Tales from the frontline

Internal Medicine 2020 Annual Report

MICHIGAN MEDICINE
UNIVERSITY OF MICHIGAN
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While 2020 was a once-in-a-lifetime experience with a global pandemic raging, I am beyond proud of what our department was able to accomplish last year. First and foremost, we all worked together to control and contain the pandemic’s effects on our organization, to provide exemplary care of all of our patients (with and without COVID-19) and to pursue new ideas and solutions to help our world move forward. All of this was done in a rapidly changing environment with many unknowns. As vaccinations are helping us look forward to life beyond COVID-19, I wanted to take time to reflect on the incredible efforts and contributions of our internal medicine community during 2020 at the University of Michigan, throughout the state, the country and the world.

National Honors

U.S. News & World Report
2020–2021 Rankings

Hospital  No. 11 (Honor Roll)

Specialty Areas
Pulmonary  No. 8
Gastroenterology & GI Surgery  No. 8
Diabetes & Endocrinology  No. 10
Geriatrics  No. 12
Cardiology & Heart Surgery  No. 14
Nephrology  No. 17
Cancer  No. 38

Medical Education
The U-M Medical School was ranked No. 6 for training primary care physicians and for internal medicine. It is No. 15 nationally among research medical schools.
Tales from the Frontline

This year’s theme, “Tales from the Frontline,” was chosen to capture the tremendous spirit and impact of our work in all areas of patient care, research and education:

COVID-19 responses and patient care were exemplary for both Michigan Medicine and the VA Ann Arbor Health System—a testament to the extraordinary faculty, house officers, nurses and leadership for a positive response to the crisis (page 36). To help our patients receive appropriate care with minimal risk of spreading disease, we began increased access to virtual care and at-home options (page 54). A new post-COVID multidisciplinary clinic for long haulers, initially focused on post-COVID diabetes, was developed and launched in early 2021 (page 61).

Research underwent an incredible shutdown in March 2020 and an amazing phased startup in June 2020 (page 78). Many research groups pivoted their work to focus on finding new treatments and cures for COVID-19 (page 76).

Educational programs went completely virtual to comply with social distancing rules during the pandemic. Our residents and fellows provided care on the frontlines (page 114) while our medical students found creative ways to contribute to COVID-19 efforts at Michigan Medicine and in the community (page 124).

New Leaders and Transitions

Kevin Chan, MD, became vice chair for our newly revamped Clinical Experience and Quality group (page 6). He is joined by Roma Gianchandani, MD, associate vice chair for quality; Vikas Parekh, MD, associate vice chair for inpatient & hospital operations and Timothy Laing, MD, as our billing and compliance officer.
Ben Margolis, MD, our vice chair for basic and translational research, stepped down from this role in summer 2020. We are thankful for his many valuable contributions supporting our faculty, as well as our research staff within each division, and for providing input and advice on countless initiatives and challenges over the last 14 years. Vibha Lama, MD, became the new vice chair for basic and translational research in July 2020. (page 14)

Julie Bynum, MD, was named associate vice chair for faculty affairs this year (and will become vice chair in July 2021 after Richard Simon, MD, retires from this role).

Kathleen Collins, MD, PhD, was appointed associate dean for physician scientist education and training in the U-M Medical School, effective July 1. Collins was also appointed director of the Medical Scientist Training Program in the Medical School in May 2020.

John Varga, MD, joined our department in September 2020 as chief of the Division of Rheumatology. He comes to us from Northwestern’s Feinberg School of Medicine and is an expert in the process of fibrosis. He is known internationally for his work on defining TGF-beta-mediated fibrosis. I am thankful for the service of Raymond Yung, MD, who served as interim division chief for the Division of Rheumatology, in addition to his other role as the division chief of Geriatric and Palliative Medicine.

David Spalinger, MD, transitioned from his role as president of the U-M Health System and executive vice dean on December 31, 2020. He will remain a faculty member in the Division of Hospital Medicine.

Vikas Parekh, MD, was named the associate chief medical officer for capacity management and operations at Michigan Medicine. In this role — a brand-new position that began in January 2021 — he provides clinical and operational leadership to systemwide efforts in capacity management, oversees the capacity and operations analytic team, and the medical directors of select institutional functions.

Beyond Words
There are no words that can adequately express the heartfelt appreciation I feel for all of my colleagues in the Department of Internal Medicine this year. This was the most challenging time of all of our lives. Even through waves of uncertainty, exhaustion and frustration, our dedication, creativity and resilience allowed us to continue to make a tremendous impact in all areas.

“Even through waves of uncertainty, exhaustion and frustration, our dedication, creativity and resilience allowed us to continue to make a tremendous impact in all areas.”
— John Carethers, MD
VICE CHAIRS

Top Row (l to r):
Cyril Grum, MD (Vice Chair, Undergraduate Medical Education)
John Carethers, MD (Chair, Department of Internal Medicine)
Rodica Busui, MD, PhD (Vice Chair, Clinical & Health Services Research)

2nd Row (l to r):
Richard Simon, MD (Vice Chair, Faculty Affairs)
Kevin Chan, MD (Vice Chair, Clinical Experience and Quality)
Sanjay Saint, MD, MPH (Vice Chair, Veterans Affairs)

3rd Row (l to r):
Vibha Lama, MD (Vice Chair, Basic and Translational Research)
John Del Valle, MD (Vice Chair, Graduate Medical Education)
Scott Flanders, MD (Vice Chair, External Relations)

Bottom Row (l to r):
Julie Bynum, MD (Vice Chair, Faculty Affairs)
Michael Lukela, MD (Vice Chair, Diversity, Equity & Well-Being)
Musty Habhab (Chief Administrative Officer)
CLINICAL EXPERIENCE & QUALITY
Kevin Chan, MD  |  Vice Chair for Clinical Experience & Quality

Clinical Experience & Quality
Our new Clinical Experience & Quality initiative officially began in January 2020. Just as we were getting established, the pandemic hit and we had to shift our focus and energy to meeting the urgent clinical needs of our department. As you will read in the stories throughout this report, we had to make changes at both a scale and pace that's never been done before. In less than two weeks, we went from our regular daily operations to a dramatic ramp down in both ambulatory care and hospitalized patient activity in order to create capacity for COVID-19 patients and limit risks to our other patients. We opened up an isolation unit called the Regional Infectious Containment Unit (page 42) and had to find ways to increase access to virtual and at-home care options (page 54). Given these developments, we are still planning and defining our next steps as a group.

Our Vision & Goals
Over the next year we will be developing and refining an updated vision and goals for Clinical Experience & Quality for the next five years. Both will be in line with Michigan Medicine’s mission and vision and focus on improving our efficiency while optimizing the care of patients in both our inpatient and outpatient settings through quality, innovation and safety.

