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The Innovator

Baystate Health | ADVANCING CARE. ENHANCING LIVES.

Resilience and Innovation: Baystate Responds to COVID-19

The impact of the COVID-19 pandemic on our healthcare system has been profound. Such disruption is often a great source of innovation, so I am pleased to present this issue of *The Innovator* focused on how Baystate's researchers, innovators and community partners stepped up to meet the challenge.

The necessity to source essential supplies for diagnostic testing, personal protection, and care has indeed been a "mother of invention." Baystate's Diagnostic Services and Department of Pathology quickly ramped up internal testing capabilities, despite shortages of reagents and other essential supplies (page 6). They also partnered with local industry to address a shortage of nasopharyngeal swabs (page 2). Baystate's 3D printing capabilities allowed production of novel face masks (page 3), and our academic relationship with UMass facilitated collaborations to develop face shields (page 5), enhancements to our ventilators (page 4) and viral testing media (page 7). A spirit of clinical innovation also led to the early adoption of non-invasive ventilation and proning to reduce intubations (page 7), and a novel urine marker to assess need for dialysis (page 5).

Dr. Peter D. Friedmann, Chief Research Officer at Baystate Health.

The need to facilitate telework and manage information was similarly crucial, and Baystate I&T and TechSpring nimbly advanced solutions to meet this demand (page 3). I&T also collaborated with the Office of Research and the Institute for Healthcare Delivery and Population Science (IHDPS) to develop COVID-19 patient registries (page 5) that have been vital to tracking the local progress of the pandemic. These and other developments during COVID-19 have jumpstarted our efforts towards becoming a Learning Health System[1].

COVID-19, a disease for which standardized treatment has yet to be defined, also highlighted the key role of Baystate's research enterprise in bringing state-of-the-art treatments to the patients we serve. Our investigators have enrolled patients into clinical trials of experimental therapies like convalescent plasma (page 1), tocilizumab (page 4), and hydroxychloroquine (page 6). The growing demand for Emergency Use Authorizations has shown the mettle of our Human Research Protection program.

The COVID-19 pandemic is not going away quickly, and Baystate research will continue to play an important role in the search for treatments and a safe, effective vaccine. Our new outpatient Clinical Trials Unit at 80 Wason Avenue, which should open later this year, will add important infrastructure to support these efforts. The challenges to our usual research programs, like that for breast cancer (page 2) have also been substantial.

As we adjust to a new normal, I hope you will take some time to read this issue, and appreciate the resilience and innovation that is Baystate Health and its people.

- Peter Friedmann

[1]Stefan MS, Salvador D, Lagu T. Pandemic as a catalyst for rapid implementation: How our hospital became a learning health system overnight; American Journal of Medical Quality. In press.

Convalescent plasma for COVID-19 therapy

The key to preventing COVID-19 may lie in the blood of those who have already been infected with the virus.

What is convalescent plasma?

Patients who have successfully recovered from a viral infection typically have antibodies as proteins in the liquid part of their blood, which is called plasma. Convalescent plasma is collected from the blood of consenting patients (similar to blood donation procedures) who have recovered from an infection. Their plasma usually contains large amounts of antibodies that their body produced to fight off the infection. The convalescent plasma can then be infused into a patient who is at risk for or is currently afflicted with the targeted infection to give them the antibodies to help them fight it off.

"This method has been a fundamental idea in science for over 100 years," said Dr. Hans Schlecht of Baystate Health's Infectious Diseases Division. He also serves as Primary Investigator (PI) for Baystate's convalescent plasma studies. "Infusing antibodies has been proven to prevent certain infections in others (e.g. rabies and hepatitis A virus) and is one of the important elements of vaccine development. Until we have a vaccine, this is another way to help prevent infection." For patients already sick with an infection, the benefits of convalescent plasma are less clear but the track record from other diseases is favorable.

How is convalescent plasma being used to help fight COVID-19?

Researchers believe that convalescent plasma might be one of the key ingredients to fighting COVID-19.

"We are hoping that COVID-19 plasma antibodies will be protective in newly exposed patients," said Dr. Schlecht. When the convalescent plasma is injected into patients with severe COVID-19, the hope is that it will help heal the infected patient.

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Convalescent plasma trials for COVID-19: Expanded Access to Convalescent Plasma for the Treatment of Patients With COVID-19

This "Expanded Access Program" has provided convalescent plasma to over 50 hospitalized patients with COVID-19, allowing them access to investigational, unproven but promising treatments outside of the clinical trial setting. Under this expanded access program performed in collaboration with the Mayo Clinic, the convalescent plasma is transfused to hospitalized patients suffering from severe or life-threatening illness or who are believed to be at high risk of progression to severe or life-threatening disease.

Baystate Health hopes to participate in other COVID-19 trials related to convalescent plasma, including but not limited to:

1.) Post-Exposure prophylaxis protocols where patients exposed to COVID-19, but not yet infected, are given a dose of convalescent plasma with protective antibodies to help counter a potential infection and protect them.

