

Every Patient, Every Time: Sepsis Screening Leads to 45% Mortality Rate Reduction



Avera Health is an integrated health system comprising 35 hospitals with more than 300 locations throughout eastern South Dakota and four surrounding states. Avera serves a population of nearly 1 million, covering a geographical footprint of 72,000 square miles in 86 counties. The organization is committed to keeping the Avera brand promise to deliver exceptional care across the entire system. In 2019, Avera Health was recognized by CHIME as a HealthCare's Most Wired organization, earning the highest status of Level 10. (Profile updated in December 2019.)

Executive Summary

In 2013, the Avera Clinical Leaders Forum, supported by robust business and clinical intelligence data, looked across their system and identified \$20 million in cost opportunities across ten different care settings. They ranked the top ten opportunities for care improvement based on financial reimbursement and non-standard practice. Sepsis prevention was number one.

"100% of patients in our EDs and currently in Avera hospitals are screened for sepsis. Rarely does a clinical tool touch every patient. We've seen a dramatic improvement in both mortality and morbidity related to sepsis care."

Jennifer McKay, MD, MIO
Avera Health

Soon after, the organization defined a system-wide goal to reduce sepsis mortality by collaborating with multiple disciplines, providers, and facilities throughout the Avera system to implement a standardized sepsis toolkit in MEDITECH.

Today, early recognition of sepsis triggers an immediate intervention at Avera, which has led to a 45% reduction in sepsis mortality. The following outcomes are based on data from four of their hospitals combined, comparing the time period of August 2012- January 2014, to February 2014 - January 2015:

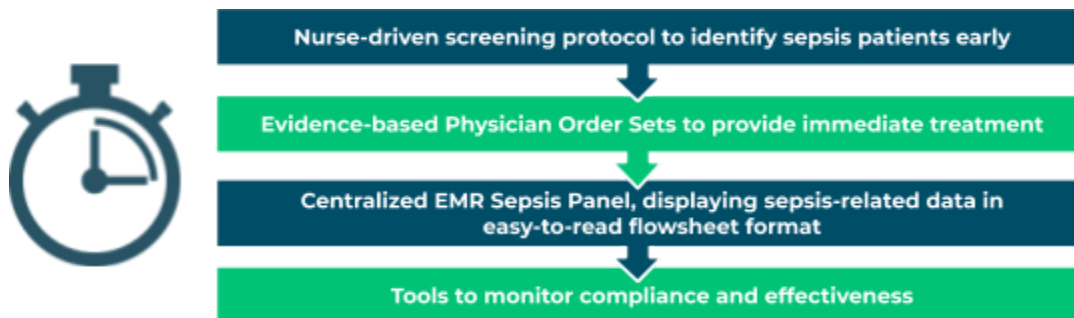


- **\$10 million cost savings** based on a \$5,080 decrease in cost per case.
- Sepsis readmission rate dropped from 12.9% to 10.3%.
- Readmission observed to expected ratio fell from .70 to just above .60 - **exceeding top performers in the nation.**
- Standardized sepsis screening assessments and early treatment bundles provide consistent data across the system to measure.

Opportunity Identified

Avera Health's Clinical and Business Intelligence Teams identified sepsis as the number one opportunity for care improvement across their system, based on financial reimbursement and non-standard practice. Prior to initiating the project, Avera Health's sepsis mortality rate was 16.1% (July 2012 to June 2013). As the organization prepared to take on this challenge, they looked across their system and noted that mortality varied from site to site. Avera Health recognized that hospitals within the system were not providing consistent screening and treatment of sepsis at all their facilities.

To address this issue, the organization set a system-wide goal to reduce sepsis mortality. Avera focused on improving patient outcomes by embedding the following elements into the nursing and physician workflow:



A key focus of the project was ensuring that the screening and treatment protocol could be used universally across the system, ensuring the Avera brand promise of providing consistent standardized care at all Avera hospitals.

Path to Quality Improvement

Avera assembled a multidisciplinary team comprised of an infectious disease physician/infection prevention nurse dyad, a Medical Information Officer (MD), a pharmacist with specialized training in antibiotic management, as well as representation from nursing management and leadership, IT system analysts, and informaticists. Their collaborative expertise was crucial to advancing the design and implementation of the organization's sepsis program.

