Post-market clinical follow-up and registries – the example from SWEDEHEART

ESC: Engaging with the new European regulatory landscape for medical devices – Challenges and opportunities

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Data bases for baseline characteristics and outcomes in Sweden

Since 1947

540219-9750

year month day place sex ctrl

Public mandatory registries

Outpatient diagnosis registry

Prescription registry

Sweden statistics

Population registry

EHRs Hospitals and primary care

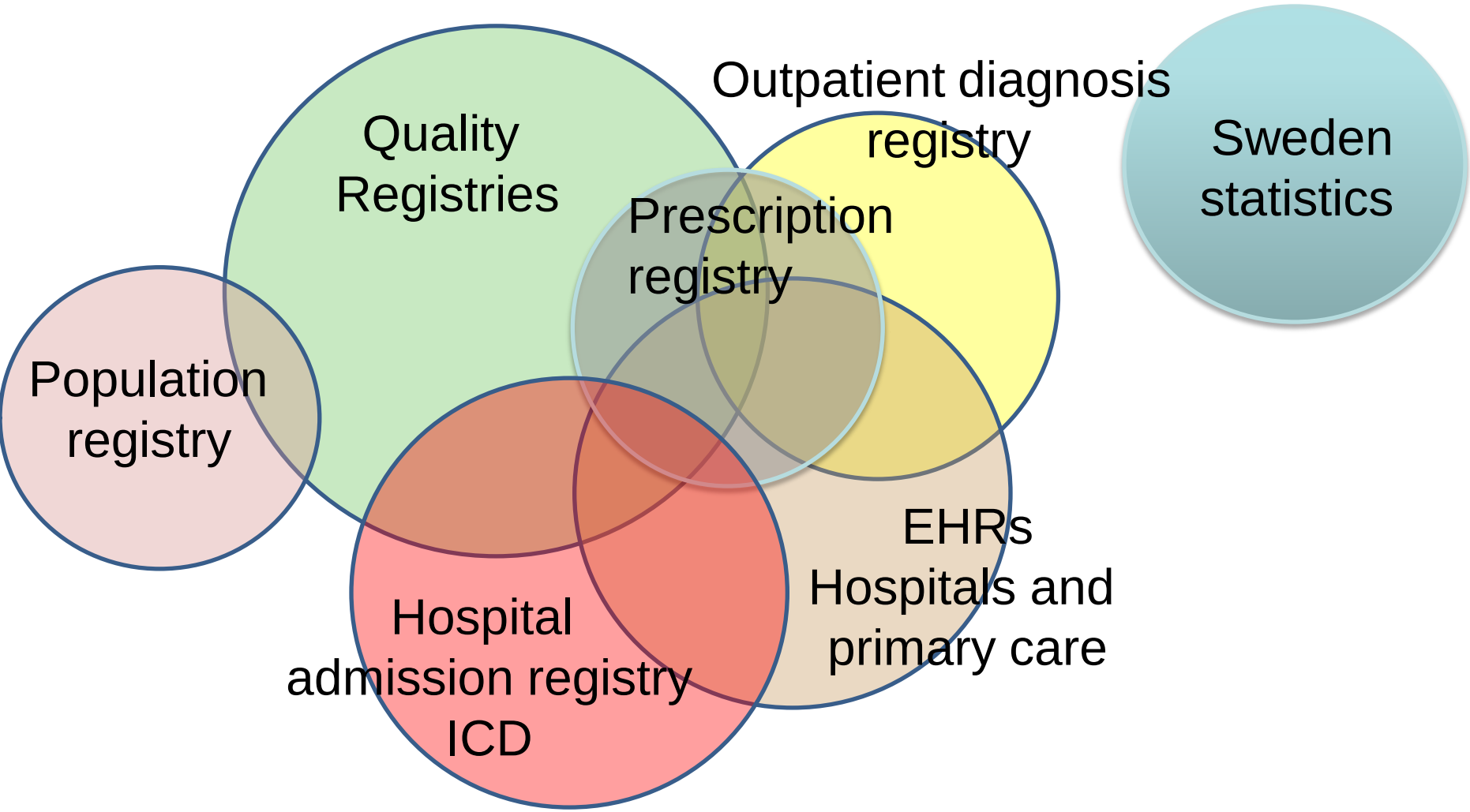
Hospital admission registry ICD

Data bases for baseline characteristics and outcomes in Sweden

Since 1947

540219-9750

year month day place sex ctrl



SWEDEHEART

- The Swedish Web-system for Enhancement and Development of Evidence-based care in Heart disease Evaluated According to Recommended Therapies (**SWEDEHEART**) was launched 2009 after merging of the:

  - National registry of acute cardiac care (**RIKS-HIA**)
  - Swedish coronary angiography and angioplasty registry (**SCAAR**)
  - National registry of secondary prevention (**SEPHIA**)
  - Swedish heart surgery registry

- *Registries evolved from the users to fulfill a need from the profession!*

SWEDEHEART: Funding

- The registry is financed by the **Swedish government** and the Association of Local Authorities and Regions (the **counties public health care provider**)
- Also supported by the Swedish Heart & Lung Foundation.
- Participating hospitals are not reimbursed by the registry and costs of local data entry are borne by their internal budget.

SWEDEHEART

- SWEDEHEART includes patients with acute coronary syndrome (ACS), and patients undergoing coronary angiography/PCI or heart surgery.
- The registry enrolls **80,000** cases each year:
  - **30,000 with ACS**
  - **40,000 undergoing coronary angiography/PCI**
  - **7,000 undergoing heart surgery**
  - **6,000 followed for secondary prevention (1 y)**.
- The platform is in direct contact with the Swedish National Population Registry for immediate access to personal data and deaths.
- The registry is **continuous** year after year. A patient that has a new MI or PCI is reported again.

