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Tele-ICU

eICU Program Customer Success Stories

How our customers are changing the delivery of healthcare

Customer Success Stories

For further information, please contact:

Philips eICU Program

www.philips.com/enterprisetelehealth

(205) 527-5033

The Challenge

You know the story. Radical shifts in healthcare delivery with changing reimbursement models, an aging population, and a shortage of clinicians means that hospitals must do more with less. In intensive care, this issue is magnified.

Because of the limited supply of intensivists and the cost to attract and retain them, many hospitals find it difficult – even impossible – to staff their ICUs with intensivists on a 24/7/365 basis. This problem is becoming more pervasive as the supply of intensivists is projected to meet only 22% of the demand for services by 2020. In fact, despite compelling evidence that intensivist coverage can significantly reduce mortality in the ICU, today only 47% of hospitals have the recommended intensivist coverage in place.

The Solution

The concept of tele-ICU was born of the need to maximize resources and to prepare for a projected increase in ICU usage in the coming years. In its simplest form, tele-ICU can be described as off-site clinicians who interact with bedside staff to consult on patient care. One centralized care team can manage a large number of geographically dispersed ICU locations, whether they are scattered throughout a single network or are departments within smaller rural institutions.

Tele-ICU programs concentrate clinical resources in remote care centers (central monitoring facilities) and then extend those resources to the bedside via technology, independent of the care center's or hospital's location. With a real-time data-stream of patient information from multiple interfaces and the ability to interact with the bedside staff via A/V conferencing, a physician working from a care center in New York City can rapidly care for a patient in Seattle, day or night. The connectivity inherent in the model enables an already engaged intensivist to promptly intervene and consistently provide care aligned with best-practices.

By leveraging tele-ICU, healthcare organizations can make optimal use of their existing critical care resources, instead of adding additional resources. Numerous studies have demonstrated both the clinical and financial benefits of tele-ICU, and the continuous stream of patient data captured by tele-ICU programs can enable health systems to take a more evidence-based approach to population health.

Philips and Tele-ICU

We are the industry leaders in telehealth. But don't just take our word for it. We have assembled this collection of customer success stories to demonstrate the innovative ways our customers are using eICU to better care for patients around the clock. See what success with eICU looks like and how hospitals and health systems around the country have overcome common healthcare challenges by leveraging the eICU program.

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1. Angus DC, et al. Current and Projected Workforce Requirements for Care of the Critically Ill and Patients with Pulmonary Disease. *JAMA*. 2000 Dec 6; 284(21): 2762-70.

2. Castlight Health, The Leapfrog Group. "Intensive Care Unit Physician Staffing," 2016. http://www.leapfroggroup.org/sites/default/files/Files/Castlight-Leapfrog-ICU-Physician-Staffing-Report-2016.pdf

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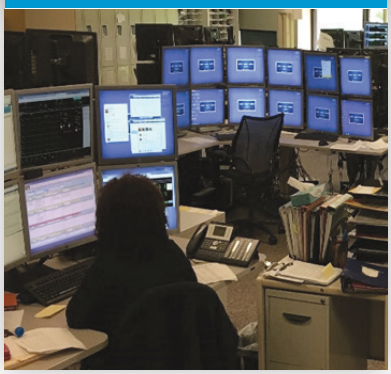
Success Story

Advocate Health Care



Critical Care without Walls

How Advocate Health Care uses its eICU program to provide intensivist care and monitor critical care patients in the Emergency Department

By leveraging Philips eICU program, Advocate Health Care has been able to:

- Improve the quality of care provided to ICU patients in the ED by integrating ICU telehealth
- Achieve clinical and financial benefits across the health system
- Expand on its existing telehealth infrastructure to form an enterprise telehealth system

Advocate Health Care has long been at the forefront of providing innovative solutions to its patients. As home to the first eICU program in Illinois – and now one of the largest eICUs in the country – Advocate has demonstrated the clinical and financial benefits of the transformative telehealth technology. However, what really differentiates Advocate is how it has leveraged the Philips eICU program in pioneering ways, extending the telehealth technology far beyond its original application.

eICU Background

Advocate established its eICU in 2003, long before tele-ICU had become the standard of care that it is today. Even though Advocate already had excellent morbidity and mortality rates, the eICU was seen as a patient safety initiative that would allow the health system to further improve its outcomes. Implementing the eICU across all adult intensive care units (ICUs) ultimately gave Advocate the platform to move towards standardizing care to evidence-based protocols and to leverage the significant critical care expertise and talent across the system.

The eICU leadership initially focused on Advocate's APACHE data and the opportunities for improvement that it demonstrated in areas like ventilator days and ICU length of stay. By demonstrating decreases in these areas, Advocate not only improved patient outcomes, but was also able to save on system expenditures. Additionally, having the eICU allows Advocate to meet The Leapfrog Group's criteria for ICU coverage without the cost of 24/7 onsite intensivists in units that do not have the patient volume to support such coverage. While there were certainly challenges in the beginning for both the bedside and eICU staff, over time, the eICU evolved and Advocate was able to better leverage technology in support of individual ICU initiatives and population-based monitoring. This provided the ICUs with valuable data from which to derive improvement in clinical outcomes.

eCareMobile Carts in the ED

As Advocate's eICU program matured, it demonstrated the value it could bring to other areas within the health system, outside of the ICU. The use of eCareMobile carts in the Emergency Department (ED) is just one example of how Advocate has leveraged the core eICU technology to bring enhanced care throughout the health system.

It started when an elderly patient was admitted to the ED with shortness of breath and a decision was made to admit him to the ICU. While boarding

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As critical care resources are increasingly strained due to growing demand for ICU beds and a lack of intensivists, ICU patients are often either denied ICU admission or placed in alternative subspecialty units. Research indicates that when ICU patients are "boarded" in non-preferred units – such as Emergency Departments or other ICUs – outcomes are worse.[1] A new study conducted by researchers at the University of Pennsylvania suggests that one explanation for these poorer outcomes is that ICU boarders receive less attention from their doctors and other providers. The researchers found that ICU boarders are often seen at the end of rounds and receive less bedside attention from ICU provider teams, possibly due to the inconvenient distance between the home-ICU and boarding ICU, a reduced sense of ownership over the patient by the home-ICU, or the fact that nursing staff in the boarding-ICU might not have the full skill set needed to care for their boarders.[2] The eICU program can help address these issues by bringing the expertise of dedicated, board-certified intensivists to patients 24/7, regardless of their location in a hospital.

in the ED due to lack of ICU bed availability, the patient continued to deteriorate, suffered a cardiac event, and ultimately expired. This led to an analysis of root causes and the conclusion that monitoring ED boarders by leveraging continuous eICU monitoring and technology in that setting could prevent further similar events.

The ED opted to install four carts in February 2015 in order to better monitor ICU overflow patients. Before implementation of the eCareMobile carts, the critical care, ED, and eICU teams spent several months working to develop and improve a workflow specific to triggers for the use of the cart, handovers, and expected interventions for medical ICU patients being boarded in the ED while awaiting a bed.

Working as a team to define workflows that made sense in that environment made adoption of the carts relatively easy. Because the eICU technology was already established and well known across the system, there were few challenges associated with employing the carts and it was mostly a matter of adapting the workflows and leveraging the technology in a different care location. As mock patients were trialed before go-live, the need to improve communication between the bedside clinicians in both the ED and ICU was identified as an opportunity for improvement which was corrected with an interdisciplinary conference call.

Results of the ED and eICU Collaboration

The main advantage of the eCareMobile carts in the ED is that it allows a remote intensivist – located in the eICU center miles away – to monitor patients and provide assessment and interventions in a timely manner from the very beginning of the patient's hospital stay. Beginning ICU care as soon as it is known the patient will await a bed allows for earlier intervention, continuation, and advancement of the established plan of care. This intervention ultimately resulted in no further safety events in the ED for ICU boarding patients.

In the first 15 months of use, about 30% of the patients who were initially identified for admission to the ICU were able to be placed either in a stepdown unit, telemetry bed, or medical bed rather than the ICU. Early care and ongoing monitoring allowed patients to physiologically improve during their time in the ED, resulting in the continuation of care being provided in a more appropriate setting. This avoidance of an ICU stay resulted in $500,000 in avoided costs for the system.[3] Additionally, preliminary analysis of the data demonstrate a reduced hospital length of stay and mortality, and further analysis is underway to risk adjust these results.