2.) Early infection protocols where someone not sick enough to be at the hospital, but with stable vital signs, is able to recover at home with convalescent plasma, hopefully preventing them from becoming sicker.

Like any clinical trial, certain inclusion and exclusion criteria will apply.

Dr. Hans Schlecht of the Infectious Diseases Division at Baystate Health.

Next steps

Currently, the majority of the convalescent plasma used at Baystate Medical Center has come from the New York Blood Center. Providing a safe framework for the collection of convalescent plasma donations from consenting patients in the Pioneer Valley who have recovered from COVID-19 began in May 2020. Staff at Baystate Medical Center's Blood Bank and Blood Donor Center have worked diligently to overcome several regulatory and logistical hurdles in developing and implementing such a complex program.

Additional trial using convalescent plasma

In addition to the Expanded Access Program, the C3P0 (outpatient plasma project) study is funded by the National Heart, Lung, and Blood Institute (NHLBI) and the National Institute of Neurological Disorders and Stroke (NINDS) as part of the SIREN Emergency Trials Network. People who can take part in this study are those who come to the emergency department with symptoms and get a test indicating COVID-19 illness. The purpose of this clinical trial is to determine if receiving one dose of convalescent plasma (CP) for mild COVID-19 illness prevents illness progression.

How you can help

For those who have had COVID-19 and want to donate their plasma, please visit:

BaystateHealth.org/Services/Blood-Donor/Covid19-Plasma

Partnering with industry to develop swabs

Baystate Health partnered with local brush manufacturer Sanderson MacLeod in Palmer, MA to produce new types of nasopharyngeal and nasal swabs for COVID-19 testing. These brushes were meant to increase our inventory of swabs, which continue to be in short supply. Baystate Health first connected with Sanderson MacLeod in mid-March and began proof of concept testing with emergency approval from the Baystate Institutional Review Board (IRB).

"Standard nasopharyngeal and nasal swabs were very difficult to acquire in large quantities," said Dr. Franklin Moore of the Department of Pathology. "And, without a sustained supply of swabs, we were (and continue to be) challenged to provide expanded testing capacity." For their first visit to Sanderson MacLeod, Dr. Moore and his team brought a typical swab used to sample for COVID-19. From this, the group at Sanderson MacLeod was able to develop prototype swabs with a nylon brush to collect samples. Swabs created by Sanderson MacLeod, or "San Mac swabs" as Dr. Moore calls them, were sent to Baystate Noble to be sterilized before use.

Dr. Franklin Moore of the Department of Pathology.

During Phase I, the new swabs were tested in volunteers to see how many cells the new swabs collected compared to standard swabs. In Phase II, the new swabs were used in parallel with standard swabs to collect samples from patients who were being tested for COVID-19. The initial results of each Phase suggested that the "San Mac swabs" were collecting sufficient amounts of viral particles in comparisons to standard swabs; correlating testing results of known negative and positive patients. Nonetheless, in early July, Baystate and Sanderson Macleod unfortunately had to put their validation efforts on hold. The "hold" was due to 2 key factors: 1.) Reduced positive incidence rates leading to challenges in validating a sufficient volume of "San Mac swabs" vs. standard swabs, and 2.) significant shortage of testing reagents available to be used for this comparison study vs. for actual patient testing. The correlation efforts remained on hold as of early August 2020.

"Even though we are still on hold with our correlation efforts at this time, this effort truly exemplifies the power of collaboration between Baystate Health and a local manufacturer," says Jason Newmark, Vice President of Diagnostic Services at Baystate Health. "The work of this team has shown that together, organizations in our region are capable of rapidly pivoting from their traditional focus and driving true collaborative innovations."

Note: As of early August, Baystate and Sanderson Macleod were still continuing to seek out alternative options to possibly restart validation efforts of the prototype swabs over the coming weeks.

Breast cancer research adjusts to COVID-19

Preparations for COVID-19 have meant that many surgical procedures, including those for breast cancer diagnosis and treatment, have been delayed or moved from Baystate Medical Center to other Baystate hospitals. Baystate investigative teams from the D'Amour Cancer Center, Department of Pathology, and Pioneer Valley Life Sciences Institute (PVLSI) worked closely with the Baystate IRB to quickly allow the research use of tissue specimens from patients going to surgery at Noble Hospital.

"To set up this study, we relied on consenting and tissue procurement protocols that are part of the Rays of Hope Breast Research Registry," said Baystate's Dr. Grace Makari-Judson. "However, with surgeries redeployed to other Baystate hospitals, this required swift actions to make it possible. Thanks to the team of oncologists, surgeons, pathologists, and scientists at Baystate working with the Cancer Services Clinical Research team and the IRB, protocols were revised and reviewed within 48 hours and processes were modified, allowing collections to be initiated."