Our task of merging Clinical Operations and Quality and Innovation for our department is a huge undertaking. That’s why we need a full team to oversee these efforts (see photo). Kendra Brown, our director of clinical affairs, manages three continuous improvement specialists and one data analyst that help us track everything that’s happening within the department. They develop dashboards to measure metrics, so our faculty members and 13 divisions can closely monitor their quality and safety efforts. Another area under our purview is billing and compliance — ensuring that all of our processes and documentation are appropriate and correct — that is being led by Timothy Laing, MD.

Clinical Operations
One role of our office is essentially to provide oversight of both the inpatient and outpatient care of the Department of Internal Medicine, which is quite an extensive task. As you can see in the charts, our department was responsible for more than 23,000 hospital admissions the past year and 490,000 outpatient visits at 12 different centers. Overall, our clinical activity for 2019-2020 was reduced due to the consequences of COVID-19. Vikas Parekh, MD, our associate vice chair of hospital and inpatient operations, was instrumental in moving Michigan Medicine’s plans forward during the COVID-19 pandemic by providing modeling for planning and assisting in managing inpatient movement throughout University Hospital and the Frankel Cardiovascular Center (page 38). Another big change that happened organizationally for us this past year is that the University of Michigan Medical Group now controls the operations of our outpatient care centers. Our role has shifted from directly overseeing these operations to collaborating with the operations managers at these sites to support and represent our faculty and staff so they can provide the best care for our patients.

Quality & Innovation
On the quality side, Roma Gianchandani, MD, our associate vice chair for quality
& innovation will be building upon and expanding the great work undertaken by Vice Chair of External Relations Scott Flanders, MD, and his team over the last five years. We will still provide metrics and dashboards to help our department stay on track and ensure that we’re meeting our goals to provide the best patient care. We’ll also continue to operate or oversee quality projects that improve efficiency at many levels throughout our department. Our partnership with the Internal Medicine Residency Program providing residents with patient safety and quality improvement curricula, projects and mentorship continues to grow and improve. Several of our quality projects have moved on to higher levels to further improve patient care throughout Michigan Medicine. Most notably, our medication monitoring project began being implemented into the workflow of the hospital and expanded to other specialties outside of internal medicine this past year. Based on the success of these efforts, we’re now also developing a fellowship quality program.

Prepared for the Future
I have been deeply inspired by the willingness of all of our faculty, residents, fellows and staff that stepped up during the COVID-19 crisis. We had to develop new scheduling structures and expand our ability to care for a dramatic increase in the number of inpatients — up to 500 from our normal level of nearly 300. During this crisis, our leadership, most notably our Chair John Carethers, MD, and Associate Vice Chair Vikas Parekh, MD, were able to mobilize our department and all of our divisions to develop effective plans quickly, both during the initial COVID-19 upturn and for the mini-surge in the fall. On top of these changes, we all had to learn how to care for patients with a new disease in different areas of the hospital with different teams. We were able to come together and deliver exceptional care. So much has been learned in such a short period of time. There were many good lessons that we can now carry into the future.

Facility Updates
Our East Medical Campus expansion will begin in 2021. Its first phase will include moving high-volume ambulatory services to this location to serve our patients while opening up space for more specialty clinics on the main medical campus. Michigan Medicine’s inpatient tower expansion that was put on hold for most of 2020 has officially been scheduled to open in fall 2025. It will add 154 beds to University Hospital and convert 110 semi-private rooms to private rooms.

“We had to make changes at both a scale and pace that’s never been done before.”
— Kevin Chan, MD
“So much has been learned in such a short period of time. There were many good lessons that we can now carry into the future.”

— Kevin Chan, MD
Clinical Experience & Quality Team

Top Row (l to r): Liz Spranger - Continuous Improvement Specialist, Katie Grzyb - Continuous Improvement Specialist, Tammy Ellies - Manager, Quality and Performance Improvement

Middle Row (l to r): Roma Gianchandani, MD - Associate Vice Chair, Quality and Innovation, Kevin Chan, MD - Vice Chair, Clinical Experience and Quality, Kendra Brown - Director, Clinical Affairs

Bottom Row: Linda Bashaw - Data Specialist

Not pictured: Tim Laing, MD - Billing & Compliance Officer, Vikas Parekh, MD - Associate Vice Chair for Inpatient & Hospital Operations
Despite the many challenges of a pandemic year, our faculty continued to advance the missions of the Department of Internal Medicine across all areas through their persistence, dedication and innovation.

**Growth**

The total number of Department of Internal Medicine faculty continued to grow in our clinical track during 2020 and remained steady in the instructional and research areas. The chart on the following page breaks down our faculty growth trends by year and faculty type.

**Promotions**

Forty-four faculty members from the Department of Internal Medicine were promoted, effective September 1, 2020. We congratulate these faculty members on their new status and achievements.

**Honors**

Department of Internal Medicine faculty recognized for their expertise and excellence in 2020:

- **Santhi Ganesh**, MD, an associate professor in the Division of Cardiovascular Medicine, was named a member of the American Society for Clinical Investigation.
- **Kenneth Langa**, MD, PhD, the Cyrus Sturgis Professor of Medicine, was inducted into the American Association for the Advancement of Science Clinical Excellence Society.

**Clinical Excellence Society**

The department inducted nine new members (virtually) into the Clinical Excellence Society in 2020 in honor of their expertise and dedication to providing the best patient care possible and mentorship of other clinicians.

**2020 Inductees**

- **Liselle Douyon**, MD (Metabolism, Endocrinology, and Diabetes)
- **Tejal Gandhi**, MD (Infectious Diseases)
- **Julieann Grant**, MD (Hospital Medicine)
- **Megan Mack**, MD (Hospital Medicine)
- **Adam Marks**, MD, MPH (Geriatric & Palliative Medicine)
- **Michael Rice**, MD (Gastroenterology & Hepatology)
- **Rommel Sagana**, MD (Pulmonary & Critical Care Medicine)
- **Eleanor Sun**, MD (General Medicine)

**2020 Endowed Professorships**

Two new professorships were inaugurated in the Department of Internal Medicine during 2020:

- Daniel F. Hayes M.D. Breast Cancer Research Professor – **Lynn Henry**, MD
- Melvyn Rubenfire Professor in Preventive Cardiology – **Venkatesh Murthy**, MD

**Junior Faculty Endowment Awards**

The department named three new Junior Faculty Endowment Awards after esteemed faculty:

- Carol Chenoweth, MD
- Juanita Merchant, MD, PhD
- Michael Shea, MD

The awardees were:

- Carol E. Chenoweth, MD
- Michael Sjoding, MD

Department of Internal Medicine Early Career Endowment Award – **Michael Sjoding**, MD
“I have never ceased to be amazed by the quality, creativity and dedication of our faculty. And this is especially true during this last year when everyone rose to the occasion and met the challenges of the pandemic.”

