EARLY SEPSIS WARNINGS AND THE USE OF RAPID RESPONSE TEAMS

Brandy McKelvy, MD, FCCP
Associate Professor
McGovern Medical School at UT-Houston
Division of Pulmonary, Critical Care & Sleep Medicine

UTHealth
McGovern Medical School
The University of Texas Health Science Center at Houston

OBJECTIVES

Describe tools available to assess hospitalized patients at risk for deterioration

Discuss outcomes associated with the use of rapid response teams (RRT) to recognize and respond to sepsis

SEPSIS

Sepsis is an life threatening, dysregulated, exaggerated physiologic response to infection which leads to organ dysfunction

>750,000 patients suffer with sepsis each year in the United States[1]

- ~200,000 patients die annually from sepsis in the US[1]
- 383,000 receive ICU care[2]
- 130,000 are on mechanical ventilation[2]

Inpatient mortality varies 20-40% depending on serenity of illness and co-morbidities

Sepsis leads to poor outcomes when treatment is delayed or inadequate

1 JAMA 2016; 315 (8): 801-810
2 Critical Care medicine 2001 Vol 29(7): 1303-1310

SEPSIS

Estimated cost of care per case $22,000 with total costs estimated >16.7 billion annually[1]

Most expensive condition billed to Medicare in 2011, $20 billion[2]

1 Critical Care medicine 2001 Vol 29(7): 1303-1310
2 2010:statistical brief #146

RAPID RESPONSE TEAMS (RRT)

Specialized teams are called to review hospitalized patients who are demonstrating signs of clinical instability

Can be trained to assess for sepsis as the cause of instability and intervene with protocols and physician assistance

SEPSIS CALLS & RRTS

Sepsis and SIRS make up between 20-75% of in patient calls depending on study methods and criteria

Use of RRT could theoretically improve sepsis outcomes by early detection of patients who are deteriorating and administrating timely antibiotics

Several studies show many of the patients RRT respond to are already on antibiotics, but antibiotics are modified or changed to appropriate antibiotics 30%-50% of the time

RRT can be used initiate sepsis protocols and to administer volume resuscitation

USE OF EARLY WARNS

Patients have increased mortality with sepsis:

- If they have Lactic acid >4 mmol/L and admitted to floor bed or IMU bed
- Delay in interventions: cultures, antibiotics, fluid boluses

Early identification with early antibiotic administration is one of the best metrics to lower mortality

Sepsis Management: (things we can ask RRT to do)

- Early detection
- Prompt recognition
- Acquisition of cultures
- Source control
- Early administration of appropriate antibiotics
- Timely resuscitation of organ dysfunction

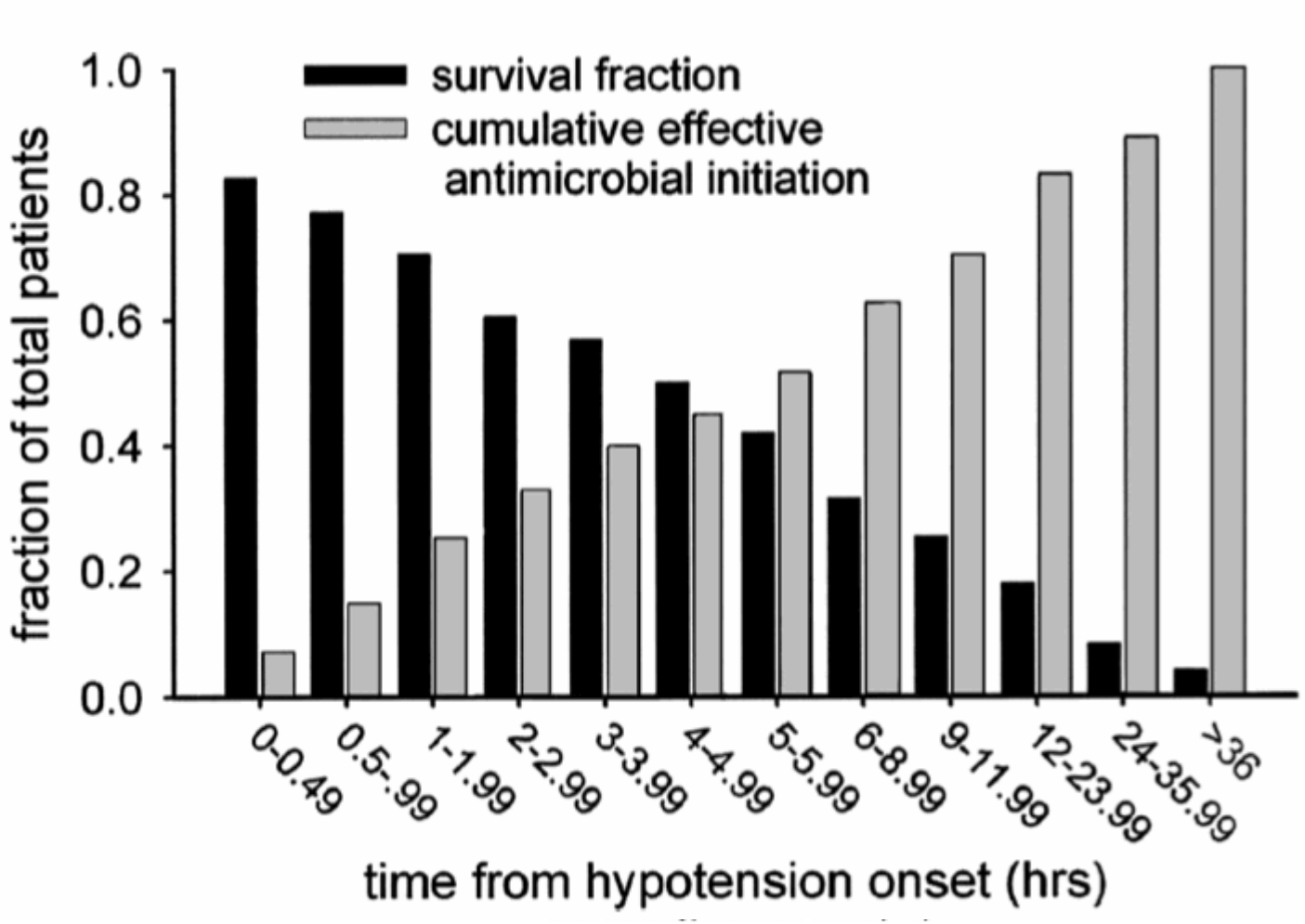


Figure 1. Cumulative effective antimicrobial initiation following onset of septic shock-associated hypotension and associated survival. The x-axis represents time (hrs) following first documentation of septic shock-associated hypotension. *Black bars* represent the fraction of patients surviving to hospital discharge for effective therapy initiated within the given time interval. The *gray bars* represent the cumulative fraction of patients having received effective antimicrobials at any given time point.

