AHRQ Agency for Healthcare Research and Quality
H·CUP HEALTHCARE COST AND UTILIZATION PROJECT

Overview of Outcomes for Inpatient Stays Involving Sepsis, 2016–2021

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Introduction

Sepsis is a systemic inflammatory response to infection that results in tissue damage and organ failure, and can lead to death.[1] In 2017, there were about 2 million inpatient stays in the U.S. related to sepsis, accounting for 8.8 percent of all hospital costs.[2] One in three patients who died in a hospital had sepsis during their hospitalization.[3] Though traditionally associated with bacterial infection, sepsis can develop from many types of infection, including viral and fungal infections. With the emergence of inpatient stays in 2020 related to COVID-19, an infectious disease caused by the SARS-CoV-2 virus, came additional vulnerability to developing sepsis.[4]

This Healthcare Cost and Utilization Project (HCUP) Statistical Brief presents national trends in inpatient stays involving sepsis by mutually exclusive patient populations using weighted estimates from the 2016–2021 National Inpatient Sample (NIS). These patient populations are 1) adults 65 years and older with nonmaternal conditions, 2) adults 18–64 years with nonmaternal conditions, 3) patients with maternal conditions regardless of age, 4) children aged 28 days–17 years, and 5) neonates aged 0–27 days. Sepsis-related inpatient stays were identified by any diagnosis of sepsis. The number of inpatient stays related to sepsis includes hospitalizations in which sepsis was the reason for the stay (i.e., principal diagnosis) or was a co-occurring condition or complication of the stay (i.e., reported as a secondary diagnosis).

Outcomes (mortality rates, hospital costs, length of stay, and discharge disposition) are reported when sepsis was the reason for the stay. For stays in which sepsis was a co-occurring condition or complication of the stay, other conditions, such as cancer, pneumonia, or heart failure, may be the reason for the inpatient stay and contribute to increased length of stay or hospital costs. Thus, outcomes for these inpatient stays cannot be attributed solely to sepsis. Additional information on the clinical coding criteria for identifying sepsis and maternal conditions is included in the Methods section and Appendix A.

Because of the large sample size of the NIS, small differences can be statistically significant but not clinically important. Thus, only differences greater than or equal to 10 percent are discussed in the text.

Highlights

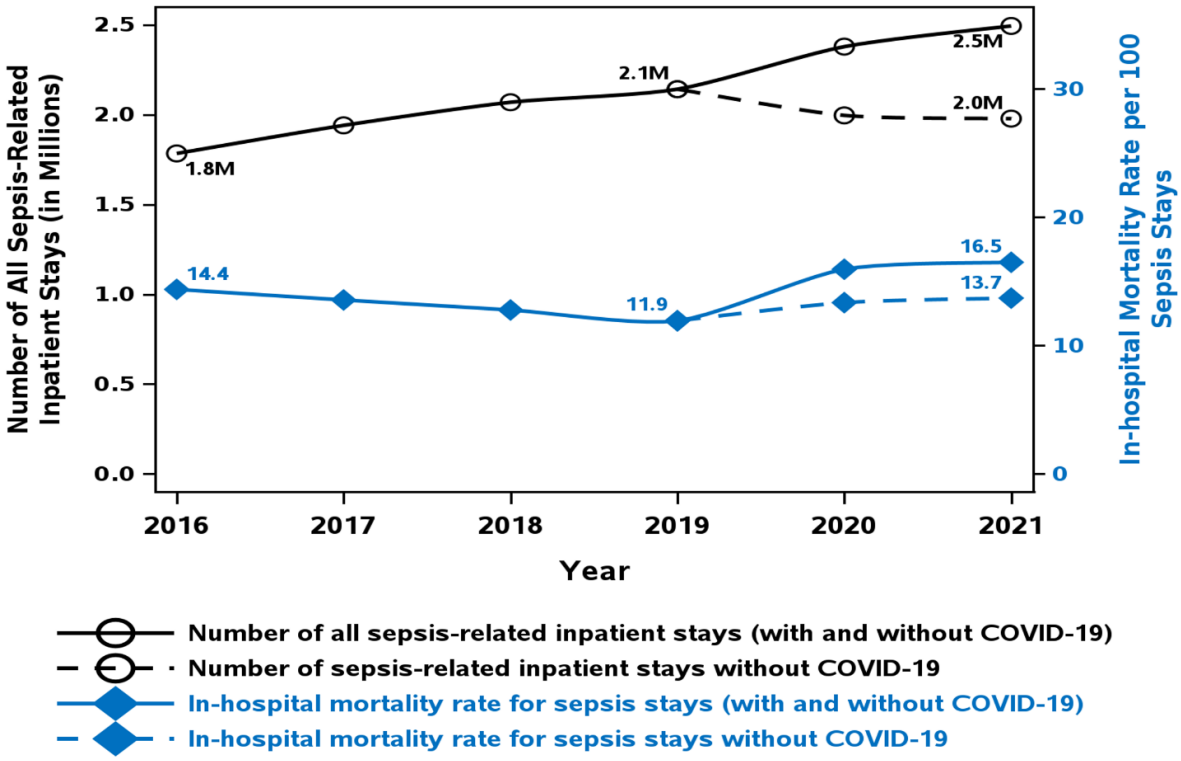
- From 2016 to 2019, the number of all sepsis-related inpatient stays in the U.S. increased by 20.1 percent to 2.1 million stays.
- With the emergence of COVID-19, the number of all sepsis-related inpatient stays increased by 16.5 percent from 2019 to 2021 to 2.5 million stays.
- The in-hospital mortality rate for sepsis stays decreased by 17.0 percent from 2016 to 2019 (14.4 to 11.9 per 100 sepsis stays).
- With the emergence of COVID-19, the in-hospital mortality rate for sepsis stays increased from 11.9 per 100 stays in 2019 to 16.5 per 100 stays in 2021.
- Aggregate hospital costs for sepsis stays increased by 66.8 percent from 2016 to 2021 to $52.1 billion.
- In 2020 and 2021, sepsis stays expected to be billed to Medicare accounted for over half of the aggregate hospital costs of sepsis; Medicaid and private insurance each accounted for 20 percent of the aggregate hospital costs for sepsis stays.

Findings

Annual Trends in the Number of Inpatient Stays and In-hospital Mortality Rate for Stays Involving Sepsis

Figures 1 and 2 present national trends from 2016 to 2021 in the number of inpatient stays with any diagnosis of sepsis and the in-hospital mortality rate for stays with a principal diagnosis of sepsis. Trends are presented separately for each patient population. When examining annual trends in inpatient stays involving sepsis, it is important to also understand the impact of COVID-19 beginning in 2020. For this reason, the trends include information on all inpatient stays involving sepsis and those without COVID-19 for 2020–2021.