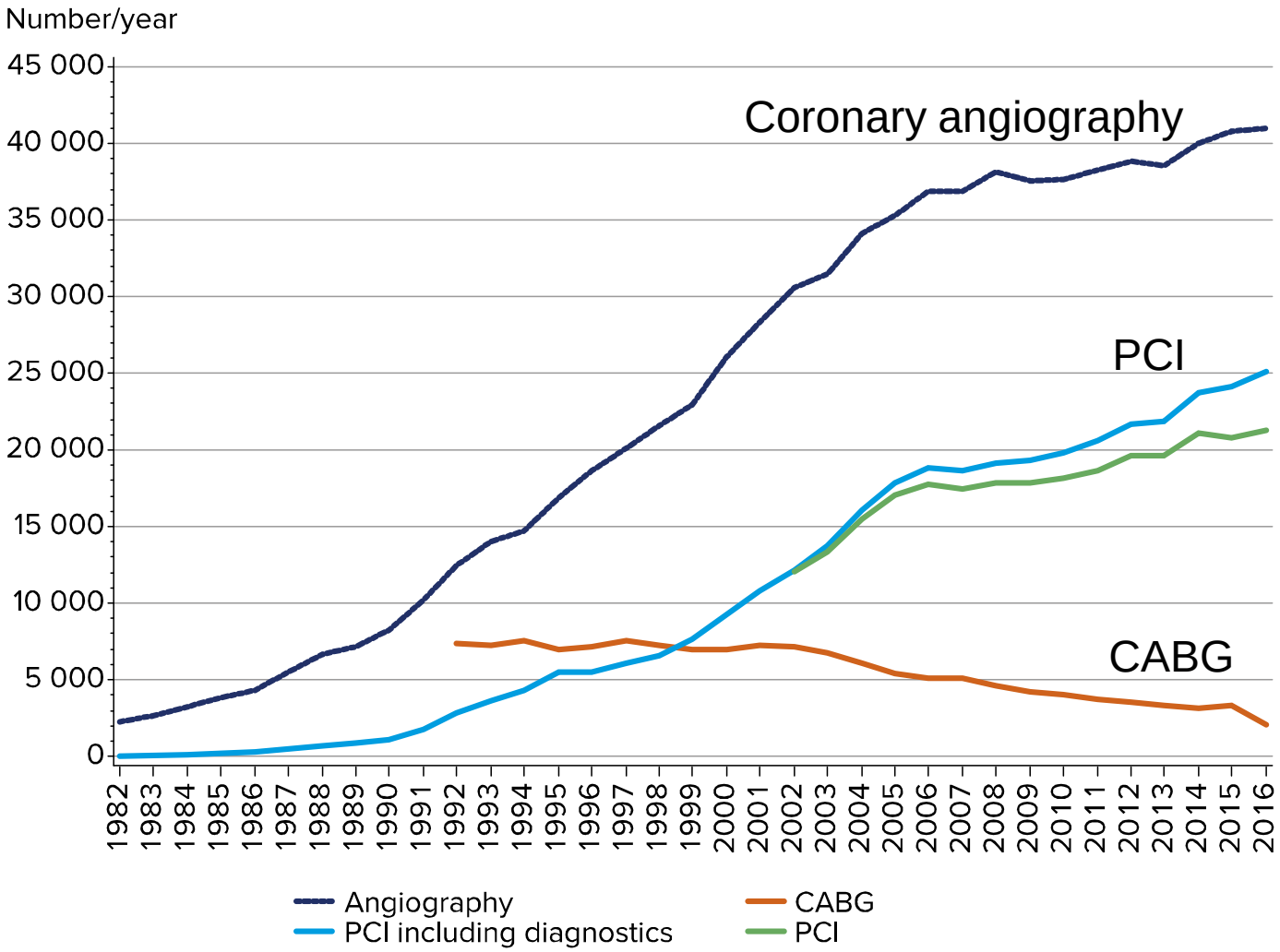
Yearly report 1982-2016

2016

Issued in 2017 – SCAAR

Figure 1. Volume trends, 1982–2016.

Since 2006, the number of angiographies and PCIs have continued to increase, although at a lower rate than previously observed. Since 2002, therapeutic PCI procedures have been separated from PCI procedures with use of intracoronary physiology only (fractional flow reserve [FFR] and instantaneous wave-free ratio [iFR]) The number of CABG procedures following coronary angiography continues to display a declining trend.



SWEDEHEART

- ACS patient information is collected prospectively for **106 variables** and include patient *demographics, admission logistics, risk factors, past medical history, medical treatment prior to admission, electrocardiographic changes, biochemical markers, other clinical features and investigations, medical treatment in hospital, interventions, hospital outcome, discharge diagnoses and discharge-medications.*
- For patients undergoing coronary angiography/angioplasty on any clinical indication approximately **150 variables** are registered.
- For patients <80 years with ACS a follow-up visit is performed after 6-10 weeks and after 12-14 months. From these visits approximately **75 new variables** are added.

Information in SWEDEHEART

SWEDEHEART – 2016

PatientID:

- Angiografiska bakgrundsdata
  - Angiografför
- Angiografi Avslut
  - Angio f
  - Segm
  - Diag
    - Någon
    - Om Ja
  - Angio f patient
  - Stressk
  - Primärt
  - Avböjd
  - Sponta kranskä
- PCI
  - Operat
  - Operatö
  - Lokal framgån
- Sekundärt beslut
  - Sekun
  - Adju
    - Någon
    - Om Ja
    - Labnar
    - Stråldo
    - Genom
    - Kontra
    - Kontra
    - Annan
  - Artärfö
- Antitrombotisk medicinering
  - Antitrombotisk medicinering under/direkt i anslutning till PCI
  - Om JA
- Komplikation på lab
  - Komplikation
  - Om JA
- Överflyttad till
  - Överflyttad till
    - 0 Nej
    - 2 Annat sjukhus
    - 3 Annan vårdenhet inom sjukhuset
    - 4 Ej registrerande sjukhus
  - Ange vårdenhet
  - Anteckningsfält för inmatning

SWEDEHEART – 2018

PatientID:

START – RIKSHIA (1/2)

- Överflytta
  - Överflyttad
  - Ange sjukh /enhet (om
  - Beslutsgr
  - EKG rytm
  - EKG QRS
  - Vänstergren
  - EKG STT
  - Hjärtfrekver
  - Blodtryck Syst/diast
  - Lungrassel
  - Cardiogen vid ankoms
  - Prehospit
  - Intagningso
  - Symtomdet
  - Ambulans
  - Prehospital Tidpunkt
  - HLR före sj
  - Prehospital trombolys
  - Preh trombo läkemedel
  - Preh trombo tidpunkt
  - Ankomstu
  - Ankomst till
  - Avresa till P
  - HIA/AVD/P
  - Klinisk ba
  - Längd
  - Vikt ____ kg
  - Sysselsättning 1 Arbete
- Riskfaktorer
  - Rökning* 0 Aldrig rö
  - Snusning* 0 Aldrig va
  - Skörhet 1 Mycket … 6 Måttligt skör … 7 Allv

SWEDEHEART – 2018

Patient

START – RIKSHIA (2/2)

- Tidigare hjärtsjukdom*
  - Tidigare hjärt-infarkt
  - Känd nedsatt vänsterkammar-funktion
  - Tidigare PCI
  - Tidigare hjärt-kirurgi (avser ej pacemaker)
- Tidigare sjukdon
  - Diabetes
  - Hypertoni
  - Tidigare stroke (ej TIA)
- Medicin vid ank
  - ACE-hämmare
  - A2-blockerare
  - Antikoagulantia
  - ASA
  - Övriga trombocyt-hämmare
  - Betablockerare
  - Ca-hämmare
  - Diabetesbe-handling insulin
  - Diabetesbehand-ling per oral
  - Digitalis
  - Diuretika
  - Aldosteron-blockad
  - Statiner
  - Ezetimibe (Ezetrol)
  - Övriga lipid-sänkare
  - Nitroglycerin långverkande
- Kommentarer

SWEDEHEART – 2018

VÅRD – RIKS…

- Ankomst HIA/
- Revaskularis
  - Reperfusionsbe
  - Trombolys
  - Trombolys kont
  - Trombolys tidpu
  - Reperfusionsgn = Prehospitalta
  - Reperfusionsgru Tid
- Medicinering
  - iv/sc Antikoagul
  - iv Betablockera
  - iv Diuretika
  - iv Inotropa
  - iv Nitroglycering
- Utredningar
  - Typ av stresste
  - Resultat av stre
  - Vänsterkammar mätt
  - Vänsterkammar (LVEF)
  - CABG
  - PM/ICD
  - CPAP
- Laboratorieu
  - Infarktmarkör
  - Maxvärde infark
  - Kolesterol
  - LDL direktmät:
  - P-Glucos
  - Kreatinin*
  - CRP
  - Hb
- Komplikation
  - Reinfarkt under
  - Blödning under
  - HLR/Defibrillerin
  - Cardiogen choc
  - AV-block*
  - Nytt förmaksflim
  - Mekanisk komp
- Överföring ut
  - Överförs till vår

SWEDEHEART – 2018

SLUT – RIKSHIA

- Ankomst HIA/Avd/P
- Avliden*
  - Avliden
- Medicinering*
  - ACE-hämmare
  - A2-blockerare
  - Antikoagulantia
  - ASA
  - Planerad behandlin
  - Övriga trombocythä
  - Planerad behandlin
  - Betablockerare
  - Ca-hämmare
  - Diabetesbeh insulin
  - Diabetsbeh per oral
  - Digitalis
  - Diuretika
  - Aldosteronblockad
  - Statiner
  - Ezetimibe (Ezetrol)
  - Övriga lipidsänkare
  - Nitroglycering långv
- EKG*
  - EKG-rytm
- Diagnos*
  - Infarkttyp
  - Subklass. av hjärtin
  - Diagnos 1
  - Diagnos 2
- Utskrivning*
  - Utskrivningsdatum
  - Planerad koronaran
  - Planerad PCI efter utskrivning 0 Nej
  - Planerad CABG efter utskrivning 0 Nej
  - Uppföljning 0 Nej
  - Uppföljande sjukhus/enhet

