ANALYSIS PAPER

Bridging the Gap: Developing a Standardized Metric for Sepsis Readmission Using CMS Methodologies

By Candice Cam, Senior Data Analyst
ccam@hqinstitute.org

June, 2025

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EXECUTIVE SUMMARY

Sepsis is a significant contributor to hospital mortality nationwide, yet the Centers for Medicare & Medicaid Services (CMS) does not provide a standard metric for its measurement. The CMS Hospital Readmissions Reduction Program, which aims to reduce hospital readmissions, does not include sepsis among its targeted conditions or specific metrics. Given the frequent prevalence of sepsis among Medicare and Medicaid patients, along with the high mortality rate for sepsis, the omission of sepsis from CMS' established measures for both mortality and readmissions is conspicuous.

In response to the lack of a standardized CMS metric for sepsis readmissions, the Hospital Quality Institute (HQI) developed a sepsis-specific readmission measure based on CMS' condition-specific readmission methodology, which is the foundation for this report. This approach supports the current analysis and offers a framework for HQI to develop additional readmission measures for other conditions in the future.

In developing a sepsis-specific readmission measure, HQI provides metrics for multiple definitions of sepsis and septic shock, including SEP-3 sepsis and septic shock, SEP-1/SEP-2 sepsis, and CMS Medicare Severity Diagnosis Related Groups (MS-DRG) 870-872 sepsis. This methodology aims to provide a comprehensive set of sepsis-specific readmissions measures for the purposes of reducing sepsis readmissions and improving patient outcomes.

KEY POINTS

- Sepsis remains a leading cause of hospital mortality. Given its profound impact on health care outcomes, its exclusion from the CMS-targeted readmission metrics raises concern.
- Using CMS' condition-specific readmission methodology as a foundational framework, HQI's analysis found that sepsis readmissions occur at a rate similar to other conditions targeted by CMS interventions, such as heart failure and pneumonia, and sheds light on whether readmission led to mortality.
- A standardized approach to managing sepsis, such as through quality-based payment adjustments, is needed to improve patient care.

METHODOLOGY

Key Terms

Index admission represents a qualifying inpatient admission coded with a sepsis diagnosis.

Readmission refers to an unplanned inpatient admission for any reason that occurs within 30 days following the discharge of an eligible index admission. Exclusions include:

- Planned readmissions
- Readmissions on the same or next calendar day of the index admission discharge, as this is considered a continuation of an episode of care[1]
- Readmissions with a principal diagnosis code of COVID-19 (U07.1) or with a secondary diagnosis code of COVID-19 coded as present on admission (POA)

[1] A patient is transferred between hospitals when: (a) discharged from one hospital and admitted to another on the same or next day, and (b) both hospitals are acute care facilities. Patients moving from outpatient or ED settings are not transfer patients. They do not need the same diagnosis or procedures for a transfer designation.

HQI Readmission Methodology

HQI combined inpatient patient-level encounter records from calendar years (CYs) 2020, 2021, and 2022 into one dataset. This approach allowed patients to be tracked between 2020-21 and 2021-22 if they were discharged in December and readmitted in January (see Appendix A for the initial construction of analytical cohort for potential index cases).

HQI Initial Data Processing

HQI conducted initial data cleanup to remove any records:

- Missing a unique patient identifier, such as the record linkage number (RLN) (cases missing RLN or a unique identifier cannot be used to track readmissions; RLN = Missing)
- With length of stay (LOS) greater than a year (LOS > 365)
- From pediatric hospitals
- From facilities that do not provide short-term acute care (i.e., skilled nursing, psychiatric, chemical dependency, physical rehabilitation, and long-term care facilities)
- From the two California prospective payment system (PPS)-exempt cancer hospitals (City of Hope National Medical Center and USC Kenneth Norris Jr. Cancer Hospital)
- Unrelated to acute care (i.e., skilled nursing, psychiatric, chemical dependency, physical rehabilitation, and missing/invalid)

