



HALIFAX HEALTH

Live your life well.

Battle Sepsis with Prescriptive Alerts, Rapid Communication



HALIFAX HEALTH

Tom Stafford, Vice President & CIO

Education:

Bachelors of Science Aerospace Engineering

Masters of Science Mechanical Engineering

Career:

United States Navy

Medical Device Design and Manufacture

Healthcare IT

IT Accolades:

10th Best Place to work in IT 2015 – Computerworld

2nd Best Place to work in IT 2016 – Computerworld

5th Best Place to work in IT 2017 – Computerworld

5th Best Place to work in IT 2018 – Computerworld

10th Best Place to work in IT 2019 - Computerworld

Premier 100 Technology Leaders 2017 – Computerworld

Top 105 CIOs to watch in 2018/19 – Becker's Healthcare



Stephen Claypool, M.D.

Medical Director, Clinical Surveillance & Compliance, Wolters Kluwer, Health

Career

- 20 years of medical experience, having practiced internal medicine with Saint Paul Internists and was a hospitalist with St. Joseph's Hospital, HealthEast, in Minnesota.
- 25 years of medical informatics experience and is board certified by the ABPM in Clinical Informatics and by the ABIM in Internal Medicine.

Education

- Medical degree from the University of Minnesota School of Medicine
- Residency and chief residency in internal medicine at Hennepin County Medical Center in Minneapolis
- Undergraduate degree from The Colorado College in Colorado Springs



About Halifax Health



Halifax Health Medical Center, Daytona Beach

- Opened in 1928
- 600 beds
- “100 beds in intensive units”
- More than 500 physicians, representing
- 54 subspecialties

Halifax Health - Medical Center of Port Orange

- Opened in 2006
- 80-bed community hospital
- 20-bed emergency department
- 8-bed intensive care unit



More About Halifax Health

Emergency Department

- *Largest in Florida: 99,000 square feet, 102 treatment rooms*
- *Area's only Level II Trauma Center*
- *Area's only Pediatric Emergency Department*

Area's only Neonatal Intensive Care and Pediatric Intensive Care Unit

Center's for Neurosciences, Cardiology, Oncology, and Orthopedics

16 Provider Offices/Clinics with more opening soon

Halifax Health Hospice

- *Area's largest Hospice Program*
- *Four Inpatient Care Centers*

Behavioral Health Service: Adolescent and Adult – Inpatient and outpatient



The Epidemic



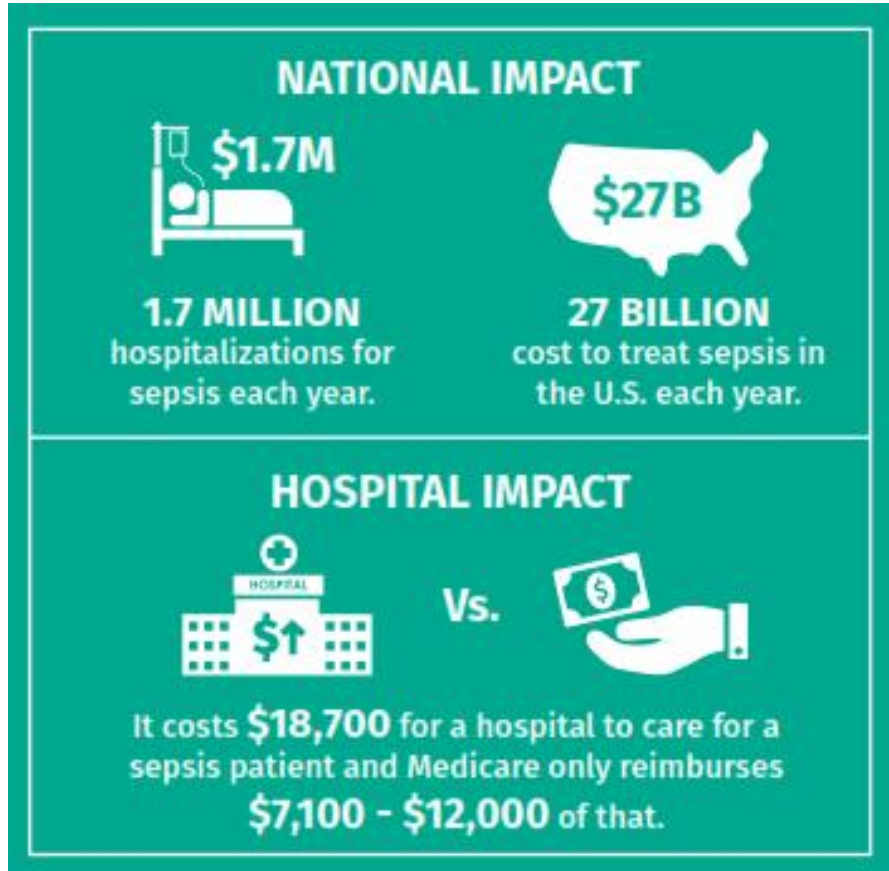
“Sepsis is the body’s overwhelming and life-threatening response to infection that can lead to tissue damage, organ failure, and death. In other words, it’s your body’s over-active and toxic response to an infection.”

~ Sepsis Alliance, accessed August 28, 2019

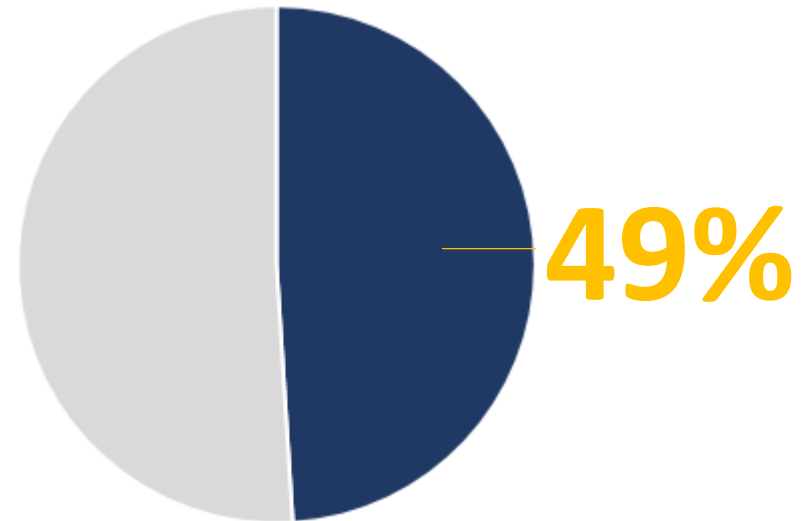
Sepsis Impact: Quality & Cost

COST

QUALITY



Only 49% of patients nationally receive APPROPRIATE care for severe sepsis or septic shock



CMS Bottom 10 Performing States (2019)

Minnesota | Oregon | Missouri | Virginia | Arizona | Washington | Rhode Island | District of Columbia | Delaware | Puerto Rico

The State of Sepsis Care in the U.S.

