SwissCaRe

REGISTRY REPORT

YEAR 2024


SWISS
CaRe


SWISSRDL
UNIVERSITÄT
BERN

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On behalf of the SwissCaRe Steering Committee

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09.04.2025

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10.06.2025

Contents

1 Preface

Dear SwissCaRe participant, dear quality responsible, dear reader

We are pleased to provide you with the second SwissCaRe report on the period 2024. The Swiss Society of Cardiology and the Swiss Working Group Interventional Cardiology are proud, that the launch of the first consecutive and prospective quality registry on PCI & CA in Switzerland was successful as evidenced by this second report. More than 39'000 interventions were recorded, which reflects approximately 70% of the expected annual procedures in Switzerland. The SwissCaRe registry has thereby already become one of the largest quality registries in Switzerland.

Information on the background, aims and methods of SwissCaRe are provided below.

Please note that several sites started submitting quality data during the year 2024 and not necessarily at the beginning of 2024, thus numbers may not reflect a complete year. This is important when comparing sites with each other (benchmark analysis). We are pleased that the Federal Office of Statistics has approved our request to link SwissCaRe with the national mortality statistics for patients who agreed to provide their identifying information. We anticipate including the first mortality data in the 2025 report.

Two reports are available

1. The **main report** released in public presenting the overall cohort and comparing hospital categories (i.e. University, Public non-university, and Private)
2. The **hospital reports** provided to each participating site includes a detailed comparison among i) hospitals of the same category ii) to the overall cohort independent of hospital category.

We welcome any feedback (directed to luisa.schaefer@swisscardio.ch) with the aim to improving SwissCaRe on a yearly basis. Any written feedback will be discussed within the Steering Committee.

We thank all participating sites for their contribution to SwissCaRe with the ultimate aim to improve the quality in coronary interventions in Switzerland.

On behalf of the SwissCaRe Steering Committee

Prof. Lorenz Räber, MD, PhD
Chair of the SwissCaRe Steering Committee

Background

PCI is by far the most frequent intervention in cardiovascular medicine. According to the last PCI Statistics published by the Swiss Working Group of Interventional Cardiology for 2021, 30'042 coronary angiographies and 26'513 PCIs were performed by 208 operators at 36 interventional centers located in 17 of the 26 Swiss cantons: 5 university hospitals, 14 non-university public hospitals and 17 private institutions. These previous analyses were not based on prospective data collection and did not include associated patient characteristics, procedural quality and outcomes. However, there is growing interest from patients, media, politics and authorities to assess quality of medical treatments with particular focus on interventions. The KVG Art. 58 and KVV Art. 77 approved by the Swiss parliament on 21.6.2019 mandate quality assessment (actual state), and definition of measures to improve quality. Both require public release of the results. Also, the ESC guidelines recommend participation in prospective PCI quality registries (IB). Against these developments, the Swiss Society of Cardiology and its Working Group Interventional Cardiology have set up the prospective quality registry SwissCaRe proactively for the most frequent cardiology interventions in Switzerland, i.e. coronary angiography (CA) and percutaneous coronary interventions (PCI). The conduction of a Swiss PCI quality registry is supported by the members of the Swiss Society of Cardiology and its Working Group Interventional Cardiology Interventional Cardiology based on a general assembly voting. The SwissCaRe quality registry for CA & PCI was initiated in 2022. In its first reporting year 2023, SwissCaRe included an est. 30% of Swiss CA & PCI procedures. Now, in its second reporting year, SwissCaRe includes an est. 70% of Swiss CA & PCI procedures for 2024.

Primary Aim

To maintain and constantly improve the quality of coronary angiography (CA) and percutaneous coronary interventions (PCI) in Switzerland. The definition of indication and treatment quality is based on the European (ESC) guidelines on CCS, N-STEMI and STEMI and shall be adapted to changes whenever necessary.

Specific Aim

To monitor the treatment quality of consecutive patients undergoing coronary angiography (CA) and/or percutaneous coronary interventions (PCI) in Switzerland.

1. Prospectively report the annual number of patients undergoing CA and PCI in Switzerland and describe relevant baseline and procedural characteristics
2. Assess the clinical indications of patients undergoing CA and PCI
3. Assess selected ESC-guideline endorsed procedural quality indicators of patients undergoing PCI (CCS, N-STEMI, STEMI)
4. Assess selected ESC-guideline endorsed contraindications (Class III recommendations)
5. Report severe procedural complications of all patients undergoing CA and PCI occurring in the catheterization laboratory
6. Report mortality (48h, 30 days) of all patients undergoing PCI

The publicly available "main report" shall provide results on indication and treatment quality on a nationwide level and comparisons between three hospital categories (i.e. university, public non-university, and private). The "hospital reports" shall provide the participating sites with a detailed benchmark analysis in which the hospital performance is being compared with other hospitals of the same category in Switzerland.

Mortality will be collected through the federal office of statistics and require patient consent.

2 Steering Committee

Chair: Prof. Lorenz Räber, MD, PhD

Quality responsible Swiss Society of Cardiology
Vice-President Swiss Society of Cardiology
Board Swiss Working Group Interventional Cardiology

Dr. Béatrice Veragut Davies, MD

President Swiss Society of Cardiology

Prof. Oliver Gämperli, MD

President Swiss Working Group Interventional Cardiology

Prof. Raban Jeger, MD

Board Swiss Working Group Interventional Cardiology

Prof. Marco Valgimigli, MD, PhD

Delegate Swiss Working Group Interventional Cardiology

Prof. Philippe Meyer, MD

Board Swiss Working Group for Cardiovascular Prevention, Rehabilitation and Sports Cardiology

Prof. Lars Englberger, MD

Board Swiss Society for Heart and Thoracic Vascular Surgery

3 Sponsorship

The professional set up of large registries requires financial resources. We are grateful for the support of below mentioned sponsors, who kindly supported the SwissCaRe Registry:

Major Sponsors

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SMT

4 Methods

Eligible patients

Any patient undergoing CA and/or PCI in Switzerland.

Consent

As identifying information is stored to obtain mortality data through the Federal Statistical Office (FSO), patients have to agree to they use of identifying data. Generally, this consent can be obtained within the consent form for the CA/PCI (no specific registry consent form is needed). A standardized consent form for CA/PCI that includes the registry consent is available via the Swiss Heart Foundation, accompanying patient information are available in the login area or from the SSC. In the absence of consent the procedures are collected anonymized, and the mortality cannot be collected for these patients. Anonymized data entry is standardized via a No Consent SOP.

Follow up

There is no active follow-up. However, mortality data is obtained through the Federal Office for Statistics.

Mortality data acquisition (future reports)

To make the registry linkable to administrative data, such as cause-of-death statistics, identifying information is required (last name, first name, and date of birth). This identifying information is securely sent to the central compensation office (CCO), where it is matched to the social security number (SSN). At the FSO, the SSN with the registry-data is then linked to the cause-of-death registry and population data to determine the status of the patients.

The FSO prepares the cause-of-death and population data by the end of the following year for data from the previous year. Therefore, the linkage process can only be initiated after a lag of approximately 12 months and will be performed for the first time in the coming weeks, after which analysis and reporting of mortality will be developed. It is anticipated that mortality data will be included in next year's report, covering mortality up to the year 2024. Once established, the process will be repeated annually. The status of patients is not allowed to be fed back into the registry.

Monitoring

Central monitoring is conducted on a quarterly basis by SwissRDL for all entered procedures. On-site monitoring has commenced in 2024 and all participating sites will be monitored within the first two years. Thereafter, monitoring will follow a risk-based approach. Monitoring focuses primarily on 1) consecutive enrollment, 2) data completeness and 3) data correctness (compared to source data).

Definition of Case and Case identifying information

Every single patient is uniquely identified by patient name, last name, date of birth and sex. Patients undergoing repeated interventions at the same clinic will be documented under the same hospital patient ID. Patients undergoing treatment at a second hospital will be recorded as new patients (as identifying information cannot be shared between hospitals).

Data security and storage

SwissRDL is part of the Institute of Social and Preventive Medicine ISPM at the University of Bern. Security and safety of the data are guaranteed by the IT regulations of the University and are described in respective SOPs at the ISPM. The hardware of SwissRDL is hosted at secure data centers at the University of Bern. Backup and security, as well as control and access systems are redundant and managed by the IT group of the ISPM and the University of Bern. Backup data are stored in a second data center at the University. SwissRDL has implemented a two-layered server structure for data collection to provide the best possible security and privacy protection of patient data. Clinical data are stored on the SwissRDL main server in a central Oracle database. Sensitive patient identifying information are stored on physically separated servers in the SwissRDL trust center. To match the clinical data stored on the main server, an internal ID is used. Identifying information is never sent to the main server, and vice versa. This basic setup of the SwissRDL registry servers is part of the privacy preserving and security enhancing measures.

Data access

Access to the SwissRDL registry system is protected by password protected user accounts. Each user has one or more profiles assigned. Each profile defines the main purpose (e.g. data entry, administration) and handles access rights on different levels, like clinic, users, patients and forms. Each clinic has access to its own data and can export it. Access to the pooled registry data is ruled by contract with the SSC. Every site receives their raw data upon request.

Data entry

There are two possible modes of data entry:

1. Online data entry - Data can be entered directly into the registry using a web browser. ECRFs can be filled in from anywhere using the online forms.
2. Web services - Ideally, data is directly transferred from a data warehouse or clinic information system (CIS), if all mandatory variables for the registry already exist in the clinic. REST (Representational state transfer) API is used. With the support of SwissRDL, the IT personnel at the clinics implement the web services.

Registry staff

Coordination: Luisa Schäfer (SSC) and Camille Blochet (SwissRDL)
Data analysis and reporting: Andreas Boss (SwissRDL)

5 List of abbreviations

ACS acute coronary syndrome
API application programming interface
ASA acetylsalicylic acid
CA coronary angiography
CABG coronary artery bypass grafting
CAD coronary artery disease
CathLab catheterization laboratory
CCO central compensation office
CCS chronic coronary syndrome
CCTA cardiac computed tomography angiography
CI confidence interval
CIS clinic information system
CTO chronic total occlusion
cvRF cardiovascular risk factors
DCB drug-coated balloon
door-to-balloon time time between hospitalization (door) and revascularization (balloon)
ECG electrocardiogram
ECMO extracorporeal membrane oxygenation
eCRF electronic case report form
ESC European Society of Cardiology
FFR fractional flow reserve
FSO Federal Statistical Office
HTX heart transplantation, heart exchange
iFR/RFR instantaneous wave-free ratio/resting full-cycle ratio
IQR interquartile range
ISPM Institute of Social and Preventive Medicine
IVUS intravascular ultrasound
KVG Krankenversichungsgesetz
KVV Krankenversicherungsverordnung
LVEF left ventricular ejection fraction
MRI magnetic resonance imaging
N/OAC new oral anticoagulants/oral anticoagulants
NSTEMI non-ST-segment elevation myocardial infarction
OCT optical coherence tomography
PCI percutaneous coronary intervention
Private h private hospital
Public n-u h public non-university hospital
QI quality indicator
SOP Standard Operating Procedure
SSC Swiss Society of Cardiology
SD standard deviation
SSN social security number
staged PCI percutaneous coronary intervention at a later date separate from the performance of the initial PCI
STEMI ST-segment elevation myocardial infarction
TTE transthoracal echocardiography
University h university hospital

6 Results

Caution

Form versions V1 and V2.0 For the SwissCaRe yearly reports for 2024, both currently active form versions - version 1 and version 2.0 - were considered. Remarks are provided wherever the differences between the form versions may impact the results presented in this report.

Pre-processing After recoding the data from form version V1, the data from both form versions were appended. Thereafter, obvious and likely duplicates, as well as apparent records from test patients, were excluded from further analysis.

Inclusion of records For this report, form entries were considered if they met the following criteria:

1. The procedure occurred in 2024, and
2. the type of intervention was specified.

Caution

Note: P-values are provided to indicate potential differences between hospital types. However, no corrections for multiple testing have been applied.

6.1 Overview of performed interventions

Table 1

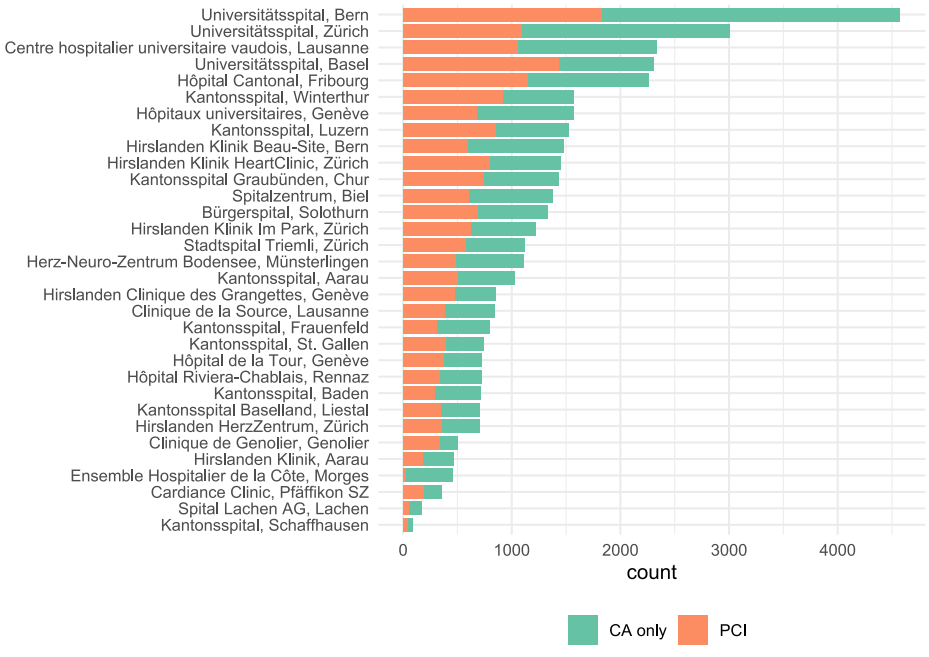
Characteristic	**Overall**, N = 39'576[1]	**University h.**, N = 13'804[1]	**Public n-u h.**, N = 14'877[1]	**Private h.**, N = 10'895[1]	**p-value**[2]
Procedure					<0.001
CA only	20'936 (53%)	7'727 (56%)	7'434 (50%)	5'775 (53%)	
PCI	18'640 (47%)	6'077 (44%)	7'443 (50%)	5'120 (47%)	
CA and PCI	16'003 (40%)	5'172 (37%)	6'153 (41%)	4'678 (43%)	
Staged PCI (planned PCI)	2'637 (6.7%)	905 (6.6%)	1'290 (8.7%)	442 (4.1%)	

[1] n (%)

[2] Pearson's Chi-squared test

6.2 Overview by center

Figure 1: Number of documented procedures by center



The following centers started data entry during 2024 (the start of data entry is given by the date of the first 2024 procedure): (1) Clinique de la Source Lausanne, 02.02.2024; (2) Stadtspital Triemli Zürich, 01.07.2024; (3) Kantonsspital Luzern, 01.07.2024; (4) Kantonsspital St. Gallen, 09.09.2024. While Universitätsspital Bern documented CA procedures throughout 2024, the recording of PCI procedures began on 02.03.2024.

