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Impact of COVID-19 pandemic on cardiovascular diseases hospitalisation, management and mortality in Switzerland

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ABSTRACT

Background COVID-19 pandemic led to a reduction in hospital admissions and intervention for other diseases in many countries. We aimed to assess the effect of COVID-19 pandemic on cardiovascular disease (CVD) hospitalisations, management and mortality in Switzerland.

Methods Swiss hospital discharge and mortality data for period 2017–2020. CVD hospitalisations, CVD interventions and CVD mortality were assessed before (2017–2019) and during (2020) the pandemic. Expected numbers of admissions, interventions and deaths for 2020 were computed using simple linear regression model.

Results Compared with 2017–2019, 2020 was characterised by a reduction of CVD admissions in age groups 65–84 and ≥85 by approximately 3700 and 1700 cases, respectively, and by an increase in the percentage of admissions with a Charlson index >8. The total number of CVD-related deaths decreased from 21 042 in 2017 to 19 901 in 2019, and increased to 20 511 in 2020, with an estimated excess of 1139 deaths. This increase was due to out-of-hospital deaths (+1342), while the number of in-hospital deaths decreased from 5030 in 2019 to 4796 in 2020, which concerned mostly subjects aged ≥85 years. The total number of admissions with cardiovascular interventions increased from 55 181 in 2017 to 57 864 in 2019, and decreased in 2020, with an estimated reduction of 4414 admissions; percutaneous transluminal coronary angioplasty (PTCA) was the exception, as the number and percentage of emergency admissions with PTCA increased. The preventive measures applied against COVID-19 inverted the seasonal pattern of CVD admissions, the highest number of admissions being found in summer and the lowest in winter.

Conclusion The COVID-19 pandemic led to a reduction in CVD hospital admissions, planned CVD interventions, an increase in total and out-of-hospital CVD deaths and a change in seasonal patterns.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ The COVID-19 pandemic decreased cardiovascular disease (CVD) procedures but its effect on seasonality of CVD has seldom been assessed.

WHAT THIS STUDY ADDS

⇒ Confinement measures led to a shift on the seasonality of CVD events and mortality, and an increase in overall and out-of-hospital CVD deaths. A rebound in hospitalisations occurred after the measures were lifted.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ CVD admissions cannot be postponed due to confinement measures, and hospitals must maintain their capacity to admit patients with CVD during a pandemic.

INTRODUCTION

Cardiovascular disease (CVD), such as acute myocardial infarction (AMI) and stroke, has been the leading cause of death in Europe over the last four decades.[1 2] CVD is also the leading cause of death in Switzerland, accounting for 20 596 deaths in 2018.[3] Management of AMI includes revascularisation procedures such as percutaneous coronary intervention or, to a lesser degree, coronary artery bypass graft (CABG).

With the arrival of a global pandemic of COVID-19, there have been over 600 million confirmed cases, including over 6.5 million deaths, as of 30 September 2022.[4] Rapid spread of COVID-19 pandemic has severely disrupted CVD-related services in nearly 75% of the countries in the world.[5] In the beginning of the COVID-19 pandemic, many patients presenting with CVD delayed their admission to hospital for fear of being contaminated or due to hospital overload. According to a recent study, there was a considerable reduction in the number of patients with acute coronary syndromes attending the emergency department, and a reduction in hospitalisation of patients with CVD in England.[6] The admission rate of patients with acute coronary syndrome also decreased considerably in Italy and the USA during pandemic.[7 8] Further, COVID-19 itself has been suggested of precipitating acute

CVD events.[9] Whereas this reduction in hospital admissions for CVD also occurred in Switzerland has not been established.

Thus, we aimed to analyse the impact of COVID-19 pandemic on the CVD hospitalisations, procedures and mortality in Switzerland. Using hospital discharge data from 2017 to 2020, we compared CVD admissions, characteristics and severity of patients with CVD, and in-hospital and outside-hospital CVD mortality before (2017–2019) and during (2020) the COVID-19 pandemic.

MATERIALS AND METHODS

Swiss hospital discharge database

Deidentified data from the Swiss hospital discharge database for years 2017 –2020 were used. The database was provided by the Swiss Federal Office of Statistics (www.bfs.admin.ch). Data provision is compulsory and covers over 98% of public and private hospitals in Switzerland; all stays for each hospital are collected.[10] The information collected includes main and secondary diagnoses, year, month, gender, age group, nationality, type of admission (ie, emergency or planned), type of management, intensive care unit (ICU) stay, in-hospital death (yes/no) and length of stay (LOS). Main and secondary diagnoses at discharge were coded using the International Classification of Diseases, 10th revision (ICD10) of the WHO. Type of management was coded using the systematic inventory of the Swiss Classification of Operations (CHOP), which contains 'procedure codes' to illustrate specific medical services provided.[11] Overall LOS was indicated in days and LOS in an ICU in hours; when the LOS in the ICU was zero, it was considered as no stay in ICU.

The following diseases were considered: AMI; coronary heart disease (not AMI); congestive heart disease; heart rhythm disorders; stroke and transient ischaemic attack. The ICD10 codes corresponding to each condition are summarised in online supplemental table 1. For AMI, the ICD10 coding does not distinguish between STEMI and non-STEMI.

