

SUPPLEMENT

Hospitalizations for emergency-sensitive conditions in Germany

during the Covid-19 pandemic

Insights from the German-wide Helios hospital network

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Figure S1. Hospitalizations per hospital in 2019 and 2020.

German Diagnosis Related Groups

The German Diagnosis Related Groups (G-DRG) system is used for hospital reimbursement in Germany since 2004 and is subject to encoded diagnoses (International Statistical Classification of Diseases, German Modification; ICD-10 GM) and procedures (German procedure classification; OPS). This obligatory documentation and accounting system is specified and regulated in detail by mandatory coding instructions and requires the coding of a main diagnosis for all in-hospital cases reflecting the underlying cause for hospital admission. Up to 15% of the codes are controlled – and corrected if required – by specialized physicians (“Medizinischer Dienst der Krankenversicherung”) independently from health insurances and hospitals. Administrative data for this study were extracted from QlikView (QlikTech, Radnor, Pennsylvania, USA).

Table S1. Emergency hospital admissions in the German-wide Helios hospital network during the Covid-19 pandemic. ICD-10 codes for the emergency-sensitive conditions are provided in parenthesis.⁷

| | | Deficit period | | | Resumption period | | | |
|--|----------|------------------|---------------------|----------------|-------------------|------------------|---------------------|----------------|
| | <i>n</i> | Daily admissions | IRR (95% CI) | <i>P</i> value | <i>n</i> | Daily admissions | IRR (95% CI) | <i>P</i> value |
| Diabetes mellitus type 2 (E11) | | | | | | | | |
| 2019 | 1,291 | 13.7 | | | 2,147 | 13.7 | | |
| 2020 | 1,102 | 11.7 | 0.85 (0.79–0.92) | < 0.01 | 2,057 | 13.1 | 0.96 (0.90–1.02) | 0.16 |
| Other disorders of fluid, electrolyte and acid-base balance (E87) | | | | | | | | |
| 2019 | 412 | 4.4 | | | 920 | 5.9 | | |
| 2020 | 357 | 3.8 | 0.87 (0.75–1.00) | 0.04 | 919 | 5.8 | 1.00 (0.91–1.09) | 0.98 |
| Other disorders of brain (G93) | | | | | | | | |
| 2019 | 59 | 0.6 | | | 121 | 0.8 | | |
| 2020 | 49 | 0.5 | 0.83 (0.57–1.21) | 0.34 | 122 | 0.8 | 1.01 (0.78–1.30) | 0.95 |
| Pulmonary embolism (I26) | | | | | | | | |
| 2019 | 660 | 7.0 | | | 1,215 | 7.7 | | |
| 2020 | 660 | 7.0 | 1.00 (0.90–1.11) | 1.00 | 1,386 | 8.8 | 1.14 (1.06–1.23) | < 0.01 |
| Cardiac arrest (I46) | | | | | | | | |
| 2019 | 143 | 1.5 | | | 238 | 1.5 | | |
| 2020 | 138 | 1.5 | 0.97 (0.76–1.22) | 0.77 | 233 | 1.5 | 0.98 (0.82–1.17) | 0.81 |
| Heart failure (I50) | | | | | | | | |
| 2019 | 6,152 | 65.4 | | | 9,054 | 57.7 | | |
| 2020 | 5,187 | 55.2 | 0.84 (0.81–0.87) | < 0.01 | 9,101 | 58.0 | 1.01 (0.98–1.03) | 0.73 |
| Subarachnoid haemorrhage (I60) | | | | | | | | |