Table 2

			PCI				
Center	**Total**	**CA Only**	**N**	**% ACS**	**% CCS**	**% staged**	**% Radial access**
Universitätsspital, Bern	4577	2752	1825	43.6	36.9	19.6	71.0
Universitätsspital, Zürich	3009	1915	1094	50.1	29.9	20.0	55.8
Centre hospitalier universitaire vaudois, Lausanne	2337	1283	1054	53.7	41.3	5.0	86.4
Universitätsspital, Basel	2310	878	1432	44.2	43.9	11.0	79.6
Hôpital Cantonal, Fribourg	2264	1121	1143	27.5	71.9	0.3	67.8
Kantonsspital, Winterthur	1575	660	915	49.9	28.5	21.5	86.1
Hôpitaux universitaires, Genève	1571	899	672	56.0	21.6	17.7	93.3
Kantonsspital, Luzern	1522	672	850	34.0	31.8	34.2	86.1
Hirslanden Klinik Beau-Site, Bern	1483	892	591	19.1	60.2	20.6	74.5
Hirslanden Klinik HeartClinic, Zürich	1449	655	794	18.5	71.4	10.1	87.4
Kantonsspital Graubünden, Chur	1436	694	742	51.1	29.2	19.7	80.9
Spitalzentrum, Biel	1375	768	607	36.4	43.5	20.1	91.6
Bürgerspital, Solothurn	1336	651	685	43.8	29.1	27.0	65.2
Hirslanden Klinik Im Park, Zürich	1219	598	621	20.5	69.4	10.1	82.3
Stadtspital Triemli, Zürich	1119	547	572	56.1	29.4	14.5	89.7
Herz-Neuro-Zentrum Bodensee, Münsterlingen	1109	626	483	47.2	42.4	10.4	90.9
Kantonsspital, Aarau	1029	524	505	55.6	33.9	10.5	85.4
Hirslanden Clinique des Grangettes, Genève	853	381	472	5.9	84.7	0.0	88.0
Clinique de la Source, Lausanne	846	468	378	2.1	97.4	0.0	85.5
Kantonsspital, Frauenfeld	793	482	311	33.1	66.2	0.6	88.8
Kantonsspital, St. Gallen	745	357	388	32.7	32.7	34.5	96.6
Hôpital de la Tour, Genève	724	351	373	20.4	79.1	0.0	95.6
Hôpital Riviera-Chablais, Rennaz	719	381	338	41.7	45.9	12.4	88.2
Kantonsspital Baselland, Liestal	709	368	341	44.3	48.7	7.0	88.2
Kantonsspital, Baden	709	416	293	48.5	34.1	15.7	81.4
Hirslanden HerzZentrum, Zürich	703	350	353	29.7	60.9	9.3	85.2
Clinique de Genolier, Genolier	504	171	333	0.6	96.4	0.0	86.1
Hirslanden Klinik, Aarau	467	289	178	25.3	58.4	16.3	82.9
Ensemble Hospitalier de la Côte, Morges	461	440	21	19.0	76.2	4.8	92.6
Cardiance Clinic, Pfäffikon SZ	358	173	185	9.2	78.9	11.9	63.4
Spital Lachen AG, Lachen	173	119	54	13.0	85.2	1.9	81.5
Kantonsspital, Schaffhausen	92	55	37	10.8	83.8	5.4	90.2

6.3 PART I - Overview of diagnostic Coronary Angiographies (CA) (without PCI)

6.3.1 Characteristics of patients undergoing diagnostic CA (without PCI)

Table 3

Characteristic	**Overall**, N = 20'638[1]	**University h.**, N = 7'565[1]	**Public n-u h.**, N = 7'347[1]	**Private h.**, N = 5'726[1]	**p-value**[2]
age [y]					<0.001
Mean (SD)	69 (12)	68 (13)	69 (12)	70 (11)	
Median (IQR)	70 (61, 78)	69 (60, 78)	70 (61, 78)	71 (63, 78)	
age group					<0.001
<40 y	325 (1.6%)	183 (2.4%)	100 (1.4%)	42 (0.7%)	
40 - 60 y	4'179 (20%)	1'657 (22%)	1'509 (21%)	1'013 (18%)	
60 - 80 y	12'446 (60%)	4'390 (58%)	4'511 (61%)	3'545 (62%)	
80+ y	3'688 (18%)	1'335 (18%)	1'227 (17%)	1'126 (20%)	
sex					<0.001
female	6'916 (34%)	2'446 (32%)	2'433 (33%)	2'037 (36%)	
male	13'722 (66%)	5'119 (68%)	4'914 (67%)	3'689 (64%)	

[1] n (%)

[2] Kruskal-Wallis rank sum test; Pearson's Chi-squared test

Note

Note that from all form entries with procedure ‘CA only’, only the latest entry per patient was counted for Table 3.

Figure 2: Age distribution by sex

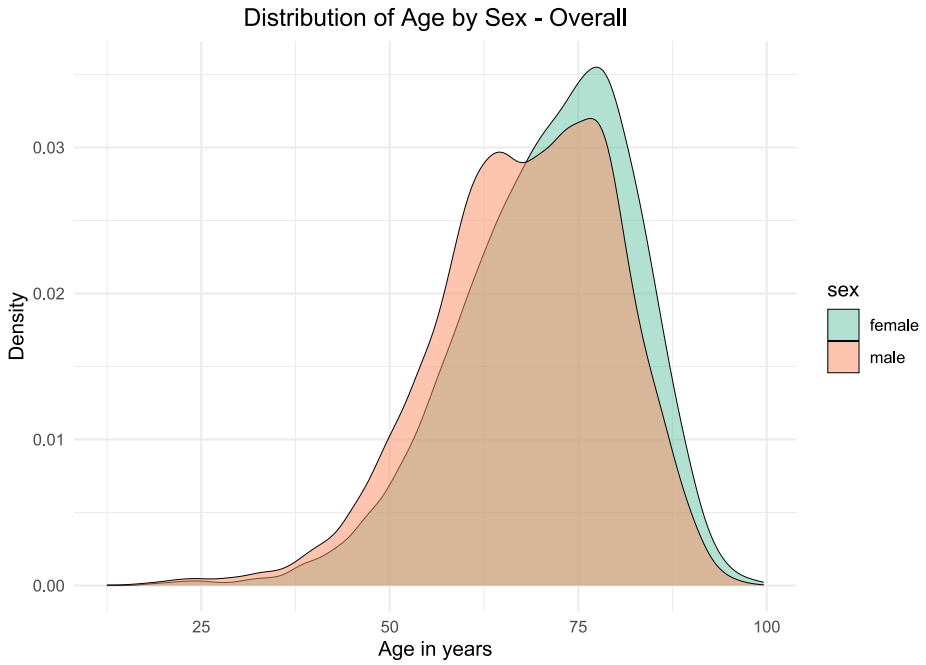
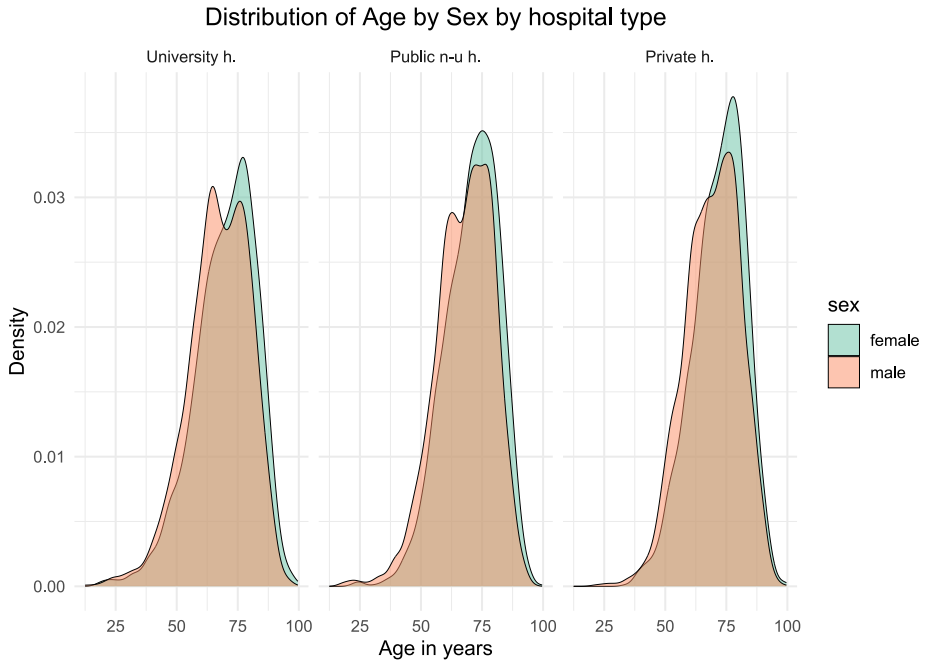


Figure 3: Age distribution by sex



6.3.2 Clinical presentation of patients undergoing diagnostic CA (without PCI)

Table 4

Characteristic	**Overall**, N = 20'936[1]	**University h.**, N = 7'727[1]	**Public n-u h.**, N = 7'434[1]	**Private h.**, N = 5'775[1]	**p-value**[2]
Type of Coronary Syndrom					<0.001
ACS	4'020 (19%)	1'812 (24%)	1'512 (20%)	696 (12%)	
CCS	16'748 (81%)	5'801 (76%)	5'886 (80%)	5'061 (88%)	
Missing	168	114	36	18	
Type of ACS					<0.001
Unstable angina pectoris	879 (22%)	323 (18%)	382 (25%)	174 (25%)	
Non-STEMI	2'327 (58%)	1'073 (59%)	885 (59%)	369 (53%)	
STEMI	394 (9.8%)	214 (12%)	142 (9.4%)	38 (5.5%)	
Unknown	420 (10%)	202 (11%)	103 (6.8%)	115 (17%)	

[1] n (%)

[2] Pearson's Chi-squared test

Note

Unlike form version V2.0, the 'Unknown' option is not available in SwissCaRe form version V1 for the 'type of ACS' variable. This option was created during post-processing of the data when the indication was reported as 'ACS,' but further specification was missing.

Patients categorized as STEMI without interventions are frequently patients referred with a suspected STEMI (i.e. indication for coronary angiography) in whom angiography did not confirm the diagnosis (e.g. in case of Tako Tsubo, Perimyocarditis, etc.)

Patients undergoing diagnostic CA only (without PCI) may be referred to CABG.

6.3.3 Indication in patients undergoing diagnostic CA (without PCI)

Table 5

Characteristic	**Overall**, N = 20'936[1]	**University h.**, N = 7'727[1]	**Public n-u h.**, N = 7'434[1]	**Private h.**, N = 5'775[1]	**p-value**[2]
Indication					<0.001
Clinical presentation as ACS	4'020 (19%)	1'812 (24%)	1'512 (20%)	696 (12%)	
Suspected CAD or suspected progression of known CAD	10'698 (52%)	2'954 (39%)	4'046 (55%)	3'698 (64%)	
Planned valvular heart disease intervention	2'725 (13%)	1'123 (15%)	820 (11%)	782 (14%)	
Follow-up after HTX	256 (1.2%)	236 (3.1%)	9 (0.1%)	11 (0.2%)	
Heart failure	1'239 (6.0%)	492 (6.5%)	515 (7.0%)	232 (4.0%)	
Routine follow-up	624 (3.0%)	268 (3.5%)	233 (3.1%)	123 (2.1%)	
Tachy- or bradyarrhythmia	445 (2.1%)	211 (2.8%)	144 (1.9%)	90 (1.6%)	
Planned vascular surgery	195 (0.9%)	115 (1.5%)	48 (0.6%)	32 (0.6%)	
Planned major surgery	566 (2.7%)	402 (5.3%)	71 (1.0%)	93 (1.6%)	
Missing	168	114	36	18	

[1] n (%)

[2] Pearson's Chi-squared test

6.3.4 Preceeding diagnostic tests in patients with suspected (progression of) CAD undergoing diagnostic CA without subsequent revascularization (PCI or CABG)*

Table 6

Characteristic[1]	Overall, N = 9'126[2]	University h., N = 2'584[2]	Public n-u h., N = 3'436[2]	Private h., N = 3'106[2]	p-value[3]
Preceeding tests suggesting CAD*	5'429 (60%)	1'365 (53%)	1'912 (56%)	2'152 (69%)	<0.001
Missing	55	0	47	8	
Exercise stress test indicating ischemia*	1'598 (18%)	290 (11%)	596 (18%)	712 (23%)	<0.001
CCTA with significant stenoses*	1'491 (16%)	359 (14%)	453 (13%)	679 (22%)	<0.001
Stress MRI with ischemia*	574 (6.3%)	172 (6.7%)	172 (5.1%)	230 (7.4%)	<0.001
Stress TTE with ischemia*	446 (4.9%)	84 (3.3%)	191 (5.6%)	171 (5.5%)	<0.001
TTE with hypokinesia*	830 (9.2%)	302 (12%)	350 (10%)	178 (5.7%)	<0.001
Nuclear test with ischemia*	623 (6.9%)	218 (8.4%)	181 (5.3%)	224 (7.2%)	<0.001

[1] *: Multiple-choice variable

[2] n (%)

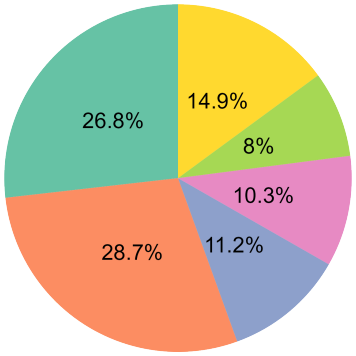
[3] Pearson's Chi-squared test

Note

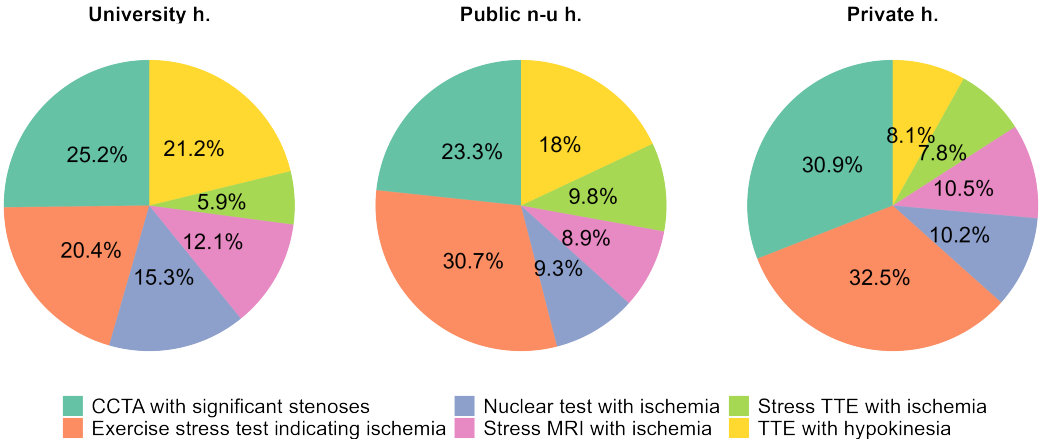
*Records for patients with future revascularization (CABG or PCI, including patients referred to the heart team, Table 9) were excluded from this analysis.

Figure 4: Distribution of the preceeding tests suggesting CAD.

A



B



100% corresponds to the total number of tests. Note that more than one test may be applied per record.
A: Overall. B: Distribution by hospital type.

6.3.5 Symptoms in patients with suspected (progression of) CAD undergoing diagnostic CA without subsequent revascularization (PCI or CABG)*

Table 7

Characteristic	**Overall**, N = 9'126[1]	**University h.**, N = 2'584[1]	**Public n-u h.**, N = 3'436[1]	**Private h.**, N = 3'106[1]	**p-value**[2]
Asymptomatic patients	2'989 (36%)	1'090 (42%)	906 (30%)	993 (37%)	<0.001
Missing	798	15	384	399	
Dyspnea	3'732 (45%)	998 (39%)	1'466 (48%)	1'268 (47%)	<0.001
Missing	834	16	399	419	
Angina pectoris	2'708 (30%)	761 (29%)	1'154 (34%)	793 (26%)	<0.001
Missing	3	0	3	0	
if Angina: CCS					<0.001
I	385 (14%)	87 (11%)	189 (16%)	109 (14%)	
II	1'861 (69%)	498 (65%)	802 (69%)	561 (71%)	
III	270 (10.0%)	80 (11%)	105 (9.1%)	85 (11%)	
IV	81 (3.0%)	32 (4.2%)	29 (2.5%)	20 (2.5%)	
Unknown	111 (4.1%)	64 (8.4%)	29 (2.5%)	18 (2.3%)	
if Angina: Anti-anginal drugs (prior or current)					<0.001
No	1'355 (50%)	360 (47%)	585 (51%)	410 (52%)	
Yes	1'198 (44%)	254 (33%)	562 (49%)	382 (48%)	
Unknown	155 (5.7%)	147 (19%)	7 (0.6%)	1 (0.1%)	

[1] n (%)

[2] Pearson's Chi-squared test

Note

*Records for patients with future revascularization (CABG or PCI, including patients referred to the heart team, Table 9) were excluded from this analysis.

Please note that symptoms are assessed only in those patients with indication 'Suspected CAD or suspected progression of known CAD'.