Kumar, et al Critical Care Medicine 2006

[Original Research **Critical Care**]

CHEST

ED Door-to-Antibiotic Time and Long-term Mortality in Sepsis

Ithan D. Peltan, MD; Samuel M. Brown, MD; Joseph R. Bledsoe, MD; Jeffrey Sorensen, MStat; Matthew H. Samore, MD; Todd L. Allen, MD; and Catherine L. Hough, MD

ER STUDY

Retrospective cohort study

Non-trauma adult ED patient with clinical sepsis

4 hospitals in Utah from 2013-2017

10,811 eligible patients

Measured time to antibiotic administration

Median time to antibiotic therapy 166 mins with 1 year mortality 19%

Each 1 hour increase in time to antibiotics associated with 10% increased adjusted odds of death at 1 year

1.1% per hour increase in risk-adjusted absolute mortality

Peltan et al, CHEST May 2019: 938-946

Journal of Critical Care 40 (2017) 296–302

Contents lists available at ScienceDirect

Journal of Critical Care

journal homepage: www.jccjournal.org

Managing sepsis: Electronic recognition, rapid response teams, and standardized care save lives☆,☆☆,☆☆☆

Faheem W. Guirgis, MD[a,*], Lisa Jones, MD[b], Rhemar Esma, MD[c], Alice Weiss, RN[c], Kaitlin McCurdy, MD[d], Jason Ferreira, PharmD[e], Christina Cannon, MD[a], Laura McLauchlin, DNP[f], Carmen Smotherman, MS[g], Dale F. Kraemer, PhD[g], Cynthia Gerdik, DNP, MBA[h], Kendall Webb, MD[a], Jin Ra, MD[i], Frederick A. Moore, MD[j], Kelly Gray-Eurom, MD, MMM[a]

UNIVERSITY OF FLORIDA COLLEGE OF MEDICINE

Implemented a hospital-wide program which included an electronic health record (HER) sepsis recognition tool, education, standardized management bundles and designated team responders including RRT for inpatients

Retrospective review of all patients treated at UF Health Jacksonville for sepsis from Oct 1, 2013 to Nov 10, 2015

12 months “before”: and 12 months “after” phase

Patients with >2 SIRS alerts and a documented source of infection, AMS, SBP <90 or lactate > 3 mmol/L

Journal of Critical Care 10 (2017) 296-302

SEPSIS ALERTS

RRT consisted of a critical care RN available 24/7, on-call ICU physician, critical care pharmacist, respiratory therapist

Interventions: IV access, administering fluids & antibiotics and facilitated transfer to higher level of care

EHR had an automatic sepsis screening with adjusted MEWS-SRS

Positive predictive value >50%

Screening q 1h

- Score >5 sent page to RRT for ward patients

Sepsis: alert order set (3 hour Sepsis bundle)

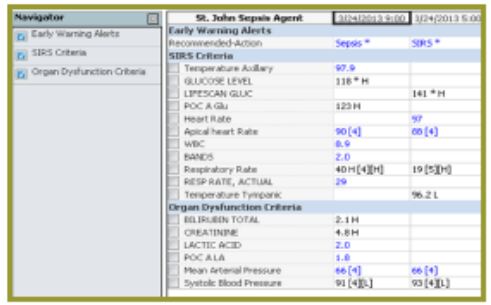
- POC lactic acid
- Two sets of blood cultures
- Antibiotics recommendations
- 30 cc/kg fluid bolus

Adjusted modified early warning signs - sepsis recognition score							
Score	3	2	1	0	1	2	3
T	<32	<35	<36	36–38.4	38.5–38.9	39–40.9	≥41
HR	<40	40–44	45–50	51–100	101–110	111–129	>130
RR	≤7	8	9	10–14	15–20	21–29	≥30
SBP	≤70	71–80	81–100	≥101			
Latest WBC	<1	1–2.9		3–12.9	13–17.9	18–37.9	≥38

RESULTS

Multivariable analysis					
Outcome	Before	After	Odds ratio	*P* value	Confidence interval
Inpatient Mortality			0.62	0.046	95% (0.39, 0.99)
ICU LOS	2.13	1.95		<0.001	95% (1.97, 2.34) (1.75, 2.06)
Hospital LOS	11.74	9.92		<0.0001	95% (10.9, 12.7) (9.3, 10.6)
Mechanical ventilation			0.70	0.007	95% (0.54, 0.91)
Vasopressor Use			0.89	0.181	95% (0.75, 1.06)

St. John Sepsis Agent Flowsheet



To review the triggering criteria for the alerts, simply go to the St. John Sepsis Agent Flowsheet. The St. John's Sepsis Agent Flowsheet can be accessed by using the dropdown menu in the Quick View section of the EMR.

Key Points for Successful Documentation

- Document Vital Signs in "Real-Time"
- Dock glucometers to upload results after every patient or every 15 minutes when testing multiple patients.
- Send specimens to lab as soon as they are drawn.
- Make sure that the time the specimen is drawn, matches the time printed on the lab requisition.
- Be sure to properly position tympanic thermometers into the ear canal. If inserted improperly, a false-low temperature may result.

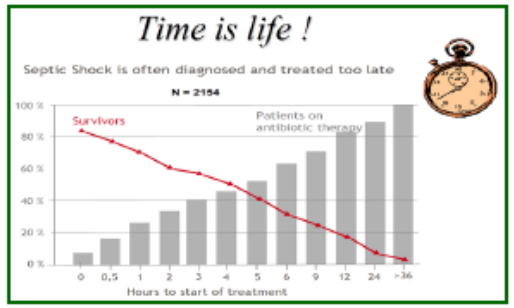
Failure to comply with the principles stated above could lead to false-positive Sepsis Alerts or Sepsis Alerts failing to fire. Remember that you could be a "Lifesaver".

LET'S DECLARE WAR ON SEPSIS

MEMORIAL HERMANN

Introducing... St. John Sepsis Agent

Memorial Hermann Hospital System is implementing the St. John Sepsis Agent that constantly monitors the electronic medical record (EMR) and scans for data that indicate possible signs of SIRS or Sepsis through "Cloud" technology. The goal of the alerts is to detect signs of SIRS or Sepsis *and* initiate rapid resuscitation within 1 hour.



Sobering Statistics About Sepsis

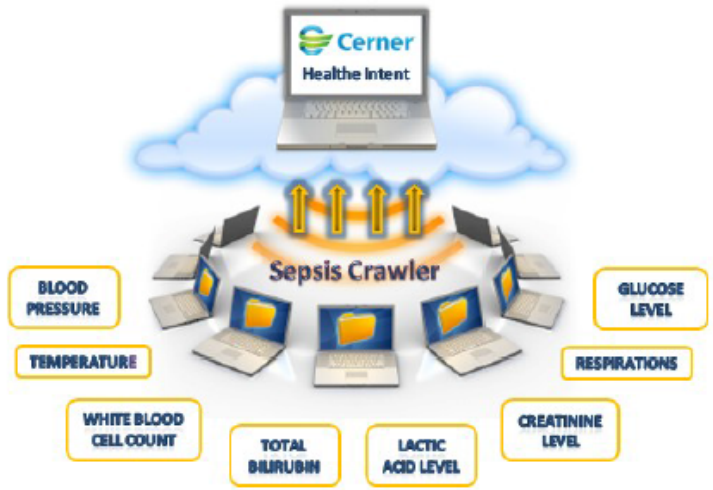
- Patients hospitalized for septicemia or sepsis were more than eight times as likely to die during their hospitalization.
- Hospitalization rates for septicemia or sepsis more than doubled from 2000 through 2008.
- Those hospitalized for septicemia or sepsis had an average length of stay that was 75% longer than those hospitalized for other conditions.

MEMORIAL HERMANN

WHAT IS "CLOUD" TECHNOLOGY?

