

Based on a standardised questionnaire completed by 36 centres

The SWISS PCI Survey – coronary and structural heart interventions in Switzerland 2020

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Summary

For almost 35 years, the Swiss Working Group for Interventional Cardiology of the Swiss Society of Cardiology has evaluated and assessed the invasive diagnostic and therapeutic heart interventions performed annually in Switzerland. The aim of this survey, which was completed by 36 centres using a standardised questionnaire, was to report the data for the year 2020. Overall, 53,088 coronary angiographies with 48.8% subsequent percutaneous coronary interventions, i.e., 8.6% less than in 2019, were performed. Regarding structural interventions, there were 1790 transcatheter aortic valve implantations, with a decrease of 6.4% compared with 2019. This decrease was most likely due to the coronavirus disease (COVID-19) pandemic and its consequences on the Swiss healthcare system.

Introduction

Despite major improvements in diagnostic and therapeutic options, such as broad and early access to coronary angiography, cardiovascular disease including acute myocardial infarction remains the leading cause of death worldwide, with 17.6 million people dying per annum [1]. Therefore, current international guidelines highlight the importance of established international and national networks for the management of acute and chronic heart disease [2, 3]. The Working Group for Interventional Cardiology of the Swiss Society of Cardiology (SSC) has coordinated the annual assessment of invasive diagnostic and therapeutic procedures performed in Switzerland since 1987 [4]. Based on a standardised questionnaire, the number of diagnostic and therapeutic procedures are self-reported by each centre and published by the Swiss Working Group for Interventional Cardiology of the SSC [5–10]. In contrast to previous years, the performed procedures in 2020 were influenced by the evolving coronavirus disease (COVID-19) pandemic.

Methods

We contacted all interventional cardiology centres in Switzerland and asked them to complete the standardised online questionnaire via the Survio[®] platform. In the case of technical difficulties or according to their preference, the questionnaire was completed using a standardised pdf-file. In total, we assessed 69 items including basic information on the catheterisation centres, and more specific details on the type and indications of interventions, material used and outcome (if available). Detailed information on the assessed variables is given in the online appendix.

Data were collected using Excel[®] for Windows[®] and we solely used descriptive statistics without formal statistical analysis. As no specific patient data were assessed, and as data collection and analysis for in-hospital mortality after interventional procedures were for quality assurance/control purposes only, no formal approval by local institutional review boards and/or written patient consent was required.

Results

In the year 2020, 36 of 38 (94.7%) Swiss centres with interventional cardiology available on site reported their numbers. Of note, the *Herzlinik Hirslanden Zurich* and *HerzZentrum Hirslanden Zurich* reported their numbers together as one centre. The *Kantonsspital Baden* and the *Herz-Gefäss-Klinik Bethanien Zurich* did not report any numbers. The participating centres consisted of 5 university hospitals, 15 non-university public hospitals and 16 private institutions. Centres from 17 of the 26 cantons of Switzerland participated. Sixteen (46%) of these centres have cardiac surgery on site with the possibility to perform procedures with surgical backup (table 1).

Table 1: Interventional cardiology centres in Switzerland in 2020.

City, centre	Clinic description	Canton	Number of catheter labs	Cardiac surgery on site	Number of PCI operators		
					2020	2019	Diff.
Aarau, Hirslanden Klinik	p	Aargau	2	Yes	8	–	–
Aarau, Kantonsspital	n-u	Aargau	2	No	5	5	0
Basel, St. Claraspital	p	Basel-Stadt	1	No	3	3	0
Basel, University Hospital	u	Basel-Stadt	2	Yes	9	9	0
Bern, Hirslanden Klinik Beau-Site	p	Bern	2	Yes	8	7	1
Bern, Lindenhofspital	p	Bern	2	No	5	6	–1
Bern, University Hospital (Inselspital)	u	Bern	4	Yes	14	11	3
Biel, Spitalzentrum	n-u	Bern	1	No	5	4	1
Chur, Kantonsspital Graubünden	n-u	Graubünden	2	No	2.4	4	–1.6
Frauenfeld, Spital Thurgau AG	n-u	Thurgau	1	No	1	1	0
Fribourg, Hôpital Fribourgeois	n-u	Fribourg	2	No	6	6	0
Genève, Hirslanden Clinique d. Grangettes	p	Genève	1	No	5	4	1
Genève, Hôpital de La Tour	p	Genève	2	Yes	7	8	–1
Genève, University Hospital	u	Genève	2	Yes	7	7	0
Genolier, Clinique de Genolier	p	Vaud	1	No	4	4	0
Kreuzlingen, Herz-Neuro-Zentr. Bodensee	p	Thurgau	1	Yes	5	6	–1
Lachen, Spital Lachen AG	n-u	Schwyz	1	No	5	3	2
Lausanne, CHUV	u	Vaud	2	Yes	8	6	2
Lausanne, Clinique de La Source	p	Vaud	1	No	4	4	0
Lausanne, Hirslanden Clinique Cecil	p	Vaud	2	Yes	4	19	–15
Liestal, Kantonsspital Baselland	n-u	Basel-Land	1	No	1.5	2	–0.5
Lugano, Fondazione Cardiocentro Ticino	n-u	Ticino	4	Yes	9	9	0
Luzern, Hirslanden Klinik St. Anna	p	Luzern	1	No	4	4	0
Luzern, Kantonsspital	n-u	Luzern	4	Yes	8	7	1
Morges, Hôpital de Morges	n-u	Vaud	1	No	5	4	1
Pfäffikon, Cardiance Clinic	p	Schwyz	1	No	2	3	–1
Sion, Centre de cardiologie du Valais	p	Valais	1	No	3	3	0
Sion, Hôpital de Sion	n-u	Valais	1	Yes	4	5	–1
Solothurn, Bürgerspital	n-u	Solothurn	2	No	4	4	0
St. Gallen, Kantonsspital	n-u	St. Gallen	3	No	8	8	0
Winterthur, Kantonsspital	n-u	Winterthur	2	No	6	5	1
Zürich, Hirslanden Klinik/ Herzzentrum Hirslanden	p	Zürich	2	Yes	14	14	0
Zürich, Klinik Im Park	p	Zürich	3	Yes	7	7	0
Zürich, Stadtspital Triemli	n-u	Zürich	3	Yes	7	7	0
Zürich, University Hospital	u	Zürich	2	Yes	7	9	–2
<i>Baden, Kantonsspital</i>	<i>n-u</i>	<i>Aargau</i>	<i>1</i>	<i>No</i>	<i>–</i>	<i>4</i>	<i>–</i>
<i>Zürich, Herz-Gefäss-Klinik Bethanien</i>	<i>p</i>	<i>Zürich</i>	<i>1</i>	<i>No</i>	<i>–</i>	<i>1</i>	<i>–</i>
Total		17	65	16	204.9	208	–3.1

