PHILIPS

IntelliSpace Console
Critical Care

Insights: **Use of bedside analytics in the ICU**

An interview with the inventors:
Brian Pickering, MD, BAO, B.Ch and **Vitaly Herasevich**, MD, PhD

Brian Pickering

Vitaly Herasevich

In the rapid-paced environment of the intensive care unit, patient conditions change quickly and clinicians often have only a few minutes to make informed decisions. Efficient access to the right patient data can greatly impact care. Mayo Clinic (Rochester, MN) physicians Brian Pickering, MD, BAO, B.Ch, Vitaly Herasevich, MD, PhD and Ognjen Gajic, MD collaborated with Ambient Clinical Analytics and Philips to develop a clinical analytics system for the ICU in order to present essential patient data to healthcare providers at the bedside.

Piloted in three ICUs – medical, surgical, and transplant/hematology – it now serves 550 beds (including non-ICU beds on high-acuity hospital floors) at the Mayo hospitals locations in Rochester, MN, Phoenix, AZ, and Jacksonville, FL. In this interview, Drs. Pickering and Herasevich discuss the need for bedside analytics and the impact the system has had on clinicians and patient care.

What was the impetus for bedside analytics in the ICU?
The intensive care unit is a very information-intensive environment. In a typical hospital, 10% of the total beds are in the ICU. Those 10% contribute approximately 60-70% of the total clinical information in the hospital by volume.[1] We wanted to extract high-value information from the ICU environment – EMR, monitors, ventilators, infusion pumps, ADT, orders, and labs, to name a few – and display all of it in a way that allowed us to navigate through it quickly. That way, we could spend less time looking at the electronic medical record and spend more time at the bedside with the information we needed to make clinical decisions.

What does your bedside analytics system provide?
Essentially, the system scans the electronic medical record for relevant clinical information and presents it to clinicians, organized by organ system, on a single monitor screen. The system includes this organ-based computerized dashboard to view information about ICU patients, rules-based smart alerts, a checklist and rounding tool, and a reporting tool.

The system is designed so that the majority of information is available within the first two clicks. This contrasts with an EMR system in which it can take five to seven clicks to get to the information you need to make simple decisions.

Can you give me an example?
Let's look at a simple problem, like trying to decide if a patient should be given subcutaneous Heparin to prevent deep vein thrombosis. With our system, all the information is right in front of you. You know if there is a bleeding risk, if the platelet count is low, and if the patient has a history of allergy to Heparin. I can make a decision with almost no clicking. In contrast, if you're relying on a traditional EMR system, that would take seven pages of navigation.

How did you develop the system?
We started with a small group that came up with a list of data points that we thought were essential for decision-making in the ICU. Then for at least 18 months, we conducted a clinical study in which we gave clinicians a questionnaire after patient interactions to determine what information they used to make care decisions. This allowed us to identify more high-value data that clinicians relied on often. We discovered that there are about 50 data points in the entire electronic medical record environment that are used frequently to make decisions.

Next, we looked at how people navigate and interact with that data. We learned that there is no standard way, so we knew that a linear system wouldn't work. We needed an interface that would allow clinicians to hone in on data as they choose. So we organized the data in organ-system views, with contextual data off to the side and acute physiological data in the middle.

Then we moved to clinical trials. We embedded a feedback mechanism so clinicians could tell us if they found data points that they used to make a decision that weren't in our system. During five years of gathering feedback from the treatment of 50,000 patients, we received over 5000 suggestions.

Why can't you get the data by interacting directly with the EMR?
As they exist now, EMRs tend to gather information in a way that is quite difficult to sift through. So while a lot of the information I need to make decisions is in the EMR, it is spread out over a lot of different tabs and fields because these systems were developed as database viewers.

"There has been a shift from data-gathering and regurgitation to decision-making and patient interaction."

-Brian Pickering

To develop a realistic picture of the patient, I need to click through about 20 screens and dig through 30 tables and after doing all that I've been interrupted five times and lost my train of thought.

When I first began working with EMRs, what struck me was that there's a wealth of information in the electronic medical record, but no natural navigation tool. It was so disconnected from the "gather the team around the bed" experience that we had when we used paper charts. I spent ages digging through data to answer my questions, and then I would go to the bedside and try and reconcile that data with what the patient was experiencing at that moment. By the time I got to the bedside I had little time to spend with the patient and sometimes the information I just looked up had changed and I wasn't aware of it.