| | | | | | | | | |
|--|-------|------|---------------------|--------|-------|------|---------------------|------|
| 2019 | 67 | 0.7 | | | 110 | 0.7 | | |
| 2020 | 62 | 0.7 | 0.93 (0.66–1.31) | 0.66 | 112 | 0.7 | 1.02 (0.78–1.32) | 0.89 |
| Intracerebral haemorrhage (I61) | | | | | | | | |
| 2019 | 320 | 3.4 | | | 546 | 3.5 | | |
| 2020 | 331 | 3.5 | 1.03 (0.89–1.21) | 0.67 | 498 | 3.2 | 0.91 (0.81–1.03) | 0.13 |
| Other non traumatic intracranial haemorrhage (I62) | | | | | | | | |
| 2019 | 57 | 0.6 | | | 102 | 0.6 | | |
| 2020 | 43 | 0.5 | 0.75 (0.51–1.12) | 0.16 | 102 | 0.6 | 1.00 (0.76–1.32) | 1.00 |
| Cerebral infarction (I63) and unspecified stroke (I64)* | | | | | | | | |
| 2019 | 3,018 | 32.1 | | | 4,960 | 31.6 | | |
| 2020 | 2,824 | 30.0 | 0.94 (0.89–0.98) | 0.01 | 5,035 | 32.1 | 1.02 (0.98–1.06) | 0.45 |
| Aortic aneurism and dissection (I71) | | | | | | | | |
| 2019 | 131 | 1.4 | | | 224 | 1.4 | | |
| 2020 | 138 | 1.5 | 1.05 (0.83–1.34) | 0.67 | 271 | 1.7 | 1.21 (1.02–1.44) | 0.03 |
| Adult respiratory distress syndrome (J80) | | | | | | | | |
| 2019 | 11 | 0.1 | | | 16 | 0.1 | | |
| 2020 | 34 | 0.4 | 3.09 (1.57–6.09) | < 0.01 | 25 | 0.2 | 1.56 (0.84–2.92) | 0.16 |
| Respiratory failure, not elsewhere classified (J96) | | | | | | | | |
| 2019 | 184 | 2.0 | | | 277 | 1.8 | | |
| 2020 | 131 | 1.4 | 0.71 (0.57–0.88) | < 0.01 | 305 | 1.9 | 1.10 (0.94–1.29) | 0.23 |
| Duodenal ulcer (K26) | | | | | | | | |
| 2019 | 329 | 3.5 | | | 577 | 3.7 | | |
| 2020 | 306 | 3.3 | 0.93 (0.80–1.08) | 0.35 | 598 | 3.8 | 1.04 (0.93–1.16) | 0.53 |

| Vascular disorders of intestine (K55) | | | | | | | | |
|--|-------|------|---------------------|--------|-------|------|---------------------|------|
| 2019 | 288 | 3.1 | | | 440 | 2.8 | | |
| 2020 | 287 | 3.0 | 1.00 (0.85–1.17) | 0.97 | 471 | 3.0 | 1.07 (0.94–1.22) | 0.30 |
| Diverticular disease of intestine (K57) | | | | | | | | |
| 2019 | 1,225 | 13.0 | | | 2,190 | 14.0 | | |
| 2020 | 1,101 | 11.7 | 0.90 (0.83–0.97) | < 0.01 | 2,166 | 13.8 | 0.99 (0.93–1.05) | 0.71 |
| Peritonitis (K65) | | | | | | | | |
| 2019 | 122 | 1.3 | | | 220 | 1.4 | | |
| 2020 | 122 | 1.3 | 1.00 (0.78–1.29) | 1.00 | 233 | 1.5 | 1.06 (0.89–1.27) | 0.53 |
| Hepatic failure (K72) | | | | | | | | |
| 2019 | 75 | 0.8 | | | 103 | 0.7 | | |
| 2020 | 50 | 0.5 | 0.67 (0.47–0.95) | 0.03 | 95 | 0.6 | 0.92 (0.70–1.22) | 0.57 |
| Acute pancreatitis (K85) | | | | | | | | |
| 2019 | 745 | 7.9 | | | 1,221 | 7.8 | | |
| 2020 | 651 | 6.9 | 0.87 (0.79–0.97) | 0.01 | 1,195 | 7.6 | 0.98 (0.90–1.06) | 0.59 |
| Other diseases of digestive system (K92) | | | | | | | | |
| 2019 | 548 | 5.8 | | | 916 | 5.8 | | |
| 2020 | 467 | 5.0 | 0.85 (0.75–0.96) | < 0.01 | 865 | 5.5 | 0.94 (0.86–1.04) | 0.22 |
| Shock, not elsewhere classified (R57) | | | | | | | | |
| 2019 | 54 | 0.6 | | | 101 | 0.6 | | |
| 2020 | 61 | 0.7 | 1.13 (0.78–1.63) | 0.51 | 122 | 0.8 | 1.21 (0.93–1.57) | 0.16 |
| Fracture of lumbar spine and pelvis (S32) | | | | | | | | |
| 2019 | 1,065 | 11.3 | | | 1,796 | 11.4 | | |