Diff. = difference; "–" = not applicable; u = university centre; n-u = non-university community centre; p = private clinic; PCI = percutaneous coronary intervention. The last two centres (in italics) did not participate.

Diagnostic and interventional procedures for coronary heart disease

Overall, 205 percutaneous coronary intervention (PCI) operators performed 53,088 coronary angiographies (CAGs) in 65 catheterisation laboratories at 36 centres.

Of note, we observed a relative reduction in CAG cases of 8.4% compared with 2019. In 25,933 (48.8%) CAG cases, a subsequent PCI was performed (fig. 1), with a PCI per CAG rate ranging between 24% and 68% among different centres (table 2). The average number of total cases/

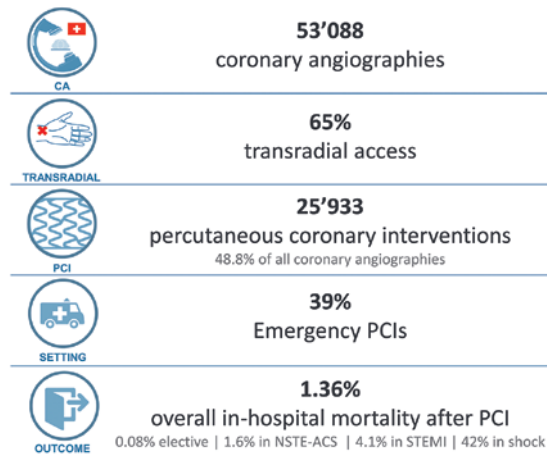


Figure 1: Central Illustration

year and PCIs/year per operator were 255 and 124, respectively (tables 1 and 2). The overall numbers of diagnostic and interventional cases per centre, ranked by absolute numbers, are shown in figure 2. Similarly to 2019 [10], radial access was used in 66% of all cases. However, we still observed a wide range from 18% to 98%, depending on site and operator preference (table 3). Thirty-two centres provided complete data on PCI indications. Among emergency PCIs (39% of total PCIs), non-ST-elevation acute coronary syndrome (NSTEMI-ACS), ST-elevation myocardial infarction (STEMI) and

cardiogenic shock accounted for 59%, 37% and 4% of cases, respectively (table 2). Interventions for chronic total occlusions (CTOs) accounted for 5.3% of PCIs and were primarily performed using an antegrade approach (65%). Among all coronary interventions, drug-eluting stents (DES) were the most used stent type at 99.7% of cases (bare metal stents 0.1%, self-expandable stents 0.1%, bioabsorbable scaffolds 0.2%, and bifurcation dedicated stents 0.1%; table 3). The use of drug-coated balloons (DCBs) remained stable at 2.9% versus 2.8% of all cases in 2020 and 2019, respectively. Lesion preparation using techniques other than balloon angioplasty were applied in 1937 cases (7.5% of all PCIs). Rotational atherectomy, intravascular lithotripsy, and thrombus aspiration were used in 345 (1.3%), 318 (1.2%), and 1274 (4.9%) cases, respectively (table 4). The degree of coronary artery stenosis was further assessed in 6783 cases (12.9%) and quantified by fractional flow reserve (38.9%), instantaneous wave-free ratio (27.7%), intravascular ultrasound (10.9%) or optical coherence tomography (22.5%). Left ventricular assist devices were used in 468 cases (0.9% of all cases; table 4).

Interventions for structural heart disease

For the first time since its clinical introduction in Switzerland in 2007 and similarly to CAG, cases of transcatheter aortic valve implantation (TAVI) decreased in