— Richard Simon, MD

Juanita L. Merchant, MD, PhD
Department of Internal Medicine
Early Career Endowment Award
— Salim Hayek, MD

Michael J. Shea, MD
Department of Internal Medicine
Early Career Endowment Award
— Pooja Lagisetty, MD, MSc

The Next Chapter

Julie Bynum, MD, MPH, was named associate vice chair for faculty affairs this past year and will take on the position of vice chair when I retire from this role in July 2021. She will continue to provide leadership and direction on faculty affairs issues and guide the academic and administrative needs for our faculty on all tracks in the coming years. It has been an honor to serve in this role for 14 years. Throughout the entire time, I have never ceased to be amazed by the quality, creativity and dedication of our faculty. And this is especially true during this last year when everyone rose to the occasion and met the challenges of the pandemic. It has again made me proud to be a member of our fine faculty.
The VA Ann Arbor Healthcare System (VAAAHS) continued to experience steady outpatient and inpatient activity in 2020. Our Ann Arbor campus handled 777,856 outpatient encounters and 86,451 inpatient encounters. As one would expect, the COVID-19 pandemic upended our usual workflow and clinical duties. The state of Michigan has experienced the third-highest number of COVID-19 cases in the country, and southeastern Michigan became one of the national epicenters of coronavirus cases.

All Hands on Deck

VAAAHS is part of the Veterans Health Administration, the largest integrated health care system in the country and one of the largest in the world, with about 170 hospitals and 1,000 clinics and other ambulatory care centers. Our Medicine Service has approximately 360 staff including ~160 physicians and ~200 non-physicians (respiratory therapists, nurses, administrators, dialysis technicians). The service is divided into 11 sections, each led by a section chief who is a physician. All of the physicians in the Medicine Service are faculty members from the Department of Internal Medicine. As COVID-19 is an acute respiratory tract illness, the patients admitted to the hospital — whether on the floor or in the intensive care unit — have been cared for primarily by doctors and trainees in the Medicine Service. In terms of trainees, we have subspecialty fellows and house officers who work under the supervision of attending physicians. Advanced practice providers including physician assistants and nurse practitioners are also integral members of our team.

As COVID-19 surged and became a national emergency, we had to throw out carefully prepared attending and learner schedules, and replace them with an ‘all-healthy-hands-on-deck’ philosophy. Before COVID, we had four resident teams with one attending physician, one senior medical resident, two interns (sometimes a third from psychiatry) and three to four medical students. Each team could care for up to 16 patients. When medical students were removed from clinical duties on March 17, 2020, following guidance from the American Association of Medical Colleges, our internal medicine residency implemented a new approach (page 114) in which the four resident teams each consisted of one senior medical resident, one intern and one non-medicine “intern equivalent” with a rotating weekly schedule. We also established three new teams including one team of hospitalists to focus on the care of COVID-19 patients in a geographically localized ward.

Our Fourth Mission

For the first time in its 67-year history, on April 5, 2020, VAAAHS began accepting non-Veteran patient transfers from overburdened area hospitals. In this historic move, John D. Dingell VA Medical Center in Detroit and the VAAAHS each activated their response to the VA’s “Fourth Mission”: to improve the nation’s preparedness for response to national emergencies and to support local critical needs to non-veterans in times of crisis (page 46).

Given this unique opportunity, a team of our VAAAHS researchers conducted a survey to better understand non-Veteran perceptions of the quality of
During 2020, the following faculty took on new appointments:

- Alice Cusick, MD, became chief of the Hematology Section
- Nithya Ramnath, MD, became chief of the Oncology Section
- Sameer Saini, MD, MS, was selected as the new director of the Veterans Affairs Ann Arbor Center for Clinical Management Research

Awards & Recognition

Our VAAAHS internal medicine faculty are regularly honored and recognized for their expertise in Michigan and across the country.

- Eve Kerr, MD, MPH, received the 2020 Society of General Internal Medicine John Eisenberg National Award for Career Achievement in Research, an award that recognizes senior members whose innovative research has changed the way we care for patients, conduct research or educate students.
- Grace Su, MD, received the Roger J. Grekin Research Award from VAAAHS. This award recognizes outstanding clinical researchers who contribute to the VA research mission through excellence in clinical care, research, mentorship and leadership.

Faculty Appointments

During 2020, the following faculty took on new appointments:

- Alice Cusick, MD, became chief of the Hematology Section.
- Nithya Ramnath, MD, became chief of the Oncology Section.
- Sameer Saini, MD, MS, was selected as the new director of the Veterans Affairs Ann Arbor Center for Clinical Management Research.

COVID-19 Research Highlight

The landscape of caring for hospitalized patients shifted dramatically during the pandemic. Nathan Houchens, MD, the associate chief of medicine at VAAHS and an associate professor from the Division of Hospital Medicine and Renuka Tipirneni, MD, MSc, an assistant professor from the Divisions of General Medicine and Hospital Medicine, published an article in the Journal of Hospital Medicine titled “Compassionate Communication Amid the COVID-19 Pandemic,” that shares strategies on how to communicate with both patients and families despite the challenges of this year.

First Fisher House Opens

Despite the many pauses caused by the pandemic this year, the first Fisher House in Michigan officially opened as planned in June 2020, just a short walk from the VA Ann Arbor Healthcare Center. With this new facility, up to 16 families at a time can stay free of charge in this home away from home, allowing them to be close to their loved ones at a very stressful time during hospitalization at the VAAAHS. The 16-suite, 13,400-square-foot “comfort home” is one of 87 Fisher Houses operating in the United States and Europe.

Vaccine Clinical Trial

In December 2020, VAAAHS began participating in a phase 3 clinical trial to test a new COVID-19 vaccine candidate developed by the pharmaceutical company Novavax. Novavax is the fifth large-scale COVID-19 vaccine trial in the United States.

First Fisher House in Michigan.

“...The volunteerism and openness to change demonstrated by all involved have been incredible.”

— Sanjay Saint, MD, MPH
My colleague, Ben Margolis, MD, stepped down as vice chair of basic and translational research this past summer 2020 after serving in this role for 14 years. I am honored to continue to build upon his work supporting our faculty and research staff within each division, as well as providing input and advice on our research initiatives, challenges and opportunities. This past year definitely had many of these to report on.

**Slowing Down and Accelerating Research**

When COVID-19 hit Michigan, we had to close all of the basic labs except for very essential activities. We were allowed to start slowing ramping back up in June 2020 with new protocols in place and are now “almost” back to normal (page 78). These efforts have been successful at safely getting our teams back to their research, but it has definitely been a setback for many.

While on the other end of the spectrum, when some labs were closing down, others were coming up with brand-new ideas, starting clinical trials and doing cutting-edge work in COVID-19. Our circumstances really pushed forward a lot of innovative work during this time.

In addition, the overall amount of grant applications also went up dramatically to more than 1,100. Which was surprising because one would think that COVID-19 would have the opposite effect with labs having difficulty staying open. In fact, people were putting out more applications.

