WMC Health | Westchester Medical Center

Westchester Medical Center Health Network

BUSINESS TRANSFORMATION & OPERATIONAL EXCELLENCE AWARDS

2019 Award Application

Utilizing eHealth to Optimize Adherence to Consensus Best Practice Therapies:

Making Sure Every Patient Is As Safe As Possible

WMCHealth BACKGROUND

Located in Valhalla, New York, Westchester Medical Center is the Hudson Valley region's advanced medical care and referral hospital, serving more than 3.5 million people. Each year, more than 120,000 patients receive care at Westchester Medical Center in every clinical specialty through our main hospital, our Maria Fareri Children's Hospital – the only all-specialty children's hospital in the region - and our Behavioral Health Center.

Spanning every adult and pediatric medical specialty Westchester Medical Center (WMC), the 895-bed regional medical system serving New York's Hudson Valley region and beyond, encompassing a regional academic medical center, children's hospital, community hospital, two inpatient behavioral health centers, homecare and numerous outpatient health and related services serves as a lifeline to the more than 3.5 million people in the Hudson Valley region and beyond.

Westchester Medical Center has the highest case-mix index in the U.S., caring for the most severely ill or injured patients in the nation. And as such, WMC places a strong focus on delivering the most advanced services in the region and identifying clinical and operational improvements to help transform the delivery of care. In October of 2015, WMCHealth unveiled a technology-driven eHealth program. The eHealth program represents an initial $7 million investment in technology, infrastructure, staff and additional resources in the well-being of Hudson Valley residents by WMCHealth. It was the first telehealth program of its kind based in the Hudson Valley.

SYNOPSIS

At the core of WMCHealth's eHealth initiative is the network's 5,500-square-foot eHealth operations center, which features 20 multimedia stations equipped with the latest telehealth patient monitoring technologies and software. This hub is staffed 24-7 by highly-trained physicians, nurses and other healthcare professionals who will serve, remotely, as a complement to – and not a replacement for - the dedicated care teams for WMCHealth patients in network hospitals, nursing homes, physician offices and, eventually, homes across the region.

Using the eHealth Center's state-of-the-art, telehealth technology expertly-trained medical staff are able to accurately monitor patients in this centralized location. Vital signs, medications, blood test results, X-rays and other pertinent information from bedside monitors is sent to the eHealth control center by secure, high-speed data lines. These electronic ICU (eICU) patients will be monitored through the use of special, two-way video cameras which allow the eHealth team to consult directly with bedside doctors, nurses, family members and patients.

Since its inception, the eHealth center has focused on identifying opportunities to promote better patient outcomes and improve operational efficiencies through the identification, implementation and adherence to best practices. Two such initiatives that have had a direct impact on patient outcomes are outlined in this application. The first Project discusses the impact of utilizing the eICU to implement best practices to help reduce stress ulcer prophylaxis. The second project discusses the impact of utilizing the eICU to implement and maintain compliance in lung protective ventilation.

OVERVIEW – PROJECT 1

Mechanical ventilation is often necessary to support the respiratory system of critically ill patients. While often necessary and potentially life-saving, positive pressure mechanical ventilation is also well known to be injurious to the human lung through several mechanisms (barotrauma, volutrauma, atelectrauma and biotrauma).[1] There is clear evidence that patients with acute lung injury (Acute Respiratory Distress Syndrome (ARDS)) benefit from mechanical ventilation settings aimed at limiting ventilator induced lung injury (VILI). A landmark study published in 2000 by the ARDSnet consortium achieved an impressive 9% absolute mortality reduction by using a lung protective ventilation (LPV) strategy consisting of (1) low tidal volumes and (2) limited plateau pressures.[2] Despite the strong evidence supporting the value of LPV, adherence to LPV strategies remains variable.[3,4] Current guidelines have expanded the evidence base on LPV strategies, but have upheld the original LPV parameters.[5] There is growing consensus that limiting injurious ventilator settings Is also beneficial in patients who do not meet diagnostic criteria for ARDS.[6,7] In addition to the impressive reduction in mortality, LPV also reduces time on mechanical ventilation and thereby indirectly decreases complication rates associated with duration of mechanical ventilation.[2]

