

Sepsis Symposium

October 1, 2020



Welcome & Housekeeping

- All phones muted
- Type your question into the Q & A box
 - All questions will be viewable, and the software can be utilized for 'up voting' using the thumbs up icon
 - During each session, as time allows, we will direct the top questions to the speaker(s)
- CME will be offered for attending this symposium
 - Details provided at the close of the presentation
- For those attending for pay for performance for MHA/HMS, you must sign in with your name to receive credit



Opening Remarks

Scott Flanders, MD

HMS Program Director

Professor of Medicine, Chief Clinical Strategy Officer, Michigan Medicine



Thank You!

- Thank you for attending the HMS & MHA-sponsored Sepsis Symposium
- ~450 individuals attending across many disciplines



Why Sepsis?



Leading cause of global morbidity and mortality



Significant cognitive and functional limitations have been reported following sepsis admissions

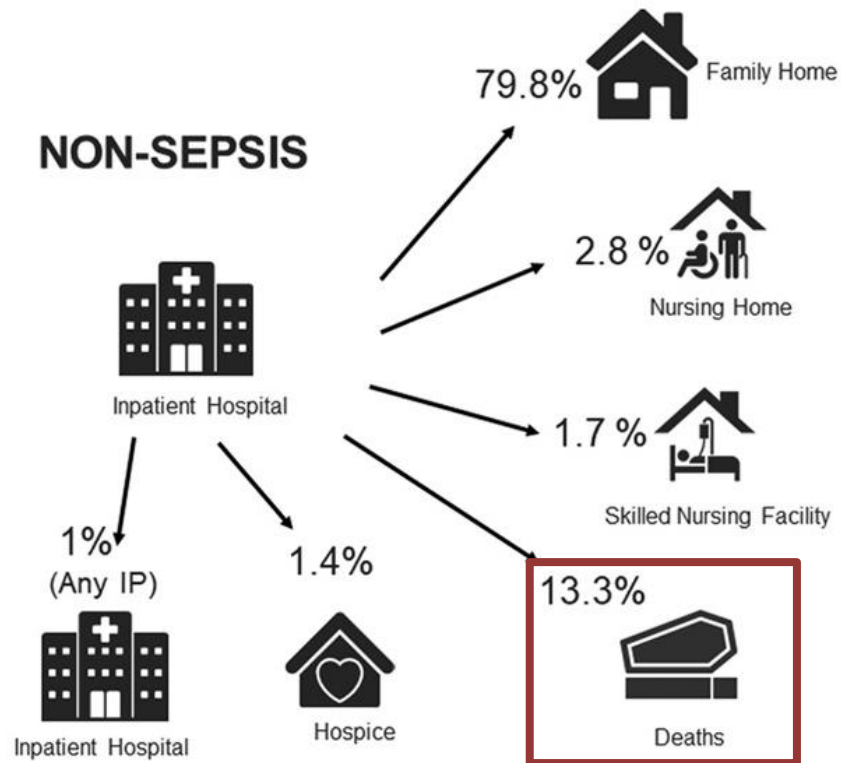
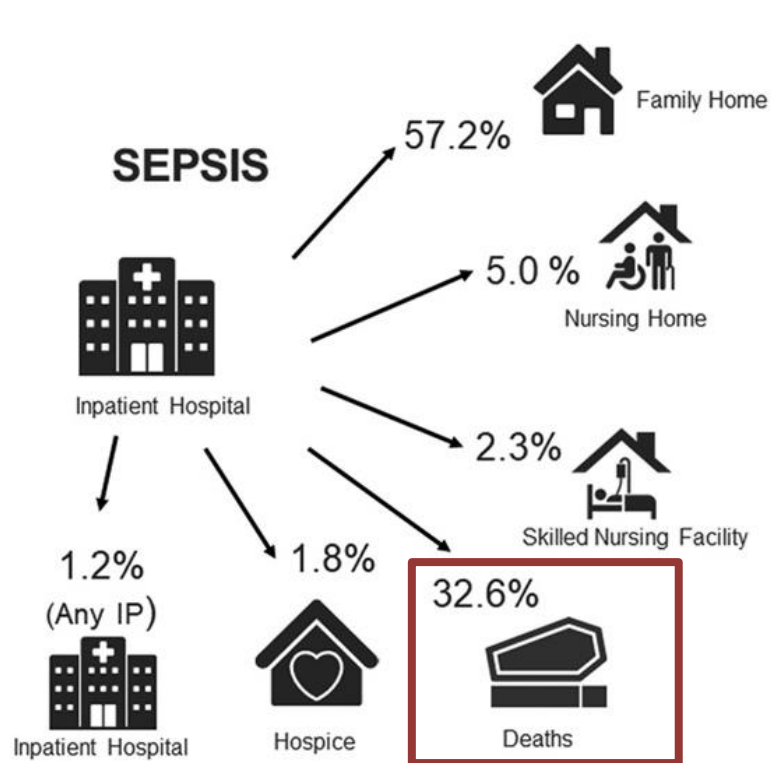


High readmission rates



Sepsis costs have increased dramatically over the last several decades

Inpatient Sepsis Admissions - Patient Trajectories Among Medicare Beneficiaries 2012-2018



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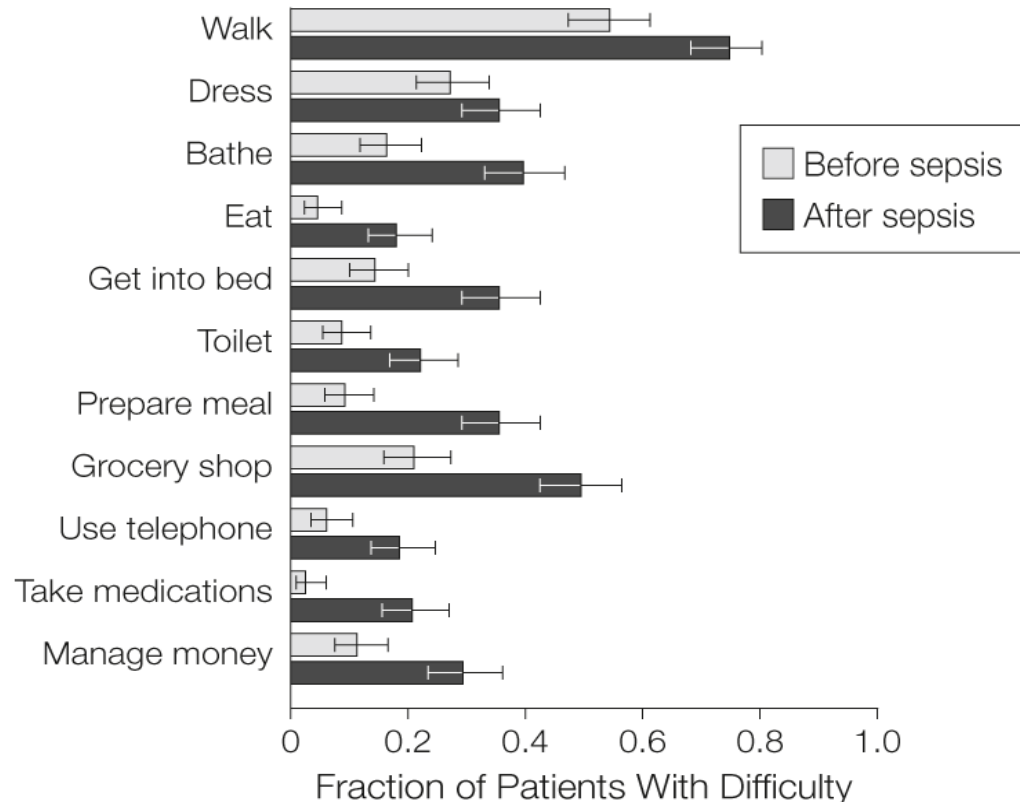
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Change in Individual Activities of Daily Living *Before Sepsis vs. After Sepsis*

Mild to moderate limitations (n = 195)



Declines in cognitive and
physical function persisted
for at least **8** years!

Why Sepsis?



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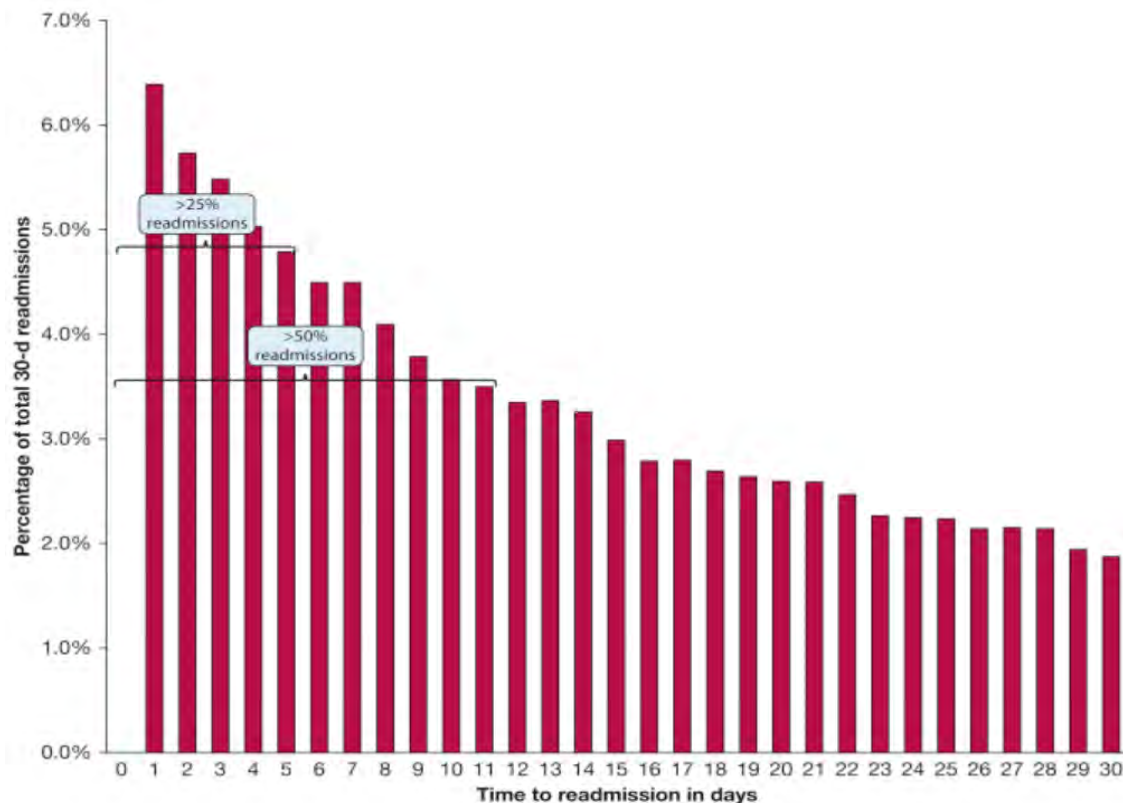


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Readmission Rates Among Sepsis Survivors



17.5% of sepsis survivors were readmitted within 30 days of their initial discharge, most occurring within the first 2 weeks¹

42% of sepsis survivors were readmitted within 90 days of their initial discharge²

1. Gadre S. et al (2019). Epidemiology and predictors of 30-day readmission in patients with Sepsis. CHEST 155 (3)
2. Prescott, H. et al (2015). Readmission diagnoses after hospitalization for severe sepsis and other acute medical conditions. JAMA



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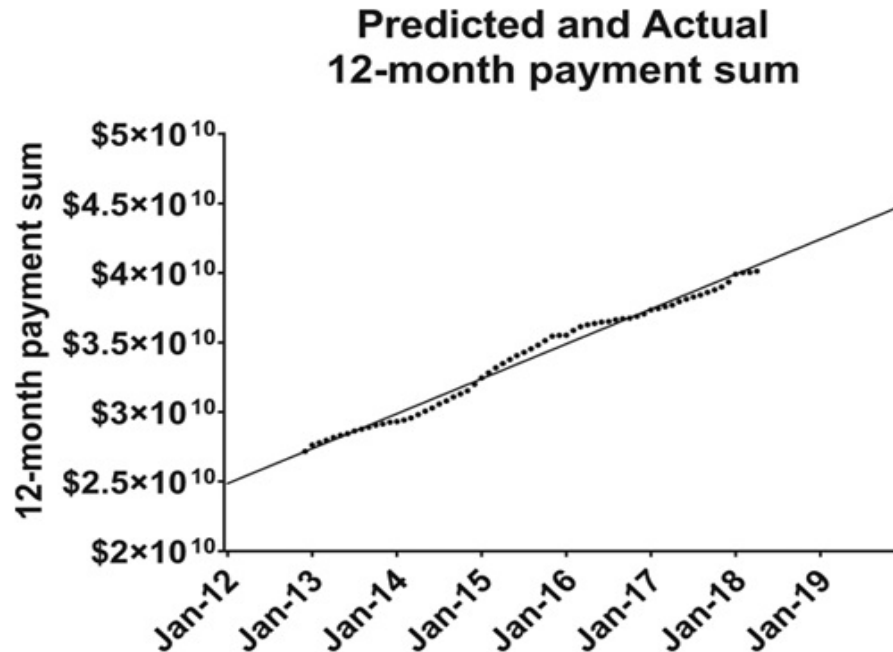


High readmission rates



Sepsis costs have increased dramatically over the last several decades

Rising Sepsis Costs Among Medicare Beneficiaries



Total inpatient/skilled
nursing costs among
Medicare beneficiaries
for 2019 =

\$44.5 – 44.7 billion

Why the Michigan Hospital Medicine Safety (HMS) Consortium?



Collaborative
multidisciplinary
infrastructure in place



History of improving
performance in quality
measures



National experts
to lead initiative



Launched registry in
2020 for COVID-19 or
'Viral Sepsis'



Partnership with BCBSM



Partnerships with National Leaders



10 years of experience
collecting detailed clinical
data



Why HMS & MHA?

- HMS and the MHA have had a long history of working together to improve care and outcomes for patients across Michigan
 - Joined forces in 2012 to prevent hospital associated venous thromboembolism across Michigan hospitals



Overview of the Day

Sepsis Symposium Agenda

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• Current State of Sepsis Michigan



Brittany Bogan, FACHE
Senior Vice President, Safety & Quality and Executive Director, MHA Keystone Center



Scott Kaatz, DO, MSc
Hospitalist, Medical Director for Professional Development and Research in the Division of Hospital Medicine at Henry Ford Hospital



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• Hospital Management



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Professor of Internal Medicine, Pulmonary
& Critical Care at Michigan Medicine
Vice chair of the Surviving Sepsis
Campaign Guidelines & council member of
the international Sepsis Forum



Pat Posa, RN, MSA, FAAN
Quality and Patient Safety Program
Manager at Michigan Medicine
Sepsis Alliance Advisory Committee
Member



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• Sepsis & National Policy



Reena Duseja, MD, MS
Chief Medical Officer, Quality Measurement and Value Based Incentives Group
Centers for Clinical Standards and Quality
Centers for Medicare & Medicaid Services (CMS)



Runa Gokhale, MD, MPH
Medical Officer, Centers for Disease Control and Prevention (CDC)
Division of Healthcare Quality Promotion

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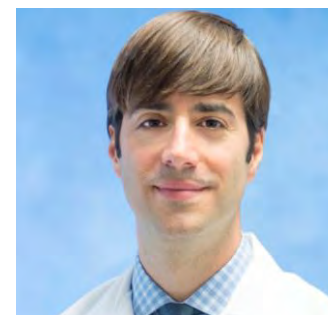
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• HMS Sepsis Initiative Sneak Peek



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Current State of Sepsis in Michigan





MHA Keystone Center Sepsis Improvement Update

Brittany Bogan, FACHE, CPPS

Senior Vice President, Safety & Quality

Michigan Health and Hospital Association



GLPP HIIN Sepsis Improvement Data

Sepsis Mortality

7.1%



Post-Op Sepsis

5.1%



*Per 1000 patient days compared baseline period Q4 2015 – Q3 2016 to performance period 10/1/2016 – 12/31/2019 for the 316 HIIN hospital participants



Sepsis Simulations

3 scenarios

- Emergency Department (ED)
- Care transitions (ED to Intensive Care Unit)
- General medical floor

Train the trainer

- How to effectively lead a simulation in your organization

Total Simulations	Hospitals Represented
12	53

Simulation Events



MHA Community Library

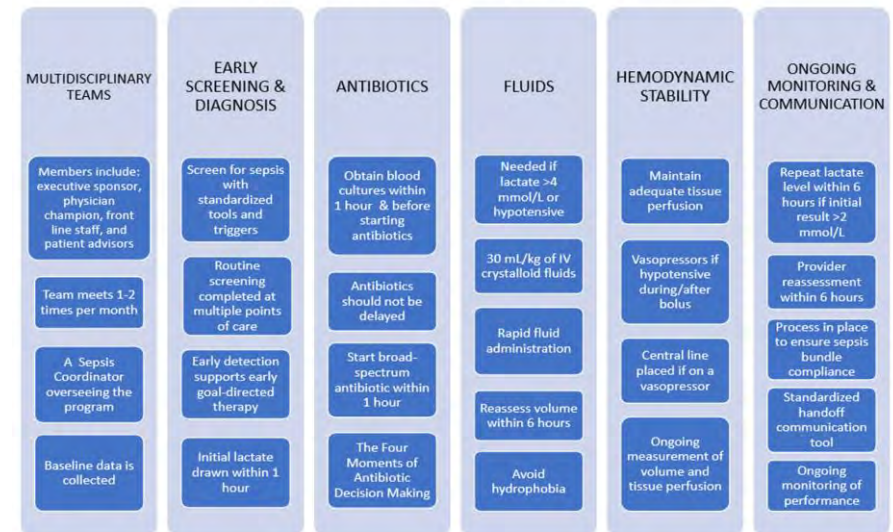
Sepsis Practice Collaborative Model

Based on the MHA Keystone Center Spring Workshop 2019 Presentation by Pat Posa RN, MSA, FAAN

- ✓ Measure success and maintain accountability.
- ✓ Effectively implement an evidence-based sepsis bundle.
- ✓ Screen for sepsis with standardized tools and triggers.
- ✓ Build organizational consensus that sepsis must be managed early and aggressively.