**Addressing the Impact of COVID-19**

In order to try to understand how COVID-19 impacted research, we did a survey of our investigators. What we realized was that it was not just because of new protocols and social distancing that people couldn’t come to work. It was also the impact of COVID-19 on families. There were many parents who had to stay at home to help their children with school or deal with the illness of a loved one. This impacted our research to a higher degree than the labs being shut down and phasing back slowly. One of our goals for 2021 is to look at how we can help our investigators gain back some of the time and productivity they lost during the pandemic.

**Building Collaborative Teams**

Another goal for our next year is to build more collaborative research teams. At Michigan, we have a lot of strong individual investigators. We would like to encourage more of these individuals to get team funding and work collectively on projects to promote more impactful research.

We have so many researchers who are doing cutting-edge work in different areas, yet their ability to know about each other’s work and interact with one another is limited. Our annual research symposium, which provides such an avenue, had to be canceled in 2020 secondary to COVID-19. However, we had a virtual symposium in May 2021 which was very successful, with a record number of abstract submissions and thematic mini-symposia featuring researchers across divisions and research arenas. We are also introducing a new thematic multi-speaker format research conference which will be held quarterly called “Internal Medicine Research Rounds.” This disease-based discovery science forum will allow us to populate ideas across divisions and to increase interaction among investigators. We are also hoping that a conference like this will attract basic science
departments and possibly lead to new collaborations.

Realizing the Value of Research

While we saw a high number of research applications in 2020, the inability of many to do experiments and generate data will definitely have an impact in the coming years. One of our major goals will be focusing on how we can soften that blow. The best lesson of COVID-19 may be the impact of its urgency on research. If we could mobilize this type of urgency for some other diseases, we’d be able to accelerate the pace of developing life-saving therapies and other discoveries. The impact of COVID-19 on research has been fascinating. It really brought the world’s attention back to our work. So many take for granted how important research is for both medicine and humanity.

2020 Research Overview

The University of Michigan reported $1.62 billion in research volume during 2020, which led to many important advancements including those addressing the COVID-19 pandemic. U-M has ranked No. 1 in research volume among the nation’s public universities for the past 10 years. Among U-M units, the Medical School ranked No. 1 in research expenditures, with $678 million. Nearly a third of that funding comes from the work of internal medicine faculty. The Department of Internal Medicine competed for and obtained $216M in research support in 2020 and published more than 2,300 research publications.

“So many take for granted how important research is for both medicine and humanity.”

— Vibha Lama, MD

$216M IN RESEARCH SUPPORT IN 2020
All research at the University of Michigan and the Medical School underwent an incredible shutdown in March 2020. When faced with this challenge, our faculty not only found ways to continue critical research studies, they also began designing protocols and studies to specifically address this horrible pandemic, starting with understanding new treatment methods and other mechanisms that could have an impact on COVID-19 care. On top of all of this, we needed to keep our faculty, research teams and patients safe and continue to mentor and support our early career investigators.

Managing the Shutdown

Since human studies cannot be restarted from scratch, many investigators had to be extremely creative throughout the pandemic by using the latest safety protocols and integrating virtual components to continue their research (page 78). Some observational studies were placed on hold if they could not collect their information virtually. However, considering the unprecedented challenges of this pandemic and the many unknowns we faced at the beginning, due to the amazing work, dedication and creativity of all of our investigators, most of our research studies were able to continue in one form or another and precious data could be preserved and further developed. In addition, the vast majority of our health outcomes-related projects, which were using large, existing datasets that did not require in-person visits with participants, could successfully continue with relatively lower impact on health outcomes researchers.

After more than three months of shutdown, while the first wave of the pandemic was progressively getting better, and following OVPR, UMOR and Medical School guidelines, we transitioned to a progressive reopening of all human studies in a tiered approach following standardized COVID-19-related safety protocols. This process, which was staggered over several months and involved tremendous work and validations by the Research Reactivation Committee headed by Anna Lok, MD, and with strong participation of our department, led eventually to the successful reopening of all human subjects trials and studies in the fall and late fall.

COVID and Post-COVID-Related Clinical Research and Care

From the very beginning, many of our faculty became engaged in COVID-19-related research, whether to unveil distinct mechanisms for complications, to develop and validate the best therapeutic strategies for the acute care to prevent severe forms, to understand the impact of social determinants of health, to pioneer new drugs or to participate in the new vaccine trials (page 98). Many of these projects were funded by NIH and other agencies. As the year progressed, we also became aware of the fact that many of the COVID-19 patients who recovered and were discharged started to experience very serious lingering effects caused by the infection. We wanted to learn more about why this was happening and what we could do to help current patients and prevent these issues from happening in future patients. Therefore, our department was at the center of also pursuing cutting edge research into the long-term Post-Acute Sequelae of COVID or “PASC.” We received initial funding for research and are now also integrating these insights into our clinical care through a post-COVID clinic at Michigan Medicine. We are currently helping patients while...
also researching the impact of this severe infection on their health and quality of life (page 61).

**Michigan Medicine COVID-19 Cohort**

To examine and understand the impact of the acute inflammatory and immune pathways triggered by COVID-19, with **Salim Hayek**, MD, and several other internal medicine investigators, we established the Michigan Medicine COVID-19 Cohort (M2C2). M2C2 is a funded and ongoing multidisciplinary cohort which has currently enrolled more than 1,500 adult patients with severe COVID-19 who had been admitted at the University of Michigan. The purpose of M2C2 is to define the in-hospital course of these patients and understand the role of inflammation as a determinant of organ injury and outcomes in COVID-19. This is just one example of the wealth of COVID-19 research developed by internal medicine faculty this past year. Many are featured in the research section of this report (page 78).

**2020 Clinical Trials Academy**

Despite the unprecedented challenges, we were able to completely overhaul the 2020 class of the Clinical Trials Academy (CTA) into an entirely virtual platform that was designed to offer the same level of training with mixed lectures/hands-on direct mentor and statistician supervised work for our trainees. This was possible due to the dedication of CTA Program Manager **Claire Wolniewicz**, who working together with our faculty was able to establish, in just a couple weeks, the necessary Zoom infrastructures needed to allow all mentees and their mentors to work together at the same level of interactions as in person.

The class of 2020 also marked the third year of offering the six-month program, the main objective of which is to train early career investigators on how to formulate and finesse a clinical research protocol to submit for funding. This program’s success is highlighted by the high level of funding success, with 50 percent of the students who graduated to date being able to secure independent funding with the projects fully developed during the CTA from either NIH (56 percent of all), industry and private foundations.

**Making Us Stronger**

This year has showcased the many strengths of the Department of Internal Medicine and the immense value of our missions of research, education and patient care. Through our creativity, innovation, dedication and teamwork we were able to mobilize and provide vital care on the frontlines while continuing to pursue new answers and solutions that will make a difference for many in the future.

**10 Years of the Joint Institute**

The pandemic didn’t stop Michigan Medicine and Peking University Health Science Center (PKUHSC) from celebrating their 10-year partnership.