Sepsis Cloud

Data is extracted in "real-time" by the Sepsis Crawler. The Sepsis Agent then analyzes the data for potential triggers of Sepsis.



When the Sepsis Agent finds a risk for Sepsis, communication alerts are sent to clinicians.

SIRS ALERT

SEVERE SEPSIS ALERT

"Cloud Computing" is where apps or data are accessible on the Internet instead of on a single computer or network. Computers, tablets, and smart phones use this technology to run various features within their apps. When you receive a "Weather Alert" or a "News Alert" or pay bills on-line, "Cloud Technology" is most likely being used.

St. John Sepsis Cloud works like this:

Clinical data is entered into the EMR (Care4) by the lab, bedside nurse, and PCA. The data is then extracted by the Sepsis Crawler and transmitted through the internet to Kansas City. Once in Kansas City, the data is analyzed by the *St. John Sepsis Agent*. If the *Sepsis Agent* identifies possible signs of SIRS or Severe Sepsis, "*Communication Alerts*" are immediately sent back to Houston to the patient's EMR in Care4. This entire process takes about 5 minutes round trip.

MEMORIAL HERMANN

MHH-TMC

Cerner St Johns' sepsis tool launched in July 2013

Uses lab data and vital sign measurement for 30 hours

SIRS ALERT - The patient must meet at least 3 SIRS criteria below:

- Temp (<36°C or >38.3°C)
- HR (>90 bpm)
- RR (>20 b/min)
- Glucose Level (<50 mg/dL or >180 mg/dL)
- WBC (<4 or >12 K/L)
- Bands (>10%)

Task for Nursing to Review

SEPSIS ALERT - The patient must meet at least 2 SIRS criteria and 1 Organ Dysfunction criteria below:

- Lactic Acid level (>2.0)
- SBP (<90mmHg) or SBPΔ 100
- MAP (<65mmHg)
- Creatinine Level (> 2.0 mg/dL or Δ0.5 mg/dL increase)
- Total Bilirubin (≥2 mg/dL and ≤10 mg/dL)
- INR > 1.5 and not on warfarin
- Platelets <100,000 µL