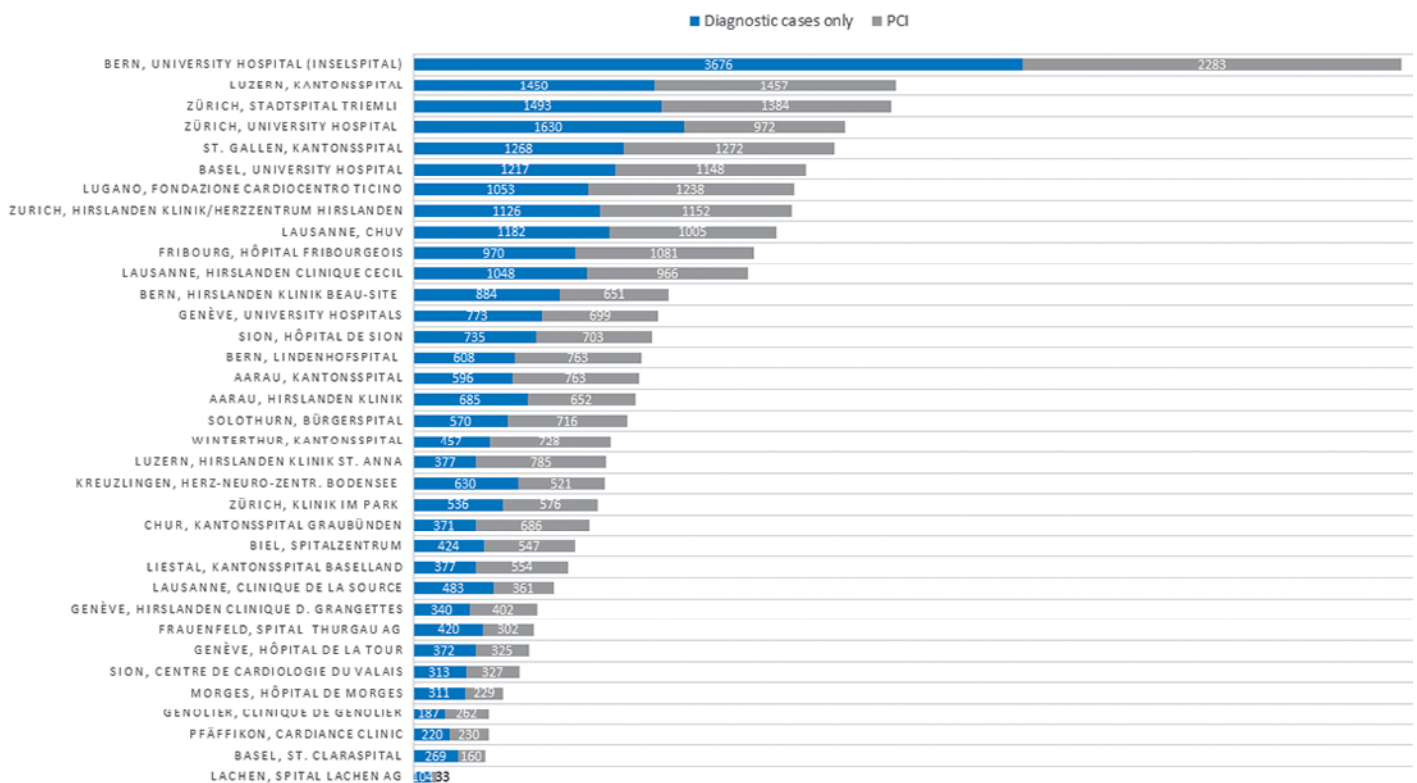


Figure 2: Coronary angiographies and interventions during the year 2020 in Switzerland.

Table 2: Overall cases performed in 2020 versus 2019 and specific indications for percutaneous coronary interventions.

Centre	Total number of cases			Diagnostic cases only			PCI			PCI in % of total			PCI for						
	2020	2019	Diff.	2020	2019	Diff.	2020	2019	Diff.	2020	2019	Diff.	NSTE-ACS	STEMI	Cardiogenic shock	CTO	Ante-grade CTO	Retro-grade CTO	% Emergency PCI
Aarau, Hirslanden Klinik	1337	–	–	685	–	–	652	–	–	49	–	–	177	116	–	–	–	–	45
Aarau, Kantonsspital	1359	1935	–576	596	988	–392	763	947	–184	56	49	7	203	137	–	20	14	6	45
Basel, St. Claraspital	429	457	–28	269	287	–18	160	170	–10	37	37	0	20	14	0	12	12	0	21
Basel, University Hospital	2365	2649	–284	1217	1425	–208	1148	1224	–76w	49	46	2	291	303	41	65	52	13	55
Bern, Hirslanden Klinik Beau-Site	1535	1319	216	884	791	93	651	528	123	42	40	2	122	42	0	33	30	3	25
Bern, Lindenhofspital	1371	1482	–111	608	692	–84	763	790	–27	56	53	2	161	51	0	25	22	3	28
Bern, University Hospital (Inselspital)	5959	6567	–608	3676	3877	–201	2283	2690	–407	38	41	–3	–	–	–	127	–	–	–
Biel, Spitalzentrum	971	1074	–103	424	612	–188	547	462	85	56	43	13	163	101	12	43	27	16	50
Chur, Kantonsspital Graubünden	1057	1317	–260	371	553	–182	686	764	–78	65	58	7	167	162	12	39	32	7	50
Frauenfeld, Spital Thurgau AG	722	713	9	420	381	39	302	332	–30	42	47	–5	105	6	0	14	12	2	37
Fribourg, Hôpital Fribourgeois	2051	2169	–118	970	1090	–120	1081	1079	2	53	50	3	396	208	31	76	71	5	59
Genève, Hirslanden Clinique d. Grangettes	742	693	49	340	330	10	402	363	39	54	52	2	83	16	0	27	25	2	25
Genève, Hôpital de La Tour	697	771	–74	372	434	–62	325	337	–12	47	44	3	68	40	2	18	15	3	34
Genève, University Hospital	1472	1821	–349	773	988	–215	699	833	–134	47	46	2	241	196	58	50	40	10	71
Genolier, Clinique de Genolier	449	491	–42	187	212	–25	262	279	–17	58	57	2	–	2	0	21	20	1	1
Kreuzlingen, Herz-Neuro-Zentr. Bodensee	1151	1231	–80	630	687	–57	521	544	–23	45	44	1	45	107	17	40	37	3	32
Lachen, Spital Lachen AG	137	169	–32	104	126	–22	33	43	–10	24	25	–1	0	0	0	2	2	0	0
Lausanne, CHUV	2187	2491	–304	1182	1468	–286	1005	1023	–18	46	41	5	576	322	12	42	34	8	91
Lausanne, Clinique de La Source	844	1031	–187	483	519	–36	361	512	–151	43	50	–7	38	0	0	48	48	0	11
Lausanne, Hirslanden Clinique Cecil	2014	2060	–46	1048	1119	–71	966	941	25	48	46	2	–	–	0	–	–	–	–
Liestal, Kantons-spital Baselland	931	1001	–70	377	381	–4	554	620	–66	60	62	–2	259	43	5	75	–	–	55
Lugano, Fondazione Cardio-centro Ticino	2291	2352	–61	1053	1029	24	1238	1323	–85	54	56	–2	416	237	46	43	30	13	56
Luzern, Hirslanden Klinik St. Anna	1162	1345	–183	377	436	–59	785	909	–124	68	68	0	62	51	7	37	34	3	15
Luzern, Kantons-spital	2907	3256	–349	1450	1747	–297	1457	1509	–52	50	46	4	676	276	49	108	78	30	69
Morges, Hôpital de Morges	540	389	151	311	217	94	229	172	57	42	44	–2	79	4	0	7	7	0	36
Pfäffikon, Cardiance Clinic	450	433	17	220	217	3	230	216	14	51	50	1	38	5	0	22	19	3	19
Sion, Centre de cardiologie du Valais	640	723	–83	313	347	–34	327	376	–49	51	52	–1	0	0	0	23	23	0	0
Sion, Hôpital de Sion	1438	1621	–183	735	823	–88	703	798	–95	49	49	0	180	131	10	30	28	2	46
Solothurn, Bürgerspital	1286	1537	–251	570	609	–39	716	928	–212	56	60	–5	252	146	19	14	14	0	58

