SMArTVIEW tests early warning system for post-op patients

Ground-breaking system aims to reduce complications and mortality after cardiac or vascular surgery.

BY DIANNE DANIEL

The sooner you learn of a potential risk, the more likely you are to mitigate it. That's the premise behind recent strides to bring early warning systems to hospital surgical wards, where the goal is to reduce complications, emergency room visits, hospital readmissions and mortality rates after surgery by more closely monitoring patients – even after discharge.

In January, Ontario's Hamilton Health Sciences (HHS) started to enrol patients in its SMArTVIEW trial, a ground-breaking project that aims to reduce complications and improve outcomes in patients aged 65 and older who undergo cardiac or vascular surgery.

While in hospital recovering from surgery, patients are outfitted with wireless respiratory pods, blood pressure cuffs and oxygen saturation monitors, all of which are continuously monitored by the Philips Guardian system. Radio frequency hot spot transmitters placed throughout the surgical ward allow them to roam freely without losing connection.

If there is a change in their vital signs that reaches a predefined threshold score, nurses are notified via a verbal message on their smartphones to "check vitals" and are given two minutes to respond. If they don't answer, they get a second verbal reminder with an additional 30 seconds, and if they fail to respond to that, an alert is sent to the charge nurse.

This paging interface was built by ThoughtWire, and was conceived by the team to recognize that busy nurses need a timeframe to respond, and contingency built in place, in case they can't respond right away.

"Research from leaders in our group has shown that hypoxia, where your oxygen saturation is less than 90, can be related to complications, such as having a heart attack post-op," said Dr. Michael McGillion, a scientist at HHS's Population Health Research Institute and Principal investigator for SMArTVIEW, along with HHS cardiologist and co-lead Dr. PJ Devereaux.

"The idea is to call early attention back to bedside," he added.

In order to reduce alert fatigue, there is a delay built into the system so that it doesn't send notifications with every little change in patient status, explained Dr. McGillion, noting that some patients will normalize on their own. When responding to SMArTVIEW notifications, nurses check patient vitals and input additional information required by the system, such as temperature. The Guardian system provides an early warning score, and if warranted, clinicians intervene, engaging the rapid response team when necessary.

SMArTVIEW is considered a pioneering study because close patient monitoring continues for 30 days after discharge – the period which is known to be the likeliest for an adverse event to occur. Each patient enrolled in the program goes home with a tablet, plus Bluetooth-enabled vital signs equipment, such as a blood pressure monitor and weigh scale, oxygen saturation probe.

The SMArTVIEW trial provides a cellular data bundle, so there's no cost to patients. At the end of 30 days, they simply box everything up and return the equipment via pre-paid courier.

Once at home, patients are asked to measure their vital signs three times daily – morning, afternoon and evening – and results are automatically sent to the tablet. The only measurement entered manually is temperature.

They then use their tablets to hold daily video visits with their SMArTVIEW nurse, a newly created role for the hospital. Appointments are scheduled, but nurses adapt to the patients' schedules as required.

Because the management and collection of patient data – including vital scores – is handled remotely by the Philips eTrAC ambulatory telehealth program, SMArTVIEW nurses are able to monitor their at-home patients using the Philips eCareCoordinator dashboard. Patients also use their tablets to photograph their surgical wounds, which are either sternal or leg incisions, enabling SMArTVIEW nurses to perform visual assessments and watch for signs of infection.

"We've had a tremendous response from patients who are saying, 'This is wonderful. Now I get to take the hospital home with me'," said registered nurse Filomena Toito, one of four initial SMArTVIEW nurses. "Patients have expressed that sense of relief that they are still connected to the hospital team and that their care continues even beyond the hospital walls."

SMArTVIEW nurses are a new addition to the hospital workflow, serving as a bridge between the new monitoring technology, the patients, and the nursing staff to help resolve issues and coach people on how to use the devices. In addition to monitoring the early warning scores, the SMArTVIEW nurses gauge their patients' overall wellbeing, asking how they're eating and sleeping, for example.

"Patients feel so empowered that they're using this new technology," Toito said, "Having that connection is so reassuring and it's helping with best possible care as an outcome."

Karen Barrett, Natalia Worek, and Carley Ouellette are also key members of the SMArTVIEW nursing team.

"A key concept of the study is that when there's a transition from hospital to home, there are gaps," added Dr. McGillion. "The argument we are making

is that the SMArTVIEW nurse gets to know the patient on the ward, know their story, know their issues, and then follows them for the first 30 days at home."

Patients are also empowered to take part in their own healing process. Researchers involved in the project have developed SMArTVIEW Restore and Recover, a five-week education program developed in collaboration with QoC Health that includes interactive videos and podcasts. Patients learn how to communicate pain, what foods to eat to promote recovery and how to transition back to physical activity over time, for example. They also stay in contact with a recovery coach stationed at the hospital.

SMArTVIEW is funded in part by Ontario's Health Technologies Fund, a fund administered by Ontario Centres of Excellence on behalf of the Office of the Chief Health Innovation Strategist. In addition to Philips Healthcare and ThoughtWire Corp., partners include QoC Health Inc., CloudDX, XAHIVE Inc., Argyle Public Relations and the Ontario Telemedicine Network. McMaster University and HHS are also collaborating with Coventry University and Liverpool Heart and Chest Hospital in the U.K., where trials are under way this year.

