

# CLN

October 2019

Clinical  
Laboratory  
News

An AACC Publication | Special Supplement

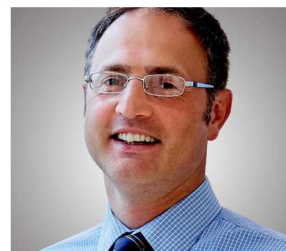
**IMPROVING  
MATERNAL  
HEALTH**

**9.8**

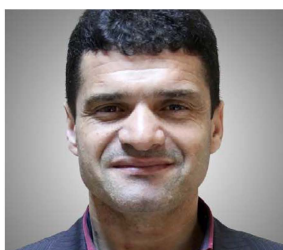
**PER 100,000  
LIVE BIRTHS**

The decline in maternal  
mortality between 2015  
and 2017 in Palestine.

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**INTEGRATED TEAMS CHALLENGE  
THE STATUS QUO  
FOR IMPROVED  
DELIVERY OF CARE**



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# INTEGRATED TEAMS CHALLENGE THE STATUS QUO FOR IMPROVED DELIVERY OF CARE

BY KIMBERLY SCOTT

Clinical laboratories are partnering with clinicians and other vital stakeholders in healthcare to transform patient care across the globe, advancing insights from lab medicine to achieve better outcomes. Multiple best practices were recently recognized by AACC, Abbott, and other leading healthcare organizations associated with the prestigious UNIVANTS Healthcare of Excellence award.

From reducing mortality following non-cardiac surgery to improving quality outcomes for prenatal care, many of the interdisciplinary teams received elite honors of distinction and achievement for measurable, innovative impact within their healthcare systems. In addition, three teams were previously featured as winners of the 2019 UNIVANTS of Healthcare Excellence Awards (*CLN Special Supplement*, July/August 2019).

Below, we profile several additional initiatives with standout recognition in association with the 2019 UNIVANTS of Healthcare Excellence program. Additional standout best practices will be featured in the December issue of *CLN*, highlighting the many teams the program is recognizing for advances in patient care through unique, team-based approaches in laboratory medicine.

## Reducing Complications Following Non-Cardiac Surgery

Each year, more than 200 million people worldwide undergo non-cardiac surgery, and millions of these patients experience complications, including more than 1 million deaths within 30 days following surgery. In 2005, a team from Hamilton Health Sciences Population Health Research Institute (PHRI)

and McMaster University in Ontario, Canada, began studying whether they could identify which patients might experience negative outcomes following non-cardiac surgery.

The researchers began the Vascular Events in Non-cardiac Surgery Patients Cohort Evaluation (VISION) study, which ultimately enrolled more than 40,000 patients aged 45 years or older from 23 hospitals in 14 countries. VISION found that approximately 18% of patients sustained heart damage within 30 days of non-cardiac surgery and 1.8% died. Among adults undergoing non-cardiac surgery, 44.9% of the post-surgery deaths were associated with three complications: major bleeding, myocardial injury after non-cardiac surgery (MINS), and sepsis.

The team, led by P.J. Devereaux, MD, scientific leader of perioperative medicine at PHRI, set out to determine which markers could predict negative outcomes. Initially, the team focused on troponin T (TnT) levels. They found that an elevated TnT after non-cardiac surgery could predict 30-day mortality. Specifically, 1 in 25 patients with a peak TnT measurement of 0.02 ng/mL, 1 in 11 patients with a peak TnT value of 0.03 to 0.29 ng/mL, and 1 in 6 patients with a peak TnT measurement of at least 0.30 ng/mL would be expected to die within 30 days of surgery. They also identified that the vast majority of these MINS events would have gone undetected without troponin monitoring after surgery.

