

# Detecting the Undetected: MEDITECH's Surveillance Identifies and Prevents Infections at Valley



The Valley Hospital is a 451-bed, fully accredited, acute care, not-for-profit hospital in Ridgewood, New Jersey. In 2015, Valley's volume included nearly 47,000 admissions and more than 74,000 emergency department visits. Located just outside New York City, Valley has earned 13 Disease-Specific Certifications (also known as Gold Seals of Approval®) from The Joint Commission.

## Executive Summary

The Valley Hospital uses MEDITECH's electronic surveillance to monitor patients for signs of infection, comply with quality measures, and improve patient throughput — supporting their mission to deliver high quality healthcare.

One of the greatest successes to come out of the project is a profile for early recognition of sepsis. The surveillance system detects subtle changes in a patient's condition that care teams may miss, alerting clinicians and providing guidance for the timely initiation of sepsis care. The Sepsis Surveillance Board draws their attention to patients who may be deteriorating — even if they are not septic — leading to better outcomes.

In less than a year, MEDITECH's 6.1 Surveillance has earned the Valley organization's confidence for its power and versatility, and the hospital sees no limit to its potential. With 23 surveillance boards in use, including *sepsis, urinary catheter, central line catheter, VTE, and vaccine administration*, Valley is yielding impressive results.

## The Power of Electronic Surveillance



**100% of HIM-coded septic patients** were found by electronic surveillance in March 2016.



**93% of patients** who qualified for sepsis surveillance board were coded with sepsis diagnosis by HIM (6/1/2015 to 5/15/2016).



Improvement in **sepsis 3-hour bundle compliance**.



**78% to 98% increased compliance** in flu vaccine administration rates.



**30 minutes in estimated nursing time saved** by eliminating manual counts of urinary catheters and central lines for CAUTI and CLABSI rates.



**93% VTE prophylaxis compliance rate**, a dramatic improvement from the low 70s.

## Opportunity Identified

Like most healthcare organizations, The Valley Hospital had always struggled with early identification of sepsis, both in the ED and on inpatient floors; physiological evidence of sepsis is often too subtle to detect until after the syndrome has progressed.

Motivated by the Institute for Healthcare Improvement's 100,000 Lives Campaign, Valley's leadership assigned advanced practice nurses (APNs) and quality assessment staff to track specific conditions and evaluate patients. In addition, the organization formed a rapid response team (RRT) 7 years ago to evaluate patients who show signs of clinical deterioration.

When Valley moved forward with their implementation of MEDITECH's 6.1 EHR, the hospital's leadership team recognized the potential for a new electronic surveillance tool in helping clinicians with the early detection of sepsis, and accepted the opportunity to be an early adopter.

Valley collaborated with MEDITECH on the real-time monitoring system, which simultaneously analyzes clinical and demographic data from throughout the EHR to detect subtle changes that clinicians might miss. Using rule logic grounded in evidence-based medicine, Surveillance identifies at-risk patients, automatically alerts care teams within their workflows, and cues providers to take the next step.

## Collaborative Design and Implementation

### *Agile Development*

In keeping with the EHR vendor's agile development methods, MEDITECH worked closely with Valley, seeking their input at every stage in the design of 6.1 Surveillance. For example, Valley and MEDITECH participated in conference calls, webinars, and on-site meetings at the hospital to discuss product requirements. In addition, when coding new features, MEDITECH programmers requested feedback from Valley's IT department, and shared the code with them before rolling out the software. Valley and MEDITECH representatives touched base daily with conference calls after go-LIVE.

### *Governance*

Valley's quality assessment department led the project, with the support of IT and nursing informatics on the building of rules and surveillance profiles. In addition, the RRT provided input on qualifying criteria. Engaging nurse leaders in defining workflows was critical, as nurse managers and unit-based APNs monitor surveillance boards, while staff nurses are alerted via indicators that populate their status boards. After electronic surveillance had been operational for a few months, APNs were assigned primary responsibility for their units' surveillance boards.

