Decoding the Chaos:
Sepsis Incidence, Mortality,
Readmission and Missed Opportunities

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Hospital Quality Institute

- 501 C 3 Non-Profit Organization

- Part of California Hospital Association

- Independent Board of Directors

- 495 members

- 21 states

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HQI Data Platforms

Hospital Quality Improvement Platform

- Comparative Analytics Platform
- Patient Encounter Data

CHPSOData

- Reporting, Standardization, & Analytics Platform
- Safety Event Data

SpeedTrack

HQIP and CHPSOData are powered by our analytics partner

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Cracking the Code: Why do so many sepsis cases return to hospitals?

1. *What* is sepsis clinically and administratively?

2. *How* big of an issue are returning sepsis cases ?

3. *Why* are sepsis cases returning?

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The Burden of Sepsis

Severity

- 270,000 deaths each year
- 1 in 3 hospital deaths
- Top reason for hospital stay

Prevalence

- Nearly 2 million Adults in US

Costs

- Estimated to cost an avg $30K per patient
- Estimated to cost $20 billion a year in US

Mellhammar L, Wollter E, Dahlberg J, Donovan B, Olséen CJ, Wiking PO, Rose N, Schwarzkopf D, Friedrich M, Fleischmann-Struzek C, Reinhort K, Linder A. Estimating Sepsis Incidence Using Administrative Data and Clinical Medical Record Review. JAMA Netw Open. 2023 Aug 1;6(8):e2331168. doi: 10.1001/jamanetworkopen.2023.31168. PMID: 37642964; PMCID: PMC10466163.

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Sepsis & Septic Shock Clinical Definitions

Defined

- Syndrome not a disease

- Dysregulated response

Hunter P. Sepsis under siege: a new understanding of sepsis might lead to the development of therapies to treat septic shock. EMBO Rep. 2006 Jul;7(7):667-9. doi: 10.1038/sj.embor.7400742. PMID: 16819459; PMCID: PMC1500822.
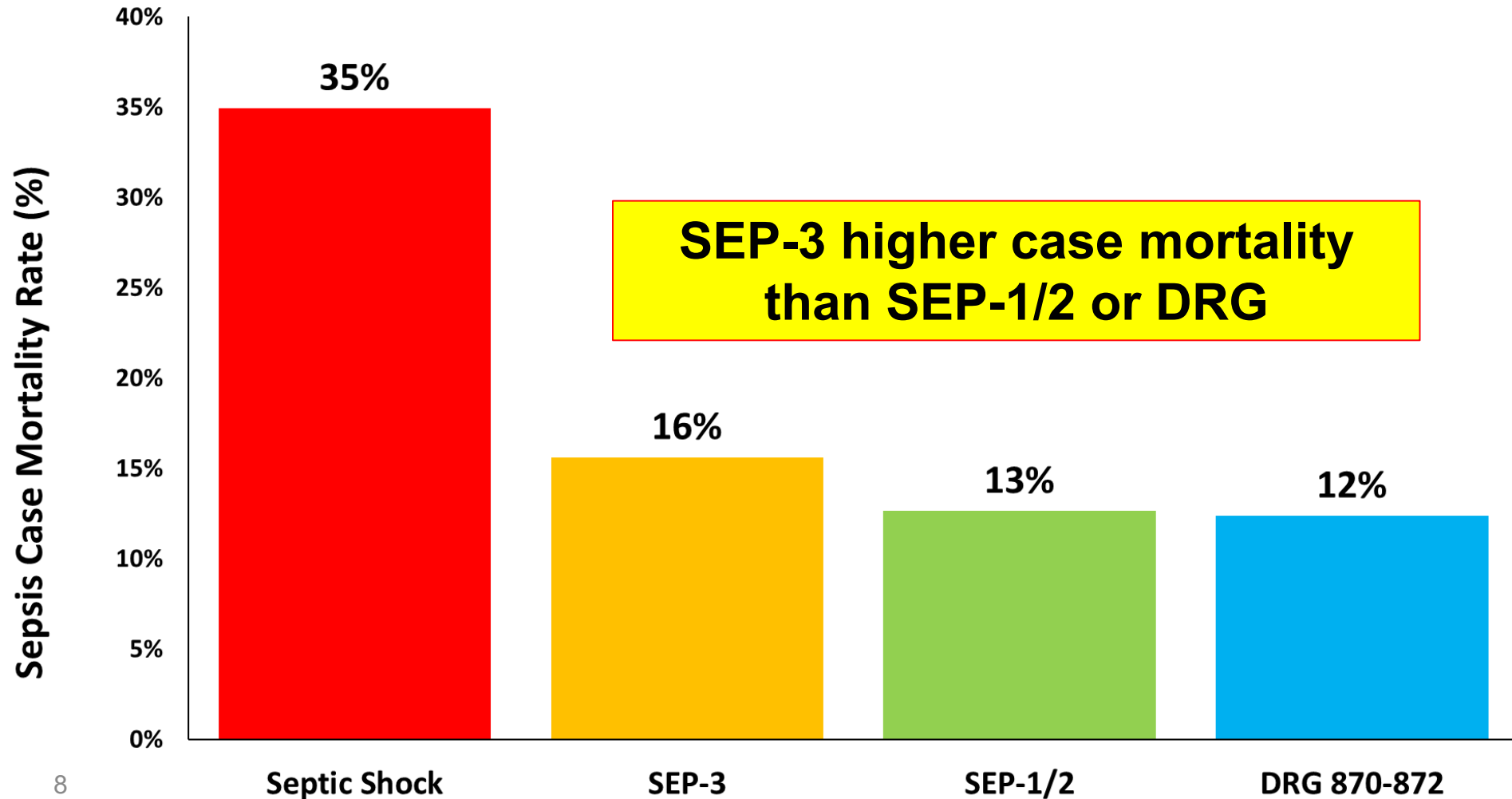
Sepsis & Septic Shock Proxy Case Definitions