As a result of the study, the researchers made several recommendations about testing, including measuring TnT levels before and after surgery. In a paper published in *The Lancet* in June 2018, they also recommended that in patients with MINS, physicians consider prescribing dabigatran 110 mg twice daily to reduce the risk of a major vascular complication, based on the

## Reducing Complications Following Non-Cardiac Surgery

HAMILTON HEALTH SCIENCES TEAM

18%

of patients undergoing noncardiac surgery  
who potentially can have heart damage  
prevented using TnT measurements

1.8%

of these patients who  
potentially will avoid death  
due to TnT measurements

results of a large international randomized controlled trial they undertook. In another paper published in *CMAJ* on July 29, 2019, the researchers reported having identified a total of eight perioperative complications that were independently associated with 30-day mortality, noting that these complications are promising targets for research on prevention, early identification, and management to decrease perioperative mortality.

"Our goal was to understand and identify major complications after non-cardiac surgery and their impact on 30-day mortality," explained Devereaux. "It became obvious that there were other factors beyond just the heart, so we added on additional sub-studies as we went."

The team, which was recognized with distinction, is currently undertaking several sub-studies to examine what other markers might be associated with poor outcomes or death, such as biomarkers for chronic and acute kidney disease, sepsis, heart failure, hypoxemia, and blood loss. Thus far, more than 30 papers have been published as a result of the original VISION study and the subsequent add-on studies. The VISION database contains a biobank of samples that allows researchers to go back 5 years and mine data and perform new analyses as needed.

"We're not adding new patients to VISION, but we are still asking questions," noted Matthew McQueen, MD, PhD, a professor in the Department of Pathology and Molecular Medicine at McMaster University. "Many more analyses are continuing, and we expect to publish a number of studies based on them."

The laboratory plays a critical role in this research, said Devereaux. "We've done more than 30 VISION publications," he explained. "We asked a lot of the lab to make this happen. As physicians, we don't have the knowledge about precision and instrumentation that is important in the lab. I can't overstate the role of the laboratory in the success of VISION."

As a result of VISION, the diagnostic criteria, characteristics, predictors, and 30-day outcomes for the new diagnostic category of Myocardial Injury Due to Ischemia After Non-Cardiac Surgery have been established and are being applied. Data supports application of this project across troponin assay generations and isoforms (troponin I, troponin T). Additional efforts are underway to identify novel approaches to reduce perioperative cardiovascular events in high-risk patients and to manage patients who develop post-operative myocardial injury.

### Optimizing Test Utilization for Better Patient Care

Since 2011, Cleveland Clinic has sequentially implemented 10 ongoing interventions designed to reduce unnecessary daily and duplicate orders, promote the conscientious use of molecular testing, implement evidence-based guidelines, and reduce *C. difficile* infection rates.

"Our focus was on decreasing inappropriate testing," explained Gary W. Procop, MD, co-chair of the Laboratory Stewardship Committee at Cleveland Clinic's Pathology and Laboratory Medicine Institute, which UNIVANTS recognized with distinction. "Early in the process, our former CEO requested feedback from employees, and we heard complaints from phlebotomists about too many draws. They recognized that doctors were over-ordering, but they didn't have the authority to cancel the orders," he explained. "We also brought in clinical stakeholders to examine the problems and approach the issues in an evidence-based manner."

**"They recognized that doctors were over-ordering, but they didn't have the authority to cancel the orders."**

—GARY W. PROCOP

The Laboratory Stewardship Committee, an interdisciplinary team of clinicians, pathologists, administrators, nurses, and other caregivers, was charged with optimizing test utilization to promote best practices. To start, the committee determined which tests did not need to be repeated more than once per day and worked with the informatics team to build a program that would automatically block a second test if one had already been ordered that day. While it was possible for clinicians to find out whether a test had already been ordered, it involved some digging into patients' medical records, which many physicians did not have the time to do.

### Optimizing Test Utilization

CLEVELAND CLINIC TEAM

**1.2k**

tests on same-day,  
hard-stop menu

**210k**

number of unnecessary  
tests prevented

**\$6M**

cost savings to  
healthcare system

## "Using just one eGFR measurement in older patients who are already ill can lead to inaccurate results."

—MATTHIAS ORTH

"One physician said, I only have so much time with my patients. I am going to order the test I need and let the laboratory sort it out," explained Procop.