Bundle compliance only

Poor 

at “higher” adherence hospitals



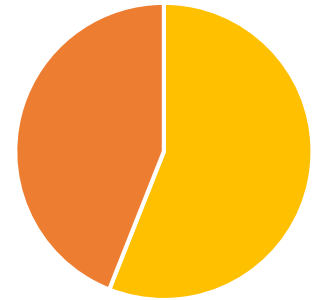
Non-compliance
6hr. Bundle =

2x
mortality

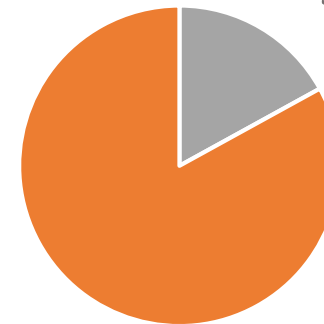
Historically, usual care
~ **33%**
mortality

House officers correctly
identify sepsis only

56%
of the time



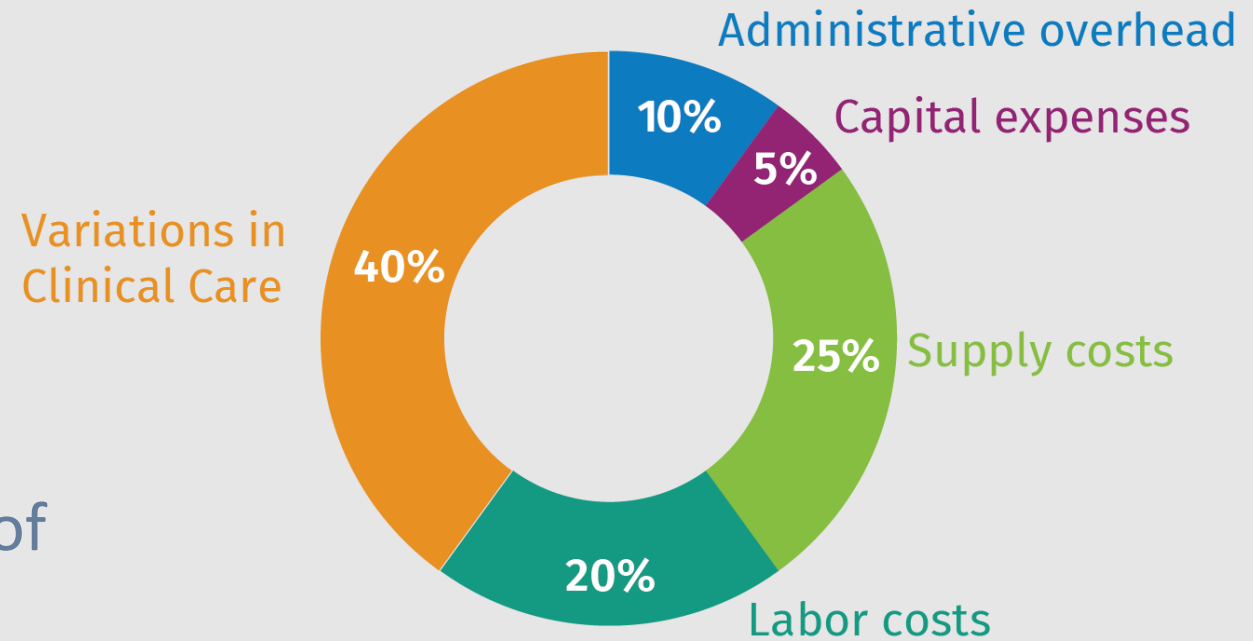
Nurses **correctly identify**
sepsis only



17%
of the time

Reduce Care Variation for Cost Savings

TRADITIONAL MARGIN LEVERS NO LONGER SUFFICIENT



CFOs' Estimated Breakdown of
Cost Savings Opportunities

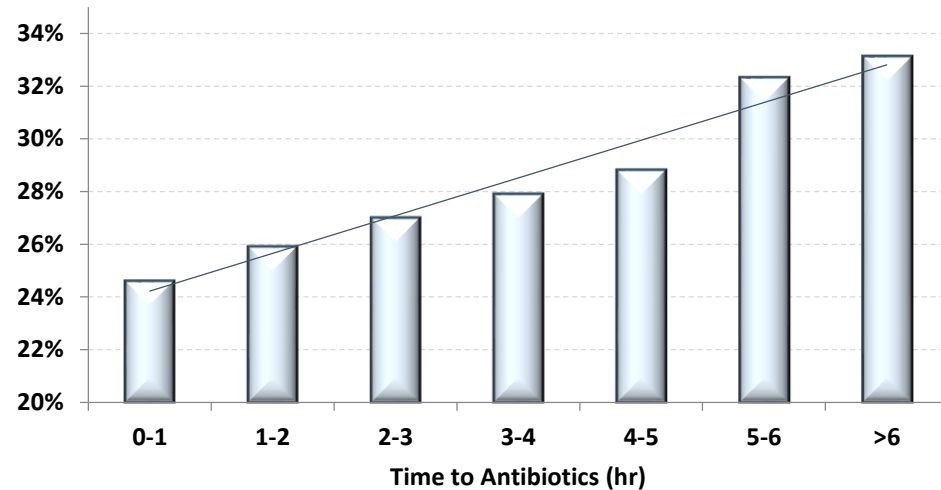
(n=45)



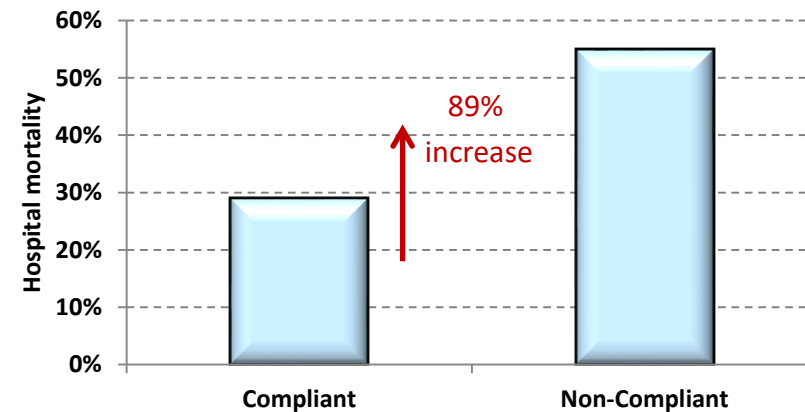
Sepsis...Early Detection & Treatment Saves Lives

EVERY HOUR WITHOUT TREATMENT SIGNIFICANTLY RAISES THE RISK OF DEATH

Probability of Mortality for Time to Antibiotics⁸



Compliance with 6-hour Sepsis-Care Bundle and Hospital Mortality⁹



8) Ferrer, Ricard MD, PhD1; Martin-Loeches, Ignacio MD, et al. "Empiric Antibiotic Treatment Reduces Mortality in Severe Sepsis and Septic Shock From the First Hour: Results From a Guideline-Based Performance Improvement Program," *Crit Care Med.* 2014 Aug;42(8):1749-55.

9) Gao F, Melody T, Daniels DF, Giles S, Fox S. The impact of compliance with 6-hour and 24-hour sepsis bundles on hospital mortality in patients with severe sepsis: a prospective observational study. *Crit Care.* 2005;9(6):R764-70.