St. Gallen, Kantonsspital	2540	2931	-391	1268	1510	-242	1272	1421	-149	50	48	2	301	225	3	105	84	21	62
Winterthur, Kantonsspital	1185	1331	-146	457	507	-50	728	824	-96	61	62	0	246	210	39	30	25	5	68
Zürich, Hirslanden Klinik/ Herzzentrum Hirslanden	2278	2520	-242	1126	1281	-155	1152	1239	-87	51	49	1	114	98	14	45	33	12	20
Zürich, Klinik Im Park	1112	1202	-90	536	634	-98	576	568	8	52	47	5	-	-	-	-	-	-	0
Zürich, Stadtspital Triemli	2877	2949	-72	1493	1599	-106	1384	1350	34	48	46	2	431	400	-	64	-	-	60
Zürich, University Hospital	2602	3169	-567	1630	1608	22	972	1561	-589	37	49	-12	209	246	26	36	-	-	49
Total	52,668	57,199	-4531	27,159	29,524	-2365	25,509	27,675	-2166	48.4	48.4	0.0	6119	3895	403	1341	868	171	

Diff. = difference; PCI = percutaneous coronary intervention; NSTEMI-ACS = non-ST-elevation acute coronary syndrome; STEMI = ST-elevation myocardial infarction; CTO = chronic total occlusion.

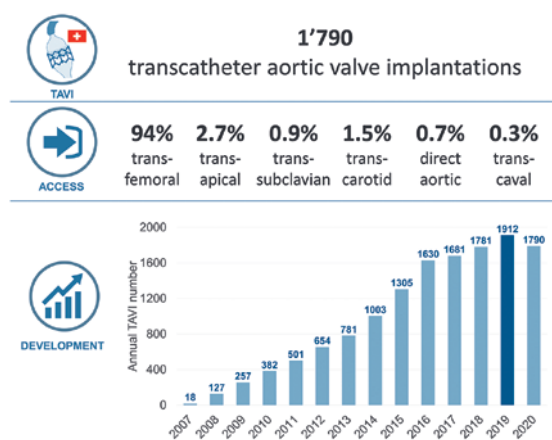


Figure 3: Trend in transcatheter aortic valve implantations and access routes

2020 compared with the preceding year. We observed an overall reduction of 122 interventions (-6.4%; figs 3 and 4). In 2020, 1790 TAVIs were performed with femoral access being used in 94% and trans-apical access in 2.7% of all implantations (table 5).

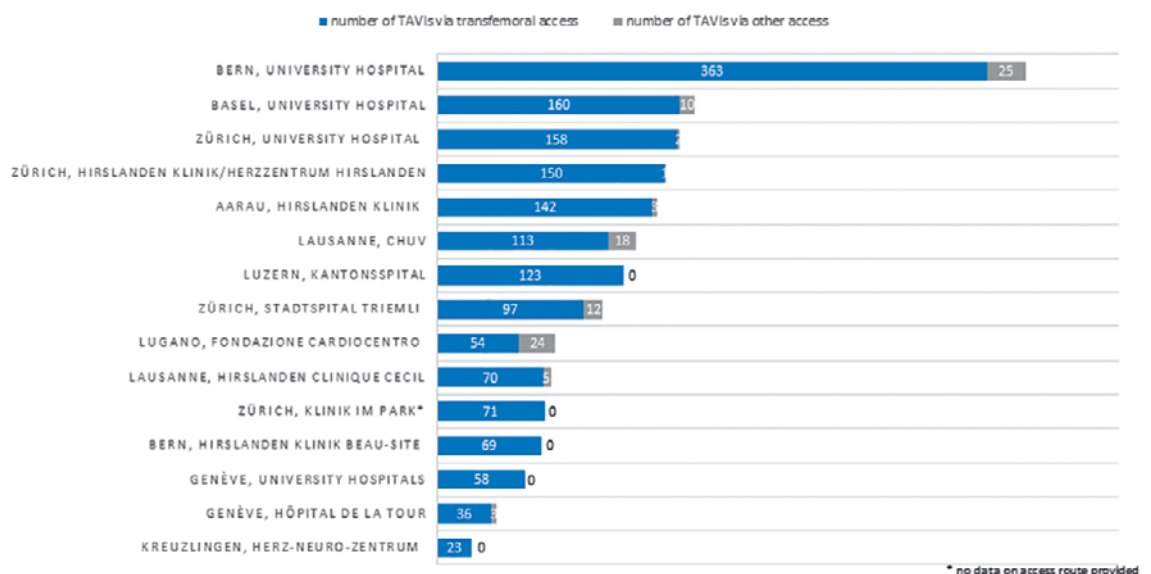


Figure 4: Transcatheter aortic valve implantations (TAVIs) during the year 2020 in Switzerland.