The laboratory, in conjunction with informatics and other departments, implemented hard stops on select duplicate tests ordered within a 24-hour period, as well as identical genetic tests ordered twice on the same individual when there is a lifetime limit on these tests. In addition, cost information was added into the ordering system on very expensive tests so providers would be aware and would be able to consider cost when ordering tests from a value-based-care point of view. There are now more than 1,200 tests on the same-day, hard-stop menu.

"This was a sea change within Cleveland Clinic," said Procop. "Doctors orders had never been stopped by the laboratory before. It just wasn't done. Once the blocks were in effect, if a test was ordered that had already been done, the physician would be notified that the test was already ordered and given the results if they were available. Also, we devised a way that if they thought it was really medically necessary to override the block, we gave them an avenue to do that, and in the vast majority of the time, more than 90%, they did not."

In addition to having an effect on patient safety, the interventions also have an impact on patient experience, satisfaction, and diagnosis, noted Procop. When unnecessary tests are performed on a population known to not have a disease (i.e., known from previous testing), the possibility of a false-positive test result is substantially increased. False-positive test results lead to more repeat testing, including the possible addition of radiologic studies and unnecessary medications.

"For example, a patient who was

proven not to have *C. difficile* enteritis by previous testing, who is re-tested and gets a false-positive result, could get abdominal imaging and antibiotics directed at *C. difficile*," said Procop. "This has patient safety issues, as well as patient satisfaction implications. Stopping unnecessary tests positively impacts all these metrics."

Another benefit for patients in reducing unnecessary testing is avoiding unnecessary phlebotomy, Procop noted. "You can appreciate this if you've ever had a loved one in the hospital whose arm is black and blue from too many needlesticks. It's like death by a thousand cuts."

Since 2011, ten ongoing interventions have been integrated into care delivery at Cleveland Clinic, which have stopped almost more than 210,000 unnecessary tests and saved almost \$6 million, according to the Clinic's data. These include reducing daily orders, optimizing blood culture, expanding the genetic counselor team, implementing a non-fasting lipid panel, implementing a Lyme disease serology algorithm, and reducing duplicate respiratory viral panel orders. While the initiatives started at the main campus, many have now been implemented at Cleveland Clinic's 18 regional hospitals.

The Laboratory Stewardship Committee is looking to add additional initiatives to optimize lab testing, including optimizing reflex testing for HIV and hepatitis C virus, as well as improving testing for cytomegalovirus in neonates.

### Co-Reporting eGFRs for Personalized Drug Therapy

Patients with impaired renal function are at high risk for morbidity and mortality and can be associated with high costs, longer lengths of stay, or significant side effects of drug therapy. Correct renal function testing in the hospital is important to detect chronic kidney

### Co-Reporting eGFRs for Personalized Drug Therapy

MARIENHOSPITAL TEAM

25%

of patients who see improved CKD staging and drug dosing as a result of parallel reporting of creatinine and cystatin C-based eGFR

€105k

cost savings from a reduction in chemotherapy drugs

disease (CKD), to avoid further damage to the kidneys, and to obtain an optimized pharmacological therapy. However, current protocols for renal function testing have been known to wrongly classify certain patients, leading to inappropriate drug dosing and poor outcomes.

Researchers at Marienhospital in Stuttgart, Germany, one of the teams UNIVANTS recognized with distinction, knew that if they could optimize noninvasive renal function testing, they could improve pharmacological treatment and avoid further renal damage without consuming additional resources. About a third of the inpatients at Marienhospital

have severely impaired renal function. A team of researchers found that parallel reporting of creatinine- and of cystatin C-based estimated glomerular filtration rate (eGFR) mitigates wrongful CKD classification and improves accuracy of CKD staging and drug dosing in 25% of these patients.

"Using just one eGFR measurement in older patients who are already ill can lead to inaccurate results," said Matthias Orth, MD, PhD, head of the Institute of Laboratory Medicine at Marienhospital, who proposed parallel reporting of renal function using two different equations. "In some countries, clinicians don't use cystatin testing at all," noted Orth. "I don't know why. Price is not an issue. We know that it is a good renal-function marker."