Sepsis in Adults - Best Practice Flow Diagram



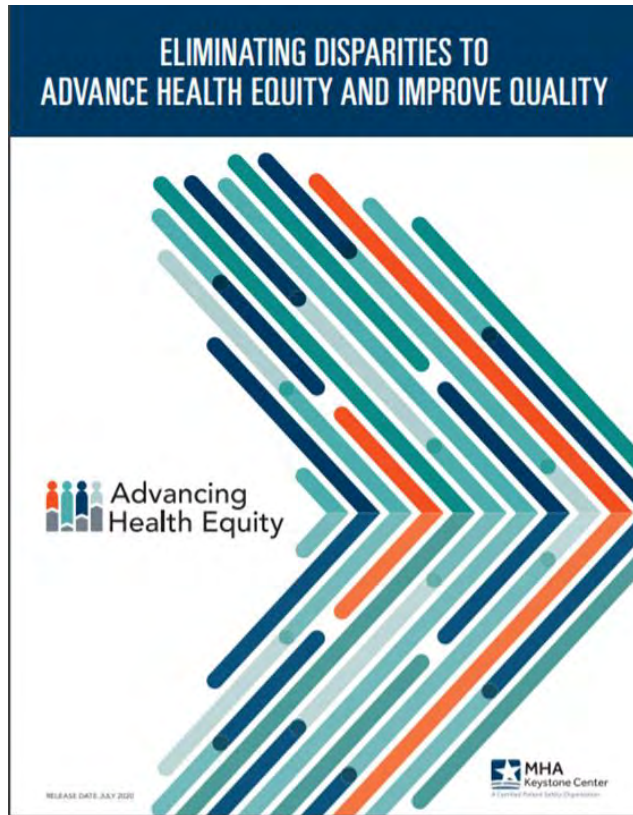
Click Image to Access the Library



Current Challenges

- Managing health during the pandemic
 - Hospitals are still safe
 - “Don’t Delay Care” Campaign
- Using data to assist hospitals in finding trends
 - Readmissions
 - Sepsis Mortality
- Implementing best-practices
 - Competing priorities during the pandemic
 - Sepsis bundle compliance
 - Conflicting information on timeframes

Future Sepsis Work



MI AIM

MICHIGAN ALLIANCE FOR INNOVATION
ON MATERNAL HEALTH





Scott Kaatz, DO, MSc

Hospitalist, Medical Director for Professional Development and Research in the Division of Hospital Medicine at Henry Ford Hospital





John Syrjamaki, MPH

Manager, Data Analytics, Michigan Value Collaborative (MVC)





Michigan Value
Collaborative

Statewide Variation in Sepsis Care

October 1st, 2020

John Syrjamaki, MPH
Manager, Data Analytics

Disclosures

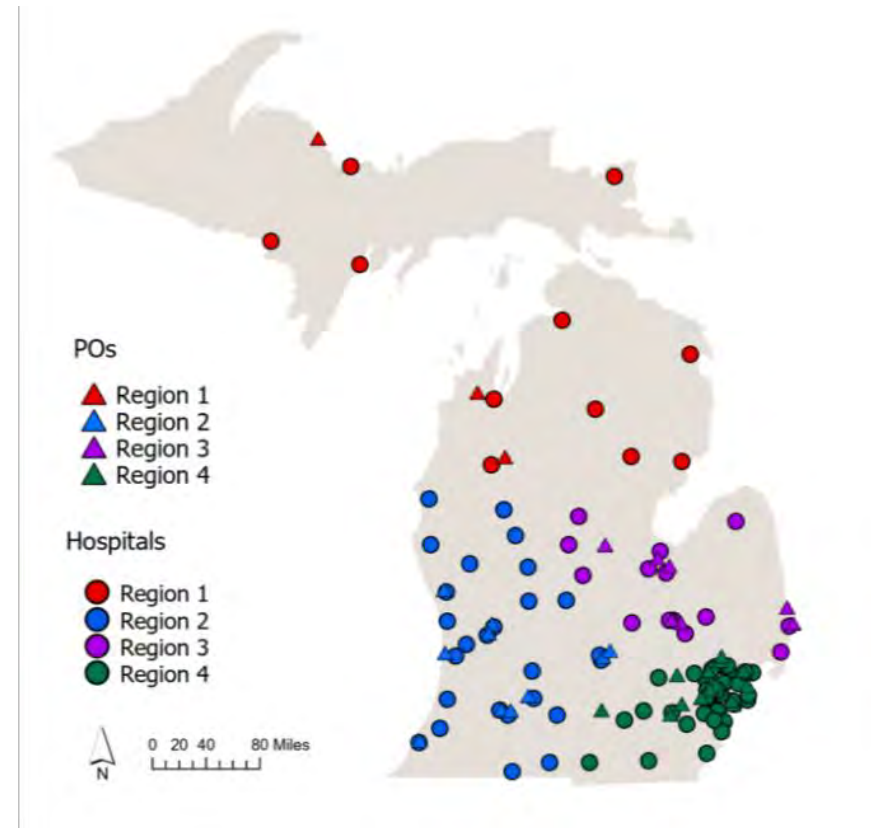
- Salary support from Blue Cross Blue Shield of Michigan (BCBSM) for my role with MVC.

Outline

1. Overview of MVC
2. Statewide Sepsis Data
3. Engagement activities
4. Summary and Next Steps
5. Questions

What is the Michigan Value Collaborative?

- Collaborative quality initiative (CQI) funded by Blue Cross Blue Shield of Michigan (BCBSM)
 - Established in 2013
 - Physician organizations incorporated in 2018
- MVC is a coalition of 87 hospitals and 40 physician organizations
 - Represented by quality leaders
 - Variety of different hospital types
 - Coordinating Center located at the University of Michigan



MVC Core Identity



Purpose

*To improve the health of
Michigan through sustainable
high-value healthcare*



Vision

*People accessing the right
care, at the right time, at the
right cost*

MVC Levers for Improvement



Data Analytics

- Online registry to provide ready web-access to data
- Episode-based intelligence

Hospital & PO Engagement

- Collaborative meetings
- Regional dinners
- Virtual workgroups
- Monthly webinar training

CQI Synergy

- Quality & value integration
- Comprehensive claims

MVC Data



A nonprofit corporation and independent licensee
of the Blue Cross and Blue Shield Association



**Blue Care
Network
of Michigan**

A nonprofit corporation and independent licensee
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**Blue Care
Network
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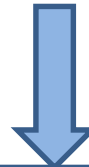
**Blue Cross
Blue Shield
of Michigan**

Medicare PLUS
BlueSM PPO

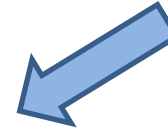


**Michigan Value
Collaborative**

Adjudicated data:



- **Data Analytics**
- **CQI collaborations**
- **Peer-to-peer best practice sharing**



Pending data sources:



MVC Data Sources

Number of covered lives

- Medicare FFS: 1.9 million
- BCBSM PPO: 3.5 million
- Blue Care Network (BCN): 800k
- BCBSM Medicare Advantage PPO: 300k
- BCN Medicare Advantage HMO: 100k
- *Michigan Medicaid (pending): 1.8 million*

MVC data sources will comprise >80% of Michigan's insured population

What does MVC measure?

30 & 90-day episodes for 38 medical & surgical conditions



Index
Admission



Professional
Services



Post-acute
Care



Readmission

How do we estimate episode payments?



Final payments represent utilization, not actual dollars

Price standardization accounts for:

1. Contractual differences between payer and hospital



2. Payer variation



3. Geographic & wage index differences



4. Inflation



How does MVC risk-adjust?

- Patient characteristics
 - Age/Gender
 - Insurance Type



- Hierarchical Condition Categories (79)
- Prior 6 month spending
- Condition-specific characteristics
(e.g. reoperation, valve + CABG)

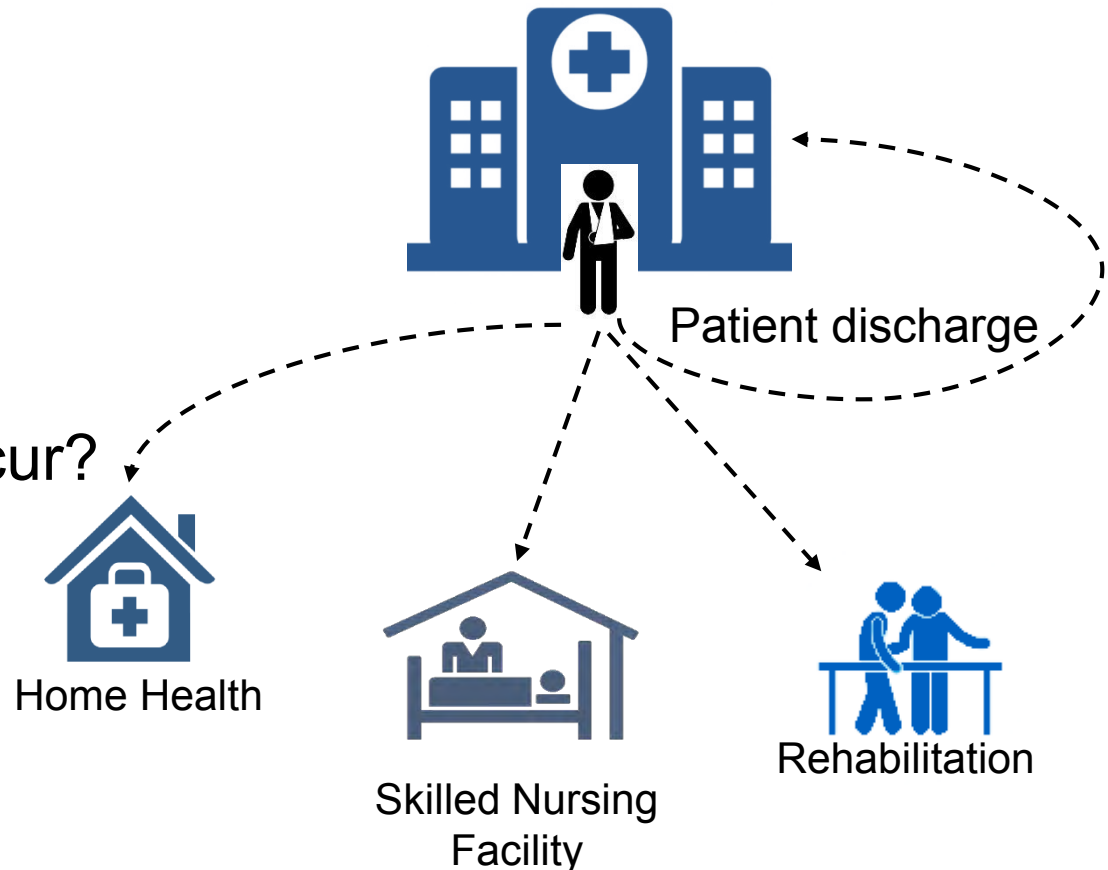
What MVC data tells you...

- What care was provided after discharge?

- From where?
- When?
- How long?
- Payments

- Did readmission occur?

- From where?
- When?
- Why?
- Payments



MVC PO and Hospital Engagement

Regional Networking Dinners



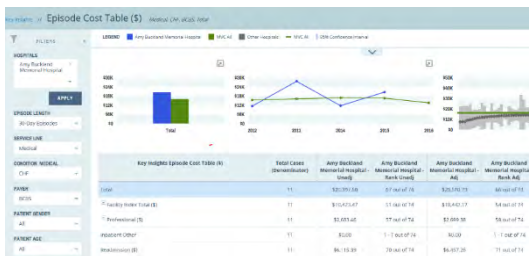
Virtual Workgroups



Semi-annual Collaborative Meetings



Custom registry support



Virtual Site Visits



Blog



<https://michiganvalue.org>

<http://www.themvcblog.com>

CQI Collaboration



$$\text{Value} = \frac{\text{Quality}}{\text{Cost}} * \text{Appropriateness}$$



Adapted from M. Porter, D. Spahlinger

Success Stories



Use of Heart Failure clinics to decrease readmissions



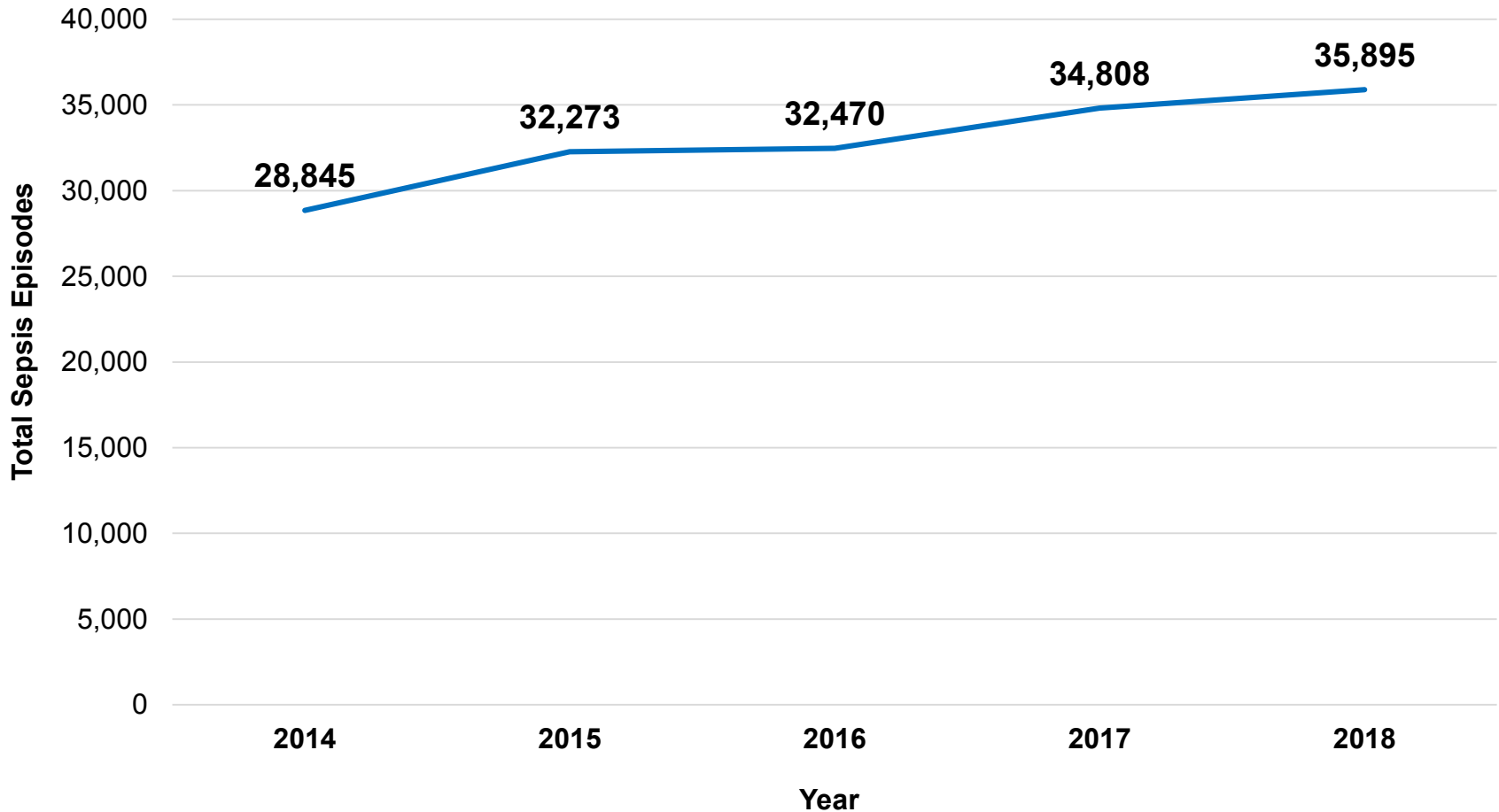
Dissemination and sharing of patient and staff education resources in CHF and Sepsis



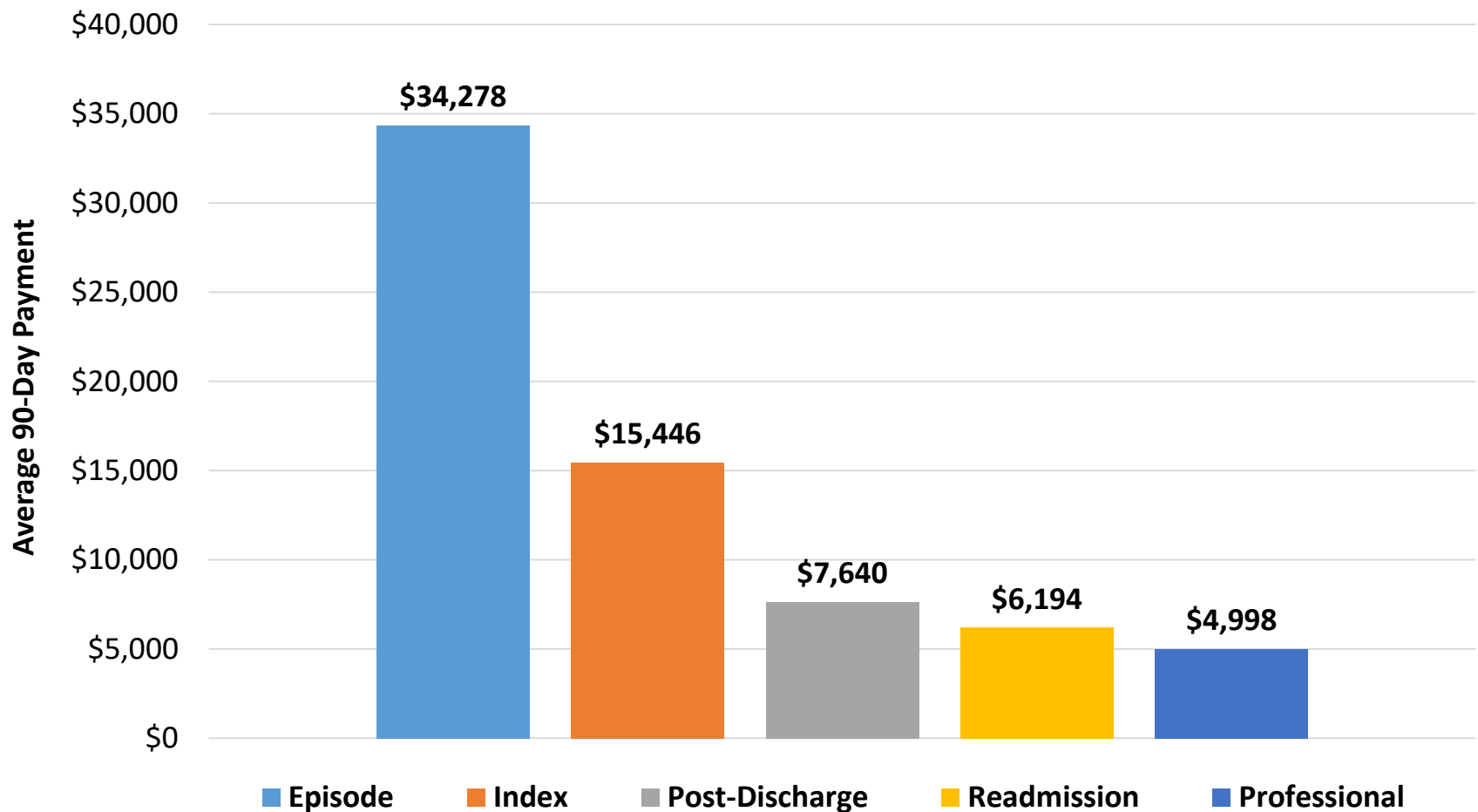
Reduction in SNF utilization for post acute joint care in conjunction with MARCQI

