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Original article

Causes of Non-COVID-19 Hospitalization in the United States in 2019 and 2020

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Introduction

Although much literature has been devoted to the impact of Coronavirus disease 2019 (COVID-19) on various conditions, less is known about the impact on those hospitalized for non-COVID-related causes. We reviewed the top 20 diagnoses resulting in hospitalizations in 2019 and 2020, focusing on the changes from 2019 to 2020.

Methods

This retrospective cohort study was performed using the National Inpatient Sample database from 2019 and 2020. We identified all hospitalizations using their Clinical Classifications Software Refined categories. Descriptive statistics were performed to obtain mortality rates along with examining hospital-level factors such as length of stay (LOS) and hospitalization costs. Results are reported as percentages and mean for categorical and continuous variables, respectively.

Results

Total hospitalizations in 2019 were 30,219,558, and 26,618,621 in 2020. The top 5 causes of hospitalizations in 2019 were: septicemia, heart failure, osteoarthritis, complications specified during childbirth, and diabetes mellitus with complication. The top 5 causes in 2020 were: septicemia, heart failure, complications specified during childbirth, diabetes mellitus with complications, and osteoarthritis. Mortality increased by 0.2% in septicemia (3.52%), respiratory failure/insufficiency/arrest (1.51%), pneumonia (except that caused by tuberculosis) (1%), acute myocardial infarction (0.45%), heart failure (0.26%), cerebral infarction (0.26%), and acute and unspecified renal failure (0.2%). An increase in LOS by more than 0.15 days was observed in septicemia (0.72 days), respiratory failure/insufficiency/arrest (0.24 days), acute and unspecified renal failure (0.17 days), and schizophrenia spectrum and other psychotic disorders (0.16 days).

Conclusions

The COVID-19 pandemic in 2020 brought about changes in hospitalization patterns related to non-COVID-19 conditions. These changes could be attributed to hospitals being hesitant to admit non-COVID-19 patients, limited bed availability, and reduced resources for them. Understanding the impact of non-COVID-19 hospitalizations may help stakeholders plan for future pandemics to ensure that care for patients hospitalized for non-pandemic illnesses is not compromised.

INTRODUCTION

From 2005 to 2018, sepsis consistently ranked as the most common cause of hospitalization in the United States.[1,2] Hospitalizations exert a substantial strain on the healthcare system, patient well-being, and the overall economy.[3] Much of the published literature to date has focused on the direct effects of COVID-19 on morbidity and mortality,[4] but far less is known about how the pandemic reshaped admissions for non-COVID conditions. Disruptions in outpatient care, postponement of elective procedures, changes in patient health-seeking behavior, and hospital capacity constraints may have shifted the case mix of hospitalized patients, with important implications for severity at presentation and resource utilization.[4] A study from Canada examined outcomes among patients hospitalized with non–COVID-19 conditions before and during the pandemic, further highlighting global shifts in healthcare utilization patterns.[5] Despite these concerns, national-level data describing how non-COVID-19 hospitalizations changed during the first year of the pandemic remain limited. To address this gap, we reviewed the top 20 primary discharge diagnoses in the United States in 2019 and 2020 and analyzed changes in their relative frequency between

these two years. We further evaluated in-hospital mortality, length of stay, and total hospitalization costs for each diagnosis group to contextualize their clinical and economic impact. We hypothesized that the shifts observed in 2020 largely reflect the indirect consequences of the COVID-19 pandemic, which altered the volume and composition of U.S. hospital admissions.[4] Understanding these changes may inform planning for future system shocks, guide resource allocation, and highlight diagnoses requiring targeted quality and safety efforts.

METHODS

This descriptive study aimed to identify the 20 most common primary discharge diagnoses for hospitalizations. Furthermore, the study investigated the causes of hospitalization in the years 2019 and 2020, along with their mortality rate. The study also examined patient-level variables such as mortality rates, length of stay, and hospitalization costs. To conduct this study, we utilized the National Inpatient Sample (NIS), a part of the Healthcare Cost and Utilization Project sponsored by the Agency for Healthcare Research and Quality. The NIS database is an all-payer database of inpatient hospitalizations in the United States, providing nationally representative estimates of hospital stays. It includes a stratified sample of approximately 20% of all discharges from community hospitals, encompassing nongovernmental, acute care hospitals, and specialty hospitals, including both teaching and non-teaching hospitals. Veteran's hospitals and long-term acute care hospitals are excluded.[6] The sample reflects over 35 million hospitalizations annually. To ensure privacy protection, the NIS data is de-identified, and individual identities remain confidential. As the study solely utilized the NIS database, it was exempt from review by the Institutional Review Board.

