

Consultations Decline for Stroke, Transient Ischemic Attack, and Myocardial Infarction during the COVID-19 Pandemic in Germany

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Keywords

Coronavirus disease 2019 · Pandemic · Stroke · Transient ischemic attack · Myocardial infarction · Germany

Abstract

Background: The coronavirus disease 2019 (COVID-19) pandemic raises the concern that other non-COVID conditions will be affected by a decline in care. Therefore, we aimed to investigate the decline in ambulatory presentations for vascular events (stroke, transient ischemic attack [TIA], and myocardial infarction [MI]) during the COVID-19 pandemic. **Methods:** Patients with a diagnosis of ischemic stroke, TIA, or MI documented anonymously in 1,262 general practices in Germany were included. We studied the differences between 2019 and 2020 (between April and June) in terms of rates and baseline characteristics by comparing monthly absolute frequencies. **Results:** A total of 3,496 patients with stroke (mean age: 72.2 years), 1,608 patients with TIA (mean age: 71.5 years), and 2,385 patients with MI (mean age: 66.8 years) were identified between April and June 2020, indicating a decrease of 10% (stroke), 16% (TIA), and 9% (MI) compared to 2019. For patients with stroke, the decrease in men was 13% (women: –6%) but reached 17% in the age category 51–60 years. For MI, the decrease was only obvious in

males (14%). The largest decrease in stroke (–17%) and MI (–19%) was noted in April, while that for TIA occurred in May (–22%). In June for all 3 conditions, the previous year's level was achieved. Only in TIA, the age differs between 2019 and 2020 (mean age: 69.9 vs. 71.5 years; $p < 0.05$). In patients with stroke and MI, the proportions of men were lower in 2019 than in 2020 (stroke: 54.8–50.5%, $p < 0.05$ and MI: 64–60.2%, $p < 0.05$). **Conclusion:** Although the decline in the number of patients presenting with stroke, TIA, and MI was not as noticeable in the ambulatory sector as it was in the area of emergency hospital-based care, our data indicate that the COVID-19 pandemic affected all sectors within the medical care system.

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Introduction

The implementation of strict rules worldwide for combating the impact of severe acute respiratory syndrome coronavirus-2, such as closure of medical practices, reduction of seat places in waiting rooms in medical practices, social distancing, and “stay at home” campaigns, has resulted in a decline in the number of people seeking medical care and also in how people are coping with illnesses [1–5].

Amid the current situation, maintaining the delivery chain for the provision of medical care is essential for stroke neurologists and cardiologists, as time is the most important factor when it comes to saving brain/heart tissue in case of acute ischemia [6]. In the algorithm for the treatment of an acute ischemic vascular event, the first step, the patient's awareness in recognizing the dysfunction and calling for medical assistance, may well be the most critical of all [7–9]. While acute care delivery could be optimized by streamlining infrastructures in order to recuperate resources for potential coronavirus disease 2019 (COVID-19) patients, the environment of a pandemic with “stay at home” appeals to the public may have deterred many from seeking help rapidly [7–9], and this might be one of the reasons for a reduction in presentations.

There is evidence supporting this hypothesis, as the incidence rates of various medical emergencies were lower during the COVID-19 pandemic [10]. Where stroke is concerned, the frequencies of acute hospital admissions decreased worldwide during the COVID-19 pandemic, resulting in lower rates of recanalization procedures such as thrombolysis or thrombectomy [11–15]. In an extended analysis including data from a large comprehensive department for neurology in Barcelona, Rudilosso et al. [13] detected a decline for acute ischemic strokes from 517 in March 2019 to 426 cases in March 2020 (–18%). In a comprehensive stroke center in New York, the monthly absolute number of acute interventions for stroke treatment decreased from 78 in February 2020 to a low mark of 25 cases in May 2020 [15]. Fewer cases of myocardial infarction (MI) were also reported, rendering lower rates of percutaneous coronary interventions [16–20]. In this regard, an analysis including hospital admissions for acute coronary syndromes in England a reduction of 40% during the pandemic was noted (weekly rate prior pandemic: 3,017 cases vs. 1,813 cases per week in the pandemic) [17]. As the short-term development information on acute vascular ischemic events during the COVID-19 pandemic is derived from hospital-based datasets, no comparable information on stroke and MI is yet available from the ambulatory sector [10–20].