Statewide MVC Sepsis Data 2014- Q3 2019

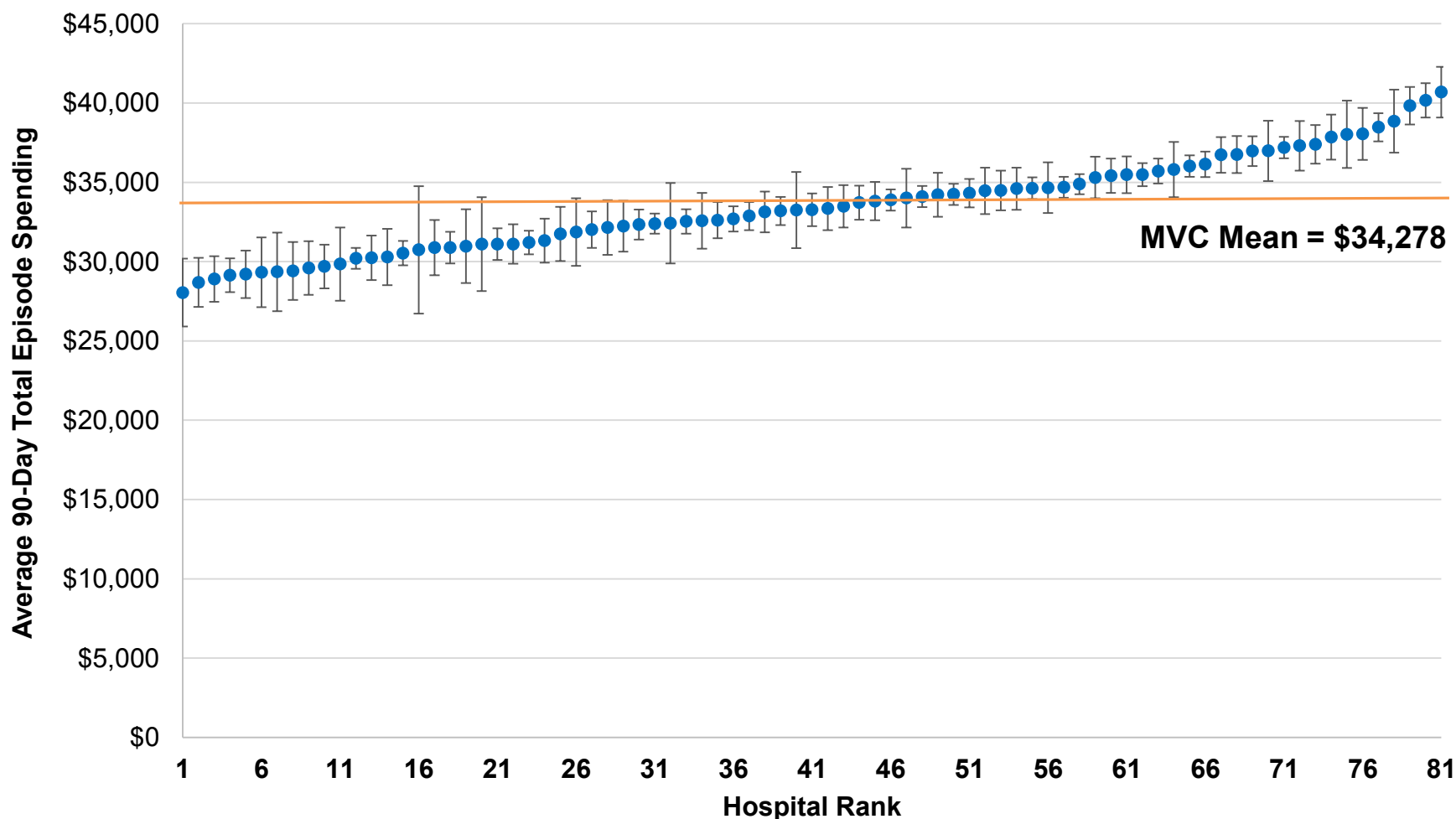
Sepsis Episode Volume by Year



Average 90-Day Payment Component Breakdown

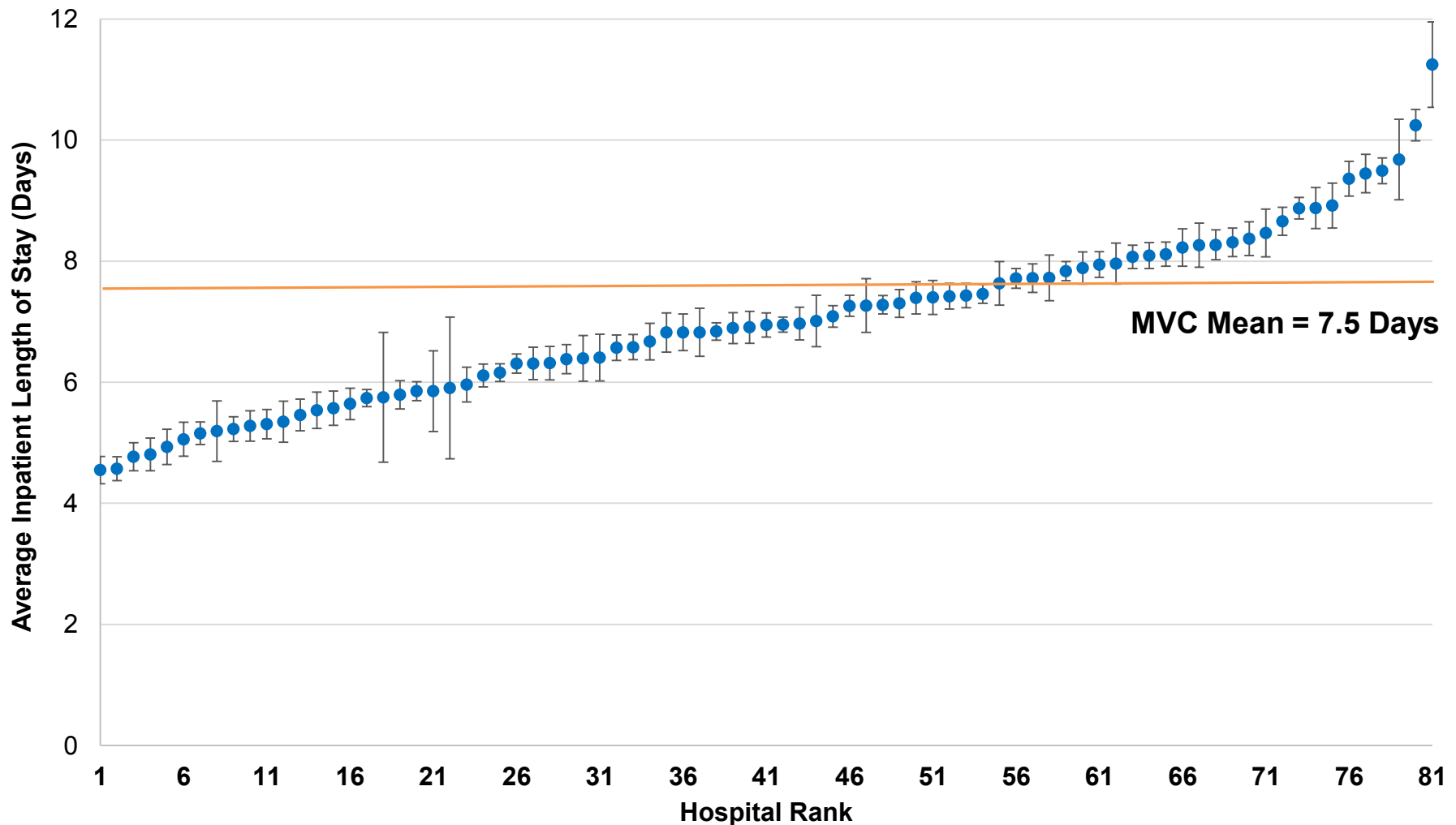


Average Total 90-Day Episode Payment

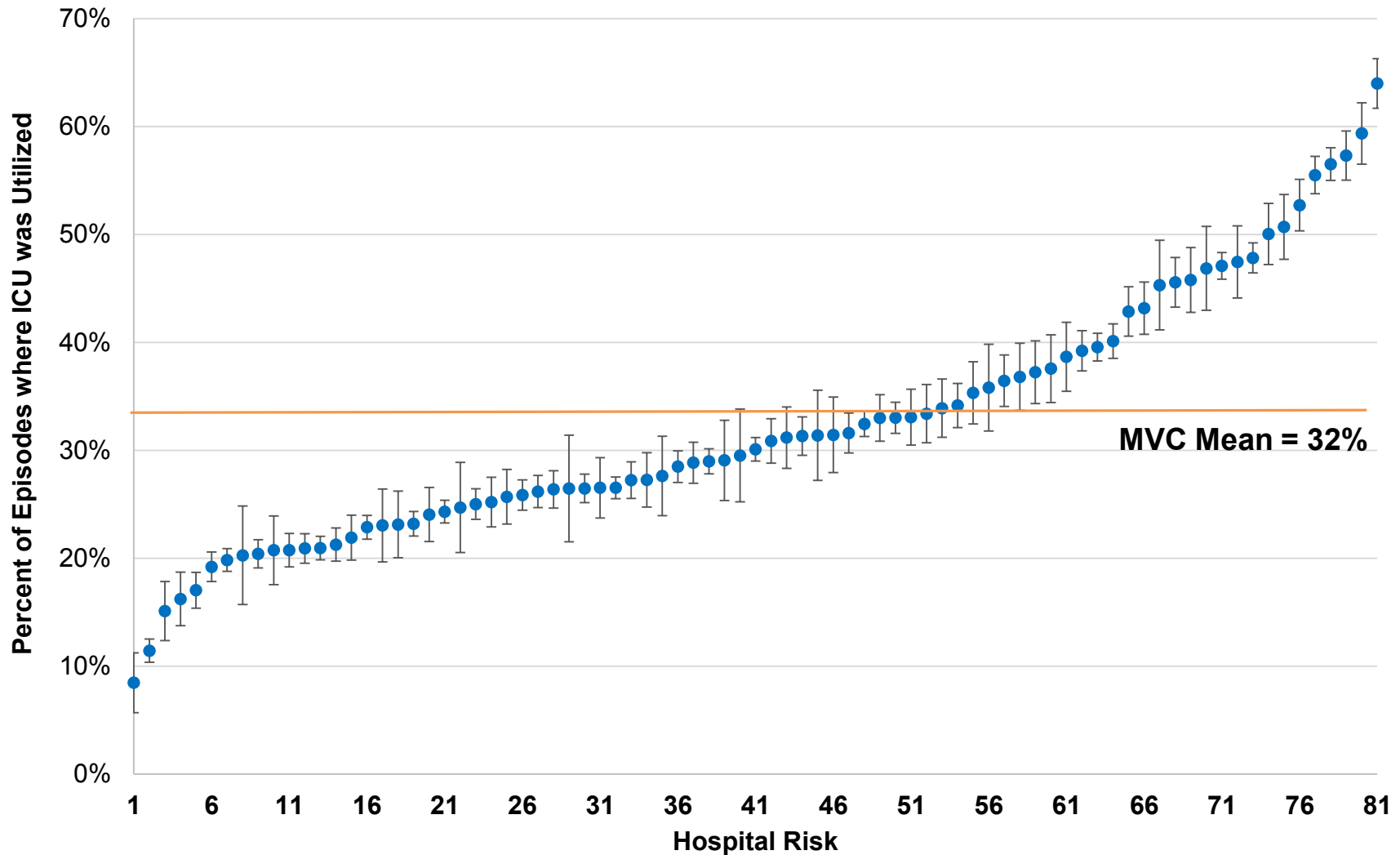


Index Hospitalization

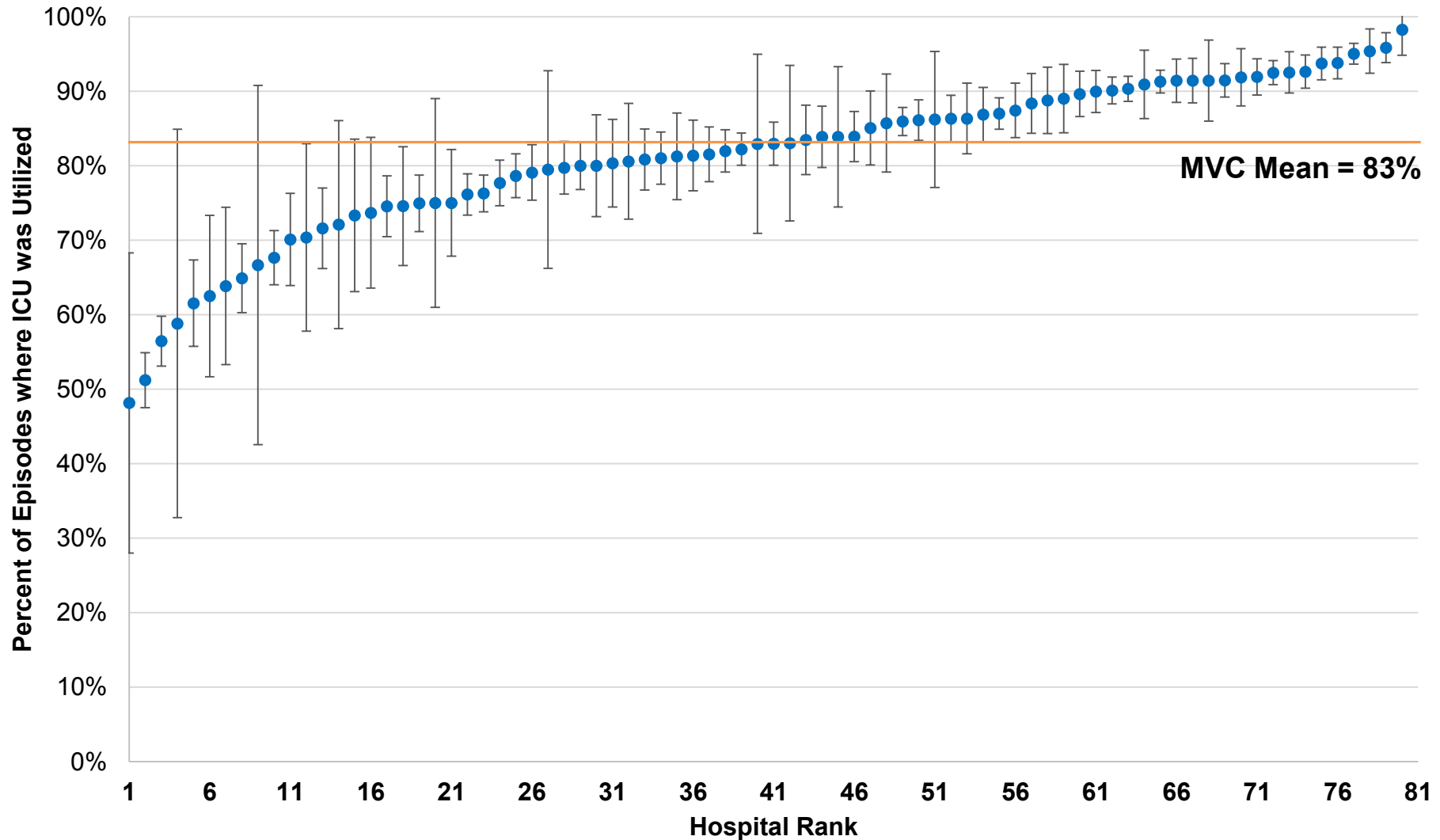
Average Inpatient Length of Stay



ICU Utilization during Index Hospitalization



ICU Utilization during Index Hospitalization for Septic Shock

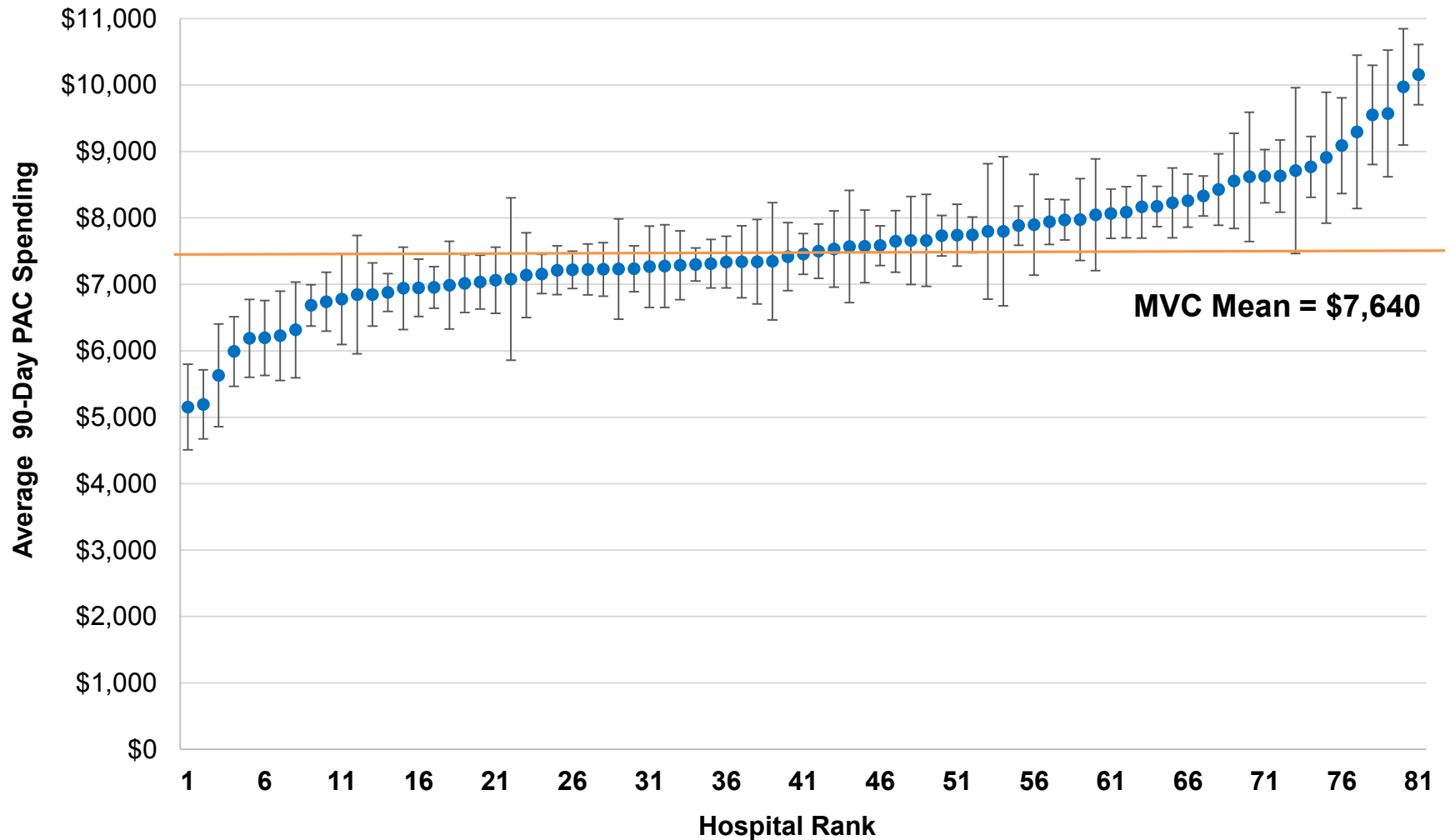


Inpatient Mortality and Rates of Hospice Discharge

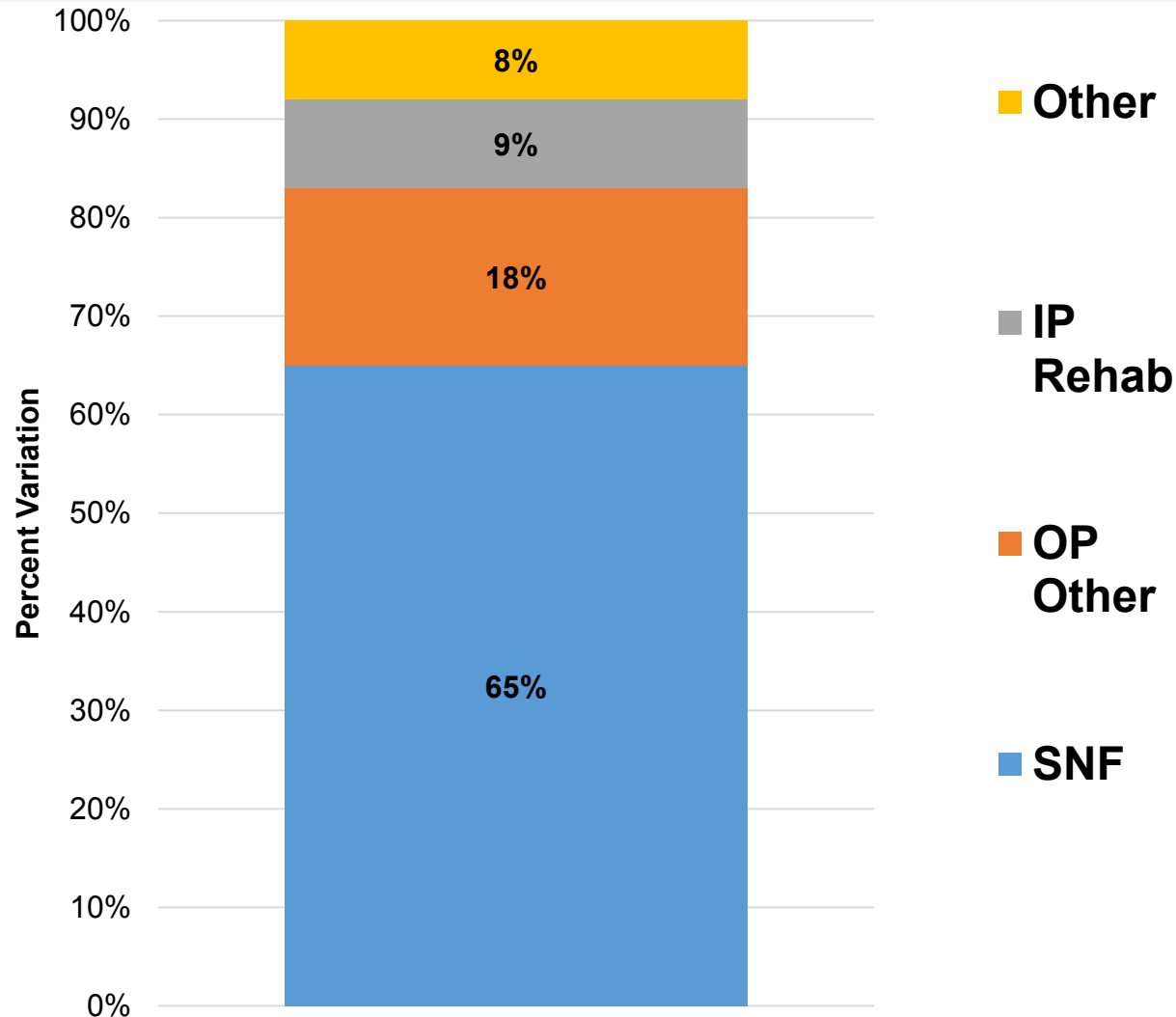
Discharge Disposition	Percent
Expired or did not recover in the hospital	10.3%
Hospice – Medical facility	5.4%
Hospice - Home	2.8%