| | | | | | | | | |
|--|-------|------|---------------------|------|-------|------|---------------------|--------|
| 2020 | 1,013 | 10.8 | 0.95 (0.87–1.04) | 0.25 | 1,711 | 10.9 | 0.95 (0.89–1.02) | 0.15 |
| Fracture of femur (S72) | | | | | | | | |
| 2019 | 2,322 | 24.7 | | | 3,787 | 24.1 | | |
| 2020 | 2,398 | 25.5 | 1.03 (0.98–1.09) | 0.27 | 4,097 | 26.1 | 1.08 (1.04–1.13) | < 0.01 |
| Complications of cardiac and vascular prosthetic devices, implants and grafts (T82) | | | | | | | | |
| 2019 | 382 | 4.1 | | | 677 | 4.3 | | |
| 2020 | 357 | 3.8 | 0.93 (0.81–1.08) | 0.35 | 658 | 4.2 | 0.97 (0.87–1.08) | 0.60 |

Table S2. Hospitalizations in emergent bed-based, emergent bed-based for emergency-sensitive conditions and ambulatory care between 2016 and 2020. Please note, that the reduction is also apparent when comparing IRR of 2020 with previous years.

| Year | n | Daily admissions | IRR (95% CI) | P value |
|--|---------|------------------|------------------|---------|
| Inpatient cases | | | | |
| 2016 | 462,204 | 1435.4 | 0.95 (0.95–0.96) | < 0.01 |
| 2017 | 476,534 | 1479.9 | 0.98 (0.98–0.99) | < 0.01 |
| 2018 | 479,388 | 1488.8 | 0.99 (0.99–0.99) | < 0.01 |
| 2019 | 484,368 | 1504.2 | Reference | |
| 2020 | 453,082 | 1407.1 | 0.94 (0.93–0.94) | < 0.01 |
| 2020* | 435,793 | 1353.4 | 0.90 (0.90–0.90) | < 0.01 |
| Inpatient cases, emergency-sensitive conditions | | | | |
| 2016 | 123,449 | 383.4 | 0.92 (0.91–0.93) | < 0.01 |
| 2017 | 130,573 | 405.5 | 0.97 (0.96–0.98) | < 0.01 |
| 2018 | 133,942 | 416.0 | 1.00 (0.99–1.00) | < 0.37 |
| 2019 | 134,409 | 417.4 | Reference | |
| 2020 | 124,559 | 386.8 | 0.93 (0.92–0.93) | < 0.01 |
| 2020* | 119,802 | 372.1 | 0.89 (0.88–0.90) | < 0.01 |
| Outpatient cases | | | | |
| 2016 | 35,896 | 111.5 | 1.15 (1.13–1.16) | < 0.01 |
| 2017 | 31,757 | 98.6 | 1.01 (1.00–1.03) | 0.07 |
| 2018 | 29,892 | 92.8 | 0.95 (0.94–0.97) | < 0.01 |
| 2019 | 31,306 | 97.2 | Reference | |
| 2020 | 17,813 | 55.3 | 0.57 (0.56–0.58) | < 0.01 |
| 2020* | 17,356 | 53.9 | 0.55 (0.54–0.56) | < 0.01 |

* Exclusion of hospitals with inconsistent data availability.

Table S3. In-hospital mortality for emergency-sensitive conditions.