SWEDEHEART – 2018

PatientID:

UPPFÖLJNING 1 – SEPHIA

(* = obligatorisk)

- Dödsfall
  - Avliden*
  - Datum för dödsfal
- Uppföljning
  - Uppföljning*
  - Datum för uppföljning*
  - Typ av uppföljni
- Symtom
  - Bröstsmärta*
  - Andfåddhet/Trötth
- Sysselsättnin
  - Sysselsättning*
  - Heltidssjukskriver
- Återinläggnin
  - Någon återinlägg-ning*
  - Återinläggning pg ny hjärtinfarkt*
  - Planerad återinläg ning för kor.angio PCI/CABG
  - Återinläggning pg angina*
  - Återinläggning pg hjärtsvikt*
  - Återinläggning pg Övrig hjärtsjukdor
  - Återinläggning pg stroke*
  - Återinläggning pg blödningskomplik: ion*
  - Återinläggning pg annan sjukdom*
  - Aktuell hjärtkirurgi komplikation utan återinläggning*[1]
  - EKO utfört efter v tillfället
  - Vänsterkammarfunktion (LVE
  - ICD implanterat 0 Nej

Åtgärder efter utskrivning*	0 Nej	1 Ja	9 Okänt	
Koronarangiografi*	0 nej	1 Ja	9 Okänt	Datum för första koronarangiografin* ____-__-__
PCI				
CABG				

- Riskfa
  - Rökning
  - Slutat rö hjärtinfa
  - Snusnin
  - Slutat sn hjärtinfa
  - Antal m senaste
  - Diabetes
- Matva
  - Hur ofta rotfrukte
  - Hur ofta (färska, f
  - Hur ofta huvudrä
  - Hur ofta klad/goc
- Deltag
  - Deltagar skrivning
  - Påbörjat efter uts
  - Deltagar program
  - Deltagar gram eft

Medicinering						
ACE-hämmare*	0 Nej	1 Ja	9 Okänt			
A2-bkockerare*	0 Nej	1 Ja	2 ARB + Neprilysin	9 Okänt		
Antikoagulantia*	0 nej	1 Waran	3 Dabigatran	4 Rivaroxa-	5 Apixaban	9 Okänt
ASA*						
Andra trom						
Betablocke						
Ca-hämma						
Diabetes-b						
Diabetesbe						
Digitalis*						
Diuretika*						
Aldosteron						
Statiner*						
Ezetimibe (						
Övriga lipid						
Nitroglyceri						

- Livskvali
  - Rörlighet*
  - Hygien*
  - Aktiviteter*
  - Smärtor/Be
  - Oro/Nedstä
  - Nuvarande
- Deltagar
  - Deltagande studie*
- Provtagn
  - Triglyceride
  - Kolesterol
  - HDL-kolesterol
  - LDL-kolesterol (direktmätt)
  - ApoB
  - ApoA1
  - ApoB / ApoA1
  - fP-Glucos

SWEDEHEART – 2018

PatientID:

UPPFÖLJNING 1 – SEPHIA

(* = obligatorisk)

HBA1c	__.__ mmol/L

Mätning	
Blodtryck	___/___ mmHg
24-timmars blodtrycksmätning Medelblodtryck Dygn	___/___ mmHg
24-timmars blodtrycksmätning Medelblodtryck Dag	___/___ mmHg
24-timmars blodtrycksmätning Medelblodtryck Natt	___/___ mmHg
Hemblodtryck - Dag 1 morgon	___/___ mmHg
Hemblodtryck - Dag 1 kväll	___/___ mmHg
Hemblodtryck - Dag 2 morgon	___/___ mmHg
Hemblodtryck - Dag 2 kväll	___/___ mmHg
Hemblodtryck - Dag 3 morgon	___/___ mmHg
Hemblodtryck - Dag 3 kväll	___/___ mmHg
EKG-rytm	1 Sinus / 2 FF/fladder / 3 PM-rytm / 4 Annan
Vikt	___ kg
BMI – Body mass index	___
Midjemått	___ cm

Fortsatt uppföljning	
Fortsatt uppföljning på sjukhus (anges endast om ditt sjukhus valt fler än 2 uppföljningar)	

Kommentar:

[1] Denna variabel är enbart aktuell om sjukhuset valt att följa upp CABG

Recurrent registrations of a patient in SWEDEHEART

Stable Angina → PCI

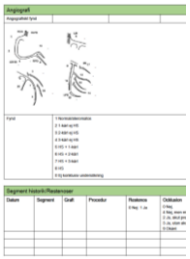
ACS → MI/Stent thrombosis

Secondary Prevention → 1 year

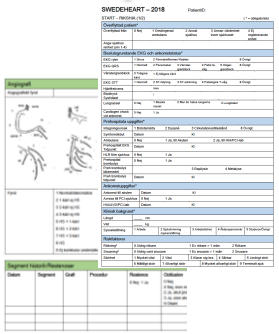
Heart Attack at home → Death

Time (years)

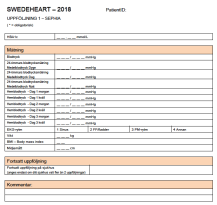
SCAAR



RIKS-HIA & SCAAR



SEPHIA



Cause of death registry

Death automatically transferred to SWEDEHEART

Merging with other registries

- The use of personal identification number enables **merging with the National Cause of Death Register and the National Patient Registry, which includes diagnoses at discharge** for all hospital stays in Sweden.
- Every merge of registries is approved by the National Board of Health and Welfare, the Swedish Data Inspection Board and an ethical committee.
- After merging of the registries, researchers have access to hospital identity but not to patient identity.

Monitoring

- To ensure the correctness of the data monitors visit about 20 hospitals each year and compares data entered into the SWEDEHEART with the information in the patients' records from 30–40 randomly chosen patients in each hospital.
- In 2007, there was a **96.1%** agreement.
- In 2016, there was a **97%** agreement.
- Regarding patients with ACS over **90%** are covered by the registry.
- For angiography and PCI **100%** are covered.

SWEDEHEART

- The main purpose of the registry is to support the improvement of care.
- The long-term goals are to contribute to decreased mortality and morbidity and increase cost effectiveness.
- The registry ***compares performance of participating hospitals*** and different treatment modalities and medical devices.
- A national, regional and county based report is presented on a yearly basis.

