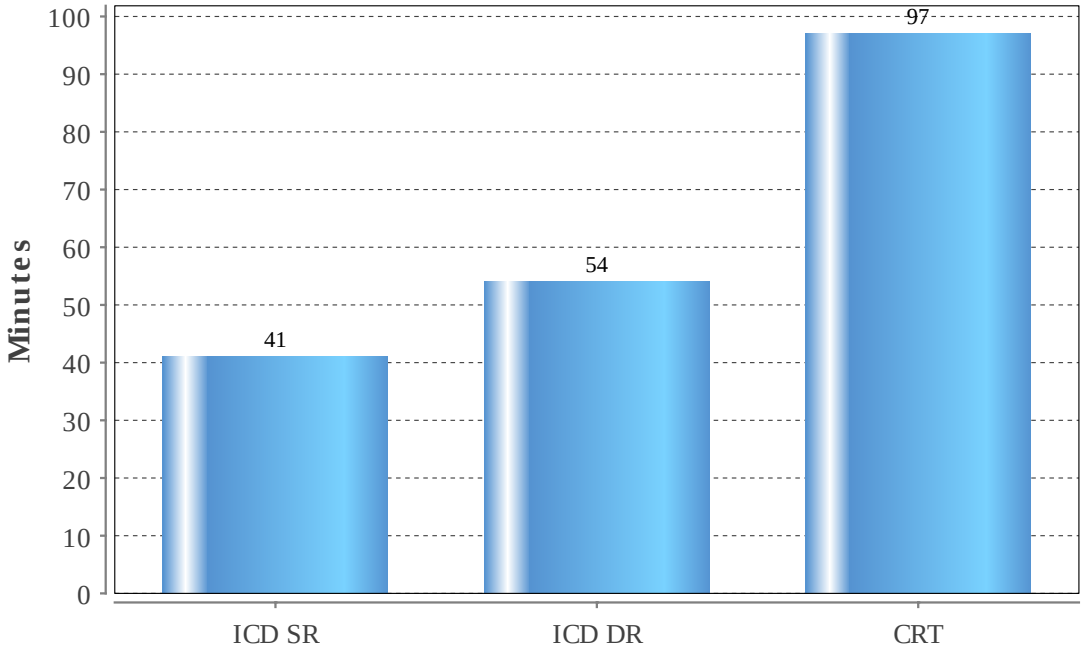
National mean fluoroscopy duration for a new implant of different subtypes

Fluoroscopy time	Average	Standard deviation
ICD SR	4	5.9
ICD DR	5	5.2
CRT	15	11.9