ICD-10-CM diagnosis [code-based](#) proxy case definitions:

- **Septic Shock:** [Third International Consensus Definition for Septic Shock](#)
  - ==Any code for septic shock==

- **SEP-3 Sepsis:** [Third International Consensus Definition for Sepsis (SEP-3)](#)
  - Any code for septicemia AND any code for organ dysfunction; OR septic shock
  - ==Both septicemia AND organ dysfunction required==

- **SEP-1/2 Sepsis:** [First International Consensus Definition for Sepsis (SEP-1)](#) or [Second International Consensus Definition for Sepsis (SEP-2)](#)
  - Any code for septicemia OR septic shock (==organ dysfunction not required==)

- **DRG 870-872 Sepsis:** [MS-DRG 870-872](#)
  - All SEP-1/2 codes plus: Meningococcal infections, Hypovolemic shock, Bacteremia (==organ dysfunction not required==)

Note: Not necessarily the primary diagnosis or cause of death

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Sepsis Case Mortality Rate (%) by Proxy Case Definition, CA 2022

SEP-3 higher case mortality than SEP-1/2 or DRG

- Septic Shock: 35%
- SEP-3: 16%
- SEP-1/2: 13%
- DRG 870-872: 12%

Data Source: HCAI inpatient encounters.

Sepsis & Septic Shock Bundles

CMS Inpatient Quality Measure

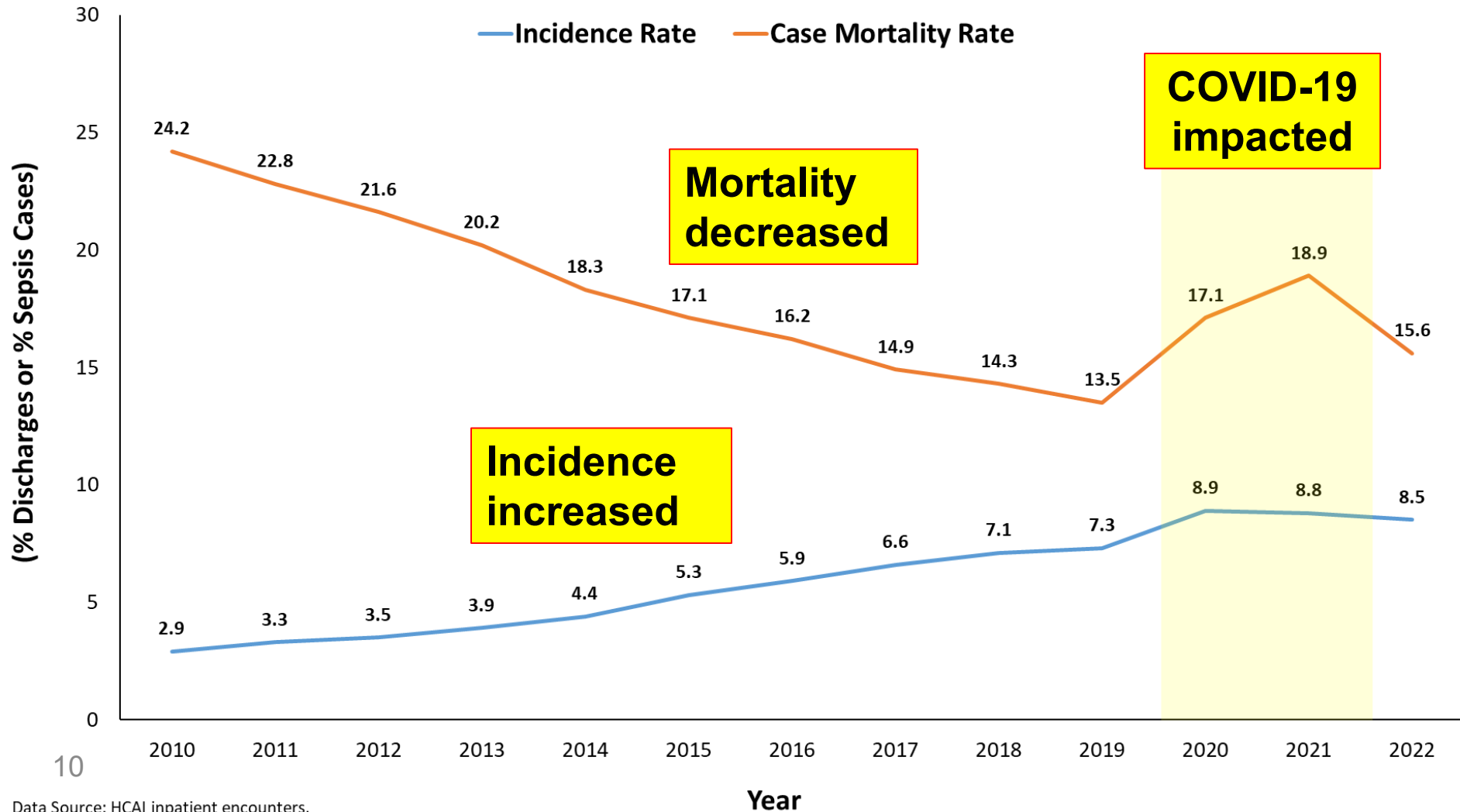- Severe Sepsis and Septic Shock Management Bundle (SEP-1)

Timely

- Lactate & blood cultures

- Antibiotics

- Fluid resuscitation at 30ml/kg PRN

MAP/BP unresponsive to fluids

- Vasopressors if necessary

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Sepsis (SEP-3) Incidence & Case Mortality Rates (%), CA 2010-22

Data Source: HCAI inpatient encounters.