| | Deficit period | | | Resumption period | | |
|--|----------------|---------------------|---------|-------------------|---------------------|---------|
| Year | Proportion (n) | Odds ratio (95% CI) | P value | Proportion (n) | Odds ratio (95% CI) | P value |
| Diabetes Mellitus type 2 | | | | | | |
| 2019 | 2.9% (36) | | | 2.4% (50) | | |
| 2020 | 3.9% (41) | 1.33 (0.85– 2.11) | 0.21 | 2.6% (52) | 1.08 (0.73– 1.60) | 0.70 |
| Volume depletion | | | | | | |
| 2019 | 4.3% (67) | | | 3.6% (111) | | |
| 2020 | 5.1% (62) | 1.21 (0.85– 1.73) | 0.29 | 3.0% (85) | 0.82 (0.61– 1.09) | 0.16 |
| Delirium, not induced by alcohol and other psychoactive substances | | | | | | |
| 2019 | 4.8% (16) | | | 4.0% (23) | | |
| 2020 | 5.0% (12) | 1.04 (0.47– 2.23) | 0.92 | 4.0% (19) | 0.98 (0.52– 1.83) | 0.96 |
| Other disorders of brain | | | | | | |
| 2019 | 18.2% (10) | | | 8.8% (10) | | |
| 2020 | 6.7% (3) | 0.32 (0.07– 1.13) | 0.10 | 16.1% (18) | 1.99 (0.89– 4.69) | 0.10 |
| Acute Myocardial Infarction (AMI) or Other acute ischemic heart disease | | | | | | |
| 2019 | 6.4% (158) | | | 5.5% (216) | | |
| 2020 | 7.1% (165) | 1.10 (0.88– 1.38) | 0.40 | 6.2% (261) | 1.13 (0.94– 1.36) | 0.19 |
| Pulmonary embolism | | | | | | |
| 2019 | 10.5% (67) | | | 10.8% (126) | | |
| 2020 | 8.7% (55) | 0.81 (0.55– 1.17) | 0.27 | 8.8% (117) | 0.80 (0.61– 1.04) | 0.10 |
| Cardiac arrest | | | | | | |
| 2019 | 96.3% (129) | | | 94.4% (219) | | |
| 2020 | 92.7% (127) | 0.49 (0.15– 1.43) | 0.21 | 91.2% (206) | 0.61 (0.29– 1.25) | 0.18 |
| Subarachnoid haemorrhage | | | | | | |
| 2019 | 28.8% (15) | | | 23.3% (20) | | |

| | | | | | | |
|--|-------------|-------------------|------|-------------|-------------------|------|
| 2020 | 28.6% (14) | 0.99 (0.41– 2.35) | 0.98 | 31.5% (29) | 1.52 (0.78– 2.99) | 0.22 |
| Intracerebral haemorrhage | | | | | | |
| 2019 | 37.4% (102) | | | 38.5% (174) | | |
| 2020 | 37.8% (104) | 1.02 (0.72– 1.44) | 0.91 | 39.2% (162) | 1.03 (0.78– 1.36) | 0.83 |
| Other non traumatic intracranial haemorrhage | | | | | | |
| 2019 | 8.7% (4) | | | 9.4% (8) | | |
| 2020 | 22.2% (8) | 3.00 (0.86–12.13) | 0.10 | 16.5% (15) | 1.90 (0.78– 4.96) | 0.17 |
| Cerebral infarction or Stroke, not specified as haemorrhage or infarction | | | | | | |
| 2019 | 6.1% (168) | | | 6.3% (283) | | |
| 2020 | 6.9% (178) | 1.13 (0.91– 1.41) | 0.26 | 5.6% (254) | 0.88 (0.74– 1.04) | 0.14 |
| Aortic aneurism and dissection | | | | | | |
| 2019 | 26.7% (31) | | | 24.0% (44) | | |
| 2020 | 23.9% (27) | 0.86 (0.47– 1.56) | 0.62 | 26.6% (61) | 1.15 (0.73– 1.80) | 0.55 |
| Pneumonitis due to solids and liquids | | | | | | |
| 2019 | 29.2% (115) | | | 29.6% (187) | | |
| 2020 | 32.3% (109) | 1.16 (0.85– 1.59) | 0.36 | 26.4% (187) | 0.85 (0.67– 1.08) | 0.20 |
| Adult respiratory distress syndrome | | | | | | |
| 2019 | 57.1% (4) | | | 87.5% (7) | | |
| 2020 | 76.0% (19) | 2.37 (0.38–14.13) | 0.33 | 82.4% (14) | 0.67 (0.03– 6.38) | 0.74 |
| Duodenal ulcer | | | | | | |
| 2019 | 7.3% (23) | | | 6.6% (37) | | |
| 2020 | 6.3% (18) | 0.86 (0.45– 1.62) | 0.63 | 7.4% (43) | 1.13 (0.71– 1.78) | 0.61 |
| Paralytic ileus and intestinal obstruction without hernia | | | | | | |
| 2019 | 5.6% (63) | | | 5.6% (103) | | |
| 2020 | 5.1% (52) | 0.92 (0.63– 1.34) | 0.67 | 5.0% (99) | 0.89 (0.67– 1.18) | 0.42 |