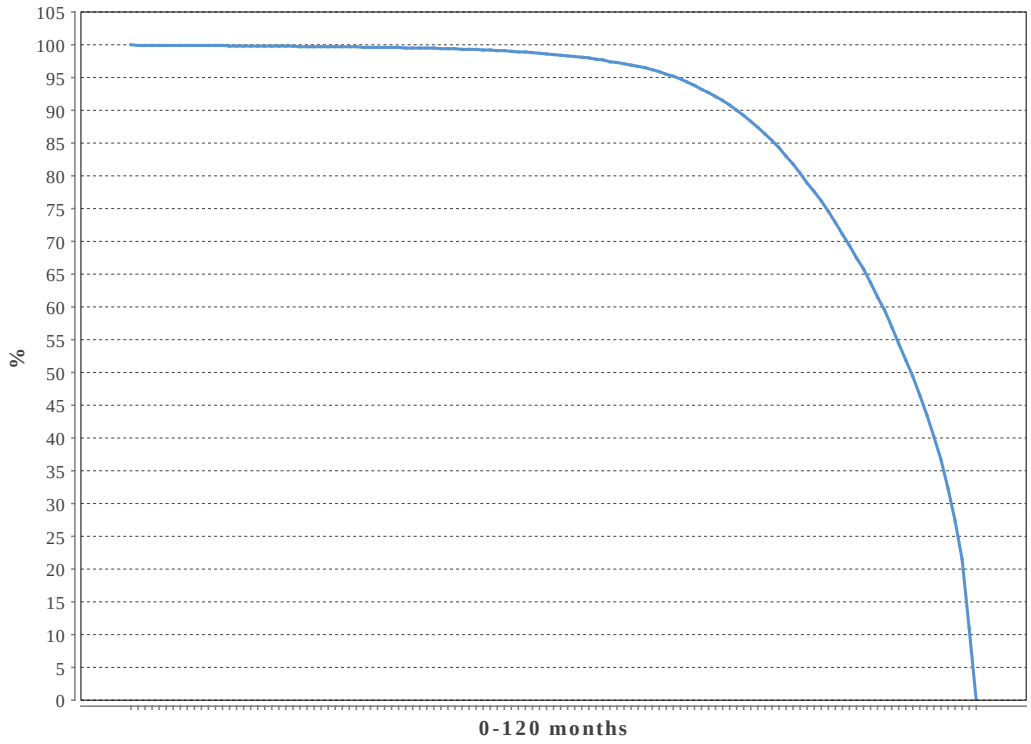


National mean skin to skin duration for a new implant of different subtypes

Knife time	Average	Standard deviation
ICD SR	41	19.1
ICD DR	54	27.0
CRT	97	39.2

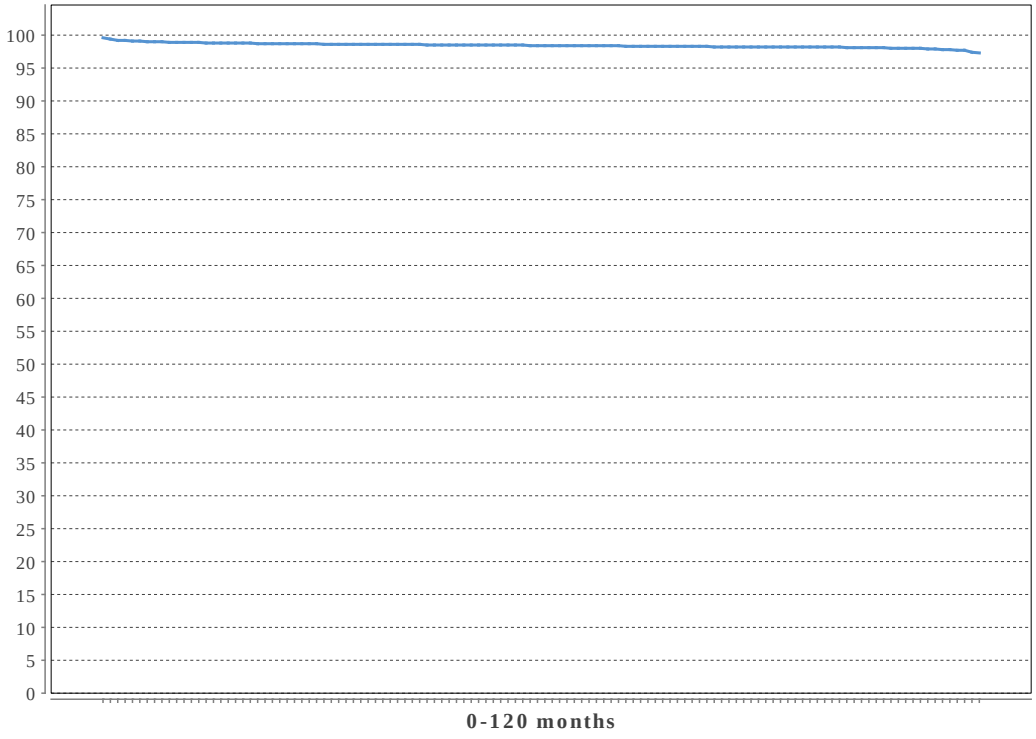


Year	At risk	Survival probability %
1	165767	100.0
2	141388	99.9
3	118201	99.7
4	97700	99.6
5	79299	99.3
6	63414	98.5
7	48750	96.7
8	34750	91.5
9	21295	78.9
10	9369	57.0



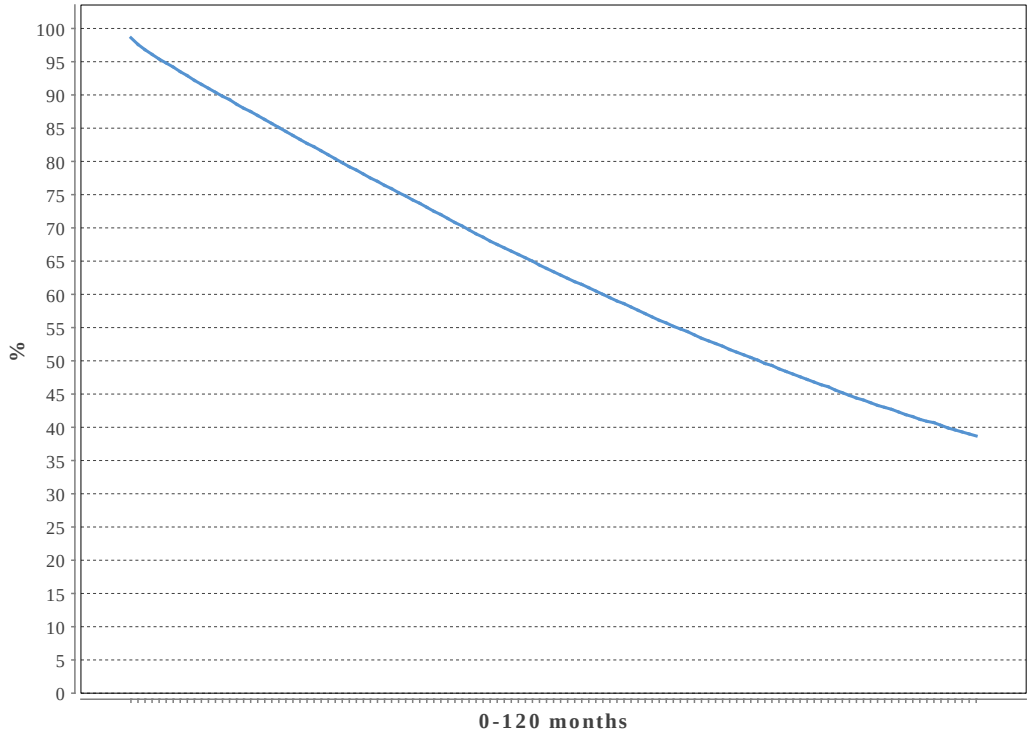
Based on all implants after 1990

Year	At risk	Survival probabilty %
1	227878	99.6
2	193577	98.9
3	161631	98.7
4	132738	98.6
5	105815	98.5
6	82429	98.4
7	61034	98.3
8	41883	98.2
9	25847	98.2
10	11830	98.0