In Germany, individuals with severe cardiovascular symptoms usually call and let call emergency doctors, since people with mild or moderate and especially unclear symptoms of stroke, MIA, and transient ischemic attack (TIA) often call or visit general (family) physician. Therefore, the present study was aimed at investigating rates of vascular events including stroke or TIA and acute MI during the COVID-19 pandemic using data from a large database provided by general practitioners in Germany.

Methods

Database

This study was based on data from the Disease Analyzer database (IQVIA), which contains diagnoses, drug prescriptions, and basic medical and demographic data obtained directly and in anonymous format from computer systems used in the practices of general practitioners and specialists [21]. The database covers approximately 3% of all outpatient practices in Germany. Diagnoses (according to the International Classification of Diseases, tenth revision [ICD-10]), prescriptions (according to the Anatomical Therapeutic Chemical Classification system), and the quality of reported data are monitored by IQVIA on an ongoing basis. In Germany, the sampling methods used to select physicians' practices are appropriate for obtaining a representative database of general and specialized practices. The sampling method for the Disease Analyzer database is based on summary statistics from all doctors in Germany published yearly by the German Medical Association. The statistical unit of IMS uses these statistics to determine the panel design according to the following strata: specialist group, German federal state, community size category, and age of physician [21]. This study contained 1,152 general practices which were open during the last 36 months including pandemic time and continuously delivered data to IQVIA.

Study Outcome

The outcome of this study was the development in the number of patients in 1,152 general practices receiving suspected or insured diagnoses of ischemic stroke (ICD-10: I63 and I64), TIA (ICD-10: G45), or MI (ICD-10: I21 and I22) for the first time between January and June 2020, as compared to January–June 2019. The absolute numbers were shown monthly. In order to reveal the pandemic-related trend, we compared the number of patients receiving initial diagnoses in each month of 2020 with numbers for same months in 2019 and calculated the change as follows (e.g., in June):

$$\frac{\text{Patients in June 2020} - \text{Patients in June 2019}}{\text{Patients in June 2019}} \times 100.$$

In the second step, the change was calculated for complete pandemic period (April–June 2020) versus the nonpandemic period (April–June 2019). This change was estimated for all patients with stroke, TIA, and MI and was also stratified by age-group (≤ 50 , 51–60, 61–70, and >70 years) and sex (male and female).

Finally, the baseline characteristics of patients initially diagnosed with stroke, TIA, or MI in April–June 2020 were compared with those of patients initially diagnosed with stroke, TIA, or MI in April–June 2019. These characteristics included age, sex, and comorbidities diagnosed within 12 months prior to the first diagnosis of stroke, TIA, or MI (diabetes [ICD-10: E10–14], hypertension [ICD-10: I10], hyperlipidemia [ICD-10: E78], atrial fibrillation [ICD-10: I48.0, I48.1, I48.2, and I48.9], and depression/anxiety disorder [ICD-10: F32, F33, and F41]).

Statistical Analysis

This study is of a descriptive nature, and no hypotheses were tested. As absolute patient numbers and not proportions were analyzed, the tests performed were not suitable for producing specific reasoning but instead only allowed for a trend descrip-

Table 1. Basic characteristics of stroke, TIA, and MI patients diagnosed in April–June 2019 and April–June 2020