A 2018 cost-benefit analysis involving 606 patients who underwent parallel testing using cystatin C testing in addition to creatinine testing showed a cost savings of about €105,000 from a reduction in chemotherapy drugs. The cost avoidance in 2018 for reduced expensive chemotherapeutic dosing was almost €60,000 for Trastuzumab alone.

This testing intervention, which is easy to implement, could be introduced in all clinical laboratories by programming the alerts into the laboratory information system (LIS) or middleware in a very straightforward way, noted Orth.

"This is highly scalable and highly governed," he said. "Dosing of drugs occurs by a team of oncologists and pharmacists and is supported by the nephrologists if necessary. The detection of patients with large discrepancies is automatically triggered by the LIS or middleware and is fully reliable. The dosing of chemotherapy drugs is performed by the pharmacy on a case-by-case basis using the most recent reports from the LIS. This leads to an essentially complete governance within the initiative." This team, not unlike other standout initiatives covered in this issue of *CLN*, was recognized for their valued contributions and measurable benefits for patients, payors, clinicians, and the health system.

#### **Maximizing Patient Care in a Cost-Conscious Environment**

Through a 3-year integrated approach to improving quality, the Palestine

Laboratory Services Network was able to significantly decrease maternal and infant mortality, reduce hospital admissions, mitigate errors in hematology and chemistry, all while increasing laboratory revenues.

In Palestine, the laboratory services network consists of the central public health laboratory, 14 governmental hospital labs (intermediate), and 193 governmental primary health care laboratories (peripheral). Prior to 2015, laboratory services within the network were neglected at both primary health centers and hospital laboratories, according to Osama Najjar, general director of Allied Health Services. Most of these laboratories failed to meet the most basic requirements needed to support healthcare, due in part of the lack of a standardized quality system and updates needed to support infrastructure equipment, supplies, and human resources.

"Before 2015, there was a list of essential lab tests that did not meet the needs of patients," explained Najjar. "Most of the advanced tests were not done within Palestine but were referred outside of the country. Also, most of the equipment was old, which resulted in poor quality results, and there was an inefficient procurement system, which compromised the quality of laboratory services."

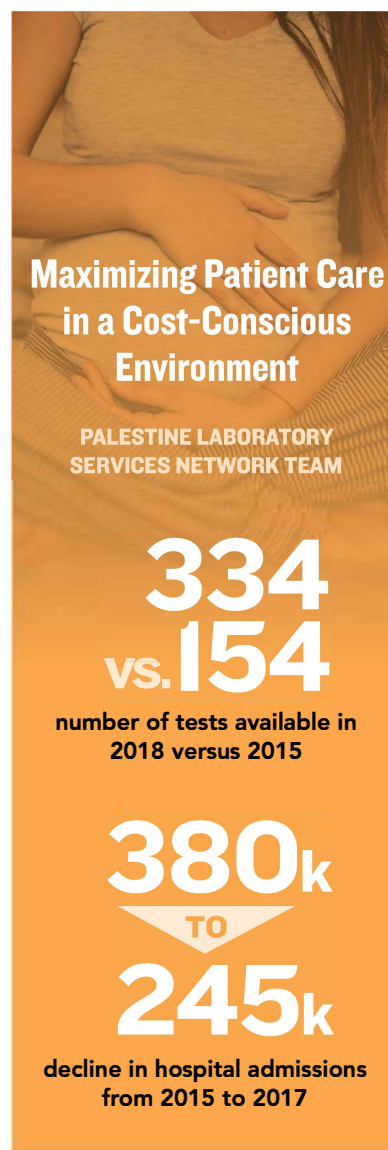
In collaboration with the Palestine Ministry of Health, the Palestine Laboratory Services and Allied Health Services sought to overcome these challenges by mobilizing resources and implementing an external and comprehensive quality system. The 3-year integrated approach, which UNIVANTS recognized with achievement, included quality measures for documentation, as well as training and operations to reinforce the transformational impact that quality systems, services, and equipment can have on clinical decisions, patient length-of-stay, resource optimization, medical errors, and mortality.