HQI Index Admissions Identification

1) HQI defined index admissions as those records remaining after initial data processing and cleanup that satisfied **all** the following criteria:
    - Age 18 or older at admission
    - Discharged **alive** from a non-federal short-term acute care hospital (DISP ≠ 2, 20, 66, 82, or 94)
    - **Not** an acute-to-acute transfer. If the discharge date from a previous visit and the admission date of the next visit is within one calendar day for the same RLN, HQI treats the records as a single episode of care involving a transfer. In the case of transfers, HQI retains the earlier visit's admission date and uses it in place of the subsequent visit's admission date. Multiple admissions and discharges can be chained in this manner. Through this process, the records are combined into a single continuous visit. Table 1 shows an example of the HQI transfer methodology applied to a chain of four encounter records for the same RLN that are combined into a single episode of care.

Table 1. *Illustration of HQI Transfer Methodology Applied to Multiple Acute-to-Acute Transfer Records Combined into a Single Episode of Care*

RLN	Admit Date	Disch Date	Days Difference	Transfer	RLN	Admit Date	Disch Date
A	1/12/21	1/15/21	.		A	1/12/21	2/4/21
A	1/15/21	1/21/21	0	Y			
A	1/22/21	1/23/21	1	Y			
A	1/29/21	2/4/21	0	Y			

2) Then, HQI flagged sepsis cases using HQI's definitions:[2]
    - SEP-1/2 Sepsis: 1st and 2nd International Consensus Definitions (Appendix B)
        - Definition: Infection + Systemic Inflammatory Response Syndrome

[2] For other condition-specific readmission measures (acute myocardial infarction, chronic obstructive pulmonary disease, heart failure, pneumonia), replace this section with the relevant codes.

  - Codes: D_x Infection **OR** D_x Septic Shock
- DRG 870-872 Sepsis: CMS MS-DRG 870-872 Sepsis (Appendix C)
  - Definition: Infection + T_x Resource Burden (e.g., ventilator hours)
  - Codes: D_x SEP-1/2 **OR** D_x (meningococcal infection **or** hypovolemic shock **or** bacteremia)
- SEP-3 Sepsis: 3rd International Consensus Definition (Appendix D)
  - Definition: Infection + Organ Dysfunction
  - Codes: D_x Septic Shock **OR** D_x (infection **and** organ dysfunction)
- Septic Shock: 3rd International Consensus Definition (Appendix E)
  - Definition: Septic Shock
  - Codes: D_x (infection + organ dysfunction + circulatory and metabolic dysfunction)

3) After completing the steps above, HQI **excluded** index admissions that otherwise qualify if they met **any** of the following criteria:
   - A principal diagnosis of COVID-19 (DIAG_P = 'U071')
   - Any secondary diagnosis of COVID-19 that was present on admission (ODIAG# = 'U071' and ODIAG#_POA = 'Y')
   - Discharged against medical advice (DISP = 7)

4) The remaining records were flagged as index admissions with the index flag variable (INDEX = Y). The dataset was sorted by discharge date, and the days difference between encounters for each sepsis case was calculated (days difference = current admission date – prior discharge date). For sepsis index admissions that occurred within 30 days of a prior index admission, the index flag was removed from the subsequent encounter. This is because encounters within 30 days of an index admission are readmissions, not indexes, according to CMS' condition-specific readmission methodology. Table 2 shows an example of identifying eligible index admission cases.

Table 2. *Illustration of HQI Validating Cases as Eligible Sepsis Indices*

RLN	Admit Date	Disch Date	Days Difference	Index		RLN	Admit Date	Disch Date	Index
A	1/12/21	1/15/21	.	Y		A	1/12/21	1/15/21	Y
A	1/30/21	2/4/21	15	Y		A	1/30/21	2/4/21	

5) To conclude the index admission identification, the index flag was merged back to the initial data processing data set, including condensed transfer chains, as displayed in Table 1. This final data set excluded encounters with missing RLNs, LOS > 365 days, and transfer chains that were consolidated into single records. When merging the index flag variable to this data set, some flags did not match. These were excluded given that they were part of a transfer chain in which only the last record was kept.