The hospital established a quality/informatics group, which consists of representatives from quality assessment and nursing informatics. This team meets every other week and is responsible for determining whether a surveillance profile is warranted, prioritizing the development of profiles, and educating staff on electronic surveillance.

### *Valley's Sepsis Profiles*

When both teams were satisfied with the software's stability, Valley started developing the complex rules required to create the sepsis profile.

The hospital uses vital signs and lab results to determine if a patient qualifies for the sepsis profiles. Within the EHR, these values are aggregated and fed to sepsis screening algorithms built with sophisticated rules and calculations based on a series of checks. A patient with three vital signs out of range or two vital signs and one lab result out of range within the last 24 hours will qualify for the Sepsis Surveillance Board.

Valley uses identical Systemic Inflammatory Response Syndrome (SIRS) criteria for their adult inpatient and adult ED sepsis profiles. However, if the patient presents at the ED and a chief complaint of "sepsis, suspected" is entered, the patient

automatically qualifies for the board. To track patients who qualify in the ED, the sepsis indicator remains on the patient's account throughout the hospital stay, until he or she is discharged.

After going LIVE with the Sepsis Surveillance Board, Valley fine-tuned its qualifying criteria to improve accuracy. For example, when the profile was initially built, any lactic acid out of range was a qualifying criterion — even if the lactic acid result was from five days ago. The profile was tweaked so that the lactic acid result must be within 24 hours. After the release of the qSOFA guidelines in February 2016, Valley adjusted respirations and blood pressure values from 20/min to 22/min and <90 mmHg to <100 mmHg, respectively.

## The Valley Hospital's Sepsis Screening Algorithm for Adult Inpatient and Adult ED

Qualifying patient has either *3 vital signs* out of range or *2 vital signs and 1 lab result* out of range within 24 hours, or an ED chief complaint of "sepsis, suspected."

### Vital Signs

Heart rate > 90 bpm

Oxygen saturation by pulse oximetry < 93%

Respiratory rate > 22/min

Blood pressure < 100 mmHg or delta change of 40 mmHg

Temperature < 96.8 or > 100.9 F

### Lab Results Within the Last 24 Hours

WBC > 12,000

Lactic acid >2 mmol/L

### Exclusions

ED/inpatients/observation patients will not qualify regardless of the above if:

- Age is < 18
- Length of stay is >120 days

*Note: Patient is removed from board upon discharge.*

### Validate, Validate, Validate

In the test system, Valley entered into the sepsis profile a series of vital signs and lab values that they knew would either qualify or disqualify test patients for the board. They also performed blind testing, having clinicians enter real-life patient scenarios based on their own experiences identifying sepsis, without knowledge of the profile criteria. Blind testing helped IT to confirm that the profile was indeed catching these patients. Using the test environment allowed Valley to fine-tune the algorithm and validate that the rule logic was accurately populating the board. When the surveillance board passed this litmus test, IT staff built the profile in the LIVE system.

Because electronic surveillance functions in the background of the MEDITECH EHR, Valley set up the sepsis profile to run in the LIVE environment, but without pushing it to end users. This proved to be fertile ground for validation testing. Valley

allowed the board to run in the LIVE environment for a minimum of two weeks, during which patients qualified for the profile. IT staff and clinical analysts looked at how many times patients populated the board and checked that each occurrence was relevant. Their review consisted of checking each patient value and verifying that they did indeed meet the sepsis risk criteria.

Whenever new sepsis guidelines are released, Valley's Quality/Informatics Surveillance Team will work with other clinicians to adjust the values for the sepsis profile.

### ***Confidence Is Key***

Thorough testing of the Sepsis Surveillance Board was crucial to Valley's success. If staff were to locate a patient who was not caught by the sepsis board, the lapse would undermine their faith in the system. Valley's confidence in electronic surveillance soared a few months after go-LIVE, when the IT team compared lists of patients identified by the RRT and bedside nurses to patients populating the Sepsis Surveillance Board. The comparison revealed that the surveillance board was identifying patients whom the RRT and nurses were missing.