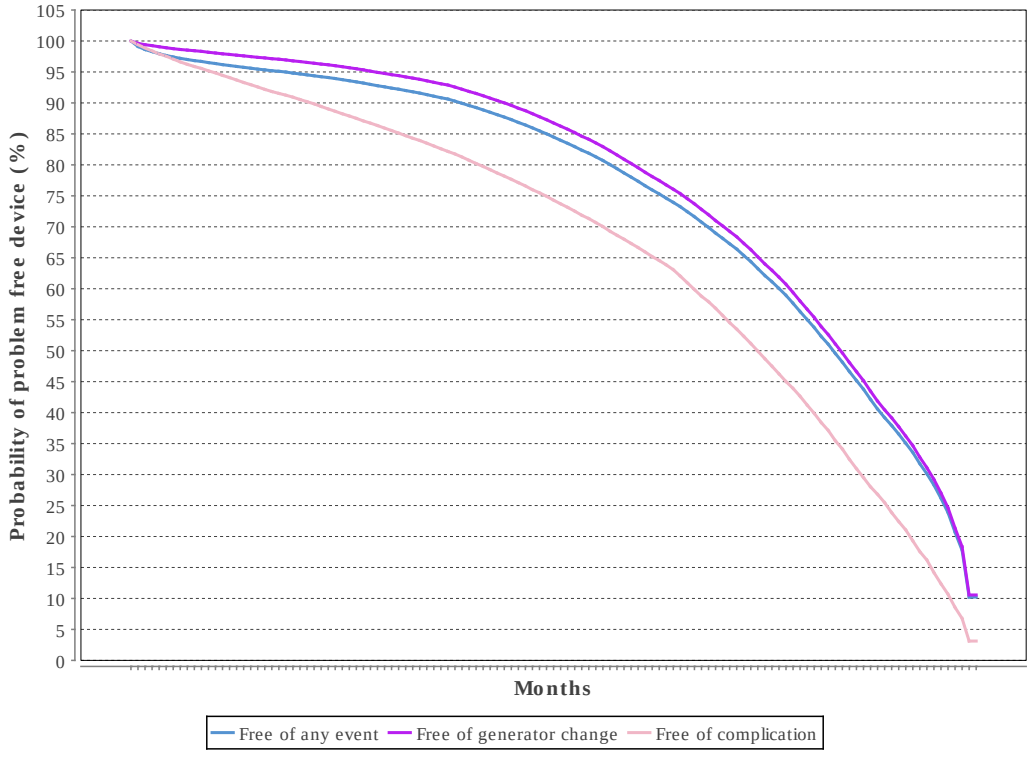
Based on all implants after 1990

Year	At risk	Survival probability %
1	180816	98.6
2	155397	90.4
3	132178	83.3
4	111592	76.4
5	93205	69.7
6	77332	63.4
7	62634	57.6
8	48744	52.2
9	35237	47.2
10	23376	42.7



Probablility of event free ICD-device

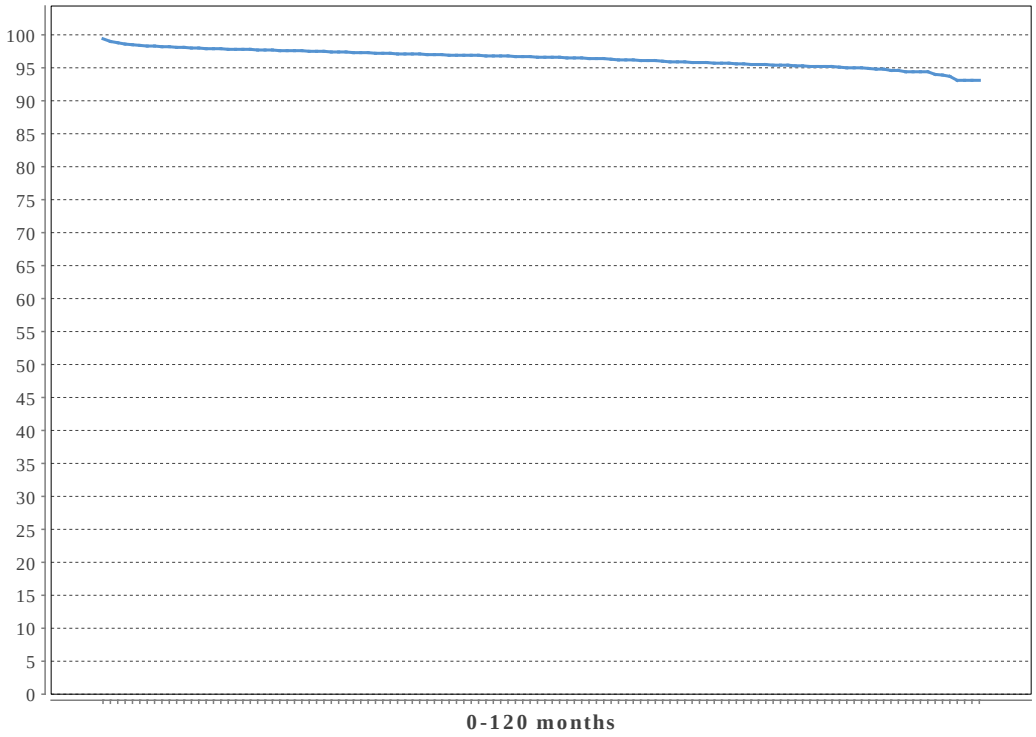
Year	At risk	Free of any event %	Free of generator change %	Free of complication %
1	38339	96.4	98.1	94.9
2	35438	94.7	96.7	90.6
3	32406	92.6	94.8	85.9
4	29045	89.6	91.9	80.7
5	24741	84.5	86.8	74.3
6	19805	77.4	79.5	66.7
7	14079	68.1	70.2	55.7
8	7980	55.0	56.7	41.2
9	2927	37.9	39.2	23.9
10	146	10.2	10.6	3.1



Year	At risk	Survival probability %
1	34917	99.9
2	30749	99.8
3	26553	99.5
4	22565	98.9
5	18664	97.4
6	14744	92.9
7	10820	84.7
8	7044	72.3
9	3673	53.1
10	1203	30.7

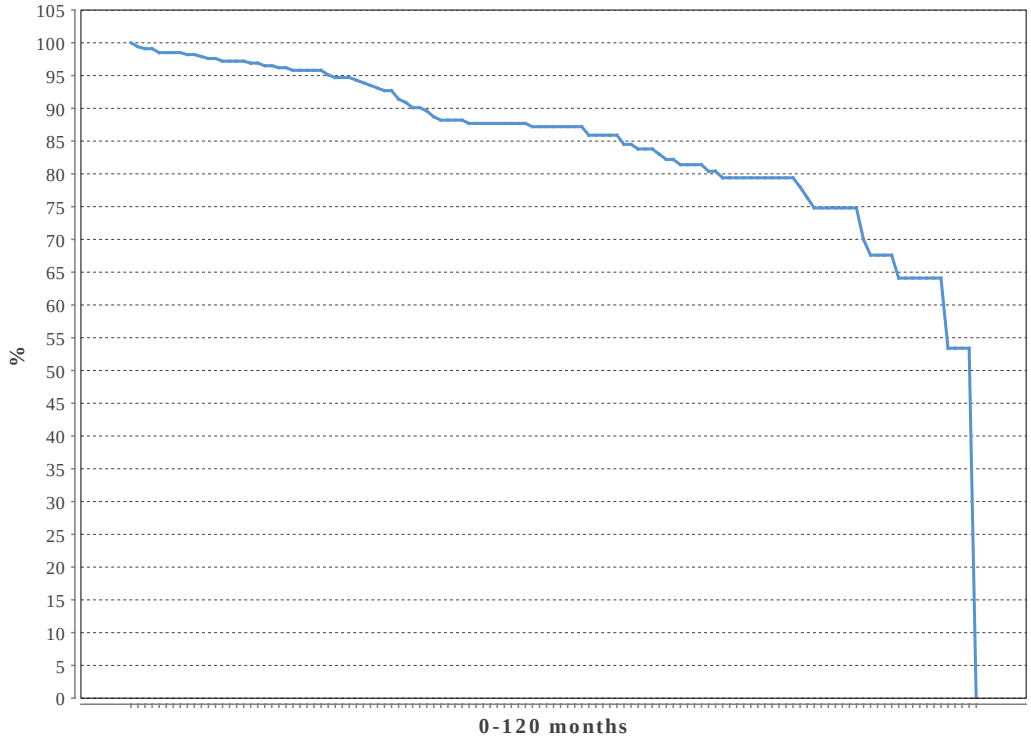
Overall survival probability for all ICD leads as a mean. Elective replacements and replacements due to infections and system changes have been considered as censored events. Based on all implants after 1990