http://www.ucr.uu.se/swedeheart/

Quality parameters

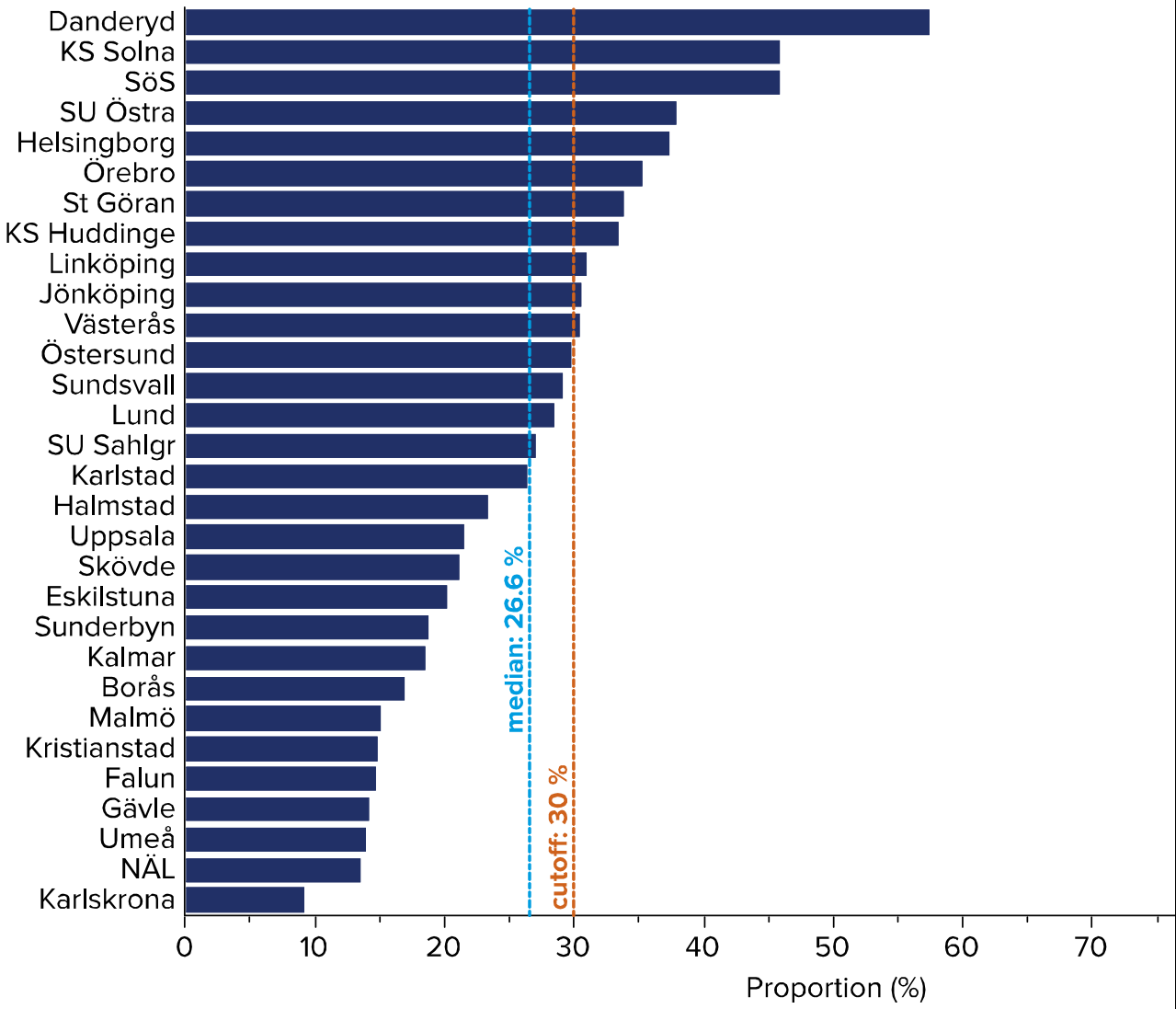
2016

Issued in 2017 – SCAAR

Figure 72. Proportion of performed coronary angiography with stable coronary artery disease in which intracoronary pressure measurement (FFR or iFR) has been used, 2016.

Target point is set at 30 %.

FFR/iFR have a great value for diagnosis and decision. The diagnostic tool has a high priority (Priority 3) in the Sweden National Heart Guidelines, 2015. FFR has recommendation and evidence level IA according to the ESC/EACTS guidelines, 2014.

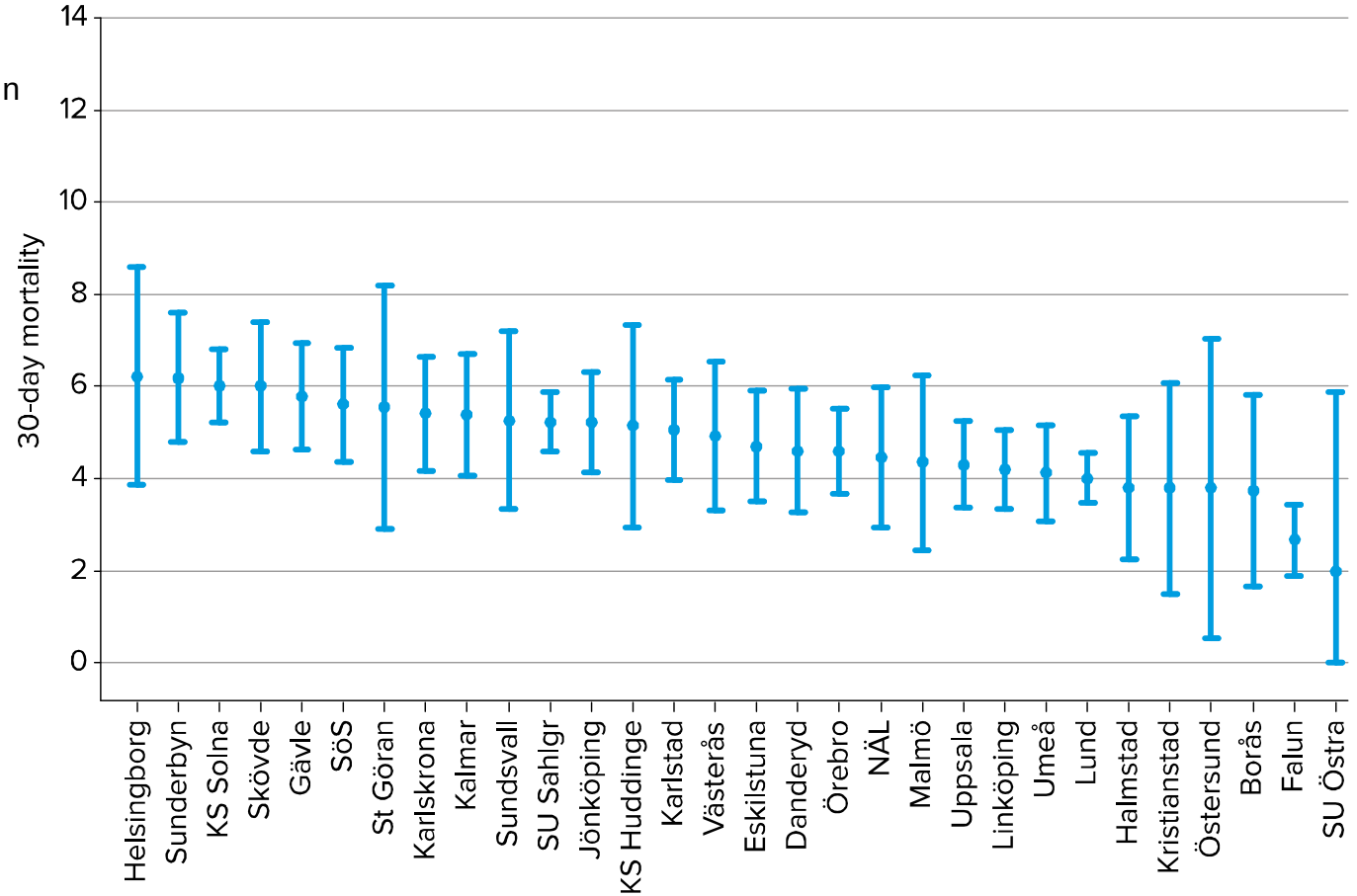


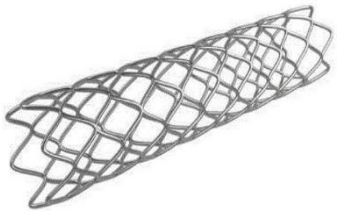
Mortality
Hospital comparison

2016

Issued in 2017 – SCAAR

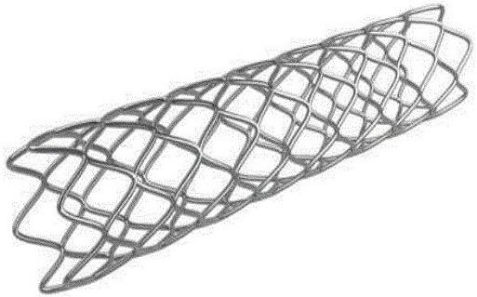
Thirty-day mortality after PCI in STEMI patients, per hospital, 2007–2016 (mean value and 95 % CI).





