Teams from Seven Countries Recognized with Achievement

From innovative algorithms to improved biomarker monitoring, the evidence shows integrated teams make a difference in patient outcomes globally.

BY KIMBERLY SCOTT

Across the globe, clinicians and laboratory medicine professionals are measurably improving patient lives by implementing care pathways that employ laboratory testing in new ways. From enhancing diagnosis of myocardial injury in babies to detecting cardiovascular risk in blood donors to identifying acute kidney injury and chronic kidney disease, the interdisciplinary teams below have implemented care initiatives that are having a measurable impact on outcomes.

The seven initiatives highlighted below have been recognized "with achievement" by AACC, Abbott, and other leading healthcare organizations through the UNIVANTS of Healthcare Excellence program. This prestigious global awards program recognizes teams who collaborate across disciplines and transform healthcare delivery and, ultimately, patient care.

IMPROVING MULTIPLE MYELOMA DIAGNOSIS
Multiple myeloma (MM), a blood cancer of mature plasma cells, predominantly presents in primary care with relatively non-specific symptoms. As a result, crucial diagnosis often can be delayed or missed if appropriate tests or actions are not performed.

Using diagnostic criteria developed by the International Myeloma Working Group (IMWG), Hampshire Hospitals National Health Service Foundation Trust in Basingstoke, United Kingdom, conducted an internal audit to determine how providers could do a better job of identifying MM. The audit highlighted two key improvement areas: requests that missed appropriate tests and inappropriate referrals being made to hematologists (or missed altogether).

Hampshire Hospitals put together a multidisciplinary working group to review the existing pathway. According to Kate Fenna, principal biochemist in the clinical laboratory, the first significant improvement made was the introduction of an electronic request profile with all required tests, sample types, and instructions accessible on all platforms. The next and largest task was writing a complete interpretation algorithm with supporting information technology (IT) rules and a risk category escalation protocol. The aims were to ensure that every sample had all tests analyzed (reducing repeats), reduce manual intervention, improve result turnaround times, and reduce variation in action.

The IT element included result entry drop down, auto-reflex testing rules, and a way to automatically send critical result reports to the hematologist on duty. This not only reduced paper use but also significantly reduced the time taken for patient review.

Another key aspect of the initiative was the creation of coded interpretive comments that were concise, informative, and referred clinicians to the most appropriate clinical guidance, Fenna said. In addition to these large changes, the team introduced several smaller IT improvements, including patient flags, ability to quantify multiple paraproteins, and therapy flagging. Team members wrote a simplified algorithm to enable biomedical scientists "first read" interpretation. And to improve communication, the hospital started a monthly pathology newsletter. The initiative relied heavily on three clinical disciplines and the clinical laboratory, with a significant amount of IT work.

Prior to implementing the initiative, the lab sent urgent patient reports to the requesting physician, often a general practitioner, for appropriate action. The requesting clinician would have to review the results and initiate an urgent patient referral to the hematologist. Under the new protocol, the duty hematologist reviews all urgent positive patient results within 24 hours of result generation. This has reduced urgent patient review from 2 weeks to 24 hours. In addition, the lab now sends all patient reports with clinical comments that guide the requesting clinician on the most appropriate next steps, which has improved clinician satisfaction.

Also prior to implementation, about 64% of patient requests had all the required tests at initial presentation. Now, that number has increased to 87% and is expected to continue to increase as the profile use becomes embedded. Inappropriate secondary care hematology referrals and queries have gone down by 10% since introduction and are expected to continue decreasing.

"Since introducing the simplified algorithm, four biomedical scientists have been trained on electrophoresis first read and interpretation," said Fenna. "Increasing the skill set and test repertoire of the laboratory staff has significantly improved staff morale and engagement, particularly as this is a manual laboratory technique with which many are unfamiliar."

While the use of IT, diagnostic algorithms, and coded commenting is not novel, its use in this context for this diagnostic pathway is, she noted. The principles applied to this diagnostic pathway could easily be transferred to other diagnostic pathways where clear criteria and guidelines exist.