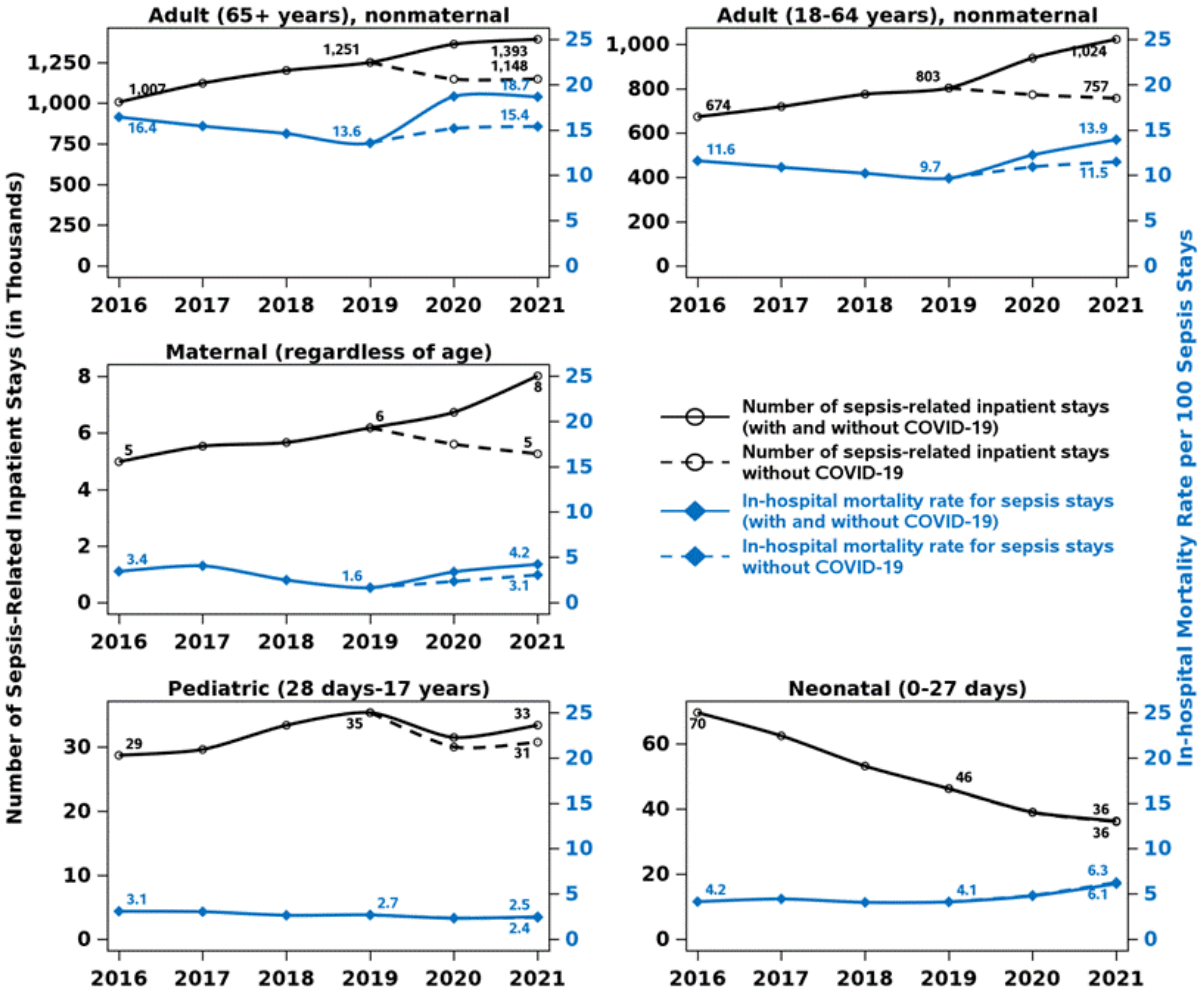
Figure 1. Trends in the number of inpatient stays and in-hospital mortality rate for stays involving sepsis, 2016–2021



Notes: The number of inpatient stays was based on any-listed diagnosis of sepsis. In-hospital mortality rates were based on stays in which sepsis was the reason for the stay (i.e., principal diagnosis). Table 3 of the Methods section includes information on the distribution of the number of stays in which sepsis was the reason for the stay versus was a co-occurring condition or complication of the stay.
Source: Agency for Healthcare Research and Quality (AHRQ), Healthcare Cost and Utilization Project (HCUP), National Inpatient Sample (NIS), 2016–2021

- From 2016 to 2019, the number of all sepsis-related inpatient stays in the U.S. increased by 20.1 percent from 1.8 to 2.1 million stays. In contrast, the number of all stays in the U.S. was relatively stable around 35.5 million for the same time period (data not shown).
- With the emergence of COVID-19, the number of all sepsis-related inpatient stays increased by 16.5 percent from 2019 to 2021 from 2.1 to 2.5 million stays.
- Sepsis-related inpatient stays accounted for 5.0 percent of all inpatient stays in 2016 and 7.5 percent in 2021 (data not shown).
- The in-hospital mortality rate for sepsis stays decreased by 17.0 percent from 2016 to 2019 (14.4 to 11.9 per 100 sepsis stays).
- With the emergence of COVID-19, the in-hospital mortality rate for sepsis stays increased from 11.9 per 100 stays in 2019 to 16.5 per 100 stays in 2021. The in-hospital mortality rate for sepsis stays without an indication of COVID-19 increased from 2019 to 2021 by 14.8 percent (11.9 to 13.7 per 100 sepsis stays).
- Sepsis stays resulting in an in-hospital death accounted for 26.3 percent of all in-hospital deaths in 2016 and 29.3 percent of all in-hospital deaths in 2021 (data not shown).

Figure 2. Trends in the number of inpatient stays and in-hospital mortality rate for stays involving sepsis by patient population, 2016–2021



Note: The number inpatient stays was based on any-listed diagnosis of sepsis. In-hospital mortality rates were based on stays in which sepsis was the reason for the stay (i.e., principal diagnosis). Table 3 of the Methods section includes information on the distribution of the number of stays in which sepsis was the reason for the stay versus was a co-occurring condition or complication of the stay.
Source: Agency for Healthcare Research and Quality (AHRQ), Healthcare Cost and Utilization Project (HCUP), National Inpatient Sample (NIS), 2016–2021

- The total number of sepsis-related nonmaternal inpatient stays increased between 2016 and 2021 by 38.3 percent for adults aged 65 years and older (1.0 to 1.4 million stays) and 52.0 percent for adults aged 18–64 years (674,000 to 1.0 million stays).
- From 2016 to 2019, the in-hospital mortality rate for adult, nonmaternal sepsis stays decreased by 17.4 percent for adults aged 65 and older (16.4 to 13.6 per 100 sepsis stays) and 16.6 percent for adults aged 18–64 years (11.6 to 9.7 per 100 sepsis stays).
- With the emergency of COVID-19, the in-hospital mortality rate for sepsis stays increased 37.5 percent from 13.6 per 100 sepsis stays in 2019 to 18.7 per 100 sepsis stays in 2021 for adults 65 years and older and 44.0 percent for adults aged 18-64 years (from 9.7 to 13.9 per 100 sepsis stays).
- The number of sepsis-related maternal stays increased 60.9 percent (5,000 to 8,000 stays) between 2016 and 2021. The in-hospital mortality rate for maternal sepsis stays decreased from 3.4 per 100 sepsis stays in 2016 to 1.6 per 100 sepsis stays in 2019 and then increased to 4.2 per 100 sepsis stays in 2021.
- The number of sepsis-related stays for children 28 days and older increased by 16.4 percent between 2016 and 2021 from 28,700 to 33,400 stays. In contrast, the number of sepsis-related stays for neonates decreased by 47.8 percent between 2016 and 2021 from 69,600 to 36,300 stays. During this period, sepsis in-hospital mortality rates for children decreased by 19.4 percent (3.1 to 2.5 per 100 sepsis stays) and increased by 45.2 percent for neonates (4.2 to 6.1 per 100 sepsis stays).