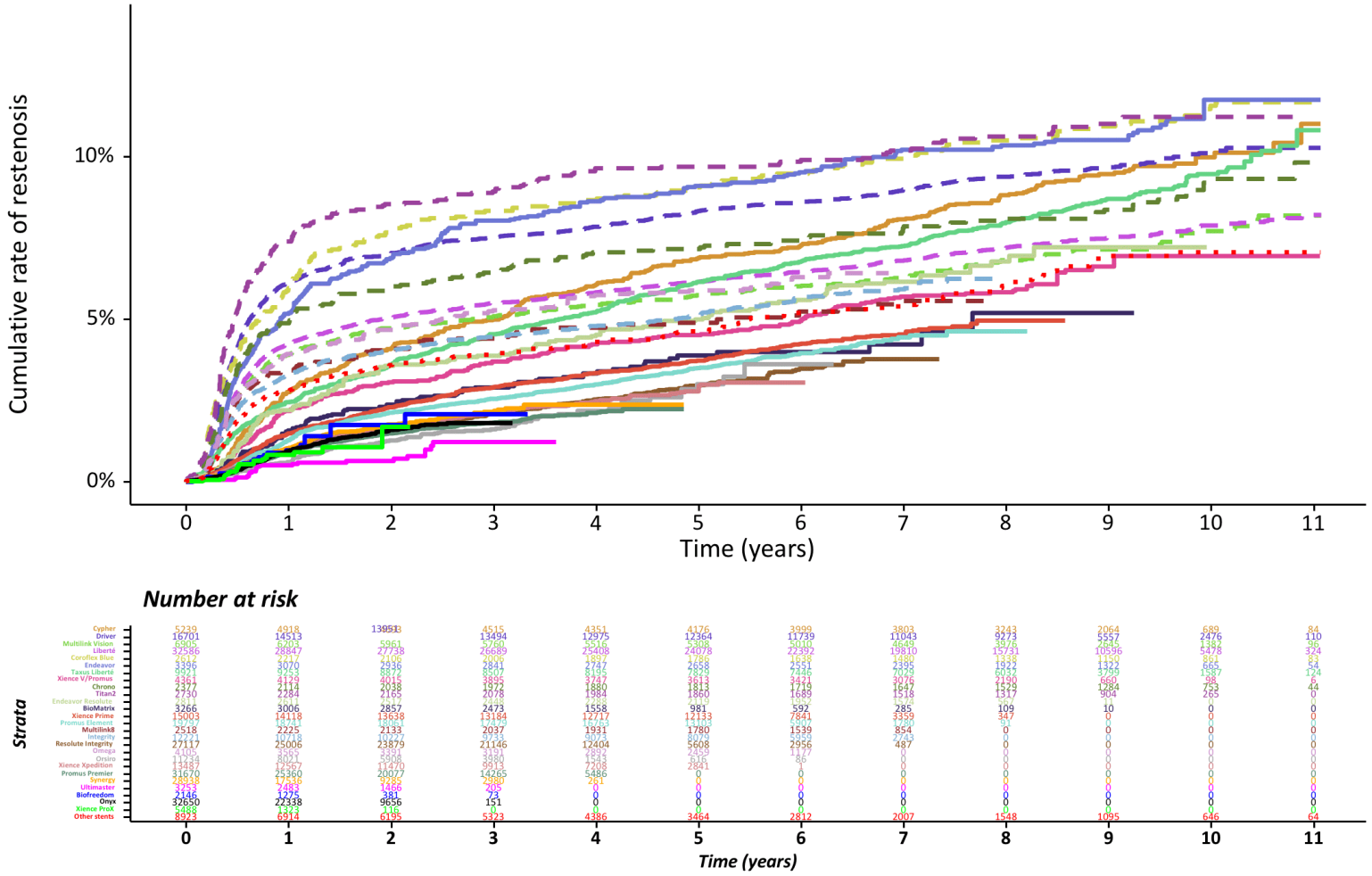
Stents in SCAAR

- All stents placed in Sweden since before 2000
- **Brand, length, diameter, pressure, postdilatation, bifurcation, lesion severity (A-C), CTO**.
- Patient demographics, STEMI, NSTEMI, stable angina etc.
- **New PCI:** Question is asked if this is an acute stent thrombosis or not.
- Analysis ***segment level*: Restenosis, Stent thrombosis**.
- Analysis ***patient level*: Death, MI and revascularisation**.
- We can provide: **Safety, Performance, Benefit-to-Risk, State-of-the-art** (comparison with similar products).

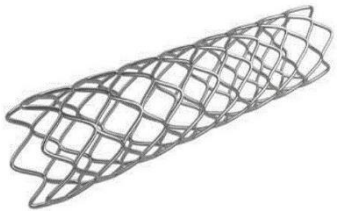


Stent: Restenosis

Restenosis in all stents implanted >1000 times in Sweden, 2007 - January 23th 2018.