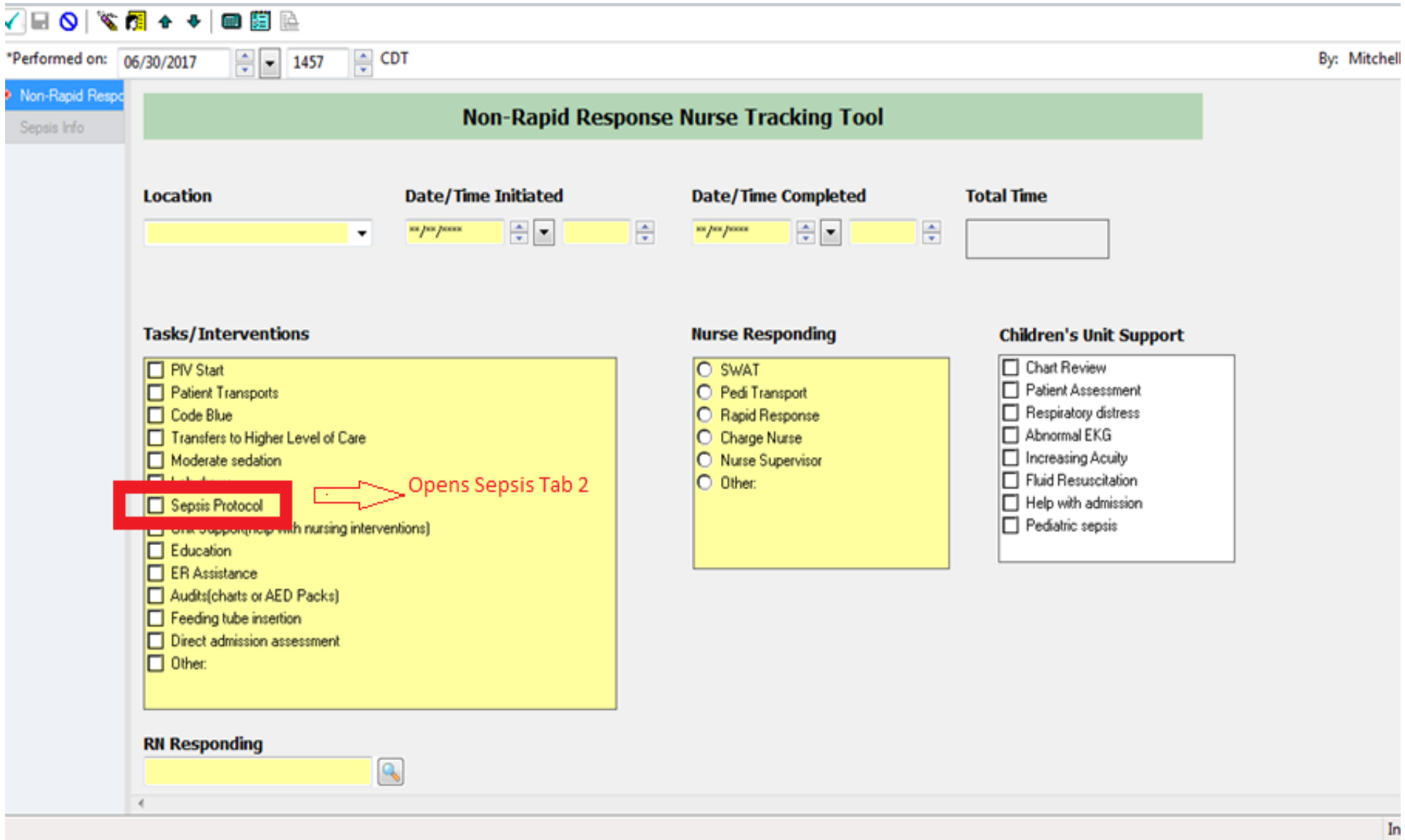
Rapid response team responds to alert

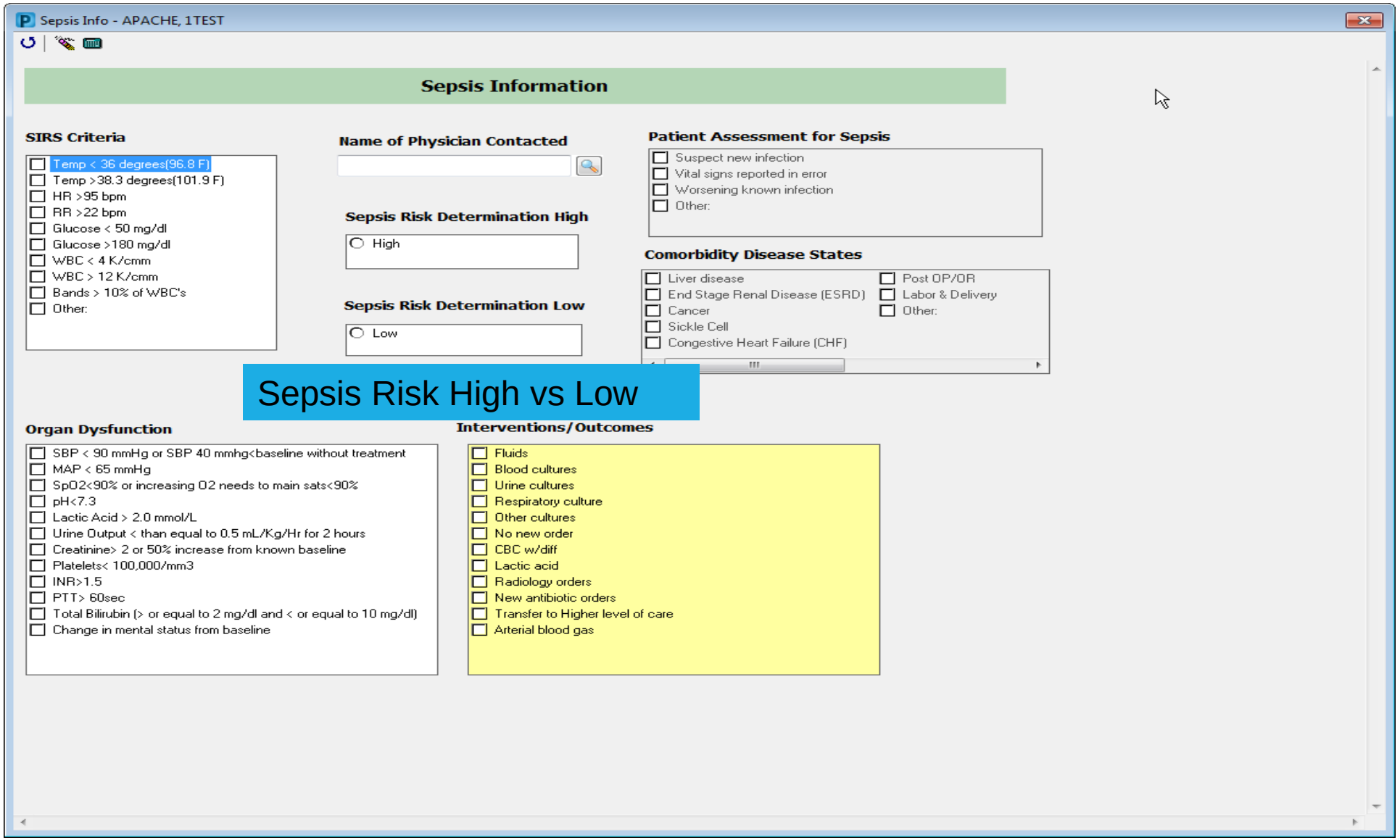
NON-RAPID TRACKING TOOL

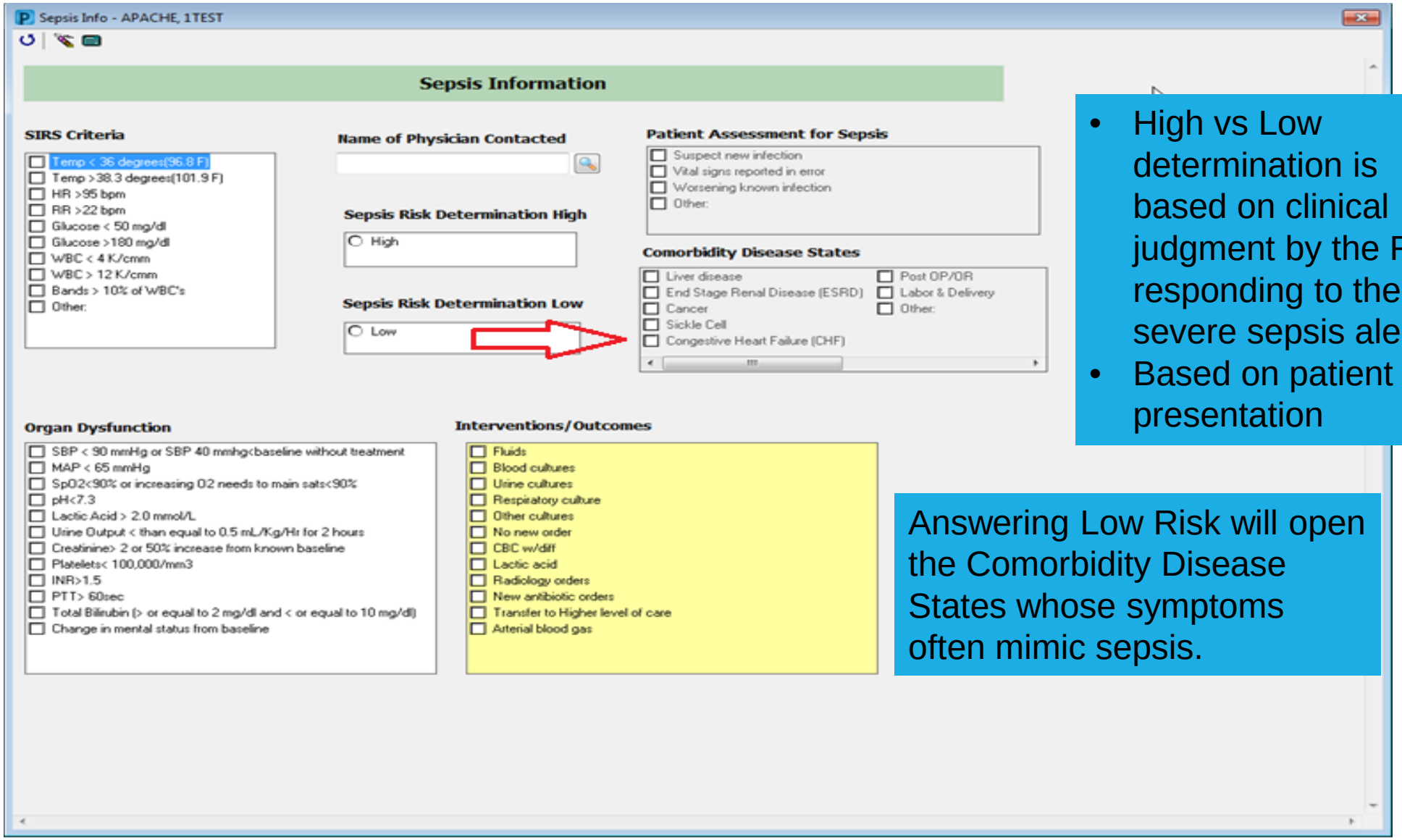
Form used to track non-Rapid response calls for Rapid Response Nurse

- Sepsis Calls
- PIVs
- Small bore feeding tube placement
- Lab draws
- Unit support
- Patient transport
- ER support