Between 2015 and 2017, maternal mortality rates declined by 9.8 deaths per 100,000 live births, infant mortality rates declined by 0.2 deaths per 1,000 live births, and under age 5 mortality declined by 1.8 deaths per 1,000.

According to Najjar, a decrease in mortality rates indicators reflect a positive

change in quality of care and reflect overall improvements in the health of the community, based on World Health Organization (WHO) determinants. Palestine's infant mortality average (10.9, 10.5, 10.7 out of 1,000 live births in 2015, 2016, and 2017, respectively) is actually significantly less than the global infant mortality average as reported by WHO in 2017 (29 per 1,000 live births).

In addition to implementing a comprehensive quality system, the laboratory network also significantly increased the availability of tests and expanded the testing menu from 154 tests in 2015





to 334 tests available in 2018. This ultimately provided clinicians with tools necessary for confident decision-making, as reflected in the increase in the number of tests ordered. With more than a doubling of available tests, ordering practices increased from less than 4 million per year in 2015 to almost 10 million tests in 2018.

Clinicians' increased access to additional testing also resulted in a reduction in the number of hospital admissions from more than 380,000 in 2015 to approximately 245,000 in 2017. This reflects an overall optimization of the admissions process as decision makers have confidence in the tools to make appropriate decisions about whether to admit or not to admit a patient, said Najjar.

Implementation of the external quality system, comprehensive testing menu, and optimized laboratory services also led to a reduction in total number of hospitalization days, from more than 930,000 in 2015 to about 525,000 in 2017. At the same time, the bed occupancy rate increased by 8.8% between 2015 and 2017, from 88.2% to 97%, while the average length of stay decreased by 0.7 days.

This external quality system has increased the level of confidence in the laboratory, according to Najjar, and enabled the system to optimize resources, as "clinicians now have the confidence to provide the right care to the right patient at the right time and patients have confidence in the system and therefore seek out care where they may not have in the past."

Another benefit of the quality improvement initiative was a 10-fold annualized error reduction in hematology and chemistry across 13 hospitals, resulting in fewer downstream costs. Overall, the initiative resulted in a substantial increase in laboratory revenues, from \$7.5 million between 2012 to 2014 to \$12.4 million between 2015 and 2017.

In addition, there have been cost savings due to increased competition from vendors, and parts and maintenance costs for equipment being included in the contracts, and a reduction in cost-per-test.

"This is a success story for medical laboratories in Palestine," said Najjar, who hopes to expand the initiative to other countries.

### Improving Quality Outcomes for Prenatal Care

New Mexico ranks 48th out of U.S. states in the delivery of adequate prenatal care before the third trimester and 30th in preterm births, largely due to a sizeable low-income population, rural communities, lack of patient understanding about the importance of prenatal care, and lack of healthcare options.

TriCore Reference Laboratories in Albuquerque in recent years has been focused on diagnostic optimization—using laboratory data to improve care and decrease costs—as part of its Clinical Lab 2.0 Initiative. Recognizing that prenatal care for New Mexico residents was an area in great need of improvement, TriCore collaborated with Blue Cross Blue Shield of New Mexico to develop and implement a statewide prospective program for pregnant women covered by Medicaid.

An interdisciplinary team consisting of the laboratory, information technology, and pharmacy worked with the University of New Mexico Department of Obstetrics and Gynecology to determine what types of lab information would be most useful in improving outcomes for pregnant women, explained Kathleen Swanson, MS, RPh, senior clinical solutions specialist for TriCore.

"In New Mexico, managed care organizations have financial incentive from the state for management of Medicaid patients, including for prenatal care, but they did not have a way to identify these women since providers did not have to file claims data for prenatal care until after birth," Swanson said. "One of the key markers we worked on was early identification of the women. Data from positive pregnancy tests came from all over but many came from emergency rooms."

Blue Cross Blue Shield would routinely send TriCore a list of its members, and the laboratory would flag women who were newly identified as pregnant and refer them to managed care organization (MCO) coordinators, who would reach out to these patients to engage them in care. TriCore tracked the women's prenatal care, delivery, and post-partum care.