### ***Soft Rollout of a Surveillance Board***

Valley Hospital strategically rolled out their Sepsis Surveillance Board. Several months after their 6.1 go-LIVE, IT staff worked through nursing leadership to understand where the boards would fit best, targeting certain end users in order to build confidence in the new initiative. For example, some bedside nurses were given access to the sepsis board to see how it correlated with the sepsis indicators generated on the trackers and status boards.

This limited rollout piqued interest among the nurses and created a buzz, prompting them to request access from their managers. Staff quickly recognized the board as a powerful, real-time tool for the early detection of sepsis, not an additional task that needed to be performed; in fact, the surveillance board does the calculating and monitoring for them. Floor nurses are now requesting access to surveillance boards for other conditions.

Nursing buy-in has been instrumental to Valley's success, as the hospital relies on their assistance to monitor the board. Although RRT nurses manage the board Monday to Friday, from 8 a.m. – 4:30 p.m., the critical care charge nurse monitors the sepsis board for the entire hospital during the off-hours.

## **How Surveillance Boards Help Clinicians**

### ***Fully Automated Sepsis Surveillance Board***

The Sepsis Surveillance Board is designed to dynamically monitor EHR data in real time, regardless of where it is documented. It identifies pertinent vital signs and lab values within a defined range and runs these data elements through the sepsis algorithm's rule logic to determine if a patient qualifies as being septic. This automated process — done in a matter of seconds — is capable of identifying subtle clinical changes in vital signs or lab values that may not be significant independently, but when combined represent a sepsis risk. These changes could easily be missed by a clinician; early detection of sepsis is a critical factor in improving chances of a positive patient outcome.

MEDITECH's seamless integration embeds data collection and alerting directly into the clinician's workflow. Because the data monitoring and evaluation occurs behind the scenes, there is no need to log into a separate system to view data or run a report. Everybody is looking at and basing their clinical decisions on the same information, which is a significant advantage of standardization.

If the patient meets the criteria for sepsis, the board immediately initiates system-wide alerts to status boards and trackers, and to the quality management team. Valley also set up their sepsis surveillance profile to automatically generate an email to the paging system. A page including the patient's room and bed number, as well as a "sepsis code," is sent to the RRT.

From 7 a.m. – 7 p.m. daily, an RRT member proceeds to the location and performs a full assessment of the patient. (If the page is sent during the RRT’s off-hours, the ICU charge nurse responds.) At the bedside, the RRT member — always an RN — is able to access the sepsis surveillance profile and initiate interventions, orders, and other actions directly from the profile screen. These orders and interventions are based on the Surviving Sepsis Campaign’s 3-hour bundle.<sup>1</sup>

The RRT documents the assessment and encounter to provide context for the situation and the patient’s condition, including the following:

- Reason for the call
- Time arrived in the room
- Whether or not the patient is indeed at risk for sepsis
- Action taken.

The assessment also captures whether the call was triggered from the Sepsis Surveillance Board, allowing Valley to run quality reports that measure the profile’s effectiveness.



