Letters

Hospitalizations for Chronic Disease and Acute Conditions in the Time of COVID-19

Concurrent with surges in hospitalizations for coronavirus disease 2019 (COVID-19), there has been evidence of decreased presentation for acute conditions, including myocardial infarction and stroke.[1-3] We examined the frequency of hospitalization for all non–COVID-19-related conditions in a health system at an epicenter of the COVID-19 pandemic.[4]

Methods | We performed a retrospective study of admissions to 4 hospitals in the NYU Langone Health system between March 1 and May 9 in years 2018, 2019, and 2020. We excluded hospitalizations for COVID-19 using discharge diagnosis codes and hospitalizations with a discharge date after May 24 in each year. Weekly admission rates were examined for 4 time periods defined by the volume of COVID-19 hospitalizations: pre–COVID-19 (March 1 to May 9, 2018, and March 1 to May 9, 2019), early COVID-19 (March 1 to March 21, 2020), peak COVID-19 (March 22 to April 11, 2020), and late COVID-19 (April 12 to May 9, 2020). We categorized each hospitalization into both system-level (eg, digestive diseases) and diagnosis-level (eg, appendicitis) classifications using principal discharge diagnoses and software from the Agency for Healthcare Research and Quality.[5] We examined weekly hospitalization rates for each time

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period for each system-level category and for the 20 most frequent diagnoses during the pre–COVID-19 period. We used incidence rate ratios to test for differences in hospitalization rates between periods and considered significance at $P = .001$, using the Šidák correction for multiple comparisons. Analyses were performed using R, version 4.0.1 (The R Foundation). The study was approved by the NYU Grossman School of Medicine Institutional Review Board, which approved a waiver of consent based on federal regulation 45 CFR §46.

Results | Between March 1 and May 9, 2020, there were 3657 non–COVID-19 hospitalizations, compared with 5368 and 6411 hospitalizations during the same period in 2018 and 2019, respectively. Hospitalization rates in the early COVID-19 period were similar to baseline (604.3 vs 584.5 per week; $P = .19$), decreased during the peak COVID-19 period (247.0 per week; $P < .001$), and slightly increased in the late COVID-19 period (309.3 per week; $P < .001$ vs peak COVID-19). Hospitalization rates decreased across all system categories during the peak COVID-19 period (**Table**). Similarly, we found a significant decline (all $P < .001$) in hospitalizations during the peak COVID-19 period for the following common diagnoses: septicemia (25.3 vs 51.1 per week), heart failure (9.0 vs 25.6), myocardial infarction (4.0 vs 16.3), cerebral infarction (7.0 vs 14.7), biliary tract disease (3.0 vs 11.7), epilepsy (3.7 vs 11.5), skin infections (2.7 vs 11.5), complications of care (3.7 vs 10.7), cardiac dysrhythmias (2.3 vs 10.6), appendicitis (2.7 vs 8.6), and chronic obstructive pulmonary disease (COPD; 2.3 vs 8.6) (**Figure**). In the late COVID-19 period, hospitalizations for myocardial in-

Table. Weekly Hospitalization Rates Over Time Categorized by AHRQ Clinical Classifications Software Refined (CCSR) Tool

| CCSR system category	Mean hospitalizations/wk						
	Baseline	Early COVID-19	P value[a]	Peak COVID-19	P value[b]	Late COVID-19	P value[c]
Diseases of circulatory system	104.3	106.3	.75	39.7	<.001	61.0	<.001
Digestive diseases	88.6	75.3	.02	29.7	<.001	46.0	.001
Injury, poisoning, other external causes	61.4	58.3	.53	29.0	<.001	40.3	.01
Infectious diseases	55.2	58.7	.45	26.7	<.001	27.8	.79
Respiratory diseases	50.4	69.0	<.001	29.3	<.001	15.0	<.001
Mental, behavioral, and neurodevelopmental disorders	37.5	42.3	.21	14.7	<.001	23.5	.009
Genitourinary diseases	30.9	29.3	.65	15.0	<.001	14.5	.86
Disease of the nervous system	27.1	24.0	.34	5.7	<.001	10.0	.05
Endocrine, nutritional, and metabolic diseases	26.2	31.7	.09	15.7	.001	16.3	.85
Pregnancy, childbirth, and the puerperium	22.1	12.7	.001	8.7	<.001	10.0	.57
Neoplasms	20.6	19.7	.74	8.7	<.001	12.5	.13
Musculoskeletal and connective tissue diseases	17.1	17.3	.93	2.3	<.001	7.0	.006
Diseases of the skin and subcutaneous tissue	14.0	15.3	.55	3.3	<.001	5.8	.15
Other diseases or conditions	29.4	44.3	<.001	18.7	.001	19.8	.75