Cracking the Code: Why do so many sepsis cases return to hospitals?

1. *What* is sepsis clinically and administratively?
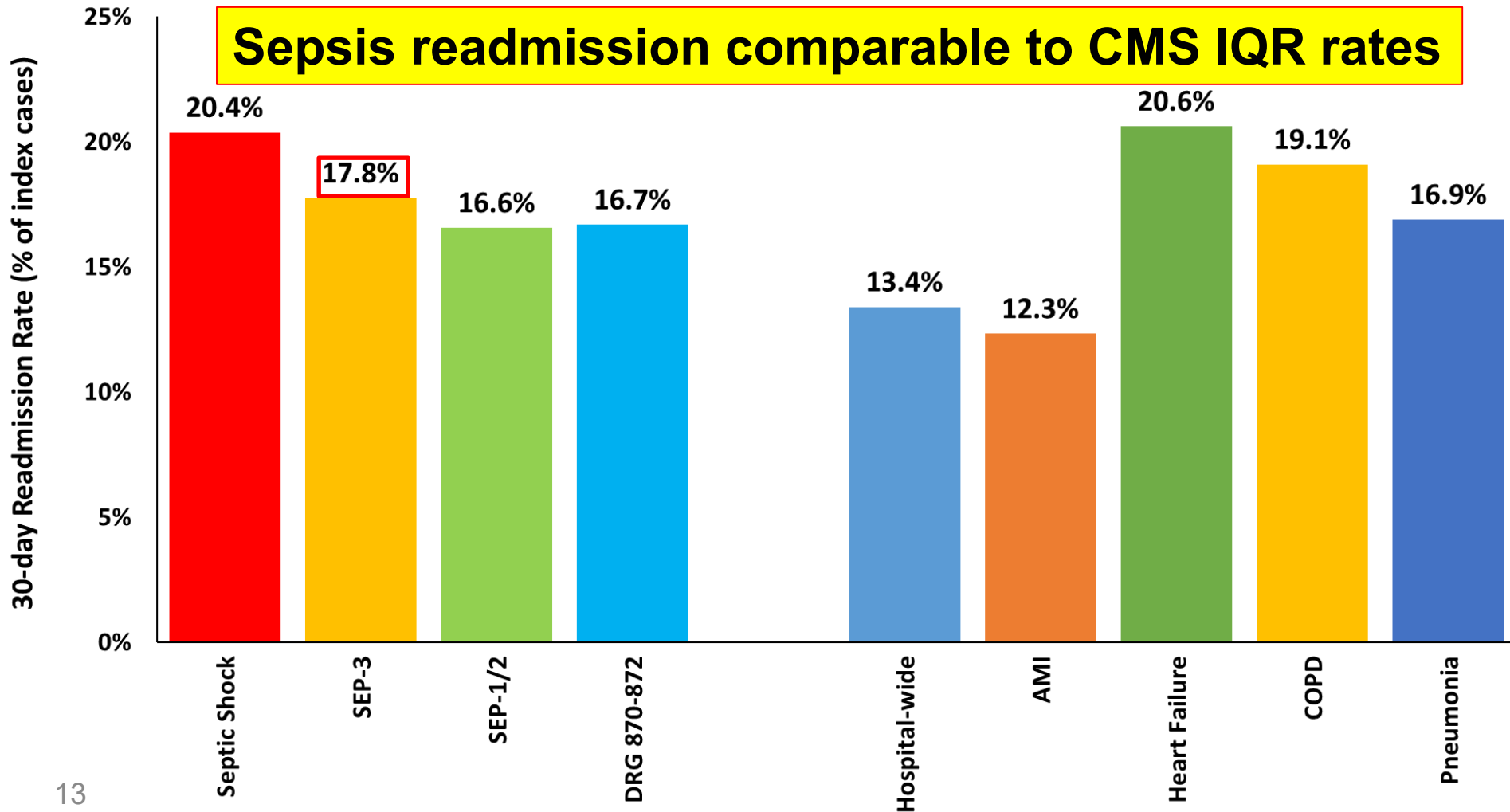
2. *How* big of an issue are returning sepsis cases ?