Average Length of Stay and Hospital Costs for Inpatient Stays for Sepsis

Table 1 presents the average length of stay and average total hospital costs for inpatient stays for sepsis (i.e., sepsis is the principal diagnosis). Information is presented as an average across years for 2016–2019 and with and without COVID-19 for 2020 and 2021. Figures 3 and 4 present annual trends in aggregate hospital costs for sepsis stays from 2016 to 2021. Figure 5 presents the distribution of aggregate hospital costs of inpatient stays for sepsis by the expected primary payer for 2020 and 2021 with and without COVID-19. Figure 5 also presents information for 2016–2019 as an average for all sepsis stays and all inpatient stays for comparison.

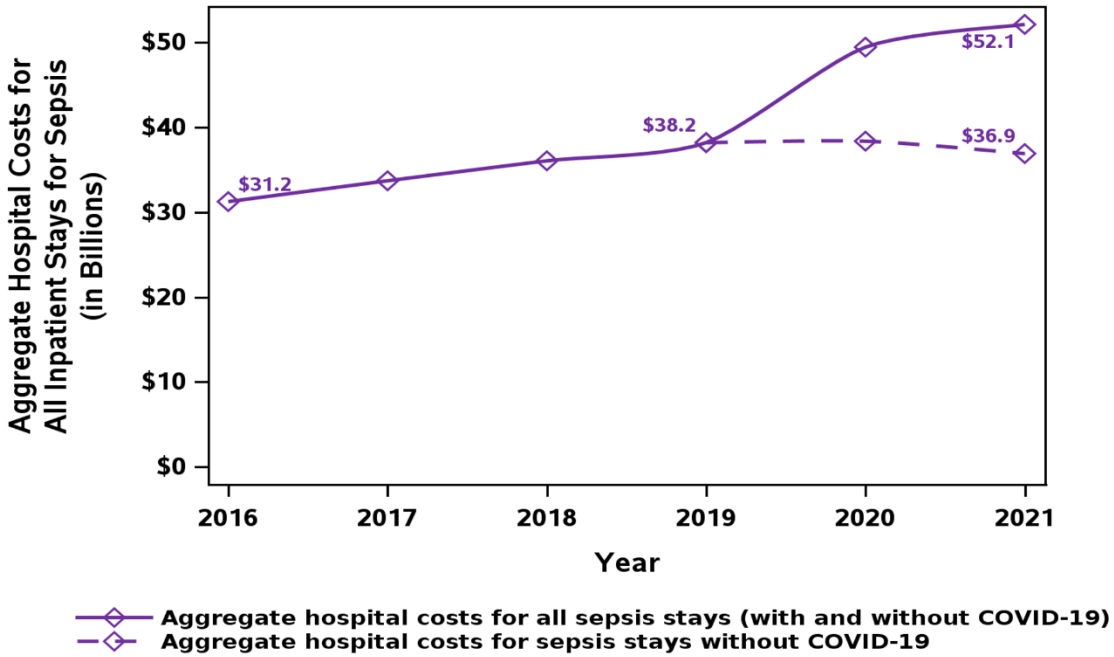
Table 1. Average length of stay and average total hospital costs for inpatient stays for sepsis by patient population, 2016–2019, 2020, and 2021

Outcome and patient population	2016–2019 Average	2020 Overall (with and without COVID-19)	2020 with COVID-19	2020 without COVID-19	2021 Overall (with and without COVID-19)	2021 with COVID-19	2021 without COVID-19
Average length of sepsis stays, days							
All sepsis stays	8.2	8.8	11.4	8.3	9.2	12.0	8.5
Adult (65+ years), nonmaternal	7.6	8.2	10.9	7.6	8.5	11.5	7.9
Adult (18–64 years), nonmaternal	9.1	9.7	12.1	9.1	10.3	12.4	9.4
Maternal	7.9	7.3	11.7	6.8	9.7	20.3	7.2
Pediatric (28 days–17 years)	9.0	9.3	8.1	9.3	9.1	10.9	8.9
Neonatal (0–27 days)	13.3	15.7	7.0	15.8	16.2	9.5	16.3
Average total hospital costs for sepsis stays, $							
All sepsis stays	24,600	28,300	37,000	26,600	28,800	38,500	26,000
Adult (65+ years), nonmaternal	21,700	25,100	33,100	23,500	25,000	34,100	23,100
Adult (18–64 years), nonmaternal	28,700	32,700	41,900	30,400	33,500	42,300	30,100
Maternal	31,000	31,000	73,700	26,400	43,800	110,100	27,900
Pediatric (28 days–17 years)	38,200	44,800	42,700	44,900	41,500	59,300	40,100
Neonatal (0–27 days)	43,400	61,100	10,300	61,700	56,300	29,000	56,900

Note: Outcomes (average length of sepsis stay and average total hospital costs) were based on stays in which sepsis was the reason for the stay (i.e., principal diagnosis). Table 3 of the Methods section includes information on the distribution of the number of stays in which sepsis was the reason for the stay versus was a co-occurring condition or complication of the stay. Charges were imputed to account for missing information prior to conversion to hospital costs. Hospital costs were adjusted to the base year of 2021. Average hospital costs were rounded to the nearest hundreds.
Source: Agency for Healthcare Research and Quality (AHRQ), Healthcare Cost and Utilization Project (HCUP), National Inpatient Sample (NIS), 2016–2021

- The average length of all sepsis stays increased by 12.7 percent from 2016–2019 to 2021, from an average of 8.2 days to 9.2 days.
- The average total cost of all sepsis stays increased by 17.1 percent from 2016–2019 to 2021, from an average of $24,600 per stay to $28,800.
- The average length of all adult sepsis stays increased by 12.1 percent from 2016–2019 to 2021 (for adults aged 65 years and older, 7.6 days to 8.5 days; for adults aged 18–64 years, 9.1 days to 10.3 days). In this same time period, the average total cost of all adult sepsis stays increased by over 15 percent, with a 15.4 percent increase for adults aged 65 years and older ($21,700 to $25,000) and a 17.1 percent increase for adults aged 18–64 ($28,700 to $33,500).
- The average length of maternal sepsis stays increased from 2016–2019 to 2021, from an average of 7.9 days to 9.7 days. The average total cost for maternal sepsis stays also increased from the 2016–2019 average of $31,000 to $43,800 in 2021.
- Regardless of the time period, the average total cost for sepsis stays was highest for neonates (an average of $43,400 in 2016–2019; $61,100 in 2020; and $56,300 in 2021).