### Adult Sepsis RRT Documentation

Time Start									
Critical Care Discharge	<input type="radio"/> Yes <input type="radio"/> No								
Post Code	<input type="radio"/> Yes <input type="radio"/> No								
Post RRT	<input type="radio"/> Yes <input type="radio"/> No								
RN Requested	<input type="radio"/> Yes <input type="radio"/> No								
Reevaluation	<input type="radio"/> Yes <input type="radio"/> No								
Sepsis Surveillance Board	<input type="radio"/> Yes <input type="radio"/> No								
Reason on Sepsis Surveillance Board	<input type="radio"/> All <table border="0"> <tr> <td><input type="checkbox"/> Heart Rate</td> <td><input type="checkbox"/> Oxygen Saturation</td> </tr> <tr> <td><input type="checkbox"/> Blood Pressure</td> <td><input type="checkbox"/> WBC</td> </tr> <tr> <td><input type="checkbox"/> Respiratory Rate</td> <td><input type="checkbox"/> Lactic Acid Level</td> </tr> <tr> <td><input type="checkbox"/> Temperature</td> <td></td> </tr> </table>	<input type="checkbox"/> Heart Rate	<input type="checkbox"/> Oxygen Saturation	<input type="checkbox"/> Blood Pressure	<input type="checkbox"/> WBC	<input type="checkbox"/> Respiratory Rate	<input type="checkbox"/> Lactic Acid Level	<input type="checkbox"/> Temperature	
<input type="checkbox"/> Heart Rate	<input type="checkbox"/> Oxygen Saturation								
<input type="checkbox"/> Blood Pressure	<input type="checkbox"/> WBC								
<input type="checkbox"/> Respiratory Rate	<input type="checkbox"/> Lactic Acid Level								
<input type="checkbox"/> Temperature									
Action Taken	<input type="radio"/> All <table border="0"> <tr> <td><input type="checkbox"/> Reviewed Pt Status with Primary RN</td> </tr> <tr> <td><input type="checkbox"/> Repeat Vital Signs</td> </tr> <tr> <td><input type="checkbox"/> Call House LIP for Lactic Acid Level Order</td> </tr> <tr> <td><input type="checkbox"/> Recommend Reassessment as Indicated</td> </tr> <tr> <td><input type="checkbox"/> Activate RRT</td> </tr> <tr> <td><input type="checkbox"/> Transfer to Higher Level of Care</td> </tr> </table>	<input type="checkbox"/> Reviewed Pt Status with Primary RN	<input type="checkbox"/> Repeat Vital Signs	<input type="checkbox"/> Call House LIP for Lactic Acid Level Order	<input type="checkbox"/> Recommend Reassessment as Indicated	<input type="checkbox"/> Activate RRT	<input type="checkbox"/> Transfer to Higher Level of Care		
<input type="checkbox"/> Reviewed Pt Status with Primary RN									
<input type="checkbox"/> Repeat Vital Signs									
<input type="checkbox"/> Call House LIP for Lactic Acid Level Order									
<input type="checkbox"/> Recommend Reassessment as Indicated									
<input type="checkbox"/> Activate RRT									
<input type="checkbox"/> Transfer to Higher Level of Care									
Time End									
Return Visit Needed	<input type="radio"/> Yes <input type="radio"/> No								

After the RRT evaluates the patient and takes action, the patient will remain on the Sepsis Surveillance Board until he or she no longer meets the criteria. The RRT continues to monitor the patient and may perform multiple assessments during this critical time.

If the RRT determines that a patient is not septic or that there are legitimate reasons for not monitoring a patient, the clinician can remove the patient from an individual board or define a timeframe for the patient to be reevaluated. For example, the RRT may determine that a patient in the ICU is already being closely watched and pause the surveillance monitoring for 8 hours.

The surveillance system also triggers an indicator that displays on ED trackers and on nursing, physician, and surgical status boards, alerting staff that the patient is at risk for sepsis. Clinicians can then select the sepsis indicator directly from the status board.

<sup>1</sup> Surviving Sepsis Campaign: <http://www.survivingsepsis.org/Bundles/Pages/default.aspx>



## Patient Care System Status Board — Surveillance Sepsis Risk Indicator

PCS Status Board - HIM Dept: AHIM (STDUNV/614.SCF/614.USEF) - Smith, Betty [EDT]  
 Dept: **Nursing** Site: **Main**

6 Patients

Rm/Bed	Patient	A/S	Acknow	New Results	Surveillance	Next Int
300-B	Doe, Jane	86 F	Stat		Sepsis Risk	15:00 Vital Signs 16:19 Central venous monitoring 16:43 Activity as ordered 16:43 Assess feeding method and intake 11:00 Measure central venous pressure (CVP) 11:30 Measure intake and output 16:43 Activity as ordered 16:00 Assess feeding method 16:43 Intake and Output 16:43 Teaching Record 16:43 Activity as ordered 16:43 Vital Signs
301-A	Public, Jane Q.	39 F	Stat	Chemistry	CAUTI Risk	
301-B	Doe, John	25 F	Ack-Med			
302-A	Public, John Q.	33 M				
302-B	Jones, Jane	75 F	Ack	Chemistry Hematology	Sepsis Risk	
303-A	Smith, Joe	67 M				

Refresh Remove from My List Edit My List Close All Charts All Show Empty Beds

Note: This image is from a MEDITECH demonstration ring. No real patient data was used in this example.