Procedures were coded according to CHOP criteria, and the following procedures were considered: CABG; percutaneous transluminal coronary angioplasty (PTCA) and other heart procedures. The CHOP codes corresponding to each procedure are summarised in online supplemental table 2. All procedures were coded as binary (yes/no) variables.

The Charlson index was computed using all ICD10 codes available and according to a Swiss formula.[12] It is the most widely used score to predict risk of death within 1 year of hospitalisation, with higher score indicating greater severity.[13]

Other databases

Population statistics by age were also obtained from the Swiss federal office of statistics.[14] COVID-19 statistics for 2020 were extracted from website COVID-19.admin.ch.

Statistical analysis

Statistical analyses were performed using R V.4.2.1.[15] Descriptive results were expressed as number of participants (percentage) for categorical variables and as average±SD or median (IQR) for continuous variables. Simple linear regression models were used with admissions, admissions with interventions and deaths per year as dependent variables and years 2017–2019 as independent variables. The resulting models were used to predict the number of admissions, admissions with interventions and deaths for year 2020, had the pandemic not occurred. The R-file computing the linear models is provided in online supplemental annex 1.

RESULTS

Hospital admissions for CVD

Overall, 104 876, 106 698, 111 077 and 104 744 CVD admissions were recorded in 2017, 2018, 2019 and 2020, respectively. The characteristics of the patients before pandemic (2017–2019) and during pandemic (2020) are summarised in table 1. Compared with the other years, 2020 was characterised by a reduction of CVD admissions in age groups 65–84 and ≥85 by approximately 3700 and 1700 cases, respectively, and by an increase in the number of admissions with a Charlson index >8. Similarly, the percentage of the emergency admissions for CVD was also the highest in 2020 while the percentage of planned admissions was the lowest. The percentages of admissions at ICU and mean LOS remain in the decreasing trend.

The number of admissions for total and specific causes of CVD is summarised in table 2. Between 2017 and 2019, the number of hospitalised CVD events increased, while in 2020 a strong decrease occurred and affected mainly heart disease events (table 2). The total number of CVD admissions increased from 2017 to 2019, followed by a sharp decrease in 2020, with an estimated reduction of 9000 CVD admissions (figure 1A). Cerebral vascular disease events continued to rise, and no decrease in admissions was observed in 2020 (table 2).

CVD DEATHS

The number of CVD-related deaths and their clinical characteristics are summarised in table 3. Between 2017 and 2019, the total number of CVD-related deaths decreased, to increase in 2020, with an estimated excess of approximately 1140 deaths (figure 1B). The number of in-hospital deaths was relatively stable during period 2017–2019, and a decrease was observed in 2020 (figure 1C), which concerned mostly subjects aged ≥85 years. Conversely, the outside-hospital deaths decrease observed for period 2017–2019 was followed by an increase of approximately 1340 deaths in 2020 (figure 1D) that concerned mostly subjects aged ≥85 years (table 3).

Seasonal variation of CVD hospitalisations and deaths

Between 2017 and 2019, the number of CVD admissions showed a seasonal variation pattern with higher admissions

Table 1 Characteristics of the patients with CVD as main diagnosis, Swiss hospital discharge data, 2017–2020

Year	2017		2018		2019		2020	
N	104 876		106 698		111 077		104 744	
Women	41 020	(39.1)	41 902	(39.3)	44 072	(39.7)	40 906	(39.1)
Age groups								
<25	183	(0.2)	191	(0.2)	178	(0.2)	209	(0.2)
25–44	2134	(2.0)	2113	(2.0)	2177	(2.0)	2070	(2.0)
45–64	24 709	(23.9)	24 905	(23.3)	25 340	(22.8)	24 486	(23.4)
65–84	57 298	(54.6)	57 958	(54.3)	60 326	(54.3)	56 649	(54.1)
≥85	19 821	(18.9)	20 828	(19.5)	22 286	(20.1)	20 569	(19.6)
NA	731	(0.7)	703	(0.7)	770	(0.7)	761	(0.7)
Swiss nationals	88 472	(84.4)	89 757	(84.1)	92 890	(83.6)	87 936	(84.0)
Type of admission								
Emergency	61 089	(58.3)	61 679	(57.8)	64 633	(58.19)	61 276	(58.5)
Planned	36 422	(34.7)	37 104	(34.8)	38 242	(34.4)	35 659	(34.0)
Other	7365	(7.0)	7915	(7.4)	8202	(7.38)	7809	(7.46)
Charlson index categories								
0–1	56 787	(54.2)	57 378	(53.8)	57 381	(51.7)	53 307	(50.9)
2–3	31 949	(30.5)	32 578	(30.5)	34 312	(30.9)	32 781	(31.3)
4–5	11 360	(10.8)	11 545	(10.8)	13 232	(11.9)	12 551	(12.0)
6–7	3064	(2.9)	3283	(3.1)	3939	(3.6)	3800	(3.6)
8+	1716	(1.6)	1914	(1.8)	2213	(2.0)	2305	(2.2)
Intensive care unit stay	18 841	(18.0)	18 266	(17.1)	17 918	(16.1)	15 825	(15.1)
Length of stay								
Median (IQR)	5	(2–11)	5	(2–11)	4	(2–11)	4	(2–10)

Results are expressed as mean±SD, median and (IQR) or as number of participants (percentage).
CVD, cardiovascular disease; NA, not available.

in the cold seasons; that is, first (January–March) and fourth (October–December) quarter, and lower admissions at third quarter (July–September). This pattern changed in 2020, with a nadir in the second quarter followed by a rebound in admissions in the third quarter (figure 2A,B).