Year	At risk	Survival probabilty %
1	21074	99.4
2	18221	98.0
3	15615	97.6
4	13094	97.3
5	10710	96.9
6	8516	96.6
7	6469	96.2
8	4538	95.7
9	2876	95.2
10	1350	94.6



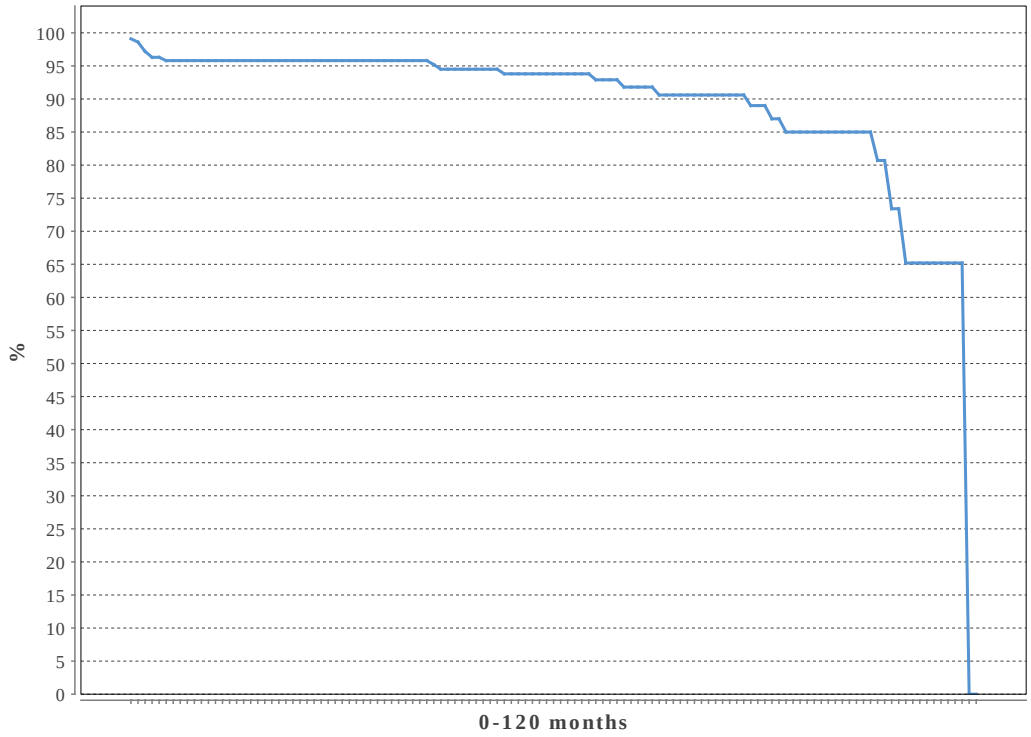
Survival probability for ICD lead Medtronic Sprint Fidelis. Elective replacement and replacements due to infections and system changes have been considered as censored events.

Year	At risk	Survival probability %
1	345	100.0
2	301	97.6
3	269	95.8
4	221	92.7
5	181	87.7
6	152	87.2
7	116	83.8
8	80	79.4
9	49	76.4
10	23	67.6



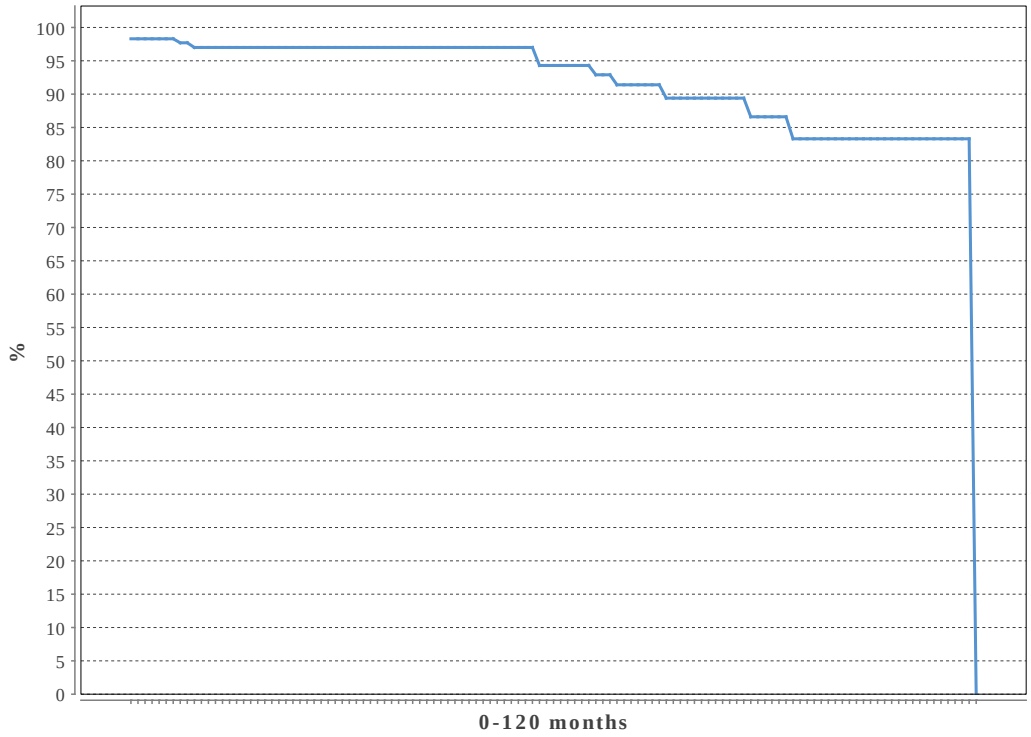
Survival probability for SJM lead type 1561,1570,1571,1572,1580,1581,1582,1591. Elective replacement and replacements due to infections and system changes have been considered as censored events.