Institute for Healthcare Improvement (IHI) collaborated to create clinical guidance

Participating organizations

- European Society of Intensive Care Medicine
- Society of Critical Care Medicine
- International Sepsis Forum

Surviving Sepsis Campaign

** Rhodes A, Evans L, Alhazzani W, Levy M, Antonelli M, Ferrer R, et al. Surviving sepsis campaign: international guidelines for management of severe sepsis and septic shock: 2016. Int Care Med 2017;43:304–77.*

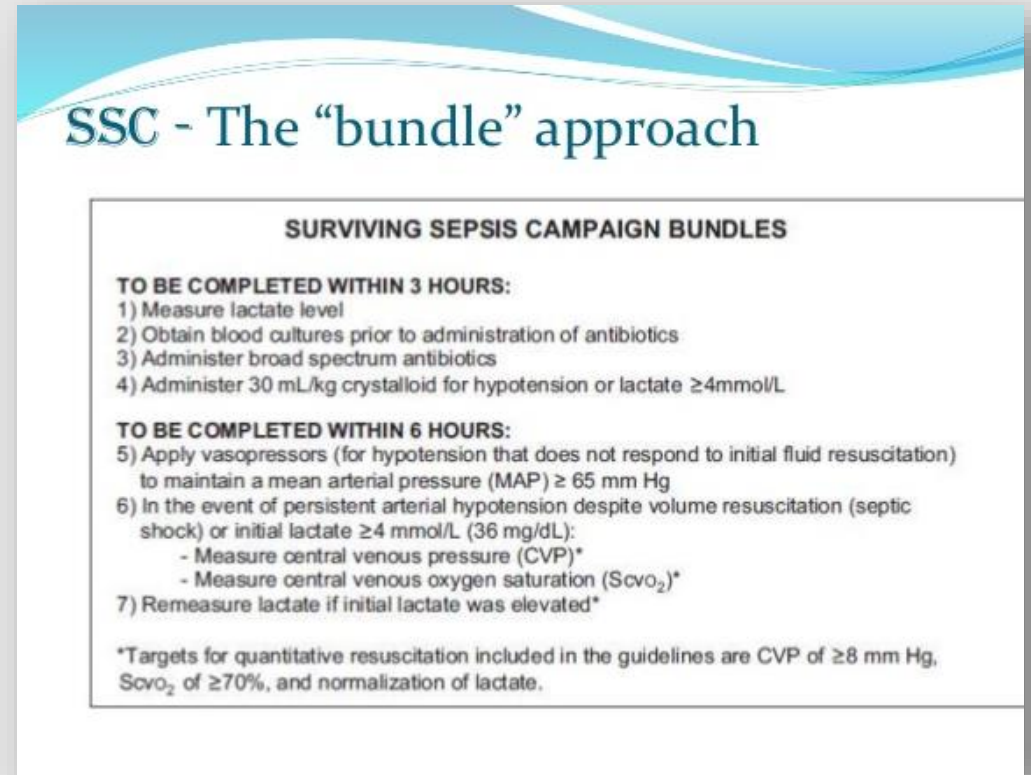
** Dellinger R, Levy M, Rhodes A, Annane D, Gerlach H, Opal S, et al. Surviving sepsis campaign: international guidelines for management of severe sepsis and septic shock, 2012. Intensive Care Med 2013;39:165–228.*

** Levy MM, Evans LE, Rhodes A. The Surviving Sepsis Campaign Bundle: 2018 update. Intensive Care Med. 2018 Apr 19;1–4.*

Do the Sepsis Guidelines Work?

Following the **SSC treatment bundles**, which are mostly in sync with CMS, is associated with improved patient outcomes for sepsis.

- Meta-analysis of 50 observational studies: **reduction in mortality** [OR 0.66; 95% CI 0.61–0.72]*



The slide features a blue and white wavy header. Below the header, the title 'SSC - The "bundle" approach' is written in a blue serif font. The main content is enclosed in a white box with a thin black border. At the top of this box, the text 'SURVIVING SEPSIS CAMPAIGN BUNDLES' is centered in a bold, black, sans-serif font. Below this, there are two sections: 'TO BE COMPLETED WITHIN 3 HOURS:' followed by a numbered list of four items, and 'TO BE COMPLETED WITHIN 6 HOURS:' followed by a numbered list of three items. The third item in the 6-hour list includes two sub-bullets. At the bottom of the box, a footnote explains the targets for quantitative resuscitation.

SSC - The "bundle" approach

SURVIVING SEPSIS CAMPAIGN BUNDLES

TO BE COMPLETED WITHIN 3 HOURS:

- 1) Measure lactate level
- 2) Obtain blood cultures prior to administration of antibiotics
- 3) Administer broad spectrum antibiotics
- 4) Administer 30 mL/kg crystalloid for hypotension or lactate ≥ 4 mmol/L

TO BE COMPLETED WITHIN 6 HOURS:

- 5) Apply vasopressors (for hypotension that does not respond to initial fluid resuscitation) to maintain a mean arterial pressure (MAP) ≥ 65 mm Hg
- 6) In the event of persistent arterial hypotension despite volume resuscitation (septic shock) or initial lactate ≥ 4 mmol/L (36 mg/dL):
 - Measure central venous pressure (CVP)*
 - Measure central venous oxygen saturation (Scvo₂)*
- 7) Remeasure lactate if initial lactate was elevated*

*Targets for quantitative resuscitation included in the guidelines are CVP of ≥ 8 mm Hg, Scvo₂ of $\geq 70\%$, and normalization of lactate.

** Damiani E, Donati A, Serafini G, Rinaldi L, Adrario E, Pelaia P, et al. Effect of performance improvement programs on compliance with sepsis bundles and mortality: a systematic review and meta-analysis of observational studies. PLoS One 2015;10:e0125827.*

Sepsis 1 Definition Components

FROM INFECTION

Systematic Inflammatory Response Syndrome (SIRS)

- HR>90
- RR>20
- Temp>38.3C
- Temp<35C
- WBC>12k or Bands>10
- WBC<3.5k
- SBP<90

Organ Dysfunction

- Creatinine>2
- Lactate>2
- Bili=>4
- PTT>60
- Platelet<100
- INR>1.5
- SBP<90

Applying CDS Alerting Analysis to Sepsis

A meta-analysis of 8 sepsis alerting studies from 2015 showed *no improvement in mortality*.

Failure was primarily due to *poor test specificity*, with PPV < 50%, resulting in alert fatigue.³



Systematic Review of Sepsis Screening tools

Reviewed all studies of sepsis tools published 1990-2016

- Tools are inaccurate
- Tools don't improve mortality (except POC Advisor)

Alberto L, Marshall AP, Walker R, Aitken LM. Screening for sepsis in general hospitalized patients: a systematic review. Journal of Hospital Infection. 2017 May 12



Alert Fatigue

Clinicians ignore EHR safety notifications **between 49 percent and 96 percent of the time!**¹



Alert fatigue can contribute to clinician burnout, dissatisfaction, and turnover.²

1) Van Der Sijs, Heleen, et al. "Overriding of drug safety alerts in computerized physician order entry." *Journal of the American Medical Informatics Association* 13.2 (2006): 138-147.