Post-Acute Care

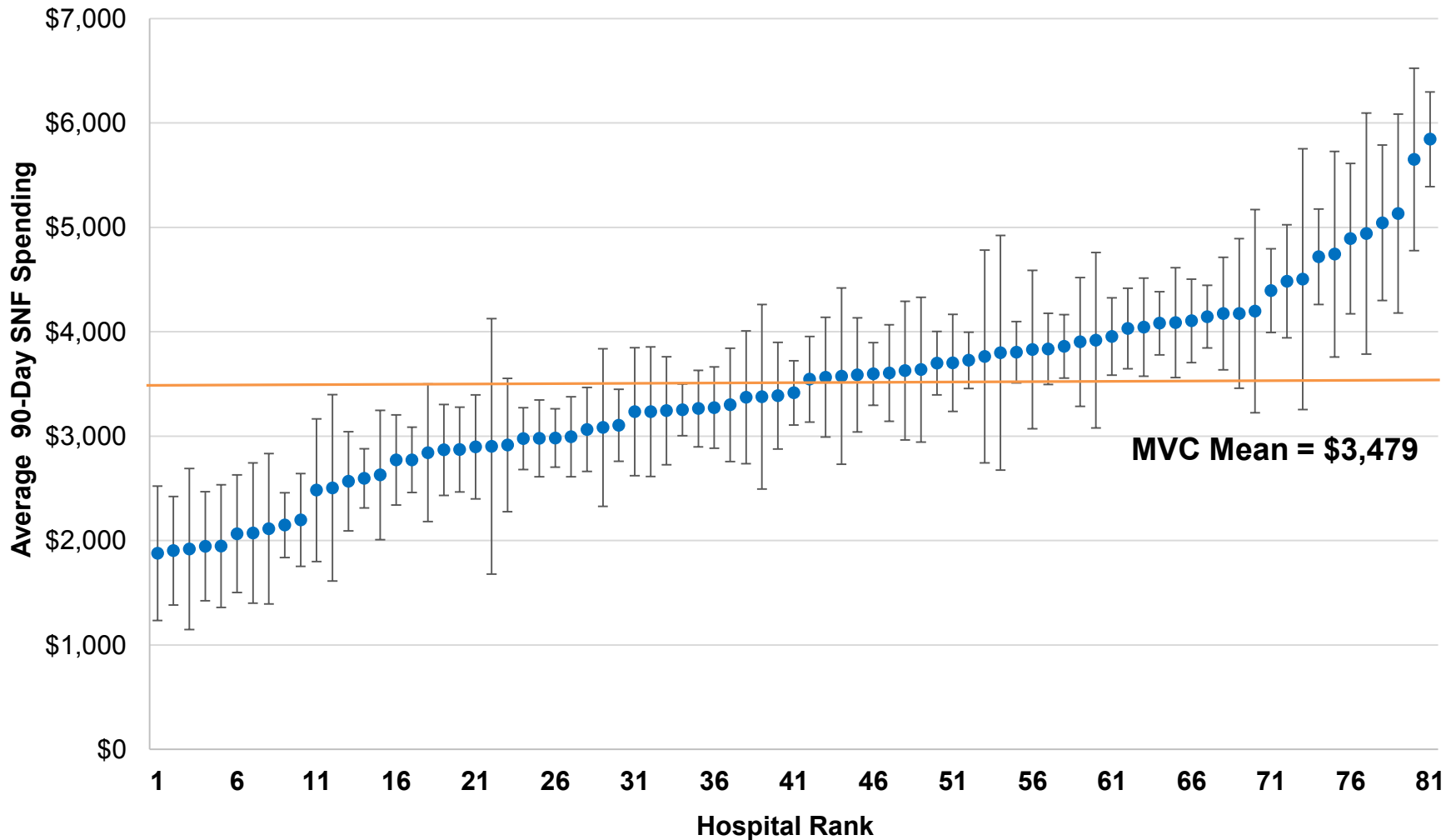
Average 90-Day Post-Acute Care Spending



Variation in PAC Payment Components

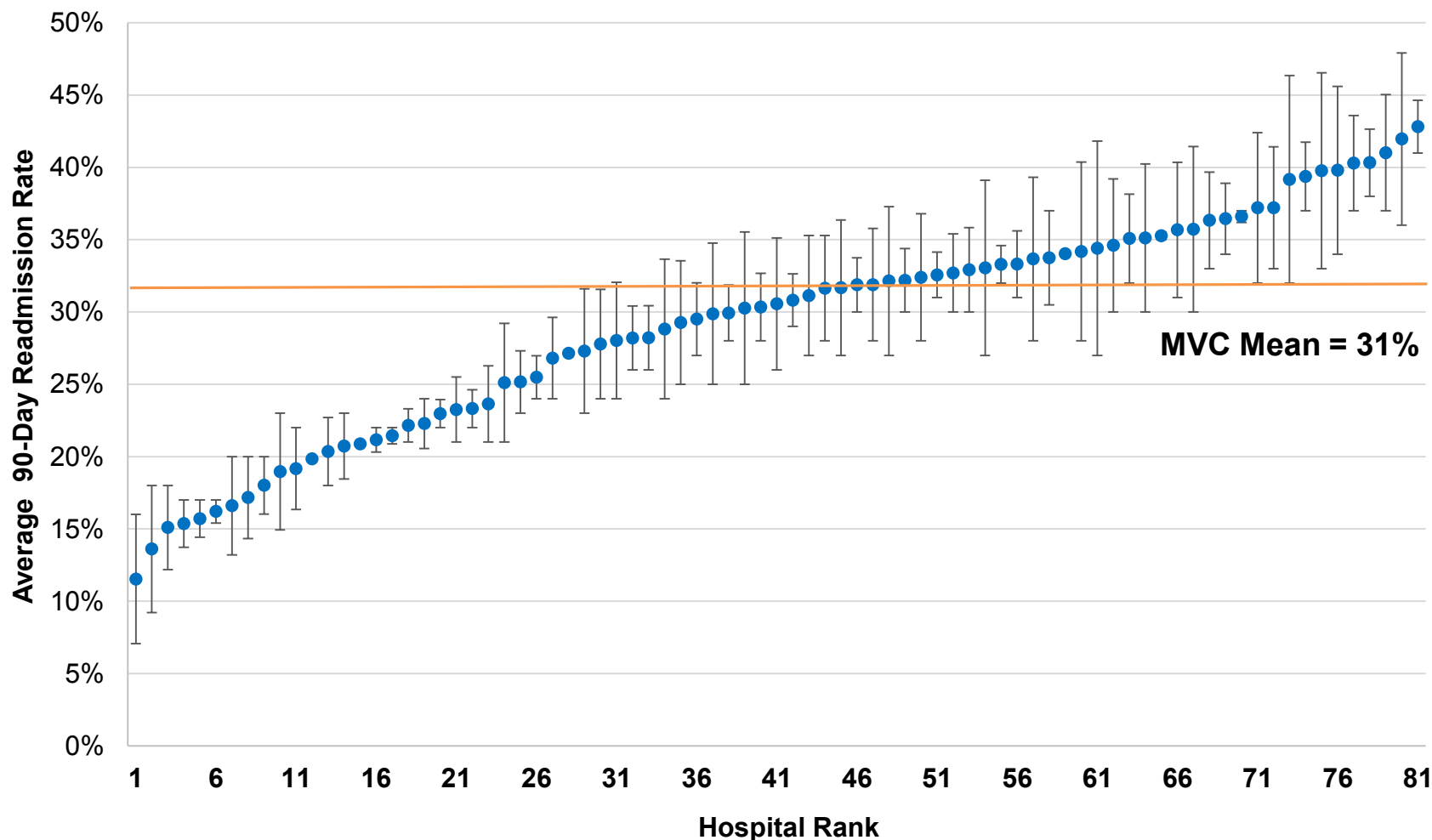


Average 90-Day SNF Spending



Readmissions

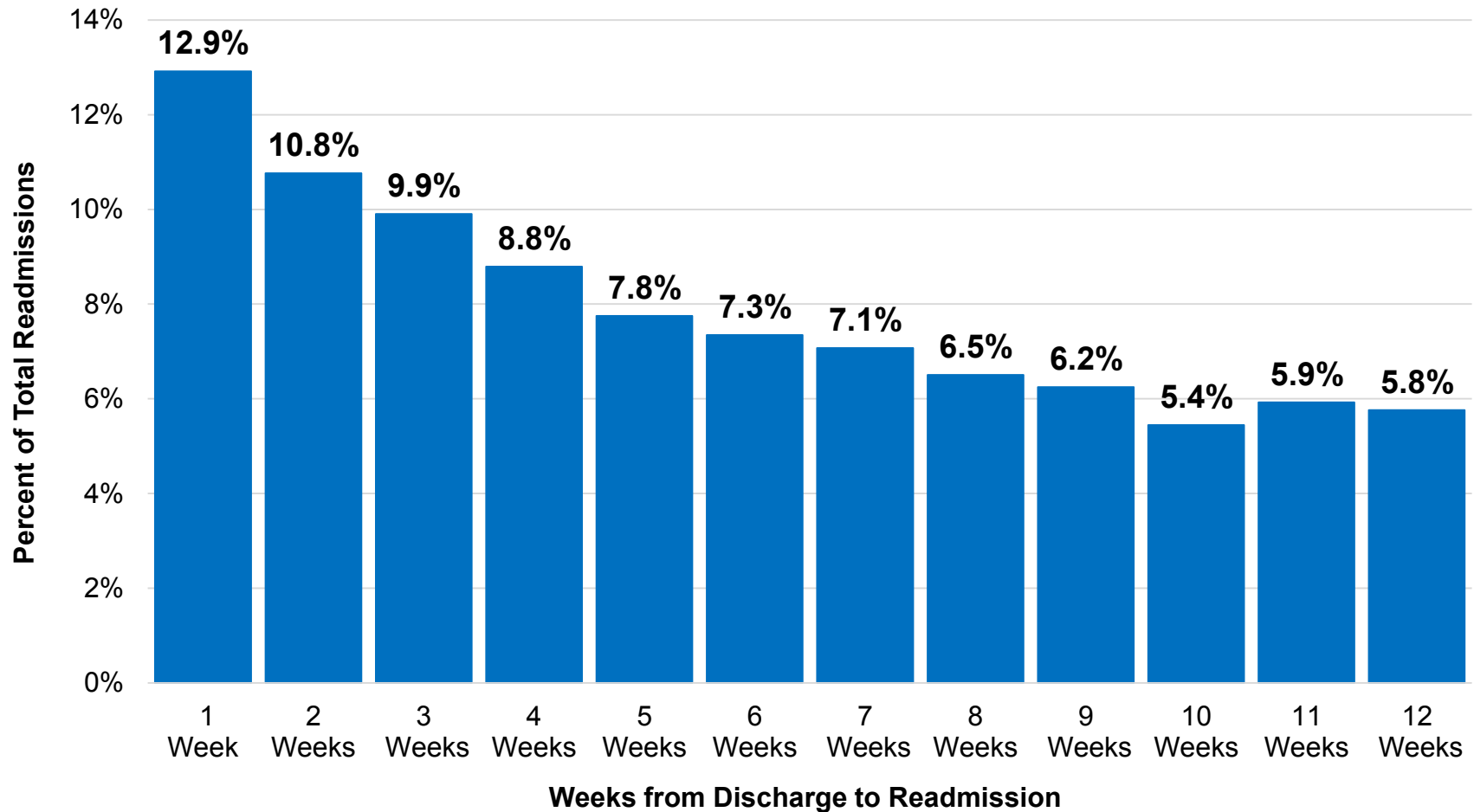
Average 90-Day Readmission Rate



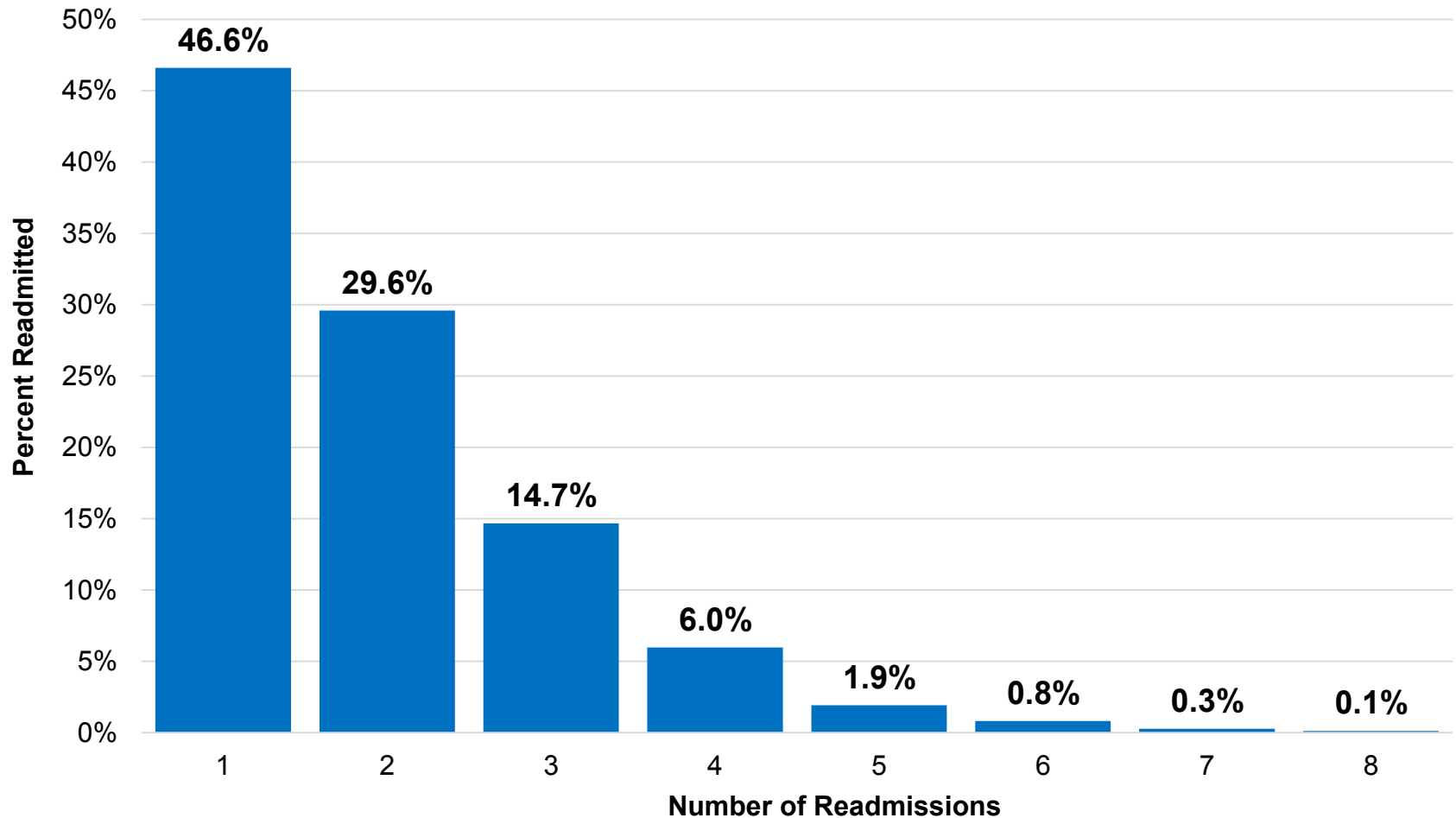
Reasons for 90-Day Readmissions

Reason for Readmission (DRG)	Percent
Septicemia or Severe Sepsis w MV 96+ Hours	22.0%
Heart Failure & Shock	5.0%
Infectious & Parasitic Diseases w O.R. Procedure	4.2%
Renal Failure	4.0%
Kidney & Urinary Tract Infections	3.1%

Timing of Readmissions in the 90 Days Post-Discharge

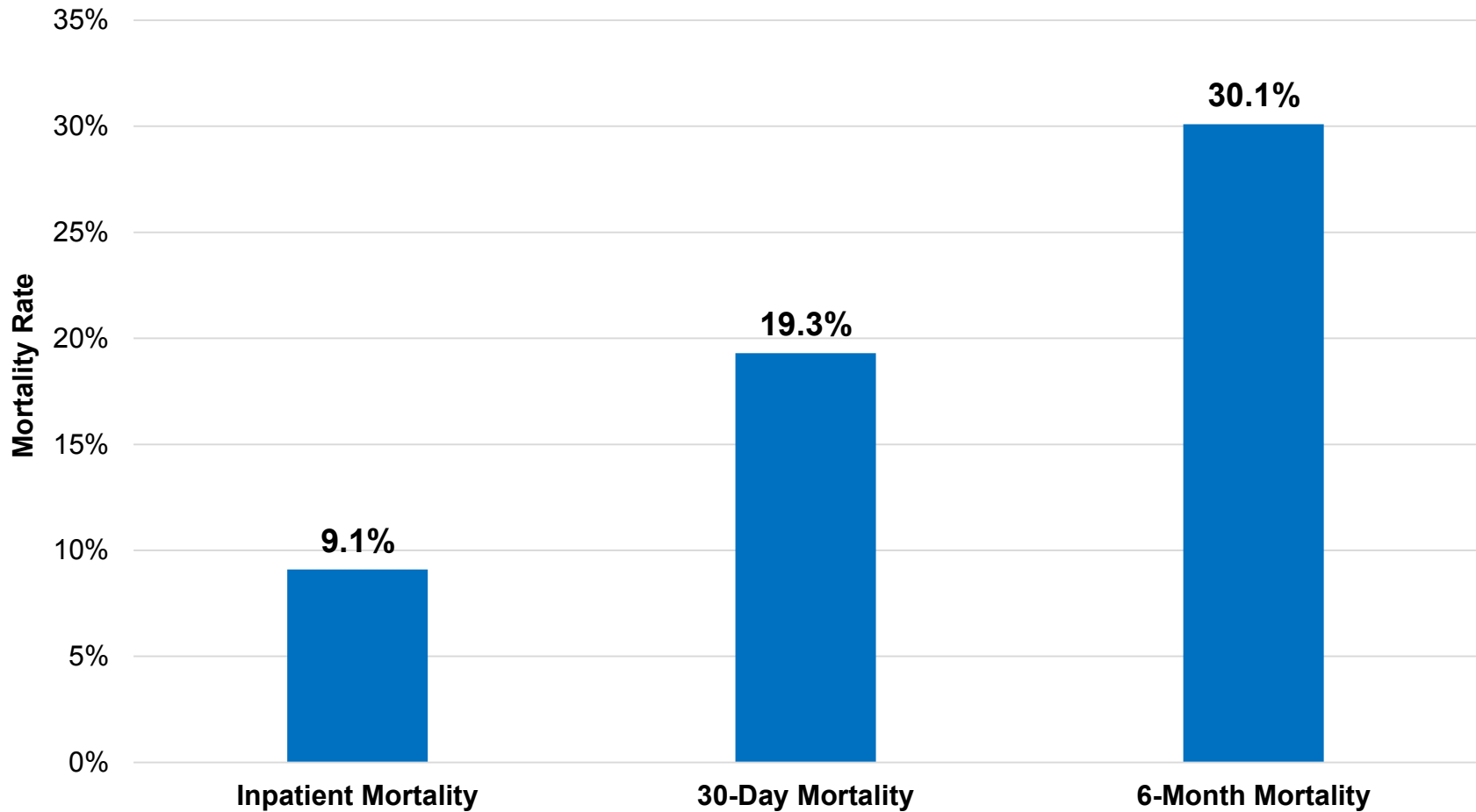


Number of Readmissions in the 90 Days Post-Discharge



Mortality

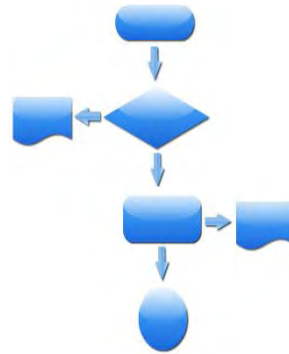
Mortality Rates among Medicare Beneficiaries



MVC Sepsis Workgroups

- Protocols for early recognition and treatment of sepsis in the ED

- CMS SEP-1 Initiative
- Risk stratification



- EHR enhancements to improve COC

- Early detection of sepsis predictive model
- Automatic medication reorders (i.e. lactate)
- Sepsis hand-off tool



MVC Sepsis Workgroups (cont.)

- Dedicated physician champions in the ED

- Staff and patient education

- Collaborative practices



Summary

- Wide variation in sepsis payments and outcomes across Michigan hospitals
- Readmissions and Skilled Nursing Facility utilization drive payment variation
- Best practice sharing and collaboration are vital to improve sepsis care

Next Steps

- MVC-HMS data linkage



- Collaborate with HMS and MHA for future workgroups and other engagement activities



- Increase engagement and collaboration statewide to equitably improve sepsis care



Acknowledgements

- MVC Team
 - Chelsea Abshire, MPH
 - Deby Evans, MBA, BSN, RN
 - Meghan Nyrkkanen, BSN
- HMS and MHA

Contact

- My email
 - syrjamaj@med.umich.edu
- MVC Coordinating Center
 - michiganvaluecollaborative@gmail.com

Break



Hospital Management





Hallie Prescott, MD, MSc

Professor of Internal Medicine, Pulmonary & Critical Care at Michigan Medicine

Vice Chair of the Surviving Sepsis Campaign Guidelines & council member of the International Sepsis Forum



Sepsis definitions and diagnostic uncertainty

Hallie Prescott, MD, MSc