Advocate's use of the eCareMobile carts demonstrates how hospitals can leverage the centralized care model developed through eICU program implementation to improve care for patients, even outside of the ICU. Leadership recognized an opportunity where care could be improved via technology, but saw the risks of adding care venue specific telehealth systems. By leveraging Advocate's investment in eICU to support the ED telehealth program, Advocate was able to build upon the enterprise telehealth platform, thereby mitigating potential IT redundancies, forming an integrated technology enabled clinical workflow standard, and ultimately improving patient access to care.

1. Pascual JL, Blank NW, Holena DN, et al. There's no place like home: boarding surgical ICU patients in other ICUs and the effect of distances from the home unit. J Trauma Acute Care Surg. 2014;76(4):1096e1102.
2. Nunn AM, et al., Boarding ICU patients: Are our rounding practices subpar?, The American Journal of Surgery (2017), http://dx.doi.org/10.1016/j.amjsurg.2017.04.019.
3. Data derived from Philips eCareManager reporting and analytics platform as compared to severity and mortality estimation tool (APACHE).

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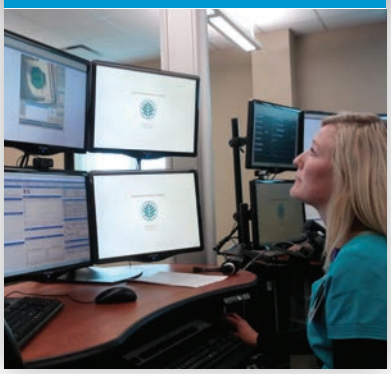
Success Story

Carolinas HealthCare System



By leveraging Philips eICU program, Carolinas HealthCare System has been able to:

- Connect telemedicine resources across the health system to focus on more timely interventions for stroke patients
- Increase tPA administration by 163% and decrease door-to-needle time by 17% across the system
- Demonstrate how hospitals can leverage the extensibility of the telehealth platform eCareManager to improve care beyond the ICU

Photo: Michael Tomsic

Delivering the Right Stroke Treatment Faster

How Carolinas HealthCare System leverages the eICU to provide seamless care to stroke patients

When it comes to treating stroke, every minute counts. However, access to rapid, life-saving treatments requires prompt evaluation by a neurologist, which many smaller and rural hospitals lack. Carolinas HealthCare System is addressing this gap by leveraging its tele-ICU capabilities to bring advanced stroke expertise to hospitals throughout its expansive system. By leveraging the eCareManager telestroke module and portable telestroke carts, it can connect local providers with stroke specialists in seconds, speeding up workflows and improving outcomes.

A leader in technology-driven care

Carolinas HealthCare System is one of the leading healthcare organizations in the Southeast, with 40 hospitals and over 900 care locations spread throughout North and South Carolina. With a history dating back to 1940, Carolinas HealthCare System has long been recognized locally and nationally for its commitment to delivering efficient, quality care.

Since May 2013, Carolinas HealthCare System's eICU – Virtual Critical Care (VCC) – has provided real-time oversight by intensivists and critical care nurses to better monitor patients in the ICU around the clock. After having demonstrated the impact of telemedicine on improving quality and outcomes in the ICU, the VCC team sought out ways to leverage the telemedicine capabilities and clinical transformation processes in other parts of the health system.

The stroke program was identified as an opportunity where telemedicine could have a powerful impact, since it is an area with both high acuity and unique time sensitivity.

Improving stroke care throughout the health system

Stroke is the fifth leading cause of death in the United States and a leading cause of long-term disability, with nearly 800,000 strokes and 130,000 deaths occurring per year.[1,2] Early action is critical for stroke. The faster a patient receives emergency treatment, the better their chances for survival and recovery. Clot-busting medications such as intravenous tissue plasminogen activator (tPA) are most effective when delivered within the first three to four hours of symptom onset, and ideally delivered within 90 minutes.[3] However, there are significant barriers that can prevent or slow treatment for many stroke patients, including having to travel a long distance to stroke center hospitals, patients not arriving at a hospital during the narrow treatment window, and a shortage of stroke specialists who can evaluate patients and determine the right course of treatment.

Carolinas HealthCare System first explored telestroke in 2014, knowing that they would have to be more creative about extending resources given the increasing shortage of neurologists and the growing number of hospitals without neurologists on site. As hospital leadership began to evaluate geographically the number

of facilities that needed acute stroke management support, it became increasingly clear that telestroke was the new and innovative solution they needed in order to address neurologist staffing. Telestroke allows neurologists to remotely evaluate stroke patients and make diagnoses and treatment recommendations. It increases the possibility that clot-busting drugs like tPA can be delivered within the crucial window of time, especially at hospitals that may have limited resources or access to stroke specialists.

Treating the patient closer to home

Carolinas HealthCare System's telestroke program now provides immediate stroke care at 22 locations within its network, revolutionizing the care of stroke patients. The Philips eCareManager stroke module extends evidence-based stroke care to patients wherever they are, connecting local providers to stroke specialists in seconds and eliminating the need to dial out on a pager or phone.

As soon as a potential stroke patient is identified, they are brought to an exam room with a telestroke cart and examined by a nurse and physician. If it is determined that the patient has likely had a stroke, the clinicians simply press a button on the telestroke cart and are connected to a VCC nurse within seconds. The VCC nurse gathers information and engages the neurologist, who then joins everyone on camera. If the patient needs tPA, the VCC nurse is a valuable resource in the background, watching the clock and monitoring the patient.

By having the VCC telestroke nurses involved early on, it ensures the patient gets the right order sets, labs, and rehab from the very beginning, which helps to decrease length of stay and improve outcomes. The VCC nurse can act as a second set of eyes and ears for the bedside staff, which is especially beneficial in facilities that are not as experienced in administering tPA.

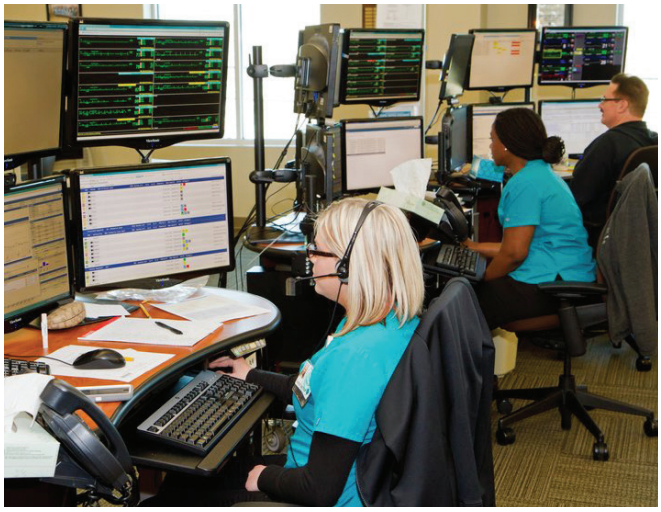


Photo: Kevin McCarthy/Carolinas HealthCare System

for better care

The telestroke initiative was implemented in 2015 and the results were immediate and compelling. Between 2015 and 2016, tPA administration increased 163% across the system while the door-to-needle time decreased 17%. Overall Code Stroke activations also increased 978% during this time period.[4]

The model that Carolinas HealthCare system created promotes patient safety and improved communication. In addition to the clinical benefits of getting access to appropriate stroke care quickly and efficiently, having the telestroke program in place enables patients to remain at their local hospital instead of being transferred to a larger tertiary facility. Having the VCC in place in most facilities and the ability to do tele-neurology rounding decreases the number of transfers and greatly reduces both cost and stress for the patient and their family. From a financial standpoint, this model provides real-time neurology expertise at a lower cost than an onsite neurologist, and it allows maximum reimbursement to be obtained by the local facility.