The study identified all hospitalizations in 2019 and 2020 using their Clinical Classifications Software Refined categories. The provided weights were utilized to generate national estimates, following the methodology outlined by the Healthcare Cost and Utilization Project. Results are reported as percentages and mean ± SD for categorical and continuous variables, respectively. Hospitalization costs were estimated using the TOTCOST variable from the HCUP Cost-to-Charge Ratio for Inpatient Files, which applies hospital-specific cost-to-charge ratios to total charges to approximate the actual resources used during care delivery. Multivariate analyses were not performed, and as a result, potential confounding variables such as age, sex, race/ethnicity, and education were not accounted for in the analysis. The findings represent descriptive changes and do not reflect adjusted associations or imply causal relationships. Analyses were conducted using Stata software version 15.1 (Stata Corp, College Station, TX).

RESULTS

CAUSES OF HOSPITALIZATION IN 2019 AND 2020

Total hospitalizations in 2019 were 30,219,558, and in 2020, there were 26,618,621. The top 20 discharge diagnoses for both years are listed in Table 1. The leading causes of hospitalizations in 2019 were septicemia (7.45%), heart failure (3.88%), osteoarthritis (3.53%), complications specified during childbirth (2.48%), and diabetes mellitus with complications (2.23%). In 2020, the top causes were septicemia (8.92%), heart failure (3.76%), complications specified during childbirth (2.77%), diabetes mellitus with complications (2.37%), and osteoarthritis (2.28%).

CHANGE IN THE TOP 20 CAUSES OF HOSPITALIZATIONS FROM 2019 TO 2020

We observed a reduction of more than 20% in osteoarthritis (43.2%), chronic obstructive pulmonary disease and bronchiectasis (37.3%), respiratory failure; insufficiency; arrest (22.3%), and skin and subcutaneous tissue infections (21.8%). Conversely, there was an increase in septicemia (5.3%) and hypertension and hypertensive-related conditions complicating pregnancy, childbirth, and the puerperium (3.4%) (Table 2)

CHANGE IN THE MORTALITY OF THE TOP 20 CAUSES OF HOSPITALIZATIONS FROM 2019 TO 2020

Mortality increased by 0.2% in septicemia (3.52%), respiratory failure/insufficiency/arrest (1.51%), pneumonia (except that caused by tuberculosis) (1%), acute myocardial infarction (0.45%), heart failure (0.26%), cerebral infarction (0.26%), and acute and unspecified renal failure (0.2%). A decrease in mortality was observed in malposition, disproportion, or other labor complications (0.001%) (Table 2)

CHANGE IN THE LENGTH OF STAY OF THE TOP 20 CAUSES OF HOSPITALIZATIONS FROM 2019 TO 2020

An increase in the length of stay by more than 0.15 days was observed in septicemia (0.72 days), respiratory failure; insufficiency; arrest (0.24 days), acute and unspecified renal failure (0.17 days), and schizophrenia spectrum and other psychotic disorders (0.16 days). A reduction in the length of stay by more than 0.15 days was observed in depressive disorder (2.16 days), previous c-section (0.21 days), hypertension and hypertensive-related conditions complicating pregnancy, childbirth, and the puerperium (0.2 days), and malposition, disproportion, or other labor complications (0.17 days) (Table 2).

CHANGE IN THE TOTAL HOSPITALIZATION COST OF THE TOP 20 CAUSES OF HOSPITALIZATIONS FROM 2019 TO 2020

Hospitalization costs represent the actual resources used to deliver care. The total cost increased for all causes, with the highest change observed in septicemia ($3,659.5) and

Table 1. Top 20 Causes of Non-COVID-19 Hospitalization in the US in 2019 and 2020.