Selecting the indicator brings clinicians to the profile criteria screen, where they can view the date and time the patient qualified for the sepsis profile, as well as clinical decision support text summarizing the sepsis algorithm and action plan. The screen also displays the patient-specific qualifying values, and allows clinicians to send a real-time message to the RRT.

### Profile Criteria Screen

Profile Qualified 06/04/16 13:25

**Adult Sepsis**

**Sepsis Alert/Action Plan**  
 Patients will qualify with 3 vitals or 2 vitals and 1 lab result that are out of the below range  
 Heart Rate > 90  
 O2, sat by Pulse Oximetry < 93  
 Respiration > 22  
 Blood Pressure < 100 OR Delta Change of 40  
 Temperature < 96.8 OR > 100.9  
 WBC > 12  
 Lactic Acid > 2  
 \*\* PLEASE SCROLL DOWN TO SEE ACTION PLAN >>

**Take Action**  
 Rapid Response Team Note

**Qualifying Values**

Age Current	29
Reg Status	ADM
O2 Sat by Pulse Oxim...	98
Blood Pressure	120/80
Pulse Rate	100
Respiratory Rate	26
Temperature Conversi...	104

Note: This image is from a test ring. No patient data was used in this example.

From a quality perspective, Valley's quality assurance department reviews every case of sepsis and is working on standardizing practice for treatment.

**Keeping an Eye on the Data**

Valley has built public trackers that auto scroll and flip back and forth, displaying patients’ statuses on a variety of conditions such as sepsis. The hospital is in the process of installing television monitors to show the public boards in break rooms and nurses’ stations, so staff can easily stay on top of critical information.

**Public Status Board**

Location - Cardiac- 2A										
23 patients as of 06/05/16 10:33										
Room/Bed	Name	Sepsis	VTE	SCIP	Vac	UC	CL	STK	DM	COPD
201-P	Test,On									
202-P	Test,Tw	Sepsis								
203-P	Test,Th		VTE							COPD
204-P	Test,Fo	Sepsis								
205-P	Test,Fi		VTE						DM	
206-P	Test,Si				Pneu				DM	

*Note: This image is from a test ring. No patient data was used in this example.*

**Surveillance Shines Light on Documentation Processes**

Implementing a Sepsis Surveillance Board enabled Valley’s IT department to identify clinical documentation inefficiencies that otherwise may have gone unnoticed.

For the surveillance board to accurately reflect sepsis risk hospital-wide, data must be entered in real time; the board is only as good as the data it processes. Nurses and other clinicians must adhere to best practice protocols and document in a timely manner. Valley realized the importance of timely documentation when a nurse jotted down vital signs on a piece of paper and entered the values into the system later in the shift. The “back timing” of documentation impeded the surveillance board from accurately detecting the patient as soon as the signs of sepsis emerged.

The board has also proven to be effective for identifying duplicate documentation practices and streamlining where data is documented. Because one query may be documented in multiple places throughout nursing and ancillary assessments, the board highlights these instances and allows Valley to evaluate where each data element is captured. MEDITECH’s audit trail reports have proved helpful in this process.

The surveillance board is a positive reminder of the power of multidisciplinary documentation. As the sepsis algorithm monitors the EHR for the latest vital signs, it does not look at a specific nursing assessment, but at the vital sign queries that are documented in multiple places by multiple disciplines. For example, a nurse questioned the validity of a patient on the sepsis board, as she knew she hadn’t yet documented his vital signs. In researching where the values came from, the IT staff determined that a respiratory therapist had entered the patient’s qualifying vital signs in an RT assessment. The board detected the patient’s changing condition prior to the nurse taking his vital signs, leading to early recognition and early intervention.