Year	At risk	Survival probability %
1	219	99.1
2	193	95.8
3	176	95.8
4	158	95.8
5	138	94.5
6	114	93.8
7	80	91.8
8	60	90.6
9	39	85.0
10	11	73.4



Survival probability for SJM lead type 7000,7001,7002,7040,7041,7042. Elective replacement and replacements due to infections and system changes have been considered as censored events.

Year	At risk	Survival probability %
1	177	98.3
2	141	97.0
3	129	97.0
4	115	97.0
5	93	97.0
6	71	94.3
7	55	91.4
8	39	89.4
9	23	83.3
10	13	83.3

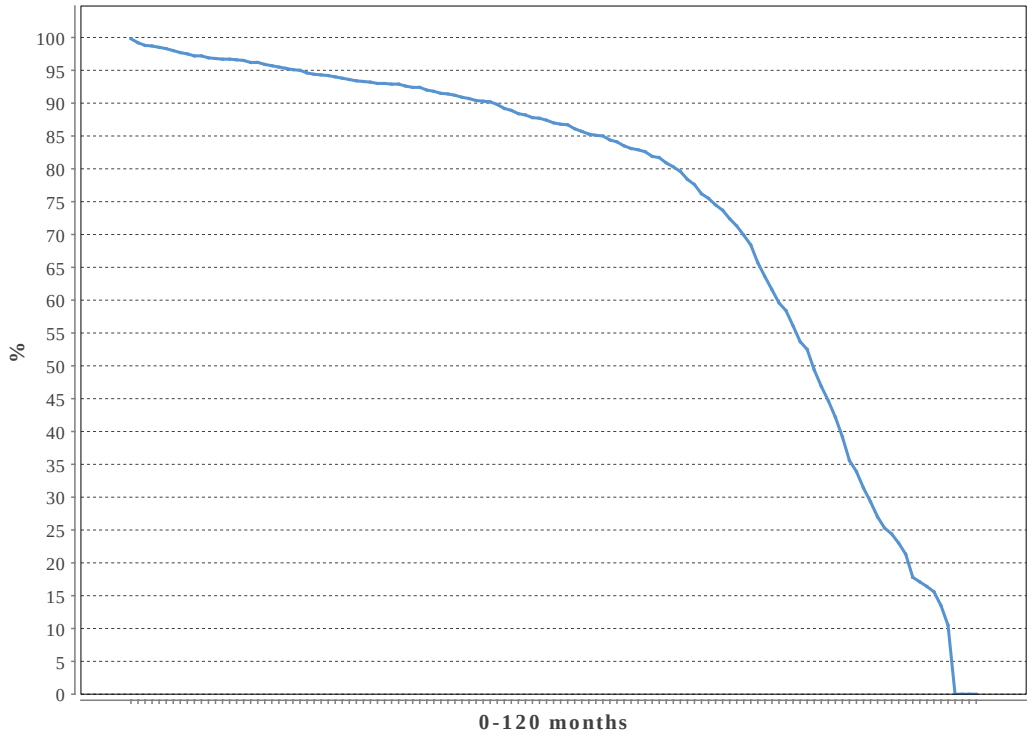


Survival probability for SJM ICD Fortify. Elective replacement and replacements due to infections and system changes have been considered as censored events.

Year	At risk	Survival probability %
1	2114	99.7
2	1925	97.2
3	1740	95.0
4	1560	92.3
5	1337	88.5
6	1120	84.6
7	933	80.8
8	737	76.4
9	519	71.7
10	268	60.2

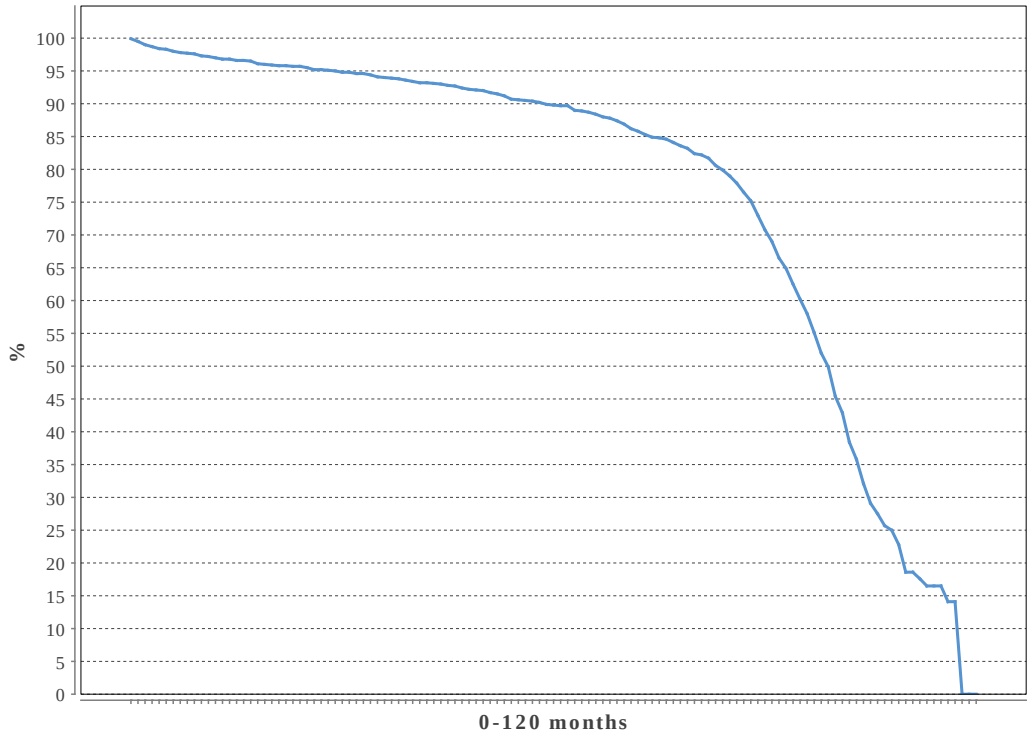
Survival probability for SJM ICD Unify. Elective replacement and replacements due to infections and system changes have been considered as censored events.