Tracks total time spent on calls

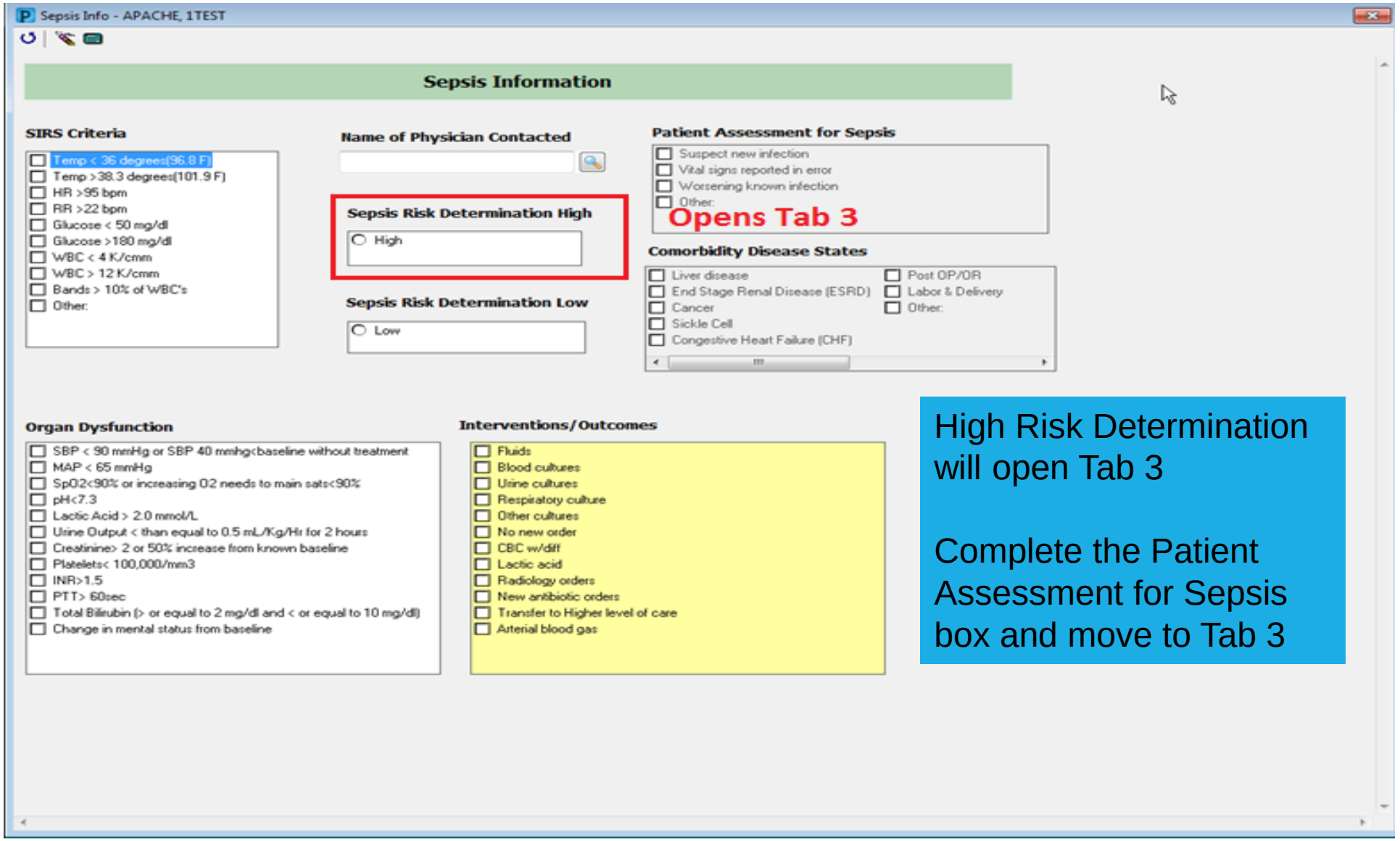

*Performed on: 06/30/2017 1457 CDT
By: Mitchell
Non-Rapid Resp
Sepsis Info
Non-Rapid Response Nurse Tracking Tool
Location
Date/Time Initiated
Date/Time Completed
Total Time
Tasks/Interventions
PIV Start
Patient Transports
Code Blue
Transfers to Higher Level of Care
Moderate sedation
Sepsis Protocol
Opens Sepsis Tab 2
Education
ER Assistance
Audits(charts or AED Packs)
Feeding tube insertion
Direct admission assessment
Other:
Nurse Responding
SWAT
Pedi Transport
Rapid Response
Charge Nurse
Nurse Supervisor
Other:
Children's Unit Support
Chart Review
Patient Assessment
Respiratory distress
Abnormal EKG
Increasing Acuity
Fluid Resuscitation
Help with admission
Pediatric sepsis
RN Responding


Sepsis Info - APACHE, 1TEST
Sepsis Information
SIRS Criteria
Temp < 36 degrees(96.8 F)
Temp >38.3 degrees(101.9 F)
HR >95 bpm
RR >22 bpm
Glucose < 50 mg/dl
Glucose >180 mg/dl
WBC < 4 K/cmm
WBC > 12 K/cmm
Bands > 10% of WBC's
Other:
Name of Physician Contacted
Sepsis Risk Determination High
High
Sepsis Risk Determination Low
Low
Patient Assessment for Sepsis
Suspect new infection
Vital signs reported in error
Worsening known infection
Other:
Comorbidity Disease States
Liver disease
End Stage Renal Disease (ESRD)
Cancer
Sickle Cell
Congestive Heart Failure (CHF)
Post OP/OR
Labor & Delivery
Other:
Sepsis Risk High vs Low
Organ Dysfunction
SBP < 90 mmHg or SBP 40 mmhg<baseline without treatment
MAP < 65 mmHg
SpO2<90% or increasing O2 needs to main sats<90%
pH<7.3
Lactic Acid > 2.0 mmol/L
Urine Output < than equal to 0.5 mL/Kg/Hr for 2 hours
Creatinine> 2 or 50% increase from known baseline
Platelets< 100,000/mm3
INR>1.5
PTT> 60sec
Total Bilirubin (> or equal to 2 mg/dl and < or equal to 10 mg/dl)
Change in mental status from baseline
Interventions/Outcomes
Fluids
Blood cultures
Urine cultures
Respiratory culture
Other cultures
No new order
CBC w/diff
Lactic acid
Radiology orders
New antibiotic orders
Transfer to Higher level of care
Arterial blood gas