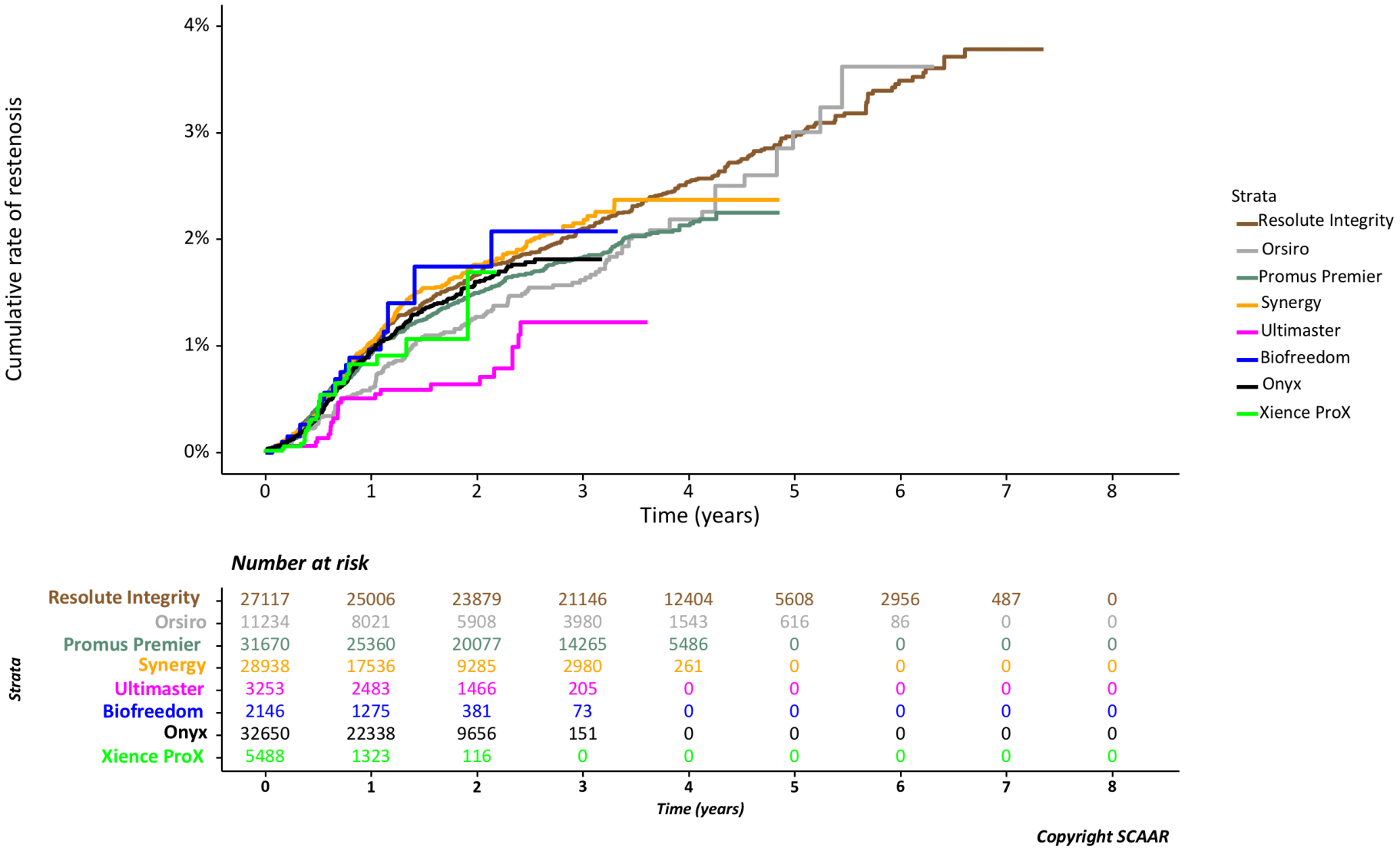


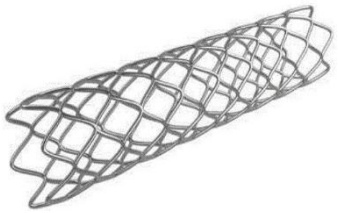
Approximately 300 000 stents placed



Stent: Restenosis

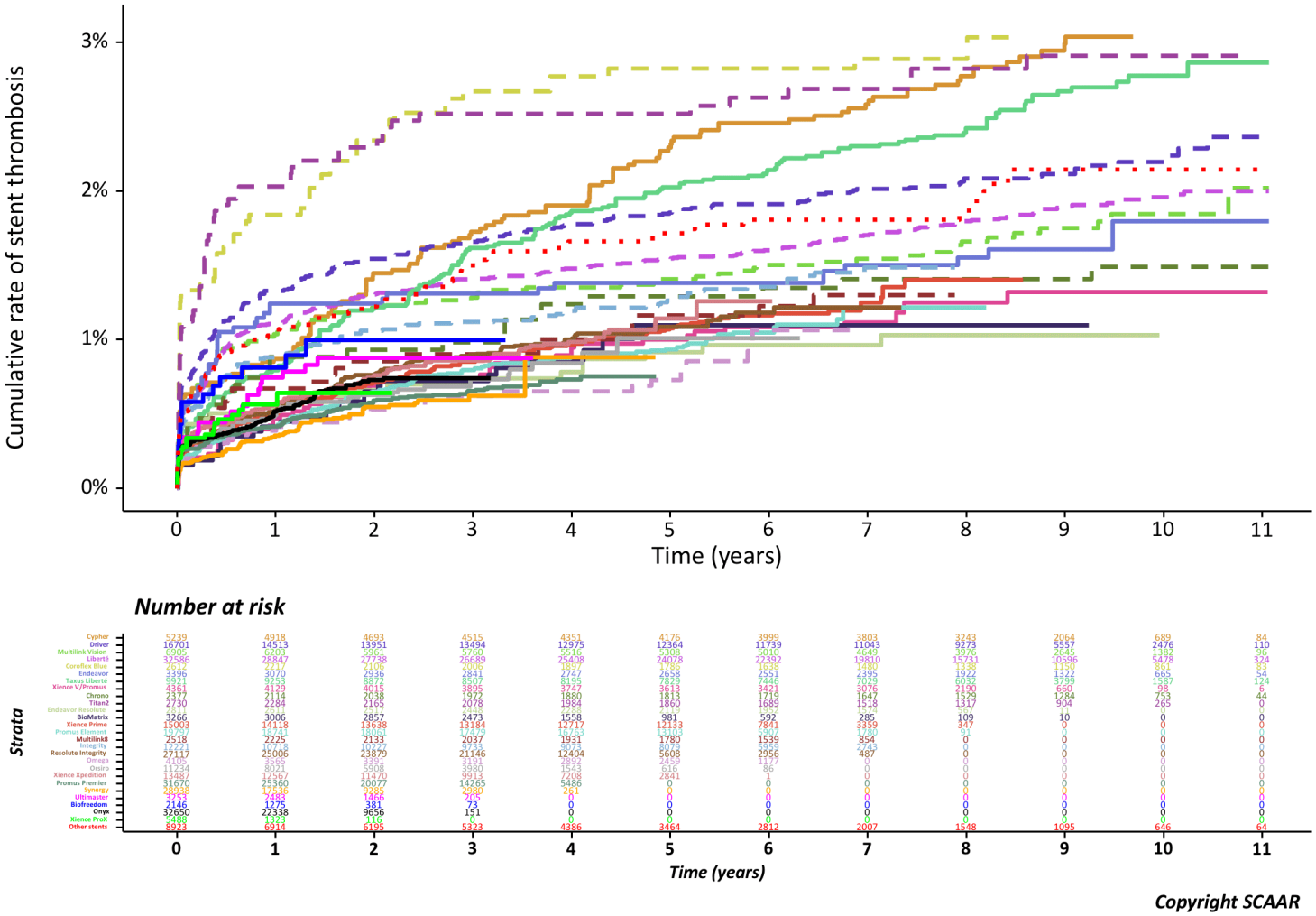
Restenosis in most used stents implanted >1000 times in Sweden, 2007 - January 23th 2018.

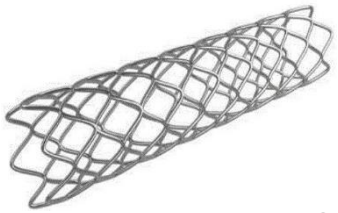




Stent: Stent thrombosis

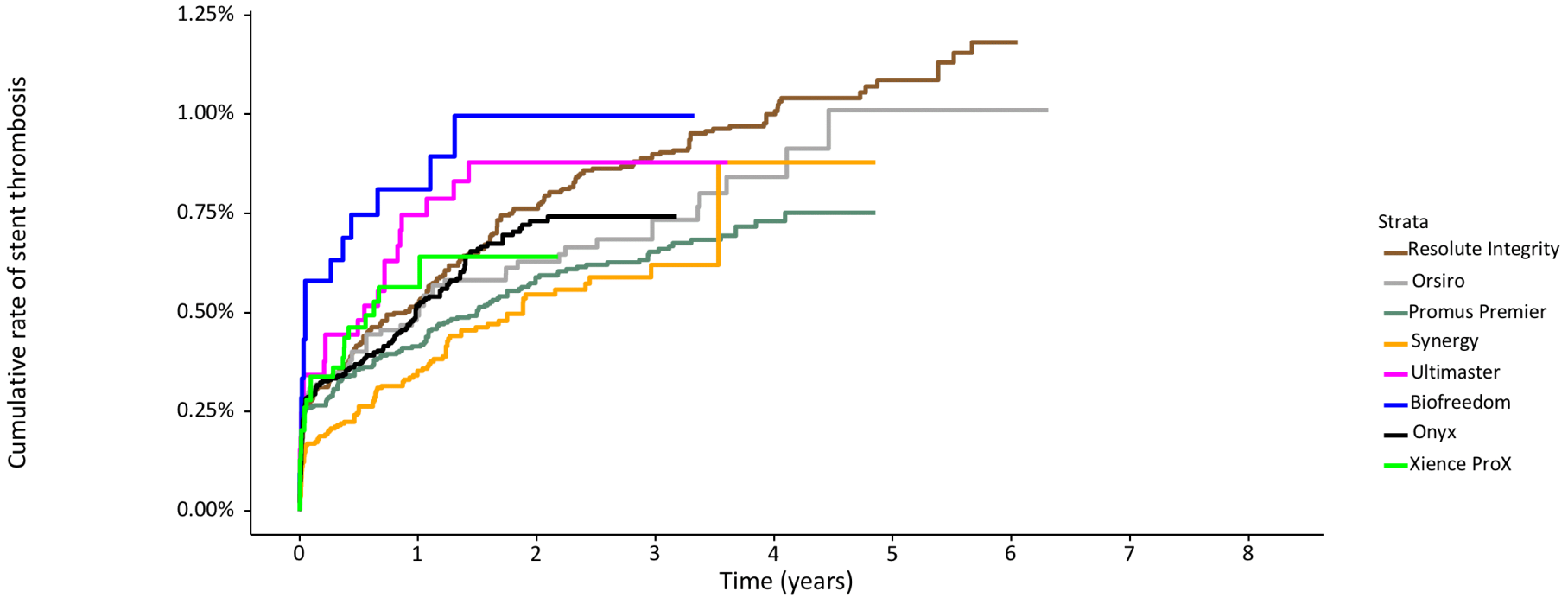
Stent thrombosis in all stents implanted >1000 times in Sweden, 2007 - January 23th 2018.