	Stroke			TIA ^a			MI ^b		
	April–June 2019	April–June 2020	change 2020 vs. 2019 (%)	April–June 2019	April–June 2020	change 2020 vs. 2019 (%)	April–June 2019	April–June 2020	change 2020 vs. 2019 (%)
N	3,870	3,496	-10	1,923	1,608	-16	2,618	2,385	-9
Age (mean, SD)	72.2 (13.2)	72.2 (13.2)	-	69.9 (15.1)*	71.5 (14.3)*	-	66.2 (15.4)	66.8 (14.8)	-
Age 18–50	255 (6.6%)	224 (6.4%)	-10	201 (10.5%)	133 (8.3%)	-34	387 (14.8%)	317 (13.3%)	-21
Age 51–60	472 (12.2%)	437 (12.5%)	-17	290 (15.1%)	212 (13.2%)	-29	563 (21.5%)	475 (19.9%)	-17
Age 61–70	867 (22.4%)	752 (21.5%)	-10	396 (20.6%)	332 (20.6%)	-17	571 (21.8%)*	587 (24.6%)*	4
Age >70	2,276 (58.8%)	2,083 (59.6%)	-8	1,036 (53.9%)*	931 (57.9%)*	-9	1,097 (41.9%)	1,006 (42.2%)	-7
Sex									
Men	2,121 (54.8%)*	1,766 (50.5%)*	-6	925 (48.1%)	767 (47.7%)	-16	1,676 (64.0%)*	1,436 (60.2%)*	1
Women	1,749 (45.2%)*	1,730 (49.5%)*	-13	998 (51.9%)	841 (52.3%)	-17	942 (36.0%)*	949 (39.8%)*	-14
Comorbidities diagnosed within 12 months prior to the index date									
Diabetes	890 (23.0%)	829 (23.7%)	-	319 (16.6%)	262 (16.3%)	-	513 (19.6%)	475 (19.9%)	-
Hypertension	1,935 (50.0%)*	1,916 (54.8%)*	-	850 (44.2%)	728 (45.3%)	-	1,191 (45.5%)	1,090 (45.7%)	-
Hyperlipidemia	1,045 (27.0%)	975 (27.9%)	-	454 (23.6%)	389 (24.2%)	-	689 (26.3%)	646 (27.1%)	-
Atrial fibrillation	642 (16.6%)	615 (17.6%)	-	206 (10.7%)	174 (10.8%)	-	270 (10.3%)	241 (10.1%)	-
Depression/anxiety disorder	565 (14.6%)	486 (13.9%)	-	258 (13.4%)	204 (12.7%)	-	275 (10.5%)	279 (11.7%)	-
PAD ^c	356 (9.2%)	262 (7.5%)	-	117 (6.1%)	125 (7.8%)	-	209 (8.0%)	169 (7.1%)	-
Ischemic heart diseases	654 (16.9%)	577 (16.5%)	-	279 (14.5%)	244 (15.2%)	-	1,202 (45.9%)	1,047 (43.9%)	-
Previous vascular events									
Stroke	-	-	-	131 (6.8%)	116 (7.2%)	-	71 (2.7%)	76 (3.2%)	-
TIA ^a	147 (3.8%)	143 (4.1%)	-	-	-	-	29 (1.1%)	26 (1.1%)	-
MI ^b	170 (4.4%)	164 (4.7%)	-	64 (3.3%)	53 (3.3%)	-	-	-	-
Medication, intake of									
Diuretics	685 (17.7%)	598 (17.1%)	-	410 (21.3%)	359 (22.3%)	-	720 (27.5%)	630 (26.4%)	-
Beta blockers	1,985 (51.3%)	1,863 (53.3%)	-	637 (33.1%)	571 (35.5%)	-	1,228 (46.9%)	1,085 (45.5%)	-
Calcium channel blockers	1,161 (30.0%)	1,108 (31.7%)	-	377 (19.6%)	357 (22.2%)	-	516 (19.7%)	494 (20.7%)	-
ACE ^b inhibitors	1,362 (35.2%)	1,308 (37.4%)	-	500 (26.0%)	407 (25.3%)	-	893 (34.1%)	797 (33.4%)	-
Angiotensin II inhibitors	414 (10.7%)	323 (9.3%)	-	200 (10.4%)	148 (9.2%)	-	244 (9.3%)	203 (8.5%)	-
Statins	2,126 (54.9%)	1,982 (56.7%)	-	746 (38.8%)	630 (39.2%)	-	1,136 (43.4%)	1,069 (44.8%)	-
Platelet inhibitors	1,792 (46.3%)	1,619 (46.3%)	-	660 (34.3%)	534 (33.2%)	-	1,074 (40.0%)	956 (40.1%)	-
Oral anticoagulants	1,014 (26.2%)*	1,098 (31.4%)*	-	275 (14.3%)	216 (13.4%)	-	319 (12.2%)	296 (12.4%)	-

TIA, transient ischemic attack; MI, myocardial infarction. ^a TIA. ^b MI. ^c Peripheral artery disease. * *p* value <0.05.