"They've kicked it up a notch, where they have international team members, trans-disciplinary teams, patient advocates, sector experts and top clinicians. It's a pretty exciting team," said OCE Director, Innovation Procurement, Tania Massa.

Massa said SMArTVIEW is addressing a significant hospital symptom by taking an active approach, as opposed to reactive, and by empowering patients to prevent adverse effects following surgery. At the end of the demonstration project, which involves 600 patients who will be monitored for a period of six months, she expects to see a strong business case put forth for wider adoption of the program

"We're hoping to see reduced readmissions and improved patient satisfaction," she said.

Rob MacLellan, Project Manager, ICT Initiatives at HHS, called early warning systems an emerging field in healthcare. His team devoted 900 hours towards integrating the system, working with the different vendors to connect the various pieces. "We crunched our brains as best we could to think of what could go wrong, and now we're just waiting for the 'Aha! Moment', as in, 'Aha! we didn't think of that one'," he said.

He, McGillion, and Devereaux credit the hospital's clinical informatics, IT and biomedical technology team for working with Philips and ThoughtWire to bring the trial live. Because ThoughtWire was already in place at HHS to support a separate early warning initiative, the alerts generated by the Philips smart monitoring technology are integrated with the existing ThoughtWire notification process.

"Patient information goes up into the Philips cloud. We don't store anything on the hospital side," explained MacLellan.

At Kaiser Permanente Northern California, an early warning system called Advance Alert Monitor (AAM) has undergone testing since 2013. By the end

of this year, 21 sites will be using AAM to observe all medical-surgical patients in order to predict and prevent crashes.

The idea for an early warning system sprouted as early as the 1980s, when a number of studies pointed out that outcomes for patients who suffered cardiac arrest on the hospital ward and were subsequently transferred to the intensive care unit were extremely poor.

"When I quantified the outcome of unplanned transfers to the ICU at our Kaiser Permanente facilities in northern California, it became clear to me that these patients were really sick; they were 3 percent of hospitalized patients, but one of five of the deaths," said Dr. Gabriel Escobar, Regional Director for Hospital Operations Research for The Permanente Medical Group (TPMG) at Kaiser Permanente Northern California.

He is also a Research Scientist at the Kaiser Permanente Northern California Division of Research.

Dr. Escobar's team realized early on that vital sign data would be key to predicting which patients were at risk. Using data from more than 650,000 patients, they worked to develop a predictive model that forms the basis for AAM. The system started out as a web service, grabbing real-time data from a hospital's Epic electronic medical record (EMR), applying advanced algorithms to arrive at an early warning score, and sending an alert for those patients at greatest risk.

The score is based on more than 62 separate factors, including multiple lab values; nursing assessment data such as vital signs, neurological status and pulse oximetry; and, patient demographics. It identifies those patients who are at risk for deterioration within 12 hours. The first sites to pilot the system were Kaiser Permanente's South San Francisco and Sacramento medical centres where AAM ran every six hours and displayed results directly in the EMR.

As Dr. Escobar described, alert fatigue was a very real issue. "There's a trade-off. If you make the alert too sensitive, you'll be generating a lot of work for physicians and nurses for no yield," he said. "If you make it too specific, you'll miss too many patients."

Based on that early experience, Kaiser Permanente decided to move ahead with a different implementation plan, incorporating an existing off-site command center called eHospital Safety Net to serve as an AAM hub.

The centre is staffed by eHospital nurses who now receive the AAM alert notifications, interpret them, and collaborate with the larger clinical team to review and plan next steps, making changes where necessary to address early changes in a patient's conditions.

The hub model means the scores can be run more frequently, increasing the likelihood of successfully intervening to prevent a patient from crashing. It also gives frontline clinicians an opportunity to understand how the scores are derived and how to apply them appropriately, noted Dr. Vivian Reyes, a Kaiser Permanente emergency physician and TPMG Regional Director of Hospital Operations,

"I'm hoping over time this will become 'Oh, of course, the predictive model' so when we roll out subsequent scores, people already know how to use them and there won't be room for misinterpretation," she

said. This spring, Kaiser Permanente Northern California will conduct an in-depth evaluation of the AAM system, looking at 1.2 million hospitalizations from before the system went live, up to February 2018. Preliminary data shows mortality rates have dropped, said Dr. Reyes. "We've also seen a decrease in the ICU length of stay, which is huge," she added. "It's hard to pull patients back once

they've crashed and coded, but if you can prevent that from happening, they get back to their normal physiological state faster and they don't need the ICU."

Moving forward, the Kaiser Permanente implementation team is planning to apply AAM to patients who are admitted to the hospital after a visit to Emergency but are awaiting a bed, referred to as ED boarders – a high-risk group.

They are also working closely with Epic to integrate the AAM workflow directly into their electronic medical record, removing the need for using web services.

"The real challenge is not in developing these predictive models," noted Dr. Escobar. "The real challenge is in making sure you integrate them seamlessly into the workflow so that they really help clinicians, not add to their burden."