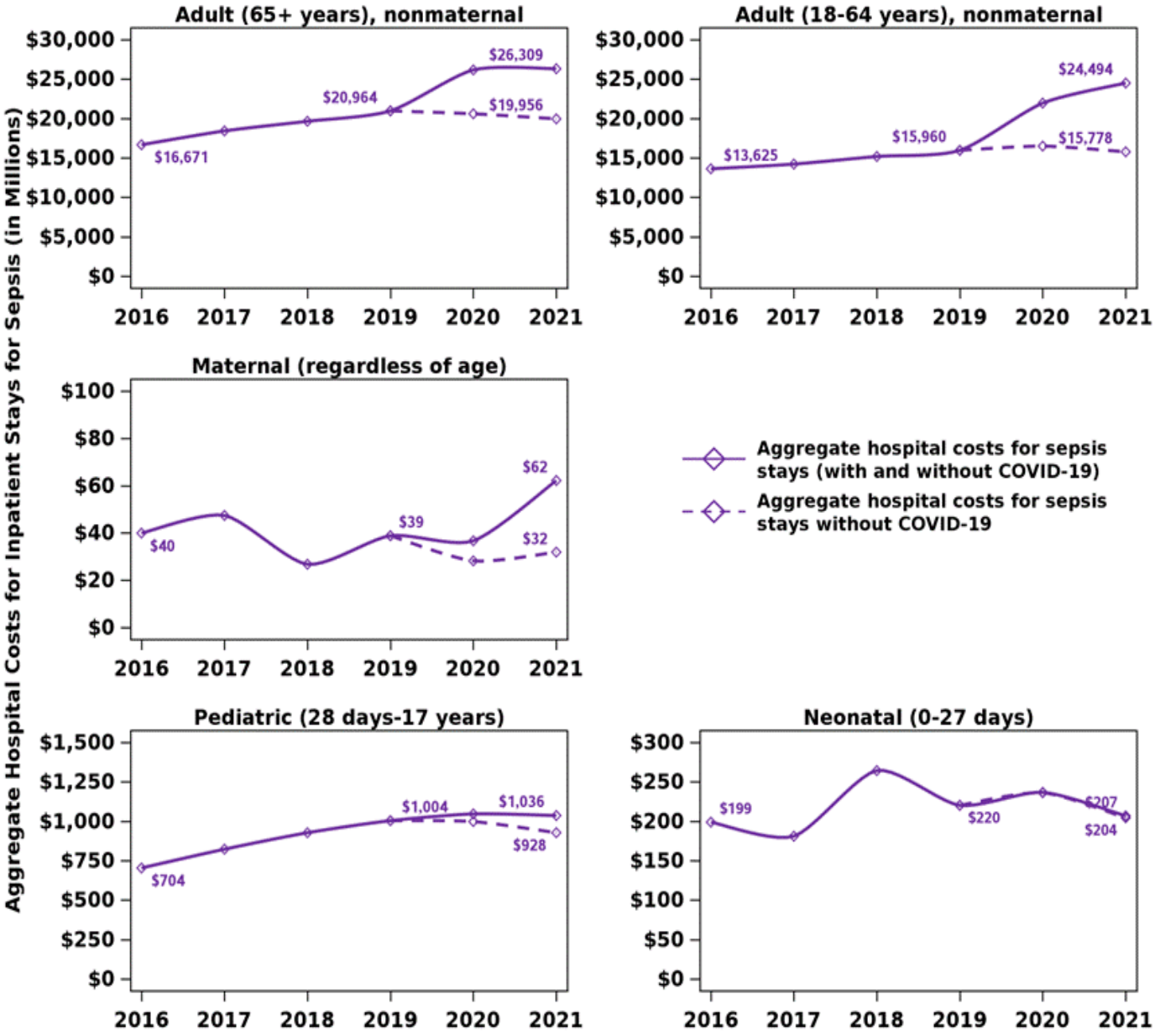
Figure 3. Trends in aggregate hospital costs for all inpatient stays for sepsis, 2016–2021



Note: Aggregate total hospital costs were based on stays in which sepsis was the reason for the stay. Table 3 of the Methods section includes information on the distribution of the aggregate total hospital costs for stays in which sepsis was the reason for the stay versus was a co-occurring condition or complication of the stay. Charges were imputed to account for missing information prior to conversion to hospital costs. Hospital costs were adjusted to the base year of 2021. Aggregate hospital costs were rounded to the nearest millions.
Source: Agency for Healthcare Research and Quality (AHRQ), Healthcare Cost and Utilization Project (HCUP), National Inpatient Sample (NIS), 2016–2021

- Aggregate hospital costs for sepsis stays increased by 22.2 percent from 2016 to 2019 ($31.2 to $38.2 billion). From 2019 to 2021, aggregate hospital costs increased by 36.5 percent ($38.2 to $52.1 billion). Excluding sepsis stays with COVID-19, aggregate hospital costs remained relatively stable at $36.9 billion in both 2020 and 2021.
- Aggregate hospital costs for sepsis stays accounted for 6.6 percent of all aggregate hospital costs in 2016 and 9.9 percent of hospital costs in 2021 (data not shown).

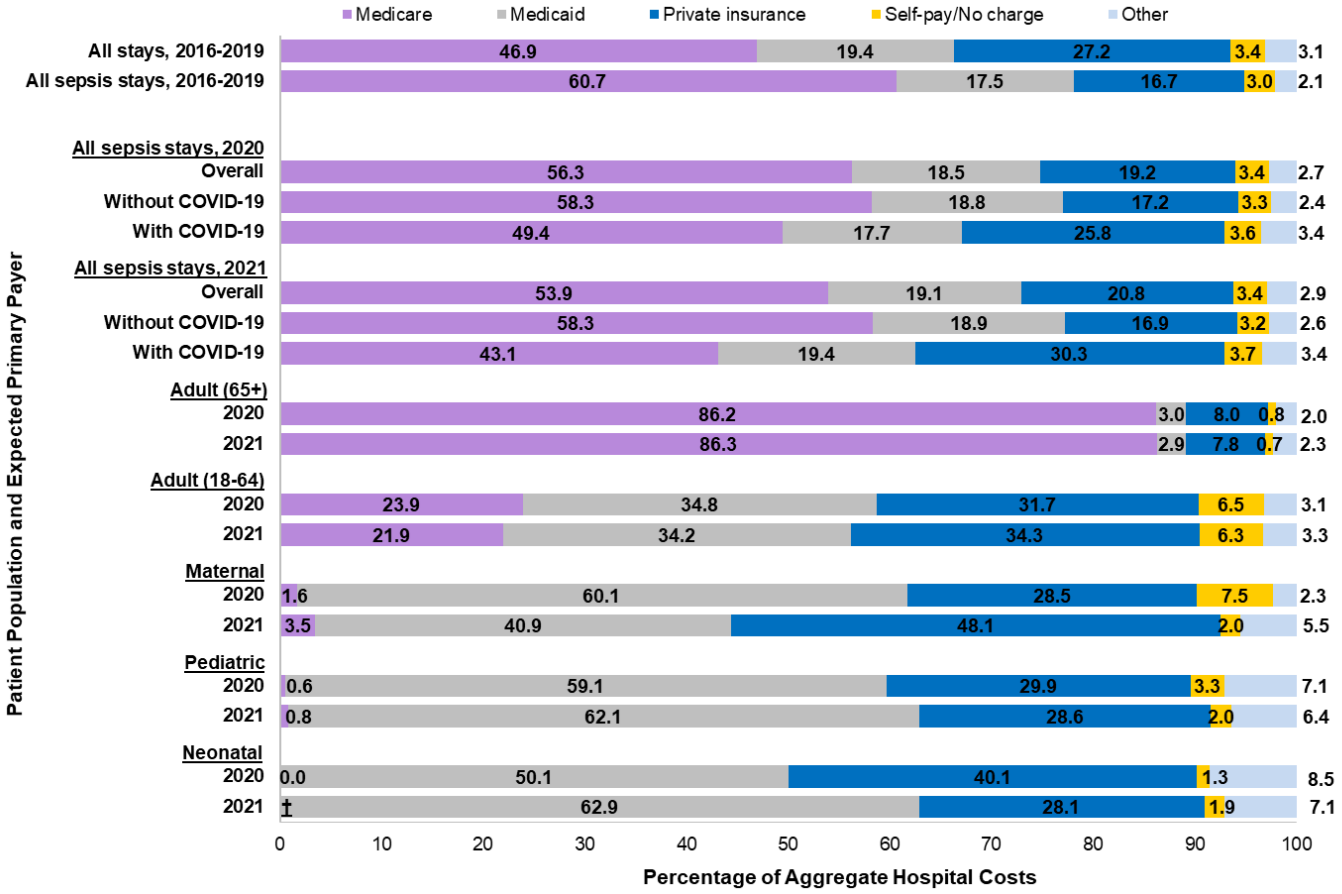
Figure 4. Trends in aggregate hospital costs for inpatient stays for sepsis, by patient population, 2016–2021



