Cumulative hospitalization deficit for cardiovascular disorders in Germany during the COVID-19 pandemic: insights from the German-wide Helios hospital network

During the early phase of the COVID-19 pandemic, reductions of hospital admissions have been shown for several cardiovascular disorders including acute coronary syndromes, heart failure, and cardiac arrhythmias in Europe1–3 and the USA.4 However, there is only scarce data on hospitalization trends during the course of the pandemic that is, moreover, limited to acute coronary syndromes.2–4 Consequently, the aim of this correspondence is to illustrate hospitalizations for several acute and chronic cardiovascular conditions and thereby to introduce the cumulative hospitalization deficit as novel metric to monitor hospitalizations as the pandemic continues.

Thus, we performed a retrospective analysis of claims data of 82 Helios hospitals in Germany.5 Consecutive cases with a hospital admission between 13 March 2020 (the begin of the protection stage according to the German pandemic plan) and 16 July 2020 (study period) were studied and compared to a corresponding period covering the same weeks in 2019 (15 March to 18 July 2019). Cause-specific hospitalizations were defined on the basis of primary discharge diagnosis according to International Statistical Classification of Diseases and Related Health Problems [ICD-10-GM (German Modification)] codes for heart failure (I42.x; I43.x; I50.x), cardiac arrhythmias (I44.x; I45.x; I47.x–I49.x, R00.0–R00.2), ischaemic heart disease (I20.x–I25.x), valvular heart disease (I05.x–I08.x; I34.x–I37.x; Q22.x–Q23.x; T82.0; Z95.2–Z95.4), arterial hypertension (I10.x–I15.x), and peripheral vascular disease (I70.x–I79.x).

Cumulative hospitalization deficit was computed as the difference between the expected and observed cumulative admission number for every week in the study period, expressed as a percentage (95% confidence interval) of the cumulative expected number. The expected admission number was defined as...
the weekly average during the control period. The difference between the expected and observed cumulative admission number was assessed using a χ² test for the admission nadir defined as the week with the lowest admission number and the last week of the study period. The P-values were adjusted for multiple comparisons using a Bonferroni correction.

A total of 139,041 hospital admissions (62,606 during the study and 76,435 during the control period) were included. There was a decline in hospitalizations during the early phase of the study period leading to an increase in the cumulative hospitalization deficit across all analysed diseases until the nadir (Figure 1). The nadir was reached in the week 10–16 April 2020 for all conditions except for heart failure (20–26 March 2020) and hypertension (27 March to 2 April 2020). During the nadir, weekly hospitalizations were reduced by 28–43% (Table 1). Thereafter, the cumulative hospitalization deficit decreased to 17–20% at the end of the study period (Figure 1, Table 1).

To the best of our knowledge, this report that analyzes hospitalizations for several cardiovascular conditions has several strengths, i.e. it uses the largest German hospital network during 4 months of the COVID-19 pandemic, the longest observation period so far. In agreement with previous studies,1–4 a significant decrease of hospitalizations reaching 43% has been observed. Our analysis confirms and extends findings from very recent studies focusing on acute coronary syndromes. These studies have reported a recovery phase with cases reaching almost previous year control period values. However, as can be appreciated from our analysis, there remains a substantial deficit in cumulative hospital admissions.

The long-term consequences of those observations deserve further studies. In that respect, delayed diagnosis of acute or deterioration of chronic cardiovascular disorders followed by increased admissions, and higher morbidity and mortality is a potential future scenario for which we must prepare. Conversely, if there is no concomitant mid- and long-term increase in morbidity and mortality, this may suggest an overly aggressive existing model of care.

Conflict of interest: none declared.

References
1. Bollmann A, Hohenstein S, Meier-Hellmann A, Kuhlen R, Hindricks G. Emergency hospital admissions and interventional treatments for heart failure and cardiac arrhythmias in Germany during the Covid-19 outbreak: insights from the German-wide Helios hospital network. Eur Heart J Qual Care Clin Outcomes 2020;6:221–222.
2. Wu J, Mamas M, Rashid M, Weston C, Hains J, Luescher T et al. Patient response, treatments and mortality for acute myocardial infarction during the COVID-19 pandemic. Eur Heart J Qual Care Clin Outcomes 2021;7:238–246.
3. Matham MM, Spata E, Goldacre R, Gair D, Cumow P, Bray M et al. COVID-19 pandemic and admission rates for and management of acute coronary syndromes in England. Lancet 2020;396:381–389.
4. Gluckman TJ, Wilson MA, Chiu ST, Penny BW, Chepuri VB, Waggoner JW, Spinelli KJ. Case rates, treatment approaches, and outcomes in acute myocardial infarction during the Coronavirus Disease 2019 pandemic. JAMA Cardiol 2020;doi: 10.1001/jamacardio.2020.3629.
5. König S, Ueberham L, Schuler E, Wiedemann M, Reithmann C, Seyfarth M et al. In-hospital mortality of patients with atrial arrhythmias: insights from the German-wide Helios hospital network of 161,502 patients and 34,025 arrhythmia-related procedures. Eur Heart J 2018;39:3947–3957.

Andreas Bollmann1*, Vincent Pellissier1, Sven Hohenstein1, Sebastian König1, Laura Ueberham1, Andreas Meier-Hellmann2, Ralf Kuhlen3, Holger Thiele1, and Gerhard Hindricks1; on behalf of Helios hospitals, Germany

1Heart Center Leipzig at University of Leipzig and Leipzig Heart Institute, Strümpellstr. 39, 04289 Leipzig, Germany; 2Helios Kliniken, Friedrichstraße 136, 10117 Berlin, Germany; and 3Helios Health, Friedrichstraße 136, 10117 Berlin, Germany

*Corresponding author. Tel: +49 341 865 1410, Fax: +49 341 865 1460, Email: andreas.bollmann@helios-gesundheit.de

Table 1 Cumulative hospitalization deficit for several cardiovascular conditions in the German-wide Helios hospital network at the nadir and in mid-July 2020 during the COVID-19 pandemic

| Disease                          | Expected (n) | Observed (n) | Hospitalization deficit (95% CI) | P-value | Expected (n) | Observed (n) | Hospitalization deficit (95% CI) | P-value |
|----------------------------------|-------------|-------------|---------------------------------|---------|-------------|-------------|---------------------------------|---------|
| Heart failure                    | 1657        | 1044        | -37% (-41; -33)                 | <0.001  | 14 917      | 11 902      | -20% (-21; -19)                 | <0.001  |
| Cardiac arrhythmias              | 4982        | 3087        | -38% (-40; -36)                 | <0.001  | 17 935      | 14 975      | -17% (-18; -15)                 | <0.001  |
| Ischaemic heart disease          | 5302        | 3567        | -33% (-35; -31)                 | <0.001  | 19 086      | 15 928      | -17% (-18; -15)                 | <0.001  |
| Valvular heart disease           | 1324        | 809         | -39% (-43; -35)                 | <0.001  | 4765        | 3863        | -19% (-21; -17)                 | <0.001  |
| Arterial hypertension            | 1782        | 1284        | -28% (-32; -24)                 | <0.001  | 10 690      | 8589        | -20% (-21; -18)                 | <0.001  |
| Peripheral vascular disease      | 2512        | 1429        | -43% (-46; -40)                 | <0.001  | 9042        | 7349        | -19% (-20; -17)                 | <0.001  |