Almost 200 faculty and leaders from both the institutions gathered online in fall 2020 for a webinar marking the anniversary of their unique collaboration. Established in 2010, the Joint Institute for Translational and Clinical Research has grown over the years to include 59 joint research projects, 86 publications and more than $25 million in extramural funding in the U.S. alone.

PKUHSC physicians, including several who worked in Wuhan, the center of the initial outbreak, have shared valuable insights with Michigan Medicine leadership on treating COVID-19 patients; they also shipped much-needed PPE donations to us in the spring when supply chain disruptions caused worldwide shortages (page 132).
Behind the Scenes During a Pandemic

In less than a year, the novel coronavirus has changed our day-to-day lives in ways we could not have imagined. It impacted all aspects of our work, and its emotional, operational and financial burden was swift and intense. Despite the trying and uncertain times, our staff, who I call our backstage heroes, surpassed what I thought possible. Many worked long hours to deal with the barrage of information and change in processes. They made difficult decisions quickly to reduce costs in order to weather the first throes of the pandemic. Clinics had to close, move or ramp down, and much of our research was suspended. The educational program for our trainees was also impacted by changes in medical school students’ ability to learn in the clinic, with residents and fellows feeling the frontline impact of this emergency. Our staff’s responsiveness allowed our work to continue. Their behind-the-scenes ‘virtual’ work supported our physicians caring for critically ill patients on the frontlines, and our researchers, as they pivoted their focus to find new ways to treat and prevent the virus.

As I reflect on the past year, I remain grateful for the dedication of our faculty, staff and learners and am optimistic about the future. Many pandemic-related changes will keep our employees safer, healthier and happier. We learned how to effectively support virtual visits and remote work, adopted innovative processes that have boosted productivity and are reimagining the use of existing office space. My hope is to take what we have learned and use this new knowledge to support a positive, permanent change in many areas of our work. We’ve identified many ways to work more efficiently, concurrently meeting the needs of our patients and employees. We need to continue to build on this important step, imagining a new future where we all have the opportunity to work in an environment that meets the needs of those we serve. At the same time, these changes will allow us to address satisfaction and well-being, all while maximizing our people and space resources in the most innovative and beneficial ways possible.

2020 Honorees

Mary Edwards, Administrative Specialist, Undergraduate Medical Education Program
Katie Grzyb, Continuous Improvement Specialist, Quality and Innovation Program
Carly Kish, Business Manager, Division of Geriatric and Palliative Medicine
Erika Koeppe, Clinical Research Project Manager, Division of Gastroenterology and Hepatology
Elizabeth McLaughlin, Project Manager Senior/Research Senior Supervisor, Division of Hospital Medicine
Samuel Rentsch, GME Program Administrator, Division of Geriatric and Palliative Medicine

Staff Award for Excellence Recipients

The Staff Award for Excellence honors a staff member’s leadership, exemplary work performance, commitment to customer service and process improvement. Because of the pandemic, our sixth annual event was celebrated a bit differently. All those who nominated a winner recorded a video to offer their praise and congratulations. It was a wonderful way to highlight the awardees in a safe manner.
Department Directors

**Top Row (l to r):**
Eric Mullen - Financial Director, Kendra Brown - Clinical Affairs Director

**Bottom Row (l to r):**
Jolena Nollar - Administrative Director, Musty Habhab - Chief Administrative Officer

**Martha Rhodes**, GME Program Administrator/Administrative Specialist Associate, Division of Metabolism, Endocrinology & Diabetes

**Dorothy Schroeder**, Administrator, Division of Hematology and Oncology

**Michelle Reinhold**, GME Program Administrator, Division of Hematology and Oncology

**Jason Ceo** joined our team as the new administrator for the Division of Nephrology. Before joining the department, he served as a senior consultant of operations and strategy with Deloitte Consulting. Prior to this, he held a role at Michigan Medicine in the Office of Clinical Safety. He has a Master of Health Services Administration from the University of Michigan and holds a Juris Doctorate from Wayne State University Law School.

**Joel Scharboneau** joined our team as the new administrator for the Division of General Medicine. He had been interim administrator for several months before he was promoted to acting administrator. Prior to this role, he served as the division’s senior financial manager. He earned his Bachelor of Business Administration from the University of Michigan and his Master of Business Administration from Central Michigan University.
During 2020, the University of Michigan Medical School was ranked the No. 6 institution for primary care training and No. 15 nationally among research medical schools. Both rankings are up one spot from last year. The school’s reputation among residency directors also continues to be strong.

The Department of Internal Medicine plays a major role in this success. Our faculty oversee 25 percent of the school’s four-year curriculum. Last year, we provided 1,382 weeks of inpatient education and over 3,564 half-day outpatient clinic experiences to 179 clinical trunk students; and 345 subinternship and elective courses. When COVID-19 disrupted our clinical rotations this spring, many stepped up to mentor the students beyond the clinical setting, including helping them find new ways to serve our frontline workers, patients and community.

Medical Students Respond to COVID-19

When taken out of their clinical rotations and classrooms, our U-M medical students mobilized to support the health system’s COVID-19 response in any way they could. The student-driven M-Response Corps orchestrated group efforts, doing everything from triaging calls coming into the Michigan Medicine COVID hotline to providing childcare services to some of the frontline health care workers. They connected student volunteers to areas in the hospital that needed help addressing the anticipated surge of COVID-19 patients. Some collected and sorted donated PPE, delivered groceries to vulnerable populations and translated documents for Spanish-speaking communities, while others trained and served as respiratory therapist extenders in the ICU.

Faculty Awards

Elizabeth Crosby Award
Andrew W. Tai, MD, PhD

Kaiser-Permanente Awards for Excellence in Teaching
Pre-Clinical: Laura Heyns Mariani, MD, MSCE
Clinical: Daniel T. Cronin, MD

Leonard Tow Humanism in Medicine Award
Russell M. Pajewski, MD

2020 Student Awards

William Dodd Robinson Award
Stephanie Chen

Eli G. Rochelson Memorial Award
Heather Schofield

Henry Fitzbutler Award
Brianna Maroukis

Department of Internal Medicine Senior Scholarships
Stephanie Chen
Laura Donahue
Alissa Kleinhenz
Evan Merryman
Juné Tomé
or helped reschedule patient appointments.

Laura Mariani, MD, organized an effort to have medical student volunteers help the General Medicine inpatient teams, by providing phone follow-ups with COVID-19 patients who had been discharged from the hospital (page 124). One of our student groups, Wolverine Street Medicine, was recognized by the American Medical Association (AMA) for their efforts to support the homeless population during the pandemic. They received a top spot in the AMA’s annual Students and Residents Impact Challenge competition.

Internal Medicine faculty member Brent Williams, MD, MPH, is the faculty advisor for the group.