Stent: Stent thrombosis

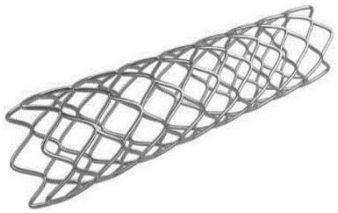
Stent thrombosis in most used stents implanted >1000 times in Sweden, 2007 - January 23th 2018.



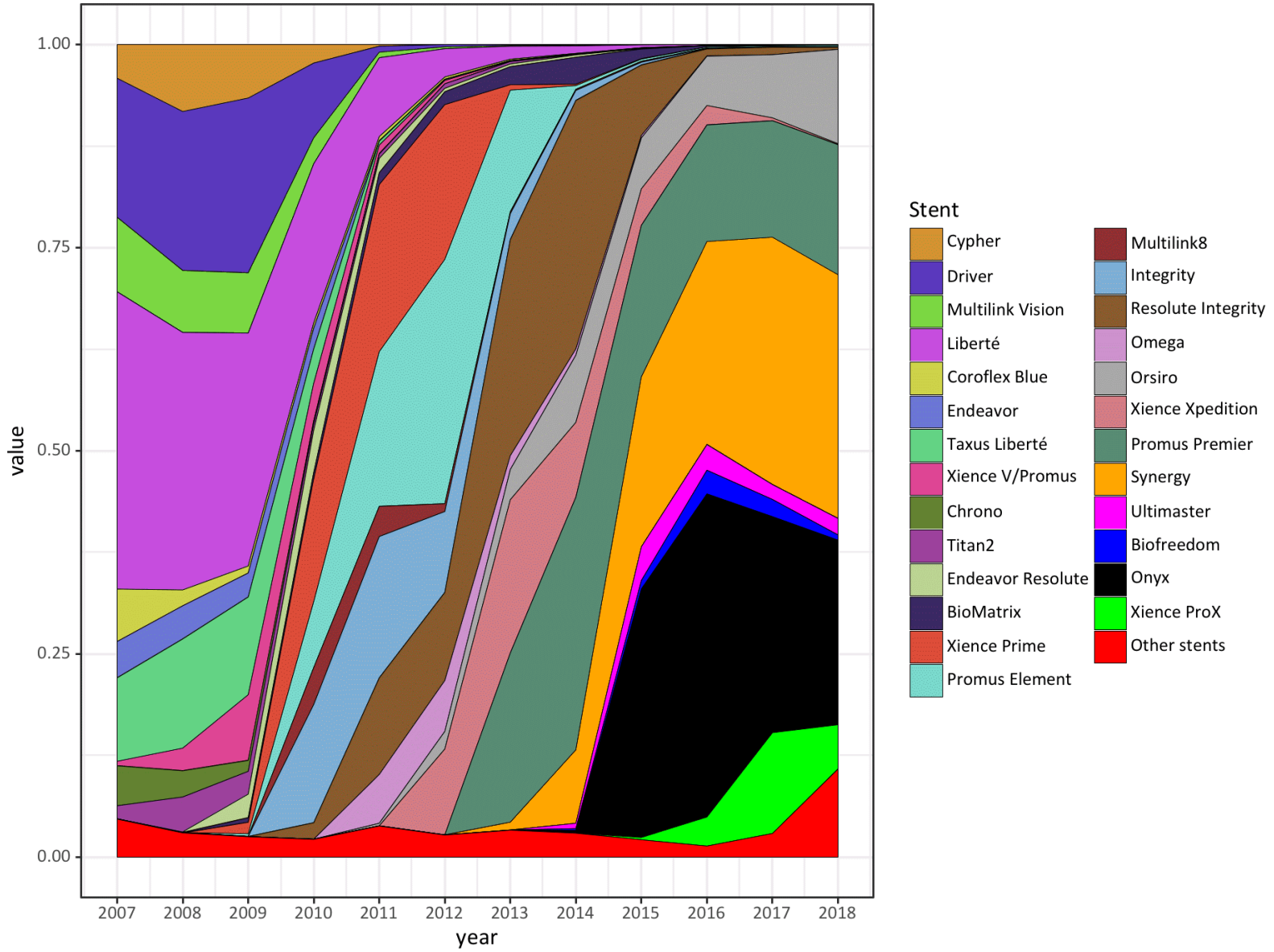
Number at risk

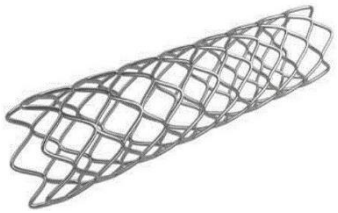
Strata	0	1	2	3	4	5	6	7	8
Resolute Integrity	27117	25006	23879	21146	12404	5608	2956	487	0
Orsiro	11234	8021	5908	3980	1543	616	86	0	0
Promus Premier	31670	25360	20077	14265	5486	0	0	0	0
Synergy	28938	17536	9285	2980	261	0	0	0	0
Ultimaster	3253	2483	1466	205	0	0	0	0	0
Biofreedom	2146	1275	381	73	0	0	0	0	0
Onyx	32650	22338	9656	151	0	0	0	0	0
Xience ProX	5488	1323	116	0	0	0	0	0	0

Time (years)



Stent use over time



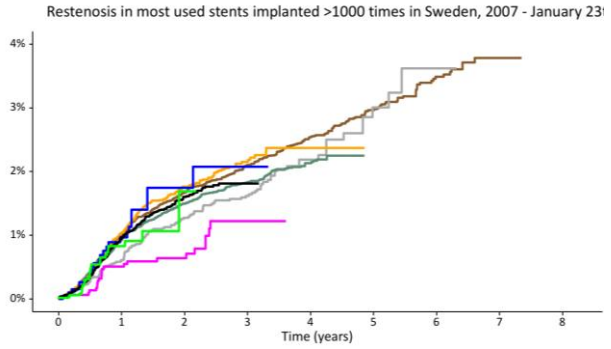


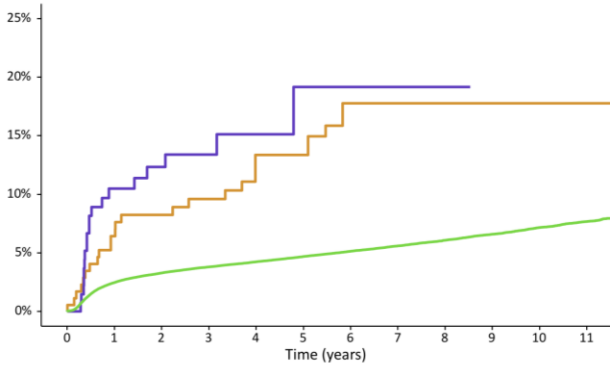
Examples of post-marketing stent evaluations in SCAAR

1. One of the most commonly used DES: Overall performance compared to other modern DES “state-of-the-art”, but also performance of subgroups: small diameter stents, bifurcations, diabetics etc.
N > 10000.