2) Hysong, Spitzmuller, et al. "Electronic Alerts and Clinician Turnover: The Influence of User Acceptance," *Am J Manag Care*. 2014;20(11 Spec No. 17):SP520-SP530.

The Solution



POC Advisor Reduces Mortality

SURVEILLANCE TECHNOLOGY—PEER-REVIEWED, SCIENTIFICALLY PROVEN



PREDICTIVE ACCURACY

- Sensitivity (99%)
- Specificity (97%)
- Minimal Alert Fatigue: PPV is ~4x EHR SIRS based solution



VERY EARLY DETECTION

- 5.5 and 7.8 hours before SIRS-based alerting at large academic facility and top IDN respectively
- ABX administration ~6 hrs. earlier at both



PRESCRIPTIVE ALERTS

- Pushed to care team in real time
- Bundle compliance
- Timely execution of labs, fluids, ABX, & documentation with reminders and escalation



How POC Advisor Works to Improve Outcomes

IDENTIFYING PATIENTS AT RISK FASTER & ENSURING EVIDENCE BASED CARE



Cloud-based solution that analyzes EHR patient data in real time using rules, algorithms and NLP to accurately identify patients at risk.



Delivers patient-specific, actionable alerts and evidence-based care advice to the front-line staff via their preferred clinical workflow.
Alerts sent to the EHR, Vocera, pagers, etc.



Real-time analytics that supports timely clinician education to reduce variability in care. Access intuitive dashboards providing a comprehensive view of performance.



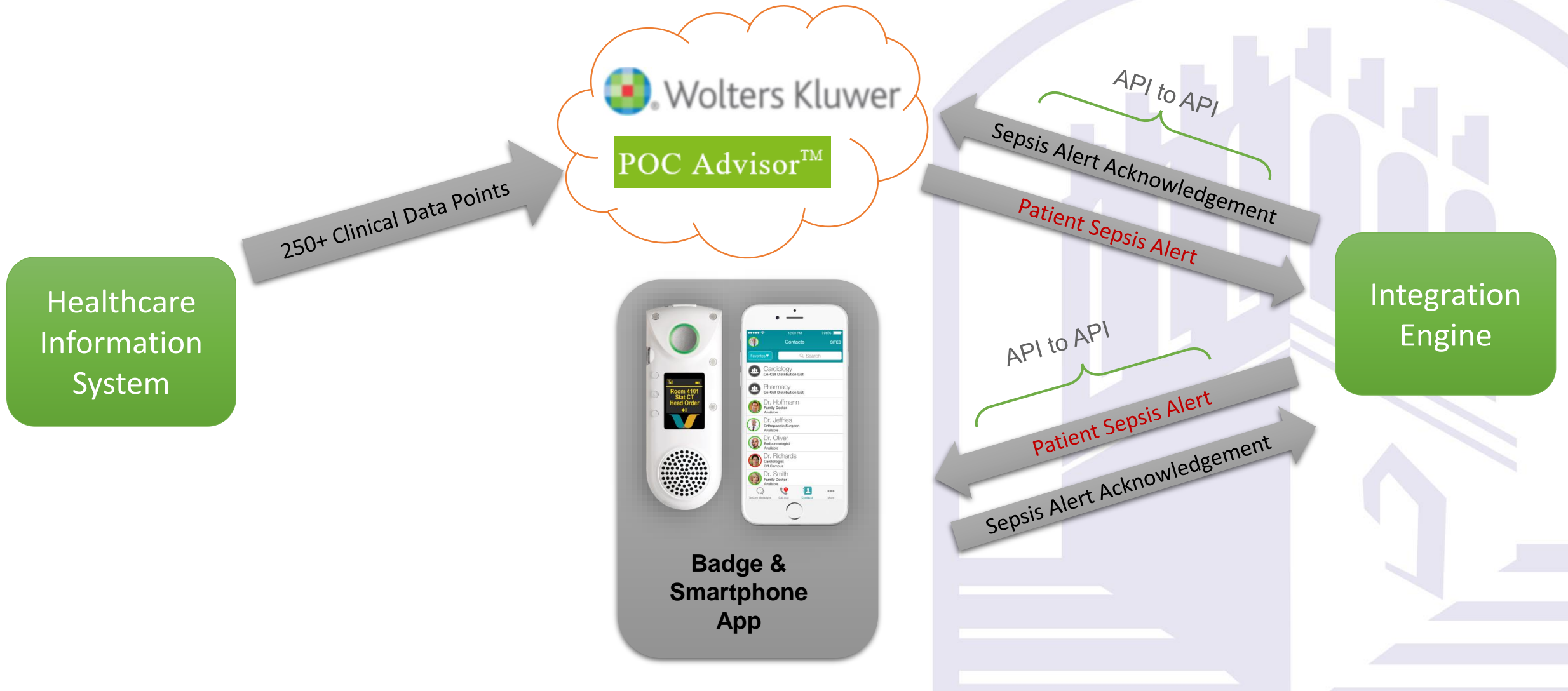
Physician consults
Comorbidities
Medications
Vitals
Patient notes
Lab results

NLP



The only surveillance solution that accurately identifies a patient with sepsis versus other abnormalities.

Sepsis Alerting



Predictive Alerting



POC Advisor (Nurse View)

Alerts **Alert Log** **Team**

Smith Ssh **Infection** Age:69 Female MRN:MRN00001 Room:UNIT - 219 - 4

74/56	104 P	20 RR	101.3 T	O2Sat	15k WBC	% Bands	Glucose	PaCO2
190k PLT	Lactate	Creat	1.4 INR	72 PTT ¹	1.1 Bili	MSΔ		

Antibiotics **Pneumonia** No Clues for Sepsis

No Current Hx No Past Hx Heparinoids¹

2019-03-25 15:59:50Z

Patient has Screened Positive for Sepsis with Hypotension

- Screen for Infection** Positive
- Signs of Hypotension** Positive

Based on new SBP < 90 mmHg that might represent organ dysfunction

Even if hypotension is not from sepsis, it is concerning. Contact physician.