Abbreviations: AHRQ, Agency for Healthcare Research and Quality; COVID-19, coronavirus disease 2019.

[a] Comparison of early COVID-19 hospitalization rate to baseline hospitalization rate.

[b] Comparison of peak COVID-19 hospitalization rate to baseline hospitalization rate.

[c] Comparison of late COVID-19 hospitalization rate to peak COVID-19 hospitalization rate.

Figure. Weekly Hospitalization Rates for 20 Most Common Diagnosis Groups in the Baseline Time Period
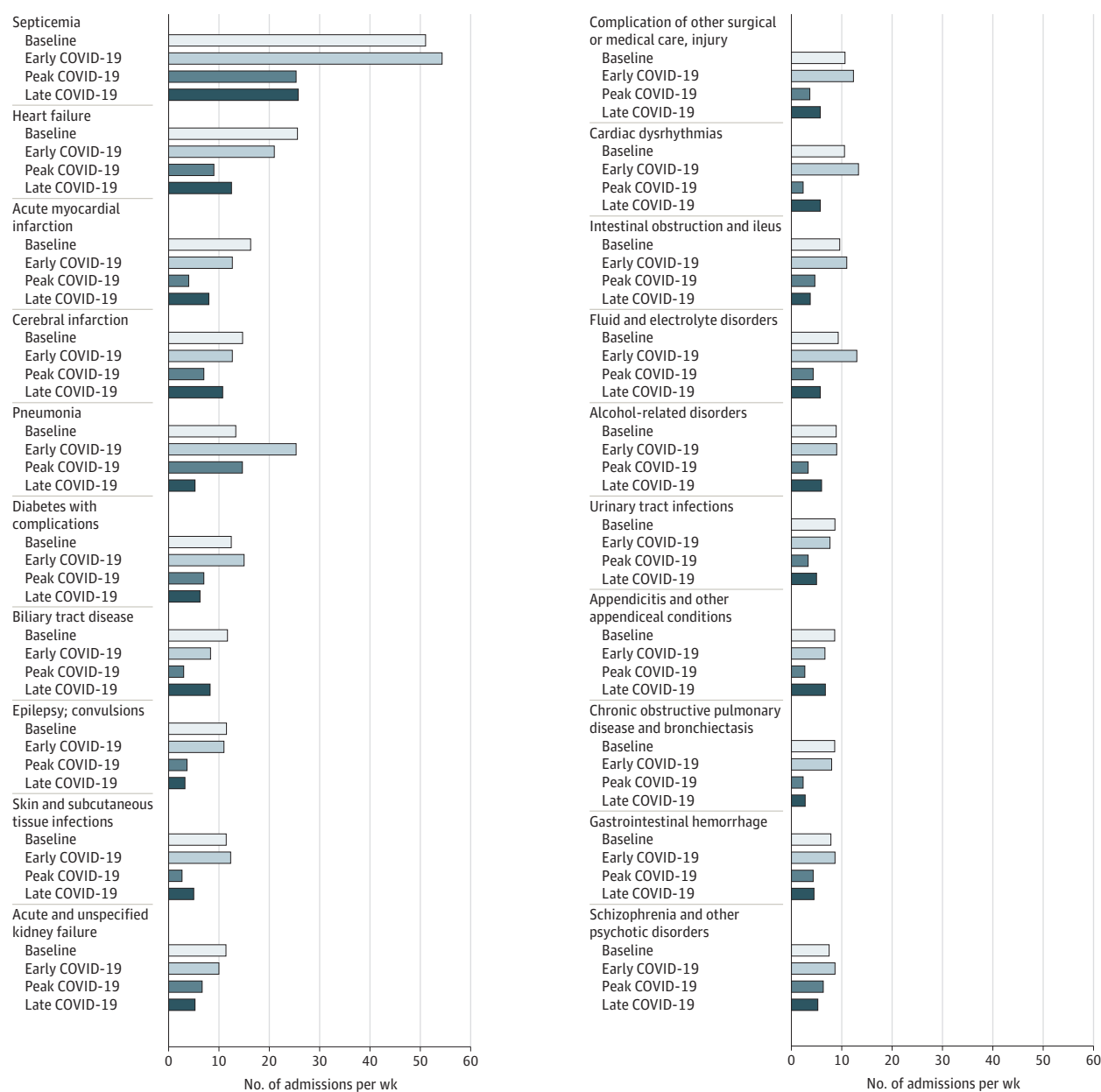
COVID-19 indicates coronavirus disease 2019.