Improved patient pathway for diagnosis, follow-up, and monitoring of multiple myeloma

2 weeks to 24 hours
Reduction in time for review of urgent positive patient results

Enhanced discrimination of myocardial injury in the pediatric population

52.62% to 82.88%
Safe exclusion of myocardial injury in babies from birth to 2 years of age

Hampshire Hospitals is currently in the process of implementing a similar approach to thyroid function testing.

ENHANCED DIAGNOSIS OF MYOCARDIAL INJURY IN CHILDREN

Pediatric heart disease is a significant concern in the children's healthcare system. Physicians use biomarkers of myocardial injury, echocardiography, and electrocardiogram readings to form a clinical diagnosis and appropriate treatment plans. High-sensitivity cardiac troponin I (hs-cTnI) is the most common biomarker in pediatric heart disease workups. However, most clinicians use the reference interval of hs-cTnI in adults to diagnose pediatric heart disease.

Due to the similar clinical presentation of disease states, such as neonatal patent ductus arteriosus, viral myocarditis, and congenital heart disease, clinicians often find it challenging to diagnose a myocardial injury. This makes it critical to improve myocardial injury discrimination in a pediatric population.

Understanding that age-specific reference intervals for hs-cTnI would increase the accuracy of myocardial injury diagnosis in pediatric patients, a multidisciplinary clinical care team at Shandong Yantai Yuhuangding

Early detection of unsuspected cardiovascular risk in asymptomatic blood donors

3%

Blood donors who were asymptomatic and had no known risk factors identified as medium-to-high risk for future CVD events

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Hospital in Yantai, China, established a pediatric hs-cTnI reference interval to improve diagnosis.

Since the level of hs-cTnI in peripheral blood varies significantly between children and adults, physician use of adult reference values in assessing a child led to many children having their hs-cTnI levels re-examined after testing showed elevated levels during hospitalization. Parents were told that their child might have heart disease and were referred for follow-up cardiac assessments.

"The level of hs-cTnI in peripheral blood varies significantly between children and adults," said Lei Chen, vice director of the laboratory at Yantai Yuhuangding Hospital. "For example, the highest hs-cTnI reference value for newborns (114.16 ng/L) was about 4.3 times for adults (26 ng/L). Physicians' use of adult reference values for myocardial injury in assessing pediatric patients results in misdiagnosis in many children."

Because direct determination of reference ranges in pediatric populations is difficult due to the inability to obtain enough healthy children to participate in the study, the multidisciplinary clinical care team established a reference interval for hs-cTnI in young children by mining laboratory data using the indirect Hoffmann method. The team established reference ranges of hs-cTnI corresponding to the specific age (days, months, or years) and provided this information to clinical departments through the laboratory information system.

After implementing the initiative, the safe exclusion of myocardial injury increased from 52.62% to 82.88% in patients from birth to 2 days of age, from 55.66% to 96% in patients ages 2 to 7 days, and from 59.6% to 82.59% in patients from 7 days to 2 months of age. Overall, the hospital saw an 84% reduction in the number of blood samples drawn for cardiac marker tests in neonatal and pediatric medicine departments.

Use of the new pediatric reference ranges for hs-cTnI has made a significant improvement in assessment of myocardial injury in children, Chen said. In addition, ruling out myocardial injury early in a child's life

eliminates the need for prophylactic nutritional drug therapies, which is estimated to save about $248 dollars (US) per patient.

EARLY DETECTION OF CARDIOVASCULAR RISK IN BLOOD DONORS

Cardiovascular disease (CVD) is the leading cause of hospitalization and death in Italy, according to World Health Organization estimates. Current tools used for cardiac risk stratification have several advantages, but also limitations, such as general correlation to risk of heart disease, inaccurate risk prediction, cutoffs that put the majority at moderate risk, and heavy dependence on age.

Cardiac-specific biomarkers, in conjunction with clinical and diagnostic findings, can help overcome these limitations, allowing an early identification, categorization, and prediction of who is at risk of future cardiovascular events.

Considering the importance of cardiovascular risk stratification for early prevention, Villa Sofia Hospital of Palermo implemented a CVD prevention initiative involving apparently healthy individuals, starting from blood donors without history of CVD, symptoms, or known risk factors, regardless of age. Together with tests performed on blood donors, Villa Sofia Hospital also included hs-cTnI as a cardiac-specific biomarker to more accurately identify and stratify early cardiovascular risk in this asymptomatic population, explained Patrizia Carta, a laboratorian in the transfusion medicine department.