OBJECTIVES & METHODS

We aimed to:

1. Characterize the compliance with LPV for all Adult Intensive Care Units (ICUs) at Westchester Medical Center (Trauma-ICU, Surgical ICU, Cardiac ICU, Cardiothoracic ICU, Medical ICU, Neuroscience ICU, Burn ICU) and MidHudson Regional Medical Center (mixed medical surgical ICU) (baseline data);

2. Share this data with all stakeholders of the individual ICUs and WMCHealth Network;

3. Identify room for improvement and jointly develop centralized eICU based eICU-to-ICU interventions to increase compliance with LPV;

4. Monitor and review ongoing compliance with LPV on a quarterly basis;

5. Modify the existing LPV algorithm based on new scientific evidence.

All arterial blood gas (ABG) sample results were imported from the clinical reporting software (A2K) into the eICU software (eCare Manager Version 4.1). Oxygenation ratios were calculated based on arterial oxygen tension (PaO2) and the associated inspired oxygen fraction (FiO2) (PaO2/FiO2). Patients were categorized as meeting ARDS criteria for oxygenation ratios of <300mmHg and as non-ARDS for oxygenation ratios of >300mmHg.

We defined a safety goal for ARDS patients of >75% of ABGs with tidal volumes <7.5ml/kg Ideal Body Weight (IBW) and for non-ARDS patients of >95% of ABGs with tidal volumes <10ml/kg IBW. Data trends for LPV ventilator compliance over time were presented on a quarterly basis in the context of comprehensive performance reviews with the stakeholders of all individual ICUs as well as the system.

To effectively and intuitively present the data, a matrix was generated plotting % of ABG-associated tidal volumes in ARDS patients (x axis) vs non-ARDS patients (y axis) (see *Figure 1*). After the baseline data was collected, the eICU team developed the following collaborative workflow to increase LPV compliance:

- The RN/MD team in the eICU identifies patients with con-compliant tidal volume settings based on entered and observed P/F ratios, TV and/or plateau pressures.
- The eICU intensivist communicates directly with the bedside team to recommend specific changes to ventilator settings to reach LPV compliance.
- The eICU team follows up every 12 hours to monitor LPV compliance. Exceptions to standard LPV settings were accepted if clinically indicated as per discretion of the treating bedside attending physician.

CONCLUSIONS

- Lung Protective Ventilation (LPV) strategies contribute significantly to the safety and clinical outcomes of patients in need for mechanical ventilation.
- Systematic monitoring of LPV parameters by the eICU staff and collaborative discussion and adjustment of LPV parameters through eICU-to-ICU interactions can significantly improve LPV adherence.
- Periodic performance reviews reinforce the workflow and collaboration to optimize LPV adherence.
- The structured performance reviews utilize visualization tools like MotionCharts to effectively and intuitively display the relevant performance metrics and changes in these metrics over time and enable anonymized comparison of different ICUs to each other to motivate the eICU and bedside multidisciplinary provider teams to continuously improve LPV adherence.

OVERVIEW – PROJECT 2

Stress ulcer prophylaxis is indicated for acutely critically ill patients who are mechanically ventilated for >24hrs (NEJM 1994 330:377), who are coagulopathic (NEJM 1994 330:377), have suffered traumatic brain injury (J Trauma 1995 39:289; Dig Sci 1995 40:645) or burns (Crit Care 2013 17:241; Am J Health Syst Pharm 1999 56:347). Stress related mucosal disease is found in 75-100% of ICU patients (Crit Care Med 2010 38:1197). Stress ulcer bleeding occurs in approximately 1-2.6% of ICU patients (J Crit Care 2014 29:696; Best Pract Res Clin Gastroenterol 2003 17:327) with an associated mortality of 40-50% (NEJM 1994 330:377; Nat Rev Gastroenterol Hepatol 2015 12:98). Stress ulcer prophylaxis reduces the bleeding risk by 59% (Intensive Care Med 2014 40:11). Accepted pharmacologic prophylaxis consists of either proton pump inhibitors, histamin-2 blockers, sucralfate or antacids.