The challenges of the COVID-19 pandemic have also provided unique opportunities to answer important clinical research questions. Because of COVID-19, breast cancer surgeries for low risk patients have been delayed. These patients are being treated with anti-estrogen therapies while waiting for surgery, a strategy that is well described but underutilized. This approach offers a cohort of patients to test responses to these treatments. This research will help us understand which early stage breast cancers need immediate treatment and which may never cause harm, with important implications that can reduce the overtreatment of early stage breast cancer.

COVID-19 has clearly demonstrated Baystate's nimbleness in adapting successfully to clinical challenges to create opportunities for investigations to improve cancer care.

"This would not have been possible in the past," added Joseph Jerry, PhD, Scientific Director of the Pioneer Valley Life Sciences Institute. "It is a resounding demonstration that Baystate is research-ready!"

Harnessing technology to support telework and clinical care

Baystate Health has been immersed in a culture of triumphs, failures, and sudden changes during COVID-19. Rapid decision-making has become vital to working efficiently as an organization.

Baystate Health Informatics & Technology (I&T) and TechSpring, Baystate's Technology Innovation Center, have made critical contributions behind-the-scenes and at the frontlines of our organization — helping us move quickly and nimbly during this pandemic.

They have launched innovative technologies, tools, and training to support clinical care, help patients and families, and assist our day-to-day business needs. These successes were, of course, in collaboration with several other departments across the health system whose willingness to adapt and try new things helped to move these innovations forward. Here are some of the innovations brought forth by I&T and TechSpring since March:

Snorkel masks were one of the many inventive research innovations that our teams have come up with during the COVID-19 pandemic.

Remote Work Transformation as a Health System

Thousands of employees began to work from home over the course of just a few days and weeks, which is the largest simultaneous volume of remote workers in the health system's history. I&T worked swiftly to prepare its systems and tools to support the huge surge in remote technology access. Enabling communication, collaboration, and connectivity was the primary focus to allow entire departments to maintain productivity while working safely from home. As these tools were new to many employees, it required ongoing communication and training to ensure smooth adoption. The teams curated and created hundreds of documents, videos, and tutorials for this purpose, and made them easily accessible on a new centralized training site. The Service Desk also amplified its availability after-hours and on weekends to support remote workers as they adjusted to the new normal.

Center for Analytics: Data to Drive Decision-Making

The Center for Analytics in I&T worked closely with clinicians and researchers to produce several dashboards to illustrate COVID-19 information about patients, PPE, capacity, and other metrics. This data — derived from multiple electronic systems (like our electronic health record CIS) — helped turn data into insights to drive decision-making for Baystate Health leaders.

Family Video Chat Offers Comfort to Patients, Families, and Employees Alike

With visitor restrictions due to COVID-19, Baystate Health enabled hospitalized patients to connect with friends and family through a Family Video Chat developed and launched at full scale within two weeks. The solution connects patients and families through a video conversation on a tablet and enables clinicians to update family members on the patient's condition in a way that is more personal than a phone call. It is available for use across Baystate.

I&T also installed Family Video Chat on 70+ tablets available for lending to patients who do not have their own smart device. Tablets have been affixed on stands at all Baystate Health hospitals. A diverse group implemented this solution, including patient experience, emergency medicine, interpreter and translation services, I&T (clinical engineering patient technologies, desktop engineering), and TechSpring.

WorkWell Remote Employee Symptom Screening

Working with Human Resources and Employee Health Services, I&T created the WorkWell mobile and computer app to help employees check daily for COVID-19 symptoms and ensure readiness to report to work. WorkWell supplements the employee fever screenings underway at our hospital entrances.

3D Printed Snorkel Masks Enabling Safe Intubation

A team of anesthesiologists investigated how to safely and quickly mass produce PPE alternative face masks to wear during intubation. After partnering with clinical engineering in I&T, TechSpring, Purchasing, and the University of Massachusetts (UMass), we created a 3D printed adapter that attached to an off-the-shelf snorkel mask outfitted with an N99 filter. Over 150 clinical team members in the anesthesia department and emergency medicine used the snorkel masks as a PPE solution.

CommunityConnect: Crowd-Sourcing Ideas, Innovations, and Donations

As its name suggests, CommunityConnect has done just that — connected Baystate Health with the western Massachusetts community (and beyond) to deliver needed supplies like masks, gowns, and testing swabs. This project was established in a collaboration among purchasing, supply chain, the Baystate Health Foundation, marketing, and TechSpring. CommunityConnect is a network that leverages people in the community who may be able to help with these issues and produce supplier leads like engineers and manufacturers.

To learn more about CommunityConnect, visit *TechSpringHealth.org/CC*.

Video QuickConnect Improves Patient-Provider Communication, Conserves PPE

A provider must don PPE every time s/he enters a patient room. I&T, TechSpring, and Emergency Medicine partnered to pilot a video solution that enables providers to have a quick bedside video chat with hospitalized patients without having to don PPE. The tool, called Video QuickConnect, has proven to be a patient satisfier, especially with the younger population. Providers have also benefitted from the increased opportunity to safely communicate with patients, from anywhere in between rounds and while at their desks.