3. *Why* are sepsis cases returning?
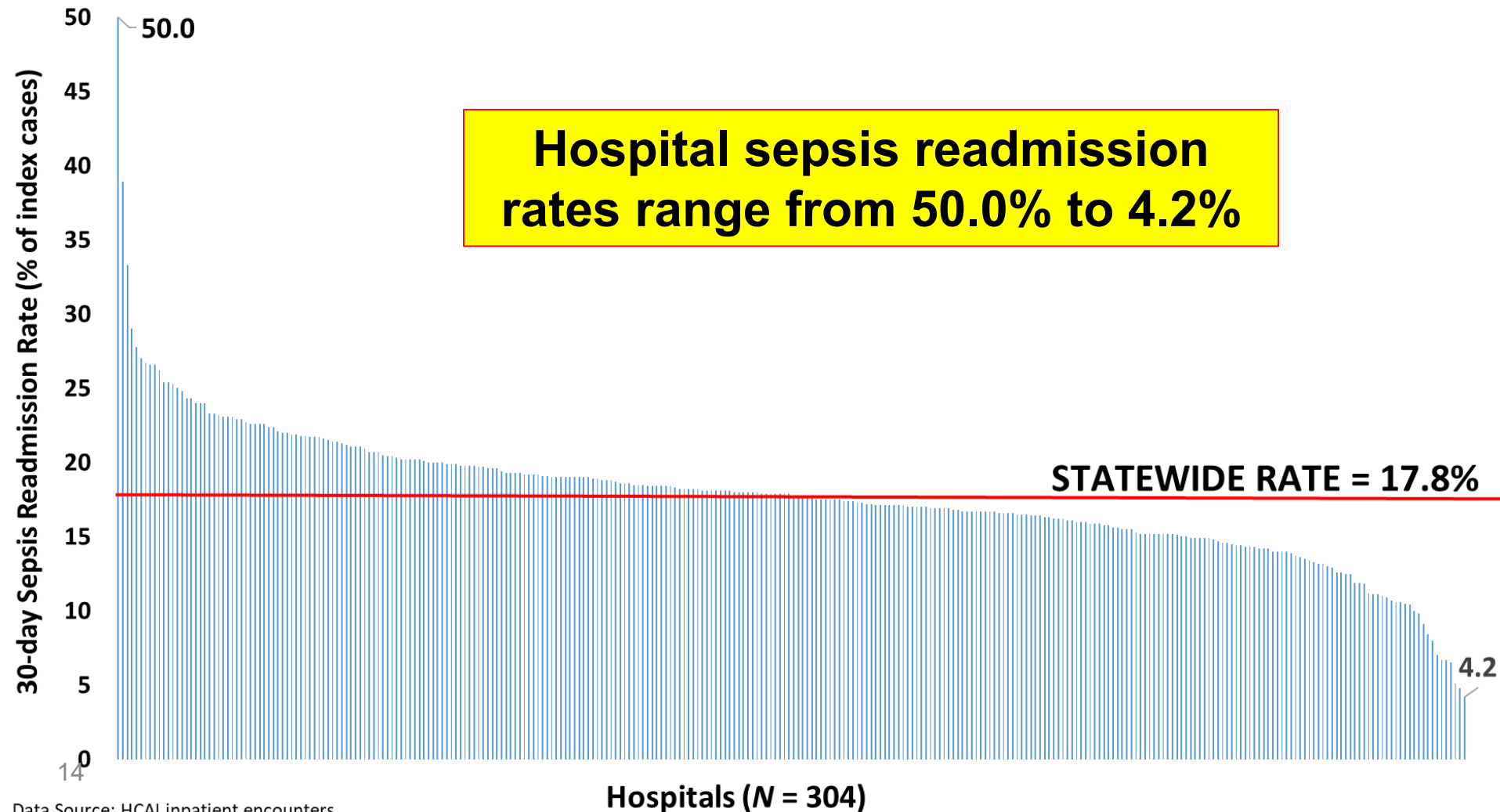

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Sepsis 30-day All-Cause Readmission Measure Development

- **Modified CMS methodology for other condition-specific readmission measures (e.g., AMI, COPD)**
  - Sepsis inpatient discharges with readmissions within 30 days
- **Excluded:** Cases missing unique ID, LOS > 365, non-acute, age < 18, died, AMA, COVID-19 diagnosis, incomplete record
- **Combined acute-to-acute transfers (0-1 days)**
- **Identified index cases for sepsis proxy definitions**
  - Not necessarily primary diagnosis for the index visit
- **Readmission within 30 days after index discharge**
  - Readmission for any reason, not necessarily sepsis
  - Readmissions within 30 days are not counted as index discharges
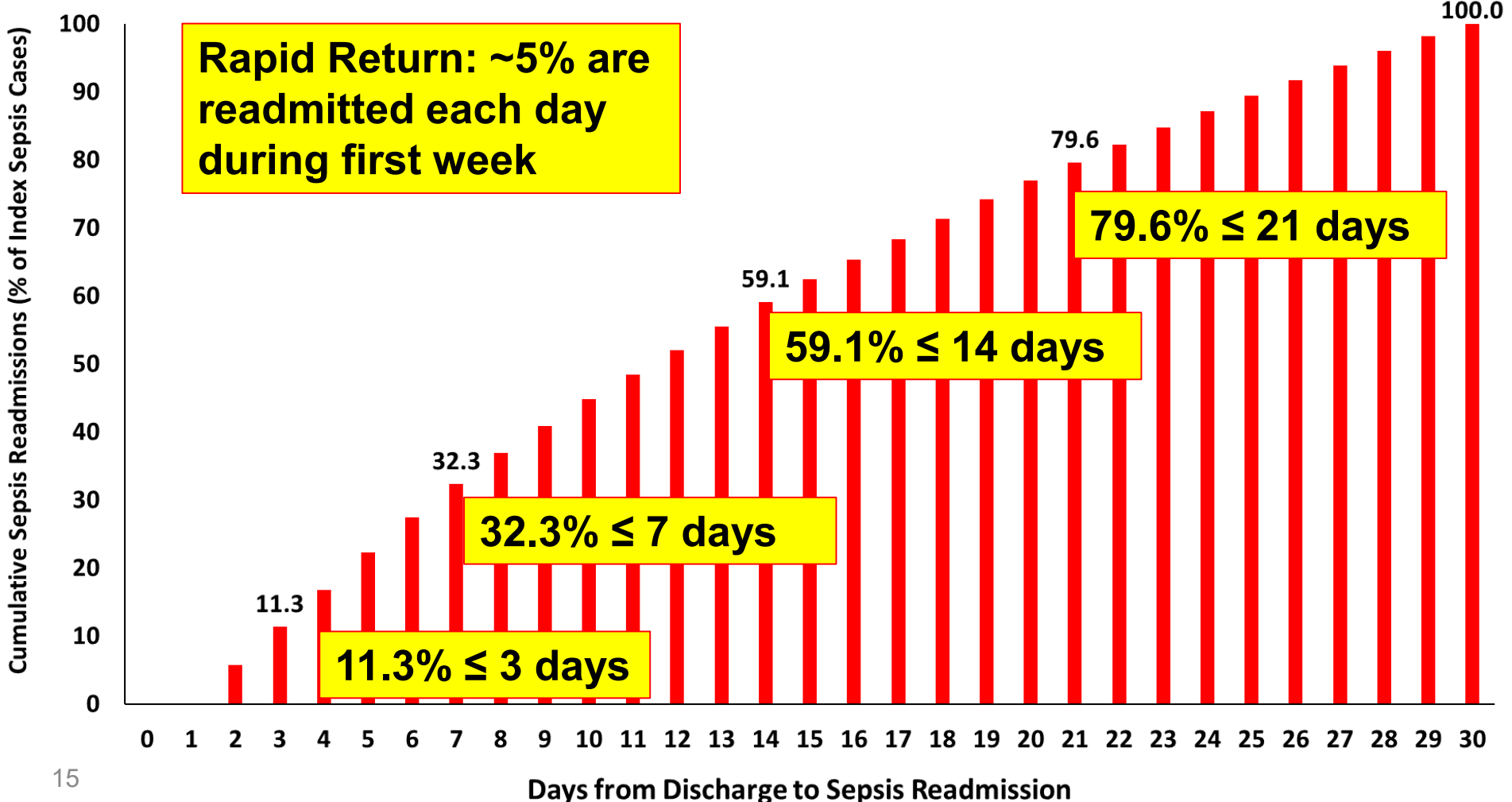 - Index hospitals "credited" with the readmissions