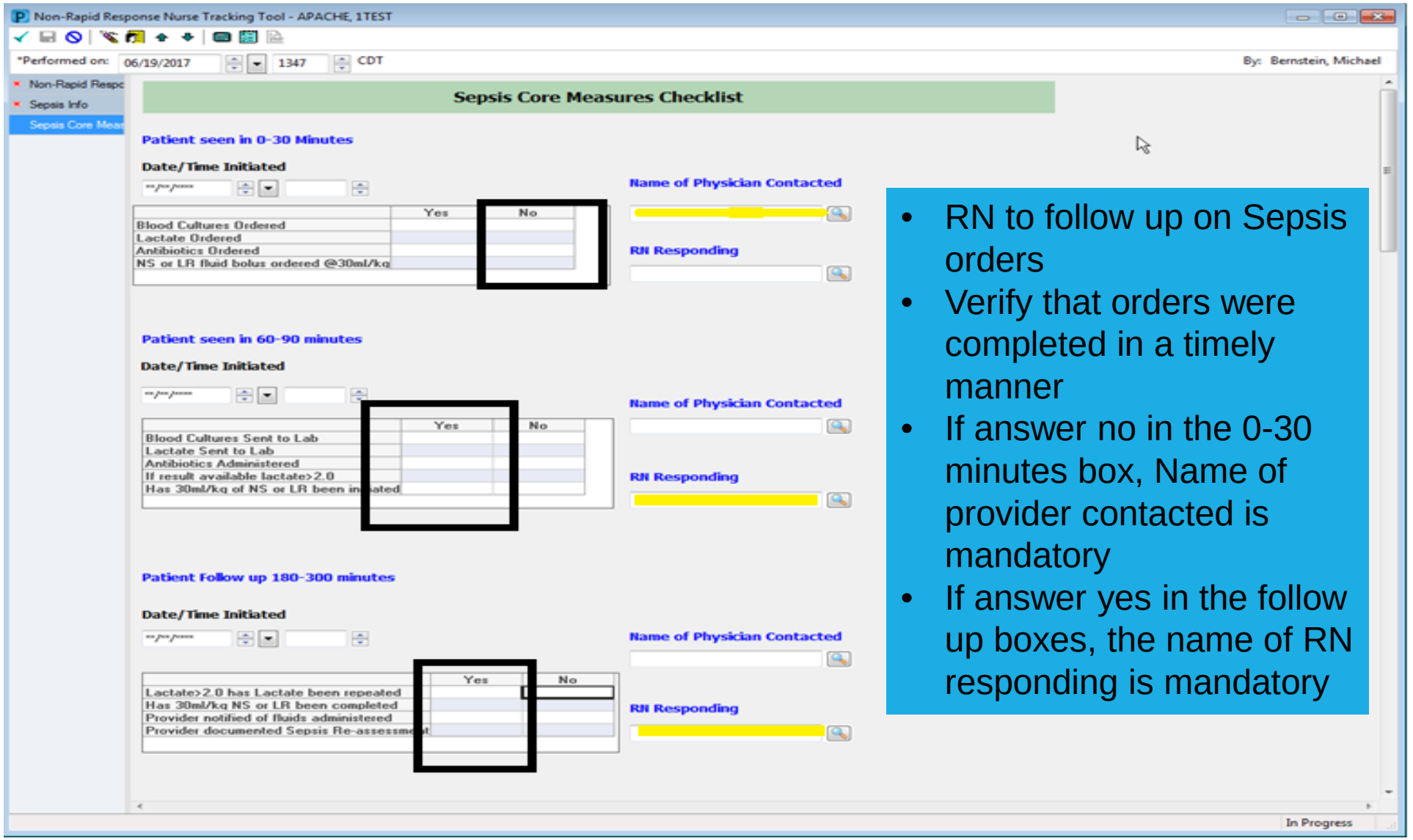
- High vs Low determination is based on clinical judgment by the RN responding to the severe sepsis alert
- Based on patient presentation

Answering Low Risk will open the Comorbidity Disease States whose symptoms often mimic sepsis.