Early intervention and seamless care makes

1. Kochanek KD, Xu JQ, Murphy SL, Arias E. Mortality in the United States, 2013. NCHS Data Brief, No. 178. Hyattsville, MD: National Center for Health Statistics, Centers for Disease Control and Prevention, Department of Health and Human Services; 2014.
2. Mozafarian D, Benjamin EJ, Go AS, Arnett DK, Blaha MJ, Cushman M, et al., on behalf of the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2016 update: a report from the American Heart Association. Circulation 2016;133(4):e38–360.
3. Hacke W et al. Association of outcome with early stroke treatment: pooled analysis of ATLANTIS, ECASS, and NINDS rt-PA stroke trials. Lancet. 2004; 363:768-774.
4. Data derived from Philips eCareManager reporting and analytics platform

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Success Story

Emory Healthcare

Leveraging Philips eICU program, Emory Healthcare has managed to:

- Save $4.6 million over 15 months – or $1,486 in Medicare spending per patient
- Discharge more patients to home healthcare rather than nursing homes or long-term care hospitals
- Improve continuity of care and increase adherence to quality guidelines

Improving Outcomes while Saving Money

How Emory's eICU program led to more timely critical care, resulting in healthier patients at discharge and millions of dollars in savings

Overview

Intensive Care Units (ICUs) are a vitally important component of U.S. healthcare, treating approximately five million of the sickest and oldest patients each year.[1] With an aging population and increased prevalence of chronic diseases, the need for high-quality and timely critical care is greater than ever before. However, managing the growing number of ICU patients is increasingly challenging due to a nationwide shortage of highly skilled critical care nurses and intensivists.[2]

Emory Healthcare confronted these challenges by using Philips eICU technology to expand access to critical care services. By remotely monitoring patients on a continuous basis, Emory's eICU program helps care teams quickly recognize and respond to changes in patients' vital signs, allowing critical care to be provided where and when it is needed most. As a result of the eICU program, Emory's patients benefited from improved continuity of care and better adherence to quality guidelines. Consequently, they were healthier at discharge and were more likely to go home, rather than to a nursing home or long-term care hospital.

Key Findings

Emory's success was highlighted in a report conducted by Abt Associates and commissioned by the Centers for Medicare and Medicaid Services, "Evaluation of Hospital-Setting HCIA Awards." The three-year independent audit analyzed financial and clinical outcomes at the nine healthcare organizations that received CMS Innovation Grants to tackle the toughest healthcare challenges, with two of the grants dedicated to eICU programs.

Emory used its $10.7 million grant from CMS to launch an eICU program to monitor critical care patients 24/7 and provide intensivist physician oversight and support on the night and weekend shifts. "The goal was to improve quality of care, shorten ICU lengths of stay, and discharge patients in a better state of recovery, potentially reducing Medicare spending," says Cheryl Hiddleson, MSN, RN, CCRN-E director of the Emory eICU Center.

Over the course of a 15-month period, Emory's eICU program was compared to nine other hospitals in the Atlanta area in order to determine the effectiveness of the program. The patients were followed for the hospitalization period and 60 days

1. Halpern NA, Pastores SM. Critical Care Medicine in the United States 2000-2005: An Analysis of Bed Numbers, Occupancy Rates, Payer Mix, and Costs. *Crit Care Med*. 2010 Jan;38(1):65-71.
2. Halpern NA, Pastores SM, Oropello, Kvetan. Critical Care Medicine in the United States: Addressing the Intensivist Shortage and Image of the Specialty. *Crit Care Med*. 2013 Jan; 41(12):2754-2761.
3. Emory Health. *CMS report: eICU program reduced hospital stays, saved millions, eased provider shortage*. April 5, 2017. Web.

"Our mission at Emory is to deliver quality care to patients at a cost they and their families can afford and to provide access whenever and wherever people need it," said Dr. Timothy Buchman, Director, Critical Care Center, Emory Healthcare. "These independent findings verify that our innovative approach to addressing a highly variable, complex patient population – those in the critical care unit – improves patient outcomes, allowing them to leave the ICU healthier, thereby reducing the need for patients and their families to have extended rehab stays or be readmitted."

after discharge. Emory achieved the following results across its 136 beds at five hospital sites:[4]

- **$1,486 reduction in average Medicare spending per episode** relative to the comparison group, yielding an estimated savings of $4.6 million around care of these federal beneficiaries during the 15 month comparison period. (p<0.01)
- **4.9% increase in the relative rate of discharges to home healthcare, while discharges to skilled nursing facilities and long-term care hospitals declined by 6.9%** (p<0.01), indicating that Emory was discharging patients with less need for institutional post-acute care after their eICU stay
- **2.1% decrease in the rate of 60-day inpatient readmissions** (p<0.10) relative to the comparison group

Core Measures Summary

Outcomes	Estimate
Aggregated Results	
Total spending	-$4.6 million
Per episode (N=3,093)	
Total spending	-$1,486
Thirty-day inpatient readmissions	-0.89
Sixty-day inpatient readmissions	-2.14
Thirty-day ED visits	0.21

It is important to note that the savings reported are specific only to Emory's Medicare population, which comprises about 65% of its total patient population. During the five quarters studied (April 1, 2014 to June 30, 2015), 8,019 unique patients were managed through the eICU program at Emory, resulting in approximately $12 million in total savings, based on the average savings of $1,486 per patient.

Patients Go Home Healthier

Due to the level of high-quality and consistent care, patients were healthier when they were discharged and had fewer readmissions for 60 days following their inpatient stay. Emory discharged more patients to home settings than long-term care or skilled nursing facilities, and patient satisfaction for those patients who received care at Emory was higher than at the comparison hospitals.

Emory's results echo those from an earlier study in *JAMA* which showed:

> *Patients in the tele-ICU group had lower rates of complications, recovered more quickly, and were significantly more likely to be discharged to their homes than patients in the pre-intervention group. These findings suggest that critical care programs that implement processes that increase adherence to best practice, lower rates of complications, shorten response times to alerts and alarms, and support early intensivist case involvement will provide better care at a lower cost.*[5]

The report's findings add to the growing evidence that telemedicine in the ICU improves outcomes and saves money. "These findings have shown that increased stability with fewer complications has longitudinal benefits beyond when a patient leaves the ICU," said Manu Varma, Business Leader, Philips Wellcentive and Hospital to Home. "As health systems transition to value-based care and depend more on population health tools, these long-term benefits to patients are not only reducing readmissions and improving outcomes, but also have the potential to increase hospital ratings and lower the cost of care."

4. Abt Associates. Evaluation of Hospital-Setting HCIA Awards. Prepared for CMS; Baltimore, MD: 2016.
5. Lilly CM, et al. Hospital Mortality, Length of Stay and Preventable Complications Among Critically Ill Patients Before and After Tele-ICU Reengineering of Critical Care Processes. *JAMA*. June 2011; 305(21): 2175-83.
6. Emory Health. *CMS report: eICU program reduced hospital stays, saved millions, eased provider shortage*. April 5, 2017. Web.

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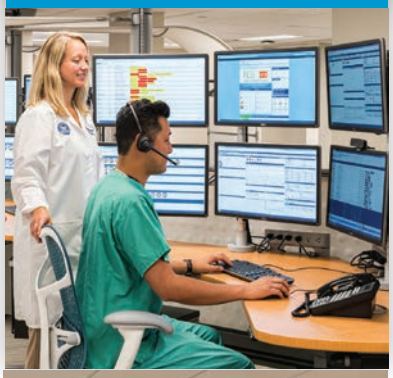
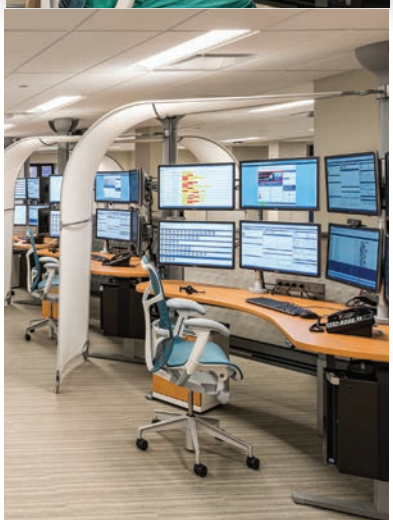
Success Story

Philips Design and Posen Architects





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A Blueprint for Enterprise Telehealth

How Philips Strategic Design Consulting and Posen Architects created a collaborative environment blending the latest technology and design concepts

Walking into the 5,500 square foot eHealth Center at Westchester Medical Center Health Network (WMCHealth) feels like walking into the future of healthcare. Equipped with 20 eICU telehealth workstations, the eHealth Center allows specialized ICU physicians and critical care nurses to support the care being provided at the bedside of ICU patients spread throughout the Hudson Valley. The workstations are equipped with vital-sign monitoring, predictive analytics, data visualization, and two-way audiovisual connection, allowing the remote specialists to provide an extra level of care and interact directly with bedside providers and patients.