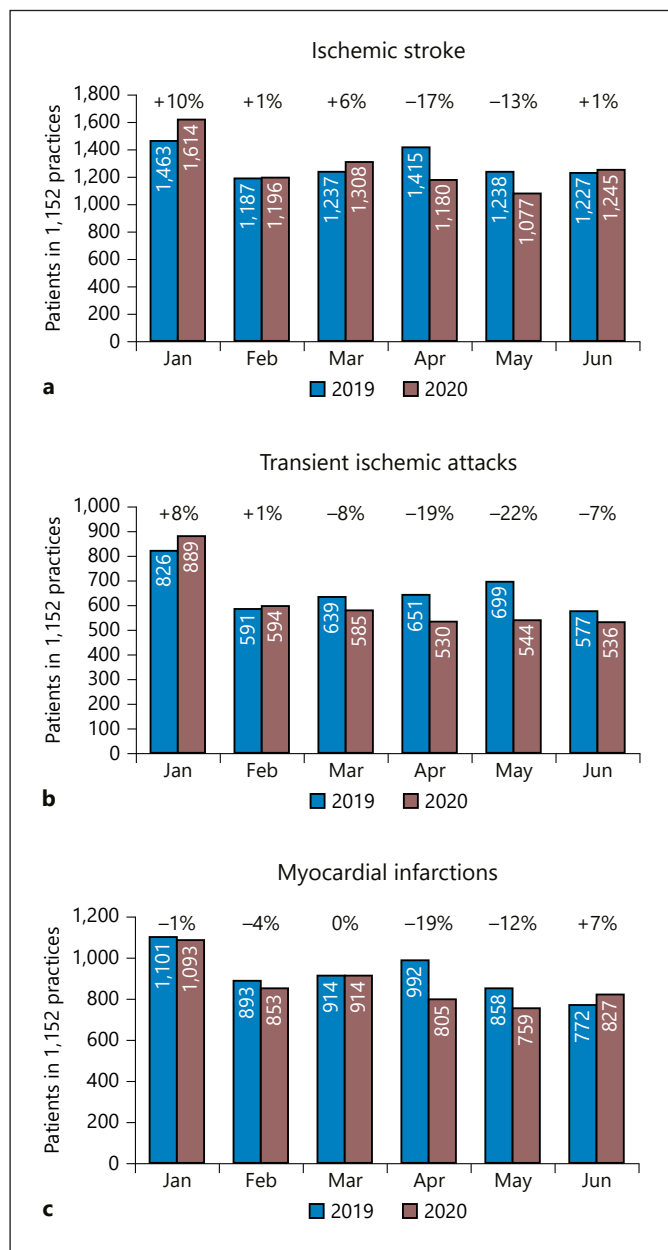


Fig. 1. Differences in the number of patients with a new diagnosis of ischemic stroke (a), TIA (b), and MI (c) in 1,152 general practices between January–June 2020 and January–June 2019. TIA, transient ischemic attack; MI, myocardial infarction.

tion. Differences in the baseline characteristics between patients diagnosed in both periods were analyzed using χ^2 tests for sex and predefined comorbidities and Wilcoxon test for age. A p value of <0.05 was considered statistically significant. The statistical analyses were performed with SAS 9.4 (SAS Institute, Cary, NC, USA).

Results

In 2019 (April–June), 3,870 patients in 1,152 private continuously accessible practices with stroke were documented in the database, while a decrease of 10% to 3,496 of cases presenting was noted for the corresponding period in 2020. The decrease in males was 13 versus 6% in females. Dichotomizing to age-classes, the largest decrease was observed in the category 51–60 years (–17%) (Table 1). A slight increase in stroke patients was documented (+6%) in March 2020 compared to March 2019. The proportions for April and May 2020 were lower than those for the same period in 2019 (–17 and –13%, respectively), while the level for June was unchanged (2019: $n = 1,227$ vs. 2020: $n = 1,245$) (Fig. 1). Comparing the number of stroke patients documented in the period between April and June for 2019 versus 2020, no differences in age distribution were noted. The proportion of male patients decreased from 54.8 to 50.5% ($p < 0.05$), and the proportion of individuals with hypertension increased from 50 to 54.8% ($p < 0.05$) (Table 1). In April–June 2020, the proportion of patients with a first-ever stroke and previous intake of oral anticoagulants was higher than in the corresponding period in 2019 (2020: 31.4 vs. 2019: 26.2%, $p < 0.05$) (Table 1).

Between April and June 2020, a total of 1,923 patients presenting with TIA were documented in the database, while a decrease of 16% to 1,608 was noted for the corresponding period in 2020. Dichotomized to age-classes, the largest decrease was observed in the category ≤ 50 years (–34%) (Table 1). A slight decrease in TIA patients was documented (–8%) in March 2020 compared to March 2019, and the figures were significantly lower in April and May 2020 than for the same period in 2019 (–19 and –22%) (Fig. 1). The mean age of TIA patients documented in the period between April and June 2020 was higher than that of patients documented in the same period for 2019 (mean 69.9 years in 2019 vs. 71.5 years in 2020, $p < 0.05$). However, no significant differences between 2019 and 2020 were observed with regard to the distribution of sex, risk factors, and comorbidities (Table 1).