Year	At risk	Survival probability %
1	2419	99.8
2	2107	96.8
3	1890	95.0
4	1658	93.0
5	1449	90.7
6	1210	87.0
7	1006	82.9
8	720	73.7
9	334	52.5
10	57	24.4



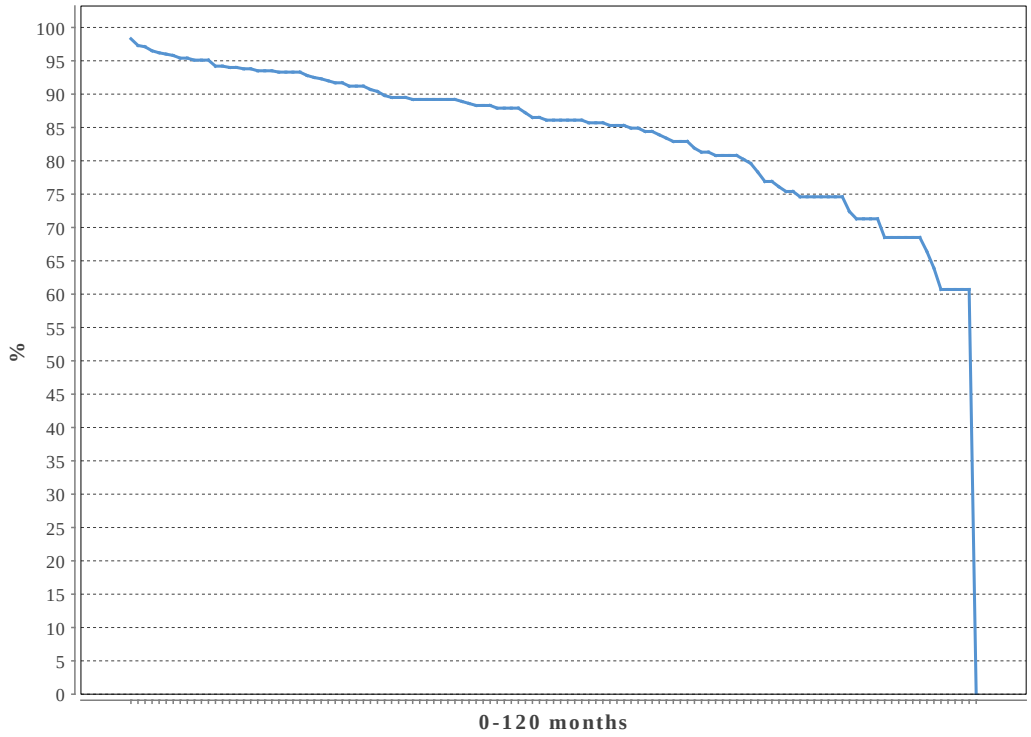
Survival probability for SJM ICD Quadra. Elective replacement and replacements due to infections and system changes have been considered as censored events.

Year	At risk	Survival probability %
1	3148	99.9
2	2770	97.0
3	2486	95.7
4	2169	94.0
5	1816	92.2
6	1421	89.8
7	1058	85.8
8	725	79.9
9	297	58.0
10	42	25.0



Survival probability for Biotronik ICD Linox. Elective replacement and replacements due to infections and system changes have been considered as censored events.

Year	At risk	Survival probability %
1	483	98.3
2	413	94.2
3	376	93.3
4	315	89.8
5	278	88.6
6	231	86.1
7	192	84.9
8	145	80.8
9	92	74.6
10	47	68.5

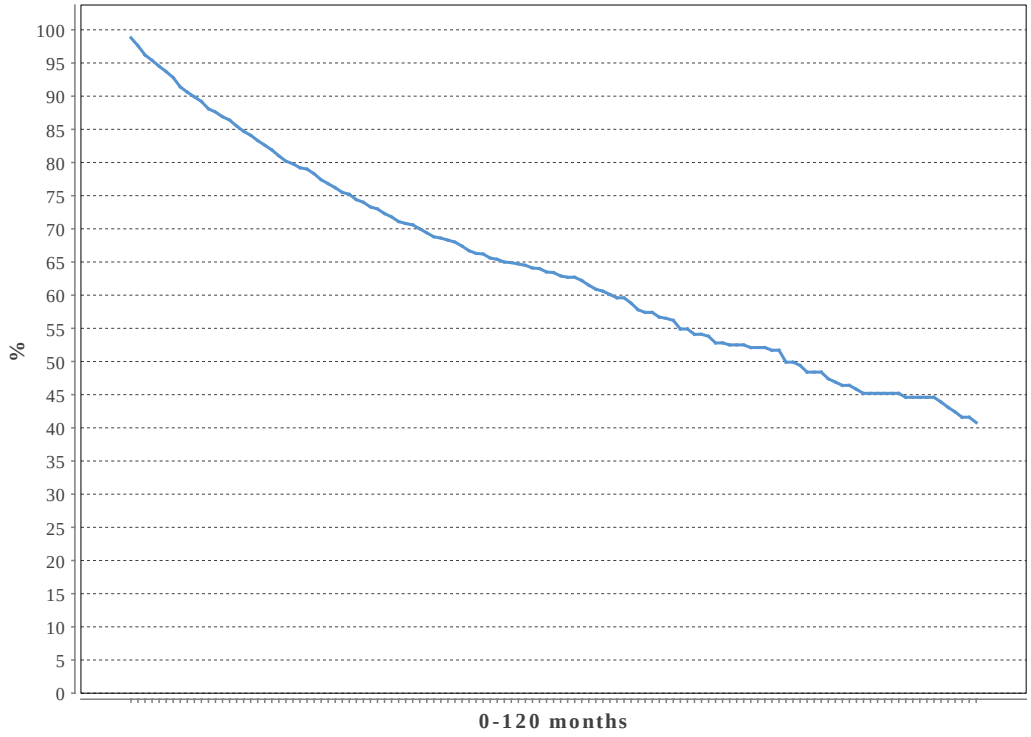


Survival probability for SJM ICDLEAD Durata. Elective replacement and replacements due to infections and system changes have been considered as censored events.