Values of hs-cTnI greater or equal to 6 ng/L for men and 4 ng/L for women, in conjunction with other diagnostic findings, identified blood donors at medium/high risk of future CVD events, triggering a follow-up visit with cardiology and further investigations with imaging diagnostics, if required. The initiative generated measurable benefits, including early identification of 89 asymptomatic individuals who were newly identified at medium/high risk of future CVD events.

Since implementing the initiative, 3% of blood donors (89 out of 3,340) who were asymptomatic and without any know risk of CVD have

been identified as medium-to-high risk for future CVD events, triggering follow up by cardiology and imaging diagnostics for more investigation. In the most extreme case, investigation results and clinical evaluation led to identification of a structural cardiomyopathy, ensuring early treatment and avoiding worse outcomes.

Another benefit is that the addition of a cardiac-specific biomarker to all blood donors regardless of age has helped drive blood donations at a time when it can be difficult to find people willing to donate. In addition, the estimated cost savings for the entire Sicily Healthcare Regional System was between 267,000 Euros and 445,000 Euros, based on mitigated outcomes associated with early risk assessment and intervention of the 89 medium-high risk blood donors.

"Our center was the only one in Italy to implement a cardiovascular risk prevention study," Carta said. "Our initiative allows us to screen a healthy population—as blood donors are by definition—allowing us to find that the healthy population could suffer from pathologies unknown to them."

RENAL OSTEODYSTROPHY MONITORING

Chronic kidney disease – mineral bone disorder (CKD-MBD) is a major cause of excess morbidity and mortality in hemodialysis patients. In Croatia, there are about 150,000 patients with chronic kidney disease (CKD), more than 2,000 of whom are on dialysis. Global clinical practice guidelines recommended by the KDIGO (Kidney Disease: Improving Global Outcomes) guidelines endorse routine monitoring of bone biomarkers, including alkaline phosphatase and parathyroid hormone (PTH) every 3–6 months in patients undergoing hemodialysis.

In patients receiving treatment for CKD-MBD, or in patients with CKD and biochemical abnormalities, more frequent monitoring can enable enhanced identification of biomarker trends, early assessment of treatment efficacy, and mitigation of associated side effects.

The integrated care team at the University Hospital Center in Zagreb, Croatia, follows this best practice of more frequent testing of bone

biomarker levels, which are monitored every 4 to 5 weeks in patients on calcimimetics (CINET) and vitamin D (or vitamin D analogs, such as ZEMPLAR). In addition, monthly PTH monitoring occurs in all children on dialysis with CKD-MBD.

"Using this approach, better titration of drug dosing is possible, preserving bone density and avoiding potential side effects for our patients," said Sanda Jelisavac Cosic, a biochemistry and laboratory medicine specialist in the department of nuclear medicine and radiation protection. With accelerated intervention in more than 60% of patients undergoing monthly PTH monitoring, the program enhances wellness, mitigates long-term risk, and reduces overall health care costs, she noted.

More frequent visits for patients who are undergoing therapy enable faster dosage adjustments, improving overall patient care and satisfaction, Cosic added. Better PTH control also has resulted in a decrease in the number of hyperparathyroid patients who need to have their parathyroid glands removed.

Patient surveys found that 100% of respondents were less stressed and feeling healthier when coming to regularly scheduled checkups. Almost all (98%) of nephrologists associated with this best practice indicated that they feel more secure in prescribing therapy and treating patients on dialysis due to more frequent PTH checkups.

"More frequent monitoring of PTH contributes to better calcimimetic titration and vitamin D analogs, slowing down the development of secondary hyperparathyroidism and preventing calcium bone loss," said Ninoslav Leko, head of nephrology at the hospital.

The best practice also has helped reduce healthcare costs. The cost of dialysis is $26,400 annually, while the cost of bone-saving therapy is an additional $10,300 annually. The reduction in cost ranged from $291 to $524 per patient per month, according to Cosic.