Unlike form version V2.0, the 'Unknown' option is not available in SwissCaRe form version V1 for the 'Angina pectoris' variable. This option was created during post-processing of the data when 'Angina pectoris' was recorded as 'Yes,' but either 'CCS' or 'Anti-anginal drugs' were missing.

6.3.6 Procedural characteristics of patients undergoing diagnostic CA without subsequent revascularization (PCI or CABG)*

Table 8

Characteristic[1]	Overall, N = 18'638[2]	University h., N = 7'057[2]	Public n-u h., N = 6'514[2]	Private h., N = 5'067[2]	p-value[3]
Access					<0.001
Femoral	3'482 (19%)	1'748 (25%)	1'058 (16%)	676 (13%)	
Radial	15'080 (81%)	5'262 (75%)	5'430 (84%)	4'388 (87%)	
Missing	76	47	26	3	
Intracoronary imaging*	454 (2.4%)	193 (2.7%)	179 (2.8%)	82 (1.6%)	<0.001
Missing	32	0	32	0	
IVUS*	161 (0.9%)	82 (1.2%)	51 (0.8%)	28 (0.6%)	0.001
OCT*	296 (1.6%)	114 (1.6%)	128 (2.0%)	54 (1.1%)	<0.001
Intracoronary physiology*	2'092 (11%)	571 (8.1%)	758 (12%)	763 (15%)	<0.001
Missing	27	0	27	0	
Resting index (iFR/RFR)*	1'514 (8.1%)	293 (4.2%)	537 (8.3%)	684 (13%)	<0.001
FFR*	1'033 (5.6%)	350 (5.0%)	355 (5.5%)	328 (6.5%)	0.001

[1] *: Multiple-choice variable

[2] n (%)

[3] Pearson's Chi-squared test

Note

*Records for patients with future revascularization (CABG or PCI, including patients referred to the heart team, Table 9) were excluded from this analysis.

6.3.7 Anticipated treatment after diagnostic CA (without ad hoc PCI)

Table 9

Characteristic	Clinical presentation as ACS				Suspected CAD or suspected progression of known CAD			
	Overall, N = 4'020[1]	**University h.**, N = 1'812[1]	**Public n-u h.**, N = 1'512[1]	**Private h.**, N = 696[1]	**Overall**, N = 10'698[1]	**University h.**, N = 2'954[1]	**Public n-u h.**, N = 4'046[1]	**Private h.**, N = 3'698[1]
Treatment in case of CAD/ACS								
None	1'125 (31%)	388 (24%)	581 (41%)	156 (24%)	2'834 (31%)	631 (23%)	1'372 (40%)	831 (28%)
Conservative medical treatment	1'834 (50%)	913 (57%)	536 (38%)	385 (59%)	4'712 (52%)	1'729 (63%)	1'472 (43%)	1'511 (51%)
CABG	397 (11%)	147 (9.2%)	172 (12%)	78 (12%)	745 (8.2%)	150 (5.5%)	296 (8.6%)	299 (10%)
PCI: follow-up PCI is planned at a later date	196 (5.3%)	89 (5.6%)	83 (5.8%)	24 (3.7%)	472 (5.2%)	124 (4.5%)	176 (5.1%)	172 (5.9%)
CABG or PCI (to be decided by Heart Team)	133 (3.6%)	64 (4.0%)	55 (3.9%)	14 (2.1%)	355 (3.9%)	96 (3.5%)	138 (4.0%)	121 (4.1%)
Missing	335	211	85	39	1'580	224	592	764

[1] n (%)

Caution

The treatment options ‘None’ and ‘CABG or PCI (to be decided by Heart Team)’ are not available in form version V1.

6.3.8 Major complications in patients undergoing diagnostic CA (without PCI)

Table 10

Characteristic[1]	Overall, N = 20'936[2]	University h., N = 7'727[2]	Public n-u h., N = 7'434[2]	Private h., N = 5'775[2]	p-value[3]
Major complications*	38 (0.2%)	19 (0.2%)	8 (0.1%)	11 (0.2%)	0.13
Missing	48	21	27	0	
Emergency open heart surgery*	13 (<0.1%)	7 (<0.1%)	1 (<0.1%)	5 (<0.1%)	0.089
Clinically overt stroke*	11 (<0.1%)	6 (<0.1%)	3 (<0.1%)	2 (<0.1%)	0.6
Procedural death*	12 (<0.1%)	4 (<0.1%)	4 (<0.1%)	4 (<0.1%)	0.9
Emergency vascular surgery (non-cardiac)*	1 (<0.1%)	1 (<0.1%)	0 (0%)	0 (0%)	0.6
Pericardial tamponade*	1 (<0.1%)	1 (<0.1%)	0 (0%)	0 (0%)	0.6
Missing	5'424	2'265	1'242	1'917	

[1] *: Multiple-choice variable

[2] n (%)

[3] Pearson's Chi-squared test; Fisher's exact test

Note

Major complications are shown in 1.) all patients undergoing diagnostic CA (Table 10) and in 2) specifically in patients with coronary syndrom types CCS and ACS (Table 11).

Caution

The major complications ‘Emergency vascular surgery (non-cardiac)’ and ‘Pericardial tamponade’ are not available in form version V1.

Table 11

Characteristic[1]	ACS				CCS			
	Overall, N = 4'020[2]	**University h.**, N = 1'812[2]	**Public n-u h.**, N = 1'512[2]	**Private h.**, N = 696[2]	**Overall**, N = 16'748[2]	**University h.**, N = 5'801[2]	**Public n-u h.**, N = 5'886[2]	**Private h.**, N = 5'061[2]
Major complications*	8 (0.2%)	3 (0.2%)	3 (0.2%)	2 (0.3%)	27 (0.2%)	14 (0.2%)	4 (<0.1%)	9 (0.2%)
Emergency open heart surgery*	2 (<0.1%)	1 (<0.1%)	0 (0%)	1 (0.1%)	11 (<0.1%)	6 (0.1%)	1 (<0.1%)	4 (<0.1%)
Clinically overt stroke*	1 (<0.1%)	1 (<0.1%)	0 (0%)	0 (0%)	9 (<0.1%)	4 (<0.1%)	3 (<0.1%)	2 (<0.1%)
Procedural death*	5 (0.1%)	1 (<0.1%)	3 (0.2%)	1 (0.1%)	5 (<0.1%)	2 (<0.1%)	0 (0%)	3 (<0.1%)
Emergency vascular surgery (non-cardiac)*	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (<0.1%)	1 (<0.1%)	0 (0%)	0 (0%)
Pericardial tamponade*	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (<0.1%)	1 (<0.1%)	0 (0%)	0 (0%)
Missing	1'011	673	147	191	4'270	1'502	1'060	1'708

[1] *: Multiple-choice variable

[2] n (%)

Caution

The major complications ‘Emergency vascular surgery (non-cardiac)’ and ‘Pericardial tamponade’ are not available in form version V1.

6.4 PART II - Overview of Percutaneous Coronary Interventions (PCI)

Note

This includes interventions of the type 'Coronary angiography and PCI', as well as 'Staged PCI'. Please note that some of the information displayed below is not available for the intervention type 'Staged PCI'.

6.4.1 Clinical characteristics of patients undergoing PCI

Table 12

Characteristic[1]	Overall, N = 15'781[2]	University h., N = 5'182[2]	Public n-u h., N = 6'200[2]	Private h., N = 4'399[2]	p-value[3]
age [y]					<0.001
Mean (SD)	69 (11)	68 (12)	69 (11)	71 (11)	
Median (IQR)	70 (61, 78)	69 (60, 78)	70 (61, 78)	71 (63, 79)	
age group					<0.001
<40 y	131 (0.8%)	61 (1.2%)	57 (0.9%)	13 (0.3%)	
40 - 60 y	3'349 (21%)	1'241 (24%)	1'360 (22%)	748 (17%)	
60 - 80 y	9'355 (59%)	2'913 (56%)	3'722 (60%)	2'720 (62%)	
80+ y	2'946 (19%)	967 (19%)	1'061 (17%)	918 (21%)	
sex					0.6
female	3'905 (25%)	1'272 (25%)	1'518 (24%)	1'115 (25%)	
male	11'876 (75%)	3'910 (75%)	4'682 (76%)	3'284 (75%)	
cvRF*	12'577 (94%)	4'042 (92%)	4'740 (94%)	3'795 (95%)	<0.001
Missing	2'361	799	1'164	398	
Arterial hypertension*	8'762 (65%)	2'706 (62%)	3'220 (64%)	2'836 (71%)	<0.001
Diabetes requiring medication*	2'854 (21%)	946 (22%)	1'060 (21%)	848 (21%)	0.8
Dyslipidemia*	9'035 (67%)	2'724 (62%)	3'316 (66%)	2'995 (75%)	<0.001
Smoking*	3'547 (26%)	1'307 (30%)	1'363 (27%)	877 (22%)	<0.001
Family history*	2'827 (21%)	882 (20%)	1'000 (20%)	945 (24%)	<0.001
cvRF unknown / not documented*	556 (5.6%)	188 (6.0%)	291 (7.1%)	77 (2.9%)	<0.001
Number of CVRFs					<0.001
0	1'399 (10%)	529 (12%)	587 (12%)	283 (7.1%)	
1	2'698 (20%)	973 (22%)	1'005 (20%)	720 (18%)	
2	4'861 (36%)	1'475 (34%)	1'800 (36%)	1'586 (40%)	
3	3'381 (25%)	1'033 (24%)	1'260 (25%)	1'088 (27%)	
4 or 5	1'081 (8.1%)	373 (8.5%)	384 (7.6%)	324 (8.1%)	
Missing	2'361	799	1'164	398	
Patient history					<0.001
None	8'494 (63%)	3'002 (68%)	3'185 (63%)	2'307 (58%)	
Prior PCI	4'100 (31%)	1'114 (25%)	1'579 (31%)	1'407 (35%)	
Prior CABG	394 (2.9%)	177 (4.0%)	106 (2.1%)	111 (2.8%)	
Prior PCI & CABG	362 (2.7%)	88 (2.0%)	122 (2.4%)	152 (3.8%)	
unknown / not documented	68 (0.5%)	2 (<0.1%)	42 (0.8%)	24 (0.6%)	
Missing	2'363	799	1'166	398	
LVEF					<0.001
Normal (50-70%)	7'939 (65%)	1'873 (48%)	3'100 (65%)	2'966 (81%)	
Mildly reduced (40-49%)	1'565 (13%)	543 (14%)	700 (15%)	322 (8.8%)	
Moderately reduced (30-39%)	786 (6.4%)	287 (7.4%)	362 (7.6%)	137 (3.8%)	
Severly reduced (<30%)	461 (3.8%)	177 (4.6%)	205 (4.3%)	79 (2.2%)	
unknown / not documented	1'512 (12%)	1'001 (26%)	366 (7.7%)	145 (4.0%)	
Missing	3'518	1'301	1'467	750	

[1] *: Multiple-choice variable

[2] n (%)

[3] Kruskal-Wallis rank sum test; Pearson's Chi-squared test

Note

Please note that among all form entries with the procedure labeled as ‘PCI’, only one entry per patient was considered for inclusion in Table 12. In cases where multiple form entries existed for a single patient, the following criteria were applied for selection:

1. Submitted forms were given priority.
2. Procedures of the type ‘CA + PCI’ were prioritized over ‘Staged PCI’.
3. The most recent procedure date was used for selection.

Please note: ‘cvRF’, ‘patient history’, and ‘LVEF’ are not available for a total of 2357 patients who only had entries of the procedure type ‘Staged PCI’ within the current report year 2024. Additional missing values are due to the inclusion of incomplete form entries.

Caution

The answer options ‘unknown / not documented’ are not part of form version V1.

Figure 5: Age distribution by sex

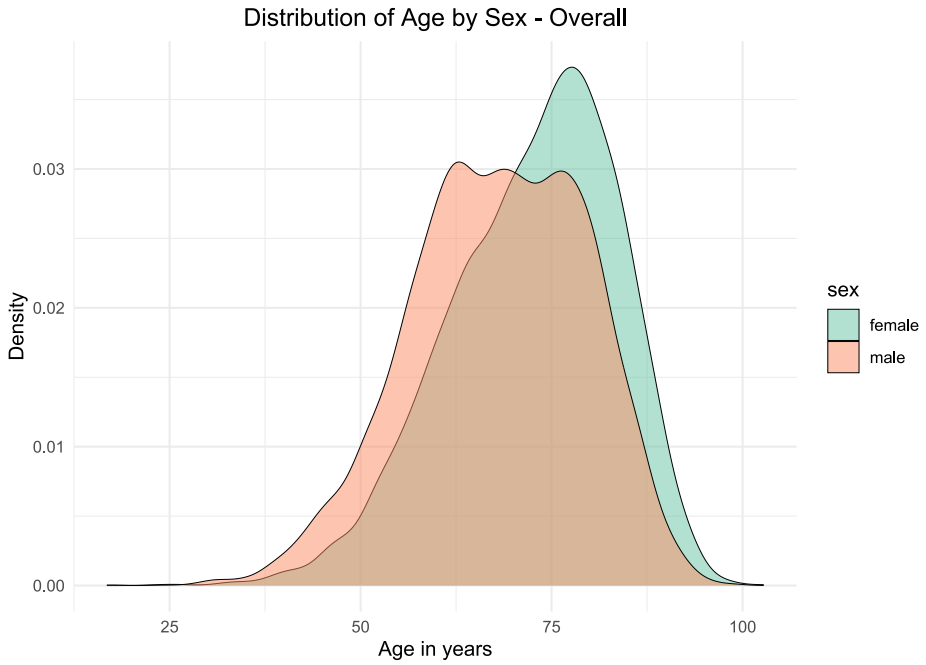
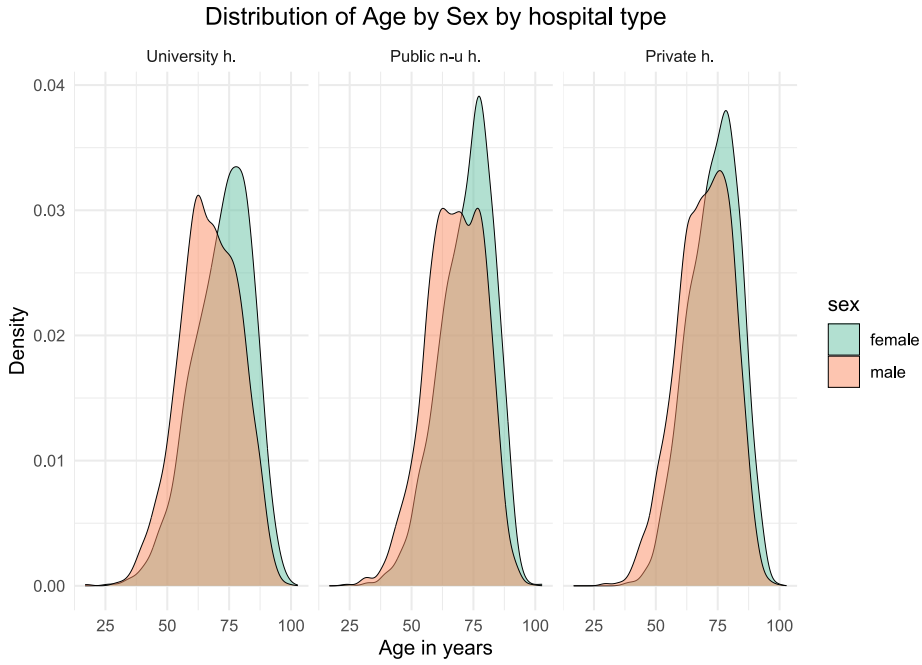


Figure 6: Age distribution by sex



6.4.2 Clinical presentation of patients undergoing PCI

Note

Unlike form version V2.0, the 'Unknown' option is not available in SwissCaRe form version V1 for the 'type of ACS' variable. This option was created during post-processing of the data when the indication was reported as 'ACS', but further specification was missing.