	2019 Diagnosis (Total admissions 30,219,558)	Percentage	2020 Diagnosis (Total admissions 26,618,621)	Percentage
1	Septicaemia	7.45%	Septicaemia	8.92%
2	Heart failure	3.88%	Heart failure	3.76%
3	Osteoarthritis	3.53%	Complications specified during childbirth	2.77%
4	Complications specified during childbirth	2.48%	Diabetes mellitus with complication	2.37%
5	Diabetes mellitus with complication	2.23%	Osteoarthritis	2.28%
6	Acute myocardial infarction	2.20%	Acute myocardial infarction	2.14%
7	Pneumonia (except that caused by tuberculosis)	2.19%	Pneumonia (except that caused by tuberculosis)	2.01%
8	Cardiac dysrhythmias	2.10%	Cardiac dysrhythmias	1.97%
9	Cerebral infarction	1.83%	Cerebral infarction	1.93%
10	Acute and unspecified renal failure	1.80%	Acute and unspecified renal failure	1.76%
11	Chronic obstructive pulmonary disease and bronchiectasis	1.77%	Spondylopathies/spondyloarthropathy (including infective)	1.64%
12	Spondylopathies/spondyloarthropathy (including infective)	1.73%	Previous C-section	1.61%
13	Urinary tract infections	1.62%	Hypertension and hypertensive-related conditions complicating pregnancy; childbirth; and the puerperium	1.54%
14	Respiratory failure; insufficiency; arrest	1.56%	Urinary tract infections	1.51%
15	Skin and subcutaneous tissue infections	1.54%	Schizophrenia spectrum and other psychotic disorders	1.43%
16	Previous C-section	1.50%	Respiratory failure; insufficiency; arrest	1.38%
17	Depressive disorders	1.38%	Skin and subcutaneous tissue infections	1.36%
18	Hypertension and hypertensive-related conditions complicating pregnancy; childbirth; and the puerperium	1.31%	Malposition, disproportion or other labor complications	1.35%
19	Schizophrenia spectrum and other psychotic disorders	1.28%	Depressive disorders	1.30%
20	Malposition, disproportion or other labour complications	1.27%	Chronic obstructive pulmonary disease and bronchiectasis	1.26%

spondylopathies/spondyloarthropathy (including infective) ($2,493.7) (Table 2).

DISCUSSION

Our results indicate that, for both 2019 and 2020, sepsis was the primary diagnosis for patients admitted to community hospitals in the United States. From 2005 to 2018, sepsis consistently ranked as the most common cause of hospitalization in the United States, showing an increasing trend over time.[1,2] Similarly, in 2020, the number and percentage of patients admitted with sepsis increased, posing a significant strain on both the healthcare system and patient well-being, as well as impacting the overall economy.[7]

In our study, heart failure remained the second most common diagnosis for non-COVID-19 hospitalizations in 2020, although the percentage of total hospitalizations declined. This aligns with findings from previous studies on sepsis and heart failure.[7,8] Many patients delayed seeking care during COVID-19, and upon presentation, had more advanced disease.[9] This may explain the increased number of patients admitted with sepsis. Patients with heart failure also delayed care due to the fear of acquiring COVID-19 in hospital waiting rooms and as inpatients.[4] We believe these patients may have been treated in the Emergency Department and then discharged rather than being admitted during a pandemic when hospital beds were at a premium and reserved for the sickest patients.

The third most common admitted diagnosis in 2019, osteoarthritis, experienced the largest reduction of all diagnoses in non-COVID-19 hospitalizations in 2020, possibly due to hospitals being reluctant to admit non-COVID-19 patients with non-life-threatening conditions.[4] Complications specified during childbirth became the third most common non-COVID-19 diagnosis in 2020. According to the National Center for Disease Control and Prevention, this may be attributed to pregnant patients not receiving in-person prenatal care due to restrictions implemented during the pandemic.[10] We hypothesize that such pregnan-

Table 2. Change in Number of Non-COVID-19 Hospitalization, Length of Stay, Total Hospital Cost and Mortality in 2020 From 2019.

	Diagnosis	Percentage Change in 2020 from 2019	Mean length of Stay changes in 2020 from 2019	Mean total Cost change in 2020 from 2019	Percentage mortality changes in 2020 from 2019
1	Septicaemia	5.3%	0.72	3659.47	3.52%
2	Heart failure	-14.6%	0.11	1139.47	0.26%
3	Complications specified during childbirth	-1.8%	-0.12	300.27	0%
4	Diabetes mellitus with complication	-6.4%	0.00	1071.93	0.14%
5	Osteoarthritis	-43.2%	-0.09	1225.69	0.01%
6	Acute myocardial infarction	-14.2%	-0.08	1800.95	0.45%
7	Pneumonia (except that caused by tuberculosis)	-19.2%	0.13	1015.41	1%
8	Cardiac dysrhythmias	-17.4%	0.04	1559.40	0.19%
9	Cerebral infarction	-6.8%	0.15	1461.57	0.26%
10	Acute and unspecified renal failure	-13.9%	0.17	1089.33	0.2%
11	Spondylopathies/spondyloarthropathy (including infective)	-16.3%	0.05	2493.65	0.03%
12	Previous C-section	-4.9%	-0.21	272.32	0%
13	Hypertension and hypertensive-related conditions complicating pregnancy; childbirth; and the puerperium	3.4%	-0.20	300.59	0.005%
14	Urinary tract infections	-18.2%	0.14	865.55	0.09%
15	Schizophrenia spectrum and other psychotic disorders	-1.6%	0.16	1176.06	0.01%
16	Respiratory failure; insufficiency; arrest	-22.3%	0.24	1915.43	1.51%
17	Skin and subcutaneous tissue infections	-21.8%	0.11	1020.90	0.04%
18	Malposition, disproportion or other labour complications	-6.7%	-0.17	226.87	-0.001%
19	Depressive disorders	-17.3%	-2.16	509.09	0.01%
20	Chronic obstructive pulmonary disease and bronchiectasis	-37.3%	-0.03	769.29	0.14%

cies may have resulted in complications during childbirth, contributing to the increased percentage of total hospitalizations in 2020.