farction, biliary tract disease, and appendicitis began to recover—though not at a level of significance when accounting for multiple comparisons—while hospitalizations for septicemia, diabetes, and COPD did not (Figure).

Discussion | We found a substantial decrease in the number of non–COVID-19 hospitalizations across a range of diagnoses during the peak COVID-19 period. The decrease was observed for exacerbations of chronic conditions (heart failure, COPD), acute medical events that typically require inpatient management (myocardial infarction, appendicitis), and injuries. Given the breadth of these diagnoses, the causes for the decrease are likely multifactorial and include patient avoidance of emergency care for fear of COVID-19[2] or because of lost health insurance,[6] increased threshold for hospitalization by clinicians, and changes in patient lifestyle and self-management in the context of social distancing. Notably, while hospitalizations for acute events began recovering in the late COVID-19 period, many of those related to chronic diseases generally did not. The implications of the decreases in hospitalizations for chronic disease are concerning for the possibility that sick patients are not obtaining necessary hospital care; alternatively, this trend could suggest prior overuse of hospitalization or improved self-management.

Study limitations include use of a single health system and reliance on diagnostic codes, which have imperfect capture of both COVID-19 and other diagnoses. However, we used a standard approach for classifying diagnoses.[5]

In an epicenter of COVID-19, we found that the pandemic was associated with substantial changes in hospitalization patterns for non–COVID-19 conditions. The long-term effects of hospitalization reductions on both patient outcomes and the health care system remain to be seen.

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1. Kansagra AP, Goyal MS, Hamilton S, Albers GW. Collateral effect of Covid-19 on stroke evaluation in the United States. *N Engl J Med.* 2020;383(4):400-401. doi:10.1056/NEJMc2014816

2. Garcia S, Albaghdadi MS, Meraj PM, et al. Reduction in ST-segment elevation cardiac catheterization laboratory activations in the United States during COVID-19 pandemic. *J Am Coll Cardiol.* 2020;75(22):2871-2872. doi:10.1016/j.jacc.2020.04.011

3. Baum A, Schwartz MD. Admissions to Veterans Affairs hospitals for emergency conditions during the COVID-19 pandemic. *JAMA.* 2020;324(1):96-99. doi:10.1001/jama.2020.9972

4. Petrilli CM, Jones SA, Yang J, et al. Factors associated with hospital admission and critical illness among 5279 people with coronavirus disease 2019 in New York City: prospective cohort study. *BMJ.* 2020;369:m1966. doi:10.1136/bmj.m1966

5. Healthcare Cost and Utilization Project. Clinical Classifications Software Refined (CCSR) for ICD-10-CM diagnoses. Accessed May 26, 2020. https://www.hcup-us.ahrq.gov/toolssoftware/ccsr/ccs_refined.jsp

6. Woolhandler S, Himmelstein DU. Intersecting US epidemics: COVID-19 and lack of health insurance. *Ann Intern Med.* 2020;173(1):63-64. doi:10.7326/M20-1491