Likewise, between 2017 and 2019, CVD deaths showed a seasonal variation pattern similar to hospital admissions. However, in 2020, even though CVD admissions rebounded at the third quarter, the number of CVD deaths remained relatively steady at the same period

Table 2 Specific causes of CVD as main diagnosis, Swiss hospital discharge data, 2017–2020

Year	2017		2018		2019		2020	
Total CVD admissions	104 876		106 698		111 077		104 744	
Total heart disease	77 191	(73.6)	77 946	(73.1)	81 599	(73.5)	74 744	(71.4)
AMI	18 997	(18.1)	18 898	(17.7)	19 244	(17.3)	18 646	(17.8)
CHD	20 853	(19.9)	21 085	(19.8)	21 035	(18.9)	18 691	(17.8)
CHF	20 813	(19.8)	21 255	(19.9)	23 255	(20.9)	20 415	(19.5)
HRD	16 528	(15.8)	16 708	(15.7)	18 065	(16.3)	16 992	(16.2)
Cerebral vascular disease	27 685	(26.4)	28 752	(26.9)	29 478	(26.5)	30 000	(28.6)
Stroke	23 213	(22.1)	24 158	(22.6)	24 766	(22.3)	25 060	(23.9)
TIA	4472	(4.3)	4594	(4.3)	4712	(4.2)	4940	(4.7)

Results are expressed as number of participants (percentage).
AMI, acute myocardial infarction; CHD, coronary heart disease; CHF, congestive heart disease; CVD, cardiovascular disease; HRD, heart rhythm disorders; TIA, transient ischaemic attack.