HQI Readmission Identification

HQI defines readmissions as **unplanned** inpatient visits for any cause from two to 30 days after index admission discharge. HQI identifies and flags records with **any** of the following as **planned** encounters (UNPLANNED = N):

- Any "always planned" procedure category indicating a bone marrow transplant, kidney transplant, or other organ transplant (CCS = 64, 105, 176)
- An "always planned" principal diagnosis category indicating chemotherapy/radiotherapy or rehabilitation care/fitting of prostheses/adjustment of devices (CCS = 45, 254)
- A "potentially planned" procedure defined as a combination of any potentially planned procedure category (see Table PR.3. Potentially Planned Procedures in the CMS HWR crosswalk) without an accompanying principal diagnosis category (see Table PR.4. Acute Diagnoses in the CMS HWR crosswalk)

Subsequently, any records not flagged as **planned** are considered **unplanned** visits (UNPLANNED = Y). The data set is then sorted in ascending order by both RLN and admission date. For each index admission, HQI then calculates the difference, in days, between the **discharge** date and **admission** date for each subsequent visit among records with the same RLN (DAYS_DIFF). Finally, records are flagged as readmissions if they meet **all** of the following criteria (READMISSION = Y):

- RLN matches the RLN for the prior record (RLN = prior RLN)
- Admission date is within two to 30 days of the discharge date for the prior record ($2 \leq$ DAYS_DIFF ≤ 30)
- Visit is unplanned (UNPLANNED = Y)

Note that for CMS condition-specific readmission, sepsis admission within 30 days of an index admission counts as a readmission, not another index admission. In addition, if there are multiple unplanned visits within 30 days of an index admission, only the *first* subsequent visit is flagged as a readmission. That is, HQI only coded readmission flags for the visit **immediately** after each index admission. If the first subsequent visit was a **planned** visit (UNPLANNED = N), even if it was within two to 30 days of the index admission ($2 \leq$ DAYS_DIFF ≤ 30), it was explicitly coded as **not** a readmission (READMISSION = N). The facility identifier of the index admission was recorded for each record flagged as a readmission (CREDIT_FAC). Table 3 illustrates an example of the HQI readmissions methodology applied to a chain of five encounter records for the same RLN that results in one readmission being flagged for one of two index admissions.

Table 3. *Illustration of HQI Readmission Methodology Applied to Multiple Records Resulting in One Readmissions for Two Indices*

Visit	RLN	Hospital	Admit Date	Disch Date	Days Difference	Index	Unplanned	Readmission	Credit_Fac
1	A	A	7/24/20	7/28/20	.	Y	Y		
2	A	A	8/10/20	8/13/20	13		N	N	
3	A	B	9/5/20	9/9/20	.	Y	Y		
4	A	C	9/18/20	9/21/20	9		Y	Y	B
5	A	C	9/24/20	10/2/20	12		Y		

Below is a visit-by-visit explanation of the example presented in Table 3:

- Visit 1 was an **unplanned index admission**.
- Visit 2 was a **planned non-index admission** 13 days after the Visit 1 index discharge. However, because Visit 2 was a **planned** visit, it was **not** flagged as a readmission for Visit 1.
- Visit 3 was an **unplanned index admission** >30 days after the prior index (Visit 1). Because Visit 3 is an index admission, DAYS_DIFF is null.
- Visit 4 was an **unplanned non-index admission** nine days after the Visit 3 index discharge and was thus flagged as a **readmission** with credit going to the Visit 3 facility (Facility B).
- Visit 5 was an **unplanned non-index admission** 12 days after the Visit 3 index discharge. Because there were multiple readmissions for one index admission, Visit 5 was **not** flagged as another readmission.

HQI Readmission Rate Calculation

For each hospital X (arbitrary value):

- Numerator = total number of readmission records (READMISSION = Y and CREDIT_FAC = X)
- Denominator = total number of index admission records (INDEX = Y and hospital = X)
- Readmission Rate = (numerator / denominator) x 100

For example, the data in Table 3 can be used to calculate the readmission rates for each facility.