All critically ill patients are considered high risk for VTE (CHEST 2011 140:706). Venous thromboembolism prophylaxis in critically ill patients is therefore indicated unless patients are either ambulatory or have a focus on comfort only measures. Prophylaxis can be either mechanical (sequential compression devices) or pharmacological (low molecular weight heparin, unfractionated heparin, Factor Xa inhibitors, Direct Thrombin inhibitors).

OBJECTIVES & METHODS

We aimed to:

1. Characterize the compliance with stress ulcer prophylaxis (SUP) and Venous Thromboembolism (VTE) prophylaxis for qualifying patients for Adult Intensive Care Units (ICUs) at Westchester Medical Center

(Trauma-ICU, Surgical ICU, Cardiac ICU, Cardiothoracic ICU, Medical ICU, Neuroscience ICU, Burn ICU) and MidHudson Regional Medical Center (mixed medical surgical ICU) (baseline data);

2. Share this data with all stakeholders of the individual ICUs and WMCHealth Network;

3. Identify room for improvement and jointly develop centralized eICU based eICU-to-ICU interventions to increase compliance with these best practices;

4. Monitor and review ongoing compliance with best practices on a quarterly basis;

5. Modify the existing Best Practice algorithm based on new scientific evidence.

All eligible therapies for SUP and VTE prophylaxis (see above) were imported from the clinical reporting softare (A2K) into the eICU software (eCare Manager Version 4.1). Patients were categorized as qualifying for SUP and/or VTE prophylaxis based on their clinical status (see above).

We defined a safety goal for SUP and VTE prophylaxis of at least 95% of eligible patients receiving the corresponding therapies. Baseline compliance data were collected for month 1 and 3 and reviewed and discussed with each ICU. A collaborative eICU-to-ICU intervention was agreed on and implemented. Post implementation data was collected and presented on a quarterly basis in the context of comprehensive performance reviews with the stakeholders of all individual ICUs as well as the system.

To effectively and intuitively present the data, a matrix was generated plotting % of appropriate stress ulcer prophylaxis (SUP) (y axis) against % of appropriate Venous Thromboembolism (VTE) prophylaxis (x axis) (see Figure 2).

After the baseline data was collected, the eICU team developed the following collaborative workflow to increase Best Practice compliance:

The RN/MD team in the eICU identifies patients with missing SUP or VTE prophylaxis every 12 hours and sends a report to each ICU every 12 hours. In addition the eICU intensivist will communicate with the bedside team and discuss all cases of missing best practices to recommend specific changes to best practice therapies to reach compliance.

The eICU team follows up every 12 hours to monitor for new indications and ensure ongoing compliance. Exceptions to standard best practices were accepted if clinically indicated as per discretion of the treating bedside attending physician.

CONCLUSIONS

Consensus Best Practice Adherence contributes significantly to the safety and clinical outcomes of patients that meet consensus criteria to receive stress ulcer prophylaxis (SUP) and/or Venous Thromboembolism (VTE) prophylaxis.

Systematic monitoring of best practice adherence by the eICU staff and collaborative discussion and adjustment of best practice therapies through eICU-to-ICU interactions can significantly improve best practice adherence.

Periodic performance reviews reinforce the workflow and eICU-to-ICU collaboration to achieve and sustain this effect.

The structured performance reviews utilize visualization tools like MotionCharts to effectively and intuitively display the relevant performance metrics and changes in these metrics over time and enable anonymized comparison of different ICUs to each other to motivate the eICU and bedside multidisciplinary provider teams to sustainably ensure appropriate use of these prophylactic therapies important to patient safety.