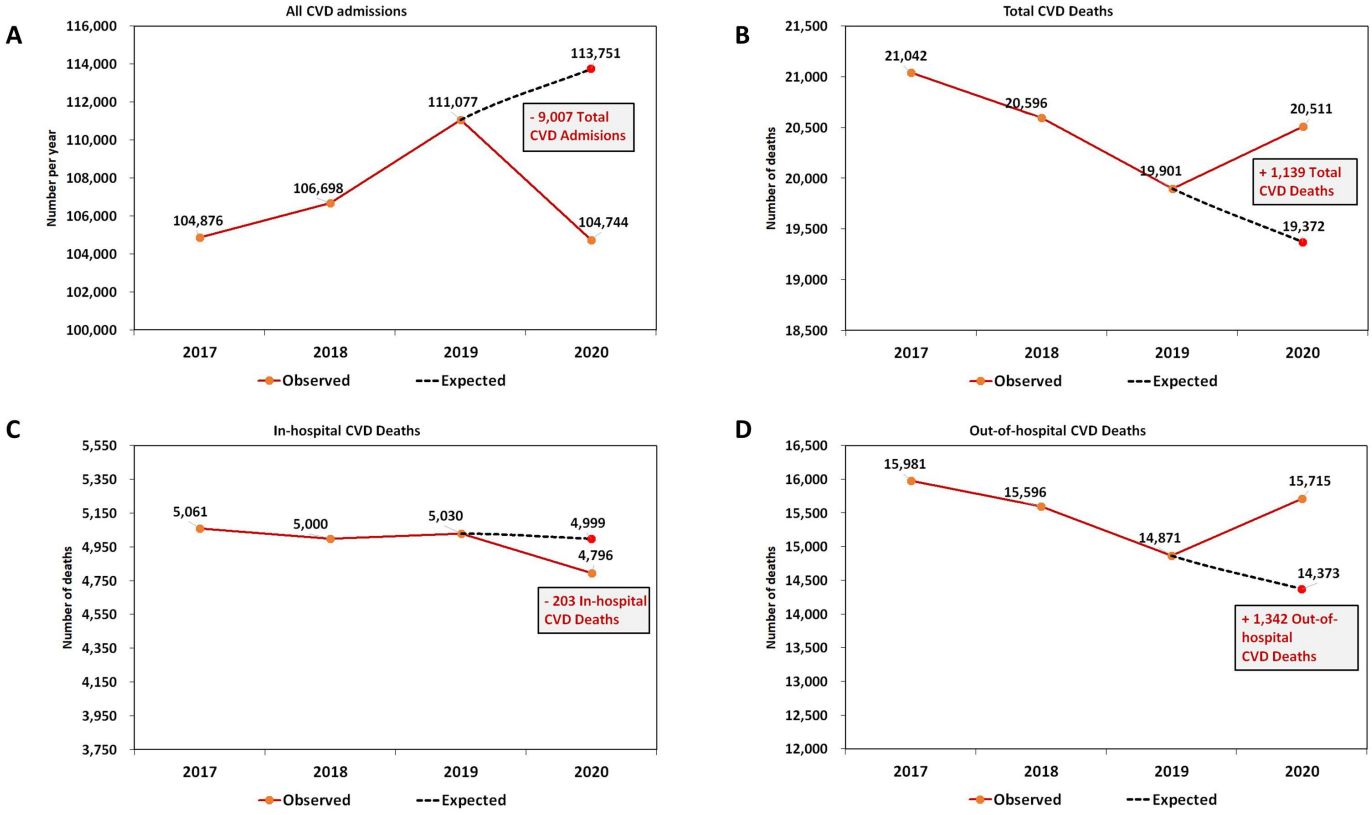

Figure 1 Observed and expected number of CVD admissions (A) and CVD-related mortality (B–D) before (2017–2019) and during (2020) the pandemic; expected values were calculated with simple linear regression model. For better visualisation of the results, the Y axes have been cut. CVD, cardiovascular diseases.

before increasing to peak at the fourth quarter. Although the number of CVD deaths at the start of 2020 was the lowest compared with other years, it became the highest compared with pre-pandemic period (2017–2019) at the end of 2020 (figure 2C,D).

Cardiovascular interventions

The total number of admissions with cardiovascular interventions increased from 2017 to 2019, followed by a sharp decrease in 2020, with an estimated reduction of 4400 admissions (figure 3A). The increase in the number of admissions with PTCA procedures during 2017–2019 stopped in 2020 and remained relatively stable, with an estimated decrease of 350 admissions. (figure 3B). Relative to the 2017–2019 period, in 2020, the number of the emergency admissions with PTCA procedures increased, while the percentage of PTCA carried out as planned admissions decreased (table 4). Conversely, the number of admissions with CABG and other heart operations decreased substantially in 2020, with an estimated loss of 160 admissions for CABG procedures and 3900 admissions for other heart operations in 2020 (figure 3C,D).

Compared with the previous year (2019), reductions of over 30% were seen for admissions with CABG and other heart operations after the first case of COVID-19 and the first restrictive measures. Similar reductions occurred after the second wave of COVID-19 and the corresponding measures. Conversely, the number of admissions with PTCA remained relatively stable with only a 9% reduction occurring after the first restrictive measures (online supplemental table 3).

DISCUSSION

Despite the fact that Switzerland is one of the countries in Europe with the lowest CVD deaths[16] with a steady downward trend over the last decade,[17] no study has assessed the trends in the CVD admissions, procedures and CVD deaths since the arrival of the COVID-19 pandemic. This study assessed the impact of COVID-19 pandemic on CVD-related hospitalisations, management and deaths in Switzerland. First, a reduction in the number of CVD admissions was seen, with a prominent deviation from the previous seasonal variation pattern. Second, a considerable reduction in admissions with CVD procedures occurred, while the number and percentage of emergency admissions for PTCA increased. Finally, the number of out-of-hospital CVD deaths increased and occurred mostly among elder patients, while in-hospital CVD deaths decreased.

Hospital admissions for CVD

The COVID-19 pandemic caused a global crisis of healthcare and greatly disrupted public healthcare system worldwide. For Switzerland, the first case of COVID-19 was detected on 25 February 2020[18] and two waves occurred,

Table 3 Characteristics of in-hospital and out-of-hospital cardiovascular deaths, Swiss hospital discharge data and mortality data, 2017–2020

Year	2017		2018		2019		2020	
	n	%	n	%	n	%	n	%
Total CVD deaths	21 042		20 596		19 901		20 511	
In-hospital deaths	5061	(24.0)	5000	(24.3)	5030	(25.3)	4796	(23.4)
Gender								
Male	2748	(54.30)	2706	(54.12)	2666	(53.00)	2609	(54.40)
Women	2313	(45.7)	2294	(45.9)	2364	(47.0)	2187	(45.6)
Age groups								
<45	65	(0.33)	66	(0.32)	49	(0.24)	45	(0.24)
45–64	487	(2.3)	496	(2.4)	499	(2.5)	490	(2.4)
65–84	2438	(11.6)	2352	(11.4)	2330	(11.7)	2326	(11.3)
≥85	2049	(9.7)	2065	(10.0)	2126	(10.7)	1910	(9.3)
NA	22	(0.1)	21	(0.1)	26	(0.1)	25	(0.1)
Swiss nationals	4405	(87.0)	4275	(85.5)	4376	(87.0)	4090	(85.3)
Out-of-hospital deaths	15 981	(76.0)	15 596	(75.7)	14 871	(74.7)	15 715	(76.6)
Gender								
Male	6841	(42.81)	6712	(43.04)	6448	(43.36)	6959	(44.28)
Women	9140	(57.2)	8884	(57.0)	8423	(56.6)	8756	(55.7)
Age groups								
<45	72	(0.3)	84	(0.4)	90	(0.5)	77	(0.4)
45–64	697	(3.3)	643	(3.1)	599	(3.0)	681	(3.3)
65–84	4988	(23.7)	4700	(22.8)	4534	(22.8)	4630	(22.6)
≥85	10 246	(48.7)	10 190	(49.5)	9674	(48.6)	10 352	(50.5)
Swiss nationals	14 975	(93.7)	14 609	(93.7)	13 858	(93.2)	14 528	(92.5)