This project has been yet another great example of "user driven innovation," in this case with Emergency Medicine in the driver's seat and TechSpring and I&T as co-pilots, to develop solution on the basis of in-vivo experiments.

GetWell Loop Enables Remote Patient Monitoring and MyBaystate Adoption

When a patient is tested for COVID-19 at any of the Baystate Health testing sites, they are given instructions to sign up for GetWell loop. This patient technology helps them check and report their symptoms from home every day, allowing Baystate nurses to monitor large numbers of patients for worsening disease. This has also been an opportunity for patients to enroll on the MyBaystate patient portal where they can access their COVID test results on their computer or mobile device immediately after the result is reported.

Ventilator Solutions Abound from UMass Collaboration

Our clinical engineering (CE) team in I&T partnered with the University of

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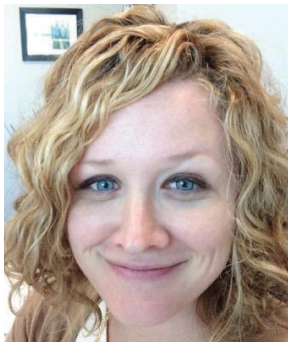


(Left to right) Jill McCormick, Director of Design & Innovation, TechSpring; and Kara Shemin, Senior Communications Specialist, Baystate I&T.

(Continued from page 3)

Massachusetts (UMass) electrical and computer engineering department on two projects to enhance our ventilators, which improved clinician experience and patient and employee safety. First, they developed a 25-foot proprietary cable that connects the patient interface from one ventilator at the patient's bedside to the monitor and controls on a different ventilator placed outside the patient room. This allowed clinicians to continue to view parameters and make settings changes to the bedside ventilator, while conserving the precious PPE necessary to enter the room of a COVID-19 positive patient. In the second collaboration, UMass and CE were able to reconfigure disaster ventilators provided by Springfield Metropolitan Medical Response System (MMRS). Rather than having to run on a D-cell battery that needed to be replaced every 48 hours, they sourced a battery replacement module that enabled the ventilators to be plugged into a standard electrical outlet. This saved valuable staff resources and supplies, while the reduced exposure kept employees and patients safe.

Baystate Health Connect: Continuing Ambulatory Care Visits, Virtually

To continue ambulatory visits while keeping patients safely at home, Baystate Health increased its use of telehealth virtual care visits through Baystate Health Connect. I&T worked to add over 1,000 new providers to the telemedicine platform since March 2020, as well as expanded training for providers to ensure their comfort level with the platform. Clinical services offering video visits for telehealth expanded from Primary Care and Neurology to include Heart & Vascular, Pediatrics, Behavioral Health, Pulmonary, and many other specialties. Over 6,000 video visits have been completed since the beginning of March. Based on responses from our patients, if they had not had the option of telehealth, 44% would have gone to the office, 13% to urgent care, and 3% would have gone to the Emergency Room.

MaskFit: PPE Fit and Tracking Tool

In an effort to properly supply employees with PPE, Employee Health Services and I&T created a tool called MaskFit. This tool helps clinical managers see which types of respirators their employees have been fitted for and track those who need fitting. This tool helps to inform PPE supply needs.

WorkTips Makes Training Mobile

Worktips, a desktop and mobile app created pre-pandemic, was adjusted to aid the health system during COVID-19. WorkTips centralizes technology training and documentation for all employees so they can access vital information on-the-go, even while logged off the Baystate Health network.

COVACTA trial of tocilizumab, a treatment for COVID-19 related pneumonia

COVID-19 related pneumonia

COVID-19 related pneumonia is one of the most serious complications from COVID-19 and can result in patients needing supplemental oxygen, often from a ventilator. There is currently no known treatment for COVID-19 related pneumonia. One theory holds that the congestion in the lung results from a "cytokine storm" in which the immune system goes into overdrive and damages the lungs. Tocilizumab is a medication approved to reduce the immune response in autoimmune diseases like rheumatoid arthritis.

A trial to evaluate effectiveness of tocilizumab in treating COVID-19 pneumonia

The COVACTA trial began at Baystate Health on April 6, 2020 and recruited participants through May 2020. In mid-March 2020, Genentech, a member of the Roche Group, sponsored this clinical trial, which was approved by the U.S. Food & Drug Administration (FDA) and the Biomedical Advanced Research and Development Authority (BARDA).

The purpose of this study was to evaluate the safety and effectiveness of the medication tocilizumab for adult patients with severe COVID-19 pneumonia. Study participants were given an infusion of either tocilizumab or a placebo infusion in addition to their standard medicine that was routinely provided for COVID-19 care. The patients were monitored for symptoms through laboratory findings and X-rays to determine whether the study drug helped improve their condition.

COVID-19 related pneumonia is one of the most serious complications from the virus and can result in patients needing supplemental oxygen.

The Primary Investigator (PI) of this study was Daniel J. Skiest, MD, who has an extensive background in infectious diseases and their causes.