Table 13

Characteristic	**Overall**, N = 18'640[1]	**University h.**, N = 6'077[1]	**Public n-u h.**, N = 7'443[1]	**Private h.**, N = 5'120[1]	**p-value**[2]
Out of hospital cardiac arrest	717 (4.5%)	265 (5.1%)	247 (4.0%)	205 (4.4%)	0.017
Missing	2'644	905	1'297	442	
Intubated	418 (2.6%)	211 (4.1%)	140 (2.3%)	67 (1.4%)	<0.001
Missing	2'645	905	1'298	442	
Cardiogenic shock	416 (2.6%)	180 (3.5%)	190 (3.1%)	46 (1.0%)	<0.001
Missing	2'655	905	1'308	442	
Type of Coronary Syndrom					<0.001
ACS	7'055 (38%)	2'918 (48%)	3'096 (42%)	1'041 (21%)	
CCS	8'836 (48%)	2'209 (37%)	3'048 (41%)	3'579 (71%)	
Staged PCI	2'637 (14%)	905 (15%)	1'290 (17%)	442 (8.7%)	
Missing	112	45	9	58	
Type of ACS					<0.001
Unstable angina pectoris	751 (11%)	179 (6.1%)	393 (13%)	179 (17%)	
Non-STEMI	3'301 (47%)	1'257 (43%)	1'491 (48%)	553 (53%)	
STEMI	2'721 (39%)	1'366 (47%)	1'104 (36%)	251 (24%)	
subacute STEMI (symptoms-onset to hospitalization > 12h)	324 (16%)	150 (15%)	138 (16%)	36 (18%)	0.6
Unknown	282 (4.0%)	116 (4.0%)	108 (3.5%)	58 (5.6%)	

[1] n (%)

[2] Pearson's Chi-squared test

6.4.3 Indication in patients undergoing PCI

Table 14

Characteristic	**Overall**, N = 16'003[1]	**University h.**, N = 5'172[1]	**Public n-u h.**, N = 6'153[1]	**Private h.**, N = 4'678[1]	**p-value**[2]
Indication					<0.001
Clinical presentation as ACS	7'055 (44%)	2'918 (57%)	3'096 (50%)	1'041 (23%)	
Suspected CAD or suspected progression of known CAD	7'763 (49%)	1'985 (39%)	2'525 (41%)	3'253 (70%)	
Planned valvular heart disease intervention	195 (1.2%)	32 (0.6%)	54 (0.9%)	109 (2.4%)	
Follow-up after HTX	18 (0.1%)	5 (<0.1%)	6 (<0.1%)	7 (0.2%)	
Heart failure	167 (1.1%)	42 (0.8%)	78 (1.3%)	47 (1.0%)	
Routine follow-up	580 (3.6%)	99 (1.9%)	351 (5.7%)	130 (2.8%)	
Tachy- or bradyarrhythmia	70 (0.4%)	27 (0.5%)	23 (0.4%)	20 (0.4%)	
Planned vascular surgery	11 (<0.1%)	3 (<0.1%)	5 (<0.1%)	3 (<0.1%)	
Planned major surgery	32 (0.2%)	16 (0.3%)	6 (<0.1%)	10 (0.2%)	
Missing	112	45	9	58	

[1] n (%)

[2] Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)

Note

Please note: The corresponding information is not available in 2637 form entries of the procedure type ‘Staged PCI’ within the current report year 2024. These entries were discarded from the table above.

6.4.4 Preceeding diagnostic tests in patients with suspected (progression of) CAD undergoing PCI

Table 15

Characteristic[1]	Overall, N = 7'763[2]	University h., N = 1'985[2]	Public n-u h., N = 2'525[2]	Private h., N = 3'253[2]	p-value[3]
Preceeding tests suggesting CAD*	4'968 (64%)	1'048 (53%)	1'608 (65%)	2'312 (71%)	<0.001
Missing	38	0	35	3	
Exercise stress test indicating ischemia*	1'350 (17%)	190 (9.6%)	469 (19%)	691 (21%)	<0.001
CCTA with significant stenoses*	1'513 (20%)	262 (13%)	435 (17%)	816 (25%)	<0.001
Stress MRI with ischemia*	666 (8.6%)	149 (7.5%)	230 (9.2%)	287 (8.8%)	0.10
Stress TTE with ischemia*	399 (5.2%)	77 (3.9%)	129 (5.2%)	193 (5.9%)	0.005
TTE with hypokinesia*	533 (6.9%)	154 (7.8%)	233 (9.4%)	146 (4.5%)	<0.001
Nuclear test with ischemia*	707 (9.2%)	262 (13%)	174 (7.0%)	271 (8.3%)	<0.001

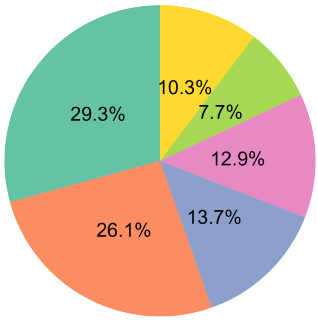
[1] *: Multiple-choice variable

[2] n (%)

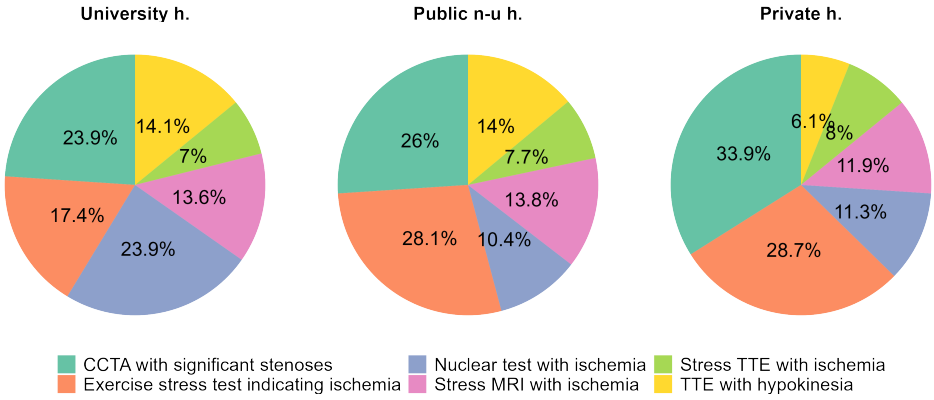
[3] Pearson's Chi-squared test

Figure 7: Distribution of the preceeding tests suggesting CAD.

A



B



100% corresponds to the total number of tests. Note that more than one test may be applied per record.

A: Overall. B: Distribution by hospital type.

6.4.5 Symptoms in patients with suspected (progression of) CAD undergoing PCI

Table 16

Characteristic	**Overall**, N = 7'763[1]	**University h.**, N = 1'985[1]	**Public n-u h.**, N = 2'525[1]	**Private h.**, N = 3'253[1]	**p-value**[2]
Asymptomatic patients	1'887 (27%)	571 (29%)	433 (19%)	883 (32%)	<0.001
Missing	774	21	279	474	
Dyspnea	3'113 (45%)	847 (43%)	1'077 (48%)	1'189 (43%)	<0.001
Missing	820	25	293	502	
Angina pectoris	3'363 (43%)	927 (47%)	1'248 (49%)	1'188 (37%)	<0.001
Missing	3	0	3	0	
if Angina: CCS					<0.001
I	242 (7.2%)	67 (7.2%)	67 (5.4%)	108 (9.1%)	
II	2'194 (65%)	556 (60%)	865 (69%)	773 (65%)	
III	688 (20%)	151 (16%)	274 (22%)	263 (22%)	
IV	85 (2.5%)	41 (4.4%)	24 (1.9%)	20 (1.7%)	
Unknown	154 (4.6%)	112 (12%)	18 (1.4%)	24 (2.0%)	
if Angina: Anti-anginal drugs (prior or current)					<0.001
No	1'380 (41%)	276 (30%)	559 (45%)	545 (46%)	
Yes	1'601 (48%)	283 (31%)	682 (55%)	636 (54%)	
Unknown	382 (11%)	368 (40%)	7 (0.6%)	7 (0.6%)	

[1] n (%)

[2] Pearson's Chi-squared test

Note

Please note that symptoms are assessed only in those patients with indication 'Suspected CAD or suspected progression of known CAD'.

Unlike SwissCaRe form version V2.0, the 'Unknown' option is not available in SwissCaRe form version V1. This option was created during post-processing of the data where 'Angina pectoris' was recorded as 'Yes', but either 'CCS' or 'Anti-anginal drugs' were missing.

6.4.6 Referral times of NSTEMI patients undergoing PCI

Table 17

Characteristic	**Overall**, N = 3'301[1]	**University h.**, N = 1'257[1]	**Public n-u h.**, N = 1'491[1]	**Private h.**, N = 553[1]	**p-value**[2]
Time between first ECG and coronary angiography					<0.001
<24 hours	2'118 (65%)	675 (54%)	1'077 (73%)	366 (67%)	
24-48 hours	485 (15%)	161 (13%)	241 (16%)	83 (15%)	
>48 hours	321 (9.8%)	115 (9.2%)	148 (10%)	58 (11%)	
unknown / not documented	355 (11%)	301 (24%)	14 (0.9%)	40 (7.3%)	
Missing	22	5	11	6	

[1] n (%)

[2] Pearson's Chi-squared test

Caution

The answer option ‘unknown / not documented’ is not available in form version V1.

6.4.7 Referral times of acute* STEMI patients undergoing PCI

Table 18

Characteristic	**Overall**, N = 2'390	**University h.**, N = 1'215	**Public n-u h.**, N = 961	**Private h.**, N = 214	**p-value**[1]
Symptoms-to-hospitalization time [h]					0.029
Mean (SD)	2.92 (2.45)	2.99 (2.50)	2.75 (2.30)	3.35 (2.79)	
Median (IQR)	2.07 (1.24, 3.77)	2.10 (1.27, 3.85)	2.00 (1.17, 3.50)	2.28 (1.36, 4.45)	
Missing	647	384	213	50	
Door-to-balloon time [min]					<0.001
Mean (SD)	75 (146)	77 (127)	72 (132)	82 (259)	
Median (IQR)	50 (30, 77)	53 (32, 80)	46 (29, 75)	35 (26, 62)	
Missing	206	94	99	13	

[1] Kruskal-Wallis rank sum test

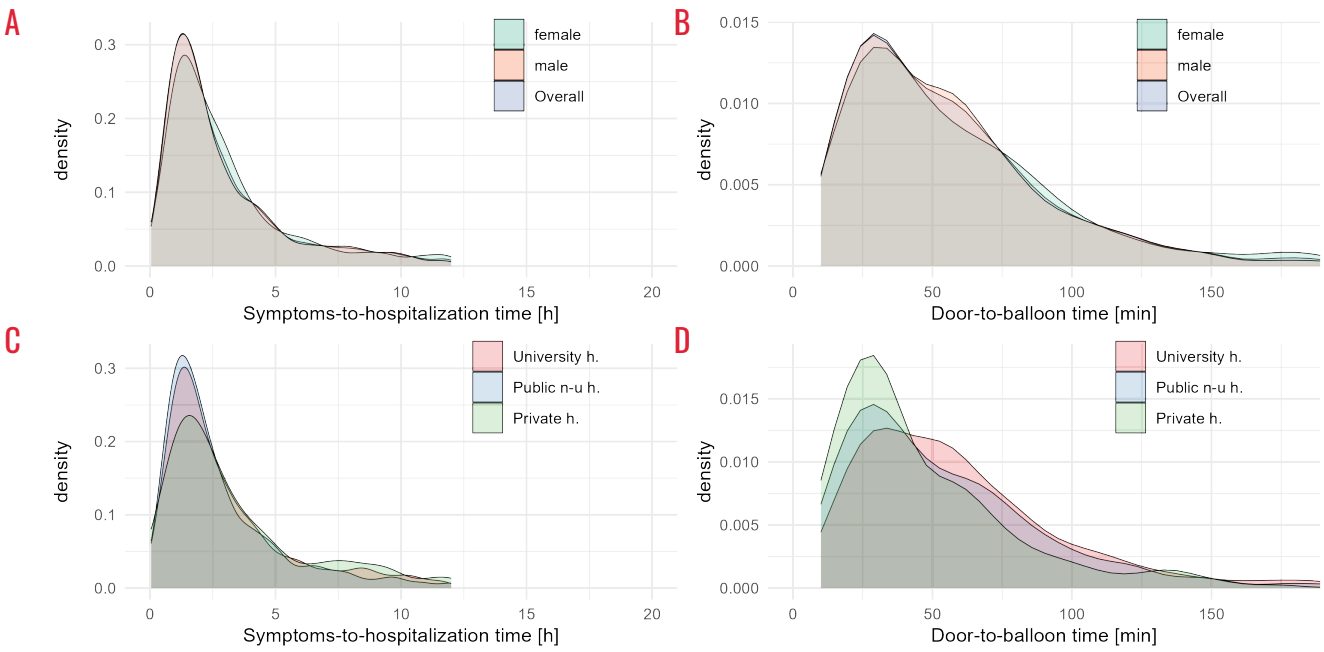
Note

*: Acute STEMI was defined as symptoms-to-hospitalization time < 12h.

Improbable and impossible referral times have been excluded from analysis and are reported as missing (together with missing values):

Door-to-balloon times < 10 minutes and > 48 hours have been excluded from the analysis. Symptoms-to-hospitalization times <= 0 have been excluded from the analysis. While it cannot be ruled out that symptoms occur only after hospitalization, these cases are not informative for an analysis of the referral times. Therefore, neither symptoms-to-hospitalization time nor door-to-balloon time are reported for cases where the 'symptoms-to-hospitalization time' is negative or zero.

Figure 8: Distribution of symptoms-to-hospitalization time and door-to-balloon time in STEMI patients undergoing PCI.



A/B) Symptoms-to-hospitalization and door-to-balloon time overall and stratified by sex. **C/D)** Symptoms-to-hospitalization and door-to-balloon time by hospital type.

6.4.7.1 Referral times of female vs. male patients

Table 19

Characteristic	**female**, N = 608	**male**, N = 1'782	**p-value**[1]
Symptoms-to-balloon time [h]			0.050
Median (IQR)	3.25 (2.18, 5.08)	2.95 (2.03, 4.75)	
Missing	175	405	
Door-to-balloon time [min]			0.4
Median (IQR)	50 (30, 81)	50 (30, 75)	
Missing	56	150	

[1] Wilcoxon rank sum test

Note

Improbable and impossible referral times have been excluded from analysis and are reported as missing (together with missing values):

Symptoms-to-balloon times <= 0 and > 72 hours have been excluded from the analysis.

Door-to-balloon times < 10 minutes and > 48 hours have been excluded from the analysis.

6.4.8 Procedural characteristics of patients undergoing PCI

Table 20

Characteristic[1]	Overall, N = 18'640[2]	University h., N = 6'077[2]	Public n-u h., N = 7'443[2]	Private h., N = 5'120[2]	p-value[3]
Mechanical support devices*	183 (1.0%)	96 (1.6%)	59 (0.8%)	28 (0.5%)	<0.001
Missing	244	178	53	13	
Impella*	157 (0.9%)	73 (1.2%)	57 (0.8%)	27 (0.5%)	<0.001
ECMO*	34 (0.2%)	30 (0.5%)	3 (<0.1%)	1 (<0.1%)	<0.001
Access					<0.001
Femoral	3'705 (20%)	1'415 (24%)	1'441 (19%)	849 (17%)	
Radial	14'737 (80%)	4'469 (76%)	5'998 (81%)	4'270 (83%)	
Missing	198	193	4	1	
Dose [cGycm2 = uGym2]					<0.001
Mean (SD)	5'351 (5'554)	6'112 (5'994)	4'487 (4'476)	5'535 (6'087)	
Median (IQR)	3'680 (1'948, 6'702)	4'237 (2'240, 7'920)	3'254 (1'789, 5'648)	3'710 (1'880, 6'817)	
Missing	2'006	213	1'292	501	
Dose above 10'000 cGycm2 (=uGym2)	2'147 (13%)	997 (17%)	519 (8.4%)	631 (14%)	<0.001
Missing	2'006	213	1'292	501	
Intracoronary imaging*	2'826 (15%)	1'251 (21%)	1'198 (16%)	377 (7.4%)	<0.001
Missing	20	0	20	0	
IVUS*	1'415 (7.6%)	852 (14%)	400 (5.4%)	163 (3.2%)	<0.001
OCT*	1'453 (7.8%)	423 (7.0%)	803 (11%)	227 (4.4%)	<0.001
Intracoronary physiology*	1'710 (9.2%)	280 (4.6%)	597 (8.0%)	833 (16%)	<0.001
Missing	15	0	14	1	
Resting index (iFR/RFR)*	1'206 (6.5%)	142 (2.3%)	427 (5.7%)	637 (12%)	<0.001
FFR*	831 (4.5%)	182 (3.0%)	269 (3.6%)	380 (7.4%)	<0.001

[1] *: Multiple-choice variable

[2] n (%)

[3] Pearson's Chi-squared test; Kruskal-Wallis rank sum test

Note

Please note: Not all variables listed in the above table are collected for 2637 form entries of the procedure type 'Staged PCI' within the current report year 2024. Additional missing values are due to the inclusion of incomplete forms.