Year	At risk	Survival probability %
1	5606	98.8
2	4740	94.9
3	4080	93.5
4	3495	92.6
5	2962	91.9
6	2455	91.0
7	1993	89.7
8	1492	88.3
9	990	87.1
10	536	84.7

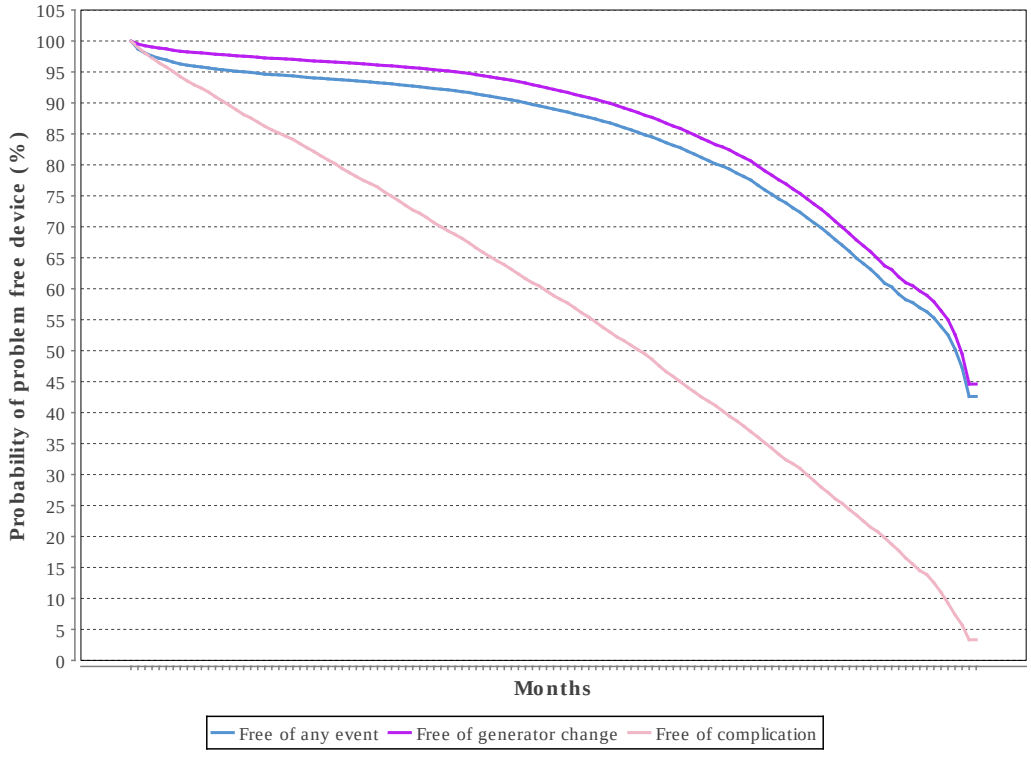
Based on all implants after 1990

Year	At risk	Survival probability %
1	1911	98.8
2	1608	87.6
3	1391	79.2
4	1106	72.3
5	792	66.7
6	502	63.4
7	294	57.8
8	161	52.8
9	103	48.4
10	74	45.2



Probablility of event free CRT-device

Year	At risk	Free of any event %	Free of generator change %	Free of complication %
1	63318	95.5	97.9	91.0
2	53442	94.3	97.0	83.4
3	44576	93.2	96.0	75.6
4	35963	91.7	94.8	67.4
5	28005	89.0	92.2	58.9
6	20617	85.3	88.4	50.2
7	13628	79.8	82.9	40.3
8	7784	71.5	74.5	30.0
9	3172	60.3	63.1	18.8
10	204	42.6	44.6	3.3

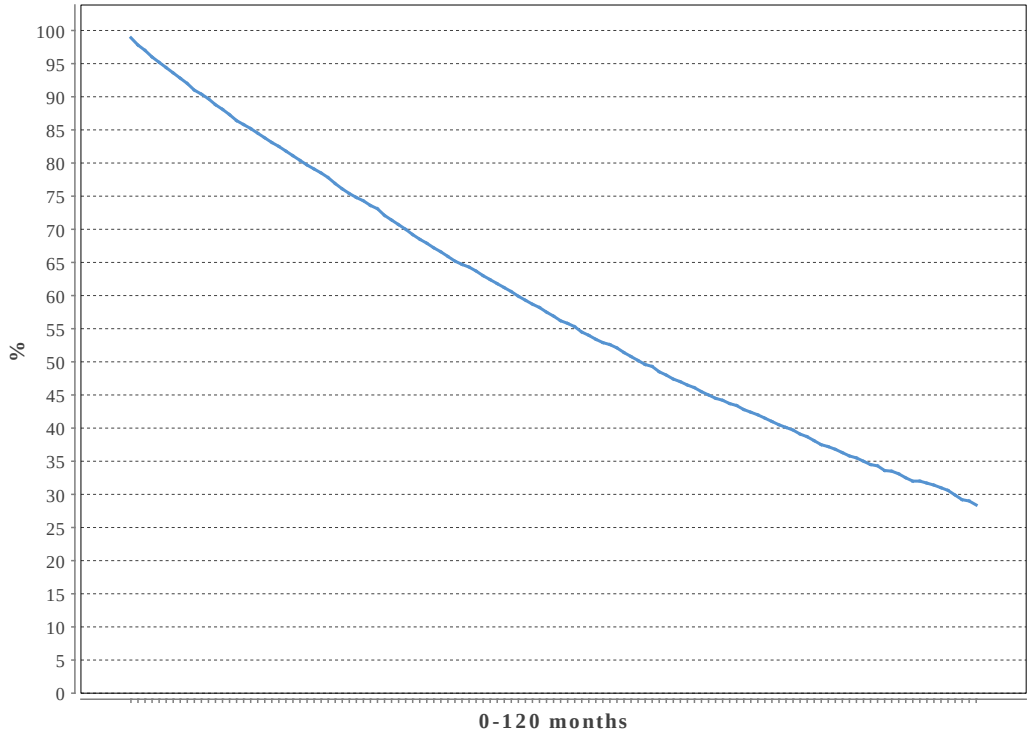


Overall CRT-P generator survival as a mean. Elective replacements and replacements due to infections and system changes have been considered as censored events. Based on all implants after 2006