Associate Professor of Internal Medicine,
Pulmonary & Critical Care at Michigan Medicine
HMS Sepsis Physician Lead



Outline

Sepsis definitions over time

Our current definition (Sepsis-3)

Diagnostic uncertainty at the bedside

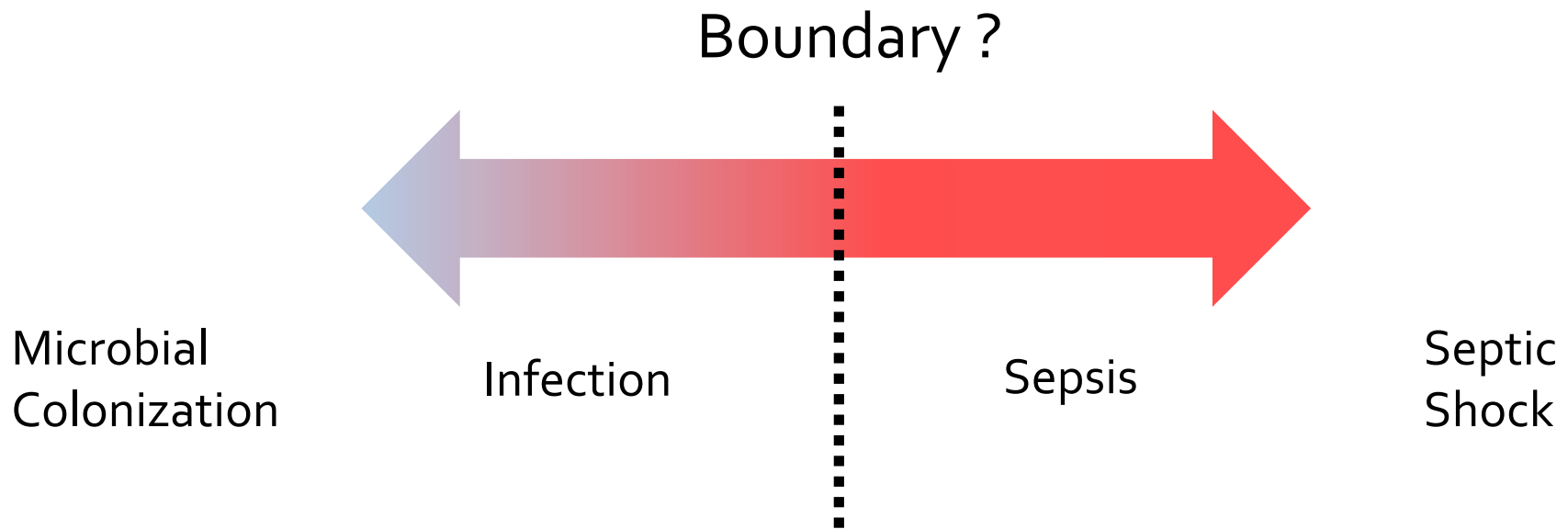
Improving patient outcomes despite diagnostic uncertainty

What is sepsis?

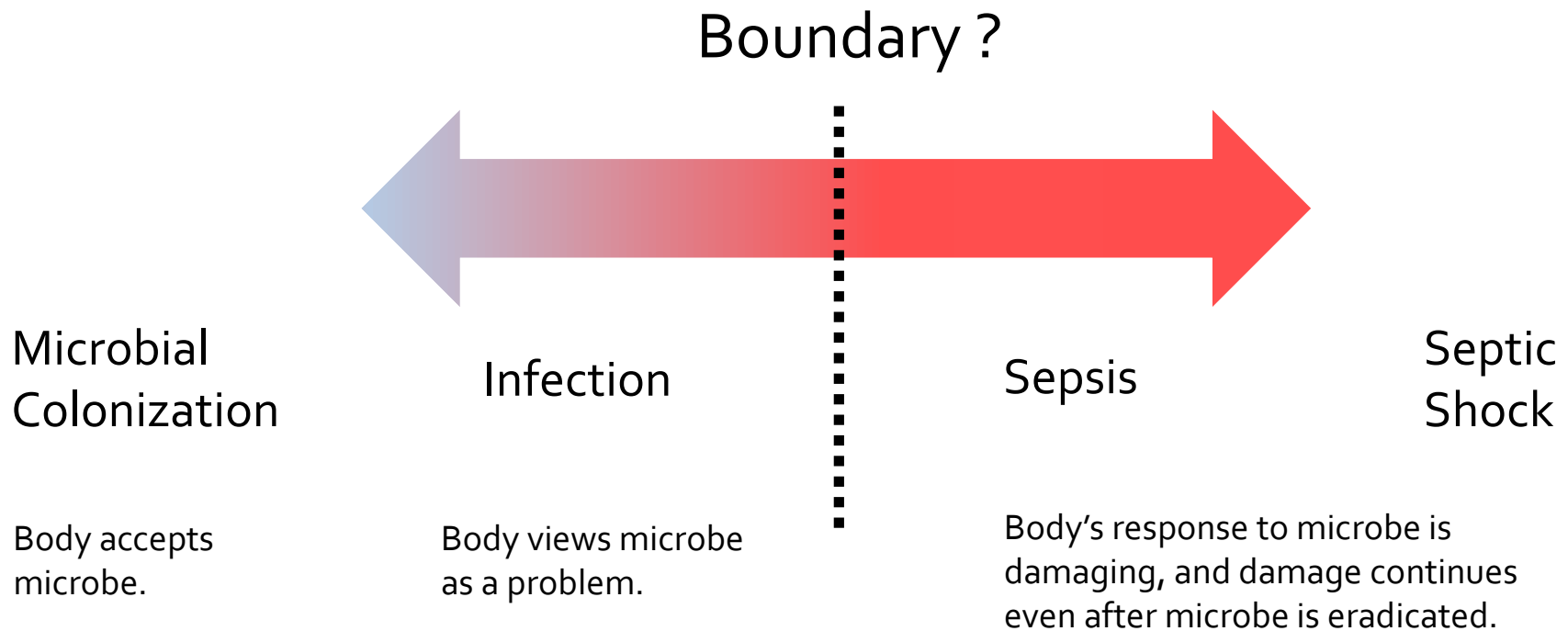
Sepsis is a life-threatening complication of infection that arises when the body's response to infection injures its own tissues and organs.

Singer, *et al.* JAMA. 2016.

What is sepsis?



What is sepsis?

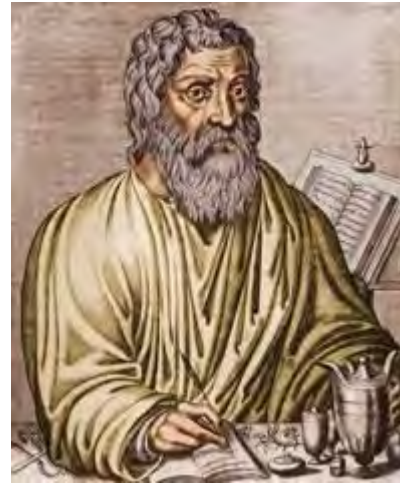


Sepsis dates back to dawn of medicine

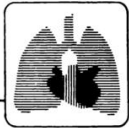
From Greek word sipsi “to make rotten” or sepo “I rot”

Poems of Homer (~850 BC)

Writings of Hippocrates (400 BC)



First modern definition in 1992 (Sepsis-1)



accp/sccm consensus conference

Definitions for Sepsis and Organ Failure and Guidelines for the Use of Innovative Therapies in Sepsis

THE ACCP/SCCM CONSENSUS CONFERENCE COMMITTEE:

Roger C. Bone, M.D., F.C.C.P., Chairman

Robert A. Balk, M.D., F.C.C.P.

Frank B. Cerra, M.D.

R. Phillip Dellinger, M.D., F.C.C.P.

Alan M. Fein, M.D., F.C.C.P.

William A. Knaus, M.D.

Roland M. H. Schein, M.D.

William J. Sibbald, M.D., F.C.C.P.

An American College of Chest Physicians/Society of Critical Care Medicine Consensus Conference was held in Northbrook in August 1991 with the goal of agreeing on a set of definitions that could be applied to patients with sepsis and its sequelae. New definitions were offered for some terms, while others were discarded. Broad definitions of sepsis and the systemic inflammatory response syndrome were proposed, along with detailed physiologic parameters by which a patient may be categorized. Definitions for severe sepsis, septic shock, hypotension, and multiple organ dysfunction syndrome were also offered. The use of severity

scoring methods when dealing with septic patients was recommended as an adjunctive tool to assess mortality. Appropriate methods and applications for the use and testing of new therapies were recommended. The use of these terms and techniques should assist clinicians and researchers who deal with sepsis and its sequelae.