Pandemic Course
In addition to supporting COVID-19 care efforts, some medical students also developed a course on pandemics that is likely to become a permanent part of the Medical School curriculum. With sections on systems response, disparities, epidemiology, PPE and more, the course delved into many facets of pandemics through the lens of the unfolding COVID-19 crisis. The material went from concept to online classroom platform in less than a month and is now required learning for all UMMS M2s and M3s. Future iterations could even expand the course’s themes beyond the medical school to include perspectives and voices from the other health sciences schools, including nursing, public health and social work.

Virtual Match Day
Just like everything else, our Match Day happened virtually this year. Each student received online notification (instead of the traditional envelopes) with the name of the medical center where they will embark on specialized training to shape their careers. Students also added pins to a Google map showing where they matched throughout the country. An outstanding 98.2 percent of our Michigan Medical School students matched, exceeding the national average of 93.7 percent, meaning that one of the residency programs named on their list is where they will head for their training. Thirty-three M4 students chose a residency in internal medicine or med/peds. This represented approximately 20 percent of the graduating class. Seven of these graduates joined our residency program.

2020 Virtual Commencement
Instead of convening at Hill Auditorium to receive their diplomas and officially become doctors, members of the graduating Class of 2020 gathered with loved ones around laptops and screens to participate in a ceremony streamed on the Michigan Medicine YouTube channel. The festivities featured remarks from commencement speaker Regina Benjamin, MD, the 18th surgeon general of the United States, University and Medical School leadership guided graduates through many of the traditional segments of the ceremony, including an official reading of each student’s name, and a recitation of the Hippocratic Oath. Department of Internal Medicine faculty member Thomas Sisson, MD, was elected Graduation Marshal by the graduating class.

2020 Virtual Commencement
As we reached the last part of the Liaison Committee on Medical Education (LCME) reaccreditation process (led by Associate Dean for Medical Student Education Rajesh S. Mangrulkar, MD) this year, we had to postpone site visits and conduct many on-campus meetings as virtual gatherings. Teams of more than 200 faculty, staff and learners have participated in this three-year journey of discovery and quality improvement. The LCME survey visit team provided a thoughtful critique of our program and was flexible in working with our teams throughout the pandemic. In March 2021, we were notified that the U-M Medical School received full 8-year reaccreditation of our MD degree.

“When taken out of their clinical rotations and classrooms, our U-M medical students mobilized to support the health system’s COVID-19 response in any way they could.”

— Cyril Grum, MD
This year has been an incredible learning journey for all of us in the Department of Internal Medicine. From senior faculty to our newest residents, we all had to come together to figure out the best way to care for a surge of patients with a disease we knew very little about while supporting our trainees and keeping ourselves, our families and other patients safe. I am grateful to be surrounded by such quick-thinking, dedicated and talented individuals, including our Internal Medicine and Medicine-Pediatrics Residency programs leadership team (see box) and our 2019–2020 chief medical residents for their outstanding work helping our department provide the best care for our patients and support our residents during this challenging time (page 114): Marcus Geer, MD; Alexandria Miller, MD; Molly Tokaz, MD; and Raymond Yeow, MD. Also, the VA Quality Improvement Chief Chris Grondin, MD, and the Medicine-Pediatrics Chief Jonathan Bender, MD.

Stepping into the role of chief medical residents for 2020–2021 in June 2020 were Paul Christine, MD; Victoria Scicluna, MD; Ginny Sheffield, MD and Govind Warrier, MD, with the new VA Quality Improvement Chief Luke Fraley, MD and Medicine-Pediatrics Chief Stephani Zakutansky, MD.

2020 Updates
The Internal Medicine Residency Program welcomed its incoming intern class of 68 trainees in June 2020. Of this group, 41 percent were newly elected members of the Alpha Omega Alpha Honor Medical Society, eight individuals have earned additional advanced degrees and seven were U-M Medical School graduates. This select group came from a pool of more than 2,900 applications, of which approximately 600 medicine and medicine-pediatric candidates were interviewed by our faculty and program leadership from October 2019 through January 2020.

• Forty-six categorical internal medicine residents, including five physician-scientists and five primary care track residents
• Seven neurology residents and seven ophthalmology residents, who will complete one preliminary year of training before transitioning to their specialty
• Eight residents in the Medicine-Pediatrics program

Faculty Awards
Associate Program Director Jennifer Lukela, MD, received the Faculty Equity and Inclusion Award from the Office of Graduate Medical Education, which recognizes faculty who have fostered an environment of equity and inclusion within their training program in efforts to improve disparities. She is the founder of a career development program called “Equal Medicine” created to support the pipeline and development of women in academic internal medicine.

Michael Lukela, MD, the director of our Med-Peds Program, received the 2020 Medicine-Pediatrics Program Directors Association Leadership in Medicine-Pediatrics Award, which is given to a physician who has made significant contribution to med-peds as a profession.
Residency Program Leadership

Kristin Collier, MD
Associate Program Director

John Del Valle, MD
Director, Internal Medicine Residency Program

Kevin Flaherty, MD, MS, FCCP
Associate Program Director

Sarah Hartley, MD
Associate Program Director

Nathan Houchens, MD
Assistant Program Director

Jennifer Lukela, MD
Associate Program Director

Michael Lukela, MD
Director, Med-Peds Residency Program

Rachel Perelman, MD
Associate Program Director

Thomas Sisson, MD
Associate Program Director
Director, Physician Scientist Training Program

Adam Tremblay, MD
Assistant Program Director

2020 Resident Awards

Bruce A. Jones Award for Outstanding House Staff Spirit
Maya Dassanyake, MD

Jacob Mack, MD

Dr. Jacob P. Deerhake Community Service Award
Ade Nuga, MD

Galens Medical Society Bronze Beeper Awards
Craig Hansen, MD
Jacob Mack, MD
Kevin Platt, MD
Virginia Sheffield, MD

Kenneth R. Stark Internal Medicine House Officer Research
Emily Harlan, MD (Oral)
Jordan Maxey, MD (Oral)

Internal Medicine Award for the Most Outstanding House Officer
Paul Christine, MD

Laurie Edmunds Award for the Most Outstanding House Officer I
Max Nagle, MD
Mary Finta, MD

[Image: (l to r): Govind Warrier, MD, MPH; Victoria Scicluna, MD, MPH; Paul Christine, MD, PhD; and Ginny Sheffield, MD]
In my roles as chief clinical strategy officer for Michigan Medicine and vice chair for external relations for the Department of Internal Medicine, I am closely involved with multiple departments and programs across all our affiliates. I also do a significant amount of strategic planning within Michigan Medicine to best connect our departments and divisions to Michigan Medicine’s long-term strategic growth plan and vision. Being in dual roles allows me to see the big picture of what is playing out in all areas. I can see the needs that our partners across the state have and very quickly engage our departments and our divisions to help fill those needs. Making these connections, providing resources and sharing insights has never been more important than this past year as our state and all of its health care providers have worked together to save lives and manage the impact of COVID-19.