Eligibility to participate in this study

To be considered for this study, participants had to meet certain criteria, including:

- Hospitalization with COVID-19 pneumonia, diagnosed by chest X-ray or CT scan.
- A positive test for COVID-19.
- 18 years or older.

Commitment was approximately 60 days, beginning on the first day of treatment with the study drug.

Recruiting patients for this study

Patients who met the eligibility criteria for this study were approached in the hospital and asked if they would be interested in participating in this study. With any clinical trial conducted at Baystate Health or other healthcare centers, patients reviewed the study documents given to them before the trial and then provided written consent that they agreed to participate in this trial.

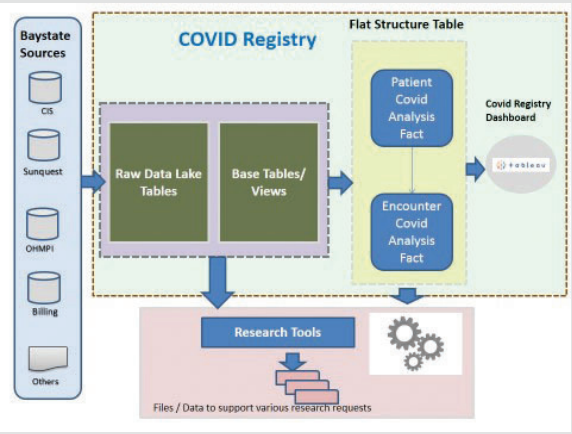
Dr. Daniel J. Skiest, Primary Investigator of the COVACTA and REMDACTA trials.

The study closed to enrollment in early June 2020 after it met the predetermined number of patients. A total of 14 patients were enrolled at Baystate. Follow up is ongoing and an analysis of the results has been taking place.

A follow-up trial, REMDACTA, which examines the combination of tocilizumab with the antiviral drug remdesivir, began at Baystate Medical Center in July 2020.

If you have any additional questions about the COVACTA or REMDACTA studies, please contact Lori Kozikowski at 413-794-5584 or send her an email at *Lori-Ann.Kozikowski@BaystateHealth.org*.

Creating a research registry of patients hospitalized with COVID-19



Considering that Baystate Health cares for a large number of patients with COVID-19 infection and the pandemic is anticipated to potentially last at least another year with recurrent waves, the Office of Research convened a workgroup of investigators, led by Mihaela Stefan, MD, PhD and Peter St. Marie, to construct a patient registry to answer clinical research questions, respond to national efforts to pool data, and evaluate quality improvement initiatives.

The registry effort brought together teams that often worked as dyads but rarely all together: data management and analytics, medical informatics, epidemiology and statistics, researchers, clinicians, and medical students. The registry will continue to collect data for duration of the pandemic and support retrospective or prospective studies to understand the characteristics and outcomes of the COVID-19 infection in western MA.

"Building the registry has proved to be a complicated and lengthy process that takes lots of resources, and it revealed some of the strengths and weaknesses," says Dr. Stefan. "Although we have developed other registries in the past, the pace to assemble them was more leisurely. The morbidity and mortality of COVID-19 created a great sense of urgency and motivation to get this work done quickly so we could learn from the data how to take better care of our COVID-19 patients."

It is not a simple task. Data has to be pulled from various sources, linked, harmonized, and cleaned. The data needs validation to ensure that the files extracted from the electronic medical records (EMR) and administration accurately reflect the clinical reality that clinicians on the ground are seeing. Finally, the most cumbersome part – an army of clinicians, residents, and students will need to extract data from the EMR that it is not contained in structured fields.

For some clinicians and clinical-investigators on the workgroup, the process seemed slow and frustrating, and it took a while to understand why it takes 'so long' to develop the registry. However, work that often takes months to years has been accomplished in a few weeks.

"Recognizing the complexity of the process and the enormous amount of work behind-the-scenes by teams from analytics, informatics and data management was a humbling experience that broke down interdepartmental silos and got all of us to appreciate the challenges of harnessing the data," says Dr. Stefan. "The good news is that we are making excellent strides towards having a robust research registry with data that we can use and trust to evaluate our innovative COVID-19 interventions, and the lessons learned will speed the development of registries for other key conditions in the future."

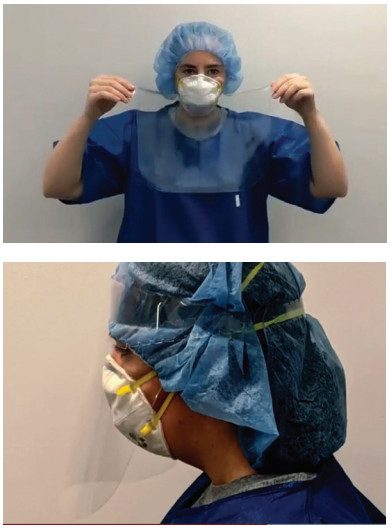
Mihaela S. Stefan, MD, PhD, Associate Director for Implementation Science within the Institute for Healthcare Delivery and Population Science, Director of the Perioperative Care Program, Director of Quality Assessment for the Division of Healthcare Quality, and Associate Professor of Medicine at UMass Medical School-Baystate.