"Our goal was to reach these women, get them into routine care, reduce

premature births, neonatal admissions, and length of stay,” Swanson said. “It was a pretty lofty goal.”

Over an 11-month-period, the TriCore laboratory delivered actionable information to MCO care coordinators for more than 1,300 pregnancies. The targeted intervention identified 76.8% of the pregnancies in the first trimester, which exceeded the state’s 2016 reported baseline of 63.4% and came close to the national average of 77.2%. The intervention also reduced preterm deliveries from 19.7% to 11.4% based on 159 women with reliable gestation age at delivery.

The prenatal care initiative also tracked gaps in care. At the start of the pilot, 450 women were identified as having gaps in care. At the end of the study period, 287 (63.6%) of the women had care gaps closed and only 163 (36.2%) of women had one or more care gaps left unclosed.

Other key performance indicators measured were admissions to the neonatal intensive care unit (NICU) for the 488 births during the pilot period and NICU length of stay. NICU admissions dropped to 10.7% for births where care coordinators used laboratory-driven clinical insights, compared to an 18.2% NICU admission rate for the group not using the laboratory’s analytics. Reduction in length of stay was not significant, which may be due in part to the small sample size, noted Swanson.

The significance of NICU admissions can be seen when comparing the average cost of care for newborns with complications compared to costs associated with healthy newborn care, according to TriCore. Data published for Medicaid births in New Mexico show the cost of care for newborns with complications in 2011 and 2012 was 14 times higher than healthy newborns. Using the average cost-per-day for a NICU bed of \$1,500, a total of \$624,071 in savings were generated for the hospital during the pilot period.

This initiative, which was recognized by UNIVANTS with distinction, is unique in that it is the first known collaboration between an MCO and clinical laboratory demonstrating the value of laboratory data to improve the identification, care coordination, and outcomes of pregnant patients, explained Swanson.

With the demonstrated success of this initiative, TriCore is now working with other MCOs in New Mexico to improve prenatal care and improve outcomes.

“We would like to scale it not only to be useful to MCOs, but also for providers in clinics,” said Swanson. “This is of value not only to the Medicaid population, but

to the commercial population as well. We are looking to expand the initiative beyond just Medicaid.” ■

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## INTEGRATED TEAMS PROFILED IN THIS ISSUE

**The UNIVANTS of Healthcare Excellence Award recognizes teams who collaborate across disciplines to transform healthcare delivery and patient care. In its inaugural year, the teams being recognized come from seven countries around the globe.**

Improving Clinical and Quality Outcomes for Prenatal Care—A Clinical Laboratory Driven Initiative, TriCore Reference Laboratories, Albuquerque, New Mexico, U.S.

- › Kathleen Swanson
- › David Grenache
- › Amy Freeman
- › Mark Koenig
- › Eugene Sun
- › Eve Espey

The Global Impact of Troponin and Biomarker on Ischemic Myocardial Injury and Surgical Care, Hamilton Health Sciences/Population Health Research Institute, Hamilton, Ontario, Canada

- › Matthew McQueen
- › Peter Kavsak
- › PJ Devereaux
- › Daniel Sessler
- › Ralph Meyer
- › Emmanuelle Duceppe

Improving Quality, Patient Care and Experience, While Lowering Costs Through Enhanced Laboratory Stewardship, Cleveland Clinic, Cleveland, Ohio, U.S.

- › Gary Procop
- › Robert Wyllie
- › Anita Reddy
- › Brian Rubin

Avoiding Insufficient Therapies and Overdosing With Co-Reporting eGFRs for Personalized Drug Therapy and Improved Outcomes, Marienhospital, Stuttgart, Germany

- › Matthias Orth
- › Karin-Johanna Haase
- › Sebastian Maus
- › Manfred Hofmann

Maximizing Patient Care in a Cost Conscious Environment, Palestinian Medical Technology Association, Ramallah, Palestine

- › Osama Najjar
- › Lina Nazzal
- › Dergham Yaseen
- › Nidal Alawneh
- › Ali Alhelou