SCREENING HEALTHCARE WORKERS FOR COVID-19 ANTIBODIES

By November 11, 2021, the COVID-19 pandemic had resulted in more than 739,847 cases of confirmed infection in Jordan and more than

9,530 deaths. Because healthcare workers (HCWs) are considered at an elevated risk of infection, vaccination strategies of many countries, including Jordan, have focused on treating HCWs as a priority group.

At King Hussein Cancer Center in Amman, Jordan, a team went one step further. Knowing that antibody levels produced after vaccination begin to decrease over time—and there is no assurance that vaccinated HCWs are immune to COVID-19—the center adopted an initiative to screen them to ensure their vaccination succeeded in generating protective immunity against SARS-CoV-2. The idea was that this, in turn, might convey some protection for the center's cancer patients as well.

The cancer center chose the most sensitive, full automated, and practical test available to quantitatively measure IgG antibodies that attach to the virus's spike protein on the virus surface in serum and plasma, according to Lina Souan, director of the clinical immunology laboratory. The center also established a COVID-19 convalescent plasma and database bank for treating COVID-19 patients.

After the initiative was implemented, 5.3% of healthcare workers at the cancer center were identified as

Early diagnosis of acute kidney injury in hospitalized patients with comorbidities

60%
Patients with elevated SCr levels who would not have a documented clinical diagnosis without the algorithm

lacking a protective antibody response to COVID-19. Those workers were strongly advised to get the vaccine or take a third booster shot. Otherwise, these workers were required to bring in a SARS-CoV-2 negative PCR test every 72.

The antibody testing also helped the cancer center determine which vaccines were most effective at inducing neutralizing antibodies for a longer period. According to the data, 43.9% of HCWs vaccinated with Sinopharm lost their vaccine induced neutralizing antibodies at 7 months after vaccination; 99.6% of HCWs vaccinated with Pfizer maintained their vaccine-induced neutralizing antibodies; and 98.2% of those vaccinated with AstraZeneca maintained their protective antibodies.

The cancer center also collected 484 convalescent plasma units to use in treating SARS-CoV-2 infected cancer patients, which led to decreased hospitalization and helped patients recover faster.

Mitigating avoidable complex procedures in cancer patients with chronic illnesses and underlying health conditions saves considerable costs while decreasing patient morbidity and mortality, noted Osama Abu Atta, section head of infectious diseases. For every cancer patient

who did not contract COVID-19, the center saved an average of JD 1,200 per day.

"Improving and reducing the length of stay improves financial, operational, and clinical outcomes by decreasing the costs of care for a patient," he said. "It can also improve outcomes by minimizing the risk of hospital-acquired conditions."

Keeping patients healthy is the best practice for cancer care, added Souan. "By understanding how employees are affected by the vaccine, we can better ensure patient safety and the safety of our frontline healthcare workers. We also learned more about the effectiveness of each vaccine in our healthcare worker population and were able to build a convalescent plasma bank to help cancer and COVID patients."

EARLY DIAGNOSIS OF KIDNEY INJURY

Acute kidney injury (AKI) is a spectrum of heterogenous conditions that develop due to rapid impairment in renal function owing to a complex, multifactorial etiology. AKI is hard to diagnose, due to its asymptomatic presentation, with about 50% of cases being missed. Without timely diagnosis and intervention, the disease may progress to chronic kidney disease

(CKD) and end-stage rental disease (ESRD). This disease is of public health importance because of its association with increased complications (life-threatening electrolyte imbalances, pulmonary edema, metabolic encephalopathy), mortality rates (as high as 40%-70%), and cost of healthcare. Optimal management of AKI can help improve patient outcomes and reduce mortality rate by 20%.

To tackle this issue in India, the biochemistry and immunology department of Kokilaben Dhirumbhai Ambani Hospital and Medical Research Institute (KDAH) created a pilot project for an alert system to facilitate early diagnosis and timely intervention for AKI. The department created an algorithm to track an increase in serum creatinine (SCr) according to the KDIGO guidelines, explained Barnali Das, a lead consultant heading the biochemistry and immunology sections in the laboratory medicine department of KDAH.