The eHealth Center represents a new vision for how hospitals can deliver care, where doctors are no longer restricted by time or distance. Hospital command centers have been gaining traction in recent years, as health systems begin to co-locate resources in order to better manage patient flow and logistics. Taking a cue from the aerospace and aviation industries, these command centers are wired with monitors that display predictive analytics and monitor a patient's movements in the hospital.

Tele-ICUs, such as Philips eICU, take the command center concept a step further. Through advanced clinical decision support providing proactive alerting, workflow change management, and integrated audiovisual technology, the eICU is a proven solution to help reduce potential medical complications leading to more stable patients across the continuum. Instead of only checking a patient's vital signs periodically, there is a continuous live-stream of data flowing from bedside monitors to the eICU, where Philips' advanced algorithms help identify and prioritize patients for early intervention. The synergistic benefits of technology coupled with care transformation help health systems realize the financial and operational outcomes in target areas of capacity and throughput through improved patient length of stay.

WMCHealth's eHealth Center was a key first step in bringing the benefits of enterprise telehealth to the entire system. It addressed one of the system's highest cost areas (the ICU) by standardizing practices, improving quality of care, and increasing access. It is a stunning example of how hospitals can blend technology and design to improve patient care, and with an eye for the future, it was designed for growth and expansion into new clinical areas beyond the ICU.

Designing a Telehealth Center

In preparation for designing and building the eHealth Center, Philips Design met with WMCHealth to understand their needs and vision for the project. WMCHealth had already spent over a year working with Philips to prepare for implementation of the eICU program, so many of the basic design elements and telehealth center components were already

established. The final step was partnering with a design team that could make their vision – to improve patient care and communication among the various WMCHealth hospitals – a reality.

The Workstation of the Future

What sets the WMCHealth telehealth center design apart from the typical bunker-style command center is how modern, light, and accessible it feels upon entering. The layout of the telehealth center was very deliberate. The workstations – where the doctors and nurses spend the bulk of their time – are located closest to the windows, while the lesser-used conference rooms and private offices are located further back. This is not just for aesthetic purposes. Exposure to daylight has been shown to not only improve mood, but also workers' health and overall well-being. The design team of Philips Design and Posen Architects focused a great deal of attention on maximizing daylight exposure, controlling glare, and installing recessed LED lights. They also worked closely with Herman Miller and furniture dealer WB Wood to design comfortable workstations with ergonomic furniture, adjustable work surfaces, and flexible monitor arms, which helps to improve both productivity and workplace satisfaction. The telehealth center staff provide bi-directional engagement with the patient and family, therefore the environment needs to be both professional and secure for patient privacy. The swinging privacy screen creates an intimate patient-to-provider relationship instantaneously, with the ability to swing away for team collaboration.

The eHealth Center is also purposefully integrated into the hospital, with a sense of connection to the rest of the hospital. It is located off the main entrance to the building in order to be highly visible and physically linked with the hospital. It was crucial that the telehealth staff be co-located on the hospital campus in order to support patient care in a collaborative way without interruption. In addition, Posen factored future growth into the design of the telehealth center, ensuring that there would be ample space to expand as WMCHealth began to use the eHealth Center with other specialties. The space is also designed for collaboration and innovation, with meeting spaces for team reviews as well as on-site training and demonstration rooms.

Challenges

In designing such a space, there are inevitably challenges. At WMCHealth, the design team had to work within the existing infrastructure, with little opportunity to change the basic structure of the space. The high profile location was a somewhat limiting factor and required updating adjacent corridors while maintaining access to other areas of the hospital. The ceilings and lighting layout were particularly difficult. With ceilings under eight feet high – and impossible to raise – the design team not only had to redesign the workstations in order to fit into the space, but also determine how to make the space feel as bright and spacious as possible.

They also had to pay special attention to the acoustics of the telehealth center and reduce noise from mechanical systems, since any background noise could interfere with communication with patients and bedside staff. In addition, the swinging privacy screens of the Herman Miller workstation solution both to give the patients a sense of privacy and to reduce any background distractions. Finally, the design team had to coordinate security requirements and design the telehealth center so that it could accommodate guests while maintaining HIPAA compliance.

The Future of Healthcare

WMCHealth's eHealth Center is a prime example of how to blend technology and design in order to deliver the best possible care to patients. It is not the detached, windowless bunker so often associated with command centers. Rather it is a bright and airy extension of the hospital, fully connected with the rest of the health system and an integral part of its overall eHealth strategy.

ICUs are one of the highest cost areas in healthcare, and therefore ICU efficiency is increasingly vital as health systems seek new cost-effective ways to manage their growing populations in this era of value-based care. The benefits of implementing a centralized telehealth center such as Philips eICU are well documented. A growing body of research has demonstrated how eICU programs reduce length of stay, lower mortality, and improve contribution margins.[2] They allow trained critical care specialists to help manage the care of critically ill patients who might be thousands of miles and several times zones away, providing a consistent high level care regardless of patient location.

By starting with an eICU, WMCHealth addressed its most cost-intensive area and made optimal use of its critical care resources. Importantly, the eHealth Center was designed with growth in mind to bring the benefits of telehealth throughout the health system.

1. Boubekri M, Cheung I.N., Reid K.J., Wang C.H., Zee P.C. Impact of Windows and Daylight Exposure on Overall Health and Sleep Quality of Office Workers—A Case-Control Pilot Study. Journal of Clinical Sleep Medicine. 2014;10(6):603–11.
2. Lilly CM, Motzkus C, Rincon T, et al. ICU Telemedicine Program Financial Outcomes. *Chest*. 2017; 151(2): 286-297.

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Success Story

Presence Health

Leveraging Philips eICU program, Presence Health has managed to:

- Standardize clinical processes, therefore reducing variation in care delivery
- Reduce the average duration of mechanical ventilation (DMV) by a full day, which has saved the system millions of dollars
- Reduce length of ICU stay, allowing the system to treat more intensive care patients and increase revenue

Standardizing Care through TeleICU

How Presence Health used telehealth to reduce variations in ICU care and help save millions of dollars as they delivered affordable, quality, and compassionate care

Overview

While there are many teleICUs across the country today, few have the experience and history of Presence Health, one of the first health systems in the U.S. to implement fully integrated teleICU technology. Presence Health is the largest Catholic health system in Illinois, serving over 4 million people in 11 counties. It encompasses over 150 sites of compassionate care including 12 hospitals, over 17,000 associates, and more than 4,000 medical professionals, and it has annual revenue of $2.6 billion.

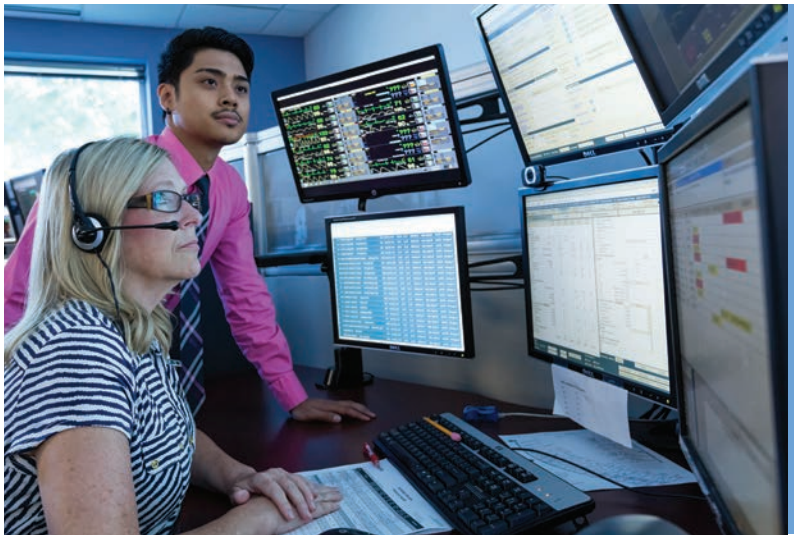
Presence Health walks the talk in investing in clinical quality and patient care. Since 2005, the Chicago-based system has been remotely monitoring thousands of patients in adult intensive care units, performing critical interventions to improve patient outcomes. Research has shown that teleICUs help improve patient care by reducing length of stay and saving lives, and Presence Health has experienced that firsthand.[1]

Addressing variations in care delivery

Prior to the implementation of its teleICU, Presence Health was faced with the challenge of how to address variations in ICU care delivery across multiple hospitals. Each hospital was using different evidence-based standards and screening tools, and as a result, there were no general guidelines in place across the system. Presence Health needed a way to connect the system and standardize care. “Senior leadership was focused on innovation and being at the forefront of transforming healthcare, and they saw the teleICU as truly disruptive technology. Their main motivations were to increase quality, decrease variability, and increase regulatory adherence, and the teleICU offered exactly that,” says Kathy Johnson RN MHA, System Director of TeleHealth Operations at Presence Health’s TeleICU Connection.