Note: Aggregate total hospital costs were based on stays in which sepsis was the reason for the stay (i.e., principal diagnosis). Table 3 of the Methods section includes information on the distribution of the aggregate total hospital costs for stays in which sepsis was the reason for the stay versus was a co-occurring condition or complication of the stay. Charges were imputed to account for missing information prior to conversion to hospital costs. Hospital costs were adjusted to the base year of 2021. Aggregate hospital costs were rounded to the nearest millions.
Source: Agency for Healthcare Research and Quality (AHRQ), Healthcare Cost and Utilization Project (HCUP), National Inpatient Sample (NIS), 2016–2021

- Aggregate hospital costs for adult sepsis stays increased from 2016 to 2021 by 57.8 percent for adults aged 65 and older ($16.7 to $26.3 billion) and 79.8 percent for adults aged 18–64 years ($13.6 to $24.5 billion).
- Aggregate hospital costs for maternal sepsis stays ranged between $27 million and $47 million from 2016 to 2020 and then increased to $62 million in 2021.
- Aggregate hospital costs for pediatric sepsis stays increased by 42.6 percent from 2016 to 2019 ($704 million to $1.0 billion) and then remained around $1.0 billion in both 2020 and 2021.

Figure 5. Distribution of aggregate hospital costs of inpatient stays for sepsis, by patient population and expected primary payer, 2016–2019, 2020, and 2021



Notes: Self-pay/No charge: includes self-pay, no charge, charity, and no expected payment. Aggregate total hospital costs were based on stays in which sepsis was the reason for the stay (i.e., principal diagnosis). Table 3 of the Methods section includes information on the distribution of the aggregate total hospital costs for stays in which sepsis was the reason for the stay versus was a co-occurring condition or complication of the stay. Charges were imputed to account for missing information prior to conversion to hospital costs. Hospital costs were adjusted to the base year of 2021.

‡Statistics based on a cell size less than or equal to 10 are suppressed.

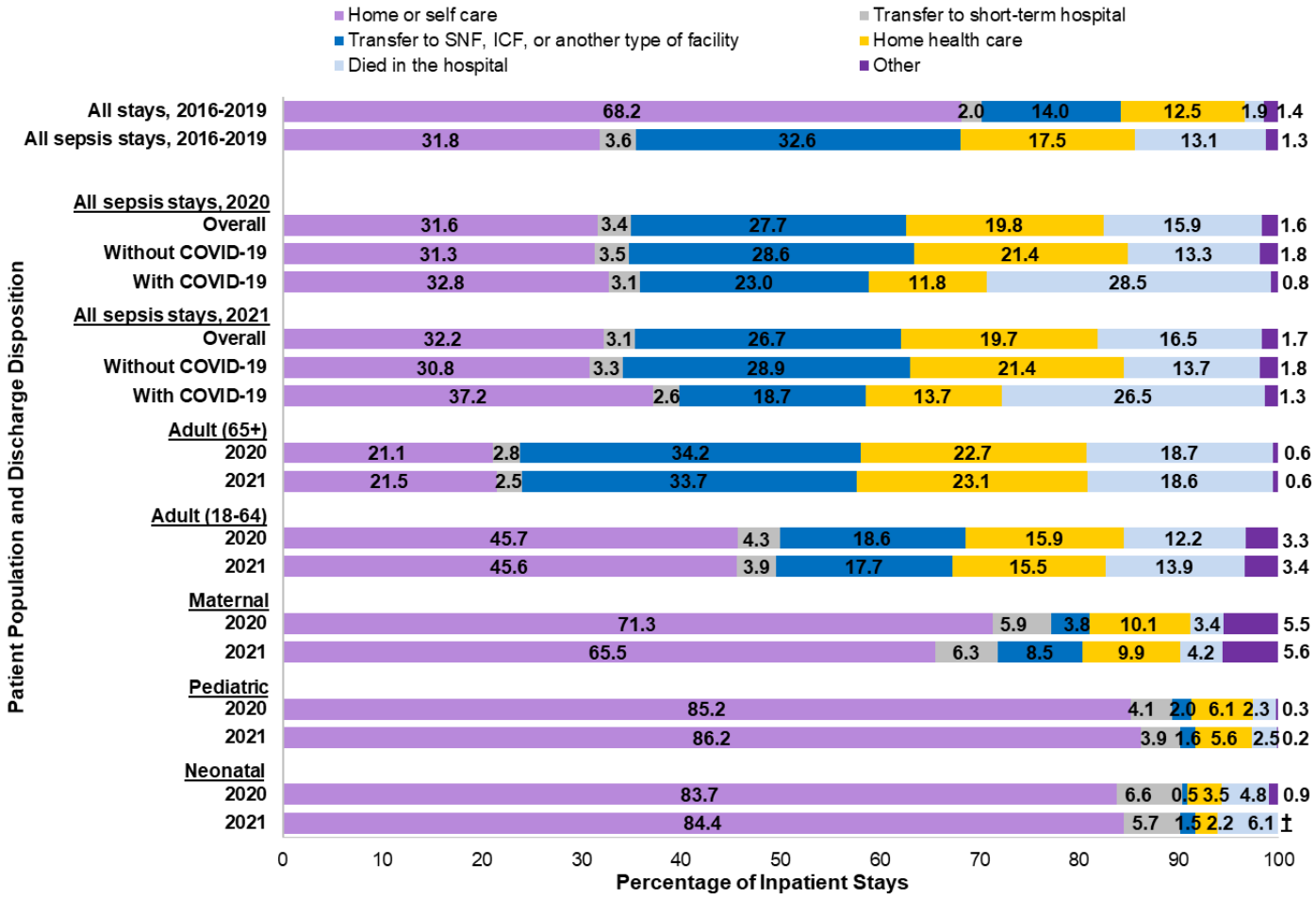
Source: Agency for Healthcare Research and Quality (AHRQ), Healthcare Cost and Utilization Project (HCUP), National Inpatient Sample (NIS), 2016–2021