Sourcing PPE: face shield development with UMass Amherst

In response to the PPE shortage at the beginning of April 2020, researchers at UMass Amherst quickly designed protective plastic face shields based on clinical feedback. IALS director Peter Reinhart, PhD along with Frank Sup and Meghan Huber of mechanical and industrial engineering at UMass Amherst, coordinated this effort. Dr. Reinhart helped to organize numerous COVID-19 response teams at UMass Amherst during the beginning and peak of COVID-19 in western Massachusetts.

The entire development process for the face shields took under two weeks and was led by engineers, nurses, and other health care professionals. The shields are made from a single, flexible sheet of 0.010-inch plastic film that can be worn over an N95 mask. The shields bend to wrap around the forehead and securely fasten at the back of the head.

Jim Flynn, the new Assistant Dean of Research Development at UMass's College of Information and Computer Sciences, identified K+K Thermoforming in Southbridge, Massachusetts to manufacture the face shields. They accepted and produced an initial order of 80,000, and then distributed them to local medical facilities and other front-line responders in western Massachusetts. The company will continue production based on demand.



A view of the protective plastic face shields developed by UMass Amherst. (Photo courtesy of UMass Amherst)

Novel Urine Marker May Reduce Dialysis-Requiring Kidney Injury in COVID-19

Baystate Medical Center has used Nephro-Check (NC), a urinary biomarker of kidney "stress," for several years to screen patients at risk for acute kidney injury (AKI) following cardiac surgery. The onset of the COVID-19 pandemic caused a high rate of Stage III AKI requiring dialysis. As a result, members of the Divisions of Nephrology and Critical Care Medicine created a continuous quality improvement (CQI) project in an effort to reduce the incidence of dialysis. Beginning in April 2020, they instituted a protocol whereby all hospitalized COVID-19 patients had a NC biomarker test performed upon admission. Pregnant patients and those that already had baseline serum creatinine of ≥ 2.0 or were already on dialysis were excluded. Patients with a NC value of ≥ 0.7 received a multidisciplinary intervention from the STREAM (Saving The Renal function by Evaluation and Management) team. A renal-protective strategy was instituted that involved volume status monitoring, urine studies and reduction of nephrotoxic medications. A "Plan-Do-Study-Act" approach was used to maximize NC testing and appropriate referral for positive tests. Prior to implementation of this CQI project, nineteen COVID-19 patients with AKI required dialysis. This number was reduced to six following implementation of the protocol. The study team is analyzing these data, with a future publication anticipated.

Scaling up lab testing and supply chain capacity

IT ALL STARTS WITH TESTING

Testing patients for COVID-19 is critical to determine treatment plans, cohort patients appropriately, and help understand the spread and incidence rates of the disease in a given population. To test, a sample is swabbed from a patient's nasal passages. Then the swab is put in a medium to preserve the viral material during transport to the laboratory, where it is then processed and analyzed to determine the results. Supplies and equipment necessary for testing include: testing machines (platforms), reagents and testing supplies (specific to each testing platform), swabs (for collecting specimens), and transport media.

"In-house testing for COVID-19 during the first few weeks [of the pandemic] was extremely difficult due to our lack of supplies," said Jason Newmark, Vice President of Diagnostic Services for Baystate Health. Mr. Newmark oversees the day-to-day operations of system-wide radiology and laboratory services.

When COVID-19 arrived, external vendors were redirecting essential equipment and supplies to the Center for Disease Control (CDC), commercial laboratories, and designated "hot spots" around the country first. After that, hospitals were being prioritized based on assessed demand/need.

"Unfortunately, Baystate Health and western Massachusetts were given lower priority," added Mr. Newmark.

COMMERCIAL LABORATORY SUPPORT

"We had to send our COVID-19 samples to commercial laboratories for testing for several weeks as we awaited reagents and supplies and worked to validate our platforms for use," Mr. Newmark explained. "The commercial labs we worked with were very collaborative and our initial turnaround times were under 24 hours." However, as regional and national testing demands increased, commercial labs could not sustain a 24-hour turnaround time. These delays had a significant impact on Baystate's ability to manage patients in the Emergency Department until results were available, leading to increased need for PPE, challenges in cohorting patients, and delayed admissions.

(Above left) Jason Newmark, Vice President of Diagnostic Services, Baystate Health. (Above right) Virginia "Ginny" Blake, MT, ASCP, Quality/ Education Coordinator for Baystate Reference Laboratories.

"We were extremely lucky to then find yet another research laboratory in the region to assist with our highest priority testing needs (Emergency Department, inpatients, and employees) and provided us results under 24 hours. However, they soon could not handle our increasing volume of testing needs."