Table 3: Access route, stent types and balloons used.

Centre	Total number of cases (CAG+PCI)	Radial access		Type of stent used					DCB
		Absolute	%	BMS	DES	Selfexpandable (DES or BMS)	Bioabsorbable scaffolds	Bifurcation dedicated stents	
Aarau, Hirslanden Klinik	1337	–	–	0	620	0	0	0	22
Aarau, Kantonsspital	1359	1012	74	0	709	0	0	–	19
Basel, St. Claraspital	429	79	18	–	149	–	–	–	2
Basel, University Hospital	2365	1801	76	0	1094	0	0	0	47
Bern, Hirslanden Klinik Beau-Site	1535	453	30	0	611	0	0	0	24
Bern, Lindenhofspital	1371	1218	89	–	711	–	–	11	20
Bern, University Hospital (Inselspital)	5959	3758	63	0	2013	–	0	–	178
Biel, Spitalzentrum	971	758	78	0	491	0	0	0	3
Chur, Kantonsspital Graubünden	1057	778	74	0	556	0	0	0	8
Frauenfeld, Spital Thurgau AG	722	617	85	0	302	2	0	0	20
Fribourg, Hôpital Fribourgeois	2051	957	47	0	953	0	0	0	86
Genève, Hirslanden Clinique d. Grangettes	742	644	87	–	376	–	–	–	21
Genève, Hôpital de La Tour	697	655	94	0	308	0	0	0	7
Genève, University Hospital	1472	670	46	0	626	0	0	0	67
Genolier, Clinique de Genolier	449	355	79	0	156	0	0	0	22
Kreuzlingen, Herz-Neuro-Zentrum	1151	863	75	0	521	0	0	0	35
Lachen, Spital Lachen AG	137	117	85	0	33	0	0	0	0
Lausanne, CHUV	2187	1739	80	–	889	–	–	–	90
Lausanne, Clinique de La Source	844	657	78	0	361	0	0	0	34
Lausanne, Hirslanden Clinique Cecil	2014	658	33	6	827	0	0	–	–
Liestal, Kantonsspital Baselland	931	884	95	0	517	0	12	0	25
Lugano, Fondazione Cardiocentro	2291	1890	82	1	1061	0	30	0	243
Luzern, Hirslanden Klinik St. Anna	1162	518	45	0	691	0	0	–	81
Luzern, Kantonsspital	2907	1736	60	1	1295	5	0	0	161
Morges, Hôpital de Morges	540	247	46	0	214	0	0	0	15
Pfäffikon, Cardiance Clinic	450	200	44	0	230	0	0	0	0
Sion, Centre de cardiologie du Valais	640	627	98	0	295	0	0	0	15
Sion, Hôpital de Sion	1438	1192	83	0	683	0	0	0	20
Solothurn, Bürgerspital	1286	690	54	0	663	0	0	0	36
St. Gallen, Kantonsspital	2540	2210	87	0	1097	0	0	0	143
Winterthur, Kantonsspital	1185	779	66	0	698	0	0	0	30
Zürich, Hirslanden Klinik/Herzzentrum Hirslanden	2278	1306	57	0	1091	0	0	0	70
Zürich, Klinik Im Park	1112	–	–	–	–	–	–	–	–
Zürich, Stadtspital Triemli	2877	2382	83	0	1310	0	0	0	–
Zürich, University Hospital	2602	1265	49	0	972	–	–	–	–
Total	5,3088	33,498	65%	8	23,123	7	42	11	1544
				0.1%	99.7%	0.1%	0.2%	0.1%	

CAG = coronary angiography; PCI = percutaneous coronary intervention; BMS = bare metal stent; DES = drug eluting stent; DCB = drug coated balloon.

Limitations

There are some limitations that need to be highlighted: First, the main limitation results from the study design, with data being submitted on a voluntary basis by the individual centres without monitoring. We aimed to minimise this effect by sending a standardised questionnaire to all involved centres. Second, unfortunately not all centres replied and provided complete data. Due to missing data, some findings of

this study are not representative, and their generalisability is limited. Third, definitions of chronic coronary artery disease, NSTEMI-ACS, STEMI, and cardiogenic shock were based on international guidelines but not predefined by the registry, and therefore may have differed among the centres. Fourth, when comparing the findings of 2020 with those from 2019 one has to consider that only 36 and not 37 centres participated. However, this had no impact on reported TAVI procedures as all Swiss TAVI centres participated in both years.

Table 4: Revascularisation techniques, quantification methods, and use of left ventricular assist devices.