How does the bedside analytics system differ from an EMR system?

They are designed for two very different environments. There is no way to simply modify the outpatient or inpatient EMR for the ICU environment.

Electronic medical records in the United States originated from billing and scheduling systems. In the 1980s they began to add clinical information. But there were programming framework and computer language limitations, which resulted in data organized around tabs, like a database viewer. So modern EMR system screens look like those of an accounting system.

In addition, EMR systems' clinical utility is often optimized for private practice patient encounters. Those physicians need to know medical history and medications, and as a repository of that kind of data, EMRs work well. For example, if you go to your physician for treatment of a chronic disease like diabetes, the historic data is clearly important for diagnosis, and prognostication is 10-15 years down the line.

Our bedside analytics system was built from the beginning with a different intent. Patients in acute care hospitals – whether in an ICU or not – have an unpredictable future. The results of interventions are apparent in a very short time. The average length of stay in our ICU is less than two days and the average length of stay in our hospital is about five or six days. These are very short timeframes in which to diagnose and get people heading back to health, and the EMR is not set up to help with that task.

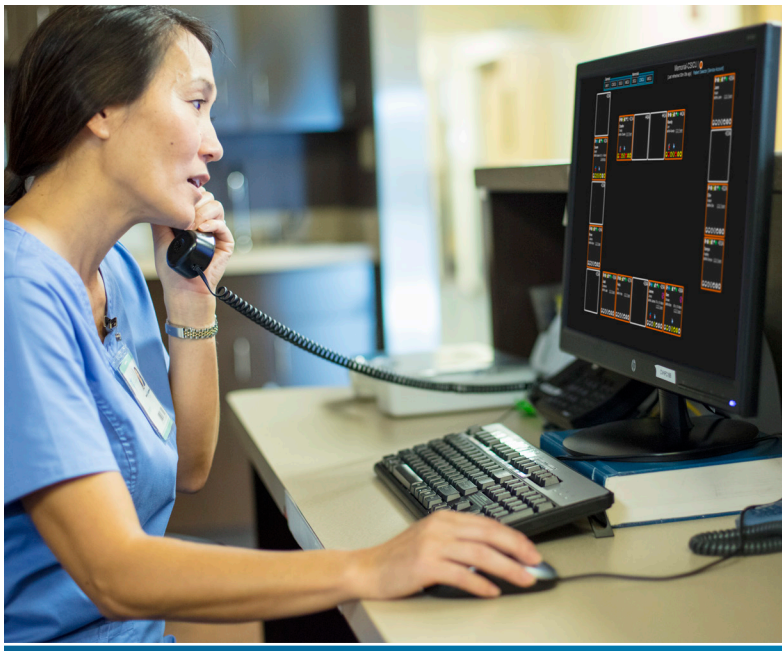
I would liken an EMR to a user manual for a car. In a user manual, you have all your references nicely laid out. Bedside analytics is like a car dashboard, which is always in front of you when you drive. You are trained how to use it, and it has all the information you're likely to need as you drive.

What was the situation before you implemented bedside analytics?

Before we saw a patient, we would spend 25-30 minutes per patient digging through EMR data at a computer terminal.

We would then write the information from the computer terminal on paper and use that in a bedside meeting, or we would gather the team around the computer in the backroom and do a virtual round using the information, taking 15-20 minutes per patient. Then we would communicate our thoughts to those on the floor.

We could easily spend 2 to 2 ½ hours on this, and then another 1 ½ hours communicating that on the floor. However, the piece of information that was relevant when collected at 7 a.m. had changed by the time we discussed it at 11 a.m. and required another round of information gathering, so it wasn't an efficient use of people's time.



AWARE is the predecessor of Philips IntelliSpace Console Critical Care

IntelliSpace Console Critical Care is a cloud-based clinical decision support dashboard that aggregates, analyzes, and presents data acquired through integration with medical devices, hospital information systems, and the electronic medical record.

IntelliSpace Console Critical Care is part of Philips' patient monitoring portfolio, which includes the central station, bedside and transport monitors, mobile applications, and services to help support transformation of clinical workflow.