Results are expressed as number of participants (percentage)
CVD, cardiovascular disease; NA, not available.

the biggest one in the fourth quarter[19] (figure 4A). As a response, restrictive measures such as closure of schools and workplaces, restriction of public and private gatherings, restricting entry to the country, and restriction of non-urgent treatments were implemented.[20 21] This led to a marked reduction in the number of CVD admissions in 2020, which was particular prominent following the outbreak and the restrictive measures put up (figure 4B). Although the changes in absolute numbers might be small (ie, a difference of 6333 admissions between 2019 and 2020, corresponding to a 6% decrease), still they can be considered as significant from a public health perspective, as Switzerland is a small country of 8.7 million inhabitants. Further, we believe it is more the sharp change in

Table 4 Total number of hospitalisations with CVD Procedures, Swiss hospital discharge data, 2017–2020

Year	2017		2018		2019		2020	
Total heart operations	55 181		56 349		57 864		54 734	
PTCA, of which	5114	(9.3)	5424	(9.6)	5978	(10.3)	6016	(11.0)
Emergency*	2589	(50.6)	2659	(49.0)	2798	(46.8)	3139	(52.2)
Planned*	1768	(34.6)	2008	(37.0)	2395	(40.1)	2039	(33.9)
Others*	757	(14.8)	757	(14.0)	785	(13.1)	838	(13.9)
CABG	3684	(6.7)	3408	(6.1)	3334	(5.8)	2969	(5.4)
Other heart operations	46 383	(84.1)	47 517	(84.3)	48 552	(83.9)	45 749	(83.6)

Results are expressed as number of participants (percentage).
*As number of participants (% of total cardiac catheterisation).
CABG, coronary artery bypass graft surgery; CVD, cardiovascular disease; PTCA, percutaneous transluminal coronary angioplasty.