Implausible dosage values have been recategorized as missing.
Dosage values < 100 and > 50'000 cGycm2/uGym2 have been deemed implausible.

6.4.9 PCI-specific procedural characteristics of patients undergoing PCI

Table 21

Characteristic	**Overall**, N = 18'640[1]	**University h.**, N = 6'077[1]	**Public n-u h.**, N = 7'443[1]	**Private h.**, N = 5'120[1]	**p-value**[2]
Number of treated lesions					0.001
Mean (SD)	1.61 (0.89)	1.59 (0.89)	1.64 (0.91)	1.61 (0.87)	
Median (IQR)	1.00 (1.00, 2.00)	1.00 (1.00, 2.00)	1.00 (1.00, 2.00)	1.00 (1.00, 2.00)	
Missing	764	245	225	294	
Number of treated vessels					0.009
Mean (SD)	1.23 (0.50)	1.22 (0.50)	1.24 (0.51)	1.23 (0.49)	
Median (IQR)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	
Missing	617	161	221	235	
Unprotected left main stenosis treated	961 (5.3%)	327 (5.5%)	419 (5.8%)	215 (4.3%)	0.001
Missing	380	91	175	114	
Number of implanted stents					<0.001
Mean (SD)	1.42 (1.01)	1.34 (0.95)	1.43 (1.03)	1.52 (1.06)	
Median (IQR)	1.00 (1.00, 2.00)	1.00 (1.00, 2.00)	1.00 (1.00, 2.00)	1.00 (1.00, 2.00)	
Missing	370	91	165	114	
Number of used drug-eluting balloons					<0.001
Mean (SD)	0.33 (0.69)	0.37 (0.68)	0.37 (0.75)	0.24 (0.59)	
Median (IQR)	0.00 (0.00, 0.00)	0.00 (0.00, 1.00)	0.00 (0.00, 1.00)	0.00 (0.00, 0.00)	
Missing	373	91	168	114	
Drug-eluting balloon only	649 (3.6%)	227 (3.8%)	308 (4.2%)	114 (2.3%)	<0.001
Missing	373	91	168	114	
Stent failure intervention*	1'519 (8.3%)	395 (6.6%)	611 (8.4%)	513 (10%)	<0.001
Missing	379	91	174	114	
Restenosis*	1'401 (7.7%)	355 (5.9%)	550 (7.6%)	496 (9.9%)	<0.001
Stent thrombosis*	136 (0.7%)	44 (0.7%)	72 (1.0%)	20 (0.4%)	<0.001
CTO procedure	1'105 (5.9%)	369 (6.1%)	388 (5.2%)	348 (6.8%)	0.001
Missing	14	0	14	0	
CTO procedure - specification					0.005
Antegrade	986 (89%)	317 (86%)	344 (89%)	325 (93%)	
Retrograde	119 (11%)	52 (14%)	44 (11%)	23 (6.6%)	
Calcium modification*	3'292 (18%)	617 (10%)	1'895 (26%)	780 (16%)	<0.001
Missing	377	91	172	114	
Cutting balloon*	1'218 (6.7%)	251 (4.2%)	760 (10%)	207 (4.1%)	<0.001
Scoring balloon*	433 (2.4%)	68 (1.1%)	262 (3.6%)	103 (2.1%)	<0.001
Rotablation*	267 (1.5%)	87 (1.5%)	97 (1.3%)	83 (1.7%)	0.3
Lithotripsy*	727 (4.0%)	245 (4.1%)	290 (4.0%)	192 (3.8%)	0.8
Orbital atherectomy*	56 (0.3%)	7 (0.1%)	35 (0.5%)	14 (0.3%)	<0.001
High-pressure balloon*	1'424 (10%)	47 (1.1%)	1'076 (18%)	301 (9.1%)	<0.001
Bifurcation	4'178 (23%)	953 (16%)	1'882 (26%)	1'343 (27%)	<0.001
Missing	376	91	171	114	
Bifurcation - specification					<0.001
1 stent	3'663 (88%)	849 (89%)	1'687 (90%)	1'127 (84%)	
2 stents	515 (12%)	104 (11%)	195 (10%)	216 (16%)	

[1] n (%)

[2] Kruskal-Wallis rank sum test; Pearson's Chi-squared test

Caution

The answer option 'High-pressure balloon' for calcium modification is not available in form version V1.

6.4.10 Key procedural and PCI-specific procedural characteristics of patients undergoing PCI by center

Table 22

		Intracoronary imaging		Intracoronary physiology				Calcium modification						
Center	Total PCI	N	%	N	%	Stents	DCB	None	Cutting balloon	Scoring balloon	Rotablation	Lithotripsy	Orbital atherectomy	High-pressure balloon
Universitätsspital, Bern	1825	298	16.3	43	2.4	2642	466	1671	29	3	19	60	5	5
Universitätsspital, Basel	1432	71	5.0	27	1.9	1794	870	1361	0	0	32	0	0	23
Hôpital Cantonal, Fribourg	1143	147	12.9	134	11.7	1474	384	864	164	86	14	67	0	0
Universitätsspital, Zürich	1094	814	74.4	75	6.9	1538	431	944	15	0	13	102	1	19
Centre hospitalier universitaire vaudois, Lausanne	1054	51	4.8	105	10.0	1350	219	932	54	25	10	48	1	0
Kantonsspital, Winterthur	915	114	12.5	37	4.0	1441	314	795	6	36	10	39	0	46
Kantonsspital, Luzern	850	417	49.1	29	3.4	1001	683	328	312	8	12	46	17	311
Hirslanden Klinik HeartClinic, Zürich	794	35	4.4	73	9.2	1196	235	614	7	7	5	21	0	148
Kantonsspital Graubünden, Chur	742	154	20.8	91	12.3	1079	148	511	23	7	6	36	0	200
Bürgerspital, Solothurn	685	39	5.7	78	11.4	1016	71	528	2	0	12	18	18	84
Hôpitaux universitaires, Genève	672	17	2.5	30	4.5	707	233	461	153	40	13	35	0	0
Hirslanden Klinik Im Park, Zürich	621	30	4.8	133	21.4	1151	90	560	2	3	17	24	0	14
Spitalzentrum, Biel	607	43	7.1	51	8.4	788	118	554	2	1	4	16	0	3
Hirslanden Klinik Beau-Site, Bern	591	15	2.5	58	9.8	871	126	509	1	26	4	24	0	36
Stadtspital Triemli, Zürich	572	44	7.7	35	6.1	661	163	513	9	0	8	12	0	21
Kantonsspital, Aarau	505	80	15.8	52	10.3	755	140	286	83	15	5	13	0	150
Herz-Neuro-Zentrum Bodensee, Münsterlingen	483	1	0.2	84	17.4	657	94	459	2	0	1	0	0	15
Hirslanden Clinique des Grangettes, Genève	472	102	21.6	81	17.2	864	206	376	56	4	14	28	5	0

		Intracoronary imaging		Intracoronary physiology				Calcium modification						
Center	Total PCI	N	%	N	%	Stents	DCB	None	Cutting balloon	Scoring balloon	Rotablation	Lithotripsy	Orbital atherectomy	High-pressure balloon
Kantonsspital, St. Gallen	388	95	24.5	5	1.3	676	286	51	149	90	25	10	0	245
Clinique de la Source, Lausanne	378	23	6.1	78	20.6	424	39	344	26	3	0	10	0	0
Hôpital de la Tour, Genève	373	57	15.3	76	20.4	518	102	260	63	13	26	31	9	0
Hirslanden HerzZentrum, Zürich	353	31	8.8	34	9.6	625	85	313	2	4	2	22	0	6
Kantonsspital Baselland, Liestal	341	27	7.9	36	10.6	443	149	316	3	14	0	3	0	1
Hôpital Riviera-Chablais, Rennaz	338	23	6.8	91	26.9	332	40	182	14	13	0	12	0	72
Clinique de Genolier, Genolier	333	28	8.4	100	30.0	413	132	275	29	20	6	7	0	0
Kantonsspital, Frauenfeld	311	10	3.2	30	9.6	488	165	287	2	0	1	17	0	2
Kantonsspital, Baden	293	28	9.6	10	3.4	454	23	267	5	5	0	13	0	0
Cardiance Clinic, Pfäffikon SZ	185	7	3.8	16	8.6	280	27	168	2	4	5	6	0	2
Hirslanden Klinik, Aarau	178	23	12.9	5	2.8	254	12	150	1	3	3	6	0	8
Spital Lachen AG, Lachen	54	0	0.0	9	16.7	80	19	51	0	0	0	0	0	2
Kantonsspital, Schaffhausen	37	0	0.0	0	0.0	52	0	25	0	0	0	0	0	11
Ensemble Hospitalier de la Côte, Morges	21	2	9.5	4	19.0	10	7	16	2	3	0	1	0	0

Caution

The answer option ‘High-pressure balloon’ for calcium modification is not available in form version V1.

6.4.11 Major complications occurring in the CathLab in patients undergoing PCI

Table 23

Characteristic[1]	Overall, N = 18'640[2]	University h., N = 6'077[2]	Public n-u h., N = 7'443[2]	Private h., N = 5'120[2]	p-value[3]
Major complications*	88 (0.5%)	35 (0.6%)	31 (0.4%)	22 (0.4%)	0.4
Missing	19	7	11	1	
Emergency open heart surgery*	12 (<0.1%)	3 (<0.1%)	4 (<0.1%)	5 (<0.1%)	0.6
Clinically overt stroke*	21 (0.1%)	7 (0.1%)	6 (<0.1%)	8 (0.2%)	0.5
Procedural death*	42 (0.2%)	17 (0.3%)	18 (0.2%)	7 (0.1%)	0.3
Emergency vascular surgery (non-cardiac)*	3 (<0.1%)	1 (<0.1%)	1 (<0.1%)	1 (<0.1%)	>0.9
Pericardial tamponade*	14 (<0.1%)	8 (0.2%)	4 (<0.1%)	2 (<0.1%)	0.13
Missing	4'612	1'764	1'164	1'684	

[1] *: Multiple-choice variable

[2] n (%)

[3] Pearson's Chi-squared test; Fisher's exact test

Caution

The major complications 'Emergency vascular surgery (non-cardiac)' and 'Pericardial tamponade' are not available in form version V1.

Table 24

	ACS				CCS			
Characteristic[1]	Overall, N = 7'055[2]	University h., N = 2'918[2]	Public n-u h., N = 3'096[2]	Private h., N = 1'041[2]	Overall, N = 8'836[2]	University h., N = 2'209[2]	Public n-u h., N = 3'048[2]	Private h., N = 3'579[2]
Major complications*	53 (0.8%)	21 (0.7%)	22 (0.7%)	10 (1.0%)	21 (0.2%)	7 (0.3%)	5 (0.2%)	9 (0.3%)
Missing	4	3	1	0	6	2	3	1
Emergency open heart surgery*	8 (0.1%)	3 (0.1%)	3 (<0.1%)	2 (0.2%)	2 (<0.1%)	0 (0%)	0 (0%)	2 (<0.1%)
Clinically overt stroke*	6 (<0.1%)	2 (<0.1%)	3 (<0.1%)	1 (<0.1%)	8 (<0.1%)	2 (<0.1%)	1 (<0.1%)	5 (0.1%)
Procedural death*	37 (0.5%)	14 (0.5%)	17 (0.5%)	6 (0.6%)	4 (<0.1%)	2 (<0.1%)	1 (<0.1%)	1 (<0.1%)
Emergency vascular surgery (non-cardiac)*	1 (<0.1%)	1 (<0.1%)	0 (0%)	0 (0%)	1 (<0.1%)	0 (0%)	0 (0%)	1 (<0.1%)
Pericardial tamponade*	3 (<0.1%)	1 (<0.1%)	1 (<0.1%)	1 (0.1%)	7 (0.1%)	3 (0.2%)	3 (0.1%)	1 (<0.1%)

[1] *: Multiple-choice variable

[2] n (%)

Caution

The major complications 'Emergency vascular surgery (non-cardiac)' and 'Pericardial tamponade' are not available in form version V1.available in form version V1.

6.4.12 Discharge medication after PCI

Table 25

Characteristic[1]	ACS				CCS			
	Overall, N = 7'055[2]	**University h.**, N = 2'918[2]	**Public n-u h.**, N = 3'096[2]	**Private h.**, N = 1'041[2]	**Overall**, N = 8'836[2]	**University h.**, N = 2'209[2]	**Public n-u h.**, N = 3'048[2]	**Private h.**, N = 3'579[2]
ASA*	6'830 (98%)	2'870 (99%)	2'973 (97%)	987 (96%)	8'071 (93%)	2'150 (98%)	2'841 (94%)	3'080 (90%)
Missing	63	18	32	13	178	4	36	138
P2Y12 inhibitor*	6'865 (98%)	2'863 (99%)	3'017 (98%)	985 (96%)	8'276 (96%)	2'160 (98%)	2'923 (97%)	3'193 (93%)
Clopidogrel	1'617 (24%)	615 (21%)	703 (23%)	299 (30%)	6'341 (77%)	1'572 (73%)	2'040 (70%)	2'729 (85%)
Prasugrel	1'983 (29%)	670 (23%)	1'057 (35%)	256 (26%)	1'021 (12%)	119 (5.5%)	609 (21%)	293 (9.2%)
Ticagrelor	3'171 (46%)	1'511 (53%)	1'240 (41%)	420 (43%)	813 (9.8%)	382 (18%)	266 (9.1%)	165 (5.2%)
Other	93 (1.4%)	67 (2.3%)	16 (0.5%)	10 (1.0%)	100 (1.2%)	87 (4.0%)	7 (0.2%)	6 (0.2%)
Missing	191	55	80	56	561	49	126	386
N/OAC*	628 (9.0%)	253 (8.7%)	277 (9.0%)	98 (9.5%)	984 (11%)	239 (11%)	391 (13%)	354 (10%)
Statin therapy	6'566 (95%)	2'771 (97%)	2'835 (93%)	960 (93%)	7'757 (91%)	2'050 (97%)	2'768 (92%)	2'939 (85%)
Missing	123	64	47	12	272	96	41	135
Low-intensity	419 (6.4%)	198 (7.2%)	103 (3.6%)	118 (12%)	942 (12%)	176 (8.6%)	205 (7.5%)	561 (19%)
High-intensity	6'137 (94%)	2'567 (93%)	2'729 (96%)	841 (88%)	6'728 (88%)	1'874 (91%)	2'516 (92%)	2'338 (81%)
Missing	499	153	264	82	1'166	159	327	680
Prescribed dual antiplatelet therapy duration								
<1 month	15 (0.2%)	5 (0.2%)	7 (0.3%)	3 (0.3%)	37 (0.5%)	6 (0.3%)	9 (0.4%)	22 (0.8%)
1 month	58 (1.0%)	35 (1.4%)	19 (0.7%)	4 (0.5%)	300 (4.4%)	87 (4.8%)	128 (5.5%)	85 (3.3%)
3 months	95 (1.6%)	26 (1.0%)	38 (1.4%)	31 (3.6%)	445 (6.6%)	47 (2.6%)	205 (8.8%)	193 (7.4%)
6 months	591 (9.7%)	170 (6.6%)	293 (11%)	128 (15%)	4'546 (67%)	1'104 (61%)	1'448 (62%)	1'994 (77%)
12 months	5'181 (85%)	2'278 (89%)	2'216 (84%)	687 (79%)	1'316 (19%)	548 (30%)	510 (22%)	258 (9.9%)
>12 months	146 (2.4%)	47 (1.8%)	80 (3.0%)	19 (2.2%)	116 (1.7%)	32 (1.8%)	35 (1.5%)	49 (1.9%)
Missing	969	357	443	169	2'076	385	713	978
Prescribed triple antithrombotic therapy duration								
<1 week	387 (72%)	164 (68%)	185 (83%)	38 (53%)	484 (69%)	169 (77%)	207 (72%)	108 (54%)
1 month	125 (23%)	68 (28%)	30 (13%)	27 (38%)	135 (19%)	44 (20%)	45 (16%)	46 (23%)
3 months	6 (1.1%)	3 (1.3%)	2 (0.9%)	1 (1.4%)	24 (3.4%)	2 (0.9%)	12 (4.2%)	10 (5.0%)
6 months	18 (3.4%)	5 (2.1%)	7 (3.1%)	6 (8.3%)	61 (8.7%)	4 (1.8%)	22 (7.7%)	35 (18%)
Missing	6'519	2'678	2'872	969	8'132	1'990	2'762	3'380

[1] *: Multiple-choice variable

[2] n (%)

Note

Please note that in version V1 of the form, statin use is captured within the multiple-choice question “discharge medication.” This structure likely leads to underreporting of statin use. In version V2.0 of the form, statin use is specifically addressed as a separate question. However, since both versions are used concurrently across the registry, systematic bias is unavoidable. Therefore, any results on statin use must be interpreted with caution.