PROCURING REAGENTS AND SUPPLIES

An internal BH conference call was held in early March between key Baystate senior leaders to strategize how to expedite the procurement of needed reagents and supplies to bring testing live in-house.

"We created a list of the senior-most contacts at each of our key vendors and began calling them directly, as well as state and federal leaders to assist with vendor discussions at the highest levels," said Mr. Newmark. These calls were successful and almost immediately helped yield reagents and supplies. "From there we conducted (and continue to conduct) weekly calls with our vendors to discuss demands and allocations, adjusting as needed."

PUTTING THE PIECES TOGETHER WITH SWABS AND SWAB KITS

Early on, thankfully, thousands of swabs were sourced from a key vendor. However, the swabs still needed to be manually assembled into full swab kits with transport media. Finding a media supplier became the number one priority.

"We learned that the virology lab at UMass Amherst was using the CDC's 'recipe' to create large volumes of testing media, putting it into test tubes, and supplying it to regional hospitals. We reached out to them and

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Outcomes Related to COVID-19 treated with Hydroxychloroquine among In-patients with symptomatic Disease (ORCHID) Trial

Effective therapies for COVID-19 are urgently needed. Hydroxychloroquine, an antimicrobial agent with immunomodulatory and antiviral properties, had promising properties. Hydroxychloroquine (administered orally as a pill) has in-vitro activity against SARS-CoV-2, the virus that causes COVID-19. Early reports suggested potential efficacy of the drug in smaller human studies. However, clinical trial data is needed to determine whether the drug is effective in treating COVID-19.

The ORCHID trial was a multicenter, blinded, placebo-controlled, randomized clinical trial evaluating hydroxychloroquine for the treatment of adults (18+) hospitalized with COVID-19. The study aimed to compare the effect of hydroxychloroquine versus placebo on clinical outcomes. Patients, treating clinicians, and study personnel were all blinded to study group assignment.

"[The ORCHID trial] started at Baystate Medical Center in late April 2020 and will end when up to 510 subjects are enrolled," said Lori Kozikowski, Program Manager for Pulmonary and Critical Care Research at Baystate Health. "It is a PETAL Network trial, funded by the National Heart Lung and Blood Institute (NHLBI). We assisted with protocol development for this trial as part of our funding from NHLBI."

Dr. Jay Steingrub, Primary Investigator of the ORCHID trial at Baystate Health.

This study hoped to improve clinical outcomes at day 15 among adults hospitalized with COVID-19 using hydroxychloroquine. Secondary outcomes included 28-day mortality, organ failure free days, and hospital free days both measured at day 28.

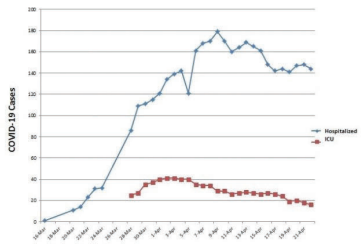
"We utilized the COVID Ordinal Outcomes Scale to evaluate disease severity," said Baystate's Dr. Jay Steingrub, Primary Investigator of this trial. "While understanding the public health implications attributed to COVID-19, it was urgent to identify effective treatments that have widespread availability and established safety profiles. Both safety and efficacy data of hydroxychloroquine from RCTs is warranted and a multi-center clinical trial demonstrating its efficacy or ineffectiveness will have pertinent impact on public heath during this pandemic."

To learn more about the ORCHID trial, visit ClinicalTrials.gov and use identifier: NCT04332991.

The ORCHID Data Safety and Monitoring Board stopped the ORCHID trial in late June 2020 because no benefit was detected for hydroxychloroquine.

Rapid development and adoption of a respiratory protocol to decrease intubation in COVID-19

Raghuveer Rakasi MD, Mridula Ann Jacob MD, Venkatrao Medarametla MD, Lauren Westafer DO



Date	Number of Intercare Patients today on D6B	on >6Li O2 [High Flow / NIV]	successfully Prone in last 24 hrs	Intubations in last 24 hrs	Downgraded in last 24 hrs	RRTs in last 24 hrs
4/09/20	25	15	7	0	5	
4/10/20	19	15	4	2	5	2
4/11/20	22	12	2	1	1	3
4/12/20	25	14	3	3	0	3
4/13/20	28	14	3	1	8	2
4/14/20	29	23	2	1	1	2
4/15/20	25	15	5	2	1	4
4/16/20	24	17	11	0	2	0
4/17/20	21	13	4	0	2	0
4/18/20	22	12	7	0	6	0
4/19/20	25	13	9	0	5	0
4/20/20	24	15	11	0	5	2
4/21/20	21	12	11	0	4	1
4/22/20	24	17	10	0	1	0
4/23/20	29	22	13	0	2	2
4/24/20	27	20	7	0	5	2

This data shows the number of hospitalized patients and a steady decline in ICU numbers since we adopted this protocol and zero intubations in the last 9 days on the designated unit.