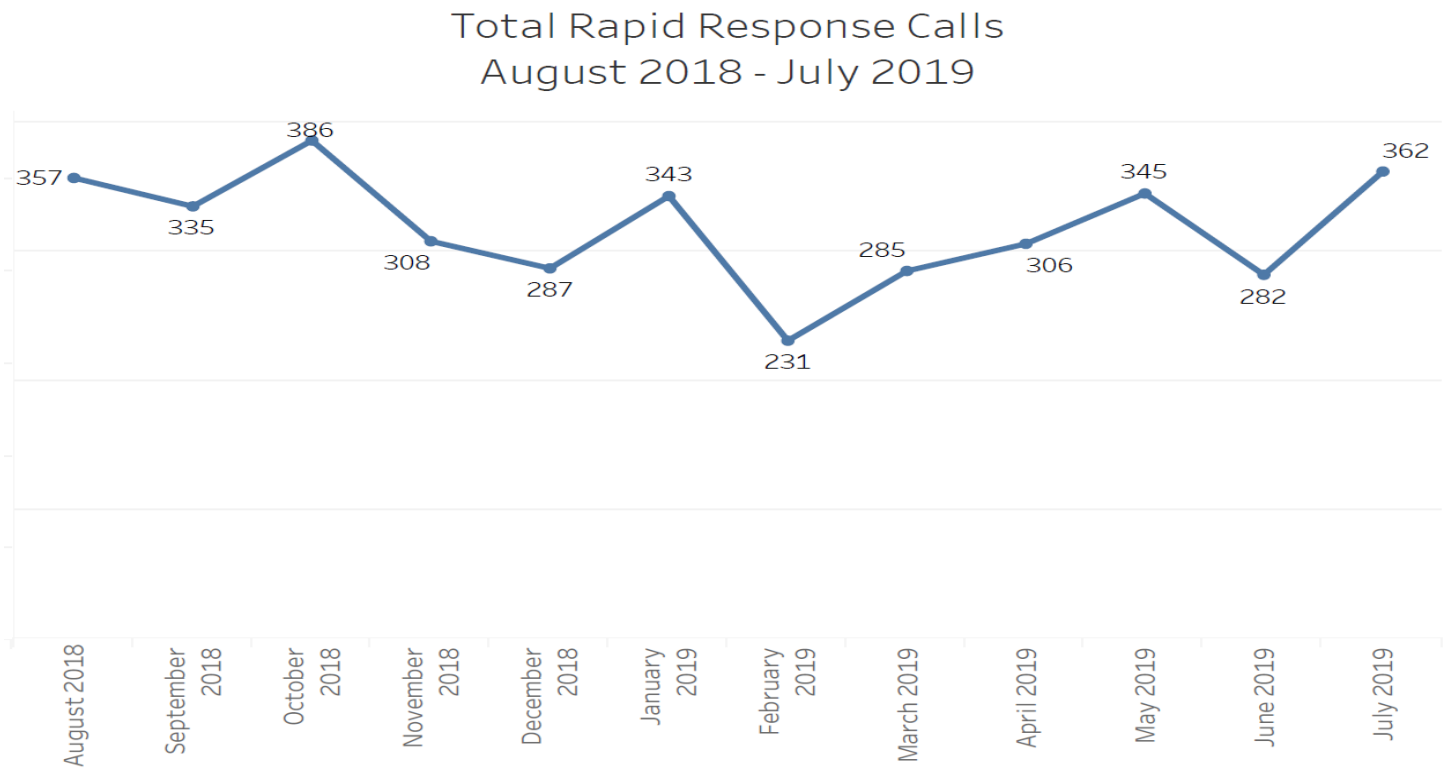
High Risk Determination will open Tab 3

Complete the Patient Assessment for Sepsis box and move to Tab 3

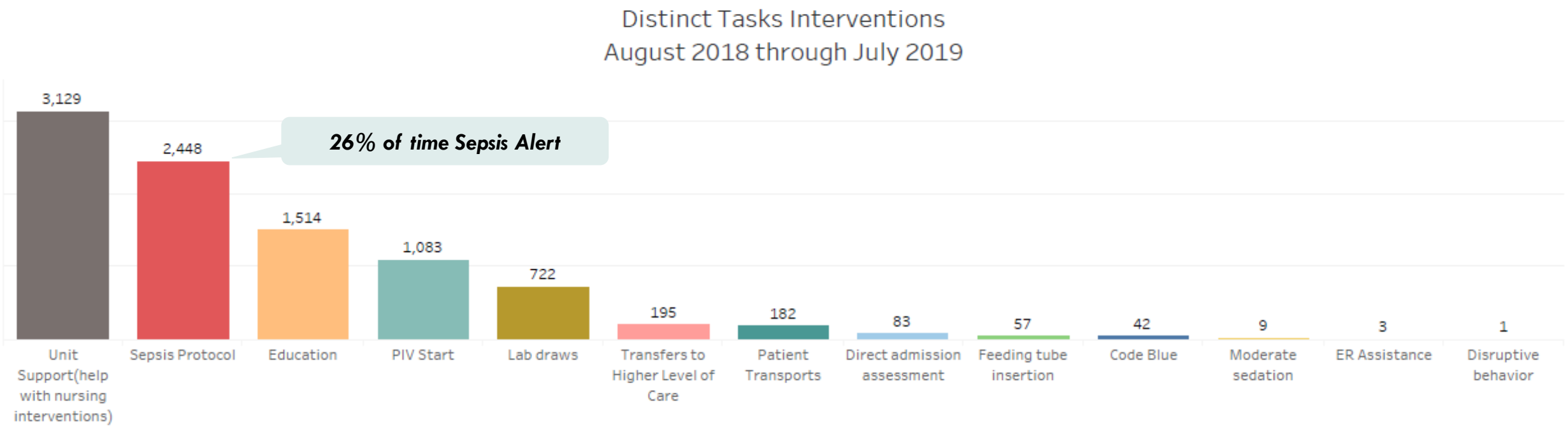


- RN to follow up on Sepsis orders
- Verify that orders were completed in a timely manner
- If answer no in the 0-30 minutes box, Name of provider contacted is mandatory
- If answer yes in the follow up boxes, the name of RN responding is mandatory

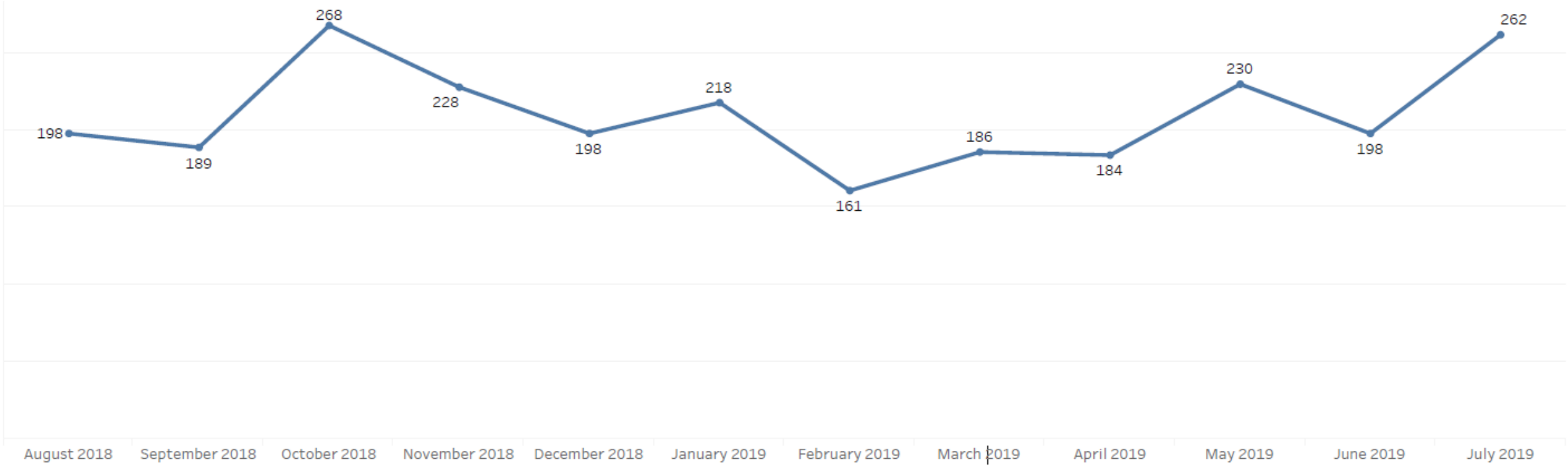
Total Rapid Response Calls



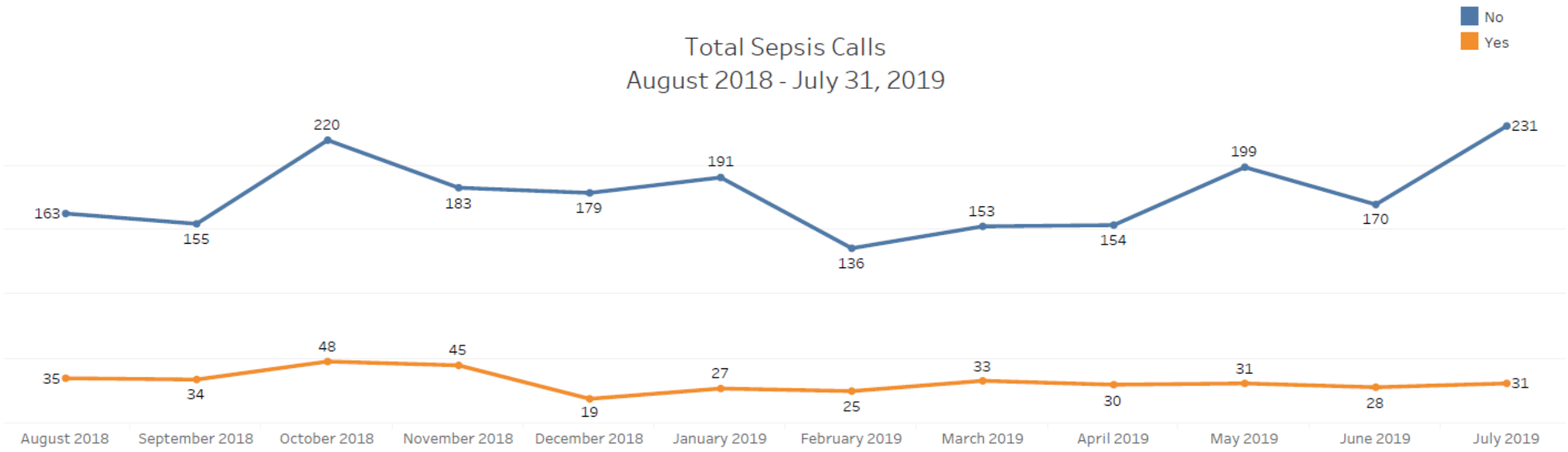
Tasks/Interventions from Rapid Response Calls



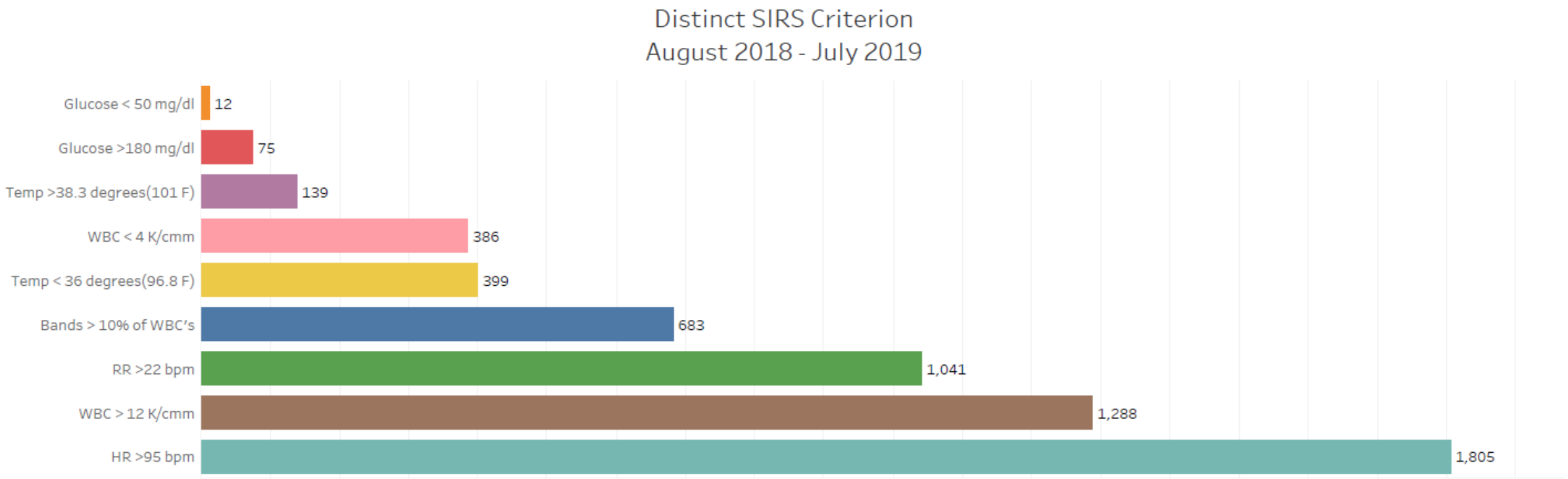
Monthly Totals of Total Sepsis Rapid Response Calls