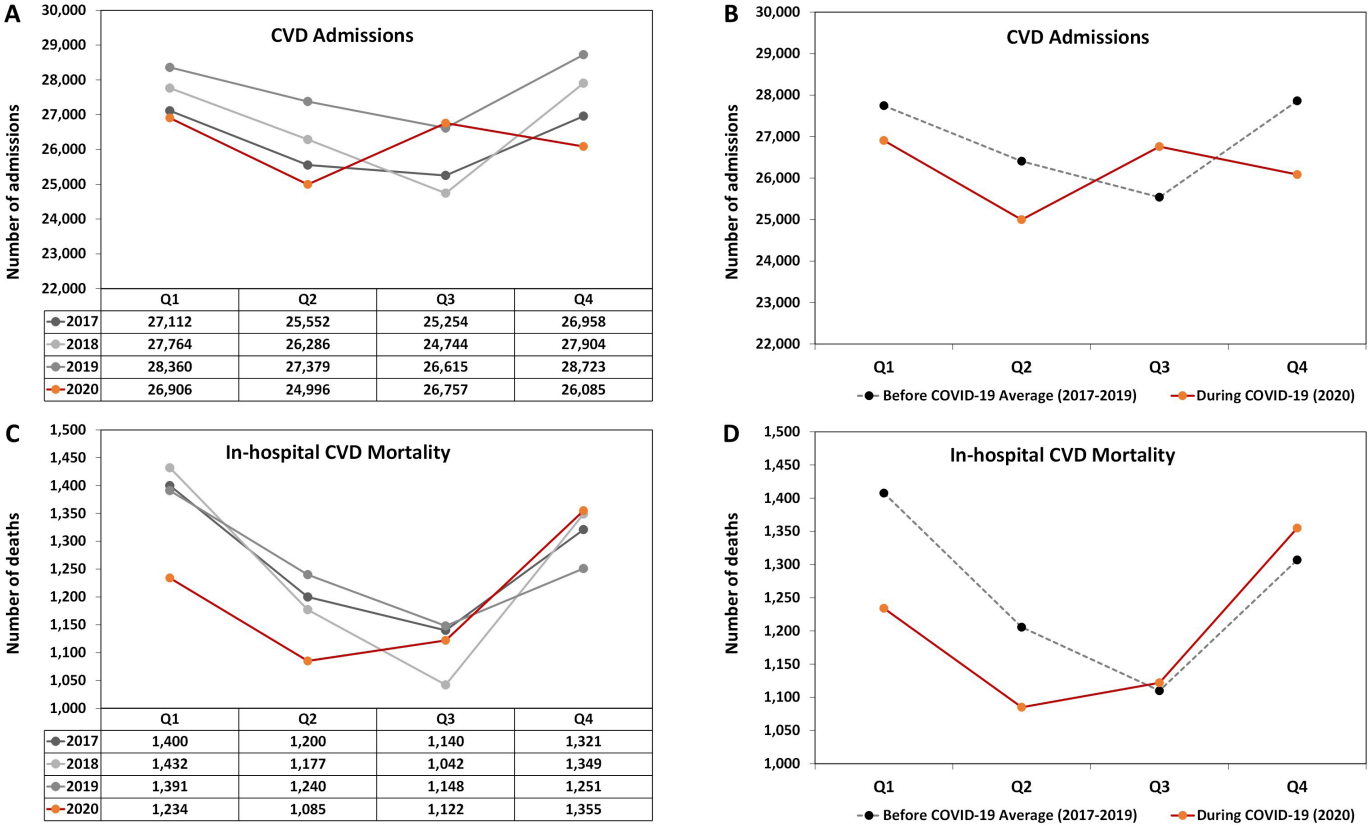

Figure 2 Comparison of quarterly CVD hospitalisations and CVD-related mortality before (2017–2019) and during (2020) the pandemic. (A) Number of CVD hospitalisations before (2017–2019) and during (2020) the pandemic; (B) average number of CVD hospitalisations before the pandemic (2017–2019) and the number of CVD hospitalisations during (2020) the pandemic; (C) number of CVD-related deaths before (2017–2019) and during (2020) the pandemic; (D) average number of quarterly CVD-related deaths before the pandemic (2017–2019) and number of CVD hospitalisations during (2020) the pandemic. CVD, cardiovascular diseases; Q (1–4), quarter (1–4) of the respective years.

the increasing trend of admissions that signals the impact of the pandemic and the corresponding restrictive measures.

The decline in the CVD admissions was first seen after the first COVID-19 case report, and it was the most prominent (ie, 24% reduction, compared with 2019) after the first restrictive measures on 20 March 2020. This decrease is within the range observed for other countries, where reductions in hospitalisations for acute coronary syndrome in March 2020 ranged from 20% to 73%.[22] This decrease was followed by a sharp upturn of CVD admissions in the third Quarter of 2020, leading to a prominent deviation of the seasonal pattern of CVD admissions; a similar trend was observed for the second wave of COVID-19 and the corresponding restrictive measures.[20] However, the decline in the admissions after the second restrictive measure was not prominent compared with the first measure, and this is most likely due to the fact that unlike the first restrictive measure, non-urgent treatments were not banned.

The number of CVD admissions with a Charlson score ≥8 increased, while the number of less severe CVD admissions decreased in 2020. This suggests that patients with CVD in need of hospitalisation delayed their admission, as reported in a survey conducted in 141 countries by the European Society of Cardiology, where an average of 48% of patients with ST-elevation myocardial infarction (STEMI) presented later than usual to the hospital, and thus developed a more severe status.[23] A large systematic review including studies from all over the world concluded that the COVID-19 pandemic substantially decreased the rate of admissions for acute CVD, the number of procedures and increased the delay between the onset of the symptoms and hospital treatment.[24]

Contrary to heart disease, the number of hospital admissions for stroke and TIA continued to increase, although at a slower pace. A recent systematic review reported varying trends in admissions for stroke during the pandemic, some studies reporting an increase, others a decrease and others no change.[24] A possible explanation is a lower control of cardiovascular risk factors such as hypertension and diabetes during the lockdown, which could have precipitated some events.[25 26]

Cardiovascular interventions

The number of admissions with CVD procedures decreased considerably in 2020, PTCA procedures being the least affected. Those findings are in agreement with the studies in England and the USA.[27 28] This is due to the fact that many elective procedures were cancelled or