In preparation for implementation, Philips worked closely with the health system’s executives, key leaders, and staff to understand current workflows and how to best integrate the eICU program technology, eCareManager, as well as provide the training needed in order to achieve the desired results. Telehealth in the ICU was still very new in 2005, so it was the first time any of the critical care nurses had seen this type of platform or technology. In addition, Philips also brought in a clinical transformation team to help determine an appropriate roll-out strategy and communications approach, and to support the ongoing operation of the teleICU.

1. Lilly CM, et al. Hospital Mortality, Length of Stay and Preventable Complications Among Critically Ill Patients Before and After Tele-ICU Reengineering of Critical Care Processes. *JAMA*. June 2011; 305(21): 2175-83.



"The teleICU has been a vehicle that through continuous communication has enhanced and improved clinical outcomes. This program has transformed critical care delivery across our health system. The clinicians in the teleICU are experts in critical care delivery. All teleICU physicians are board certified in critical care medicine, and all nurses are CCRN certified."

Kathy Johnson, RN MHA, System Director TeleHealth Operations

The Results

The Presence Health teleICU Connection has become essential to providing high-quality care and gives Presence Health a key competitive advantage, helping the system to grow. "Over the past eleven years, our teleICU program has matured and we have streamlined clinical processes to drive outcomes. We are now extending our services to external partners to enhance critical care delivery," notes Presence Health TeleHealth Strategy and Development System Director Laura Messineo RN, MHA.

The teleICU has helped Presence Health to standardize critical care delivery across ten acute care hospitals and one long-term acute care hospital, reducing variations in care delivery and ensuring that all patients were receiving the highest quality care. In 2013, the teleICU saved 7,458 patient ICU days, allowing Presence Health to treat over 2,000 more intensive care patients and increased revenue by $33 million, supporting the health system's mission to provide affordable, quality and compassionate care.[2]

As the teleICU has continued to grow and mature, Presence Health has developed several new programs such as sepsis screening tools and an organ donation process. The teleICU also spearheaded the development of a streamlined approach for daily sedation and weaning trials of ventilated patients within the critical care population. Through the sedation weaning program, Presence Health achieved a full day reduction in the average duration of mechanical ventilation (DMV), which has yielded a yearly cost avoidance of $4.5 million while reducing pain and suffering for patients and improving outcomes.[3]

Data and collaboration help to overcome barriers

Some resistance to change will always exist with such transformative technology. Presence Health overcame these barriers through a focus on communication, transparency, and dissemination of data. "The risk adjusted and benchmarked data allows us to clearly communicate opportunities to improve care delivery, celebrate the successes of driving down ICU length of stay and mortality rates, and decrease adverse events," says Johnson. Being able to measure and demonstrate the value of the teleICU has been key to overcoming initial skepticism, and bedside staff now welcome and appreciate the extra eyes, ears, and intelligence they receive from the teleICU.

Having a partner that is fully engaged and provides expert resources for the long-term – not just during implementation – has been critical to success. "Over the years, Philips has been a great partner listening to feedback from clinicians and making enhancements to the platform," says Messineo. "Twice a year, they meet to evaluate where the pain points are in the teleICU process across the whole landscape. This has resulted in multiple revisions of the platform with more enhancements and incredible improvements made in functionality." Through this regular engagement, Philips and Presence Health can collaboratively discuss how to enhance the eICU program to meet the growing needs of the ICU patient population.

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2. Data derived from Philips eCareManager reporting and analytics platform as compared to severity and mortality estimation tool (APACHE).
3. Data derived from Philips eCareManager reporting and analytics platform as compared to severity and mortality estimation tool (APACHE).

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Success Story

Northwell Health

From Fragmented to Coordinated Care

How Northwell Health built on its Philips eICU platform to bring the benefits of telehealth throughout the health system

Leveraging Philips eICU program, Northwell Health has managed to:

- Extend intensivist-led care beyond the ICU to the entire health system
- Provide the same high level of care, regardless of location
- Allow hospitals beyond Northwell Health to benefit from tele-ICU by partnering with Northwell's eICU team

As New York State's largest employer and most expansive health system, Northwell Health has long been a leader in healthcare. Serving two million patients across 22 hospitals and more than 550 outpatient facilities comes with unique challenges, however, and Northwell has increasingly turned to innovative technology in order to improve patient safety and quality. In 2014, Northwell became the first health system in the New York metropolitan area to implement an eICU program, bringing the well-documented clinical benefits of eICU to its patients.

Launch of the eICU Program

Northwell initially launched its eICU program after Critical Care Medicine (CCM) leaders from around the health system recommended to Northwell senior leadership that all of Northwell have one standard of care for patients in all Intensive Care Units. This included bedside CCM provider staffing standards, required intensivist co-management, and high quality data and outcomes metrics to assess and guide care and uncover areas of deficiency. These internal requirements were also defined to comply with The Leapfrog Group's ICU Physician Staffing (IPS) Standard, which calls for intensivist-led care for all ICU patients.[1]

In addition, the health system was trying to help support sites that were having difficulty with off-hours coverage due to the nationwide shortage of intensivists.[2] By implementing the eICU, Northwell was able to provide intensivist coverage to help assist off-shift providers such as CCNPs and PAs. It was also able to support intensivists in its tertiary facilities around the clock, triggering a more rapid and thorough response – particularly during busy times – than before.

Expansion to New Care Venues

What now sets Northwell apart is the sheer breadth of its telehealth offerings. Over the past three years, the health system has built upon its eICU platform to bring telehealth to areas like tele-neurology and telestroke. Northwell's success with these programs is already apparent, as evidenced by an increase in the number of patients receiving the clot-busting drug TPA and a decrease in the door-to-needle time. The system has also instituted a consult-based Neuro CCM eICU program as an adjunct to its core eICU program. This extends its Quaternary Neuro CCM team into the rest of its facilities to assist with complex neuro cases and transfer decisions. Furthermore, Northwell has developed a very specific workflow for organ donation that utilizes the critical care nurses in the eICU to help improve the timeliness of referrals, eliminate missed referrals, and ultimately help increase the number of organ donors and available organs to

1. The Leapfrog Group. (2016). *ICU Physician Staffing Factsheet.* Retrieved from http://www.leapfroggroup.org/sites/default/files/Files/IPS%20Fact%20Sheet.pdf.
2. Angus DC, Kelly MA, Schmitz, RJ, White A, Popovich J. Current and Projected Workforce Requirements for Care of the Critically Ill and Patients with Pulmonary Disease. JAMA. 2000; 284 (21): 2762-2770.

the community. Northwell has also connected the Pediatric CCM team at the Cohen's Children's Medical Center (CCMC) to one of their tertiary hospitals with several more on the drawing board. They have also connected CCMC to their Special Treatment Unit for highly communicable illness patients. Having the eICU operational infrastructure in place was a key first step and allowed Northwell to leverage the program governance and centralized resources to expand telehealth in a disciplined way to other care venues.

Northwell intentionally takes a staged, methodical approach to new programs, relying on pre-implementation data to help make decisions about expansion of the enterprise telehealth program. Success of these new programs depended on extensive planning to ensure that the programs were expanded in the right areas and implemented in an efficient matter. Expansion decisions were based on a number of factors, including an expressed desire of a site to take a team approach to process improvement and standardization of care, as well as a clear quality or efficiency opportunity for the expansion. It was important to only expand into areas where there was both a clearly defined need for services and a willingness to provide the services from another part of the organization.