Note that for all multiple-choice variables in this table (‘ASA’, ‘P2Y12 inhibitor’, and ‘N/OAC’), the number of missing values is displayed only for the first variable, as it is the same for all.

6.5 PART III - Quality indicators (QI)

6.5.1 QI - Methods

Quality Indicators (QIs) provide a structured approach to evaluating healthcare performance by quantifying specific processes and outcomes. They are calculated as the ratio of a defined numerator to a denominator and expressed as a percentage.

The numerator includes all cases that meet the specified criteria, such as a documented process (e.g., radial access) or outcome (e.g., complication or death). The denominator consists of all cases in which the intervention of interest, such as coronary angiography and PCI or staged PCI, was performed, and relevant information about the process or outcome was available (i.e., not missing). While the information used to calculate the QIs presented here is mandatory, it may occasionally be missing due to the inclusion of incomplete, non-submitted records.

QIs are reported for each center providing denominator data. They are visualized by plotting the total number of cases (denominator) on the x-axis against the mean QI value for each department on the y-axis.

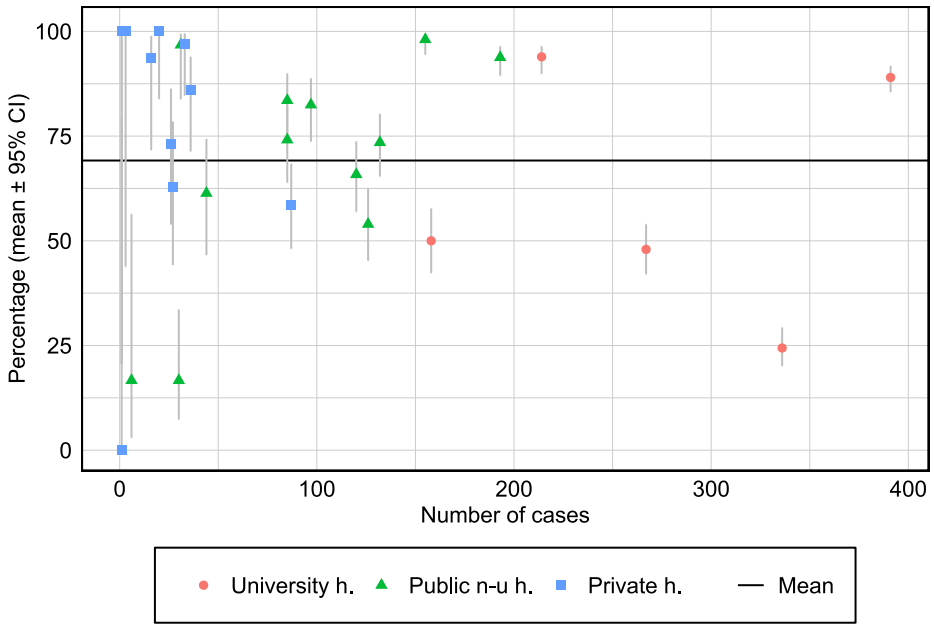
Process QIs measure adherence to specific procedural or care standards, such as the frequency of radial access. To provide a reliable estimate of the true mean based on observed data, 95% confidence intervals (CIs) are displayed. See e.g. Figure 14.

Outcome QIs, on the other hand, assess clinical outcomes, such as the incidence of major complications. These indicators are presented using funnel plots, which include control limits at 95% and 99.8%. Centers exceeding the 99.8% control limit are generally considered statistical outliers, both positively and negatively. See e.g. Figure 21.

6.5.2 Frequency of known LVEF in STEMI patients undergoing PCI

This process QI measures the proportion of STEMI patients undergoing PCI for whom the left ventricular ejection fraction (LVEF) is known. Note that LVEF is not assessed in staged PCI. 'Unknown' is defined as LVEF = 'Unknown' or missing. Please note that the response option 'Unknown' is only available in form version 2.0, which may introduce bias.

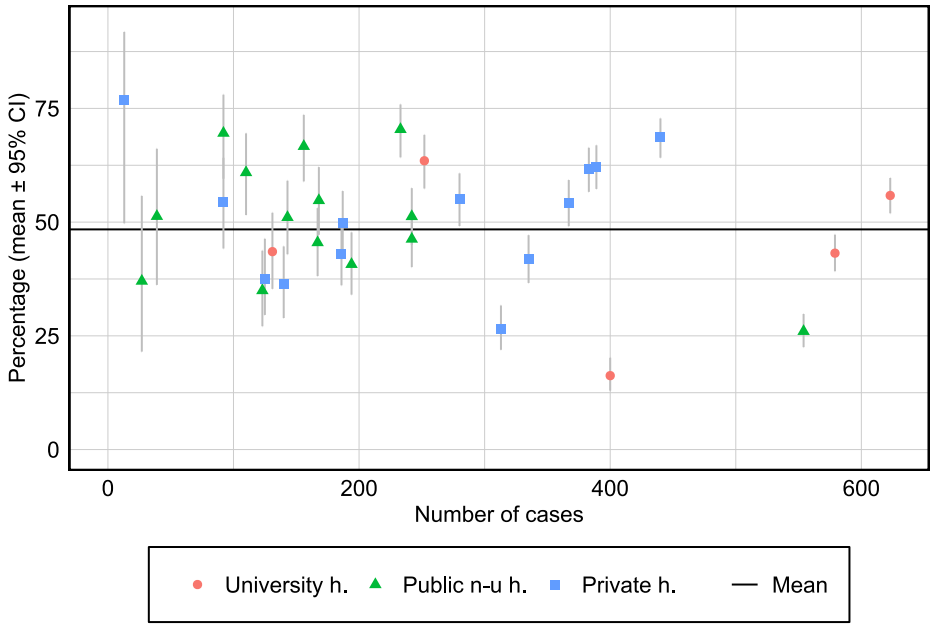
Figure 9: Frequency of known LVEF in STEMI patients undergoing PCI



6.5.3 Use of non-invasive functional or anatomical imaging tests in patients with suspected (progression of) CAD

This process QI measures the proportion of non-invasive tests indicative of CAD in patients undergoing PCI. The non-invasive tests include 'CCTA with significant stenoses', 'Stress MRI with ischemia', 'Stress TTE with ischemia', 'TTE with hypokinesia', 'Nuclear test with ischemia'. Detailed methodology can be found in Section 6.5.1.

Figure 10: Frequency of non-invasive tests indicative of CAD in patients undergoing PCIpatients undergoing PCI



6.5.4 Referral times

The following QI evaluate timely invasive management in acute coronary syndromes, distinguishing between NSTEMI and STEMI patients.

For NSTEMI, the process QI measures the proportion of patients who underwent an early invasive strategy, defined as coronary angiography performed within 24 hours of the first ECG.

For STEMI, the outcome QI assesses the proportion of patients who achieved a door-to-balloon time of less than 60 minutes or less than 90 minutes. Note that implausible values for door-to-balloon time (e.g., negative times, durations below 10 minutes, or exceeding 48 hours) as well as subacute-STEMI are excluded.

Refer to Section 6.5.1 for detailed methodology.

Figure 11: Frequency of early invasive strategy (<24h) in NSTEMI patients undergoing PCI

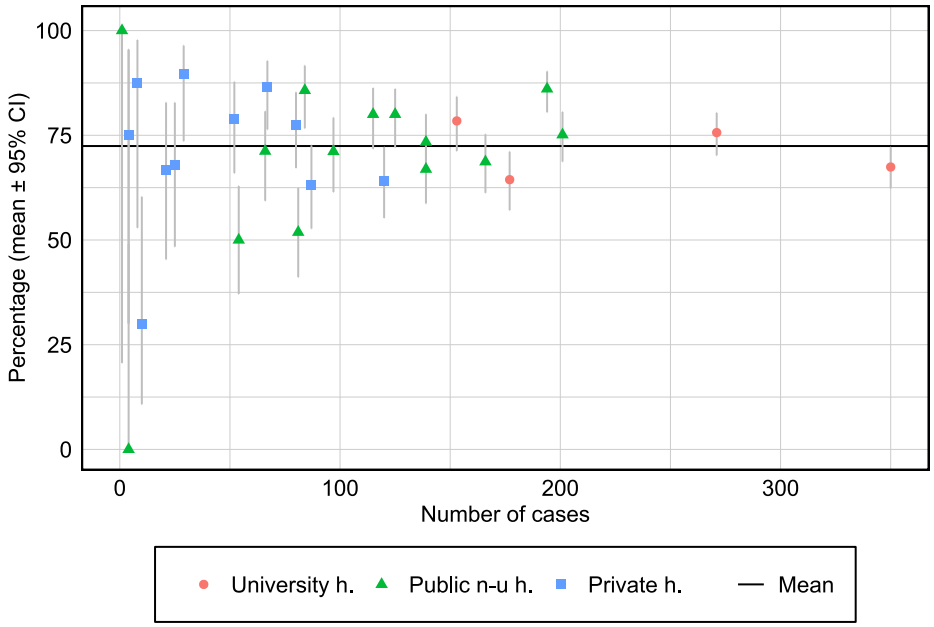
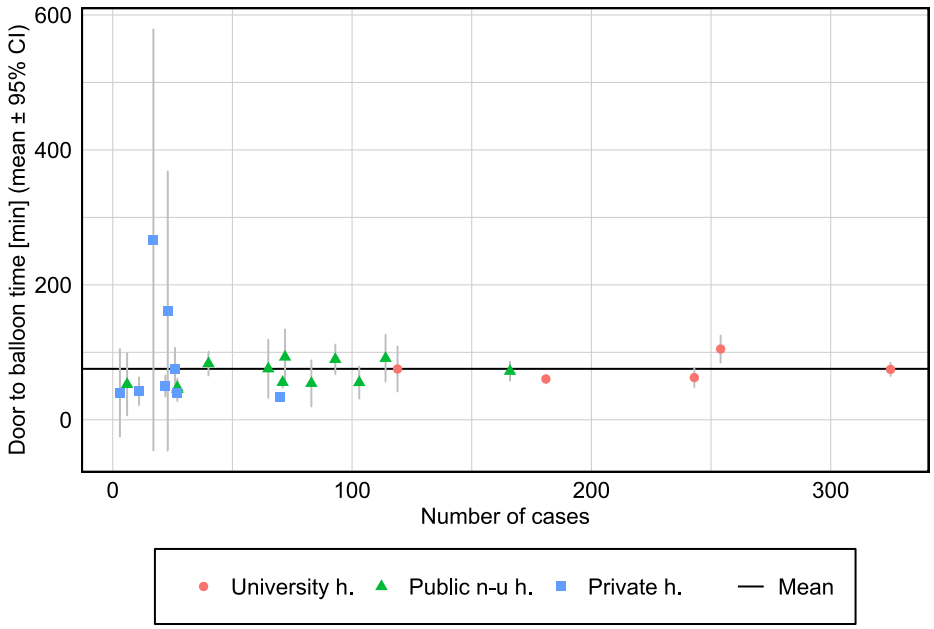


Figure 12: Mean door-to-balloon time in STEMI patients undergoing PCI



Caution

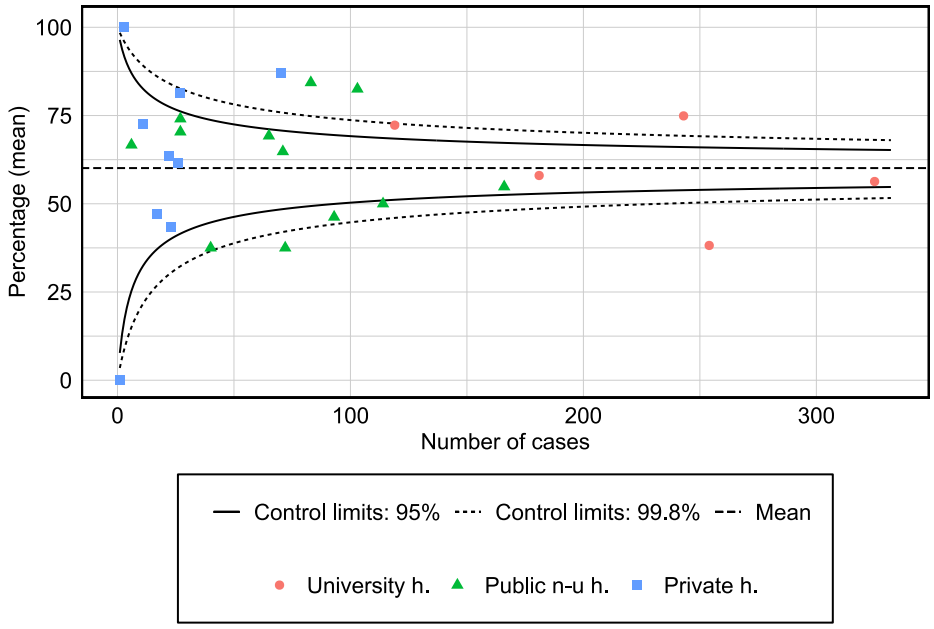
The figure above is a graphical representation of t-tests, examining whether the mean of each center significantly differs from the overall mean. The error bars represent the 95% confidence interval (CI) of the mean, assuming a normal distribution (which is one of the underlying assumptions for t-tests). Although the door-to-balloon time is unlikely to adhere to a normal distribution, t-tests are relatively robust against deviations from these assumptions.

Significant deviations from the mean are observed in centers where the error bars do not intersect the horizontal line representing the overall mean.

Caution

324 subacute STEMI patients (symptoms-onset to hospitalization > 12h) were excluded from the above analysis.

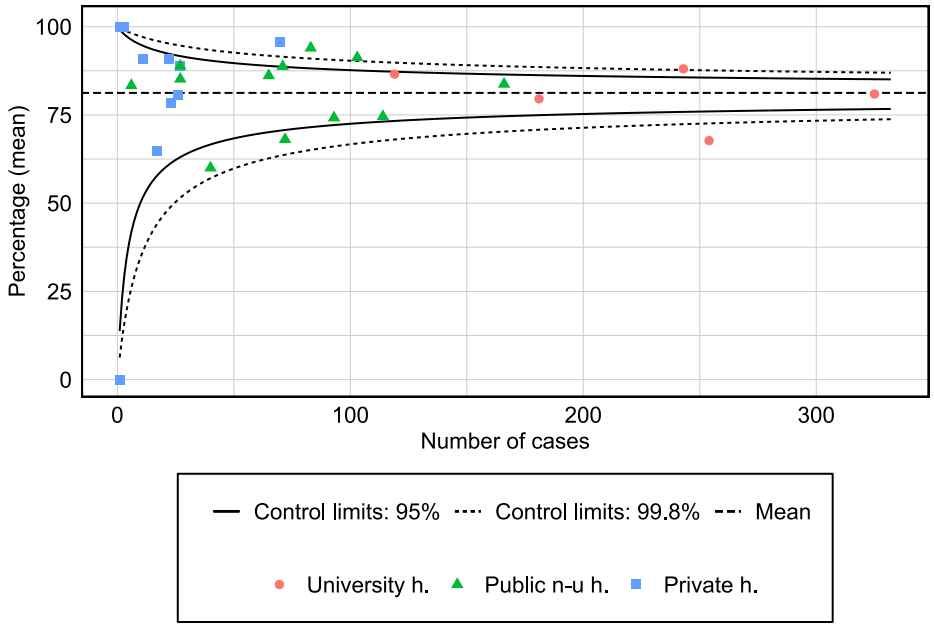
Figure 13: Frequency of door-to-balloon time below 60 minutes in STEMI patients undergoing PCI



Caution

324 subacute STEMI patients (symptoms-onset to hospitalization > 12h) were excluded from the above analysis.