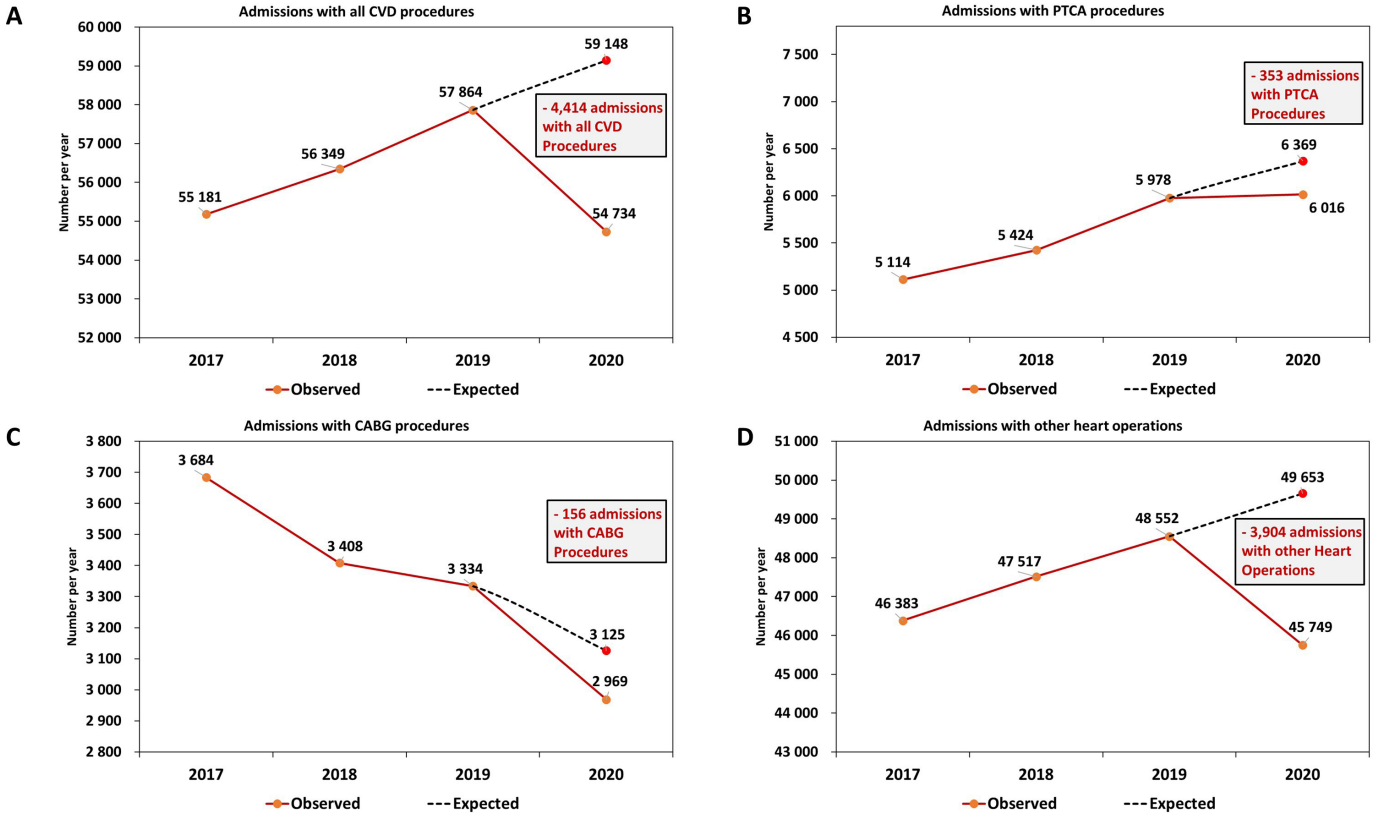

Figure 3 Observed and expected number of admissions with all CVD procedures (A), PTCA procedures (B), CABG procedures (C) and other heart operations (apart from PTCA and CABG) (D) before (2017–2019) and during (2020) the pandemic; expected values were calculated with simple linear regression model. For better visualisation of the results, the Y axes have been cut. CVD, cardiovascular diseases; PTCA, percutaneous transluminal coronary angioplasty; CABG, coronary artery bypass graft.

postponed[29] to address the outbreak of COVID-19 and its related admissions by creating additional healthcare capacities. Conversely, the percentage of emergency admissions with PTCA procedures increased, suggesting that the pandemic impacted mostly programmed procedures, as also reported in Canada.[30] However, according to the study on the management and outcomes of STEMI patients in Switzerland, the PTCA procedure in Switzerland did not change considerably in 2020 relative to the prepandemic period.[31 32] Still, a slow-down in the number of procedures was reported in 2019 and a small decrease in 2020. Further, the numbers provided in a recent study were fivefold higher than in the federal statistics.[32] A likely explanation is that the federal statistics indicate that at least one PTCA procedure has been conducted during the admission independently of the number of vessels dilated, while the data from the Swiss Society of Cardiology might relate to the number of procedures or the number of vessels dilated. Indeed, computing the number of vessels submitted to PTCA using the CHOP codes led to 41 369, 43 678, 45 455 and 40 607 vessels for 2017, 2018, 2019 and 2020, respectively, thus higher than reported previously.[32]

CVD deaths

The number of CVD deaths increased in 2020, contradicting the downward trend observed for period 2017–2019. This increase was due to the increase in the number of CVD deaths occurring outside of hospital and among elderly people. This increase in outside-hospital CVD deaths was also recorded in the USA and Italy.[33 34] The likely explanation is that elderly people, which were also the most affected aged group by COVID-19, were reluctant to reach the hospital when presenting with CVD symptoms, for fear of being contaminated. In addition, social distancing and other containment strategies imposed during the pandemic have been highlighted as a major risk factor for CVD deaths, and to be highly associated with increased CVD incidences.[35]

Study strengths and limitations

Our study adds further information to a previous studies[32 36] by reporting the effects of confinement measures on the seasonal variations in hospital admissions for CVD, CVD interventions, and in-hospital and out-of-hospital CVD deaths. Moreover, this study was based on official, exhaustive hospital and mortality data. Hence, the results are valid for the whole country.

However, there are several limitations for this study. First, the COVID-19 status of the admitted patients with CVD was not assessable in the hospital discharge data for 2020, and therefore the possible direct effect of COVID-19 on pre-existing CVD was not accounted for. Second, although the impact of COVID-19 on the