The team used a rapid cycle innovations approach based on the Minnesota Hospital Association's (MHA) Leading Edge Advanced Practice Topics (LEAPT) and the Surviving Sepsis Campaign's 3-hour and 6-hour Bundles,¹ which focused on early detection, physician leadership, and multidisciplinary collaboration in sepsis detection and treatment.



¹ Minnesota Hospital Association, Leading Edge Advanced Practice Topics (LEAPT): <http://www.mnhospitals.org/patient-safety/current-safety-quality-initiatives/severe-sepsis-and-septic-shock>

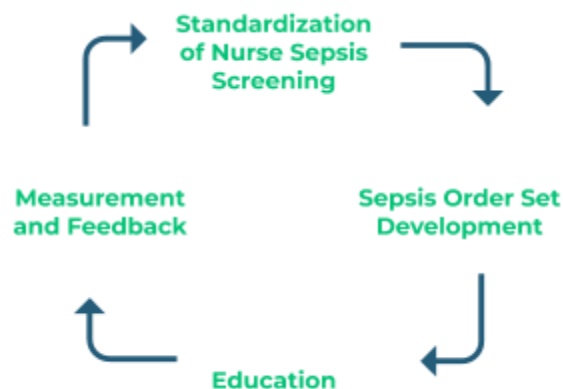
Central to this effort was using MEDITECH's EHR to facilitate and promote early recognition, trigger immediate treatment, and monitor/analyze data to measure the impact of the program and provide feedback.

Standardized Sepsis Screening

The first step of this quality improvement project was to establish a nursing process. One of the project leaders reached out to the Minnesota Hospital Association's (MHA) Leading Edge Advanced Practice Topics (LEAPT) project, which was heading up an initiative among several states to identify sepsis early on and to promote transfer to the appropriate care settings.

Out of that project came the "Rule of 100," which proved to be an effective tool for early detection of sepsis. This rule defines a patient with a temperature of greater than 100, a heart rate above 100, and blood pressure of less than 100 as being high risk for sepsis. If a patient is identified as high risk, the physician is called immediately to order blood cultures and lactic acid.

Avera adopted the "Rule of 100" because it is easy to remember and is based on clinical data readily available to the nurse. They proceeded to incorporate this rule into their nursing workflow. After piloting the workflow on paper at two locations, the team integrated nursing feedback into their electronic process.

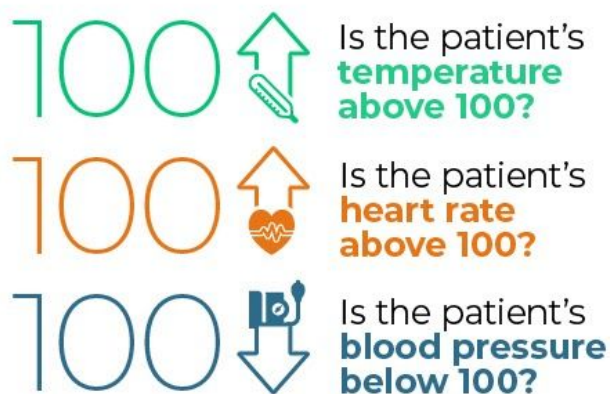


Multidisciplinary Collaboration on Order Set Development

The team also looked at ways to optimize physician workflow around order sets. Avera worked with their infectious disease physicians to establish a system-based antibiotic protocol that would allow clinicians to pick the most appropriate antibiotic therapy based on the suspected source of infection. Pharmacy staff also provided direction for antibiotic and drug orders. Once the orders to be included in each set were selected, they were arranged by infection type for ease of use, with orders having the most evidence behind them strategically located as the first choice.

Education

With the nursing and physician workflow defined, Avera launched an extensive "Seeing Sepsis" education campaign to spread awareness of sepsis and the importance of early detection using the "Rule of 100." The campaign targeted all direct provider staff across all facilities. It included videos developed as a part of Avera's involvement in the Minnesota LEAPT project, and posters displaying the algorithm:



And does the patient just not look right? Screen for sepsis and notify the physician immediately.

Reference: Minnesota Hospital Association, Leading Edge Advanced Practice Topics (LEAPT)

Measurement and Feedback

By standardizing the nursing sepsis screening assessment and physician order sets, Avera Health has consistent data elements for the sepsis team to track progress, compliance, and effectiveness of the sepsis tools. This allows Avera to provide quantifiable feedback to providers on managing sepsis care, and to refine the program as issues are identified.