Finding Synergies through One Enterprise Telehealth Platform

Expansion of telehealth programs is especially important in this era of rapid healthcare merger and acquisition (M&A) activity. Analysis by Kaufman, Hall & Associates found that hospital M&A activity jumped 55% between 2010 and 2016, as hospitals and health systems look for strategic opportunities to ensure the continued growth and success of their organizations.[3] Northwell is no exception. Over the past several years, it has acquired several new facilities and practices, all of which come with their own electronic health record (EHR) systems and challenges. Many of these acquisitions are smaller community hospitals that seek to establish the same standard of care present throughout the system. "We want to ensure the same level of care, whether it is a rural community hospital or big city hospital. Our patients should be confident that by choosing Northwell, regardless of which location, they are getting the same high level of care," remarks Martin Doerfler, MD, SVP of Clinical Strategy and Development and Associate Chief Medical Officer at Northwell.

In expanding to new sites and care areas, Northwell recognized the importance of being on one enterprise telehealth platform. Having multiple disparate systems leads to a lack of seamless engagement and interoperability, ultimately driving fragmented care and higher costs. The Philips enterprise telehealth platform brought all sites onto a common infrastructure, making fragmented care much more coordinated. It also reduced IT redundancies and simplified the experience of end users.

Further Expansion Opportunities

While Northwell has already made great gains in the expansion of telehealth, its efforts are far from complete. As Northwell's eICU program has matured internally, leadership has recognized the opportunities to expand not only to new sites and departments within the system, but also outside of it. "We see Outreach as important to our work and mission," says Iris Berman, VP of Telehealth Services at Northwell. "We believe that large systems like ours can better afford the needed investments in starting up such programs, and the economies of scale allow sharing of those capabilities with aligned partners that allows for improved quality, efficiency, and market share. We are just beginning that journey, as we looked to develop our program and mature it before pushing it out. As we do, we will offer a menu of services built on the platform." Through Philips' Outreach program, smaller hospitals that might not have the ability to implement an entire enterprise program in-house can partner with larger systems like Northwell in order to have their critical care beds monitored and realize the clinical benefits of an eICU program with modest investment.

3. Ferry, Krysta. (2017). *Hospital Merger and Acquisition Activity Continues Upward Momentum, According to Kaufman Hall Analysis*. Retrieved from http://www.prweb.com/releases/2017/01/prweb13978577.htm.

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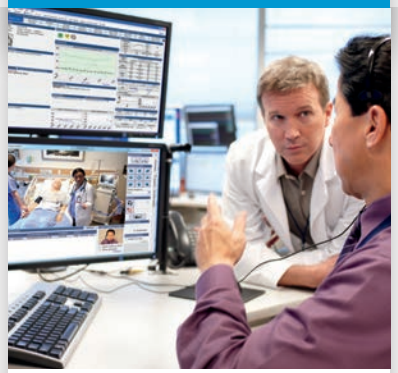
Success Story

UMass Memorial



The Financial Case for Tele-ICU

How UMass Memorial's comprehensive tele-ICU improved care while driving substantial cost savings

Key findings of the study:

- $29.8 million annual improvement in direct contribution margin for the centralized tele-ICU
- $52.7 million annual improvement in direct contribution margin for the centralized tele-ICU co-located with a logistical center
- Initial capital costs of $7.12 million were recovered in less than three months of operation of the ICU telemedicine program

Overview

There is little doubt as to the clinical value of tele-ICU, with proven reductions in length of stay and mortality.[1] Nonetheless, the capital costs and annual operating costs have often been considered a barrier to adoption. That mindset is changing, however, with the publication of a first of its kind study in the February 2017 edition of CHEST that shows how tele-ICU can improve case volume, improve contribution margins, and allow for recovery of capital costs within 3 months. The study, entitled "ICU Telemedicine Program Financial Outcomes," is the first to address in-depth the financial outcomes associated with implementing a tele-ICU, and confirms that there is a strong financial case to be made for wider adoption of telemedicine in the ICU.

Study results

Conducted by Craig M. Lilly, MD, director of the eICU program at UMass Memorial Medical Center, the study looked at more than 51,000 patients in seven adult ICUs and across three models of intensive care: traditional ICU care without telemedicine; centralized tele-ICU care; and tele-ICU care with a logistical center to improve ICU bed utilization. UMass Memorial uses the Philips eCareManager enterprise tele-ICU platform to provide remote critical care services across its hospitals. The eICU program offers centralized, remote surveillance by intensivist-led teams, proprietary algorithms that provide early warnings for proactive care, and a dedicated team to support ongoing clinical transformation.

Researchers found that implementation of an ICU telemedicine program with proven clinical benefits was also associated with significant financial benefits that substantially exceeded the program capital and operating costs. The study demonstrated that:

A centralized tele-ICU:

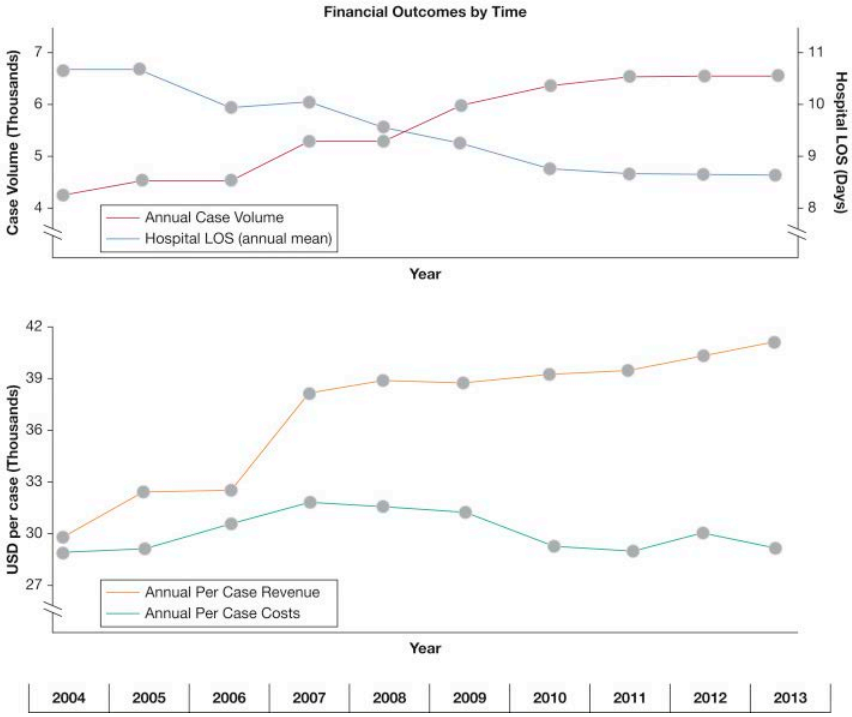
- Improved case volume by 21% over traditional models
- Improved contribution margin by 376% ($37.7 million compared to $7.9 million)

A centralized tele-ICU with added Logistics Center and quality care standardization:

- Improved case volume by 38% over traditional models
- Improved contribution margin by 665% ($60.6 million compared to $7.9 million)[2]

This care delivery model allowed recovery of the $7.12 million of initial capital costs in less than three months.

1. Lilly CM, Cody S, Zhao H, et al. Hospital Mortality, Length of Stay and Preventable Complications Among Critically Ill Patients Before and After Tele-ICU Reengineering of Critical Care Processes. *JAMA*. 2011; 305(21): 2175-83.
2. Lilly CM, Motzkus C, Rincon T, et al. ICU Telemedicine Program Financial Outcomes. *Chest*. 2017; 151(2): 286-297.
3. Philips. *New Study Demonstrates Improved Patient Flow and Financial Benefits of Philips' EICU Program for Managing Critical Care Population*. 2016. Web. 13 Dec. 2016.



UMass Memorial Health Care is the largest health care system in Central Massachusetts. It includes four hospitals with over 1,100 beds in the system. In 2006, UMass Memorial became the first health system in the state to implement an ICU telemedicine program that today supports adult patients admitted to intensive care units across the UMass Memorial Health Care System and several other Massachusetts hospitals.