Patients with COVID-19 often develop acute respiratory distress syndrome. Initial reports showed that those who require > 6 L of oxygen/minute do poorly on non-invasive ventilation, and eventually require mechanical ventilation. Like many around the world, Baystate providers pursued an early intubation strategy early in the pandemic. Many of those who got intubated subsequently had a prolonged and complicated course on the ventilator with high morbidity and mortality. Two weeks into the pandemic, reports found that if the patient wears a surgical mask, high flow oxygen would not pose an additional threat to HCP. Additionally, awake proning of patients was also found to decrease the likelihood that patients will deteriorate and need mechanical ventilation.

We assembled key Baystate stakeholders from Emergency Medicine, Hospital Medicine, Critical Care, and Respiratory Therapy. The group reached a consensus within 48 hours and developed the first draft of the "Early Intervention Respiratory Protocol." The protocol encouraged the use of High Flow Nasal cannula and tolerance of lower oxygen saturations with a target of 88% and early "awake proning." "Proning" refers to having patients lie on their abdomen which allows oxygen to more easily flow to the lungs and opens up parts of the lung. Patients typically stay in prone position as long as they can tolerate up to a maximum of 16 hours a day. We agreed to trial awake proning in our COVID-19 patients outside the ICU.

A single-page protocol was designed, rapidly disseminated and implemented by department leaders throughout the institution. For ease of monitoring and safety, we designated a COVID-19 intermediate care unit and conducted individual train-the-trainer sessions. All providers were trained within 12 hours of protocol approval. We have maintained this protocol, and have detected a reduction in the proportion of patients requiring intubation, mechanical ventilation, and ICU admission. [See above image]. This rapid development and implementation succeeded because of the intrinsic motivation of the providers to improve the outcome of this high-risk population and close collaboration of the stakeholders. Clinical outcomes, including impacts on mortality, length of stay, days on the ventilator, and days in ICU, are under evaluation.

(Continued from page 6)

asked them to collaborate directly with us. They could not have been more willing to do so," said Virginia "Ginny" Blake, MT, ASCP, Quality/Education Coordinator for Baystate Reference Laboratories (BRL). Because of this, Ms. Blake helped lead the formation of an internal BRL team (made up of redeployed lab staff) to manually create full swab kits.

"Meeting the demand for specimen collection kits took innovative thinking, workflow design, and tremendous teamwork," said Mr. Newmark. "The team literally created a completely new process from the ground up, something neither they nor any of their colleagues had done before. These efforts had an immediate impact on our ability to increase volume of testing to our Baystate Health patients and the community."

"We have had so many different sources of supplies to make these testing kits happen," added Ms. Blake. "It's amazing how people have been working together in unexpected ways during this pandemic."

ONGOING INTERNAL TESTING CAPABILITIES

Once Baystate received test kits and proper supplies for their various laboratory platforms, tests for COVID-19 could be run internally. Within days, the waiting period for test results was reduced to less than 12 hours; with the most urgent testing results being returned in under 2 hours.

"With reagents, supplies, and swab kits, we were able to increase our daily capacity to approximately 500 tests per day (up to 1,000 per day as of early June)," described Mr. Newmark. "We have been supporting testing for all Baystate Health entities, Baystate Medical Practice patients, patients from the community, our Baystate Reference Laboratory clients, local/regional non-BH hospitals' overflow COVID needs, homeless shelters, and several skilled nursing facilities."

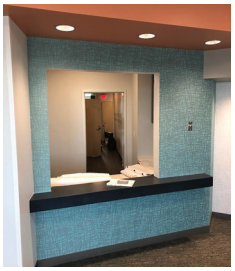
While much progress has been made related to procurement of necessary testing supplies, Baystate's supply chain is still extremely fluid.

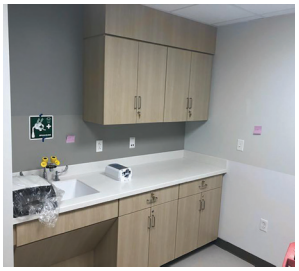
"We are in constant contact with vendors and are proactively managing our supply inventories to ensure we can support our most urgent patients' needs, our many BRL clients, and also being able to plan for expanded testing in the community," Mr. Newmark explained. He attributes our success to strong medical and administrative leadership, truly honest and transparent communication and collaboration between technical and support staff (purchasing, finance, I&T, etc.), and sustained partnership with local and state leaders and various vendors.

"These are unprecedented times and I am so proud of the collaborative efforts of our Baystate Health colleagues," added Mr. Newmark. "This has been TRUE innovation and teamwork at its best!"

Clinical Trials Unit (CTU) taking shape at 80 Wason

Check out the recent progress at the new CTU at 80 Wason Avenue in Springfield!





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We are interested in ensuring that Baystate employees and patients (and their families) are aware of the important research that goes on at Baystate and how it contributes to better patient care. *The Innovator* welcomes feedback and story ideas. Contact Allison Litera at **Allison.Litera@BaystateHealth.org** to submit yours.