**Improving COVID-19 Care**

Michigan Medicine teamed up with 40 other Michigan hospitals and Blue Cross Blue Shield of Michigan to collect comprehensive clinical data on COVID-19 patients for an extensive registry that is providing insights into best practices in treatment (page 50).

Titled Mi-COVID19, the comprehensive, multisite registry is one of the largest collections of detailed COVID-19 patient data in the country and was developed by our team from the Michigan Hospital Medicine Safety consortium, a Blue Cross-funded CQI [continuous quality initiative] that I lead. Because the registry includes anonymous patient data from multiple hospitals throughout the state, it offers a line of sight across geographic, economic and demographic boundaries. This provides a comprehensive clinical picture that’s not typically available from smaller registries that contain data from just one hospital or health system. We were fortunate in Michigan to have a mechanism in place that enables fast collaboration among providers to address critical health challenges such as the COVID-19 crisis.

**MidMichigan**

Our quality improvement work with MidMichigan has continued with the addition of a few areas of collaboration, one being with our hospital medicine groups. U-M’s Division of Hospital Medicine, led by Vineet Chopra, MD, has been collaborating with the hospital medicine program at MidMichigan. The focus this year has been around COVID-19 care. The groups have had virtual meetings to discuss best practices, and innovations in reducing the need for patients to go to the ICU by providing moderate care on the hospital wards in order to reserve ICU capacity for the sickest.

We were able to use the Mi-COVID19 Registry as a data platform that allowed us to share processes and experiences between both institutions in a data-driven manner. And work that was started last year in Pulmonary & Critical Care Medicine, continued with ongoing interactions between Jakob McSparron, MD, from our department and John Blamoun, MD, who leads Critical Care at MidMichigan. Blamoun was a regular attendee of the Mi-COVID19 webinars, leading discussions about ICU care throughout the MidMichigan system. He also discussed how to deliver care effectively across a multi-hospital system, and in
many settings that are considered rural or critical access settings.

At the highest levels of our institutions, there was very close collaboration throughout the pandemic, with sharing of clinical guidelines, best practices in the care of COVID patients and close connection around system leaders as we rolled out the COVID-19 vaccination this year.

**Michigan Hospitalist Chelsea Service**

During the pandemic, Michigan Medicine was able to use excess bed capacity at Chelsea Hospital to manage our high occupancy at University Hospital during COVID-19 surges through the Michigan Hospitalist Chelsea Service (MHC) developed by Rafina Khateeb, MD, our associate medical director for Trinity Affiliates, for the University of Michigan Medical Group (UMMG).

In 2018, U-M Health and St. Joseph Mercy Health entered into a joint venture, St. Joseph Mercy Chelsea Hospital, giving U-M a 49 percent ownership stake in the facility. University Hospital and the Frankel Cardiovascular Center often function right at — or just below — full capacity. At the same time, historically, St. Joe Chelsea has operated at less than capacity. Teams on both sides began planning how some inpatient beds could be used by Michigan Medicine patients. And then who, and how many, faculty and staff would need to move over to Chelsea. The strategic work began in 2019, with an initial launch date planned for the fall of 2020.

With the potential need for capacity to treat a surge in COVID-19 patients in Ann Arbor, we accelerated our development of the MHC and admitted our first patient to the program in mid-June 2020. To make the move happen, MHC Medical Director David Bozaan, MD, from our Division of Hospital Medicine, and his team needed to identify which patients were the right fit for care at Chelsea. Three groups quickly emerged as candidates: low-acuity general medicine patients, those suffering from low-risk heart failure and individuals with leukemia and lymphoma, who are admitted at regular scheduled intervals for specialized chemotherapy that they can get safely at Chelsea. They expect the MHC program to care for up to 12 patients per day at Chelsea.

**Metro**

In January 2020, we launched the Cancer Network of West Michigan — a collaboration between Mercy Health and Metro Health-University of Michigan Health, with assistance from Michigan Medicine — to leverage combined resources and capabilities from each partner to enhance patient care and treatment for the Grand Rapids and West Michigan community.

Activities this year have focused on building those tumor-specific programs through recruitment and consolidation of programs across multiple sites. Both myself and David Smith, MD, sit on the operating Oversight Committee for that program. Smith, UMMG’s Associate Chief Clinical Officer for Cancer and a professor in the Division of Hematology/Oncology, has also been leading the search for the executive director of that program.

**COVID-19 Collaboration**

The many relationships we’ve developed with other hospitals and affiliates over the last few years have been invaluable throughout this pandemic. Michigan Medicine’s Chief Medical Officer Jeff Desmond, MD, led calls with chief medical officers across the state, including at our affiliates, to share best practices and experiences and to remain connected and well-coordinated during COVID-19 surges in Michigan so we could all be aligned around our care and response. This allowed us to work together and manage COVID-19 in a much more effective and efficient way — to save more lives and provide better outcomes for our patients.
It’s been quite a year. The pandemic and many current events have revealed more than ever the need for increased awareness and focus on diversity, equity and well-being. Even with these challenges, we’ve accomplished quite a bit in our first year as a key department initiative, including developing our vision, mission, core values, strategic priorities and goals.

**Vision**

The Department of Internal Medicine will be a diverse and inclusive community that provides each person with the opportunities and support they need to thrive.

**Mission**

To cultivate an environment that empowers our faculty, learners and staff to fulfill their purpose and potential.

**Core Values**

- Caring & Well-Being
- Diversity, Equity & Inclusion
- Collaboration & Respect
- Learning & Innovation
- Transparency & Accountability

**Strategic Priorities, Goals & Actions**

Early in 2020, we were able to establish our high-level strategic goals which focus on four areas: developing people, improving the work environment, building partnerships and communicating our results.

**IMPOWER**

We also established the IMPOWER (Inspiring Medicine to Promote Opportunities for Well-being, Equity and Diversity) council, with staff and faculty representatives from all 13 divisions, as well as our administrative team to facilitate and promote initiatives to drive culture within their division and our department.

**Grand Rounds Series**

An IMPOWER Grand Rounds Series was developed to provide foundational information to faculty, staff and trainees related to diversity, equity, inclusion and well-being issues on a quarterly basis during Medicine Grand Rounds. Topics from the past year included an overview of the IMPOWER strategic plan, gender equity in medicine, inclusive teaching and diversity and medicine.