If erroneous vitals caused this alert, re-check and correct VS in EMR before pressing disagree

Initiate the following:

- Per protocol, initiate the IV bolus immediately and then call the physician to inform VS and get further instructions:
- Sodium Chloride 0.9% 1000 mL IV Bolus
- Peripheral Culture Blood x 2
- Lactic Acid Venous

Acknowledge MD Aware **Disagree**

Prescriptive Alerting



POC Advisor Alerting and Guidance

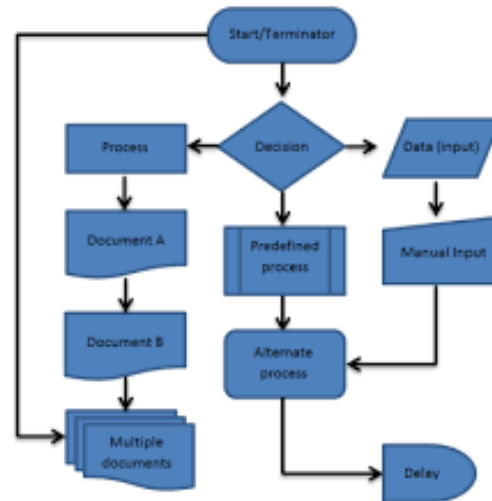
- What worked?
- What didn't work? **Why?**

People



80%

Process



15%

Technology



5%

Concept: POC Advisor Integration with Meditech

Return To **Home** **Chart** **Document** **Orders** **Discharge** **Sign** **Workload** **Menu** **Suspend**

Katherine Grant **Find Patient**

Rounds Patients 21 **Rounding** **Sign Out**

Patient	Age	Gender	Room	Admission	Physician	Code	Notes	Actions
PARKER, NORM...	71	F	ICU/ICU-18	ADM IN	Grant, Katherine	Full Code	MDRO, Abx: MIC	LAB IMG DEPT NOTE
FLAHERTY, JAM...	70	M	ICU/ICU-36	ADM IN	Grant, Katherine	Full Code	Severe sepsis Surveillance Possible Sepsis: 10/25/18 15:15	LAB IMG DEPT NOTE
DUNHAM, GABBY	76	F	ICU/ICU1-1	ADM IN	Grant, Katherine	Full Code	Sepsis, Abx: 48+ ...	LAB IMG DEPT NOTE
Gilmore, Helen	65	F	MED/MED2-D	ADM IN	Grant, Katherine	Full Code		LAB IMG DEPT NOTE
Smith, Charlotte	59	F	MED/MED2-H	ADM IN	Grant, Katherine	Full Code	Dyspnea on exertion Chest pain at rest Cough in adult	LAB IMG DEPT NOTE
WALKER, CAND...	76	F			Grant, Katherine	Resus Status Not Orde...		LAB

My Workload

- Results 2 of 2
- Notes 5 of 5
- Other 30 of 38

Concept: POC Advisor Integration with Meditech

The screenshot displays a Meditech POC Advisor interface. At the top, a navigation bar includes icons for 'Return To', 'Home', 'Chart', 'Document', 'Orders', 'Discharge', 'Sign', 'Workload', 'Menu', and 'Suspend'. Below this, a patient header for 'Katherine Grant' is visible, along with a 'Find Patient' search bar. The main content area shows a 'Surveillance Profile Criteria' window for patient 'FLAHERTY, JAMES W 70 M 06/18/1948' with an allergy/advise of 'red dye'. A table lists 'Profile Qualified' and 'Instance' information, with one instance of 'Possible Sepsis' on 10/25/18 at 15:15. The alert details include a red header 'Patient has Screened Positive for Sepsis with Hypotension', followed by 'Screen for Infection' (Positive) and 'Signs of Hypotension' (Positive). The hypotension section notes 'Based on new SBP < 90 mmHg that might represent organ dysfunction' and 'Even if hypotension is not from sepsis, it is concerning. Contact physician.' A bold instruction states: 'If erroneous vitals caused this alert, re-check and correct VS in EMR before pressing disagree'. Below this, it says 'Initiate the following:' and lists three checked items: 'Per protocol, initiate the IV bolus immediately and then call the physician to inform VS and get further instructions:', 'Sodium Chloride 0.9% 1000 mL IV Bolus', and 'Peripheral Culture Blood x 2'. At the bottom of the window are buttons for 'Add To Profile', 'Remove From Profile', and 'Edit Reevaluate Time'.

Profile Qualified	Instance
Possible Sepsis 10/25/18 15:15	1

Patient has Screened Positive for Sepsis with Hypotension

Screen for Infection **Positive**

Signs of Hypotension **Positive**

Based on new SBP < 90 mmHg that might represent organ dysfunction

Even if hypotension is not from sepsis, it is concerning. Contact physician.

If erroneous vitals caused this alert, re-check and correct VS in EMR before pressing disagree

Initiate the following:

- Per protocol, initiate the IV bolus immediately and then call the physician to inform VS and get further instructions:
- Sodium Chloride 0.9% 1000 mL IV Bolus
- Peripheral Culture Blood x 2

Concept: POC Advisor Integration with Meditech

The screenshot displays a Meditech POC Advisor interface. At the top, a navigation bar includes icons for 'Return To', 'Home', 'Chart', 'Document', 'Orders', 'Discharge', 'Sign', 'Workload', 'Menu', and 'Suspend'. Below this, the patient's name 'Katherine Grant' and a 'Find Patient' search bar are visible. The main content area is titled 'Surveillance Profile Criteria' and includes a 'CLOSE' button. The patient information is 'FLAHERTY, JAMES W 70 M 06/18/1948 Allergy/Adv: red dye'. A table on the left shows 'Profile Qualified' and 'Instance' columns, with one entry for 'Possible Sepsis' on '10/25/18 15:15' with instance '1'. The main panel displays the following criteria:

- Patient has Screened Positive for Sepsis with Hypotension**
- Screen for Infection** (Positive)
- Signs of Hypotension** (Positive)
Based on new SBP < 90 mmHg that might represent organ dysfunction
Even if hypotension is not from sepsis, it is concerning. Contact physician.

A blue callout box states: **Next Step: Interventions and Orders are queued up for review and approval**

An orange-bordered box lists the following actions to initiate:

- Per protocol, initiate the IV bolus immediately and then call the physician to inform VS and get further instructions:
- Sodium Chloride 0.9% 1000 mL IV Bolus
- Peripheral Culture Blood x 2

At the bottom of the panel, there are buttons for 'Add To Profile', 'Remove From Profile', and 'Edit Reevaluate Time'.

The Results

Halifax Bundle Compliance Analysis



Sepsis Bundle Compliance

- We know from other data that bundle compliance **improvement correlates with mortality & LOS improvements**, so it is a commonly used benchmark across sites for measuring sepsis care

JAMA | **Original Investigation**

Association Between State-Mandated Protocolized Sepsis Care and In-hospital Mortality Among Adults With Sepsis

Jeremy M. Kahn, MD, MS; Billie S. Davis, PhD; Jonathan G. Yabes, PhD; Chung-Chou H. Chang, PhD;
David H. Chong, MD; Tina Batra Hershey, JD, MPH; Grant R. Martsof, PhD, MPH, RN; Derek C. Angus, MD, MPH