The solution is the result of a research collaboration between Philips, Ambient Clinical Analytics, and Mayo Clinic under the project name AWARE (Ambient Warning And Response Evaluation).

How does that compare to the situation with bedside analytics?

Now I can quickly navigate information on all my patients. Rather than verbally going through all the data, we get straight to patient-centric decisions.

How has bedside analytics affected interaction with the patient?

Mayo Clinic is a phenomenal institution for putting the patient at the center of things, and this system helps us get back to human-centered decision-making. Eight years ago, residents would spend almost all of their time interacting with the electronic medical record in a darkened space away from the patient. Now they are out in the ICU – still interacting with data, but they're also connected with the nurses and the patients. They've got time to get to know that Mr. X isn't just low sodium, but he's a patient who loves horses and cowboy movies.

If your only interaction with the patient is through the electronic medical record, you'll lose sight of the very real concerns that patients have. Now we augment the clinician's ability to determine what is going on with the patient by adding data that isn't obvious from just a patient interaction, but we still allow the physician to have that interaction and extract all the information that just isn't really available in electronic medical record.

What has been the effect on cognitive load?

Because a large portion of what we do as clinicians is a thought process rather than a physical kind of action, we wanted to measure the burden we were placing on the clinician. So we adopted a tool that NASA developed called the NASA TLX scale to measure cognitive load. We found a fairly dramatic decrease (45% less) in cognitive load when you use our system versus the EMR.[2]

How has the system affected rounding?

There has been a shift from data-gathering and regurgitation to decision-making and patient interaction. Before, we'd gather the data, present it, think about it, confirm it – and only then discuss what we're going to do. Now that discussion about what we're going to do is the focus. Nursing staff, respiratory therapists, pharmacists, the patient and family members have always been participants in multidisciplinary rounds at Mayo Clinic, but we now have more time to listen to what they have to say without moving onto the next patient because we're running out of time. Also, the rounding tool that is part of the system provides a structured template, so that less experienced clinicians or team members can act somewhat independently of the expert decision-makers and can start addressing some low-level care questions.

While the time spent rounding with bedside analytics is reduced, it isn't reduced as much as the time spent data-gathering.

> "The system is designed so that the majority of clinically relevant information is available within the first two clicks. This contrasts with an EMR system where it can take up to seven clicks to get to the information you need to make simple decisions."
>
> – Vitaly Herasevich

How has it impacted patient care?

We have good process data that shows improvement in care processes. For example, we used to have a list of 25 questions about each patient that we were supposed to answer every day. Completion of all questions had hovered around 30%-50%. When we instituted the electronic rounding checklist, completion shot up to 80%-90%, and sometimes even 100%. We accomplished that because our system could detect if a question didn't apply to a patient and condition, and varied the checklist items to make it relevant.

Further reading:

Pickering B, Herasevich V, Ahmed A, and Gajic O. "Novel Representation of Clinical Information in the ICU: Developing User Interfaces Which Reduce Information Overload." Applied Clinical Informatics. 2010; 1(2):116-131.

Thongprayoon C, et al. "The Effect of an Electronic Checklist on Critical Care Provider Workload, Errors and Performance." Journal of Intensive Care Medicine. 2016 Mar;31(3):205-12.

Herasevich V, et al. "Limiting ventilator-induced lung injury through individual electronic medical record surveillance." Critical Care Medicine. 2011; 39 (1):1-6.

Pickering B, et al. "The implementation of clinician designed, human-centered electronic medical record viewer in the intensive care unit: A pilot step-wedge cluster randomized trial." International Journal of Medical Informatics. 201;, 84:299-307.

Pickering B, et al. "Clinical review: The hospital of the future – building intelligent environments to facilitate safe and effective acute care delivery." Critical Care. 2012; 16:220.

Giri J, et al. "Using information technology to reduce data gathering in the intensive care unit." Critical Care Medicine. 2012; 40 (12): poster.

1. Herasevich, V., Littell, J., & Pickering, B. (2012). Electronic Medical Records and mHealth Anytime, Anywhere. Biomedical Instrumentation & Technology, 46(s2), 45-48.
2. Pickering B, Herasevich V, Ahmed A, and Gajic O. "Novel Representation of Clinical Information in the ICU: Developing User Interfaces Which Reduce Information Overload." Applied Clinical Informatics. 2010; 1(2):116-131.

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