Despite decreased admissions for non-COVID-19 diagnoses, there was an increase in mortality for the majority of the top 20 causes of hospitalization. This could be attributed to the COVID-19 pandemic straining hospitals to critical capacity, thereby reducing the availability of resources for non-COVID-19 admissions.[4,11] Increased mortality was observed in cardiovascular disorders, possibly due to COVID-19-associated complications.[12] Consistent with previous work, minimal change in mortality was observed in childbirth and related complications hospitalization in 2020 compared to 2019.[13]

The change in length of stay was variable in 2020 for non-COVID-19 compared to 2019. Sixty percent of diagnoses were associated with longer lengths of stay. Interestingly, more than half of those diagnoses with shorter lengths of stay were related to obstetrical diagnoses (complications specified during childbirth, previous C-section, hypertension and hypertensive-related conditions complicating pregnancy/childbirth and the puerperium, and malposition). The remaining diagnoses with shorter lengths of stay were osteoarthritis, acute myocardial infarction (AMI), chronic obstructive pulmonary disease (COPD), and depressive disorders. The reason why these diagnoses had shorter lengths of stay is unclear. However, patients requiring non-critical service were not admitted during a time when hospital beds were at a premium.[4] This may explain the decrease in length of stay for osteoarthritis. It may also explain a shorter length of stay for depression, as hospitalization for a suicide attempt or suicide ideation was coded as a separate CCSR code and not in the top 20 non-COVID-19 diagnoses for either year. It is unclear why the length of stay for COPD decreased. A percentage of hospitalizations for COPD may have been primarily coded as COVID-19 related and not included as COPD in the NIS. Alternatively, it is possible patients were treated in the Emergency Department and discharged. The decrease for acute myocardial infarction is surprising but has been noted by

others.[4,12] Advani et al. hypothesized that this may have been due to increased sleep duration during COVID-19.[14]

The total hospitalization cost increased for the top 20 diagnoses in 2020 compared to 2019, with the highest change observed in septicemia ($3,659.5). This increase could be attributed to greater severity at presentation, possibly linked to delayed hospital visits.[4]

Our study has limitations. We utilized a national-level database, and misclassification resulting from the database's administrative nature may have led to inaccurate coding. Distinguishing between comorbidities and complications that arose during hospitalization may have contributed to inaccuracies in the final discharge diagnosis. This study utilized only the primary discharge diagnosis, which may have resulted in underestimation or omission of the effects of secondary diagnoses. Furthermore, the study is descriptive by design. We did not conduct formal hypothesis testing; therefore, no p-values or confidence intervals are reported for differences between groups. The reported associations are unadjusted and may be influenced by confounding from variables not included in the analysis, such as patient demographics, comorbidities, and hospital-level factors. Consequently, the results should be interpreted as exploratory descriptive findings that preclude any inference of causality. Additionally, although the first case of COVID-19 in the United States was diagnosed on January 20, 2020, the code for COVID-19 was not available until April. Thus, non-COVID-19 discharge diagnoses for the first three months of 2020 may have overrepresented non-COVID-19 diagnoses.

CONCLUSIONS

Our study examined non-COVID-19 hospitalizations before and during the early pandemic. Although COVID-19 decreased total hospitalizations for non-COVID-19 related diseases, it variably increased length of stay and consistently increased the cost of hospitalization. Most importantly, it was associated with an increase in mortality in nearly all of the top 20 causes of hospitalization. COVID-19 is unlikely to be the only pandemic we will experience. Given the observational nature of the data and lack of multivariable adjustment, findings should be interpreted as changes rather than causal associations. These results offer insight into how healthcare utilization shifted during the pandemic and may inform planning for future public health emergencies. Further studies are needed to evaluate the broader impact of the pandemic on non-COVID-19 illnesses and to support data-driven strategies for healthcare system preparedness.

AUTHOR CONTRIBUTIONS

Conceptualization: Aditya Sharma (Lead). Methodology: Aditi Sharma (Supporting), Tushar Mishra (Supporting). Writing – review & editing: Diane Levine (Supporting).

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SUPPLEMENTARY MATERIALS

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