Patients older than 18 years with a baseline of SCr less than 4 mg/dl were evaluated and positive alerts were generated for 214 of 4,439 hospitalized patients screened over a 45-day period. Of these, 75.2% were critically ill, with primary diagnosis of cardiac, pulmonary, and nephrological events and co-morbidities such

Screening healthcare workers for neutralizing SARS-CoV-2 IgG antibodies

5.3%
Healthcare workers identified as lacking a protective antibody response to COVID-19

Renal osteodystrophy monitoring by monthly PTH determination in hemodialysis CKD-MBD patients

$291-$524
Savings in drug and PTH costs per patient per month

as hypertension, diabetes mellitus, and CKD. Approximately 60% of patients with elevated SCr levels would not have a documented clinical diagnosis without the clinical algorithm.

Executing the AKI alert system in real time is imperative to assist physicians in early diagnosis of AKI, Das said. Algorithms that implement the recommendations from the KDIGO guidelines offer visibility to physicians about AKI risks that may have previously gone unnoticed under the usual standard of care. Accuracy of the system was 91.4%.

"To our knowledge, this is the first attempt to create and implement an alert system to facilitate early diagnosis and timely intervention for management of acute kidney injury in India," said Urja Parekh, a research scholar on the pilot project.

Das and the team from KDAH recently received a $37,500 grant from Koita Centre for Digital Health of IIT Bombay and started a collaborative project with Siuli Mukhopadhyay of IITB to develop a risk prediction algorithm and web-based model for an AKI e-alert system.

The initiative enhanced clinician confidence in their ability to detect AKI even when creatinine levels are normal, noted Kiran Shetty, a consultant intensivist in the intensive care unit. "Early alert is especially useful in patients with nephropathy, diabetes, and hypertension and helps with management of these patients," he said. "The AKI alert system also contributes to the assessment of drug-dosage modifications, informing primary consultants on early identification of AKI and potential necessary action."

Identifying AKI early also has helped the hospital reduce costs. The average length of stay for AKI patients is 12 days with an average cost of $466 per day at KDAH. Treatment of critically ill AKI patients in the ICU costs $602 per day on average. Progression of AKI to more advanced stages would require dialysis at a cost of $444 to $619 per round of dialysis. And AKI screening ranges between $13 and $35 per patient, which results in a significant savings when AKI is caught and treated early.

OPTIMIZING DIABETES TREATMENT

The expanding prevalence of diabetes mellitus (DM) and the number of patients living with DM and its comorbidities has brought about new socioeconomic challenges. DM is a significant health problem that is associated with serious complications. Even prediabetes has shown to be associated with various complications, including increased macro and microvascular damage. Patients presenting with critically uncontrolled diabetes, acute diabetes-related complications, and diabetes-related comorbidities are subject to increased risk of mortality, increased incidence of chronic complications, increased length of stay in a hospital, and increased costs per admission.

Zulekha Hospital in Dubai, United Arab Emirates, formed a working group to focus on these challenges. The group developed a systemized, five-stage multidisciplinary clinical care pathway based on international guidelines and adapted to the hospital's patient population with the aim of supporting optimal DM care and preventing anticipated complications, according to Mariam Younan, a pathologist, and head of the hospital laboratory department.

"The battery of lab tests included in the pathway was very well chosen to address all aspects of clinical care of diabetes patients," Younan noted. All critical results were automatically alerted by the software with an automated message sent to the requesting doctor's mobile, together with a phone call. All tests were flagged in the final report to easily identify when abnormally low or high. Test

Optimizing care of diabetes patients through a 5-stage multidisciplinary clinical care pathway

4.5-Fold
Reduction in cardiovascular risk due to early detection of diabetic complications

results, once authenticated by the lab, were simultaneously viewed by the treating doctor on the electronic healthcare record and by the patient on the hospital patient portal. "All the above assisted in prompt and adequate patient care with early detection of complications and timely decisionmaking," she said.

Since being implemented in January 2021, the clinical care pathway led to a 30% increase in patient engagement, 11.5% reduction in HbA1c levels, as well as enhanced early detection of DM complications like diabetic nephropathy (11% to 19%), retinopathy (6% to 14%), and neuropathy (14% to 36%). It also led to earlier detection of diabetic foot infection with no amputations after the start of the initiative, according to Magdy Allam, head of the hospital's endocrinology department.

There were other positive outcomes related to the DM clinical pathway as well. Patient obesity declined by 6.45%, dyslipidemia dropped by 21%, systolic and diastolic blood pressures were reduced by 9% and 6%, respectively, and detection of vitamin B12 deficiency increased fivefold.