Increased case volume allowed the existing ICU beds and staffing to be optimized while facilitating additional throughput of patients. Despite increased costs due to technology adoption and staffing, revenue increased at a greater rate because of the higher case volume and shorter lengths of stay. When the Logistics Center was added, the story became even more compelling. The Logistics Center acts as a gateway for proper patient admission to the right unit and type of care. Patient flow is enhanced by using eCareManager components more broadly to manage patients through greater visibility and tracking. The centralized organization of resources coupled with eCareManager supported UMass in implementing care quality initiatives across the many ICUs involved in the study more efficiently, and standardized the implementation and management of such best practices uniformly.

Helping hospitals thrive in a value-based environment

What differentiates this study from others is that it presents a model of how an eICU program can integrate population management tools to support patient flow in the hospital. This is especially significant in this era of value-based care when health systems everywhere are looking for more cost-effective ways to manage their populations. "An ICU bed costs approximately $2 million to build, and this study demonstrates a significant increase in case volume by better utilizing existing resources," said Tom Zajac, Chief Executive Office and Business Leader, Population health Management, Philips. "This shift enables care for expanding populations without having to build and staff additional ICU beds, thus helping hospitals thrive in a value-based care environment."

"The ability of tele-ICU programs to increase case volume and access to high quality critical care while improving margins suggests a strong financial argument for wider adoption of ICU telemedicine by health systems and intensivists," says Lilly. "It has been well-documented that properly implemented telehealth programs can have a significant impact on patient outcomes, and this study now supports the financial investment behind it."[3]

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Success Story

Westchester Medical Center

Translating Quality into Safety

Why Westchester Medical Center made the investment in ICU telemedicine

Situated just north of New York City in the Hudson Valley is the Westchester Medical Center Health Network (WMCHealth), a vibrant 1,700-bed healthcare system serving over 3 million people in the Hudson Valley region. After a series of acquisitions expanded the system from three hospitals to ten hospitals over eight campuses, WMCHealth needed to find a way to ensure that all locations, even in the more remote areas, had access to the same level of comprehensive care. Philips Healthcare's telehealth technology provided a solution to help unite the system, bring improved access to all hospitals, and enhance the overall quality of patient care.

WMCHealth's 5,500 square foot eHealth Center, equipped with 20 eICU telehealth workstations, opened in October 2015 and is staffed by ICU specialists 24 hours a day, seven days a week. These highly trained clinicians serve as a second set of eyes to watch over patients and complement the dedicated bedside staff. Using Philips' eICU technology and eCareManager platform, doctors and nurses can monitor patients' clinical condition and acuity around the clock as they collaborate with bedside staff in eight different ICUs from the centralized location.

Early Wins to Help Drive Change

Corey Scurlock, MD, MBA Medical Director of WMCHealth's eHealth Program, anticipated the challenges associated with achieving successful organizational transformation. He knew there would be some resistance to change since eICU causes a paradigm shift in the traditional care model in most hospitals by inserting remote team members and technology into the care model. He therefore had his team read articles on change management, such as Kotter's 8 Step Change Model, in order to increase the likelihood of successful transformation.

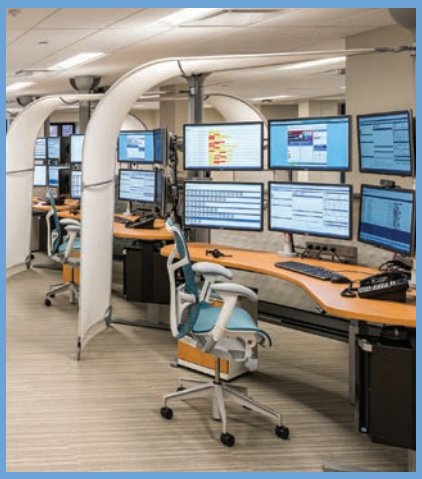
One of Kotter's 8 steps is systematically planning for short-term wins in order to help overcome resistance and build momentum. Scurlock and Christian Becker, MD, PhD, Associate Director of Telemedicine and eHealth at WMCHealth, intentionally chose to focus on adherence to ICU best practices as an early goal because it is measurable, non-controversial, and something on which leaders from each ICU could all agree. By hitting short-term goals, it would demonstrate the value of the eICU, energize the team, and help drive further change.

Leveraging Philips eICU program, Westchester Medical Center Health Network has managed to:

- Achieve significant results in less than one year of operation
- Reach VTE and SUP prophylaxis compliance rates of 100%
- Reduce the time it takes for intensivist to see patients for the first time by 30 minutes

To learn more about how Philips eICU program can transform your organization, go to: www.philips.com/enterprisetelehealth or call (205) 527-5033

While there is little doubt as to the clinical benefits of an ICU telemedicine program, there are significant upfront costs which can be a barrier to adoption. In weighing the decision whether to implement a tele-ICU, health care organizations need to see a worthwhile return on investment (ROI). To address this concern, Scurlock built an ROI calculator to demonstrate the savings that can be achieved through the appropriate use of stress ulcer prophylaxis, appropriate use of VTE prophylaxis, prevention of ventilator associated pneumonia, and avoidance of unnecessary transfusion. It calculates the cost savings based on input data from hospitals including number of ICU admissions per year, variable cost for an ICU day, and cost of a hospital stay. Even at low admission levels, the cost savings are immediately apparent. Significantly, however, the calculator demonstrates that as a hospital scales the eICU model, ROI goes up dramatically. Furthermore, this is just when including direct costs and does not even consider indirect costs such as a reduction in malpractice claims and payouts.



Westchester Medical eHealth Center courtesy of Posen Architects.

Among the first "easy wins" was venous thromboembolism (VTE) prophylaxis. The appropriate use of VTE prophylaxis is a Joint Commission core measure set and part of the hospital value-based purchasing (VBP) component of healthcare reform.[1] Despite effective, safe, and low-cost measures to prevent VTE, compliance rates are often low which can result in major complications for patients.

In order to tackle this issue and increase compliance, for the first three months that the eICU was operational, Scurlock and his team simply observed performance and measured behavior. After three months, they began to provide feedback to the various ICU teams, alerting them to how well they complied with VTE prophylaxis and how they compared to other units. This was possible through Philips eCareManager platform, which has an alerting mechanism to notify if VTE prophylaxis is not being performed. Within 6 months, WMCHealth had 100% VTE prophylaxis compliance.[2] They have since expanded their focus to include Stress Ulcer Prophylaxis as well, using the same process.

Importance of Data

Implementing an eICU allowed WMCHealth to capture a continuous stream of patient information and then utilize the advanced performance analytics embedded in Philips eCareManager to take a more evidence-based approach to caring for patients in the ICU. Being able to capture such a large amount of data, analyze it, and then visualize it in a beneficial way was critical to the program's success. "The operational data that the eICU delivers is incredible. You can get so much more data than hospitals had before, and it really drives process improvement by helping us standardize practices, reduce variability, and improve our quality of care," said Scurlock. He noted that many hospitals do not even know how well they adhere to best practices, which makes improvement very difficult. Every three months, Scurlock and his team sit down with each ICU to review how they are doing, relative to the other units. No one wants to be the unit that is underperforming.

In addition to adherence to best practices, another early initiative of the WMCHealth eICU was to decrease the time it takes to see a patient for the first time. Research has shown that having an intensivist perform a review of the care plan within one hour of admission is associated with lower mortality and length of stay.[3] By using eCareManager, WMCHealth was able to pull down its response time by half an hour, from 114 minutes to 84 minutes, and is on the way to reaching its goal of 60 minutes.[4]

Implementing such transformative technology as tele-ICU is never an easy feat, but WMCHealth is proof that real clinical benefits can be realized in as little as one year when the right team and processes are in place.

1. Michtalik HJ, Carolan HT, Haut ER, et al. Use of provider-level dashboards and pay-for-performance in venous thromboembolism prophylaxis. *J Hosp Med*. 2015;10(3):172-178.
2. Data derived from Philips eCareManager reporting and analytics platform as compared to severity and mortality estimation tool (APACHE).
3. Lilly CM, McLaughlin JM et al. A Multi-Center Study of ICU Telemedicine Reengineering of Adult Critical Care. Chest. 2014;145(3):500–507.
4. Data derived from Philips eCareManager reporting and analytics platform as compared to severity and mortality estimation tool (APACHE).