JAMA[®]
The Journal of the American Medical Association

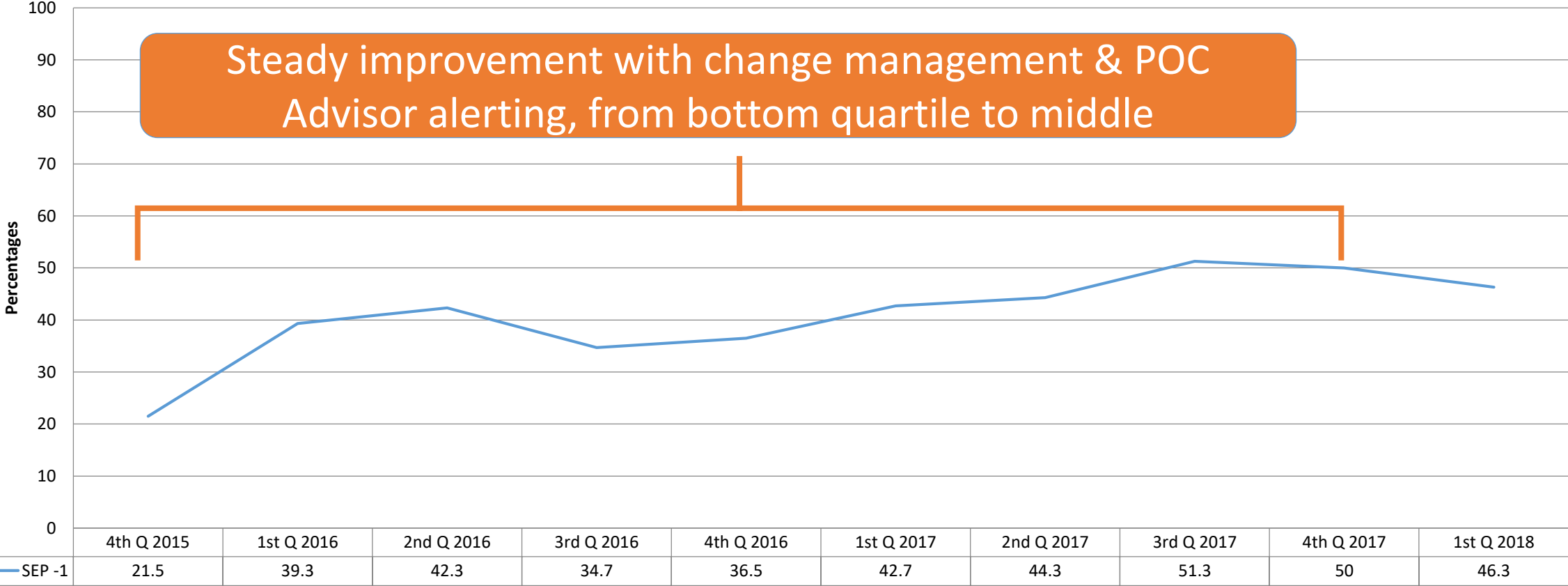
JAMA. 2019;322(3):240-250.
doi:10.1001/jama.2019.9021

Halifax Sepsis Results

- Halifax added a sepsis coordinator, a sepsis steering committee and change management focused on sepsis care
- Halifax started using alerting with POC Advisor
- Slow steady improvement in CMS bundle compliance from bottom quartile to roughly average
 - This is outstanding given that Halifax serves as the county hospital and has a very sick patient population