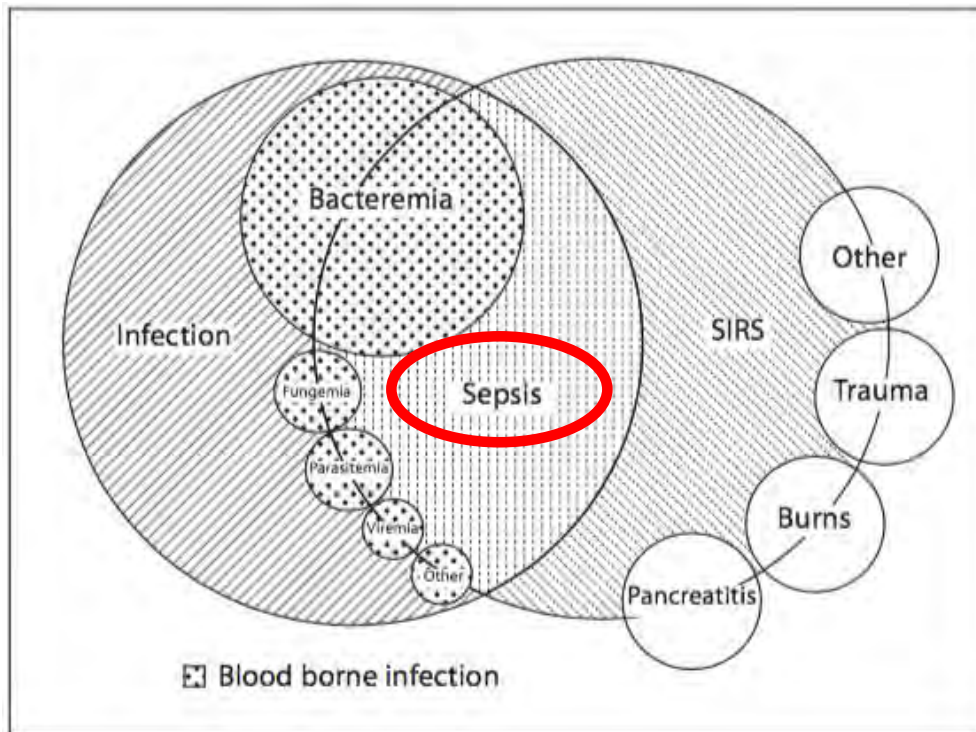
(Chest 1992; 101:1644-55)

MODS = multiple organ dysfunction syndrome; SIRS = systemic inflammatory response syndrome

“Too much inflammation”



Bone, et al. Chest. 1992.



“Systemic Inflammatory Response Syndrome” (SIRS)

A systemic inflammatory response seen following a wide variety of insults.

Includes 2 or more:

- Abnormal temperature
- Heart Rate > 90
- Elevated respiratory rate
- Abnormal WBC

Bone, et al. Chest. 1992.

SIRS

2 or more abnormalities: temperature,
heart rate, respirations, WBC



Sepsis

SIRS + Infection



Severe
Sepsis

Sepsis + Acute Organ Dysfunction
(delirium, respiratory failure, kidney failure, *etc.*)



Septic
Shock

Severe Sepsis where Acute Organ Dysfunction
includes inadequate Perfusion

Bone, et al. Chest. 1992.

2001, Sepsis-2: Essentially unchanged

Special Articles

2001 SCCM/ESICM/ACCP/ATS/SIS International Sepsis Definitions Conference

Mitchell M. Levy, MD, FCCP; Mitchell P. Fink, MD, FCCP; John C. Marshall, MD; Edward Abraham, MD; Derek Angus, MD, MPH, FCCP; Deborah Cook, MD, FCCP; Jonathan Cohen, MD; Steven M. Opal, MD; Jean-Louis Vincent, MD, FCCP, PhD; Graham Ramsay, MD; For the International Sepsis Definitions Conference

“apart from expanding the list of signs and symptoms of sepsis to reflect clinical bedside experience, no evidence exists to support a change to the definitions.”

“Too much inflammation”



Levy, et al. *Crit Care Med.* 2003.

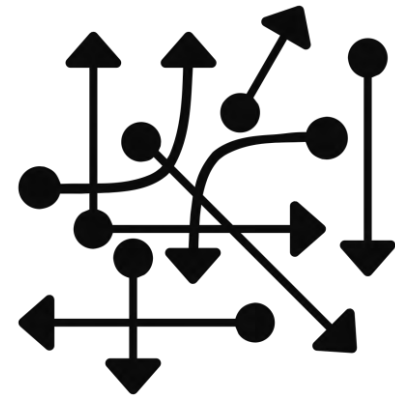
2016, Sepsis-3: Large conceptual changes

“Too much inflammation”



100s of failed trials of
anti-inflammatory
agents

Multi-pathway
“dysregulation”



Sepsis-3: Definition

“Sepsis is life-threatening organ dysfunction caused by a dysregulated host response to infection.”

Singer, et al. *JAMA*. 2016.

Sepsis-3: Definition

“Sepsis is life-threatening organ dysfunction caused by a dysregulated host response to infection.”

SIRS no longer included in definition because SIRS may simply reflect an appropriate host response.

“Severe sepsis” becomes superfluous.

Singer, *et al.* JAMA. 2016.

Sepsis-3 Operationalization: 2+ SOFA points*

	0	1	2	3	4
Resp.	P/F >400	<400	<300	<200 with support	<100 with support
Coag.	Plt >150	<150	<100	<50	<20
Liver	T.bili<1.2	1.2-1.9	2.0-5.9	6.0-11.9	>20
Cardiovasc.	MAP>70	MAP<70		Low-dose vasopressors	High-dose vasopressors
CNS	GCS 15	13-14	10-12	6-9	<6
Renal	Cr <1.2	1.2-1.9	2.0-3.4	3.5-4.9 UOP <500ml	>5 <200ml

*2+ new SOFA points due to “dysregulated host response to infection”

Singer, *et al.* JAMA. 2016.

Sepsis-3: qSOFA tool

To rapidly identify patients at highest risk for poor outcome.

Not part of definition, not a screening tool (poor sensitivity), not a confirmatory test (poor specificity).



ALTERED
MENTAL STATUS

GCS<15



FAST RESPIRATORY
RATE

RR $\geq$ 22



LOW BLOOD
PRESSURE

SBP<100

Seymour, et al. JAMA. 2016.

Outline

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Our current definition (Sepsis-3)

Diagnostic uncertainty at the bedside

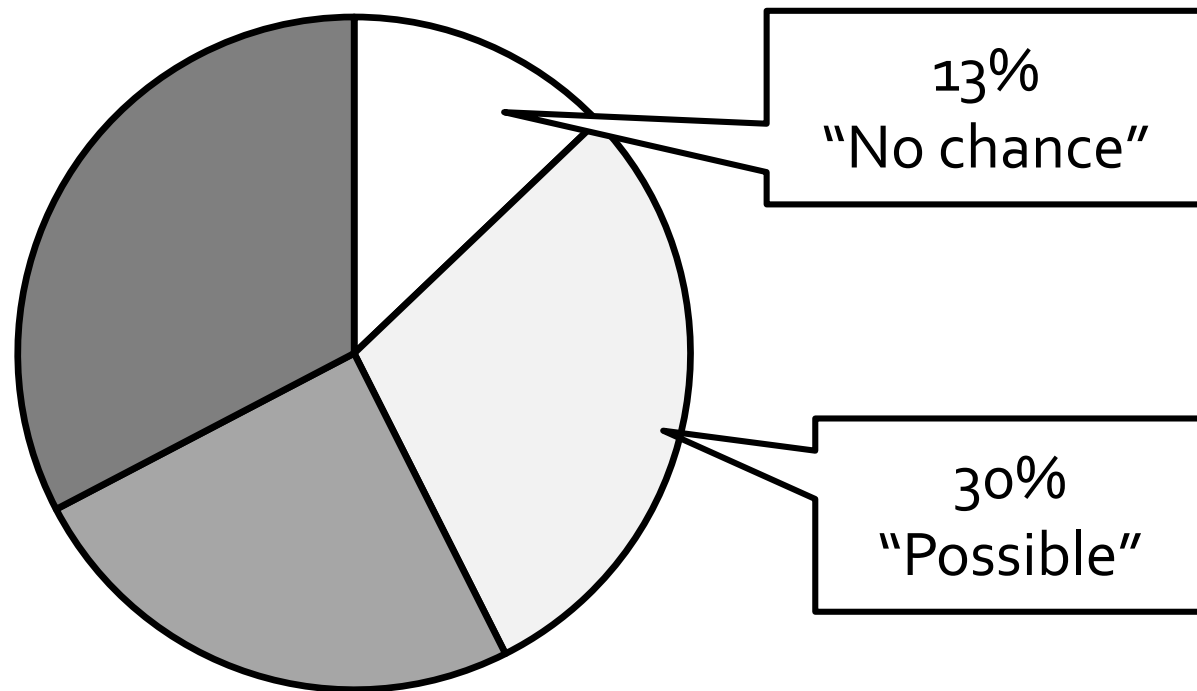
Improving patient outcomes despite diagnostic uncertainty

Poor agreement on vignettes

	YES	NO
Case 1	49%	51%
Case 2	49%	51%
Case 3	38%	62%
Case 4	32%	38%

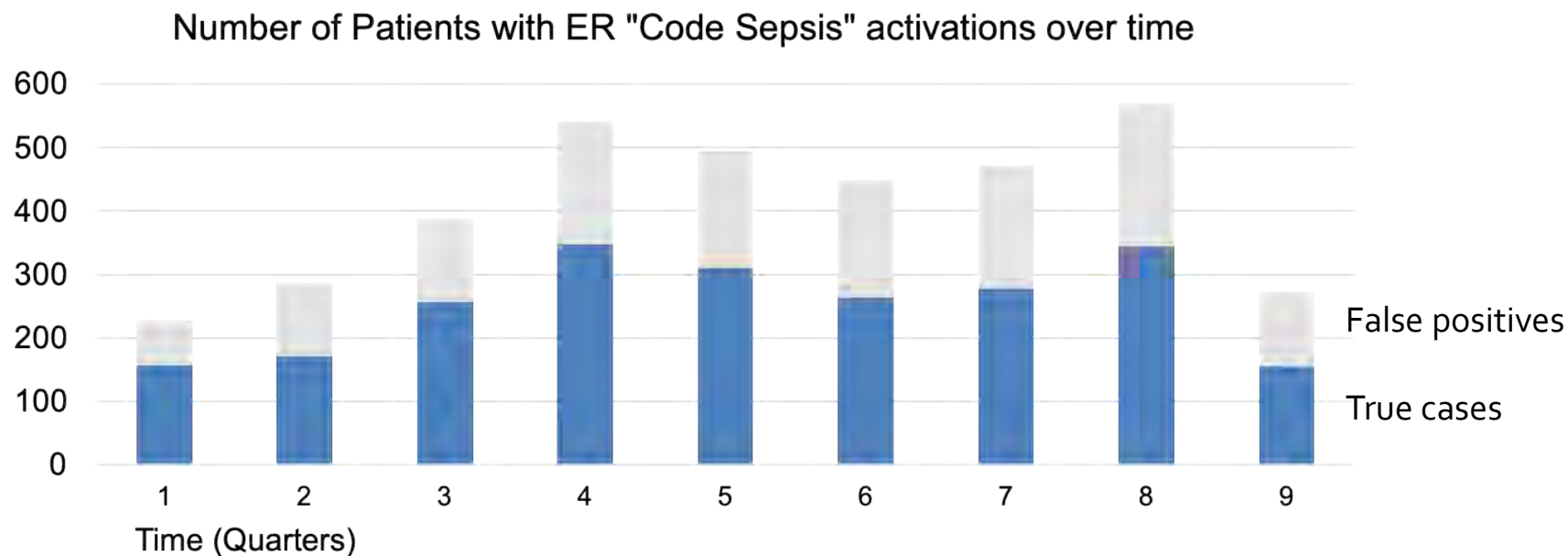
Rhee, et al. *Crit Care*, 2016.

Sepsis often deemed unlikely on *post-hoc* review



Klein Louwenberg, et al. *Crit Care*, 2015.

Sepsis often deemed unlikely on *post-hoc* review



Taylor, et al. *AnnalsATS*, 2020.

QI is possible despite diagnostic uncertainty

Improved in-hospital mortality 29 → 24%
Stable illness severity
Associated improvements bundle compliance



NY sepsis mortality has improved relative to other states
(FL, MD, MA, NJ).

Mitchell, *et al.* *AJRCCM*, 2018.
Kahn, *et al.* *JAMA*, 2019.

Important to monitor for unintended consequences

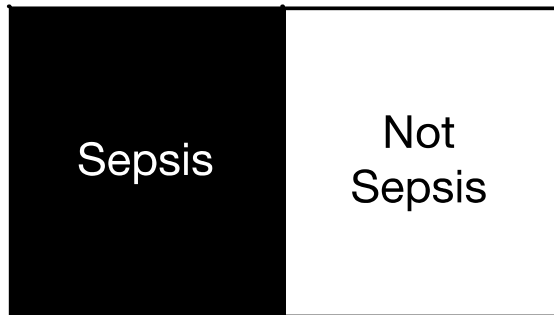
Antibiotic overuse, downstream consequences

Delays in care for non-sepsis diagnoses

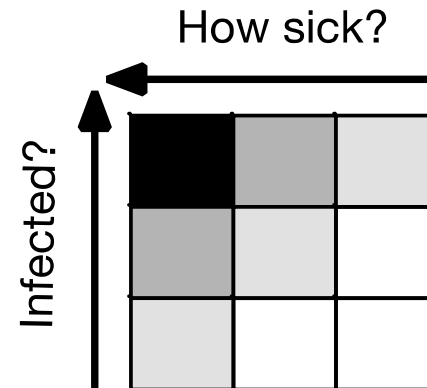
Important to reassess sepsis diagnosis, avoid premature closure

Can we better embrace uncertainty?

Current approach of guidelines
and quality improvement



An alternate approach



Prescott and Iwashyna, *AnnalsATS*, 2019.

In summary

Sepsis definition has evolved over time

Sepsis-3: life-threatening organ dysfunction due to dysregulated host response to infection.

Until better diagnostics/definition arrive, we need to incorporate uncertainty into clinical decision-making.



Pat Posa, RN, MSA, FAAN

Quality and Patient Safety Program Manager at Michigan Medicine

Sepsis Alliance Advisory Committee Member





MICHIGAN MEDICINE
UNIVERSITY OF MICHIGAN

Improving Sepsis Recognition for Frontline Clinicians

Pat Posa RN, BSN, MSA, CCRN-K, FAAN
Quality and Patient Safety Program Manager
Michigan Medicine
pposa@med.umich.edu

Sepsis

- Common, Lethal and Under recognized
- Every 2 minutes, a person in the U.S. dies of sepsis

More than

1.7 Million

People get sepsis each year in the U.S.

At least

270,000

Americans die from sepsis each year

About

1 in 3 Patients

Who die in a hospital have sepsis

Rhee C, et al. *JAMA*. 2017;318(13):1241-1249.

Angus DC, et al.. *Crit Care Med* 2001;29:1303-10.

Buchman TG, et al. *Crit Care Med*. 2020;48(3):276-288.

Novosad SA, et al. *CDC Morbidity and Mortality Weekly Report.*, 2016;65(33):864-869

Buchman TG, et al. *Crit Care Med*. 2020;48(3):276-288

TO SAVE LIVES.....



Early identification



Early antibiotics



Early fluid resuscitation

Surviving Sepsis Guidelines (SSC)

Screening

- 2016: We recommend that hospitals and hospital systems have a performance improvement program for sepsis, including sepsis screening for acutely ill, high-risk patients (BPS).
- 2012: We recommend routine screening of potentially infected seriously ill patients for severe sepsis to increase the early identification of sepsis and allow implementation of early sepsis therapy (1C)

Dellinger RP, et al. *Crit Care Med.* 2013;41:580-637
Rhodes, A et al *Crit Care Med.* 2017;45(3):486-552.

“As the physician say of hectic fever, that in the beginning of the malady it is difficult to detect but easy to treat, but in the course of time, having been neither detected nor treated in the beginning, it becomes easy to detect but difficult to treat”

Niccolo Machiavelli, 14th Century

Simpson, S. Chest. January 2018 SIRS in the Time of Sepsis-3

The Importance of Early Detection

- Efforts to **just treat recognized sepsis** alone is not enough.
- A critical aspect of **mortality reduction** has been pushing practitioners to identify sepsis early.
 - It may well be that **earlier recognition** accounts for much of the signal in mortality reduction and partially explains sharply increasing incidence.
 - Without recognition that the **clock is ticking**, there is simply no incentive to recognize a challenging diagnosis early.