Figure 14: Frequency of door-to-balloon time below 90 minutes in STEMI patients undergoing PCI



Caution

324 subacute STEMI patients (symptoms-onset to hospitalization > 12h) were excluded from the above analysis.

6.5.5 Radial access

Figure 15: Frequency of radial access in patients undergoing diagnostic CA

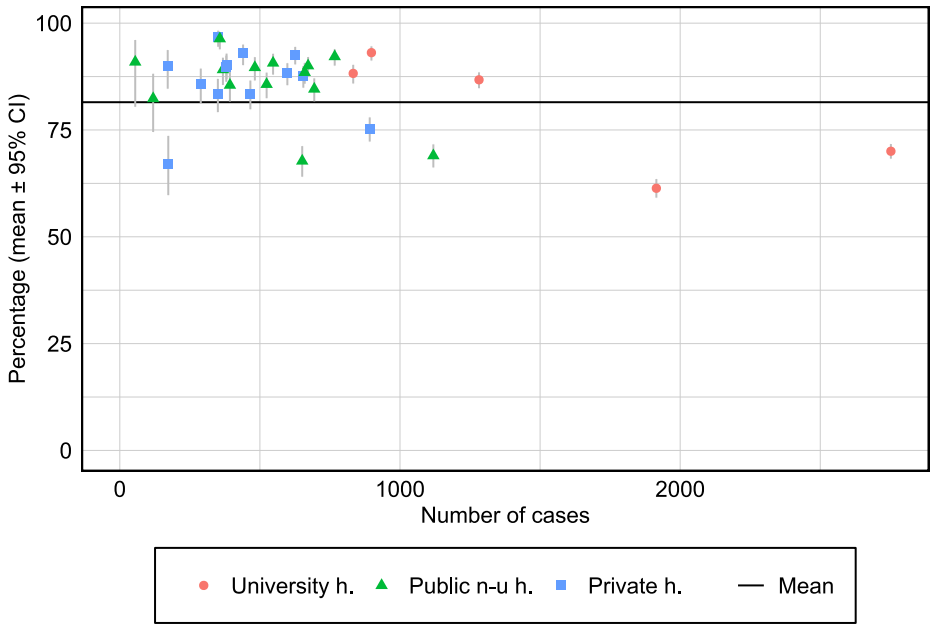


Figure 16: Frequency of radial access in patients undergoing PCI

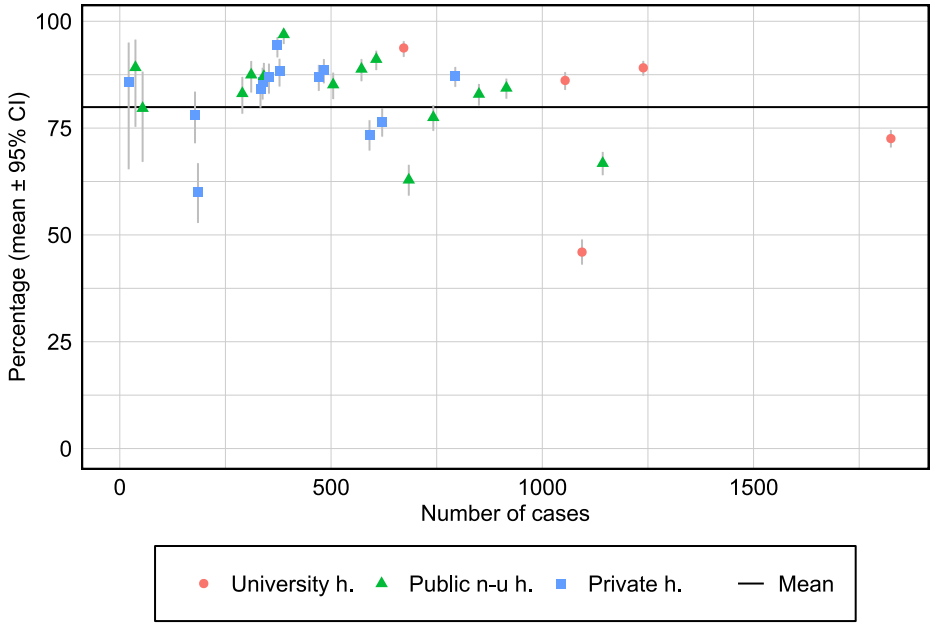


Figure 17: Frequency of radial access in CCS patients

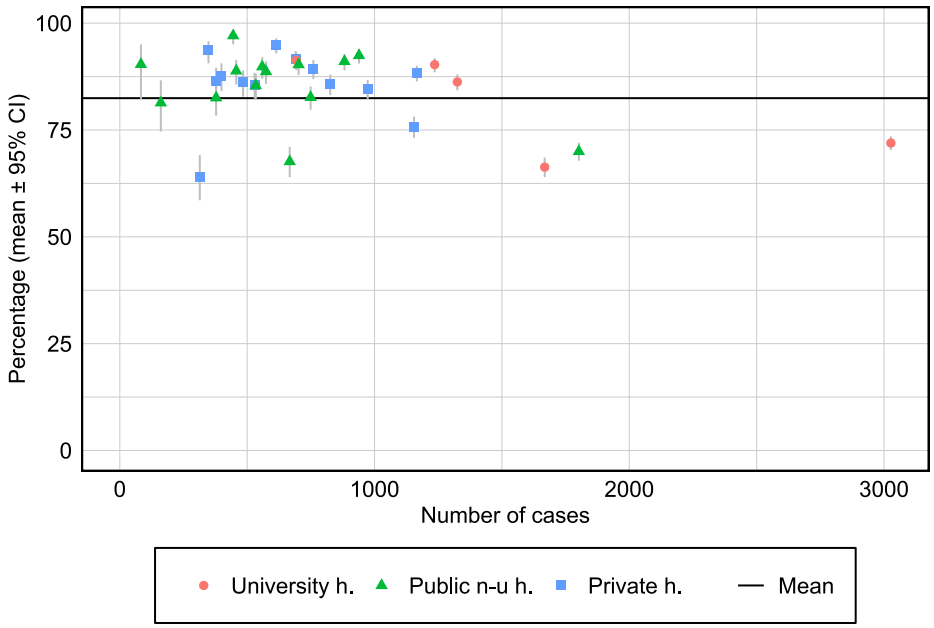


Figure 18: Frequency of radial access in unstable Angina pectoris and NSTEMI patients

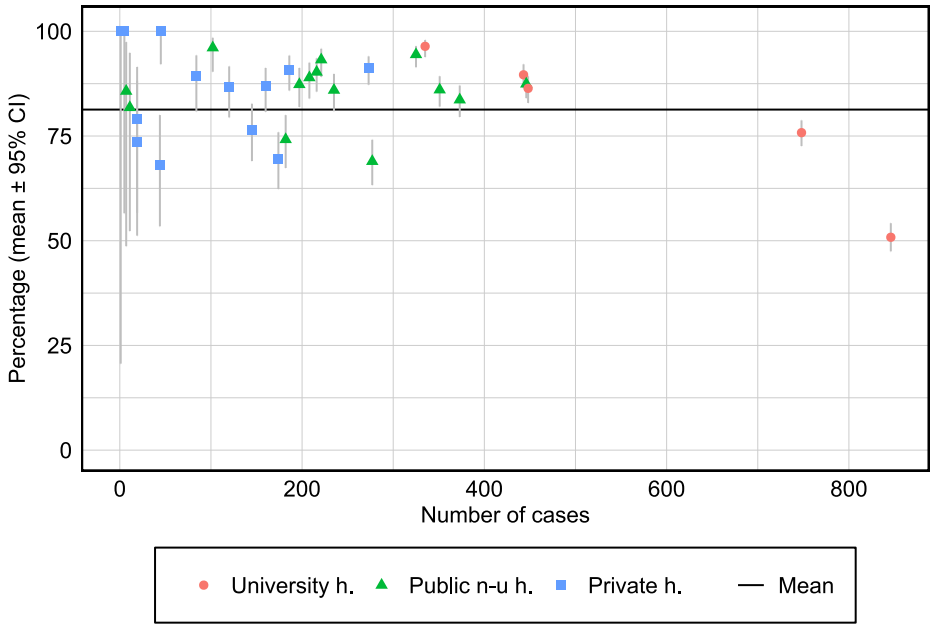
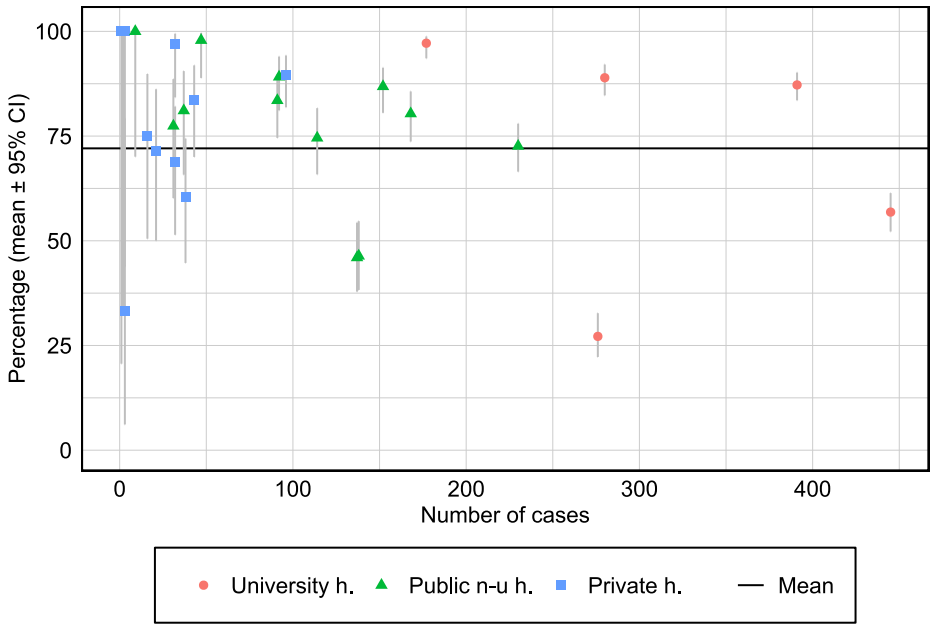


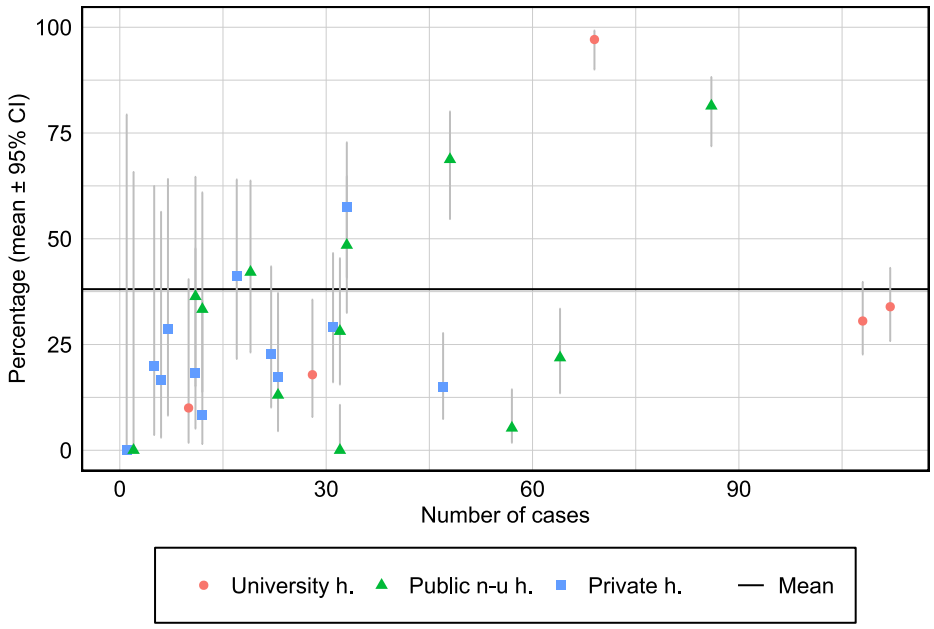
Figure 19: Frequency of radial access in STEMI patients



6.5.6 Use of intracoronary imaging in treated unprotected left main stenosis

This process-QI measures the proportion of cases where intracoronary imaging (IVUS, OCT or both) was utilized during treatment of unprotected left main stenosis. See Section 6.5.1 for details on the applied method.

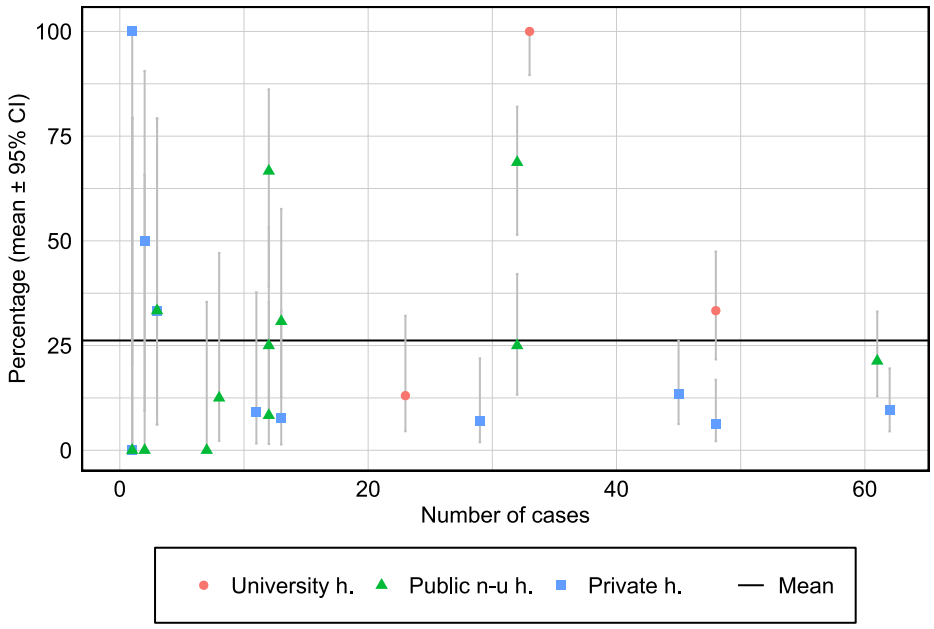
Figure 20: Frequency of intracoronary imaging in treated unprotected left main stenosis



6.5.7 Use of intracoronary imaging in bifurcation treated with 2 stents

This process-QI measures the proportion of cases in which intracoronary imaging (IVUS, OCT or both) was utilized during the treatment of bifurcation lesions using two stents. Refer to Section 6.5.1 for detailed methodology.

Figure 21: Frequency of intracoronary imaging in bifurcation with 2 stents



6.5.8 Major complications occurring in the CathLab

Caution

Major complications are rare events. Particularly for centers with low sample size, a single major complication can significantly impact whether a data point falls within or outside of the control limits.

Caution

Version V2.0 of the form includes two new answer options for major complications: ‘Emergency vascular surgery (non-cardiac)’ and ‘Pericardial tamponade’. As a result, major complications may be underreported in Version V1, potentially introducing bias.