Halifax CMS SEP-1

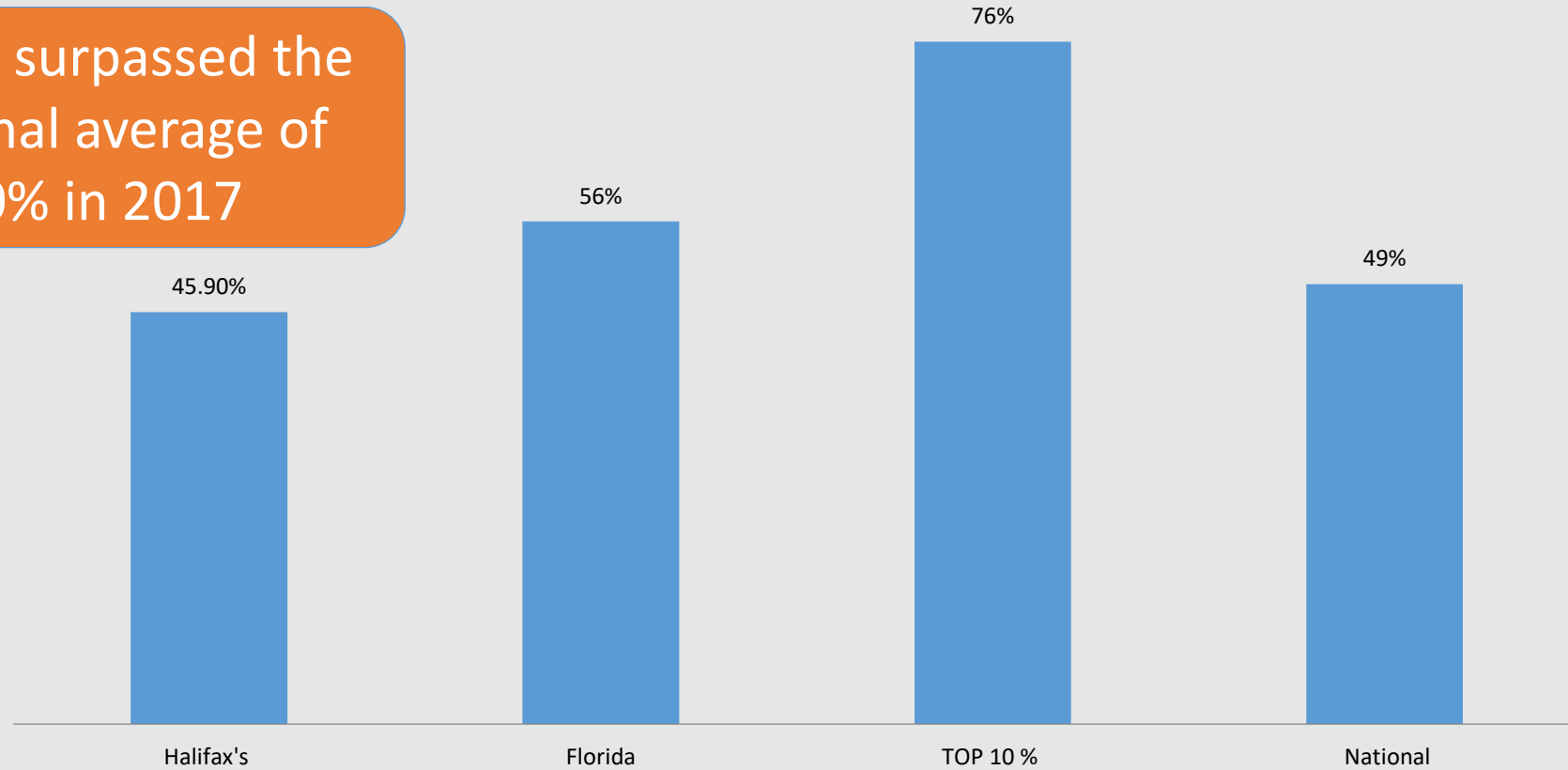
SEP 1 Q 4 2015- Q 1 2018



Halifax CMS SEP-1

Publicly Reported Benchmarks Q1-Q3 2017- Rolling Quarters

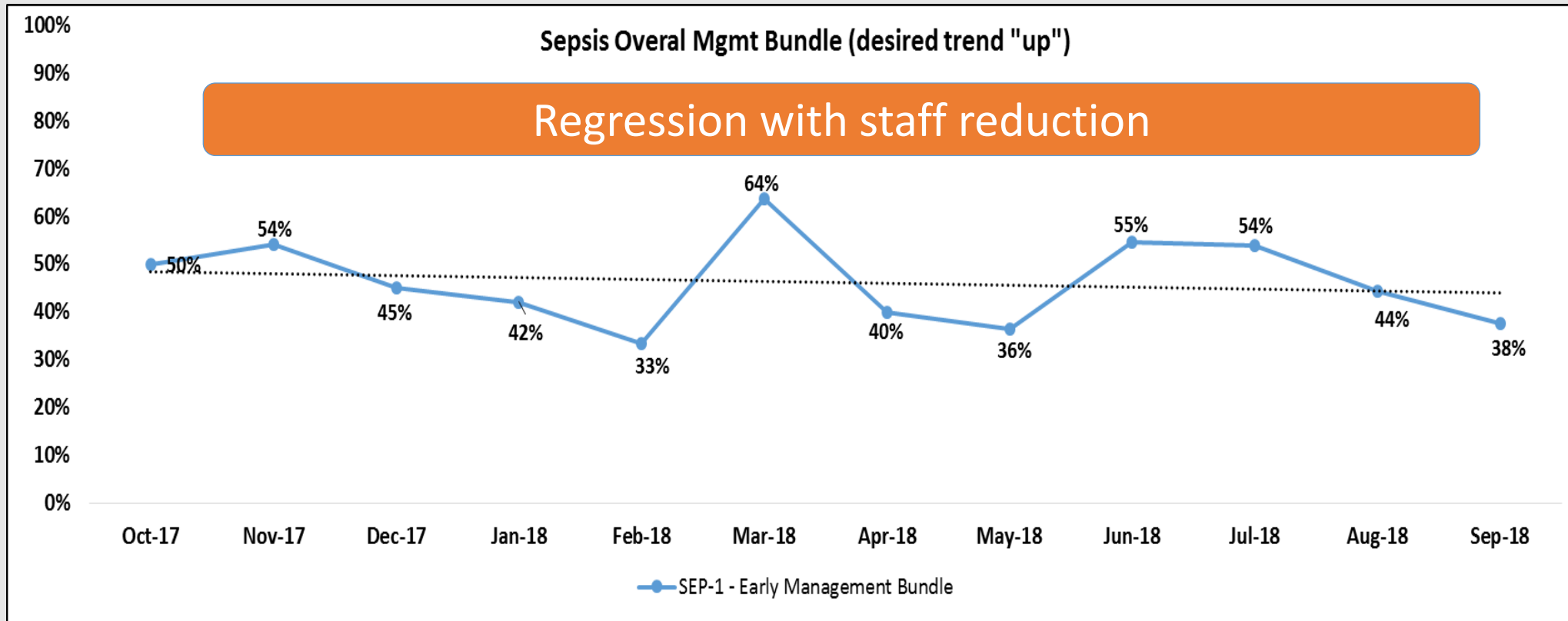
Halifax surpassed the national average of 50% in 2017



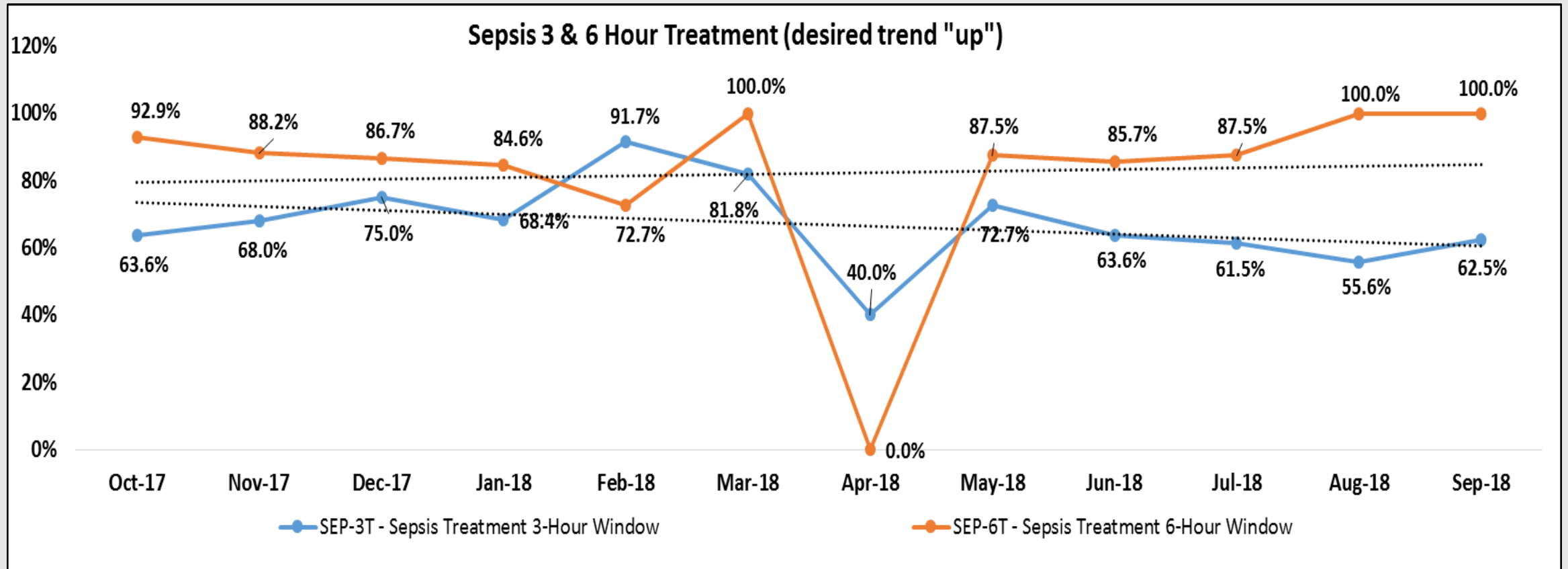
Halifax Sepsis Results

- Due to budget cuts, Halifax reduced sepsis staff
- WK focused on integration with other systems, e.g. Epic, Cerner, and didn't (yet) finish integration with MEDITECH

Halifax CMS SEP-1



Halifax CMS SEP-1



Halifax – Alert Accuracy

Total study population: **541**

Charts reviewed: **124**

(chart reviewer physician was blinded to POC Advisor diagnosis)