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Sepsis vs. CMS IQR 30-day All-Cause Readmission Rates (%), CA 2022

Sepsis readmission comparable to CMS IQR rates

Chart: 30-day Readmission Rate (% of index cases)

Category	Rate
Septic Shock	20.4%
SEP-3	17.8%
SEP-1/2	16.6%
DRG 870-872	16.7%
Hospital-wide	13.4%
AMI	12.3%
Heart Failure	20.6%
COPD	19.1%
Pneumonia	16.9%

13

Sepsis (SEP-3) 30-day All-Cause Readmission Rate (%) by Hospital, CA 2022

Hospital sepsis readmission rates range from 50.0% to 4.2%

50.0

STATEWIDE RATE = 17.8%

4.2

30-day Sepsis Readmission Rate (% of index cases)

Hospitals (*N* = 304)

14

Data Source: HCAI inpatient encounters.

Sepsis (SEP-3) Days between Index Discharge & Readmission (%), CA 2022

Rapid Return: ~5% are readmitted each day during first week

11.3% ≤ 3 days

32.3% ≤ 7 days

59.1% ≤ 14 days

79.6% ≤ 21 days

(Y-axis: Cumulative Sepsis Readmissions (% of Index Sepsis Cases))

(X-axis: Days from Discharge to Sepsis Readmission)

Data labels: 11.3, 32.3, 59.1, 79.6, 100.0

Data Source: HCAI inpatient encounters.

Missed Sepsis Opportunities (MSO) Measure Development

- **Methodology is similar to the CMS condition-specific readmission measures, but time window is reversed**
  - Index and prior visit can be inpatient or emergency department encounter
  - "Follow-up" period is 30 days *before* index encounter
  - Coded presence/absence of SEP-3 septicemia or organ dysfunction

- **Excluded:** Cases missing unique ID, COVID-19 diagnosis, overlap time records, single encounters

- **Combined ED/acute transfers (0-1 days) into episodes of care**

- **Identified index cases meeting SEP-3 sepsis proxy definition**
  - Not necessarily primary diagnosis for the index encounter

- **Prior non-sepsis encounter within 30 days of index sepsis encounter**
  - Prior encounter did not meet criteria for SEP-3 sepsis
  - If multiple prior encounters, only the most recent was considered
  - Prior encounter hospital "credited" with the MSO
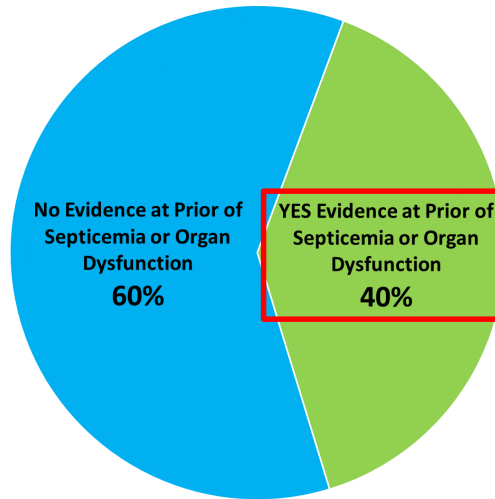
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Missed Sepsis Opportunities (MSO): Sepsis with Prior Encounter within 30 days with a SEP-3 Criterion, CA 2020-2022

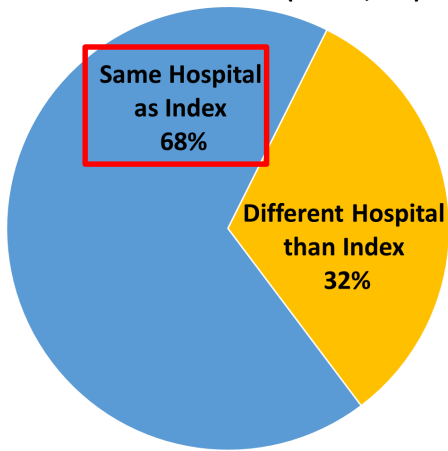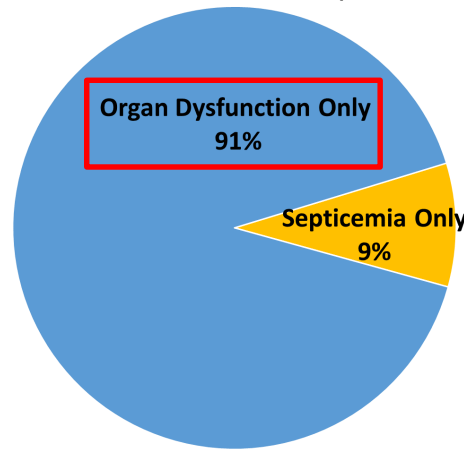**Index SEP-3 Sepsis Cases, CA 2020-2022 (*N* = 555,535)**