Not only were patients satisfied with the new pathway, but clinicians also expressed support. "Increased detection rate of neuropathy in diabetic patients after the pathway implementation increased my confidence in preventing a further chain of potential complications, including diabetic foot infection as neuropathy usually presents first in this chain," said Mohamed Elshafei, a specialist neurologist.

Prior to implementation of the pathway, 4% of patients with diabetes required hospital admission due to moderate to severe hypoglycemia (and one case was admitted with diabetic ketoacidosis). Since implementation of the initiative, no patients have experienced unanticipated hospital admissions due to diabetic complications.

Moreover, cardiovascular risk scores have improved more than 4-fold, mitigating long-term risk

and associated diabetic complications. The score predicts the 10-year risk of the following atherosclerotic cardiovascular disease events: nonfatal myocardial infarction, coronary heart disease death, and fatal or nonfatal stroke. All these illnesses would incur healthcare costs and increase patient morbidity and mortality.

INTEGRATED TEAMS MAKING A DIFFERENCE

Each of these initiatives demonstrates how laboratory testing has a crucial role to play in improving patient care and outcomes. Beyond simply providing test results, clinical laboratories are working closely with interdisciplinary teams to help diagnose health conditions earlier when they can be treated most effectively, thus potentially reducing morbidity and mortality. Not only are these teams improving patient care, but they also are helping to develop integrated care practices that improve standards of care for their communities.

To learn more about the UNIVANTS program and other winners, go to www.univantshce.com.

UNIVANTS 2021 Teams Recognized In This Issue

Improved Patient Pathway for Diagnosis, Follow-up And Monitoring of Mulitple Myeloma: A Multi-Disciplinary Collaboration to Improve the Pathway from the Initial Request to Long-Term Monitoring
Hampshire Hospital NHS Foundation Trust, Basingstoke, U.K.
Kirsty Gordon
Ross Sadler
Alex Kelly
Noel Ryman
Kate Fenna

Enhanced Discrimination of Myocardial Injury in a Pediatric Population Using Age-Specific Biomarker Reference Intervals
Yantai Yuhuangding Hospital, Yantai, China
Guozhen Chen
Chenming Sun
Lei Chen
Yanjie Ding
Guangyu Zhou

Early Detection of Unsuspected Cardiovascular Risk in Asymptomatic Blood Donors
UOC Medicina Trasfusionale Villa Sofia-Cervello, Palermo, Italy
Patrizia Carta
Francesco Arcoleo
Francesco Gioia
Calogero Falletta

Renal Osteodystrophy Monitoring by Monthly PTH Determination in Hemodialysis CKD-MBD Patients
University Hospital Centre Zagreb, Croatia
Sanda Jelisavac Cosic
Drasko Pavlovic
Boris Kudumija

Early Diagnosis of Acute Kidney Injury in Hospitalized Patients with Comorbidities
Kokilaben Dhirubhai Ambani Hospital & Medical Research Institute, Mumbai, India
Sharad Sheth
Urja Parekh
Niranjan Kulkarni
Santosh S Shetty
Barnali Das

Improving Safety, Confidence, and Clinical Care of Cancer Patients Through Screening Healthcare Workers for Neutralizing COVID-19 IgG Antibodies and Establishing a COVID-19 Convalescent Plasma Bank
King Hussein Cancer Center, Amman, Jordan
Maher Sughayer
Hala Al Salahat
Lina Souan
Mohammed Owdeh
Alaa Al-Shorman