Figure 22: Frequency of major complications - overall

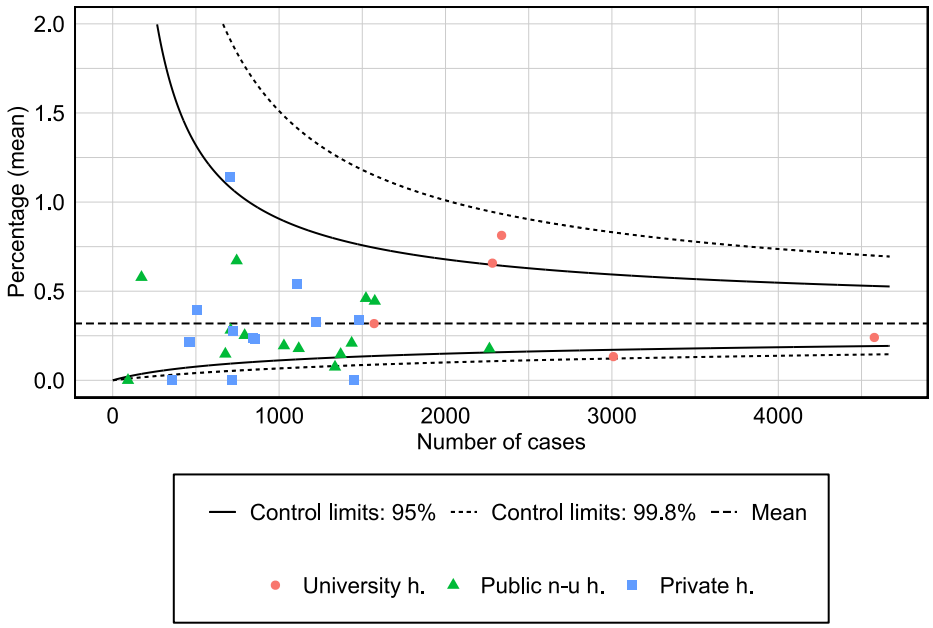


Figure 23: Frequency of major complication procedural death

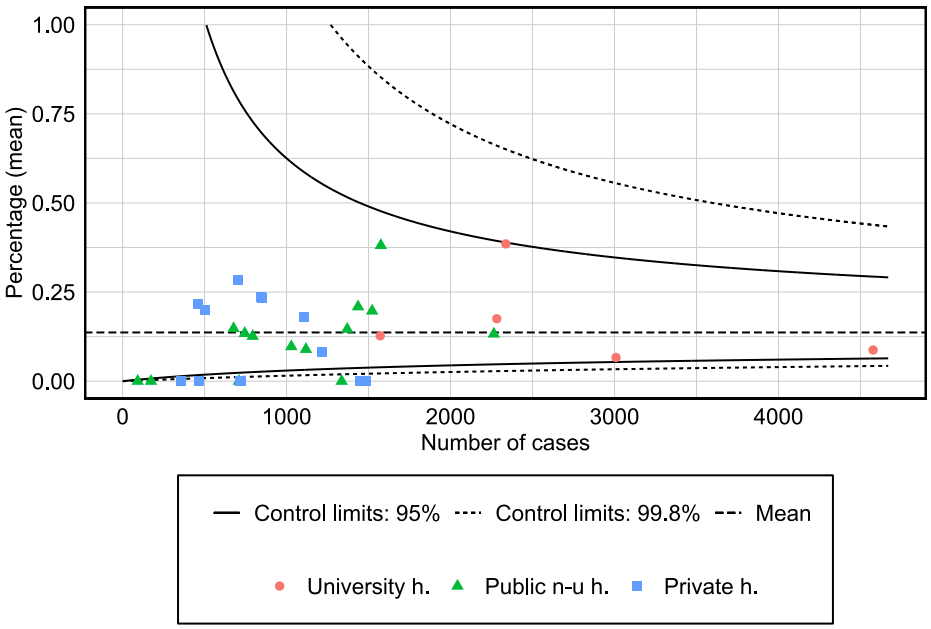


Figure 24: Frequency of major complication clinically overt stroke

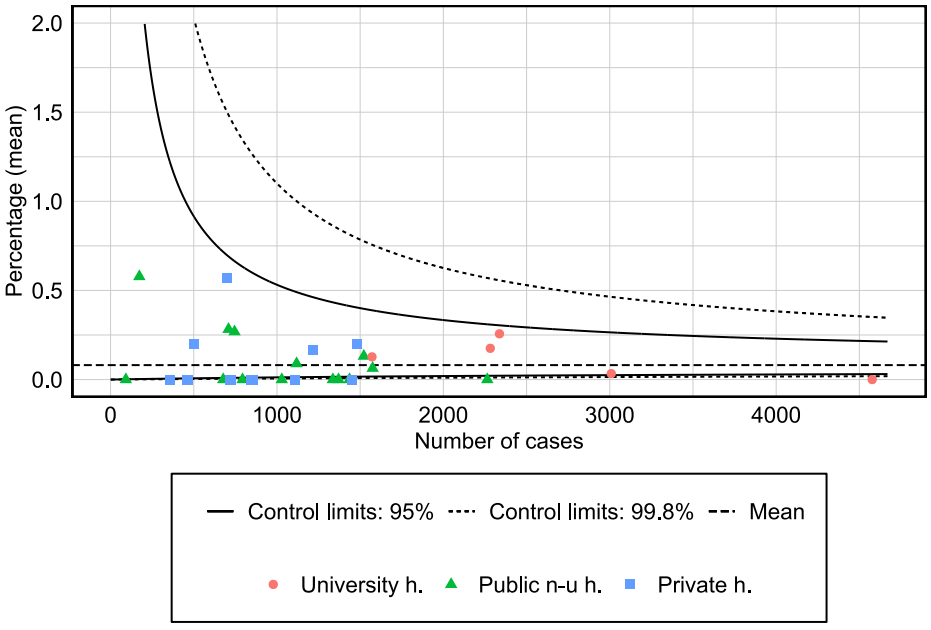


Figure 25: Frequency of major complication emergency open heart surgery

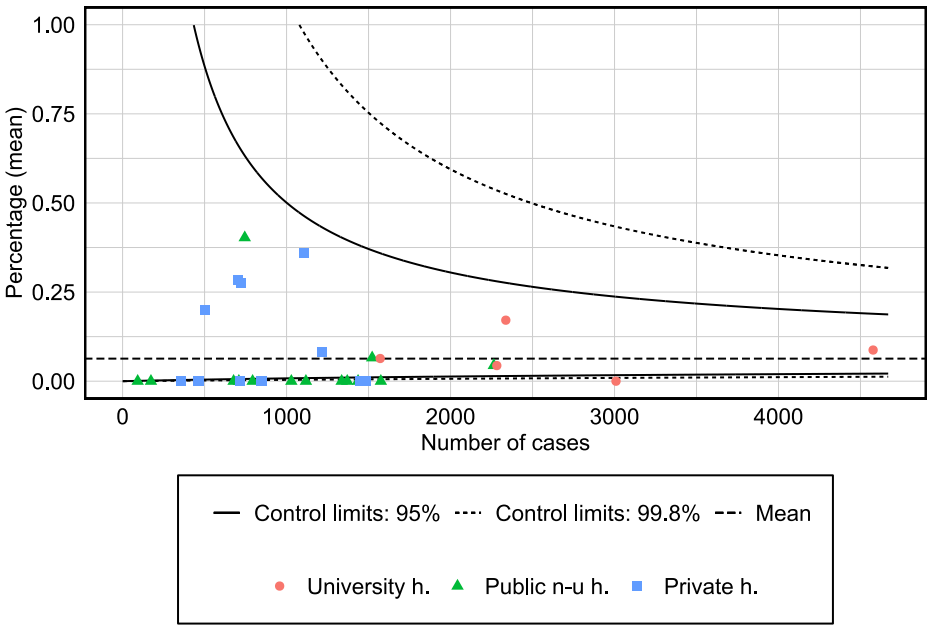
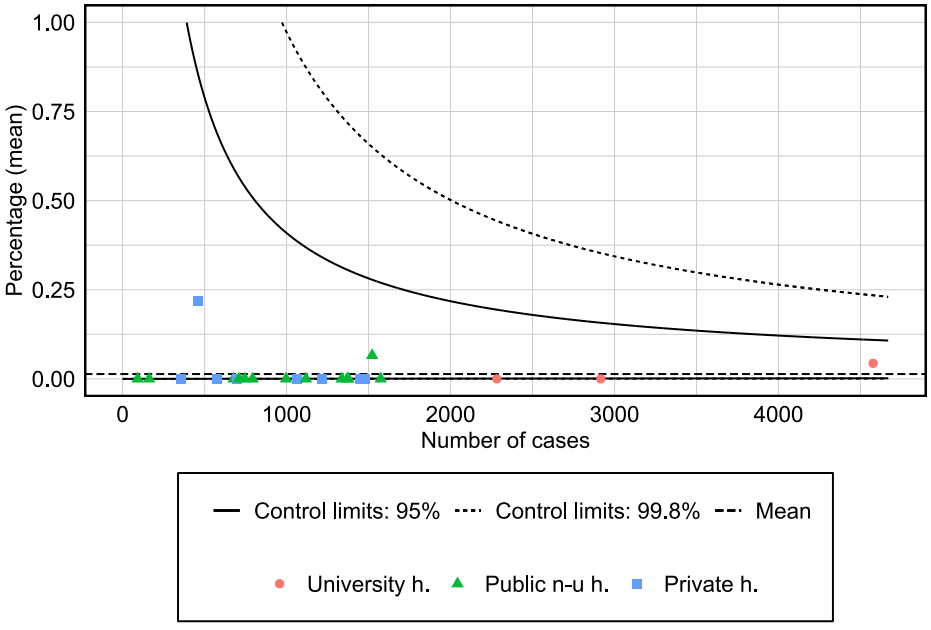


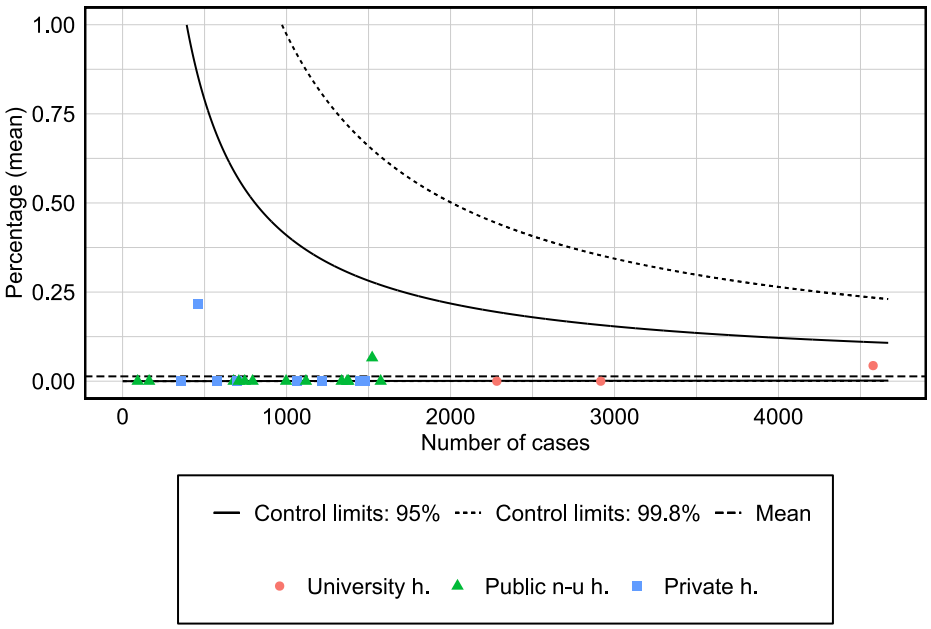
Figure 26: Frequency of major complication emergency vascular surgery (non-cardiac)



Caution

Please note that only the new form version V2.0 contains the answer option ‘Emergency vascular surgery (non-cardiac)’.

Figure 27: Frequency of major complication pericardial tamponade



Caution

Please note that only the new form version V2.0 contains the answer option ‘Pericardial tamponade’.

Note

The major complications in different indications (risk stratification) have not been determined.

6.5.9 Use of potent P2Y12 inhibitors in combination with N/OAC

This process QI measures the proportion of PCI patients (individually for CCS and ACS) discharged with both a potent P2Y12 inhibitor (prasugrel or ticagrelor) and a NOAC, as per ESC guidelines on contraindications. See Section 6.5.1 for details on the applied method.

Figure 28: Frequency of potent P2Y12 inhibitor with N/OAC use in CCS patients

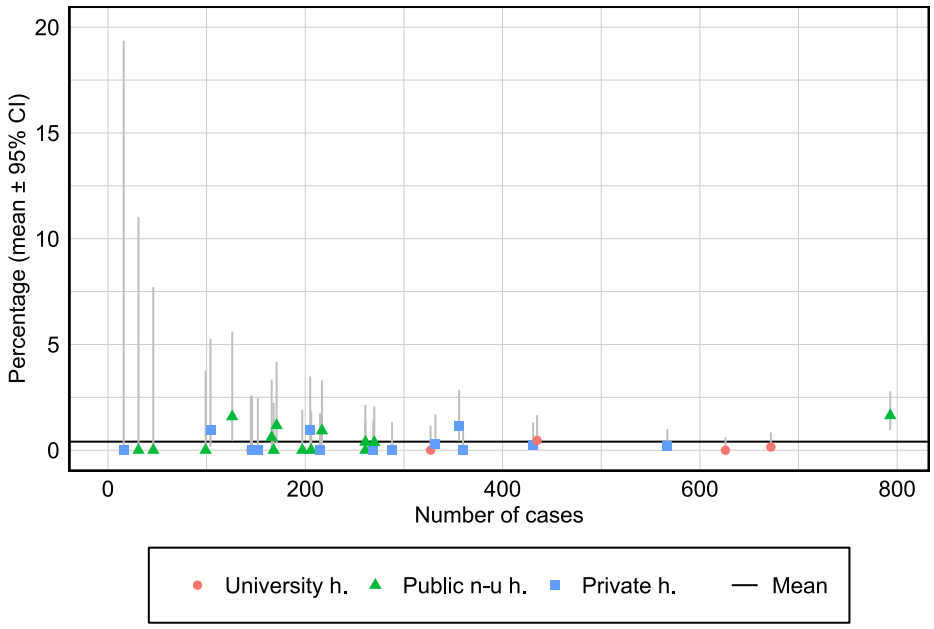
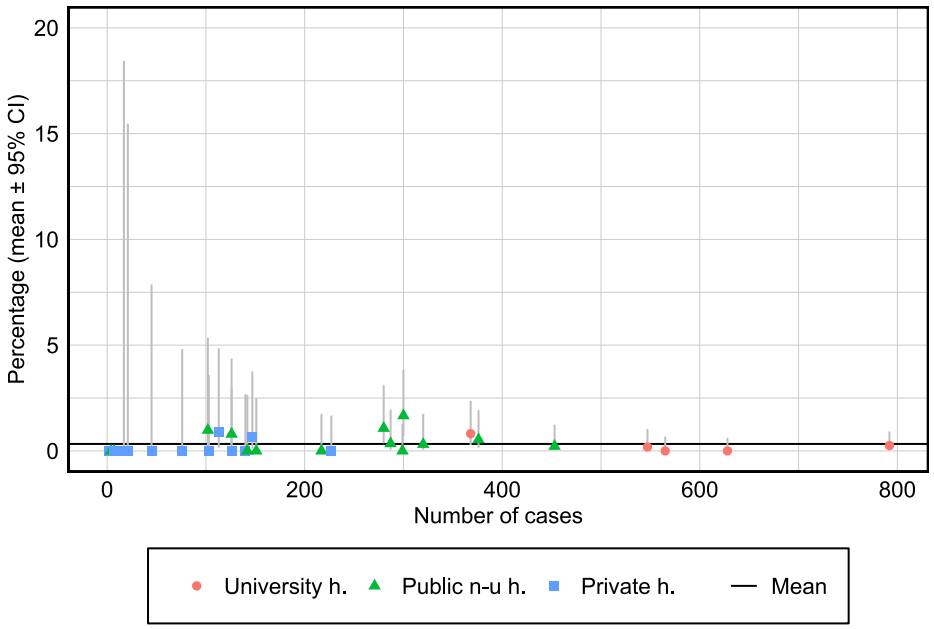


Figure 29: Frequency of potent P2Y12 inhibitor with N/OAC use in ACS



6.5.10 Patients discharged on statins in CCS

Caution

In version V1 of the form, statin use is captured within the multiple-choice question “discharge medication.” This structure likely leads to underreporting of statin use. In version V2.0 of the form, statin use is specifically addressed as a separate question. However, since both versions are used concurrently across the registry, systematic bias is unavoidable. Therefore, any results on statin use must be interpreted with caution.

Figure 30: Percentage of patients discharged on statins: CCS