Levy MM, Dellinger RP, Townsend SR, et al. Crit Care Med. 2010 Feb;38(2):367-74.
Gaieski 13 DF, Edwards JM, Kallan MJ, et al. Crit Care Med. 2013 Feb 25

Medical Surgical Floor Patients Die Disproportionately

Special Article

The Surviving Sepsis Campaign: Results of an international guideline-based performance improvement program targeting severe sepsis*

Mitchell M. Levy, MD; R. Phillip Dellinger, MD; Sean R. Townsend, MD; Walter T. Linde-Zwirble; John C. Marshall, MD; Julian Bion, MD; Christa Schorr, RN, MSN; Antonio Artigas, MD; Graham Ramsay, MD; Richard Beale, MD; Margaret M. Parker, MD; Herwig Gerlach, MD, PhD; Konrad Reinhart, MD; Eliezer Silva, MD; Maurene Harvey, RN, MPH; Susan Regan, PhD; Derek C. Angus, MD, MPH; on behalf of the Surviving Sepsis Campaign

Patient Characteristics	Subjects, %	Hospital Mortality, %
All	100	34.8
Source		
ED	52.4	27.6
ICU	12.8	41.3
Ward	34.8	46.8

Crit Care Med, 2010;38:367-374

Risk Adjusted Odds Ratio of Death 1.87% for Medical/Surgical Floor Patients

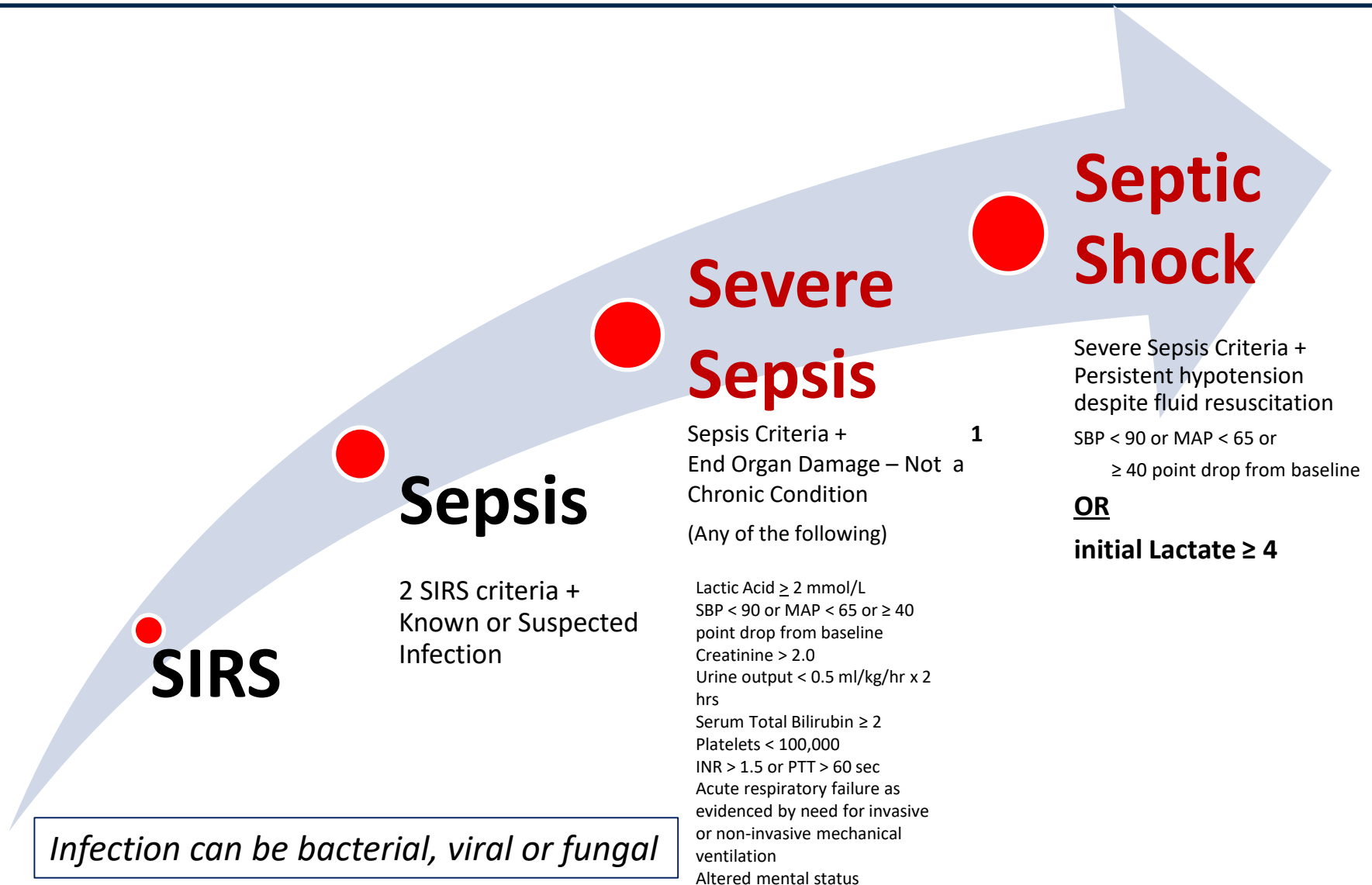
Table 4. Multivariable mortality prediction model^a

Variable	OR	95% CI	<i>p</i>
Admission source			
Ward compared to ED	1.87	1.73, 2.02	≤.0001
ICU compared to ED	2.25	2.02, 2.51	

Strategies to Find Patients with Severe Sepsis

- **Nurse screening**
- **EMR alert**
- **RRT screen on every call**
- Sepsis coordinator
- Unit sepsis champions
- ED and ICU rounding
- Part of nursing shift handoff
- Discuss sepsis screen as part of Interdisciplinary Rounds
- Reports
 - Patients who screened positive
 - Lactate

Sepsis-2: Defining a Disease Continuum



Tools for Early Identification of Sepsis/Severe Sepsis

Method	Pros	Limitations
Paper form	- Nurses critically think as they screen the patient - Easy and quick to develop - No cost	- Screening is intermittent - Paper can be misplaced - Static—no ability to automate an alert
EMR form	- Nurses critically thinks as they screen the patient - Can automate alerts for positive screens	- Screening is intermittent - Length of programming time - Cost
EMR—real time, continual screening	24-hour screening - Can automate alerts for positive screens	- Nurse does not screen patient—potential loss of screening knowledge and critical thinking - Computer not reliably able to identify patients who have infection - Computer not able to discern if SIRS is valid or organ dysfunction is new
EMR—real time & scheduled	- Form fires and pre-populates for nurse to screen upon admission and each shift—nurse critically thinks 24-hour EMR screening—looking for SIRS or new organ dysfunction - Manual (EMR form)screen completed when EMR alert fires---nurse discerns/validates appropriateness/correctness of alert	Screening form needs to be developed in EMR—programing time and costs
EMR—Prediction Model or Machine Learning	- Computer algorithm then runs continuously and will alert clinicians when a certain threshold is reached - Manual(EMR form) screen completed when EMR alert fires---nurse discerns/validates appropriateness/correctness of alert	Screening form needs to be developed in EMR—programing time and costs

Table 3. Tradeoffs among Tools for Screening for Abnormal Physiology

	Accuracy	Timeliness	Feasibility	Comments
SIRS	★	★★	★★★	With high sensitivity but very low specificity, SIRS can be expected to generate many false positives. It is incorporated into CMS's Sep-1 approach and is familiar to many providers.
qSOFA	★★	★	★★★	qSOFA is incorporated into Sepsis 3 as a prompt for clinicians to consider sepsis. It has better specificity than SIRS, but sacrifices some sensitivity.
Early Warning Scores	★★	★★	★★	Early warning scores such as MEWS, NEWS, and PEWS have been incorporated by many hospitals as part of rapid response system deployments. They require the computation of a score at bedside, which may limit feasibility.
Computerized algorithms	★★★	★★★	★	Computerized algorithms use many parameters to enhance sensitivity and specificity of detecting patients at risk of poor outcomes, but their complexity may require specialized informatics support for practical implementation. They have not been widely disseminated or adopted; therefore, their wide application has yet to be confirmed.

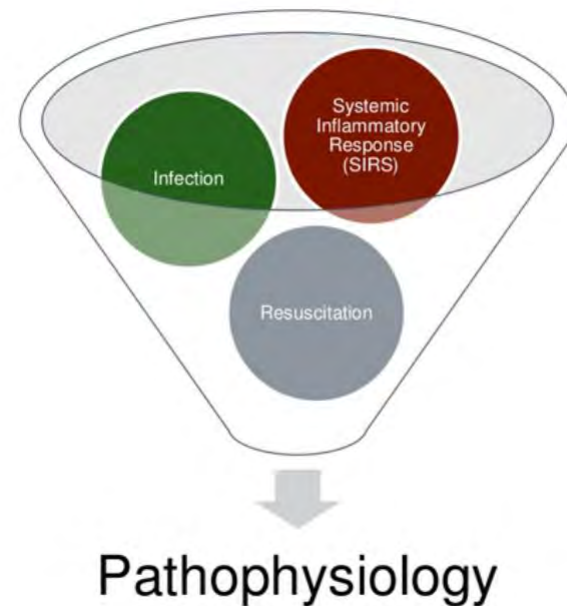
What is the purpose of nurse screening for sepsis?



Empowering Nurses for Early Sepsis Recognition
accessed
on <https://www.youtube.com/watch?v=s687VMj6iwo>

Understanding the Why: Sepsis Screening Not Just Another Task

- Pathophysiology connected to screening components
- Bundle elements
- Educational tools and reminders to help remember over time



PATIENT CARE UNIT SEVERE SEPSIS SCREENING TOOL

SEPSIS SCREEN (To be completed every shift) ✓ If response is yes.

A. Infection

D, P, N. D=Days P=PM's N=NOC's

- ☐ ☐ ☐ Patient has an infection or suspicion of infection
☐ ☐ ☐ Patient on antibiotics (not prophylaxis)
☐ ☐ ☐ If No, Stop Here

B. SIRS (Systemic Inflammatory Response Syndrome)

Patient has 2 or more of the following SIRS criteria

- ☐ ☐ ☐ T > 38.3 (101) or < 36 (96.8)
☐ ☐ ☐ HR > 90 BPM
☐ ☐ ☐ RR > 20 breaths/min
☐ ☐ ☐ WBC > 12,000, < 4000, or > 10% immature neutrophils
☐ ☐ ☐ New mental status change from baseline
☐ ☐ ☐ Glucose > 120 mg/dl (in absence of Diabetes)

Time: _____ +/- Time: _____ +/- Time: _____ +/-

If A & B are met, screen is positive for sepsis.

If sepsis screen positive for sepsis:

- > Rescreen Q 6 hours
 > Suggest Q 6 h lactate X4
 Rescreen:

Time _____ ☐ negative ☐ sepsis ☐ severe sepsis
 Time _____ ☐ negative ☐ sepsis ☐ severe sepsis
 Time _____ ☐ negative ☐ sepsis ☐ severe sepsis

C. ACUTE Organ Dysfunction

Patient meets one or more of the following criteria

- ☐ ☐ ☐ SBP < 90 mmHG or MAP < 65 mmHG
☐ ☐ ☐ SBP decrease > 40 mmHG from baseline
☐ ☐ ☐ New (or increased) oxygen requirement to maintain SpO₂ > 90%
☐ ☐ ☐ Bilateral pulmonary infiltrates with PaO₂/FiO₂ ratio < 300
☐ ☐ ☐ Urine Output < 0.5 mL/kg/hour for > 2 hours or Creatinine > 2 mg/dl
☐ ☐ ☐ Bilirubin > 2 mg/dl
☐ ☐ ☐ Platelet count < 100,000
☐ ☐ ☐ Coagulopathy (INR > 1.5 or aPTT > 60 secs)
☐ ☐ ☐ Lactate ≥ 2 mmol/L

If all criteria met for A, B & C, screen is positive for severe sepsis

Initiate RRT - Time: _____ Sepsis alert called _____

- ☐ New positive screen for severe sepsis
☐ MD _____ notified Time: _____
☐ Transferred to ICU
☐ Transferred to higher level of care.



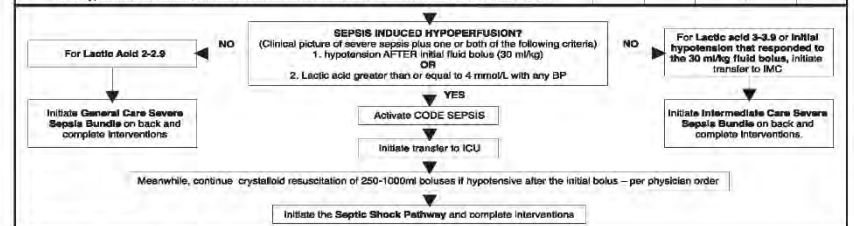
ST. JOSEPH MERCY ANN ARBOR
 ST. JOSEPH MERCY LIVINGSTON
 ST. JOSEPH MERCY SALINE

Patient Units Severe Sepsis Screening Tool

Severe Sepsis = Infection + SIRS + Organ Dysfunction

Directions: The screening tool is for use in identifying patients with severe sepsis. Screen each patient upon admission, once per shift and PRN with change in condition.

	DATE:	TIME:
I. SIRS-Systemic Inflammatory Response Syndrome (two or more of the following):		
Temperature greater than or equal to 100.4°F or less than or equal to 96.8°F		
Heart Rate greater than 90 beats/minute		
Respiratory Rate greater than 20 breaths per minute		
WBC greater than or equal to 12,000/mm ³ or less than or equal to 4,000/mm ³ or greater than 0.5 K/L bands		
Blood glucose greater than 140 mg/dL in non-diabetic patient		
Negative screen for severe sepsis (Please initial)		
If check two of the above, move to II		
II. Infection (one or more of the following):		
Suspected or documented infection		
Antibiotic Therapy (not prophylaxis)		
If check none of above - Negative screen for severe sepsis (Please initial) - answer infection question NO in I-View		
If check one of the above - answer infection question YES in I-View, call physician for serum lactic acid order and move to III		
III. Organ Dysfunction (change from baseline) (one or more of the following within 3 days of new infection)		
Respiratory: SaO ₂ less than 90% OR increasing O ₂ requirements		
Cardiovascular: SBP less than 90mmHg OR 40mmHg less than baseline OR MAP less than 65mmHg		
Renal: urine output less than 0.5mL/kg/hr, creatinine increase of greater than 0.5mg/dl from baseline		
CNS: altered consciousness (unrelated to primary neuro pathology)		
Glasgow Coma Score less than or equal to 12		
Hematologic: platelets less than 100,000; INR greater than 1.5		
Hepatic: Serum total bilirubin greater than or equal to 4mg/dl		
Metabolic: Serum lactic acid greater than or equal to 2mmol/L		
Negative screen for severe sepsis (Please initial)		
If check one in section III or a severe sepsis alert fires, patient has screened positive for severe sepsis		
1. Call rapid response team		
2. Call physician, physician assistant or nurse practitioner and implement urgent measures protocol		
3. Initiate or ensure IV access (2 large bore IV's if no central access)		
4. Obtain a venous blood gas (peripheral draw), serum lactic acid, CBC (if it has been greater than 12 hrs since last test), two sets of blood cultures (if greater than 24 hours since last set)		
5. If patient is hypotensive: Give crystalloid (NS) fluid bolus - 30mL/kg over one hour or as fast as possible until hypotension resolved, unless known EF is less than 35% or active treatment for heart failure.		



RN Signature, initial Date & Time:

--	--

20200410102603_Sever sepsis DRAT 6 6/12/1610

Electronic: Routine Screening

Sepsis Screening Tool

The purpose of this tool is to facilitate **EARLY RECOGNITION & TREATMENT OF SEPSIS**
THIS TOOL DOES NOT REPLACE CLINICAL JUDGEMENT

SIRS/Organ Dysfunction/Sepsis Screening Tool Retrieval

Note:
Blood sugar > or = 140 is SIRS criteria for a non-diabetic patient

Sepsis Screen

Systemic
Inflammatory
Response
Syndrome
(SIRS) Screen

- ☐ No criteria identified
- ☐ Resp rate greater than 20/min
- ☐ Temp less than 36 C or greater than 38.3 C
- ☐ Heart rate greater than 90/min
- ☐ WBC under 4 K, above 12 K or more than 10% bands past 4
- ☐ Altered Level of Consciousness

Temp <36 C (96.8 °F) or Temp > 38.3 (101 °F)

Positive Sepsis Screen - criteria are:

- Two or more SIRS Screen is selected

Screening Tool
24 hours

Severe Sepsis Screen

Organ
Dysfunction
Screen

- ☐ No criteria identified
- ☐ Lactic acid greater than 2 mMol/L within 12 hrs
- ☐ Systolic blood pressure (SBP) less than 90 mmHg
- ☐ Mean Blood Pressure (MAP) less than 65 mmHg
- ☐ Systolic blood pressure (SBP) decrease of 40 mmHg from baseline
- ☐ Acute respiratory failure: BIPAP or Mechanical Ventilation
- ☐ Creatinine increase more than 0.5 mg/dL within past 72 hrs
- ☐ Creatinine greater than 2 mg/dL in past 72 hrs not chronic kidney dx
- ☐ Bilirubin greater than 2 mg/dL within past 72 hrs
- ☐ Platelet count less than 100,000 K/uL within past 72 hrs
- ☐ aPTT greater than 60 sec in past 72 hrs without anticoagulants
- ☐ INR greater than 1.5 within past 72 hrs without anticoagulants

Positive **SEVERE** Sepsis
Screen Occurs when one
selection is chosen once
one Organ Dysfunction is
identified.

Automatically defaults to a
Positive **SEVERE** Sepsis
Screen.

SEVERE Sepsis Screen is
activated

A POSITIVE Sepsis Screen Result plus 1 or more signs of Organ
Dysfunction = Positive SEVERE Sepsis

Severe Sepsis
Screening Result

- ☐ Negative SEVERE Sepsis Screen ☐ Positive SEVERE Sepsis Screen

Negative
occurs when
positive screen
is not met.

**Negative SEVERE Sepsis
Screen** – occurs when
criteria for positive
screen is not met.

Electronic Routine Screening

	8/28/2020 2:05 PM	8/28/2020 8:41 AM	8/27/2020 5:34 PM	8/27/2020 8:41 AM	8/27/2020 3:55 AM
Screen Type	Shift Screen	Shift Screen	Shift Screen	Shift Screen	Shift Screen
Does patient have known or suspected infection?	Yes	Yes	Yes	Yes	Yes

Sepsis: Known or Suspected Infection Plus 2 or More SIRS Criteria
Vital signs which meet criteria are designated with a *
Lab data which meets criteria are designated as abnormal or as meeting SEP-1 criteria

Temperature (F)	99.3	99.3	98.2	98.9	98.5
Respiratory Rate	28*	16	34*	16	16
Heart Rate	87	88	96*	75	77
White Blood Cell Count	21 Abnormal	No WBC Result	No WBC Result	No WBC Result	8.3

Severe Sepsis: Sepsis Plus New Organ Dysfunction
Vital signs which meet criteria are designated with a *
Lab data which meets criteria are designated as abnormal or as meeting SEP-1 criteria
For subsequent alerts, lab data which previously contributed to the outcome must be trending to be classified as new organ dysfunction. Lab data which does not meet trending criteria are designated as not trending

Systolic Blood Pressure or Mean Arterial Pressure	SBP: 96 MAP: 76	SBP: 112 MAP: 76	SBP: 158 MAP: 111	SBP: 155 MAP: 113	SBP: 145 MAP: 105
Lactate	2.1 Meets SEP-1 Criteria	No Lactate Result	No Lactate Result	No Lactate Result	No Lactate Result
Creatinine	1.37 Abnormal Does Not Meet SEP-1 Criteria	1.10 Abnormal Does Not Meet SEP-1 Criteria	1.10 Abnormal Does Not Meet SEP-1 Criteria	No Creatinine Result	0.81
INR	No INR Result	No INR Result	No INR Result	No INR Result	No INR Result
PLT	554 Abnormal Does Not Meet SEP-1 Criteria	No PLT Result	No PLT Result	No PLT Result	545 Abnormal Does Not Meet SEP-1 Criteria
Total Bilirubin	No Total Bilirubin Result	No Total Bilirubin Result	0.8	0.8	No Total Bilirubin Result
Additional Indicators	New or worsening oxygen requirements	None of these	None of these	None of these	None of these

Screening Outcomes	Concern for Severe Sepsis	No Alert	No Alert	No Alert	No Alert
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All lab data reflects the most recent result at the time of the screening, within 6 hours for Lactate and within 24 hours for all other labs.