- Over half the aggregate hospital costs for sepsis stays in 2020 and 2021 were associated with stays expected to be billed to Medicare (56.3 percent and 53.9 percent, respectively).
- In 2020 and 2021, Medicaid and private insurance were expected to be billed for about 20 percent of the aggregate hospital costs for sepsis stays (Medicaid, 18.5 and 19.1 percent, respectively; private insurance, 19.2 and 20.8 percent, respectively).
- In 2020, the largest proportion of aggregate hospital costs for maternal sepsis stays (60.1 percent) was expected to be billed to Medicaid. In 2021, the largest proportion of aggregate hospital costs for maternal sepsis stays (48.1 percent) was expected to be billed to private insurance.
- In 2020 and 2021, Medicaid was the expected payer for over half the aggregate hospital costs for pediatric and neonatal stays for sepsis (pediatric, 59.1 percent and 62.1 percent, respectively; neonatal, 50.1 percent and 62.9 percent, respectively).

Discharge Disposition for Inpatient Stays for Sepsis

Figure 6 presents the distribution of the number of inpatient stays for sepsis by the discharge disposition for 2020 and 2021 with and without COVID-19. Figure 6 also presents information for 2016–2019 as an average for all sepsis stays for comparison.

Figure 6. Distribution of the number of inpatient stays for sepsis, by patient population and discharge disposition, 2016–2019, 2020, and 2021



Abbreviations: ICF, intermediate care facility; SNF, skilled nursing facility
Notes: Other includes dispositions of against medical advice, discharged alive, missing, and invalid. The distribution of the number of inpatient stays for sepsis by discharge disposition was based on stays in which sepsis was the reason for the stay (i.e., principal diagnosis). Table 3 of the Methods section includes information on the distribution of the number of stays in which sepsis was the reason for the stay versus was a co-occurring condition or complication of the stay.
‡Statistics based on a cell size less than or equal to 10 are suppressed.
Source: Agency for Healthcare Research and Quality (AHRQ), Healthcare Cost and Utilization Project (HCUP), National Inpatient Sample (NIS), 2016–2021

- The percentage of sepsis stays resulting in transfers to skilled nursing, intermediate care, or another facility decreased from an average of 32.6 percent in 2016–2019 to 27.7 percent in 2020 and 26.7 percent in 2021.
- Among inpatient stays for sepsis with COVID-19, the proportion of stays resulting in transfers to skilled nursing, intermediate care, or another facility was 23.0 percent in 2020 and 18.7 percent in 2021.
- The percentage of inpatient stays for sepsis that resulted in a discharge to home health care increased from the average of 17.5 percent in 2016–2019 to nearly 20 percent in 2020 and 2021 (19.8 percent and 19.7 percent, respectively).
- In 2016–2019, an average of 13.1 percent of all sepsis stays resulted in an in-hospital death. In 2020 and 2021, the proportion of sepsis stays with COVID-19 resulting in an in-hospital death was double the proportion of sepsis stays without COVID-19 resulting in an in-hospital death (in 2020, 28.5 percent compared to 13.3 percent; in 2021, 26.5 percent compared to 13.7 percent).

References

[1] Singer M, Deutschman CS, Seymour CW et al. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). JAMA. 2016;315(8):801-810.

[2] Liang L (AHRQ), Moore B (IBM Watson Health), Soni A (AHRQ). National Inpatient Hospital Costs: The Most Expensive Conditions by Payer, 2017. HCUP Statistical Brief #261. July 2020. Agency for Healthcare Research and Quality, Rockville, MD. www.hcup-us.ahrq.gov/reports/statbriefs/sb261-MostExpensive-Hospital-Conditions-2017.pdf.

[3] What is Sepsis? Centers of Disease Control and Prevention. https://www.cdc.gov/sepsis/index.html. Accessed January 23, 2024.

[4] Get Ahead of Sepsis – Know the Risks. Spot the Signs. Act Fast. Centers of Disease Control and Prevention. https://www.cdc.gov/patientsafety/features/get-ahead-of-sepsis.html. Accessed January 23, 2024.

Data Source

This Statistical Brief uses data from the HCUP 2016–2021 National Inpatient Sample (NIS). For additional information about the HCUP NIS, see: https://hcup-us.ahrq.gov/db/nation/nis/nisdbdocumentation.jsp.

Population Studied

This analysis focused on inpatient stays with any-listed ICD-10-CM diagnosis of sepsis. Although the maximum number of diagnoses varies in the 2016–2021 NIS (30 diagnoses in the 2016 NIS and 40 diagnoses in 2017–2021), this analysis used all available diagnoses in the data year. Within each year, the number of diagnoses in the individual State Inpatient Databases (SID) used to create the NIS vary and may be different than the maximum retained in the NIS. No more than one percent of records have diagnoses excluded from the NIS in any given year.

The unit of analysis is the hospital discharge (i.e., the inpatient stay), not a person or patient. This means that a person who is admitted to the hospital multiple times in one year will be counted each time as a separate discharge from the hospital.

Case definition of sepsis by patient populations

Consistent with the Third International Consensus Definitions Task Force definition of Sepsis-3, the identification of inpatient stays related to sepsis was based on ICD-10-CM diagnoses indicating the presence of sepsis and organ dysfunction[a] Patients were divided into five mutually exclusive categories for the identification of inpatient stays related to sepsis with varying age and sepsis criteria: 1) maternal regardless of age, 2) adults 65 years and older, 3) adults 18–64 years, 4) pediatrics aged 28 days–17 years, and 5) neonates aged 0–27 days (Table 2).

The ICD-10-CM diagnoses codes used to identify sepsis are included in Appendix A, Table A.1. The ICD-10-CM diagnoses codes used to identify organ dysfunction are included in Appendix A, Table A.2. The ICD-10-CM/PCS codes used to identify a maternal case are included in Appendix A, Table A.3.