MEDITECH's EHR Expedites Early Recognition and Intervention

MEDITECH's sophisticated EHR solution supports customers in the early detection and treatment of sepsis by providing access to critical patient data, evidence-based order sets, and clinical decision support to guide clinicians. Nurses documenting in real time complete a sepsis screening assessment to determine if the patient is at risk for sepsis. The physician is notified and able to initiate immediate treatment using evidence-based order sets that contain the labs, medications, and fluid resuscitation orders for the initial treatment of sepsis. MEDITECH's integration allows for all this data to flow to an EMR sepsis panel providing the physician and nurses with a full clinical picture.

Nurse-Driven Screening Protocols

MEDITECH's flexibility enables hospitals to customize assessments and screen displays. Avera was able to incorporate the "Rule of 100" directly into their sepsis screening assessments for both the inpatient and ED environments. Each assessment reflects the different workflows and data available to clinicians.

ED Sepsis Screening Tool

Key to early treatment of sepsis, is early recognition. The ED screening assessment is used on all patients admitted through the ED. It starts with the ED nurse screening the patient for a known or suspected infection. The assessment then guides the nurse by displaying the key symptoms of infections:

Sepsis Screening	
Infection Screening	<input type="radio"/> No Infection Suspected <input type="radio"/> Known/Suspected Infection
	Known or Suspected infection as evidenced by any of the following:
	<div><div><ul style="list-style-type: none">* Fever/Chills* Weakness* Cough/Shortness of Breath* On Antibiotic Therapy</div><div><ul style="list-style-type: none">* Abdominal Pain* Altered Mental Status* Cellulitis/New Purulent Wound Drainage* Recent Procedure</div></div>

If there is a known/suspected infection, the nurse proceeds to assess vital signs using the "Rule of 100" for temperature, pulse, and blood pressure. Avera also added respiratory rate and oxygen saturation to the assessment. These are all clinical values immediately available to the ED nurse. The screening is positive if there is a known or suspected infection, and two or more of the vitals meet the "Rule of 100." Clinical decision support embedded in the assessment aids the nurse by outlining the nursing care guidelines to follow and providing information on orders the nurse can anticipate:

Screening Results	
Sepsis Screening Result	<input type="radio"/> Positive <input type="radio"/> Negative
	If Sepsis Screening Result is POSITIVE - notify the Physicians Immediately.
	*Anticipate the following diagnostics: CBC, CMP, Lactic Acid, BC x2, U/A, Urine Culture, Chest X-ray. *Anticipate the following Medications: Initial IV Fluid Resuscitation, Antibiotic Therapy within 1 hour.
	NURSING CARE GUIDELINES for a Positive Sepsis Screen in ED: * Place patient on the Cardiac Monitor, monitor continuous pulse ox - Vital Signs every 15 minutes. * O2 per protocol to keep sats >90%. * Establish large bore IV.

A positive screen updates the ED Tracker, alerting staff and sending an electronic notification to the physician. If it turns out that the patient is not septic, the flag disappears.

Inpatient Sepsis Screening Tool

The inpatient screening assessment is similar to the ED assessment in that it is based on the “Rule of 100,” but with some slight modifications to reflect the inpatient environment. These modifications include incorporating lab values into the screening process and attaching frequencies to the sepsis screening intervention to generate schedules, ensuring timely completion of the assessment.

The sepsis screening intervention is included in the Standard of Care, ensuring it is placed on every patient. The intervention has a frequency of ‘Every Shift,’ cueing the nurse to complete it once per shift, or twice a day. If it is missed, the scheduled time displays in red on both the status board and worklist to reflect it is overdue.

Similar to the ED, a positive screen updates the Status Board, alerting staff to this critical change and also triggering an electronic notification to the physician.

Feedback from the inpatient nurses included a request to see all related sepsis data in one place. Avera addressed this by using associated data to provide easy access to a trended view of the patient’s recent vital signs and lab results. This change allows nurses to evaluate key sepsis-related clinical changes in a chronological flowsheet view.