High Level Workflows:

- On admission (non-ED, non-OR), the nurse needs to complete the Initial Screen Required Doc list.
- Once per shift (0800 and 2000), the nurse will need to complete the Sepsis Ongoing Required Doc list.
- In the background, MiChart is reviewing patient data, including vitals, lab data, and a sepsis risk score. If the patient is above the Michigan Medicine assigned threshold, the nurse will complete a secondary screen on the patient.
- If a patient screens positive, the Provider First Contact will be paged.

Sepsis-3:



Sepsis is: 'life-threatening organ dysfunction caused by a dysregulated host response to infection'

Sepsis-3 does away with:

- SIRS criteria (sepsis is pro- and anti-inflammatory)
- Severe sepsis (sepsis = the old severe sepsis)
- Antiquated concepts: sepsis syndrome; septicemia



Sepsis: infection plus 2 or more SOFA (Sequential Organ Failure Assessment) points



Septic shock: vasopressor-dependent hypotension + lactate >2



Sepsis-3 includes clinical criteria to predict life-threatening disease

Singer et al, JAMA 2016. 315(8):801-810

Sepsis-3

SOFA

qSOFA:

Respiratory Rate ≥ 22
Altered Mental Status
Systolic BP ≤ 100 mmHg

(have 2 or more of these, then evaluate for SOFA)

Table 1. Sequential [Sepsis-Related] Organ Failure Assessment Score^a

System	Score	0	1	2	3	4
Respiration						
PaO ₂ /FiO ₂ , mm Hg (kPa)		≥ 400 (53.3)	< 400 (53.3)	< 300 (40)	< 200 (26.7) with respiratory support	< 100 (13.3) with respiratory support
Coagulation						
Platelets, $\times 10^3/\mu\text{L}$		≥ 150	< 150	< 100	< 50	< 20
Liver						
Bilirubin, mg/dL ($\mu\text{mol/L}$)		< 1.2 (20)	1.2-1.9 (20-32)	2.0-5.9 (33-101)	6.0-11.9 (102-204)	> 12.0 (204)
Cardiovascular						
MAP ≥ 70 mm Hg		MAP ≥ 70 mm Hg	MAP < 70 mm Hg	Dopamine ≤ 5 or dobutamine (any dose) ^b	Dopamine 5.1-15 or epinephrine ≤ 0.1 or norepinephrine ≤ 0.1 ^b	Dopamine > 15 or epinephrine > 0.1 or norepinephrine > 0.1 ^b
Central nervous system						
Glasgow Coma Scale score ^c		15	13-14	10-12	6-9	< 6
Renal						
Creatinine, mg/dL ($\mu\text{mol/L}$)		< 1.2 (110)	1.2-1.9 (110-170)	2.0-3.4 (171-299)	3.5-4.9 (300-440)	> 5.0 (440)
Urine output, mL/d					< 500	< 200

Abbreviations: FiO₂, fraction of inspired oxygen; MAP, mean arterial pressure; PaO₂, partial pressure of oxygen.

^a Adapted from Vincent et al.²⁷

^b Catecholamine doses are given as $\mu\text{g/kg/min}$ for at least 1 hour.

^c Glasgow Coma Scale scores range from 3-15; higher score indicates better neurological function.

- 13% to 50% of patients with infections who died within 30 days had a q SOFA score of ≥ 2 at ED presentation
- Predictors of mortality, not designed to predict a etiology of illness

Challenges with New Sepsis-3 Definitions

- SIRS not part of the definition:
 - the most appropriate use for SIRS is that its presence prompts an immediate search for both infection, as its possible source, and organ dysfunction, as its possible companion
- Doesn't recognize 'cryptic shock'
- People will begin to use qSOFA as a screening tool
 - qSOFA and SOFA are predictors of mortality; they are not test of early sepsis at risk to progress to organ failure
- Only their predictive ability for mortality and prolonged ICU stay have been evaluated, not their utility in reducing mortality

Can Both SIRS and qSOFA Be Used?

- If SIRS is present  Look for organ dysfunction
- If qSOFA is present  Patient has a high mortality risk

Screening in the ED: The Impact

- 310 bed acute care hospital
- Development of an ER Nurse Sepsis Identification and Tracking Tool (2 or more SIRS-called a 'code sepsis')
- Pre and post measurement
- Education and next steps provided

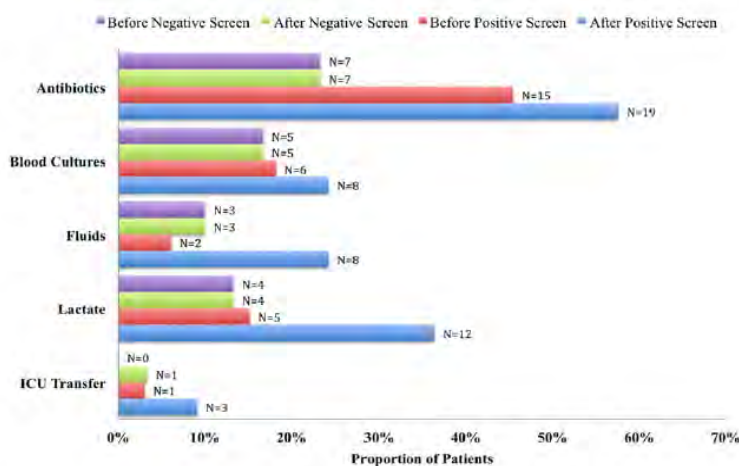
Table. Bundle Completion Time, Antibiotic Completion Time, LOS, and Mortality			
Variable	Preintervention (n = 165)	Postintervention (n = 145)	P
	Mean (SD)	Mean (SD)	
Time to bundle complete	593 (1388)	135 (236)	<.001
Time to antibiotic administration	185 (337)	84 (150)	<.001
LOS	9.15 (10.77)	9.17 (8.97)	.663
Mortality	12.1%	6.2%	.074

Abbreviations: LOS, length of stay; SD, standard deviation.

- Threatt DL. J Nurs Care Quality, 2019;35(2):135-139

Nurse Driven Screening Tool: Impact

- Academic medical center IMU
- Introduce screening every q shift
- 245 pts, 2143 screens
 - 39 pts + screen
 - Sensitivity/specificity 95%/92%
 - Negative predictive value 99%
 - Positive predictive value 54%



Evaluation for Severe Sepsis Screening Tool

Instructions: On inpatient nursing units, complete screening tool Q8 hours or when a change in patient's clinical status is noted.

Pt Stamp Here

Unit: _____ Date: _____ Time of Screen: _____ (24h clock)

RN Name (completing Screen): _____

- Are any **two** of the following systemic inflammatory response (SIRS) criteria both present and **new** to the patient?

___ Temp > 38 °C	___ HR > 90 bpm	___ WBC > 12,000
___ Temp < 36 °C	___ RR > 20 BPM or PaCO ₂ < 32 mm Hg	___ WBC < 4,000 OR more than 10% bands
- 2 SIRS? YES ☐ NO ☐
- IF 2 SIRS YES, is the patient's history and nursing assessment suggestive of a **new** infection? YES ☐ NO ☐
Possible sources: ___pulmonary; ___urinary; ___acute abdominal; ___meningitis; ___skin/soft tissue; ___bone/joint; ___wound; ___bloodstream catheter; ___endocarditis; ___implantable or other device; ___other(describe)
- IF NO - then Stop (Screen completed)
- IF 2 and 3 are YES, then suspicion of infection is present and patient screened **positive for r/o sepsis**:
 - Actions: Continue to Severe Sepsis Screen (next)

- Are **ANY** of the following organ dysfunction criteria present that are not considered to be chronic conditions?

☐ Neurological: Subtle or overt change in mental status	☐ Metabolic: Serum lactate > 2.0 mmol/L	☐ Pulmonary: RR>20 OR ↑O ₂ to maintain SpO ₂ > 90%
☐ Cardiac: • SBP <90 mmHg • MAP <65 mmHg • > 40 mmHg decrease in SBP from patient's baseline • Capillary refill > 3 seconds	☐ Renal: • UO < .5ml/kg/hr for 2 hrs (or <30 ml per hr for 2 hrs) • Serum creatinine increased by 0.3 gm/dl in past 48 hrs	☐ GI: Absent bowel sounds (except recent post op pt)
☐ Hematologic: Platelet count <100k	☐ Heme/Liver: INR > 1.5 or a PTT > 60 secs	☐ Hyperbilirubinemia: Total bilirubin > 4 mg/d
- IF NO ☐ then Call MD to inform of Positive 'sepsis' screen, implement Sepsis guidelines and continue to assess for severe sepsis.
- IF YES ☐ then patient screens positive for SEVERE Sepsis and severe sepsis guidelines should be initiated.

Call MD, Provide SBAR, Implement Severe Sepsis Management Guidelines

7 Hospital Systems: Northern California

Sepsis Mortality Reduction

- ED& ICU – continue improvements
- Emphasis placed on a new patient population

MOST



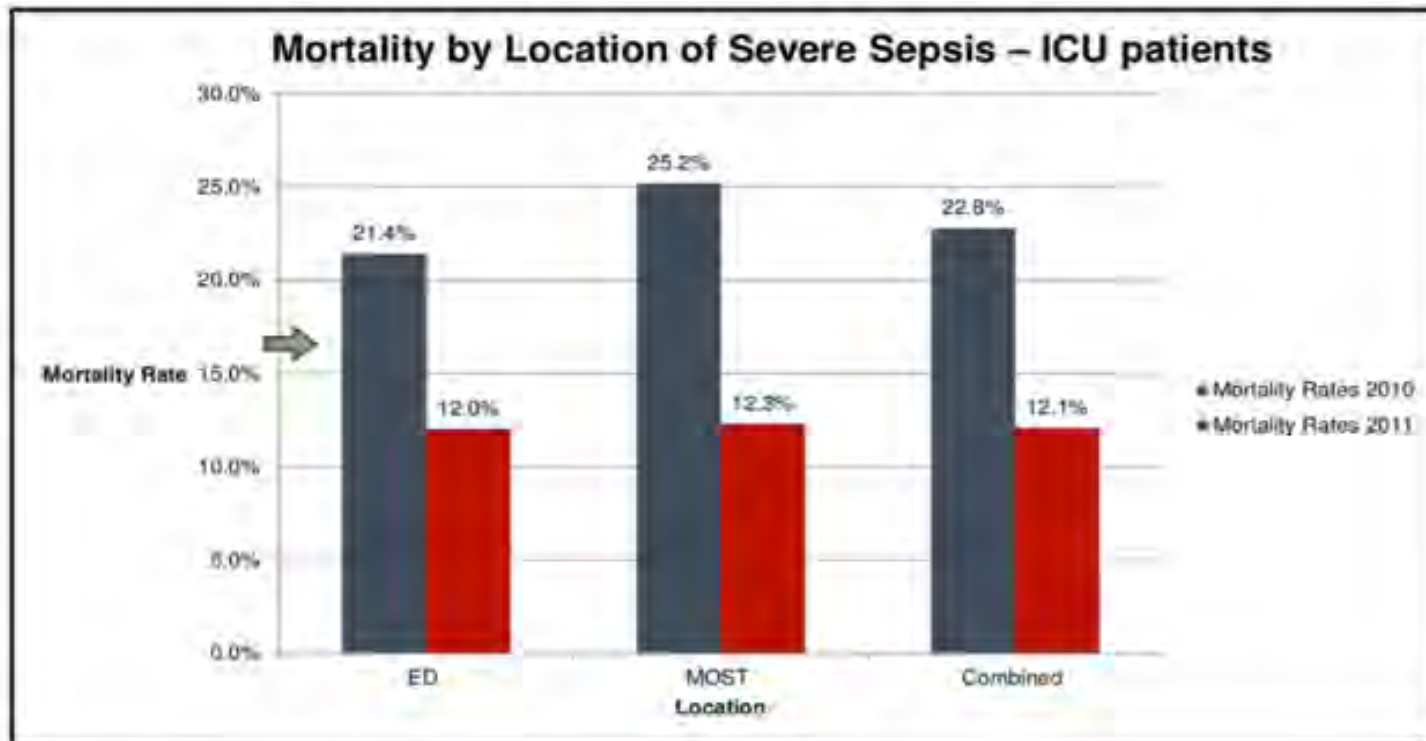
Medical
Oncology
Surgical
Telemetry

- Introduced screening as part of nurse's shift assessment on the floors
- Already occurring in ED and ICU's
- Started a 1 facility and spread to 6
- Measure impact on bundle compliance and morality

- Empowering Nurses for Early Sepsis Recognition
accessed
on <https://www.youtube.com/watch?v=s687VMj6iwo>

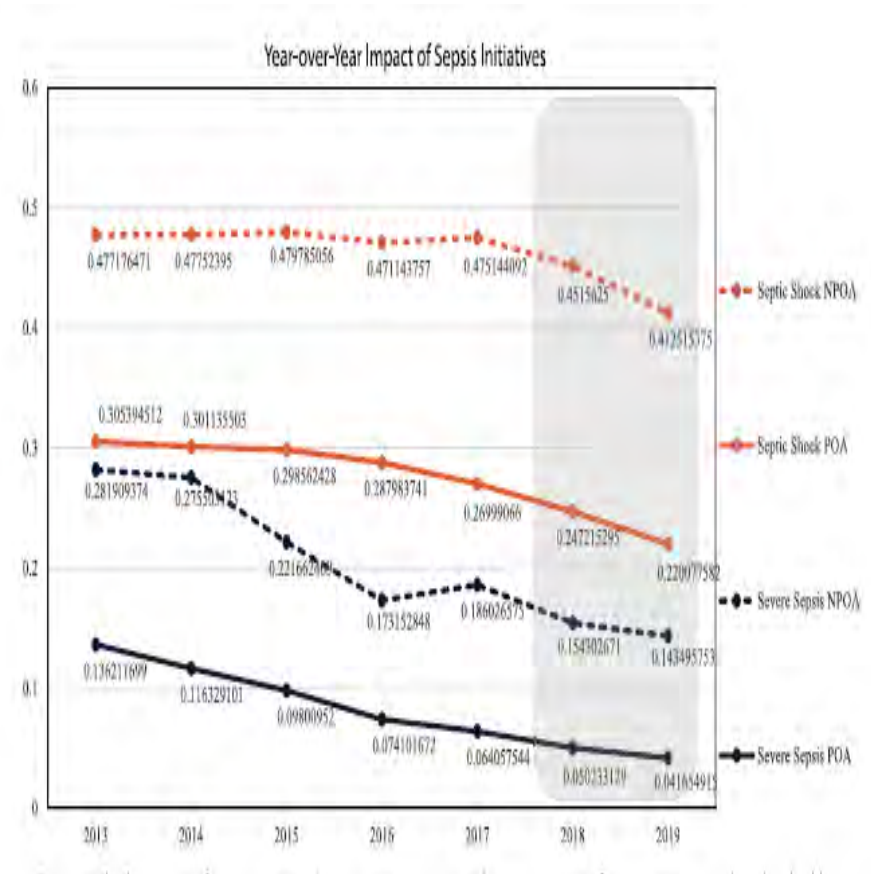
Outcomes of Screening on the Floors

2010 Baseline and 2011 Outcomes Data



SPOTting Sepsis to Save Lives: HCA Computer Algorithm to Detect Sepsis

- SPOT Algorithm designed as rules-based detection of defined criteria in near real time
- Defines sepsis as presence of SIRS, documented suspected infection (BC or therapeutic antibiotic within 24hrs of SIRS)
- Transmitted alert through telemetry techs-relays to the nurse
- Nurse preforms a sepsis screen
- Near real time data for the sepsis coordinator
- Can be reproduced by any health system or EHR company



• Perlin JB, et al. The Joint Commission Journal on Quality & Patient Safety. 2020;46:381-391

Early Recognition Challenges & Solutions

- Barriers/Contributing Factors

- Time for nurses to do it (perception vs. reality)
- Screening is not sensitive only for severe sepsis
- Positive screen is not a diagnosis of severe sepsis
- Nursing staff does not recognize when the patient has met sepsis criteria
- Hesitant to call physician regarding possible sepsis patients or hesitant to question or recommend treatment

- Targeted Education/Solutions

- Must assign responsibility and enforce accountability
- Develop enhanced education to improve knowledge of risk and sepsis recognition
- Develop and implement standardized sepsis screening tools and treatment protocols
- Perform audits to measure compliance and identify problems
- Round on unit and ask nurses how it is going and discuss issues
- Implement sepsis tool/positive sepsis screen form to communicate with charge nurse

Establish Trigger for Rapid Implementation of SSC Bundles

- Clearly define next steps for patients with positive screen for severe sepsis
 - Alert RRT/Med Team
 - Notify Physician
 - Begin 3 hour bundle: lactate, blood cultures, antibiotics, fluid

SBAR

Situation:

Screened Positive for Severe Sepsis

Background:

1. Positive Systemic Response to Infection
2. Known or suspected infection
3. Organ dysfunction: share which organs

Assessment:

Any other pertinent data or information to share

Recommendations:

1. I need you to come and evaluate the patient to confirm if they have severe sepsis
2. It is recommended that I get an ABG, lactate, blood cultures and a CBC (if > 12 hrs since last one). Can I proceed and get these?
3. Any other labs you would like me to obtain? Do you want to order antibiotics?
4. If patient is hypotensive: Can I start an IV and give a bolus of NS—30ml/kg

Date/time of call: _____

RRT called: Yes No

Develop a Protocol Based on the SSC Guidelines

- Obtain lactate when have 2 SIRS and suspected infection
- When screen positive for severe sepsis:
 - Nurse protocol to draw labs and give fluid bolus
 - Protocol done by RRT/Medical Response Team or all nurses
- Get medical staff approval

Other Strategies to Find Patients with Severe Sepsis

- Nurse screening
- EMR alert
- RRT screen on every call
- **Sepsis coordinator**
- **Unit sepsis champions**
- **ED and ICU rounding**
- **Part of nursing shift handoff**
- **Discuss sepsis screen as part of Interdisciplinary Rounds**
- **Reports**
 - Patients who screened positive
 - Lactate

Summary

- Every 2 minutes someone in the U.S dies from sepsis
- 1 in 3 people who die in the hospital have sepsis
- Efforts to **just treat recognized sepsis** alone is not enough.
- A critical aspect of **mortality reduction** has been pushing practitioners to identify sepsis early.
- Routine screening for sepsis by nursing staff, along with other early identification strategies, are important so that sepsis can be recognized early and treated in a timely fashion to achieve the best outcomes for patients