PHILIPS

Success Story

Saint Luke's Health System

Rounding with Intention

How Saint Luke's Health System uses the eICU Automated Acuity Score to drive rounding decisions and determine patient prioritization

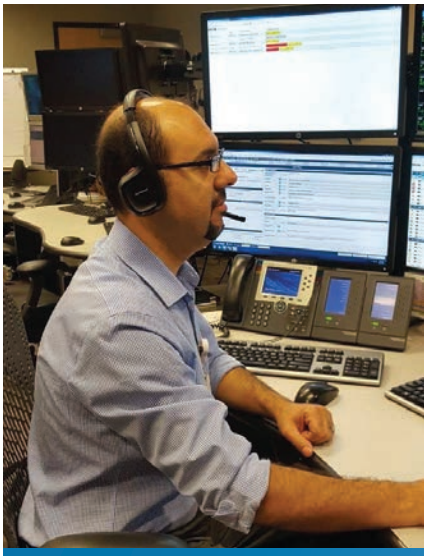
The intensive care unit (ICU) is a dynamic, challenging, and fast-paced environment where life-or-death decisions are made on a daily basis and every second counts. Physicians and nurses must make rapid judgments about patient care, and they rely on data to make well-informed decisions. However, clinicians are increasingly overloaded with too much raw data in their electronic medical record (EMR) systems. The information needed to make care decisions can be buried deep and in disparate locations within the EMR, making it very difficult to synthesize this information and take a proactive approach to patient care. The abundance of data can overwhelm clinicians with excessive information and actually hinder clinical productivity by making it more difficult to prioritize tasks and make decisions.

Saint Luke's Health System addresses this challenge by leveraging clinical decision support (CDS) tools in Philips IntelliSpace eCareManager that help telehealth center physicians to quickly identify the sickest patients and those who are deteriorating. Since 2005, Saint Luke's eICU Center has been part of the care team for over 63,000 critically ill patients in ten hospitals across Missouri, Kansas, and Iowa. Intensivists and critical care nurses are able to monitor critically ill patients across the Saint Luke's network and have face-to-face consultations with the patients and bedside teams using two-way video. eCareManager's CDS algorithms and CensusMosaic – an enhanced organ-based visual layout and information display – are designed to save valuable time with a streamlined, single-screen view. These tools help guide evaluation and risk stratification to facilitate the clinical team's communication as they prioritize which individual patients need attention first from a large population.

Traditional Rounding Pitfalls

ICU rounds facilitate regular, scheduled discussions among groups of healthcare providers to review clinical information, assess a patient's condition, and develop care plans.[1] The concept might be simple, but there can be a great deal of variability in the structure of rounds and the order in which patient visits are conducted. Ideally, clinicians would order their rounds based on patient acuity, so that they could focus on the most critical patients first. However, despite the abundance of patient data available in the EMR, it can be very difficult to make such an assessment prior to actually seeing every patient.

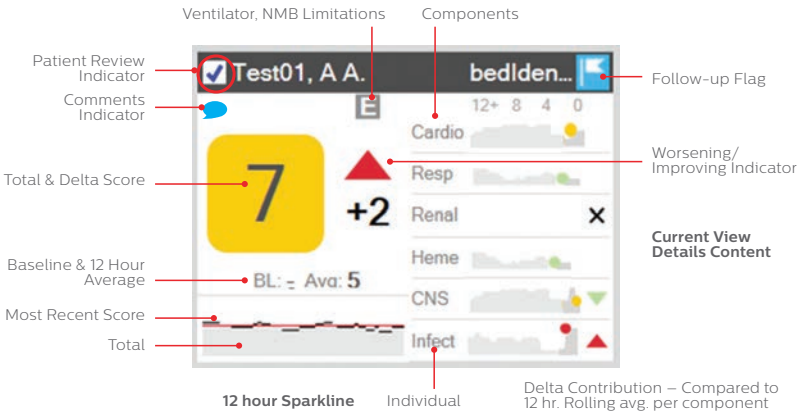
EMR data can be scattered in many different places, requiring extra work to compile. Even then, it simply gives a snapshot at a point in time. Deeper analysis of the EMR is typically required in order to gain better insight into the patient's condition over time or rank patients based on acuity. If a patient's vital signs are within normal range, it could be easy to miss that from shift to shift, they are actually trending worse – a worrying sign of potential crisis.



By leveraging Philips eICU Program, Saint Luke's has been able to:

- **Implement proactive use of Philips CDS Suite feature, Automated Acuity Score**
- **Enhance communication and collaboration between bedside and eICU teams**
- **Prioritize which individual patients need attention first from a large population**

1. Nugent KL, Coopersmith CM. How to Run Successful Rounds in the Intensive Care Unit. *ICU Management and Practice*. 2017; 17(2): 106-108.



Philips Automated Acuity Score and CensusMosaic are part of the Philips Acute Care Suite and represent innovations in patient care analytics to improve access to actionable information for bedside-to-webside providers globally.

Reducing cognitive burden through census visualization

Philips eICU Program takes an innovative approach to population health management in the ICU by leveraging census visualization tools to represent distinct patients and assist the coordinated care teams in prioritizing patient assessments. The Automated Acuity tile provides a total acuity score that is calculated from six clinical components (cardiovascular, respiratory, infectious disease, central nervous system, renal and hematology), each providing a targeted assessment of the patient's trended data in that component. Each patient is represented in a color-coded tile (green, yellow, or red) based on their score and displayed visually in the graphical census, providing a powerful combination of clinical decision support within a population management tool context.

The graphical user interface, CensusMosaic, provides physicians and nurses an alternative to view information and look for relevant trends rather than relying only on the data in its raw form. It may relieve some of the cognitive burden from eICU clinicians by placing the information directly in front of them, which is especially important in the ICU due to the tremendous amount of data that is generated. Patient conditions can deteriorate rapidly and with little outward warning, so it is essential that eICU clinicians are equipped to have meaningful consultations with those providing care at the bedside.

At Saint Luke's, the census provides a consolidated view of every ICU monitored by the eICU, removing geographic barriers like hospital and even state. By breaking down these barriers, eICU physicians and nurses can see all patients in one dashboard, allowing them to sort patients by acuity and round on them from the eICU accordingly. "I may start in Iowa, then see a few patients in Kansas, before moving on to Missouri," says Majdi S. Hamarshi, MD, Medical Director of Saint Luke's eICU. "The graphical census allows me to easily manage a list of 100 patients by helping me quickly and easily see who the sickest patients are, prioritize them based on their acuity, and then round with guidance."

Saint Luke's has found that the organ-based display mimics the way many clinicians naturally work and process a patient's condition, enabling them to quickly ascertain which organ systems are contributing to the patient's score. "This is of highest importance when I evaluate patients who are worsening and getting sicker," says Hamarshi. "The automated acuity tool displays a total score, and breaks the score down into six organ systems. It also indicates which of these systems contributes the most to the total score and which organ system is worsening. This information makes my job much easier to quickly dive in to the underlying problem."

These clinical decision support tools are particularly important in the ICU, where patients are often sedated and may not show outward signs of deterioration. The patient's vital signs may all be in the "normal" range, but the trend analysis shows how the patient's condition is changing over time by comparing the patient's current score with their score over the past 12 hours and with their admission score. The most critical patient is not necessarily the patient with the highest score, but rather the patient whose score has deteriorated most over time.

The graphical census also creates a queuing system – called the "Watch List" – to support population management workflows. It compiles a list of new admissions on whom the intensivists need to round, as well as patients who are worsening and require urgent interventions to prevent further deterioration. "Before the Watch List, I had to keep checking with the nurses about new admissions. In addition, I had to periodically round on all patients to figure out who might be getting worse," says Hamarshi. "The Watch List is important because I want to start with new patients and worsening patients."

Managing a large number of patients in a single screen improves the efficiency of the eICU staff and extends the number of patients that an individual can realistically manage at a remote site. The display of data allows the eICU clinicians to complete relevant tasks to meet the needs of specific patient populations based on hospital protocols, and enables providers to collaborate on patient management to ensure each patient is receiving the care they need.

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