Intervention	Text/Ord	Status	Src	Frequency	History	Next Scheduled ▾	Prtcl	Assoc Data
Adult Sepsis Screening Tool		A	PS	QSHIFT		1400 2200	▶	▶

<input type="checkbox"/> Associated Data	Sep 11 18:01 22:00	Sep 11 22:01 02:00	Sep 12 02:01 06:00	Sep 12 06:01 10:00
<input type="checkbox"/> Associated Data				
WBC			7.6	
Hgb			10.3 L Δ	
Plt Count			129 L	
INR				
Sodium			134	
Glucose			136 H	
Lactic Acid			2.3 H	
Patient Temperature	98.2	98.4	98.4	
Pulse Rate	80 (+)	78 (+)	74 (+)	80 (+)
Respiratory Rate	25 (+)	22 (+)	18 (+)	18 (+)
Blood Pressure Assessment Label	65 (87) (+)	113/58 (78) (+)	100/52 (71) (+)	90/48 (64) (+)
Bedside Pulse Oximetry	95 (+)	95 (+)	94 (+)	95 (+)

Physician Workflow Expedites Early Intervention

With the nursing sepsis screening process in place, Avera moved to provide physicians with the necessary workflow to improve care delivery. Knowing that faster compliance with the Surviving Sepsis Campaign's ² 3-hour and 6-hour treatment bundles of care leads to better patient outcomes, Avera incorporated these into the order sets they built.

Adult Sepsis Initial Mgmt.	
Diagnostic Criteria for Severe Sepsis	
SEVERE SEPSIS DEFINITION = Sepsis induced tissue hypoperfusion or organ dysfunction (any of the following due to infection)	
*Sepsis Induced Hypotension (SBP < 90 mmHg or MAP < 70 mmHg)	
*Lactate above upper limit of laboratory normal	
*Creatinine > 2.0 mg/dl	
*Platelet count < 100,000 ml	
*INR > 1.5	
*Urine output <0.5 ml/kg/hr for > 2 hrs (despite adequate fluid resuscitation)	
*Acute lung injury with PaO2/FiO2 < 250 (In absence of Pneumonia) OR < 200 (In presence of Pneumonia)	
Diagnostic Studies	
CBC WITH AUTOMATED DIFF (LAB) Today Now	Edit
COMPREHENSIVE METABOLIC PANEL (LAB) Today Now	Edit
LACTIC ACID (LAB) Today Now	Edit
PROTIME WITH INR (LAB) Today Now	Edit
BLOOD CULTURE (MIC) Today Now Source: PERIPHERAL VENOUS BLOOD	*Edit*
BLOOD CULTURE (MIC) Today Now Source: CENTRAL LINE BLOOD	*Edit*
UA W/MICRO REFLX TO CULT (LAB) Today Now	*Edit*
RESPIRATORY CULTURE & GS (MIC) Today Now	*Edit*

The order sets based on the Surviving Sepsis Campaign's 3-hour and 6-hour bundles not only included the initial orders for diagnosing sepsis, but also the first steps of care for treating a septic patient. This proved highly impactful for physicians in some of the smaller hospitals who may only see a few cases per year.

When the physician selects an initial sepsis management order set, they are presented with a definition and diagnostic criteria for severe sepsis, followed by the list of diagnostic studies to order, which include collecting blood culture and lactate levels to help confirm the patient's diagnosis.

Initial Fluid Resuscitation for Severe Sepsis
Administer 30 ml fluid bolus if the patient has severe sepsis defined as follows: SBP < 90 MAP < 65 SBP decrease of 40 mmHg from baseline - OR - lactic acid > 4 mmol/liter
Goal resuscitation to improve UO > 0.5 ml/kg/hr, CVP 8-12 cm of H2O, MAP >= 65 mm Hg, SCVO2 > 70, normalization of lactate if initial lactate is elevated.

The order set also includes initial fluid resuscitation orders for severe sepsis. This takes the guesswork out of how to confirm the patient is septic and what initial treatment steps to take.

² Surviving Sepsis Campaign: <http://www.survivingsepsis.org/Bundles/Pages/default.aspx>

Avera established a system-based antibiotic protocol that allows clinicians to choose the most appropriate antibiotic therapy based on the suspected source of infection. In the screenshot below, the source of infection is pulmonary. As noted earlier, orders within each set are arranged with medications having the most evidence behind them strategically located as the first choice.