- Facility A had one index admission but no readmission, as the subsequent visit was planned. Facility A's readmission rate is 0% (0 readmission/ 1 index admission = 0%).
- Facility B had one index admission and one readmission, even though the readmission occurred at Facility C. Facility B's readmission rate is 100% (1 readmission / 1 index admission = 100%).
- Facility C's readmission rate is not calculable with the current table (0 readmission / 0 index admissions = undefined).

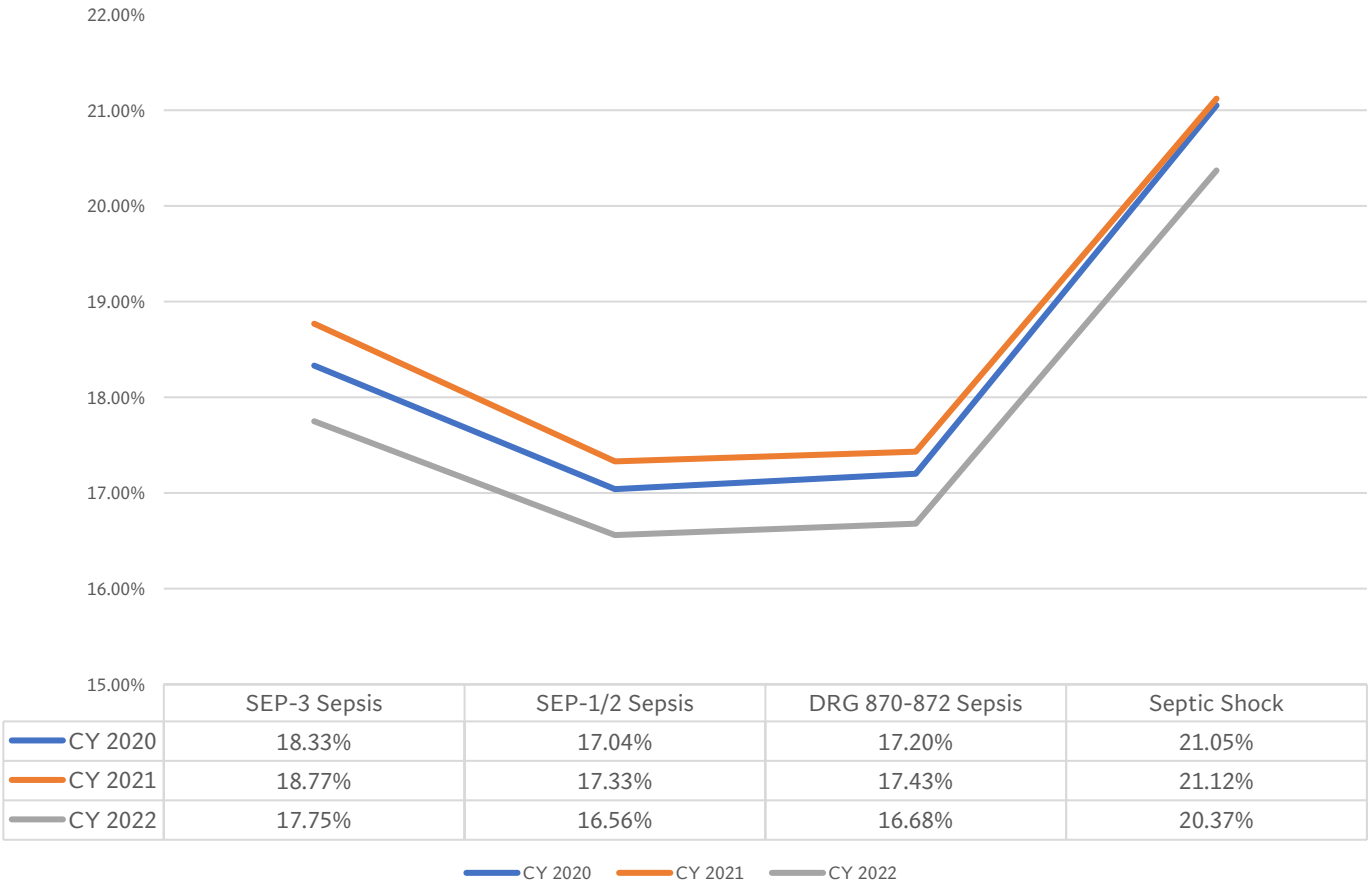
The original data set was a singular table with CYs 2020-22; however, the potential readmissions that occurred within the December 2022 data set are truncated because January 2023 data was omitted. Because of this, the 30-day readmission rates for December 2022 are biased downward, closer to 0%.