Optimizing the Care, Safety, and Wellness of Patients with Known Diabetes Through Laboratory Medicine and a 5-stage Multidisciplinary Clinical Care Pathway
Zulekha Hospital, Dubai, Dubai, United Arab Emirates
Magdy Allam
Mohamed Abdelhamid
Mariam Younan
Eman Yousef
Muhammad Khan
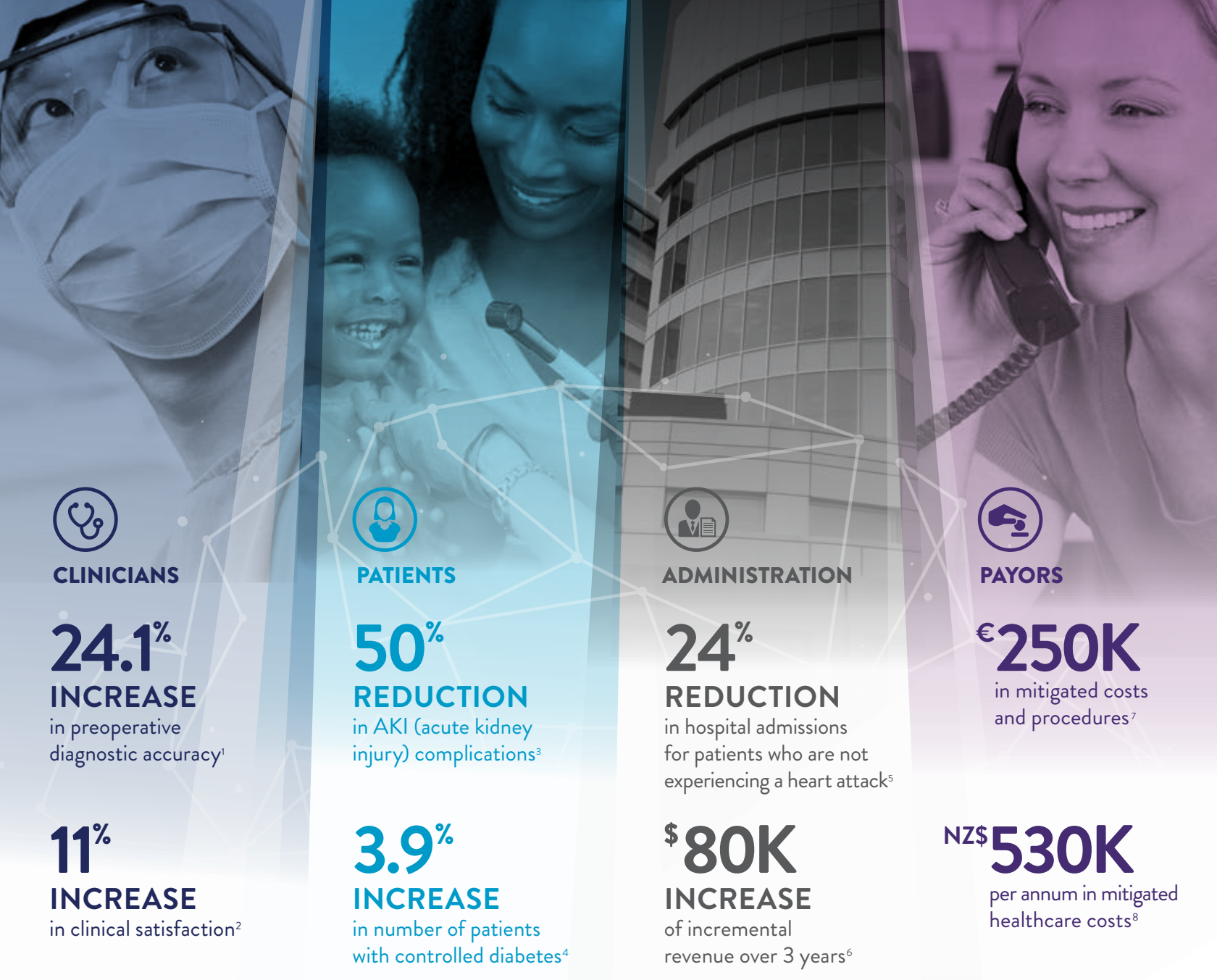
CLINICIANS

24.1%
INCREASE
in preoperative
diagnostic accuracy[1]

11%
INCREASE
in clinical satisfaction[2]

PATIENTS

50%
REDUCTION
in AKI (acute kidney
injury) complications[3]

3.9%
INCREASE
in number of patients
with controlled diabetes[4]

ADMINISTRATION

24%
REDUCTION
in hospital admissions
for patients who are not
experiencing a heart attack[5]

$80K
INCREASE
of incremental
revenue over 3 years[6]

PAYORS

€250K
in mitigated costs
and procedures[7]

NZ$530K
per annum in mitigated
healthcare costs[8]

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