No Prior Encounter within 30 days
71%

YES Prior Encounter within 30 days
29%

29%
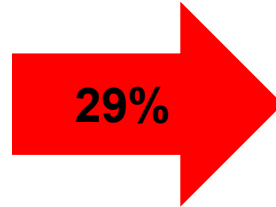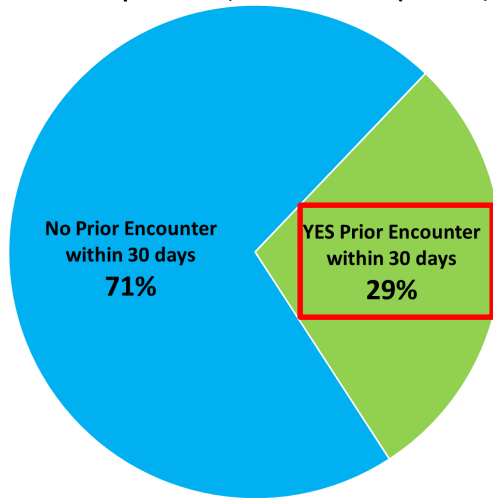
YES Prior Visit within 30 Days of Index (*N* = 159,407)

No Evidence at Prior of Septicemia or Organ Dysfunction
60%

YES Evidence at Prior of Septicemia or Organ Dysfunction
40%

11.4% MSOs

Prior Encounter Route (*N* = 63,144)

Same Hospital as Index
68%

Different Hospital than Index
32%

Prior Encounter SEP-3 Criterion (*N* = 63,144)

Organ Dysfunction Only
91%

Septicemia Only
9%

Prior Encounter Type (*N* = 63,144)

Inpatient Admission
82%

Emergency Department Encounter
18%

17
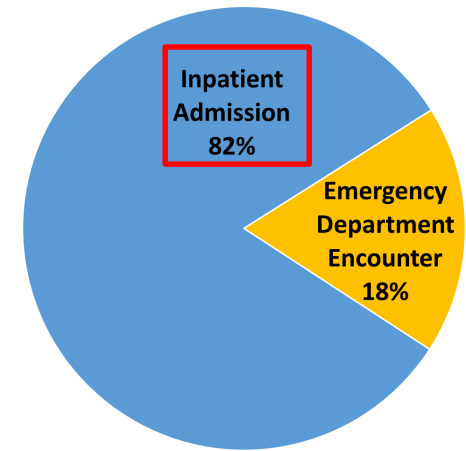
Missed Sepsis Opportunities (MSO): Mortality Rate (%) by MSO Criterion, CA 2020-2022

MSO mortality rate elevated

MSO

Sepsis Case Mortality Rate (%)

- ALL Index Cases: 13%
- Index Cases WITHOUT a Prior Encounter: 11%
- Index Cases WITH a Prior Encounter: 18%
- Index WITH Prior WITHOUT a SEP-3 Criterion: 16%
- Index WITH Prior WITH a SEP-3 Criterion: 22%

Data Source: HCAI inpatient encounters.
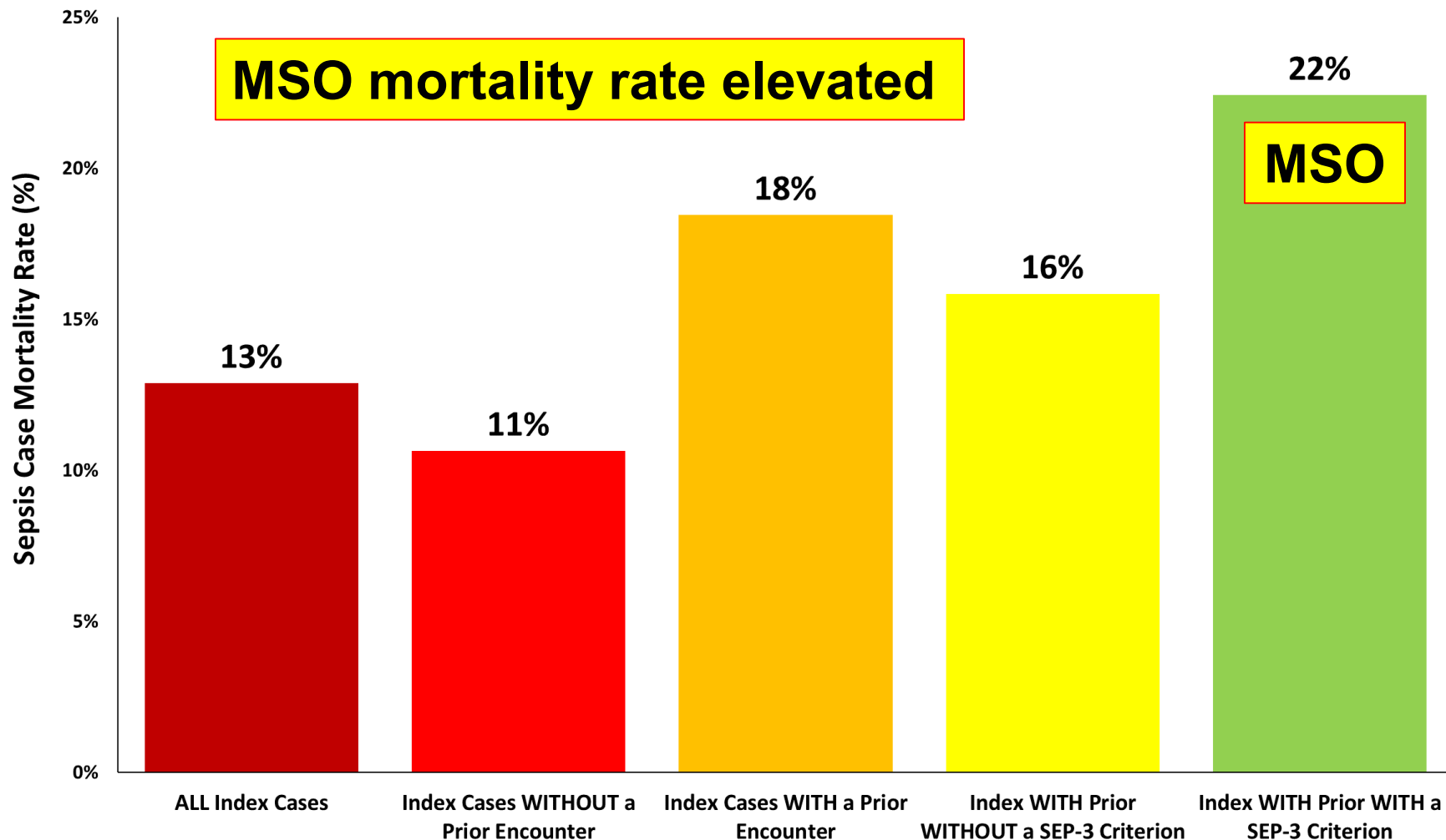
Missed Sepsis Opportunities (MSO): Rate (%) by Hospital, CA 2020-2022