FINDINGS

Longitudinal 30-Day All-Cause Sepsis Readmission Rates

Figure 1 shows the 30-day all-cause readmission rates for each sepsis definition based on the previously described methodology. While all definitions showed modest declines over time, the relative ranking of readmission risk remained stable: Septic shock was highest, followed by SEP-3, then SEP-1/2 and DRG 870–872, which had both the lowest and most similar rates throughout. These differences highlight the influence of sepsis severity and diagnostic criteria on patient outcomes.

Figure 1. *HQI's Calculated Readmission Rates for Various Sepsis Definitions from CY 2020-22*

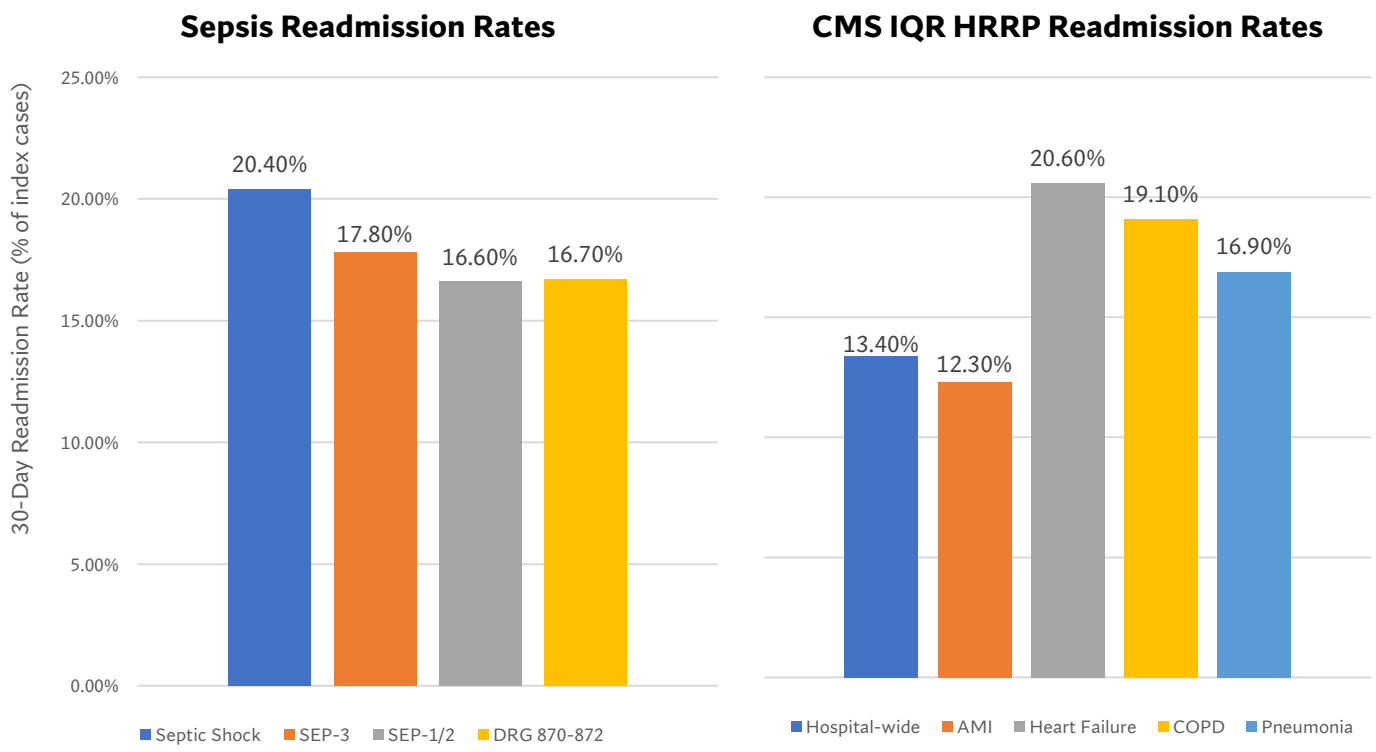


	SEP-3 Sepsis	SEP-1/2 Sepsis	DRG 870-872 Sepsis	Septic Shock
CY 2020	18.33%	17.04%	17.20%	21.05%
CY 2021	18.77%	17.33%	17.43%	21.12%
CY 2022	17.75%	16.56%	16.68%	20.37%

Comparison of 30-Day All-Cause Readmission Rates: Sepsis vs. Other Conditions

Figure 2 presents a comparison of 30-day all-cause readmission rates in California for CY 2022, highlighting sepsis readmission rates across multiple definitions alongside condition-specific rates tracked by CMS under the Inpatient Quality Reporting (IQR) Program and Hospital Readmissions Reduction Program (HRRP). The IQR Program is a CMS initiative that collects and publicly reports hospital quality data, while the HRRP targets hospitals with excess readmissions for certain high-impact conditions by adjusting Medicare payments. Conditions included in the HRRP are acute myocardial infarction (AMI), heart failure, chronic obstructive pulmonary disease (COPD), and pneumonia.

Figure 2. *30-Day All-Cause Readmission Rates in California, 2022: Sepsis Compared to CMS-Tracked Conditions Under IQR Program and HRRP*



Data source: California Department of Health Care Access and Information inpatient encounters

In 2022, 30-day readmission rates for sepsis were comparable and, in some cases, higher than those of HRRP-targeted conditions. The septic shock readmission rate was 20.4%, nearly matching the heart failure readmission rate of 20.6% — the highest rate in the group. SEP-3 followed at 17.8%, slightly below COPD (19.1%) but above pneumonia (16.9%). SEP-1/2 and DRG 870–872 had closely aligned rates of 16.6% and 16.7%, respectively, falling just under pneumonia and above hospital-wide (13.4%) and AMI (12.3%) rates.

These data underscore that sepsis readmissions, particularly in more severe or broadly defined cases, represent a concern on par with the conditions already targeted by CMS for quality-based payment adjustments.

CONCLUSION

Despite its high prevalence, complexity, impact on patients (including mortality), and cost, sepsis is not included in CMS' readmission metrics or penalty structure. This exclusion is concerning, as it means missed opportunities for both improving care transitions and reducing preventable hospitalizations.