A total of 2,618 patients presenting with MI were documented in the database between April and June 2019, while a decrease of 9% to 2,385 was noted for the corresponding period in 2020. The decrease in males between 2019 and 2020 was 14%, while the absolute number of cases increased slightly (+1%) in females. Dichotomized to age-classes, the largest decrease was observed in the category ≤ 50 years (Table 1). The number of cases of MI

in March 2020 was similar to that in March 2019 (both $n = 914$). In April and May 2020, the numbers were lower than for the same period in 2019 (-19 and -12%), and the levels for June 2020 were comparable to those in June 2019 (2019: $n = 1,227$ vs. 2020: $n = 1,245$) (Fig. 1). Comparing the number of MI patients documented in March–June 2019 to the number documented for the same period in 2020, it was observed that the proportion of male patients decreased from 64 to 60.2% in 2020 ($p < 0.05$), and the proportion of patients aged 61–70 years increased from 21.8 to 44.6% ($p < 0.05$) (Table 1).

Discussion

Our results indicate that, following the declaration of the worldwide COVID-19 pandemic on March 11, 2020, by the WHO, restrictions established in Germany led to a substantial reduction in outpatient medical consultations for potentially life-threatening conditions: stroke (10% decrease), TIA (16% decrease), and MI (9% decrease). For stroke and MI, the reduction was particularly pronounced in men and among young patients, while the decrease in TIA was caused mainly by lower numbers of younger patients presenting with the disorder. Medical consultations declined dramatically in April and May compared to the corresponding period in 2019, while the rates in June 2020 were almost equal to those for the previous year.

The restraint seeking for medical care in an outstanding situation such as the COVID-19 pandemic seems to apply for different disorders and to follow similar rules in different countries around the world [4, 5, 9, 10, 15, 19]. As the number of COVID-19 patients hospitalized increased in different countries, accumulating reports from severe acute respiratory syndrome coronavirus-2 hot spots indicated a sharp drop in the number of patients seeking other medical care [22–24]. In the early days of the pandemic in the USA, the total number of emergency department visits was 42% lower than during the same period a year earlier [25]. In one of the first investigations in Germany in the small state of Saarland, published in May 2020, Schwarz et al. [26] determined that there had been a decline in acute admissions to hospitals during the pandemic COVID-19 for stroke (-23%), TIA (-32%), and MI (decline to 2019: -41%). Analyzing visits in 38 acute emergency departments in Germany, Schlagman et al. [10] also detected a considerable reduction in acute submissions for stroke/TIA (April 2020 vs. April 2019: -24%) and MIs (April 2020 vs. April 2019: -40%). Our

results are consistent with these investigations, which are derived from figures pertaining to acute hospital-based care, especially in indicating the chronological development and, in particular, the nadir for stroke/TIA and MI consultations during the pandemic [10, 26]. In comparison with our results, however, which reflect the situation in the ambulatory sector on the basis of data provided by general practitioners, it seems the decrease observed by clinicians in acute hospitals was even more pronounced [10, 26]. The decline in consultations for stroke/TIA and MI is also obvious in the ambulatory care sector but is not as pronounced as that in hospital-based emergency care sector [10, 26].

Up to 10% of patients with suspected stroke and about 1 in every 5 patients with suspected TIA are eventually determined to be experiencing functional mimics, while in 20–30% of the patients presenting with chest pain are of functional origin [27–34]. However, the possibility that symptoms have a functional background only explains our results in part. As functional symptoms are more frequent in young patients, the reduction in the number of young stroke/TIA or MI patients depicted in our study could be linked to this observation [28, 32]. As cardiovascular events are often triggered by physical activity, this could be also a contributing factor with respect to the decline depicted, as restrictions implemented during the pandemic might also influence such activities [35]. The largest decline detected in our study was in individuals diagnosed with TIA (-16%), indicating that patients with transient deficits or even mild strokes are more likely not to seek medical care. Data reported by Siegler et al. [36] from a comprehensive stroke center in New Jersey (USA) confirm this trend; they found that mild strokes were less prevalent in stroke centers during the pandemic. Correspondingly, the mean NIH stroke scale value increased from 5 in the pre-COVID-19 period to 8 during the pandemic [36]. Furthermore, the colleagues from New Jersey observed an increasing proportion of patients presenting with acute large vessel occlusion (21–38%) during the COVID-19 pandemic [36]. It could be assumed that the lack of treatment for TIA and mild strokes as a result of patients failing to seek medical care could result in increasing numbers of severe events later on [36]. While in our study the absolute number of patients diagnosed with an acute stroke declined in the pandemic, the frequency of patients with a first-ever stroke and previously treated with oral anticoagulants increases from 26.2 in 2019 to 31.4% in 2020. This could be interpreted as a shift toward more presented stroke patients with a previous treatment with oral anticoagulants

as a result of a pandemic-related decline in 2020, but it also can be speculated the intake of oral anticoagulants might be a favorable factor for patients when soliciting medical care in case of stroke.