As per 2017 Q3 data, Westchester Medical Center ranked first in Composite Best Practice Compliance nationally when compared to all other eICU supported tertiary/ quaternary academic teaching hospital systems in the US (see Figure 3). “Composite Best Practices” in addition to SUP and VTE prophylaxis also includes ARDSnet ventilation adherence, glycemic control and Blood Transfusion Threshold Adherence.

Figure 1: Improving Adherence to Lung Protective Mechanical Ventilation Parameters through eICU-to-ICU Collaboration

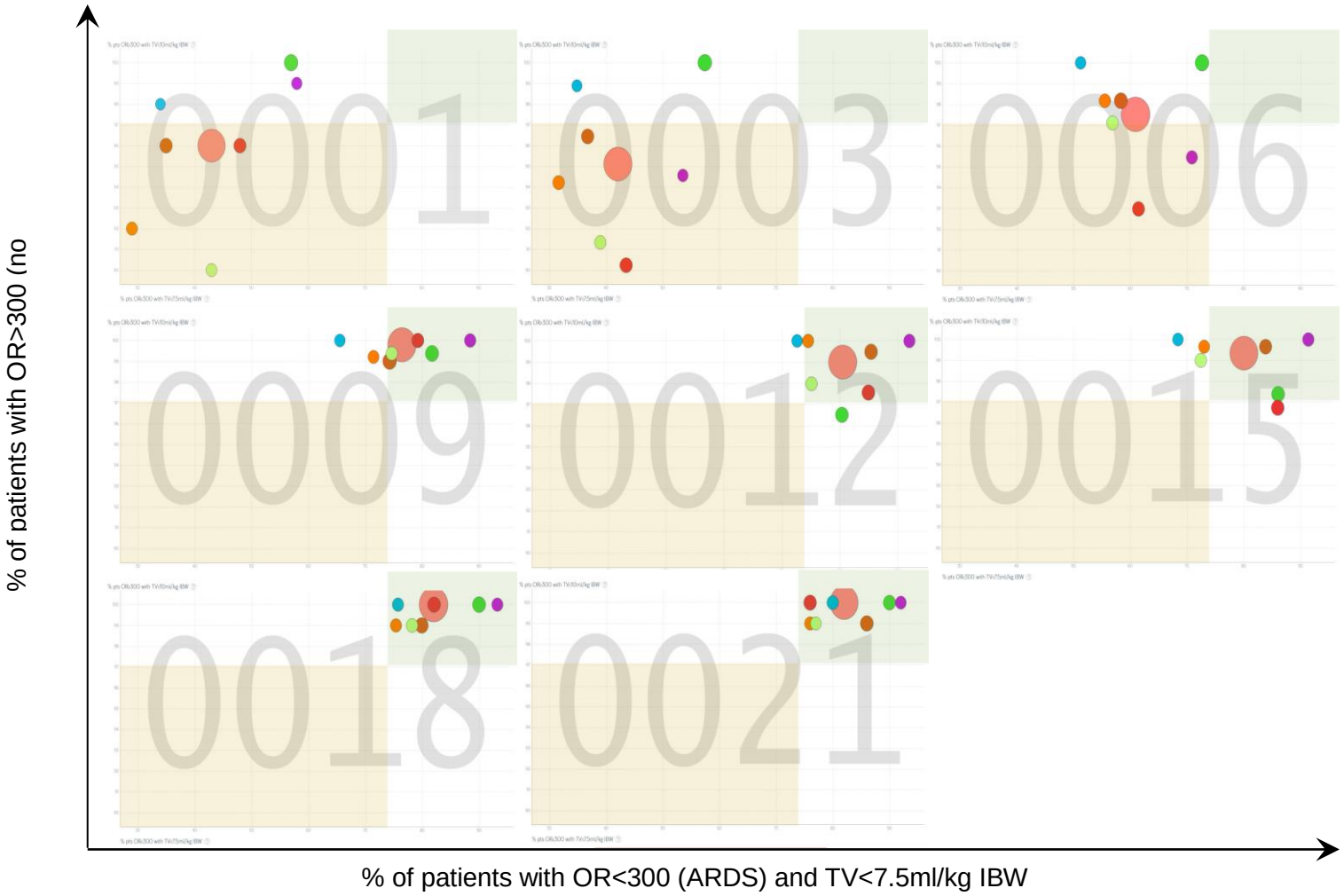

Figure 1: Depicted are 8 snapshots of the ARDSnet Lung Protective Ventilation Motionchart (month 1, 3 and 6 (upper row), month 9,12,15 (middle row) and month 18 and 21 (lower row). The month is indicated by the large number displayed in the background of each chart. Each ICU is represented as an individually colored dot. The size of the dot corresponds to the number of patients admitted in the quarter. The x axis depicts the % of patients with OR<300 who are receiving low tidal volume ventilation with TV<7.5ml/kg IBW. The y axis depicts the % of patients without ARDS who are receiving Tidal Volumes of <10ml/kg IBW. ICUs which ventilate both ARDS and non-ARDS patients with lung protective settings will be located in the green quadrant. ICUs which fall short in one of the two patient populations will be located in the white areas of the plot, whereas ICUs which fall short of the goal in both ARDS and non-ARDS patients will be located in the red quadrants. The motionchart enables to intuitively visualize the performance over time of each individual ICU and the healthcare system ICUs as a whole (largest dot). The month 1 and 3 graphs (upper left and upper middle) show the baseline distribution of ICUs before any interventions were done. Months 6 through 21 show the effect of the eICU-to-ICU collaborative intervention as described in the Methods section. Performance reviews were held with the stakeholders of each individual ICU at the beginning of each quarter (month 4, 7 and 10 for the first year, and month 1, 4, 7 and 10 for the second year). Starting with month 6 the system ICUs start converging towards the LPV compliant quadrant. Note that between month 12 and 15 three ICUs trended in the wrong direction (blue, orange and green). Performance reviews and additional vigilance in the eICU-to-ICU collaboration corrected this trend in the next quarter. The effect was sustained in month 21. All ICUs remain in the LPV compliant quadrant. *Note that the dynamic movement of the motionchart cannot be adequately visualized in print format.*