Centre	Revascularisation techniques, others than balloon angioplasty by number of cases				Quantification methods of the degree of stenosis				Left ventricular assist devices			
	Rotabl.	Shockwave	Thromb-asp	Filters	FFR	iFR	IVUS	OCT	IABP	Im-pella	ECMO	Others
Aarau, Hirslanden Klinik	9	0	12	0	76	76	0	43	0	12	1	0
Aarau, Kantonsspital	5	17	65	–	47	42	5	17	1	17	0	0
Basel, St. Claraspital	6	–	8	0	0	50	–	20	6	–	–	–
Basel, University Hospital	14	12	68	0	99	0	10	9	0	44	2	3
Bern, Hirslanden Klinik Beau-Site	2	0	13	0	26	0	0	10	0	0	1	0
Bern, Lindenhofspital	1	2	3	–	–	76	–	–	–	–	–	–
Bern, University Hospital	26	–	137	1	222	0	48	481	4	52	7	–
Biel, Spitalzentrum	6	17	7	0	79	0	0	0	0	2	0	0
Chur, Kantonsspital Graubünden	5	3	30	0	55	–	9	34	0	10	0	0
Frauenfeld, Spital Thurgau AG	0	0	0	0	13	74	0	20	0	0	0	0
Fribourg, Hôpital Fribourgeois	10	18	76	2	131	10	13	46	8	6	3	0
Genève, Clinique d. Granettes	7	3	4	4	86	–	–	22	–	5	–	–
Genève, Hôpital de La Tour	12	3	21	3	83	0	13	0	5	2	0	0
Genève, University Hospital	6	12	60	2	0	180	84	75	9	13	3	0
Genolier, Clinique de Genolier	6	0	0	0	144	144	0	15	0	0	0	0
Kreuzlingen, Herz-Neuro-Zentrum	5	0	25	0	15	365	25	0	0	0	2	0
Lachen, Spital Lachen AG	0	0	0	0	17	–	0	0	0	0	0	0
Lausanne, CHUV	12	7	62	3	255	–	24	89	2	–	5	–
Lausanne, Clinique de La Source	0	2	4	0	103	0	0	0	0	0	0	0
Lausanne, Hirslanden Clinique Cecil	0	–	–	–	–	0	–	0	0	0	0	0
Liestal, Kantonsspital Baselland	17	4	9	0	42	0	1	23	0	5	0	0
Lugano, Fondazione Cardiocentro	9	32	83	12	76	233	44	42	0	26	5	0
Luzern, Hirslanden Klinik St. Anna	0	2	11	0	97	19	11	0	0	10	0	0
Luzern, Kantonsspital	18	38	300	4	107	–	–	365	21	49	7	0
Morges, Hôpital de Morges	6	2	0	2	52	2	0	15	0	0	0	0
Pfäffikon, Cardiance Clinic	0	0	2	0	0	55	1	0	0	0	0	0
Sion, Centre de cardiologie d. Valais	–	–	0	–	88	2	–	9	–	–	–	–
Sion, Hôpital de Sion	0	0	14	2	85	0	0	15	2	0	4	0
Solothurn, Bürgerspital	0	32	12	0	139	0	0	0	0	0	0	0
St. Gallen, Kantonsspital	115	52	121	1	157	81	321	47	8	2	8	0
Winterthur, Kantonsspital	4	4	–	–	5	150	5	0	0	5	0	0
Zürich, Hirslanden Klinik/Herzzentrum Hirslanden	9	26	56	4	–	216	29	10	8	11	1	0
Zürich, Klinik Im Park	21	–	–	–	–	–	1	0	11	3	–	–
Zürich, Stadtspital Triemli	1	30	71	5	233	–	0	53	13	3	–	0
Zürich, University Hospital	13	–	–	–	106	106	93	67	–	29	12	–
Total	345	318	1274	45	2638	1881	737	1527	98	306	61	3
	1.3%	1.2%	4.9%	0.2%	38.9%	27.7%	10.9%	22.5%	20.9%	65.4%	13.0%	0.6%
	7.5%				12.9%			0.9%				
	% of PCI ases				% of total c							

Rotabl. = rotablation; Thrombasp. = thrombusaspiration; FFR = fractional flow reserve; iFR = instantaneous wave-free ratio; IVUS = intravascular ultrasound; OCT = optical coherence tomography; IABP = intra-aortic balloon pump; ECMO = extracorporeal membrane oxygenation

Table 5: Transcatheter aortic valve implantations (TAVIs) in 2020 with details on access route and use of embolic protection devices.