RESULTS

Sensitivity 100%

Specificity 98%

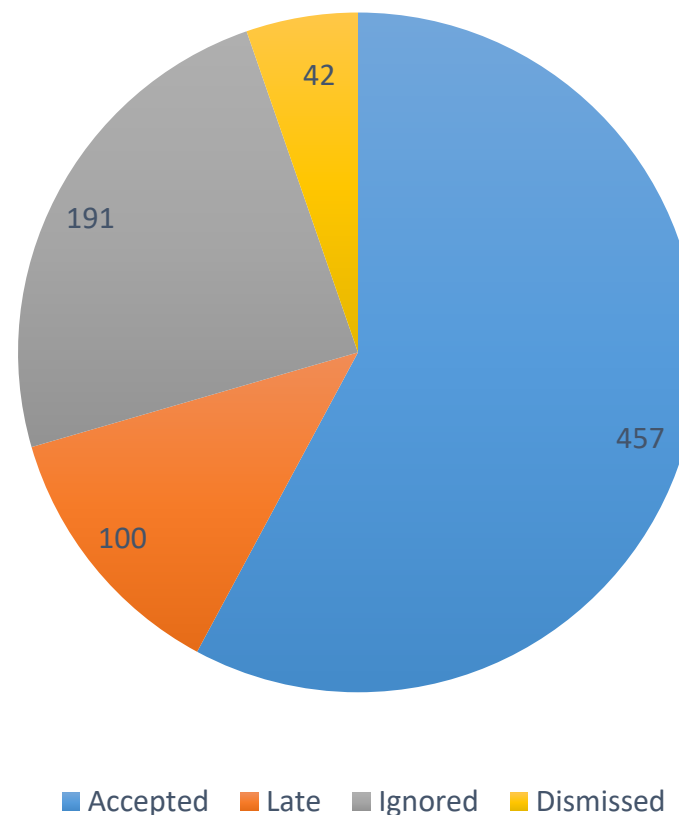
The problem wasn't that alerts weren't accurate...

Bundle Compliance Stats-Alert Acknowledgement

- 191/790 sepsis alerts were ignored since 10/1/18
- 100 were significantly delayed

The problem is that alerts were not followed and bundle components missed for patients with known sepsis

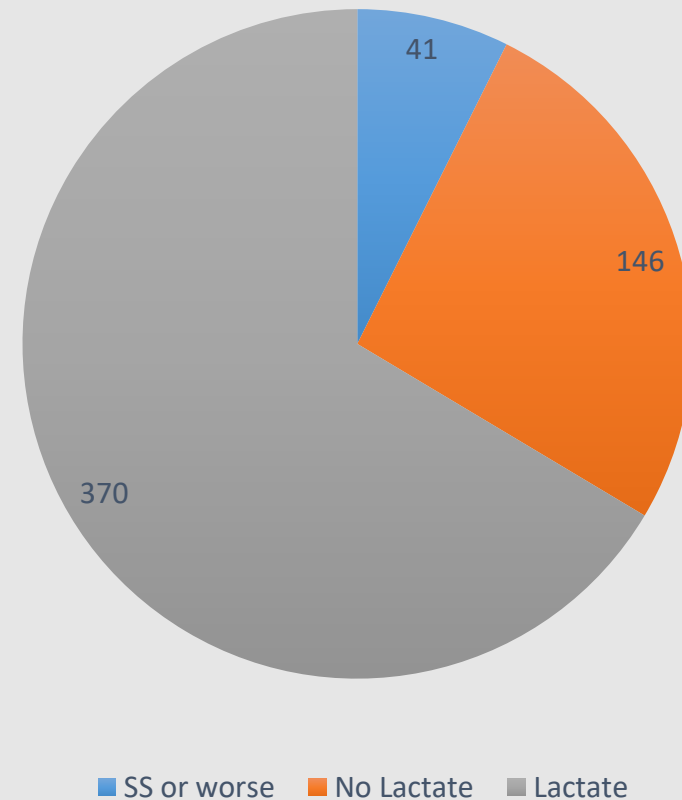
Alert Acknowledgement



Bundle Compliance Stats-1st Lactate

- 187/557 accepted alerts for sepsis, no lactate ordered since 10/1/18
- 41 of these were Severe Sepsis or worse

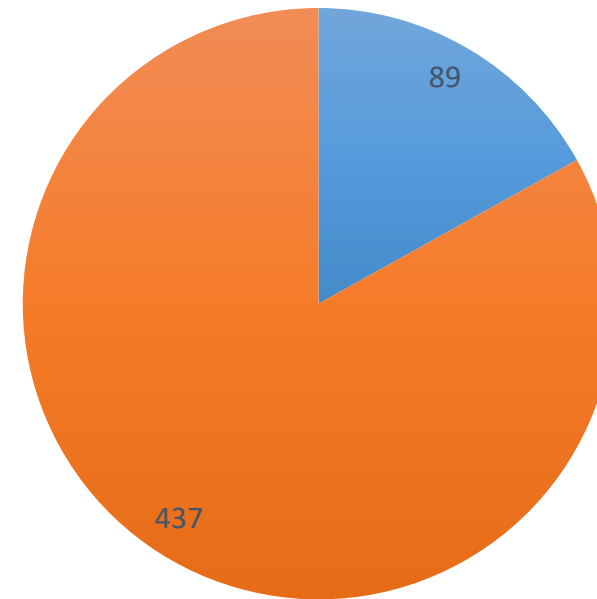
Accepted Sepsis Alerts, 1st Lactate



Bundle Compliance Stats-2nd Lactate Compliance

- 89/526 accepted sepsis alerts, 1st lactate >2, never ordered a 2nd lactate since 10/1

Accepted Alerts, No 2nd Lactate

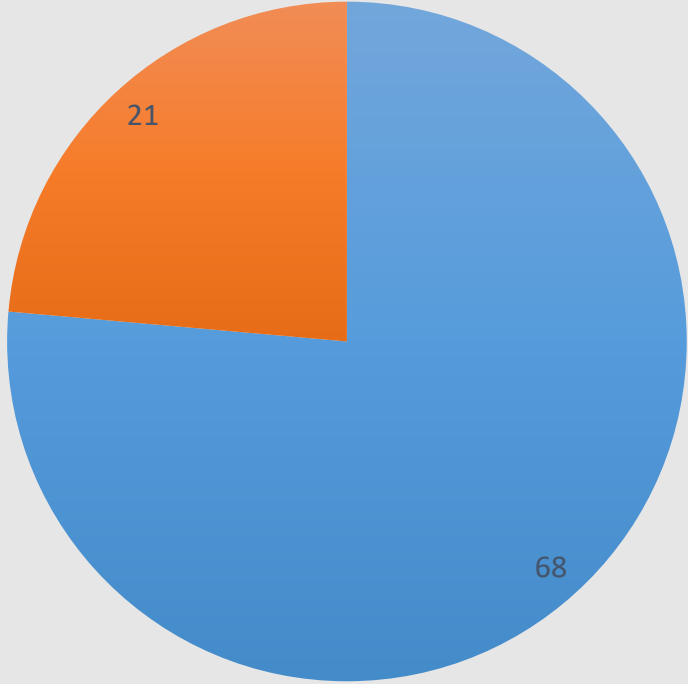


■ No 2nd Lactate ■ 2nd Lactate

Bundle Compliance Stats-No 2nd Lactate

- 68/89 sepsis cases without a 2nd lactate since 10/1 did NOT use the Sepsis Order set, so no reflex order for 2nd Lactate draw.

Sepsis Order Set, No 2nd Lactate



■ No 2nd Lact, No Sepsis Orderset ■ No 2nd Lactate, Used Sepsis Orderset

Summary

The Journey:

- Sepsis care improved 2015-2017, but not in 2018
- POC Advisor alerts are accurate, but the actions weren't always documented correctly in the record
- Staff frequently do not use the sepsis order set

The Goal:

- Interface POC Advisor into Meditech

Questions?