Figure 2: Best Practice Adherence

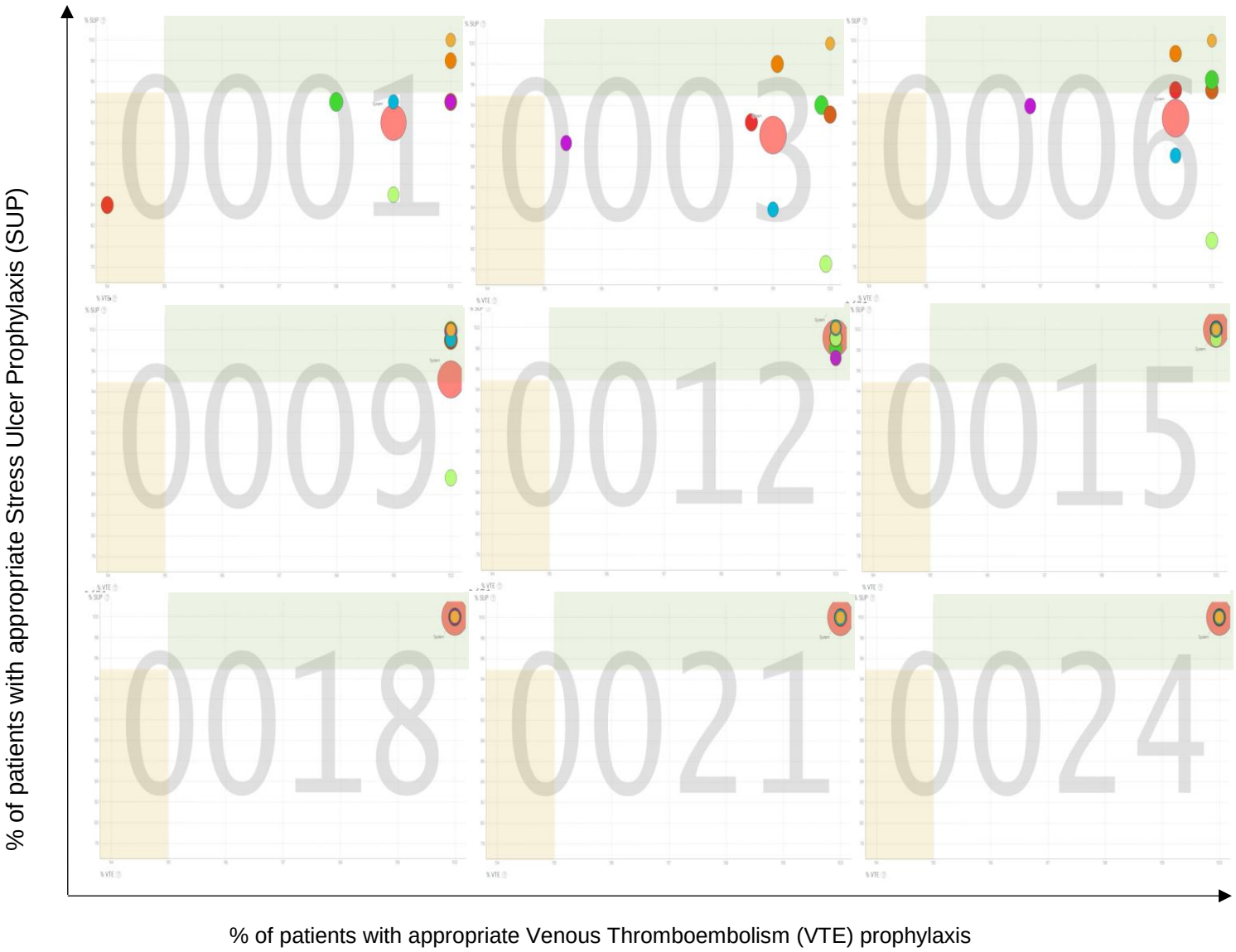

Figure 2: Depicted are 9 snapshots of the Best Practice Motionchart (month 1, 3 and 6 (upper row), month 9,12,15 (middle row) and month 18, 21 and 24 (lower row). The month is indicated by the large number displayed in the chart background. Each ICU is represented as an individually colored dot. The size of the dot corresponds to the number of patients admitted in the quarter. The x axis depicts the % of patients with appropriate venous thromboembolism (VTE) prophylaxis. The y axis depicts the % of patients with appropriate stress ulcer prophylaxis (SUP). ICUs which achieve >95% adherence to these best practices will be located in the green quadrant. ICUs which fall short in one of the two best practices will be located in the white areas of the plot, whereas ICUs which fall short in both SUP and VTE prophylaxis will be located in the red quadrants. The motionchart enables to intuitively visualize the performance over time of each individual ICU and the healthcare system ICUs as a whole (largest dot). It also enables to compare performances across different ICUs in an anonymized fashion. The month 1 and 3 graphs (upper left and upper middle) show the baseline distribution of system ICUs before any safety interventions were done. Months 6 through 24 show the effect of the eICU-to-ICU collaborative intervention as described in the Methods section. Performance reviews were held with the stakeholders of each individual ICU at the beginning of each quarter (month 4, 7 and 10 for the first year, and month 13, 16, 19 and 22 for the second year). Starting with month 6 the system ICUs start converging towards the green quadrant. Note that between months 18 and 24 no further improvement is possible, as all ICUs are superimposed at the 100%/100% mark. Performance reviews and additional vigilance in the eICU-to-ICU collaboration are ongoing to ensure that the effect is sustained. *Note that the dynamic movement of motioncharts cannot be adequately visualized in print format. The snapshot format is used to substitute.*