[a] Singer M, Deutschman CS, Seymour CW, et al. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). *Jama.* 2016;315(8):801-810

Table 2. Clinical Coding Criteria for Identifying Sepsis-Related Inpatient Stays for Mutually Exclusive Patient Populations

Population	Maternal	Age Criteria	Sepsis Criteria
Maternal	Yes – Any DX indicating a maternal condition as identified by QI setname MDC14PRINDX[*]	Any age	Any ICD-10-CM diagnosis of the following: • Septic shock[**] • Severe sepsis[***] • Any other diagnosis indicating sepsis *with* at least one diagnosis indicating organ dysfunction (including maternal "O" organ dysfunction codes)
Adult	No	65 years and older[****]	Any ICD-10-CM diagnosis of the following: • Septic shock[**] • Severe sepsis[***] • Any other diagnosis indicating sepsis *with* at least one diagnosis indicating organ dysfunction
Adult	No	18-64 years	Any ICD-10-CM diagnosis of the following: • Septic shock[**] • Severe sepsis[***] • Any other diagnosis indicating sepsis *with* at least one diagnosis indicating organ dysfunction
Pediatric	No	Age 0 with age in days > 27 days *or* age 1-17 years	Any ICD-10-CM diagnosis of the following: • Septic shock[**] • Severe sepsis[***] • Any other diagnosis indicating sepsis (no requirement to have indication of organ dysfunction)
Neonatal	No	Age in days of 0-27	Any ICD-10-CM diagnosis of the following: • Septic shock[**] • Severe sepsis[***] • Any other diagnosis indicating sepsis (no requirement to have indication of organ dysfunction)

[*]AHRQ Prevention Quality Indictor (PQI), Appendix F: MDC 14 and MDC 15 Principal Diagnosis Codes, v2023 (https://qualityindicators.ahrq.gov/Downloads/Modules/PQI/V2023/TechSpecs/PQI_Appendix_F.pdf). Accessed November 10, 2023.
[**] Septic shock identified by ICD-10-CM diagnoses R6521 and T8112XA.
[***] Severe sepsis identified by ICD-10-CM diagnosis R6520.
[****] The adults aged 65 years and older group included a small percentage of records (less than 0.02 percent) of sepsis-related inpatient stays missing patient age information. Records missing patient age information were included in this group because it was the largest of the patient populations.

Sepsis as the reason for the inpatient stay

For this Statistical Brief, outcomes (mortality rates, hospital costs, length of stay, and discharge disposition) are reported only when sepsis was the reason for the inpatient stay (i.e., principal diagnosis). Outcomes for stays when sepsis was a co-occurring condition or complication of the stay (i.e., only reported as a secondary diagnosis) are not examined in this Statistical Brief. For stays in which sepsis was a co-occurring condition or complication of the stay, other conditions, such as cancer, pneumonia, or heart failure, may be the reason for the inpatient stay and contribute to increased length of stay or hospital costs. Thus, outcomes for these inpatient stays cannot be attributed solely to sepsis.

The proportion of inpatient stays in which sepsis was the reason for the inpatient stay varies by patient population partially because of ICD-10-CM clinical coding guidelines. As such, these guidelines are important to consider in the development of the case definition for sepsis.

Table 3 presents the number and percentage of inpatient stays involving sepsis. Information is presented for 2016–2019 as an average across years and with and without COVID-19 for 2020 and 2021. Additionally, information is presented separately for sepsis as the reason for the stay versus a co-occurring condition or complication of the stay.

Table 3. Number and Percentage of Inpatient Stays Involving Sepsis by Patient Population, 2016–2019, 2020, and 2021

Outcome and patient population	2016-2019 (Average)	2020 Overall (with and without COVID-19)	2020 with COVID-19	2020 without COVID-19	2021 Overall (with and without COVID-19)	2021 with COVID-19	2021 without COVID-19
Sepsis was the reason for the inpatient stay (principal diagnosis of sepsis)							
Number of sepsis stays							
All sepsis stays	1,415,885	1,743,905	299,505	1,444,400	1,811,043	394,610	1,416,433
Adult (65+ years), nonmaternal	872,371	1,043,445	168,015	875,430	1,050,774	186,285	864,489
Adult (18–64 years), nonmaternal	514,671	672,055	130,190	541,865	730,229	206,130	524,099
Maternal	1,234	1,185	115	1,070	1,420	275	1,145
Pediatric (28 days–17 years)	22,635	23,345	1,135	22,210	24,945	1,835	23,110
Neonatal (0–27 days)	4,974	3,875	50	3,825	3,675	85	3,590
Percent of all sepsis stays, %							
All sepsis stays	71.4	73.3	78.2	72.4	72.6	76.5	71.6
Adult (65+ years), nonmaternal	76.2	76.6	78.1	76.3	75.4	76.2	75.3
Adult (18–64 years), nonmaternal	69.3	71.6	78.9	70.1	71.3	77.4	69.2
Maternal	22.1	17.6	10.2	19.1	17.7	10.0	21.7
Pediatric (28 days–17 years)	71.2	74.1	76.4	74.0	74.7	69.5	75.1
Neonatal (0–27 days)	8.6	9.9	55.6	66.8	10.1	41.5	9.9
Sepsis was a co-occurring condition or complication of the stay (any diagnosis of sepsis)							
Number of sepsis-related inpatient stays							
All sepsis stays	567,834	634,830	83,360	551,470	683,024	121,510	561,514
Adult (65+ years), nonmaternal	273,081	319,400	47,035	272,365	342,015	58,050	283,965
Adult (18–64 years), nonmaternal	228,305	266,550	34,920	231,630	293,285	60,055	233,230
Maternal	4,359	5,550	1,015	4,535	6,600	2,480	4,120
Pediatric (28 days–17 years)	9,150	8,155	350	7,805	8,470	805	7,665
Neonatal (0–27 days)	52,939	35,175	40	35,135	32,655	120	32,535
Percent of all sepsis-related inpatient stays, %							
All sepsis stays	28.6	26.7	21.8	27.6	27.4	23.5	28.4
Adult (65+ years), nonmaternal	23.8	23.4	21.9	23.7	24.6	23.8	24.7
Adult (18–64 years), nonmaternal	30.7	28.4	21.1	29.9	28.7	22.6	30.8
Maternal	77.9	82.4	89.8	80.9	82.3	90.0	78.3
Pediatric (28 days–17 years)	28.8	25.9	23.6	26.0	25.3	30.5	24.9
Neonatal (0–27 days)	91.4	90.1	44.4	90.2	89.9	58.5	90.1

Source: Agency for Healthcare Research and Quality (AHRQ), Healthcare Cost and Utilization Project (HCUP), National Inpatient Sample (NIS), 2016–2021

Identification of inpatient stays for COVID-19

The identification of inpatient stays related to COVID-19 was based on any of the following ICD-10-CM diagnoses:

- J1282, Pneumonia due to coronavirus disease 2019
- U071, COVID-19
- U099, Post COVID-19 condition, unspecified.

Definitions

Diagnoses

The *principal diagnosis* is that condition established after study to be chiefly responsible for the patient's admission to the hospital. *Secondary diagnoses* are conditions that coexist at the time of admission that require or affect patient care treatment received or management, or that develop during the inpatient stay. *Any-listed diagnoses* include the principal diagnosis plus all secondary diagnoses.

ICD-10-CM coding system

ICD-10-CM is the *International Classification of Diseases, Tenth Revision, Clinical Modification.* There are over 70,000 ICD-10-CM diagnosis codes.

Discharge status

Discharge status reflects the disposition of the patient at discharge from the hospital and includes the following six categories: routine (to home); transfer to another short-term hospital; transfer to skilled nursing facility (SNF), intermediate care (ICF), or another type of facility, such as a nursing home; home health care; died in the hospital; or other, which includes against medical advice (AMA), discharged alive (destination unknown), missing, and invalid.

Length of stay

The length of stay is calculated as the difference of the discharge date and the admission date. A patient admitted and discharged on the same day has a length of stay of zero days.