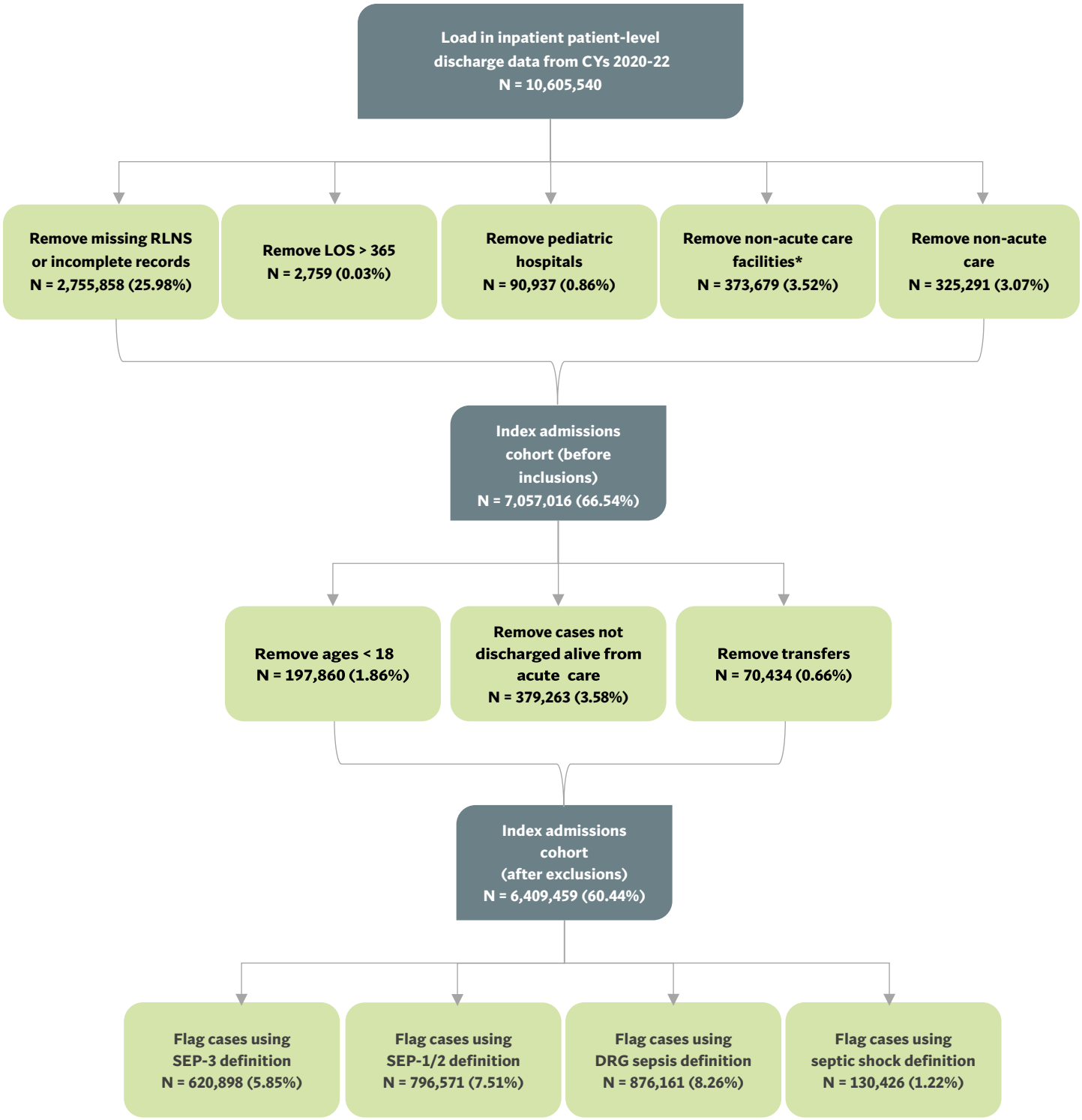
HQI's method of measuring sepsis-specific readmissions using CMS' condition-specific methodology uses standardized definitions of sepsis, offering clear criteria for identifying admissions and excluding invalid encounters. The consistent results over three years affirm this methodology's reliability.

HQI conducted this analysis to help create measures for sepsis-related readmissions, with the ultimate goal of using them to develop strategies for reducing readmissions and improving care. HQI's findings — that sepsis has a 30-day all-cause readmission rate comparable to, or exceeding, conditions targeted by CMS' HRRP — highlight the need for a standardized approach to managing sepsis. Incorporating a sepsis metric into CMS' quality measures could enable enhanced interventions, improve patient outcomes, and reduce the financial burden on the health care system.

Contact Candice Cam, senior data analyst, at ccam@hqinstitute.org with questions.