Wide range in hospital MSO rates from 50.0% to 2.2%

50.0

STATEWIDE RATE = 11.4%

2.2

30-day MSO Rate (% of index cases)

Hospitals (*N* = 375)
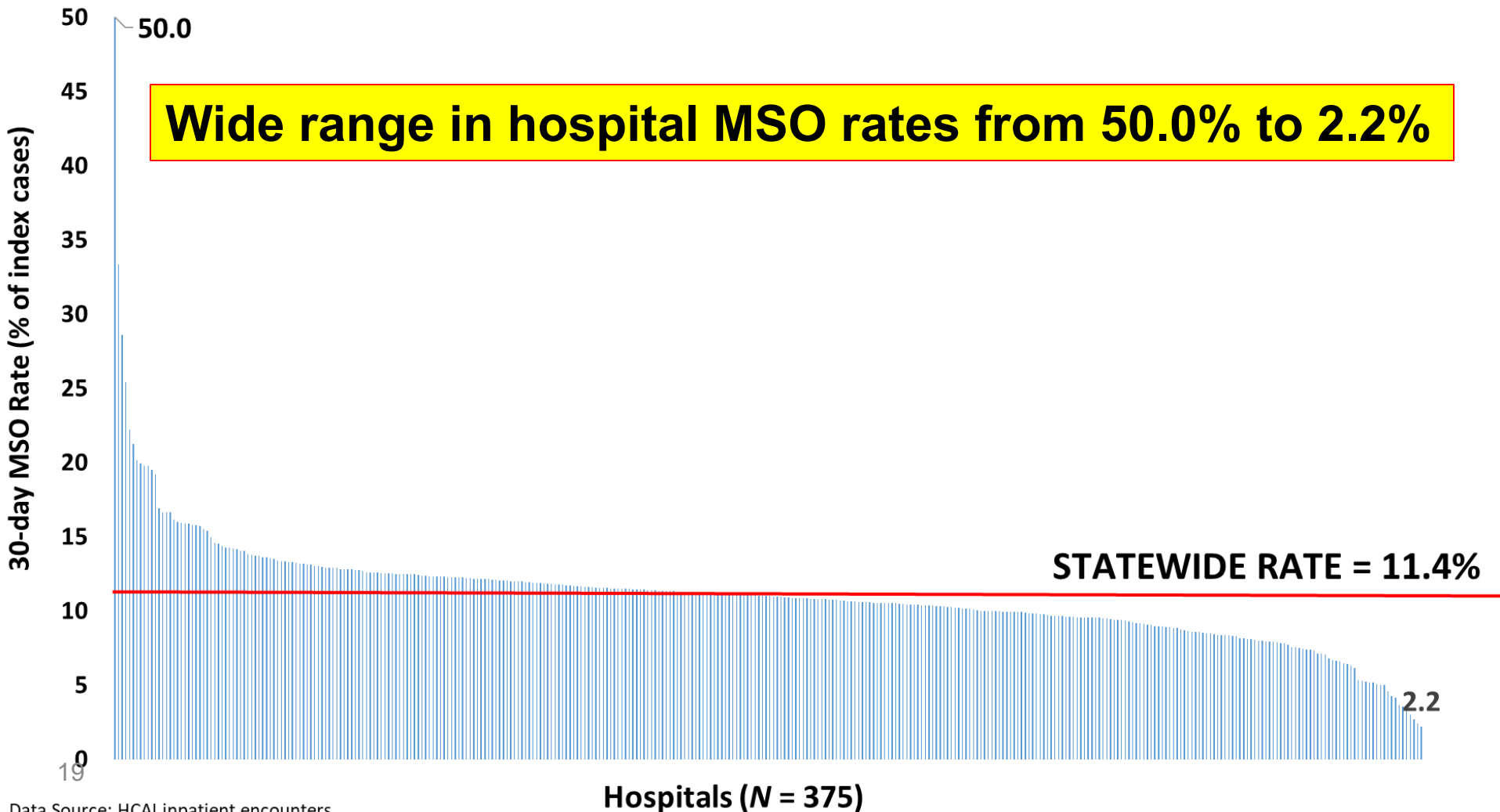
Data Source: HCAI inpatient encounters.