2. Niche product, covered stent:
n = 140

3. New introduction of extra long stent, n=700 the first year.



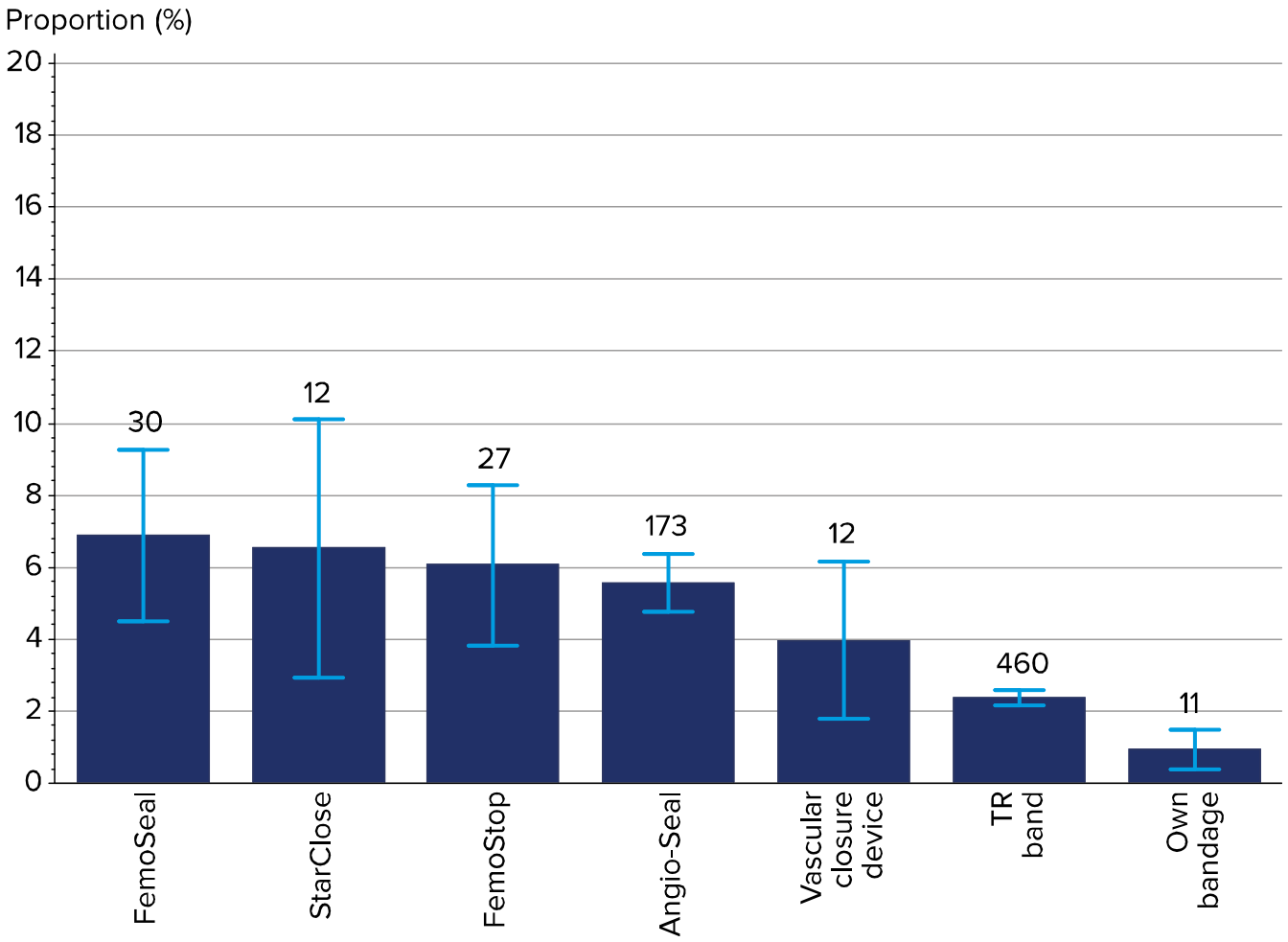


Closure devices

2016

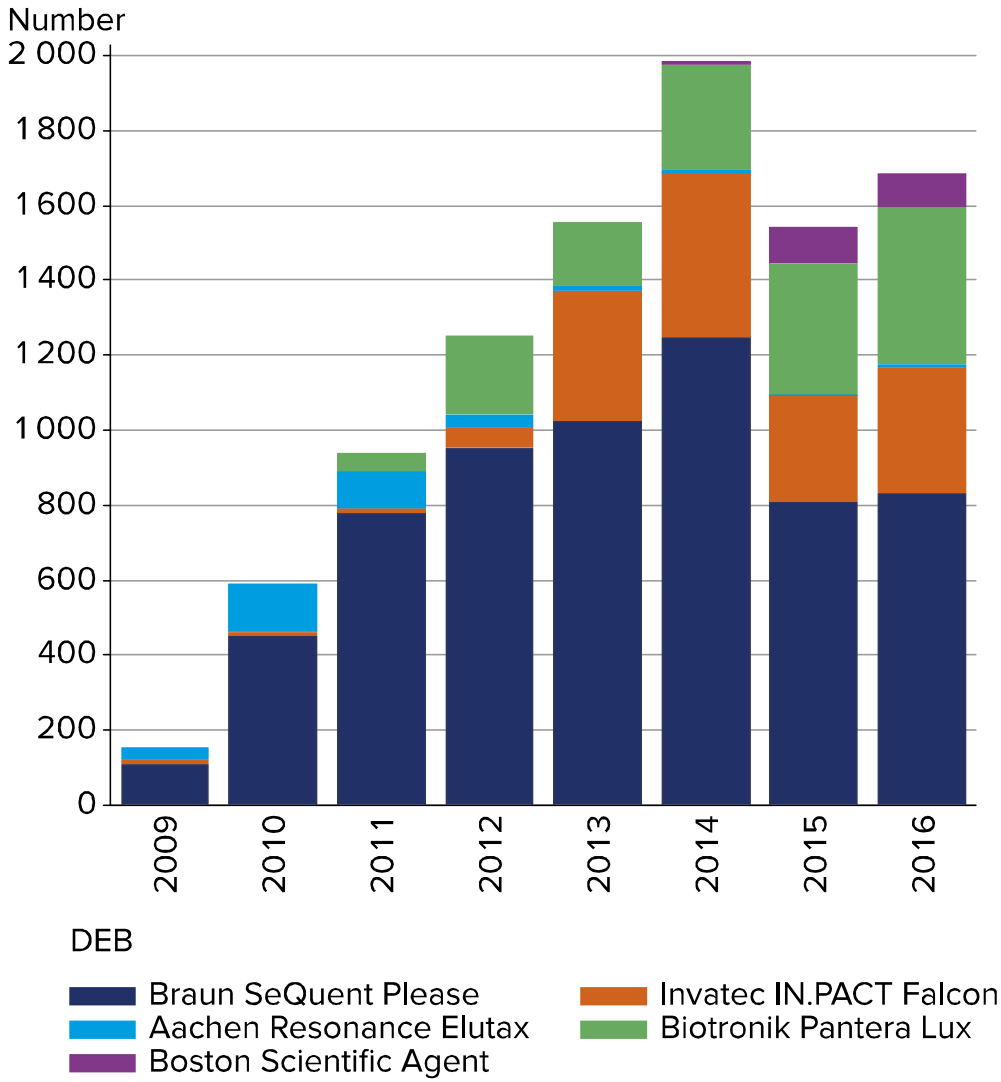
Issued in 2017 – SCAAR

Figure 54. Proportion of bleedings at puncture site in PCI patients, per vascular closure device with more than 50 uses, 2016 (bars representing 95 % CI; number of bleedings above the bar).



Drug Eluting Balloon (DEB)

Figure 33. Number of different types of drug eluting ballons (DEB) used, 2009–2016.



Other Swedish registers

- SWEDVASC (Vascular Surgery)
- SWENTRY (Percutaneous valves)
- Thoracic Surgery
- Orthopedic registers
- Diabetes
- Rheuma
- >100 registers

NATIONELLA KVALITETSREGISTER

Kunskap för bättre vård och omsorg

http://kvalitetsregister.se/index.html

Other countries

- The SWEDEHEART platform has been implemented or is under development in Norway, Iceland and England.
- Interest has been expressed from Denmark, Netherlands, France and Uganda(!).

Limitations

- Wires, balloons, guide catheters, aspiration catheters are not covered by the registry.
- We discuss adding an extra module to capture these devices

Conclusion

- The SWEDEHEART and other Swedish registries are excellent for post-marketing follow-up of medical devices.
- They are prospective, nationwide, with high coverage, continuous, long-term and detailed.