Centre	Aortic valvuloplasty without percutaneous valve replacement	Total number of TAVIs			TAVI access						Use of embolic protection device during TAVI
		2020	2019	Diff.	Trans-femoral	Trans-apical	Trans-subclavian	Direct aortic	Trans-carotid	Trans-caval	
Aarau, Hirslanden Klinik	0	145	–	–	142	0	3	0	0	0	0
Aarau, Kantonsspital	0	0	75	–75	0	0	0	0	0	0	0
Basel, St. Claraspital	0	–	–	–	–	–	–	–	–	–	–
Basel, University Hospital	1	170	165	5	160	5	5	0	0	0	68
Bern, Hirslanden Klinik Beau-Site	0	69	83	–14	69	0	0	0	0	0	0
Bern, Lindenhofspital	–	–	–	–	–	–	–	–	–	–	–
Bern, University Hospital	3	388	403	–15	363	15	4	0	4	2	–
Biel, Spitalzentrum	0	0	–	–	0	0	0	0	0	0	0
Chur, Kantonsspital Graubünden	0	0	–	–	0	0	0	0	0	0	0
Frauenfeld, Spital Thurgau AG	0	0	–	–	0	0	0	0	0	0	0
Fribourg, Hôpital Fribourgeois	2	0	–	–	0	0	0	0	0	0	0
Genève, Clinique d. Grangettes	–	–	–	–	–	–	–	–	–	–	–
Genève, Hôpital de La Tour	0	39	33	6	36	0	2	0	0	1	6
Genève, University Hospital	0	58	86	–28	58	0	0	0	0	0	56
Genolier, Clinique de Genolier	0	0	–	–	0	0	0	0	0	0	0
Kreuzlingen, Herz-Neuro-Zentrum	0	23	28	–5	23	0	0	0	0	0	0
Lachen, Spital Lachen AG	0	0	–	–	0	0	0	0	0	0	0
Lausanne, CHUV	–	131	120	11	113	1	–	1	16	–	11
Lausanne, Clinique de La Source	0	0	–	–	0	0	0	0	0	0	0
Lausanne, Hirslanden Clinique Cecil	0	75	64	11	70	1	0	0	4	0	0
Liestal, Kantonsspital Baselland	0	0	–	–	0	0	0	0	0	0	0
Lugano, Fondazione Cardiocentro	0	78	76	2	54	12	0	11	1	0	9
Luzern, Hirslanden Klinik St. Anna	0	0	–	–	0	0	0	0	0	0	0
Luzern, Kantonsspital	4	123	116	7	123	0	0	0	0	0	109
Morges, Hôpital de Morges	0	0	–	–	0	0	0	0	0	0	0
Pfäffikon, Cardiance Clinic	0	0	–	–	0	0	0	0	0	0	0
Sion, Centre de cardiologie du Valais	–	–	–	–	–	–	–	–	–	–	–
Sion, Hôpital de Sion	0	0	–	–	0	0	0	0	0	0	0
Solothurn, Bürgerspital	0	0	–	–	0	0	0	0	0	0	0
St. Gallen, Kantonsspital	0	0	–	–	0	0	0	0	0	0	0
Winterthur, Kantonsspital	0	0	–	–	0	0	0	0	0	0	0
Zürich, Hirslanden Klinik/Herzzentrum Hirslanden	1	151	150	1	150	0	1	0	0	0	4
Zürich, Klinik Im Park	4	71	75	–4	–	–	–	–	–	–	–
Zürich, Stadtsptial Triemli	0	109	78	31	97	12	0	0	0	0	8
Zürich, University Hospital	0	160	360	–200	158	0	0	0	0	2	0
Total	15	1790	1912	–122	1616	46	15	12	25	5	271
% of total					94.0%	2.7%	0.9%	0.7%	1.5%	0.3%	

No details provided by *Klinik im Park* (n = 1719 for access route calculation).

Table 6a: Mitral and tricuspid valve interventions.

Centre	Occlusion of paravalvular leakage	Mitral valve interventions					Transcath. tricuspid valve intervention	Pulmonary artery/valve interventions		
		Percut. transvenous valvuloplasty	Edge-to-edge repair devices	Direct annuloplasty (e.g., Cardioband)	Indirect mitral annuloplasty (e.g. Carillon)	Transcath. valve replacement (TMVI, e.g., Tendyne)		PTA / stenting pulmonary artery	Transcatheter pulmonary valvuloplasty	TPVI (e.g. Melody)
Aarau, Hirslanden Klinik	0	0	39	0	0	0	1	0	0	0
Aarau, Kantonsspital	0	0	8	0	0	0	0	0	0	0
Basel, St. Claraspital	–	–	–	–	–	–	–	–	–	–
Basel, University Hospital	1	1	17	1	0	5	1	0	0	0
Bern, Hirslanden Klinik Beau-Site	0	0	13	0	0	0	0	0	0	0
Bern, Lindenhofspital	–	–	–	–	–	–	–	–	–	–
Bern, University Hospital (Inselspital)	4	2	59	0	0	7	18	43		10
Biel, Spitalzentrum	0	0	0	0	0	0	0	0	0	0
Chur, Kantonsspital Graubünden	0	0	0	0	0	0	0	0	0	0
Frauenfeld, Spital Thurgau AG	0	0	0	0	0	0	0	0	0	0
Fribourg, Hôpital Fribourgeois	0	0	8	0	0	0	0	0	0	0
Genève, Clinique des Grangettes	–	–	–	–	–	–	–	–	–	–
Genève, Hôpital de La Tour	0	0	0	0	0	0	0	0	0	0
Genève, University Hospitals	0	2	13	0	0	0	0	7	0	0
Genolier, Clinique de Genolier	0	0	0	0	0	0	0	0	0	0
Kreuzlingen, Herz-Neuro-Zentrum	0	0	1	0	0	0	0	0	0	0
Lachen, Spital Lachen AG	0	0	0	0	0	0	0	0	0	0
Lausanne, CHUV	7	1	5	–	–	1	1	9	4	2
Lausanne, Clinique de La Source	0	0	0	0	0	0	0	0	0	0
Lausanne, Hirslanden Clinique Cecil	–	0	0	0	0	0	0	0	0	0
Liestal, Kantonsspital Baselland	0	0	0	0	0	0	0	0	0	0
Lugano, Fondazione Cardiocentro	0	0	15	0	0	0	2	0	0	0
Luzern, Hirslanden Klinik St. Anna	0	0	5	0	0	0	0	0	0	0
Luzern, Kantonsspital	1	3	40	0	0	0	7	0	1	0
Morges, Hôpital de Morges	0	0	0	0	0	0	0	0	0	0
Pfäffikon, Cardiance Clinic	0	0	0	0	0	0	0	0	0	0

Sion, Centre de cardiologie du Valais	–	–	–	–	–	–	–	–	–	–
Sion, Hôpital de Sion	0	0	0	0	0	0	0	0	0	0
Solothurn, Bürgerspital	2	0	0	0	0	0	0	0	0	0
St. Gallen, Kantonsspital	0	0	7	0	0	0	0	0	0	0
Winterthur, Kantonsspital	0	0	0	0	0	0	0	0	0	0
Zürich, Hirslanden Klinik/Herzzentrum Hirslanden	1	0	34	0	0	0	2	0	0	0
Zürich, Klinik Im Park	3	6	28	0	0	0	1	0	0	0
Zürich, Stadtspital Triemli	0	2	6	0	0	1	0	0	0	0
Zürich, University Hospital	1	0	16	0	0	0	0	–	–	–
Total	20	17	314	1	0	14	33	59	5	12

TMVI = transcatheter mitral valve implantation; PTA = percutaneous transluminal angioplasty; TPVI = transcatheter pulmonary valve implantation.