Year	At risk	Survival probability %
1	11229	100.0
2	9315	99.9
3	7593	99.7
4	6050	99.4
5	4742	98.5
6	3629	95.6
7	2567	88.4
8	1581	74.8
9	799	54.1
10	245	26.7

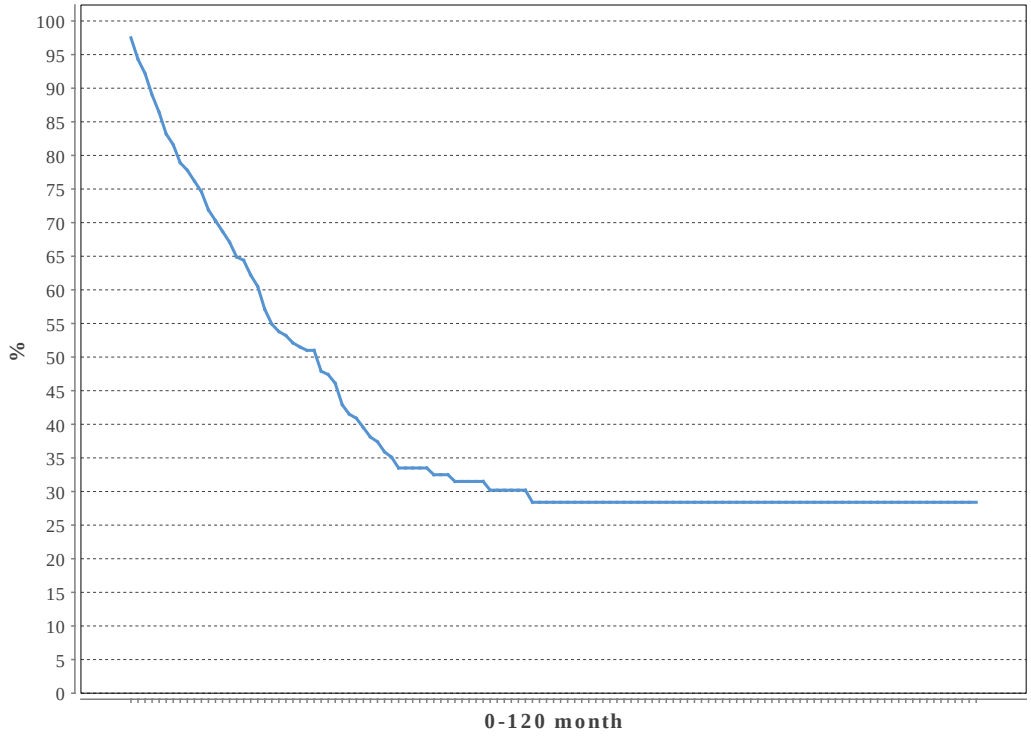
Overall patient survival probability for patients receiving CRT-P therapy. Based on all implants after 2006

Year	At risk	Survival probability %
1	11458	98.9
2	9432	88.8
3	7694	80.4
4	6163	72.1
5	4855	64.3
6	3740	56.9
7	2664	50.2
8	1684	44.2
9	894	38.7
10	346	33.5



Overall patient survival probability for patients receiving CRT-D therapy. Based on all implants after 1990

Year	At risk	Survival probability %
1	197	97.5
2	135	70.3
3	94	51.5
4	51	35.9
5	29	31.5
6	15	28.4
7	12	28.4
8	11	28.4
9	10	28.4
10	10	28.4



QUALITY – DEAD WITHIN ONE YEAR FROM IMPLANT

Ratio of patients being dead one year after implantation

Type	Implants in 2024	Death within year	%
PM	11317	821	7.3
ICD	2437	75	3.1
CRT-P	702	62	8.8
CRT-D	542	23	4.2

Intervention ratio (primary/correction)

Region	Hospital	PM	ICD
Norra Sverige	Norrlands Universitetssjukhus, Umeå	266	66
	Örnsköldsviks sjukhus	82	24
	Östersunds sjukhus	158	30
	Skellefteå sjukhus	64	10
	Sollefteå sjukhus	39	1
	Sunderby sjukhus	360	59
	Sundsvalls sjukhus	203	43
Södra Sverige	Blekingesjukhuset, Karlskrona	296	62
	Centrallasarettet Växjö	206	57
	Centralsjukhuset Kristianstad	371	44
	Hallands sjukhus, Halmstad	94	0
	Helsingborgs lasarett	286	41
	Skånes universitetssjukhus, Lund	508	247
	Skånes universitetssjukhus, Malmö	351	52
	Varbergs sjukhus	279	81
Stockholm/Gotland	Danderyds sjukhus	720	115
	Karolinska Huddinge	321	72
	Karolinska Solna	401	167
	Södersjukhuset	464	81
	St Görans sjukhus	408	80
	Visby lasarett	53	8
Sydöstra Sverige	Länssjukhuset Kalmar	190	69
	Länssjukhuset Ryhov	328	91
	Linköpings universitetssjukhus	523	134
	Västerviks sjukhus	51	0
	Vrinnevisjukhuset, Norrköping	1	0
Uppsala/Örebro	Akademiska sjukhuset	462	136
	Centralsjukhuset Karlstad	251	80
	Falu lasarett	422	86
	Gävle sjukhus	288	92
	Hudiksvalls sjukhus	96	29
	Mälarsjukhuset	318	63
	Torsby sjukhus	43	0
	Universitetssjukhuset Örebro	321	85
	Västmanlands sjukhus, Västerås	261	63
Utland	Ålands centralsjukhus	34	4
	Utland	13	5
Västra Sverige	Alingsås lasarett	77	0
	Drottning Silvias Bus	19	0
	Kungälvs sjukhus	148	0
	Sahlgrenska universitetssjukhuset	537	127
	Sahlgrenska universitetssjukhuset /Östra	155	0
	Skaraborgs sjukhus, Skövde	345	55
	Södra Älvsborgs sjukhus, Borås	293	44
	Trollhättan, NÄL	362	74