Missed Sepsis Opportunities (MSO): Days between MSO Encounter & Index Sepsis Encounter (%), CA 2020-2022

Rapid Return: ~5-8% return each day during first week after MSO

14.4% ≤ 3 days

36.3% ≤ 7 days

63.4% ≤ 14 days

82.1% ≤ 21 days

Cumulative MSOs Returned (% of MSO Cases)

Days from MSO Encounter to Sepsis Index Encounter

20

Data Source: HCAI inpatient encounters.

![Hospital Quality Improvement Platform]
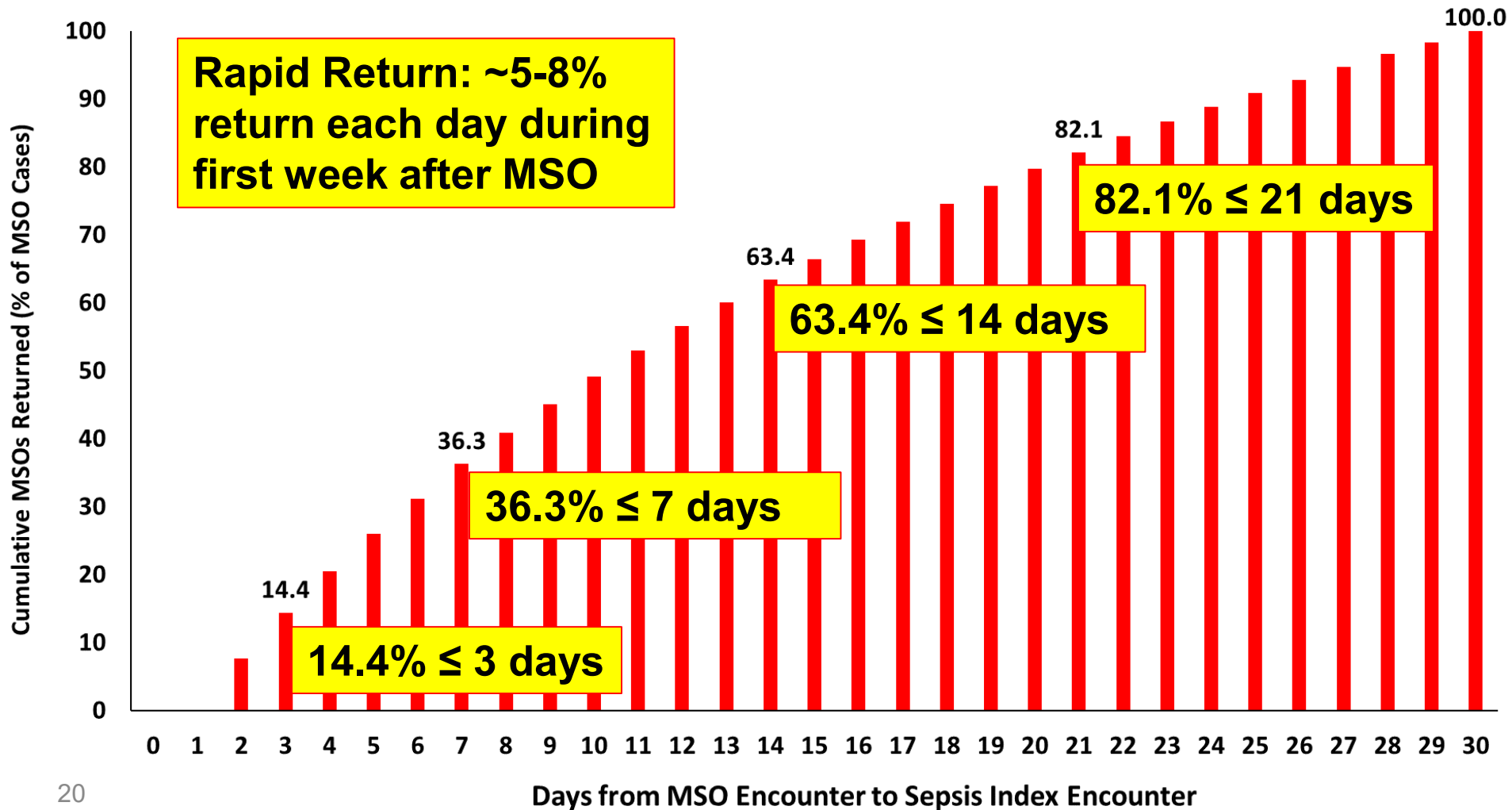
Analytics to investigate "How Big of an Issue"

Septic Shock, SEP-3, SEP-1/2, DRG 870-872, & Any Sepsis

- Incidence

- Case mortality

- Mean Length of Stay (LOS)

Sepsis Readmission (3, 7, 14, 30 day)

Missed Sepsis Opportunities (MSO)

HQIP Platform: https://hqipanalytics.org

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Why are Sepsis Cases Returning?

- What are their common characteristics?

- Is there evidence of being discharged too soon?

- Are signs and symptoms being missed?

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SpeedTrack Analytics
Live Demo

Analytics to investigate "Why are they Returning?"

Available for the HQIP Platform:
https://hqipanalytics.org

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Questions & Contacts

HQIP Participation is: *Free, Easy, and Important for California*

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2. Hunter P. Sepsis under siege: a new understanding of sepsis might lead to the development of therapies to treat septic shock. EMBO Rep. 2006 Jul;7(7):667-9. doi: 10.1038/sj.embor.7400742. PMID: 16819459; PMCID: PMC1500822.

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4. Mellhammar L, Wollter E, Dahlberg J, Donovan B, Olséen CJ, Wiking PO, Rose N, Schwarzkopf D, Friedrich M, Fleischmann-Struzek C, Reinhart K, Linder A. Estimating Sepsis Incidence Using Administrative Data and Clinical Medical Record Review. JAMA Netw Open. 2023 Aug 1;6(8):e2331168. doi: 10.1001/jamanetworkopen.2023.31168. PMID: 37642964; PMCID: PMC10466163.

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