Table 6b: Specific interventional therapy and data on closure devices.

Centre	TASH	Pericardial drainage (ad hoc or scheduled)	Catheter based therapy of pulmonary embolism	Catheter-based renal sympathetic denervation for treatment of hypertension	Coronary sinus reduction	Closure devices			
						PFO	ASD	VSD	LAA
Aarau, Hirslanden Klinik	1	–	0	0	0	23	5	–	39
Aarau, Kantonsspital	0	17	0	0	0	44	2	0	3
Basel, St. Claraspital	–	7	–	–	–	–	–	–	–
Basel, University Hospital	1	28	27	0	2	47	1	0	18
Bern, Hirslanden Klinik Beau-Site	4	2	0	0	0	16	–	0	4
Bern, Lindenhofspital	–	4	–	–	–	6	1	–	–
Bern, University Hospital	5	42	64	8	–	137	28	0	70
Biel, Spitalzentrum	0	6	0	0	0	14	1	0	0
Chur, Kantonsspital Graubünden	0	–	0	0	1	4	0	0	1
Frauenfeld, Spital Thurgau AG	0	0	0	0	0	19	0	0	0
Fribourg, Hôpital Fribourgeois	1	5	3	2	0	23	3	0	11
Genève, Hirslanden Clinique des Grangettes	–	3	–	–	–	3	1	–	–
Genève, Hôpital de La Tour	0	6	0	0	0	12	0	0	2
Genève, University Hospitals	4	26	0	0	0	30	3	1	–
Genolier, Clinique de Genolier	0	0	0	1	0	5	0	0	1
Kreuzlingen, Herz-Neuro-Zentrum Bodensee	0	5	0	0	0	3	0	0	0
Lachen, Spital Lachen AG	0	4	0	0	0	5	0	0	0
Lausanne, CHUV	3	13	–	2	–	33	11	2	7
Lausanne, Clinique de La Source	0	2	0	0	0	4	0	0	0
Lausanne, Hirslanden Clinique Cecil	0	–	0	0	0	–	–	–	–
Liestal, Kantonsspital Baselland	0	16	10	0	0	14	1	0	6

Lugano, Fondazione Cardiocentro Ticino	0	36	1	0	3	20	2	0	4
Luzern, Hirslanden Klinik St. Anna	0	2	0	0	0	6	2	1	2
Luzern, Kantonsspital	8	9	2	0	12	39	11	0	22
Morges, Hôpital de Morges	0	1	0	0	0	0	0	0	0
Pfäffikon, Cardiance Clinic	1	5	0	2	0	12	1	0	4
Sion, Centre de cardiologie du Valais	–	–	–	–	–	–	–	–	–
Sion, Hôpital de Sion	0	15	0	0	0	6	3	0	2
Solothurn, Bürgerspital	0	7	16	1	0	22	0	0	12
St. Gallen, Kantonsspital	0	25	2	0	0	37	3	0	8
Winterthur, Kantonsspital	0	8	0	0	0	10	1	0	0
Zürich, Hirslanden Klinik/Herzzentrum Hirslanden	0	17	0	0	0	24	7	0	17
Zürich, Klinik Im Park	4	–	–	1	–	58	5	–	28
Zürich, Stadtspital Triemli	5	21	0	0	0	57	7	1	20
Zürich, University Hospital	–	29	–	1	–	49	–	–	24
Total	37	361	125	18	18	782	99	5	305

TASH = transcatheter ablation of septal hypertrophy; PFO = persistent foramen ovale; ASD = atrial septal defect; VSD = ventricular septal defect; LAA = left atrial appendage

Conclusion

The national numbers of 2020, as collected by the Swiss PCI Survey, show a decrease in both cases for both coronary and as structural heart disease. Interestingly, TAVI cases decreased for the first time since 2007. Similarly, compared with 2019, we observed an 8.4% reduction in CAG and PCIs. These findings are well in line with several international studies that found a severe impact of the COVID-19 pandemic on the entire field of interventional cardiology and the number of heart interventions compared with preceding years [11–16]. Fortunately, although we have observed a reduction, it was not as dramatic as reported elsewhere [11–16]. Despite international recommendations, the number of cases with radial access remained stable at only 66%. Especially in times of the COVID-19 pandemic, radial access as the preferred route, which is known to be associated with lower complication rates and shorter hospital stays, might help to reduce the in-hospital resource use. Similarly, local versus general anaesthesia for TAVI could be beneficial, even though previous studies did not show a relevant reduction in the length of hospitalisation [17]. In order to further relieve strained hospital resources, a more liberal approach in identifying patients eligible for PCI or TAVI might be

promising. Regarding TAVI procedures, the transfemoral approach was the commonly used access (98.2%). Numbers of other structural interventions, such as the mitral edge-to-edge repair, PFO and LAA occlusions remained stable on a high level. Despite the observed decrease in overall cases due to the COVID-19 pandemic, the presented data still show a comparable performance in interventional cardiology for Switzerland compared with its European neighbours [18–21]. As a result of a well-organised and functional national network of the Swiss Working Group for Interventional Cardiology, nationwide data were collected on interventions for coronary and structural heart disease. National registries and standardised data collection as well as publication remain a key tool to assess the performance of a healthcare system and confirm outcomes and safety of procedures in interventional cardiology [22, 23].

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