Total hospital costs and charges

Total hospital charges were converted to hospital costs using HCUP Cost-to-Charge Ratios based on hospital accounting reports from the Centers for Medicare & Medicaid Services (CMS).[b] *Hospital costs* reflect the actual expenses incurred in the production of hospital services, such as wages, supplies, and utility costs. *Charges* represent the amount a hospital billed for the case. For each hospital, a hospital-wide cost-to-charge ratio is used. Hospital charges reflect the amount the hospital billed for the entire hospital stay and do not include professional (physician) fees. Further information on the Cost-to-Charge Ratio can be found at: https://hcup-us.ahrq.gov/db/ccr/costtocharge.jsp.

Annual hospital costs were inflation-adjusted using the Gross Domestic Product (GDP) Price Index from the U.S. Department of Commerce, Bureau of Economic Analysis (BEA), with 2021 as the index base.[c] That is, all hospital costs are expressed in 2021 dollars.

Expected payer

To make coding uniform across all HCUP data sources, the primary expected payer combines detailed categories into general groups:

- Medicare: includes fee-for-service and managed care Medicare

[b] Agency for Healthcare Research and Quality. Cost-to-Charge Ratio Files. Healthcare Cost and Utilization Project (HCUP). Agency for Healthcare Research and Quality. Updated November 2021. www.hcup-us.ahrq.gov/db/state/costtocharge.jsp. Accessed January 23, 2024.
[c] BEA Interactive Data query tool, National Data, GDP & Personal Income, Section 1 Domestic Product and Income, Table 1.1.4. Price Indexes for Gross Domestic Product. Accessed November 15, 2023.

- Medicaid: includes fee-for-service and managed care Medicaid
- Private insurance: includes commercial nongovernmental payers, regardless of the type of plan (e.g., private health maintenance organizations [HMOs], preferred provider organizations [PPOs])
- Self-pay/No charge: includes self-pay, no charge, charity, and no expected payment
- Other payers: includes other Federal and local government programs (e.g., TRICARE, CHAMPVA, Indian Health Service, Black Lung, Title V) and Workers' Compensation.

In 2016, hospital stays that were expected to be billed to the State Children's Health Insurance Program (SCHIP) may be classified as Medicaid or Other, depending on the structure of the State program. Because most State data do not identify SCHIP as a separate expected payer, it is not possible to present this information separately. Starting in 2017, hospital stays that were expected to be billed to the State Children's Health Insurance Program (SCHIP) are included under Medicaid.

Calculations

Percentage differences

Percentage differences between groups were calculated using the following formula:

$$\text{Percentage difference} = \frac{(\text{Group 1 value} - \text{Group 2 value})}{\text{Group 2 value}} * 100$$

The percentage differences were based on un-rounded numbers.

Mortality rate

The mortality rates per 100 sepsis stays were calculated as follows:

- Numerator of inpatient stays for sepsis in which the patient died in the hospital
- Denominator of inpatient stays for sepsis (any discharge status).

Imputation of missing charges and costs

The NIS is missing information on total hospital charges on less than 2 percent of records in 2016–2021. The missing charges were imputed using the average total hospital charges for the Diagnosis Related Group (DRG) calculated using the NIS for the same data year. The imputation of total hospital charges occurred prior to the calculation of total hospital costs. The imputation of missing charges, the calculation of hospital costs, and the adjustment to the base year of 2021 were performed per discharge prior to the calculation of average and aggregate hospital costs within and across years.

Average for years 2016–2019

The averages for years 2016–2019 were calculated by pooling discharges across the individual data years and then calculating the averages using the pooled data (instead of averaging the annual statistics).

About HCUP

The Healthcare Cost and Utilization Project (HCUP, pronounced "H-Cup") is a family of healthcare databases and related software tools and products developed through a Federal-State-Industry partnership and sponsored by the Agency for Healthcare Research and Quality (AHRQ). HCUP databases bring together the data collection efforts of State data organizations, hospital associations, and private data organizations (HCUP Partners) and the Federal government to create a national information resource of encounter-level healthcare data. HCUP includes the largest collection of longitudinal hospital care data in the United States, with all-payer, encounter-level information beginning in 1988. These databases enable research on a broad range of health policy issues, including cost and quality of health services, medical practice patterns, access to healthcare programs, and outcomes of treatments at the national, State, and local market levels. For more information about HCUP, see: https://hcup-us.ahrq.gov/.

HCUP would not be possible without the contributions of the following data collection Partners from across the United States:

Alaska Department of Health
Alaska Hospital and Healthcare Association
Arizona Department of Health Services
Arkansas Department of Health
California Department of Health Care Access and Information
Colorado Hospital Association
Connecticut Hospital Association
Delaware Division of Public Health
District of Columbia Hospital Association
Florida Agency for Health Care Administration
Georgia Hospital Association
Hawaii Laulima Data Alliance
Hawaii University of Hawai'i at Hilo
Illinois Department of Public Health
Indiana Hospital Association
Iowa Hospital Association
Kansas Hospital Association
Kentucky Cabinet for Health and Family Services
Louisiana Department of Health
Maine Health Data Organization
Maryland Health Services Cost Review Commission
Massachusetts Center for Health Information and Analysis
Michigan Health & Hospital Association
Minnesota Hospital Association
Mississippi State Department of Health
Missouri Hospital Industry Data Institute
Montana Hospital Association
Nebraska Hospital Association
Nevada Department of Health and Human Services
New Hampshire Department of Health & Human Services
New Jersey Department of Health
New Mexico Department of Health
New York State Department of Health
North Carolina Department of Health and Human Services
North Dakota (data provided by the Minnesota Hospital Association)
Ohio Hospital Association
Oklahoma State Department of Health
Oregon Association of Hospitals and Health Systems
Oregon Health Authority
Pennsylvania Health Care Cost Containment Council
Rhode Island Department of Health
South Carolina Revenue and Fiscal Affairs Office
South Dakota Association of Healthcare Organizations
Tennessee Hospital Association
Texas Department of State Health Services
Utah Department of Health
Vermont Association of Hospitals and Health Systems
Virginia Health Information
Washington State Department of Health
West Virginia Department of Health and Human Resources
Wisconsin Department of Health Services
Wyoming Hospital Association

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For More Information

For more information on this and other topics, please visit our HCUP Statistical Briefs topic area page located at www.hcup-us.ahrq.gov/reports/statbriefs/sbtopic.jsp.

For additional HCUP statistics, visit:

- HCUP Fast Stats at https://datatools.ahrq.gov/hcup-fast-stats for easy access to the latest HCUP-based statistics for healthcare information topics
- HCUPnet, HCUP's interactive query system, at https://datatools.ahrq.gov/hcupnet
- HCUP Summary Trend Tables at www.hcup-us.ahrq.gov/reports/trendtables/summarytrendtables.jsp for monthly information on hospital utilization.

AHRQ welcomes questions and comments from readers of this publication who are interested in obtaining more information about access, cost, use, financing, and quality of healthcare in the United States. We also invite you to tell us how you are using this Statistical Brief and other HCUP data and tools and to share suggestions on how

HCUP products might be enhanced to further meet your needs. Please email us at hcup@ahrq.gov or send a letter to the address below:

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