## Results Across the Board

The Sepsis Surveillance Board has been instrumental in the early identification of patients who may be septic. Valley compared a list of septic patients identified by the board versus those identified by the bedside nurse; the hospital learned that electronic surveillance caught patients whom the nurses were not catching. The board's reliability boosted organizational confidence. In addition, the hospital compared patients coded with the sepsis diagnosis by health information management to patients detected by surveillance, revealing that 93 percent of patients qualified for the board; Valley has not found any septic patients that were missed by electronic surveillance.

From a treatment perspective, Valley implemented the Surviving Sepsis Campaign 3-hour bundles in the summer of 2015, to prepare for the new CMS SEP-1 Early Management Bundle, Severe Sepsis/Septic Shock measure, effective October 1, 2015. As sepsis data prior to this date was not standardized, Valley was unable to quantify their results. They now have the data in place to measure outcomes; initial results are promising, as improvements have already been seen in 3-hour bundle compliance.

Valley has seen significant value in implementing surveillance boards for identifying other infections and tracking quality measures.

- **Vaccine Administration Board** finds patients who qualify for the flu vaccine. Compliance rates jumped from **78% to 98%**, higher than the Joint Commission standard. The board was a “quick win” for staff.
- **VTE Prophylaxis Board** determines which patients require VTE prophylaxis. By combining the board's power with reminder calls to physicians from quality assurance nurses, compliance has increased from the low 70s to approximately 93 percent.
- **Urinary Catheter and Central Line Catheter Surveillance Boards** prompt nurses to document and confirm the necessity of patients' catheters and lines. The boards saved nurses an estimated 30 minutes in rounding time by eliminating the need to manually count catheters and central lines for CAUTI and CLABSI rates.
- **Disease Management Profiles** (stroke, diabetes, and COPD) save substantial amounts of staffing time with patient identification and data retrieval.

Recognizing the tool's power and versatility, they have even implemented boards for administrative and financial purposes in the emergency department.

- **ED Copayment** surveillance profile pushes an indicator to the ED Tracker displaying whether or not the registrar *requested* the patient's copayment. The patient cannot be discharged if the required question has not been asked. A green “\$” indicates the registrar requested payment while a red “\$” indicates the registrar did not request payment, making it easy for staff to attempt to collect from patients and curb lost revenue.
- **ED Patient Transport Board** informs transport staff that an admitted ED patient is ready to be brought to the floor, improving ED throughput. Once the nurse documents that the patient is ready, an indicator displays on the board.



## “Why would you not use it?”

Surveillance has emerged as the Valley IT department’s first choice for hospital-wide problem solving. More than a tool for clinical condition identification, it demonstrates endless potential for monitoring and evaluating data, whether event- or patient-based, broad or narrow. Clinicians are especially excited about the possibilities, and have confidence that Surveillance helps them to identify conditions, provides them with the relevant data, and expedites ordering to initiate treatment sooner.

Valley believes that every hospital needs to implement Surveillance. Surveillance directs clinicians to the information that is important, in real time; rather than searching for data in the EHR, staff act on the data *pushed from* the EHR — giving them more time to focus on patients.

### **Next Steps**

Valley’s next surveillance initiative, recommended by their Performance Improvement Committee, is to pilot a board on an oversized, wall-mounted monitor in the cardiac unit. The board will be used during rounding and at the 5-minute “circle-ups” when doctors and nurses gather to discuss priority issues, to ensure real-time data and alerting is referenced during these key decision-making time periods.

With 23 boards and counting, Valley has realized the versatility of surveillance boards and is discovering uses beyond the diagnostic. For example, Valley plans to use the boards for population health purposes, to identify and monitor ACO patients.

“Why wouldn’t you want to free staff from performing repetitive tasks or surveilling patient information, when the EHR can accomplish those same functions faster and more easily?”

Chris Neumann, Project Specialist  
Valley Health System