Figure 3: Composite Best Practice Compliance

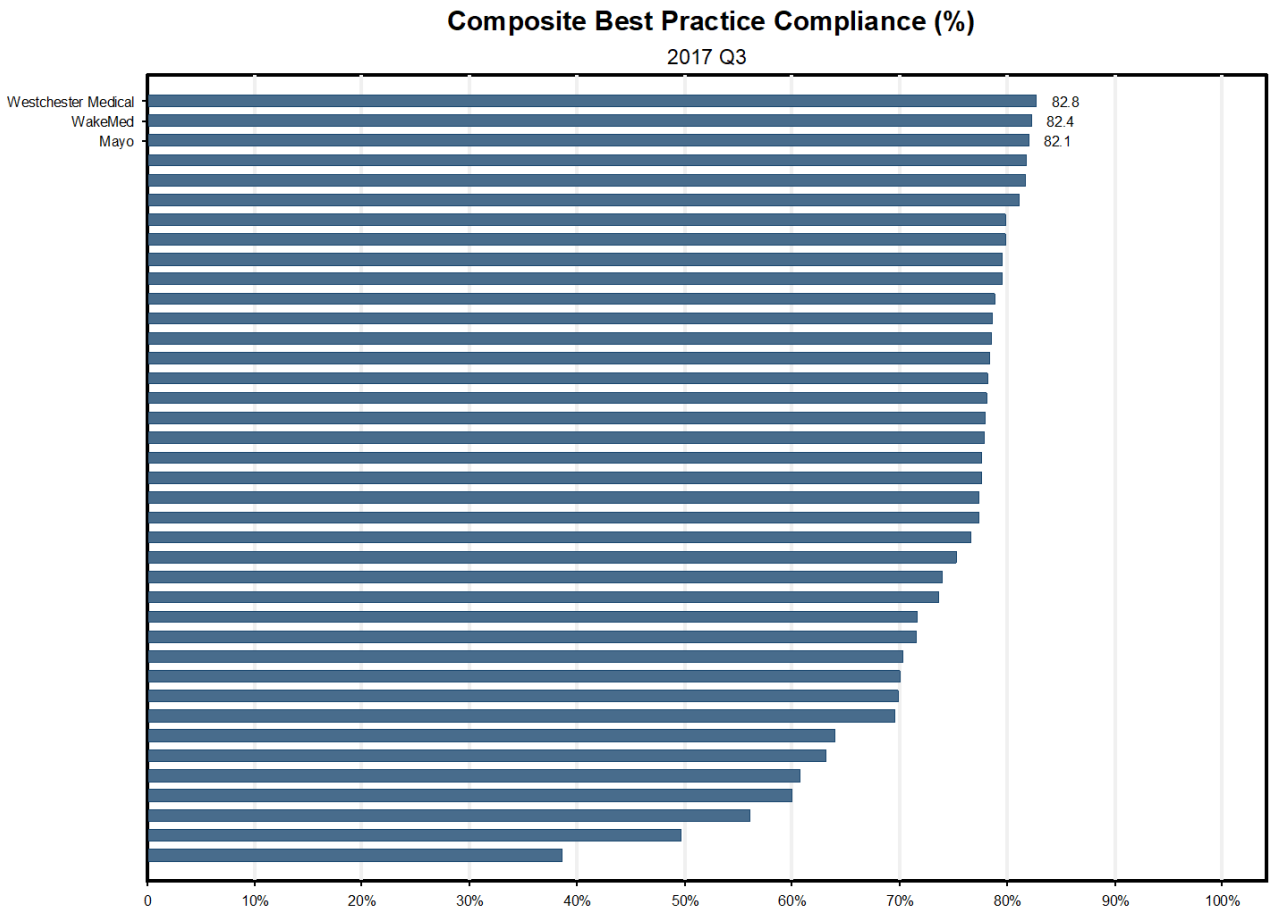

Figure 3: As of 2017 Q3 WMC ranks first in the nation for Composite Best Practices in the ICU (SUP, VTE prophylaxis, Blood Transfusion Thresholds, Glycemic Control, ARDSnet Ventilation Adherence). For this composite metric WMC is compared to all other eICU supported tertiary and quaternary academic teaching hospital systems in the US.