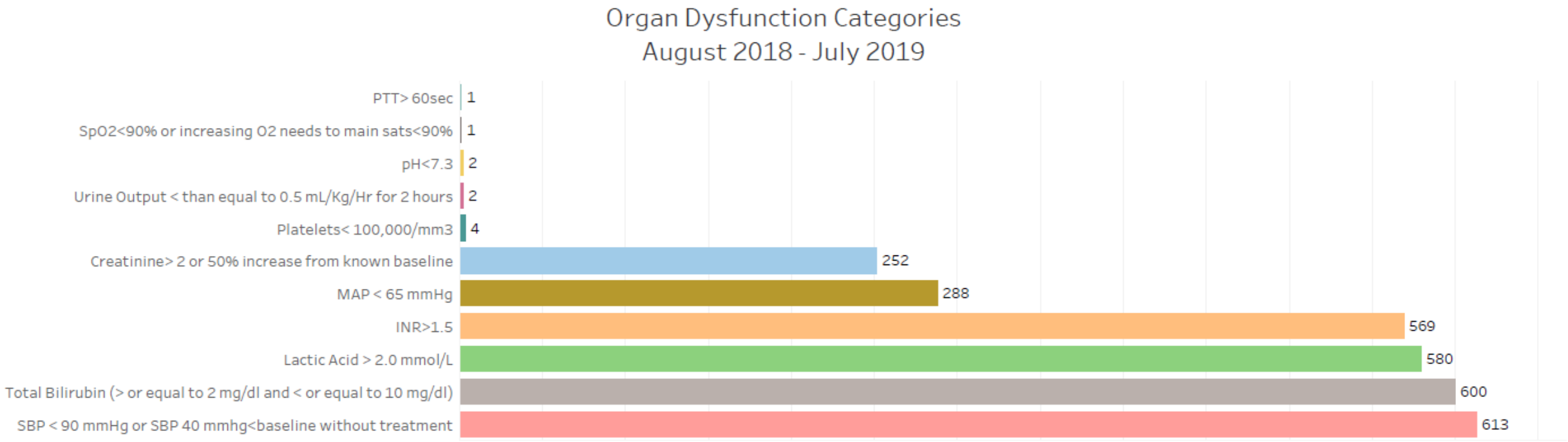
Monthly Totals of Sepsis=Yes & Sepsis=No



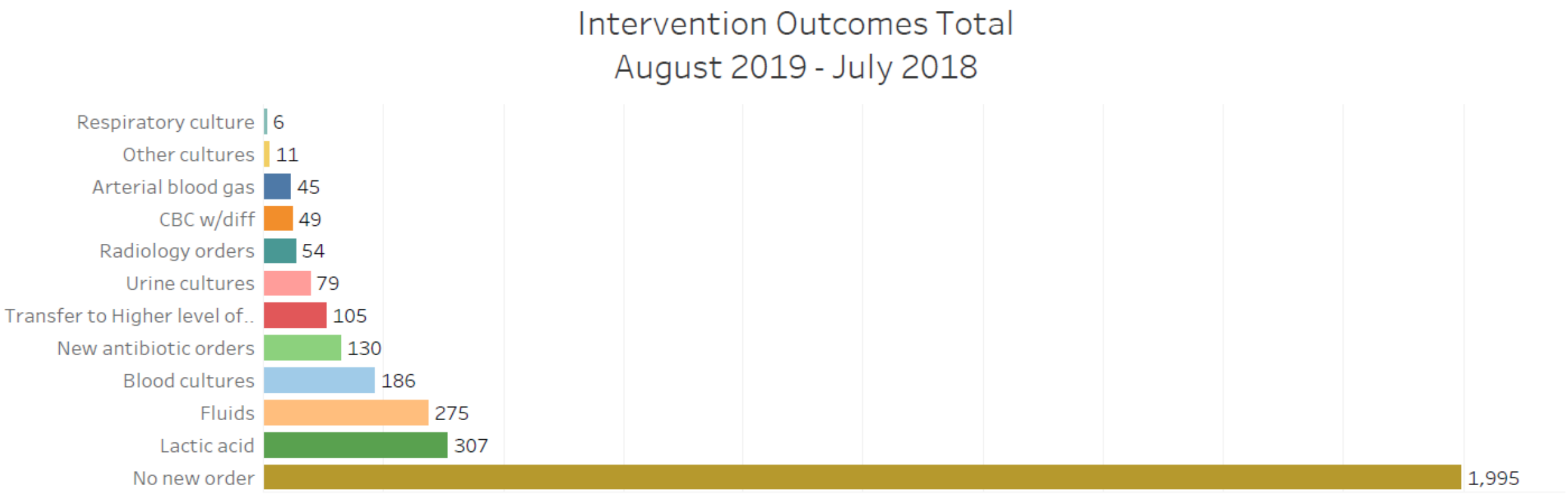
SIRS Criteria which triggered Severe Sepsis Alert



Organ Dysfunction



Interventions/Outcomes of Sepsis = Yes



MS-DRG: 870 Septicemia or severe sepsis w mv >96 hours or peripheral extracorporeal membrane oxygenation (ecmo),]
871 Septicemia or severe sepsis w/o MV >96 hours w MCC

TAKE HOME POINTS

Sepsis mortality decreases with early recognition and treatment

Sepsis screening with early aggressive care is vital to increasing the chance of survival

Use of an automated early warning system can increase the identification of septic patients but can also lead increased false positives

Use of a RRT team to clinically assess patients at the bedside can help implement therapies such as drawing blood cultures and administering antibiotics & fluids

Ideally, these interventions will improve sepsis mortality and decrease the need for transfer to higher level of care

Journal of Critical Care 40 (2017) 294-295

LEARNING ASSESSMENT QUESTIONS

The number of patients who die of Sepsis in the United States is:

A. ~200
B. ~2000
C. ~20,000
D. ~200,000
E. ~2,000,000

Correct answer is D ~200,000 die in the US from sepsis every year

Using an early warning system to identify sepsis can decrease mortality

- True
- False

The answer is True. Every hospital should utilize a system to identify sepsis earlier and have a team in place to intervene