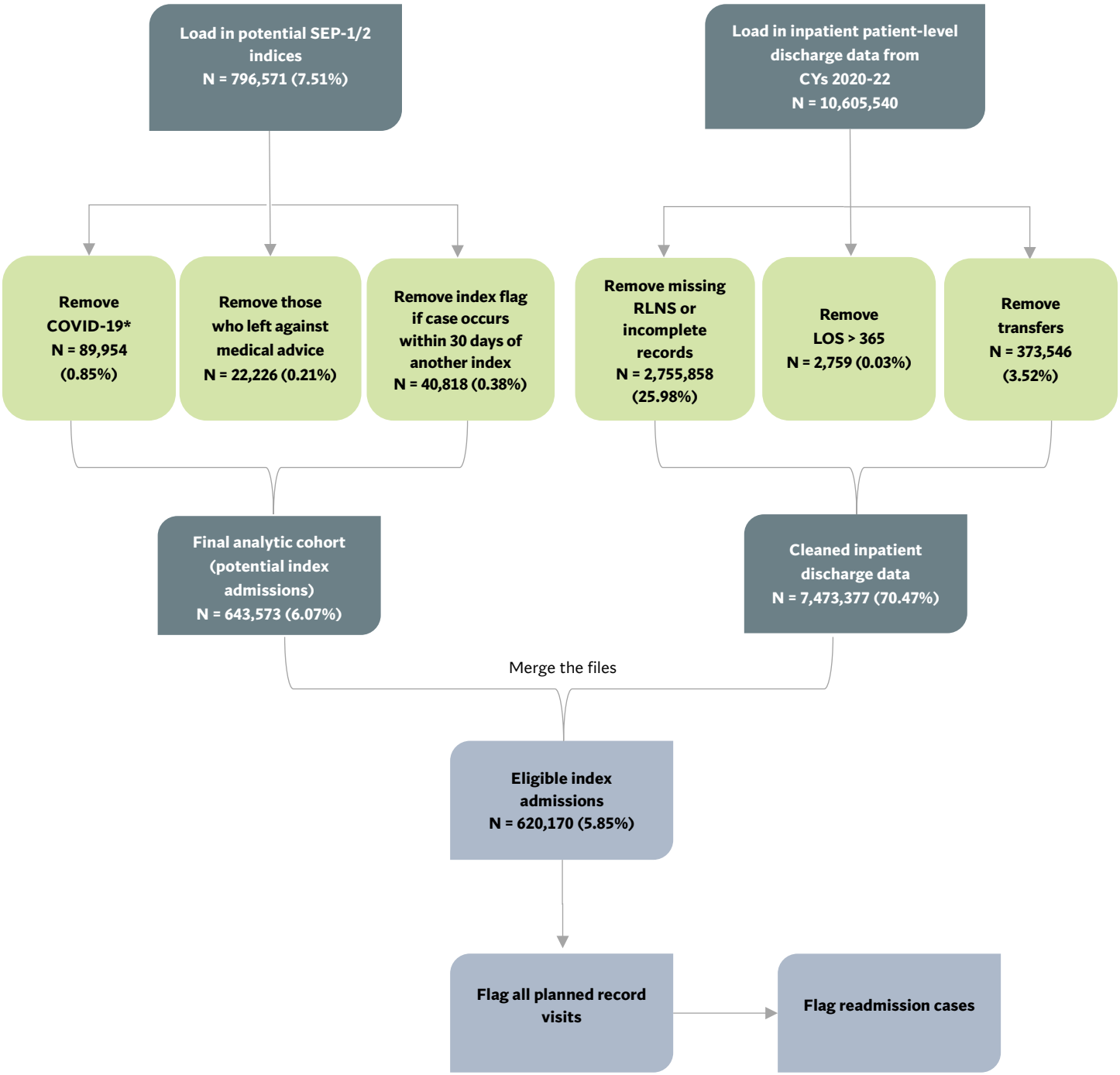
APPENDIX A

HQI Construction of Analytical Cohort for Potential Index Cases for CYs 2020-22



APPENDIX B

Construction of Final 30-Day All-cause SEP-1/2 Sepsis Readmission Rate



APPENDIX C

Construction of Final 30-Day All-Cause DRG 870-872 Sepsis Readmission Rate

APPENDIX D

Construction of Final 30-Day All-Cause SEP-3 Sepsis Readmission Rate

APPENDIX E

Construction of Final 30-Day All-Cause SEP-3 Sepsis Readmission Rate

ABOUT US

The Hospital Quality Institute (HQI) is dedicated to advancing patient safety and quality of care for all Californians. Through strategic partnerships and innovative programs, HQI supports hospitals in achieving excellence by providing data analytics, educational resources, and statewide initiatives focused on performance improvement. HQI oversees and coordinates the Collaborative Health Care Patient Safety Organization (CHPSO).