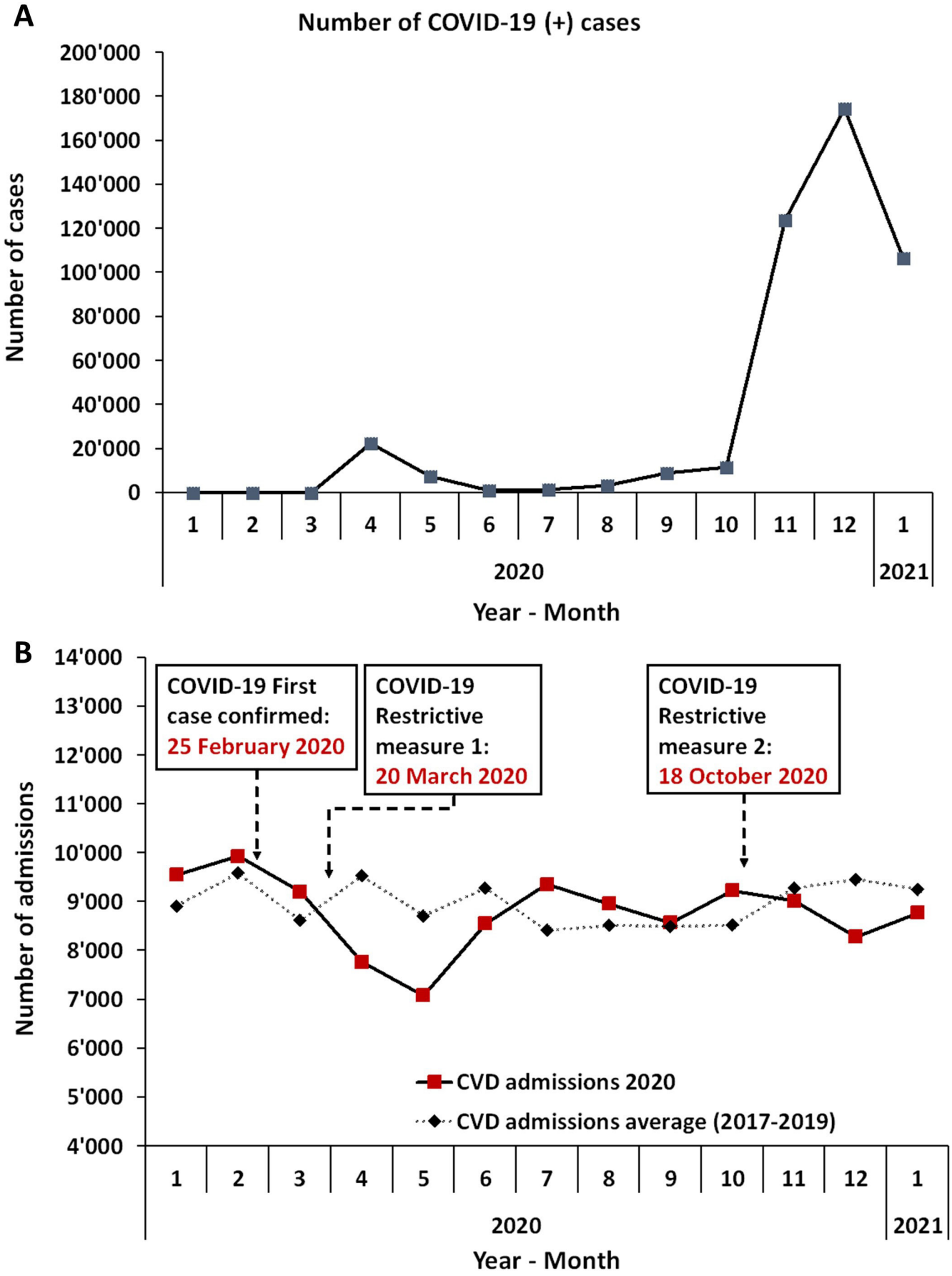

Figure 4 Incidence of confirmed COVID-19 (SARS-CoV-2) infections in Switzerland in 2020 (A), and the number of CVD hospitalisations in Switzerland and the timeline of major restrictive measures in 2020 (B). CVD, cardiovascular diseases.

CVD admissions and CVD-related procedures in 2020 was clearly visible, there is a limitation in analysing the trend due to the limited availability of the data, as only information up to 2020 was available at the time of study. Therefore, this study reflects the impact of COVID-19 for the year 2020 only. Third, pre-existing CVD is strongly associated with a poor outcome of COVID-19 infection, and the mortality of the COVID-19 positive patients with underling CVD comorbidities is substantially high.[37–40] Therefore, it is possible that the increase in patients with CVD who died from COVID-19 in 2020 (and who were not considered as dying of CVD) could partly explain the decrease of CVD in-hospital deaths in 2020. Finally, a direct effect of COVID-19 infection on CVD cannot be discarded, as it was estimated that a 10% COVID-19 prevalence could lead to up to 62 410 excess deaths in England.[41]

CONCLUSION

The COVID-19 pandemic led to a reduction in CVD hospital admissions, planned CVD interventions, an increase in total and out-of-hospital deaths, and a change in seasonal patterns in Switzerland.

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Contributors KKM: investigation, formal analysis, writing—original draft, visualisation. PM-V: conceptualisation, data curation, validation, writing—review and editing, supervision. PM-V had full access to the data and is the guarantor of the study.

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Competing interests None declared.

Patient consent for publication Not applicable.

Ethics approval The hospital discharge data are part of a Swiss government mandate and no agreement from an ethics committee is necessary. All data were coded prior to being used.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Due to legal constraints, sharing of the data is not allowed. People interested in obtaining the data should contact the Swiss Federal Office of Statistics (www.bfs.admin.ch) for further information.

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