Consider Healthcare-Associated if the following risk factor(s) present: 1. Any patient hospitalized in an acute care hospital for 2 or more days in the last 90 days 2. Any patient whom has received IV antibiotics, wound care or chemotherapy within the past 30 days 3. A resident of Long Term Care (LTC) Facility 4. A hemodialysis patient	
** Suspected Pulmonary Source **	
Community Acquired (known or suspected)	
Select Ceftriaxone PLUS Azithromycin (check BOTH boxes)	
<input type="checkbox"/> Ceftriaxone Sod Inj (Rocephin) 2 GM in Dextrose 5% (D5w) 100 ML IV daily 150 MLS/HR	Edit
BOTTLE COMMENT: Give first dose NOW if not already given in ED.	
<input type="checkbox"/> Azithromycin Inj (Zithromax Inj) 500 MG in Dextrose 5% (D5w) 250 ML IV daily 185 MLS/HR	Edit
BOTTLE COMMENT: Give first dose NOW if not already given in ED.	
Healthcare-Associated (known or suspected)	
Select BOTH cefepime AND vancomycin.	
<input type="checkbox"/> Cefepime Inj (Maxipime) 2 GM in Dextrose 5% (D5w) 100 ML IV 8h 150 MLS/HR	Edit
BOTTLE COMMENT: Give first dose NOW if not already given in ED	
<input type="checkbox"/> Vancomycin IV per Pharmacy 1 EACH IV 12h	Edit
COMMENTS: Pharmacy to dose Vancomycin IV: Dose = 15 mg/kg Q12H up to a maximum dose of 2000 mg. Give first dose NOW if not already given in ED.	

Sepsis EMR Panel Displays Right Data at Right Time

Vital signs, lab results, medications administered, and all sepsis screening results flow to the EMR in real time and are visible from an EMR Sepsis Panel. This provides a central location for physicians and nurses to see all the patient's sepsis data trended over time.

AVERA Sepsis Panel	Feb 26 18:01 00:00	Feb 27 00:01 06:00	Feb 27 06:01 12:00	Feb 27 12:01 18:00	Feb 27 18:01 00:00
Vital signs					
Temperature	98.9	98.5 (+)	97.9	97.8	98.8 (+)
Blood Pressure Systolic	108 (+)	124 (+)	117 (+)	115 (+)	136 (+)
Blood Pressure Diastolic	63 (+)	77 (+)	57 (+)	75 (+)	72 (+)
Pulse Rate	81 (+)	86 (+)	74 (+)	69 (+)	63 (+)
Bedside Pulse Oximetry	93 (+)	98 (+)	97 (+)	97 (+)	98 (+)
Patient Data					
White Blood Count	10.0	9.5			
Hemoglobin	9.5 L	9.3 L			
Platelet Count	67 L	75 L			
Prothrombin Time INR	1.4				
PTT	0.5 L (+)	0.5 L		0.5 L	
Sodium Level	129 L	128 L		127 L	
Glucose Level	119 H	98		105	
Lactic Acid Level	1.0				
Total Bilirubin	1.0	0.7			
Medications Administered					
Hydromorphone HCl	0.2 MLS/HR				
Meropenem			200 MLS/HR		200 MLS/HR
Meropenem/Sodium Chloride	200 MLS/HR	200 MLS/HR			
Sodium Chloride		125 MLS/HR		75 MLS/HR (+)	
Vancomycin HCl/Dextrose		166.667 MLS...	166.667 MLS...		
Camphor/Menthol		1 APPL			
Cyclobenzaprine HCl					
Enoxaparin Sodium				40 MG	

Physicians can use this panel to review the most recent clinical data for each patient with suspected sepsis. It serves as a compass for physicians to determine, at any given point, where the patient lies within the spectrum of sepsis, and to evaluate the next appropriate step.

Physician Champions Key to Success

Avera is quick to credit a handful of passionate physician champions who encouraged their colleagues in both large and small facilities to utilize the sepsis tools in the system. These physicians promoted the value of the order sets, reminding other doctors that by using the sets they can be confident they are not missing any opportunities for therapeutic intervention, and are following precise guidelines for diagnosing, evaluating, and managing patients with sepsis.

Good Data In, Good Data Out

Standardizing the sepsis screening assessments and order sets not only allows for consistent care across the Avera system, but also provides a unified data set that can be used to monitor compliance and effectiveness. Avera is able to audit the use of the sepsis tools and correlate it to clinical outcomes for sepsis patients. The team uses this information to continue to improve the quality of care delivered to the sepsis patient.

Using near real-time data pulled from MEDITECH's Data Repository, Avera is able to support rapid cycle performance improvement by pushing dashboards - including 'No Lactic Acid Within 3 Hours' - to appropriate end users who can impact care at the bedside. The organization also uses a dashboard to support and monitor 3-hour bundle compliance at all facilities, as well as a daily sepsis dashboard to track local performance improvement.