Differences regarding sex depicted in our study could be determined by sex-specific coping strategies with regard to illness [37]. There are no conclusive reasons for differences regarding the factors of sex depicted in our study. In stroke as well as in MI, the proportion decline during the pandemic was more pronounced in men, indicating there are sex differences in coping with illness [37–39].

In summary, the COVID-19 pandemic seems to have had an outstanding impact on established acute medical care systems, with our study demonstrating this effect in the ambulatory sector for acute vascular events which present entirely differently from a clinical perspective. In response to the drop in numbers documented, first reports are now being prepared, indicating barriers to the delivery of medical care during the COVID-19 pandemic results in higher morbidity and mortality rates [40, 41]. However, the decline in visits to emergency medical services across sectors during the COVID-19 pandemic could also be interpreted as a marker of overcapacities in the medical care system. Notwithstanding this, taking into account all of the information provided in the literature and adding the conclusions drawn from our findings, a fear of getting infected with the virus may be one of the reasons for the decline in the uptake of medical care observed in the COVID-19 pandemic. Facing the remarkable decline of treated patients during the pandemic in different parts of the globe, it could be speculated the difference to the regular emergence in the period of reference might indicate the number of individuals who probably missed an adequate therapy. Especially in cases, which required an interventional therapy such as thrombectomy in stroke or coronary angiography in MI, the detected gap might be in particular a matter of concern.

In our study, several other factors could not be analyzed. First, information of other potential reasons that medical emergency declined was lacking. These factors include fewer industrial accidents due to manufacturing and construction closures, fewer sports injuries, fewer stress-related cardiovascular events due to stress at work or spectator sporting events, and so on. Second, there may be a reduced rate at which medical services can accommodate non-COVID presentations during the pandemic. Third, stroke, TIA, and MI diagnosis data relied solely on ICD-10 codes, and no data were available on the diagno-

sis process or the severity/activity of the disease. Fourth, no information was available on behavioral factors (e.g., alcohol use, smoking, and sedentary lifestyle), and the roles played by these factors could not be examined. Fifth, the database used does not contain any data on mortality, and no effect of the delay on the diagnosis of MI and stroke on the mortality could be investigated. Sixth, no hospital data were available, and only outpatients were analyzed. The 2 major strengths of this study are the number of patients available for analysis and the detailed analyses using real-world data.

Conclusion

Our findings concerning outpatient care during the COVID-19 pandemic complement data previously reported in hospital-based reports. In our study, the decline in the number of consultations for the diagnosis of stroke, TIA, and MI was obvious but was still less pronounced than that shown in the corresponding data pertaining to hospital-based emergency care. For factors associated with the decline in consultations in the ambulatory sector, we observed the same trend as previously reported for younger age, male sex, and, in the case of TIA, the conjunction with less severe events. Our data add valuable information to the field, indicating that the decline in stroke, TIA, and MI cases during the COVID-19 pandemic affected all sectors within the medical care delivery system. Studies are needed to assess further factors possible associated with a decline in the number of patients with acute events in Germany. Especially investigations for identifying those who refrained from seeking medical care in the pandemic are important to unveil the non-COVID-19-related morbidity caused in this specific environment. This would allow to estimate the overall impact of the pandemic.

Statement of Ethics

German law allows the use of anonymous electronic medical records for research purposes under certain conditions. According to this legislation, it is not necessary to obtain informed consent from patients or approval from a medical Ethics Committee for this type of observational study that contains no directly identifiable data. Because patients were only queried as aggregates and no protected health information was available for queries, no approval from an institutional review board was required for the use of this database or the completion of this study.

Conflict of Interest Statement

We received no funding for this study. All authors hereby declare that they have no conflicts of interest or competing interests related to the current manuscript.

Author Contributions

K.K. and C.T. developed the idea for the study; K.K. analyzed the data. C.T., K.K., and L.J. wrote the manuscript. All authors contributed and reviewed the final version of the manuscript.

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