| Diverticular disease of intestine | | | | | | |
|--|-------------|-------------------|------|-------------|-------------------|------|
| 2019 | 1.7% (20) | | | 1.2% (26) | | |
| 2020 | 1.6% (17) | 0.95 (0.49– 1.82) | 0.87 | 1.3% (28) | 1.09 (0.64– 1.88) | 0.75 |
| Peritonitis | | | | | | |
| 2019 | 14.5% (16) | | | 9.6% (20) | | |
| 2020 | 13.3% (15) | 0.90 (0.42– 1.93) | 0.78 | 8.3% (18) | 0.86 (0.44– 1.68) | 0.66 |
| Hepatic failure | | | | | | |
| 2019 | 35.9% (23) | | | 42.2% (38) | | |
| 2020 | 26.8% (11) | 0.65 (0.27– 1.52) | 0.33 | 46.2% (37) | 1.18 (0.64– 2.16) | 0.60 |
| Acute pancreatitis | | | | | | |
| 2019 | 2.1% (15) | | | 1.6% (19) | | |
| 2020 | 2.2% (14) | 1.06 (0.50– 2.23) | 0.87 | 1.5% (17) | 0.91 (0.47– 1.77) | 0.79 |
| Cellulitis | | | | | | |
| 2019 | 1.2% (8) | | | 1.3% (16) | | |
| 2020 | 1.4% (7) | 1.13 (0.39– 3.16) | 0.82 | 0.6% (7) | 0.48 (0.18– 1.13) | 0.11 |
| Acute renal failure | | | | | | |
| 2019 | 15.5% (173) | | | 13.4% (236) | | |
| 2020 | 17.1% (148) | 1.12 (0.88– 1.42) | 0.36 | 14.4% (235) | 1.09 (0.90– 1.32) | 0.39 |
| Shock, not elsewhere classified | | | | | | |
| 2019 | 55.1% (27) | | | 58.8% (57) | | |
| 2020 | 69.5% (41) | 1.86 (0.85– 4.13) | 0.12 | 69.0% (80) | 1.56 (0.89– 2.75) | 0.12 |
| Intracranial injury | | | | | | |
| 2019 | 2.5% (82) | | | 2.1% (124) | | |
| 2020 | 2.7% (72) | 1.11 (0.80– 1.53) | 0.52 | 2.6% (125) | 1.21 (0.94– 1.55) | 0.14 |
| Fracture of lumbar spine and pelvis | | | | | | |

| | | | | | | |
|--|------------|-------------------|------|------------|-------------------|------|
| 2019 | 1.7% (17) | | | 2.5% (41) | | |
| 2020 | 2.5% (23) | 1.43 (0.76– 2.73) | 0.27 | 2.8% (43) | 1.12 (0.73– 1.74) | 0.60 |
| Fracture of femur | | | | | | |
| 2019 | 4.8% (96) | | | 5.9% (195) | | |
| 2020 | 4.9% (103) | 1.03 (0.77– 1.37) | 0.84 | 5.1% (178) | 0.85 (0.69– 1.05) | 0.14 |
| Complications of cardiac and vascular prosthetic devices, implants and grafts | | | | | | |
| 2019 | 1.9% (7) | | | 2.5% (16) | | |
| 2020 | 1.8% (6) | 0.91 (0.29– 2.77) | 0.87 | 1.6% (10) | 0.64 (0.28– 1.40) | 0.27 |

Based on 183,803 cases (93.8%). We excluded cases with discharge due to hospital transfer or unspecified reason. Proportion of excluded cases was stable ranging between 5.9 and 6.5% per year and period.

Figure S1. Hospitalizations per hospital in 2019 (red) and 2020 (green). Case numbers are displayed per hospital with 2019 bars below 2020 bars for every hospital.