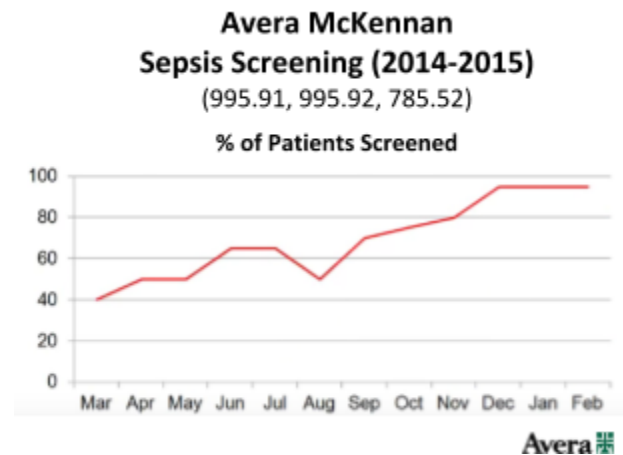


In addition to dashboards, quantifiable feedback is shared with providers to communicate how successful they are in managing sepsis care, and to refine the program as issues are identified.

Early Recognition + Early Intervention = Results

Timing is everything. Avera's early recognition of sepsis triggers early interventions, which has led to impressive results.

With the implementation of the electronic screening tool in 2014, Avera saw a dramatic increase in the number of patients screened for sepsis. For example, at Avera Health's flagship hospital, Avera McKennan, the sepsis screening percentage jumped from 40% in March 2014 up to nearly 100% in February 2015.

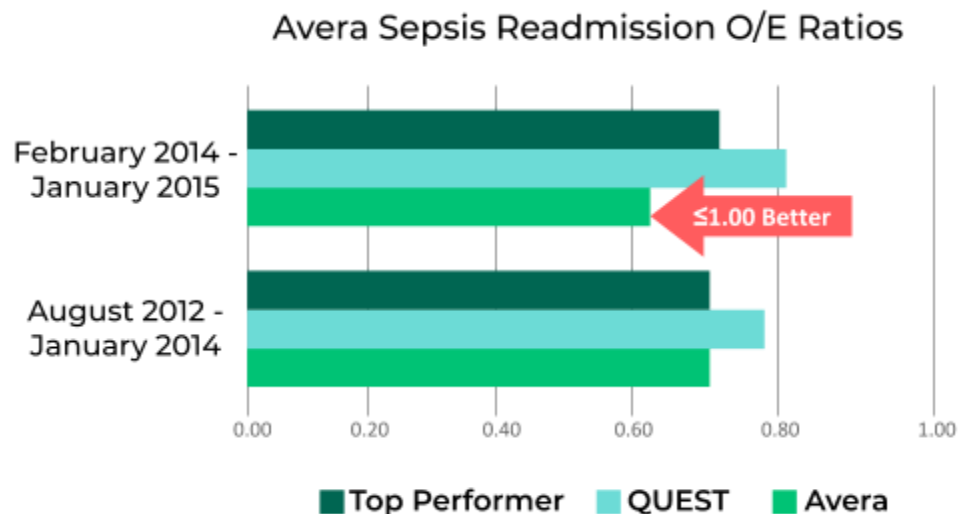


This screening increase led to a domino effect with hospitals nearing 100% compliance for the 3-hour sepsis bundle.

Avera Health has also seen reductions in several key areas, including sepsis-related mortality, cost per case, and readmission rates. The following outcomes are based on measured results across four regional hospitals combined during the time period of August 2012 - January 2014, to February 2014 - January 2015:

- Sepsis mortality rate dropped 4.28%, from 14.46% to 10.18%
- \$10 million cost savings based on a \$5,080 cost per case
- Sepsis Readmission Rate dropped from 12.9% to 10.3%; this had a positive impact on the observed to expected (O/E) ratio which fell from .70 to just above .60.

Avera advances quality beyond the required Medicare programs by voluntarily participating in the QUEST program through Premier, Inc. This program applies more stringent measurements than CMS, and also enables Avera to compare themselves to top performers nationwide. As you can see, Avera is outperforming both groups:



With its nurse-driven sepsis screening assessments and physician order set bundles, Avera Health is using MEDITECH's integrated EHR to save lives by quickly identifying patients at risk for sepsis and initiating immediate, evidence-based diagnostics and treatments. As a result, the organization has managed to significantly streamline workflows, reduce costs, and improve patient outcomes.