**Recent Initiatives**

**COVID-19 Support**

As the COVID-19 pandemic unfolded, we shifted our focus on well-being because of all of the unknowns, stress, family needs and logistical issues people were dealing with in our department. We created a resource on our website to help promote issues around wellness. Our office, in partnership with the Office of Counseling and Workplace Resilience (OCWR) and with support from the Office of Faculty Development, offered virtual group support sessions to clinical teams. Through these sessions,
Our 2020 Team

Eve A. Kerr, MD, MPH, MACP
Vice Chair, Diversity, Equity and Well-Being

Sarah Gualano, MD, MBA
Associate Vice Chair, Diversity

Michael Lukela, MD, FACP
Associate Vice Chair

Erin Price, MPH
Program Manager

Leadership Transition

Kerr transitioned out of the role of vice chair for diversity, equity & well-being in March 2021 to serve as the new chief of the Division of General Medicine. Associate Vice Chair Michael Lukela, MD has been appointed as the second vice chair for diversity, equity and well-being. He will continue working closely with Associate Vice Chair Sarah Gualano, MD and Program Manager Erin Price to refine and execute our strategic plan; oversee the newly launched IMPOWER Council; interact with divisional, departmental and medical school leadership to forward these issues; and help guide the department to become a leading example across our institution and departments of medicine nationally.

THE ROAD AHEAD

Our department, Michigan Medicine and the field of medicine have a lot of work to do in attracting, promoting and retaining more women and underrepresented minorities. It’s going to take a lot of time, energy and investment to make a difference in these areas. We also have a long way to go in respect to burnout and wellness. Currently, 50 to 60 percent of our faculty report some degrees of burnout. That’s not acceptable. We need to explore how we can make our system support outstanding physicians in doing their best work and treating patients without creating the circumstances for burnout.

Given these important needs, I am honored to be in a department that places so much emphasis and support on making sure that all our voices are heard. And treats the issues of diversity, equity and well-being seriously and is focused on leading change. This commitment has been more apparent than ever throughout this turbulent year.

The Michigan Medicine community recognized Juneteenth 2020 with a variety of events. Those who were able take time away from work, research or studies on June 19 were encouraged to kneel or observe in silence for 8 minutes and 46 seconds in honor of the annual commemoration of the end of slavery in America and the freedom of enslaved Americans.
Division Chiefs

Top Row (l to r):
- Powel Kazanjian, MD - Infectious Diseases
- John Carethers, MD - Chair, Internal Medicine
- John Varga, MD - Rheumatology

Second Row (l to r):
- Raymond Yung, MD - Geriatrics and Palliative Care Medicine
- Eve Kerr, MD, MPH - General Medicine
- Sub Pennathur, MD - Nephrology

Third Row (l to r):
- Jim Baldwin, MD - Allergy and Clinical Immunology
- Goutham Narla, MD - Genetic Medicine
- Chung Owyang, MD - Gastroenterology

Bottom Row (l to r):
- Peter Arvan, MD - MEND
- David Pinsky, MD - Cardiovascular Medicine

Not Pictured:
- Vineet Chopra, MD - Hospital Medicine
- Pavan Reddy, MD - Hematology and Oncology
- Ted Standiford, MD - Pulmonary & Critical Care Medicine
2020 INTERNAL MEDICINE AWARDS

THE PAUL DE KRUIF LIFETIME ACHIEVEMENT AWARD
James Woolliscroft, MD

CHAIRS’ AWARD FOR OUTSTANDING SERVICE TO THE DEPARTMENT OF INTERNAL MEDICINE
Richard Simon, MD
Ben Margolis, MD

DEPARTMENT OF INTERNAL MEDICINE IMPACT AWARD

- Division of Hospital Medicine:
  Vineet Chopra, MD
  Sarah Hartley, MD
  Vikas Parekh, MD
  Marisa Rodriguez
  Richard Schildhouse, MD

- Division of Infectious Diseases:
  Powel Kazanjian, MD
  Adam Lauring, MD
  Laraine Washer, MD

- Division of Pulmonary & Critical Care Medicine:
  Jakob McSparron, MD
  Ted Standiford, MD

JEROME A. CONN AWARD FOR EXCELLENCE IN RESEARCH
Robert Dickson, MD

JOHN G. FROHNA OUTSTANDING TEACHING IN MEDICINE-PEDIATRICS AWARD
Bassel Atasi, MD
Linda Balogh, MD
Greta Branford, MD
Jean Carstensen, MD
Mark Hakim, MD
Amy Hepper, MD
Liz Jahns, MD
Jason Kahn, MD
Kristen Krieger, MD
Thuy LeDesai, MD
Jen Meddings, MD
Rebecca Northway, MD
Kim O’Donnell, MD
Lindsay (Jacklyn) Quade, MD
Sara Platte, MD

H. MARVIN POLLARD AWARD FOR OUTSTANDING TEACHING OF RESIDENTS
Jakob McSparron, MD

SPECIAL RECOGNITION FOR CONTRIBUTIONS TO THE HOUSE OFFICER TEACHING PROGRAM
Sarah Hartley, MD

SPECIAL RECOGNITION FOR CONTRIBUTIONS TO THE MEDICAL STUDENT TEACHING PROGRAM
Lauren Heidemann, MD

RICHARD D. JUDGE AWARD - MEDICAL STUDENT TEACHING AWARD
Nathan Houchens, MD

STEVEN E. GRADWOHL EXCELLENCE IN CONTINUITY GENERAL INTERNAL MEDICINE TEACHING AWARD
Elizabeth Drake, MD

Dean’s Awards for Faculty
The Dean’s Awards for Faculty have been paused for 2020 and 2021 due to the COVID-19 pandemic and Michigan Medicine’s economic recovery efforts.
WE WILL BE CLOSED UNTIL THE GOVERNOR SAYS IT'S SAFE TO RE-OPEN.

BE SAFE EVERYONE!
This section provides an overview of the impact of the COVID-19 pandemic and related major events on the state of Michigan, the University of Michigan and Michigan Medicine to provide background context for the many challenges our department faced and helped address in 2020.
COVID-19 IN MICHIGAN

MARCH – DECEMBER 2020

The Department of Medicine has treated more than 2,000 patients for COVID-19 since Michigan Medicine’s first patient was admitted in early March 2020.

The numbers (as well as the dramatic response and changes) of this past year help tell our Michigan pandemic story: the steady rise of the number of patients hospitalized with COVID-19 through the spring of 2020, falling and flattening in the summer, followed by a second, smaller surge in late fall. When three vaccines became available in December 2020, the number of patients hospitalized with COVID-19 began to fall again, bringing hope that this pandemic would be behind us all soon.

March 23, Gov. Gretchen Whitmer signs the “Stay Home, Stay Safe” executive order requiring all “non-essential” businesses to temporarily cease operations, and asks all Michigan residents to stay home unless absolutely necessary.

March

- The state of Michigan announces first confirmed COVID-19 cases; Michigan Governor Gretchen Whitmer declares a state of emergency.
- World Health Organization (WHO) declares a global pandemic.
- U-M announces classes will be remote for the rest of the semester.
- Temporary restrictions become effective on human subjects research at U-M.
- The Regional Infectious Containment Unit is activated at Mott Children’s Hospital.
- U-M Medical School suspends clinical rotations and moves classes online.
- Michigan Medicine limits surgeries to the most urgent, stops in-person clinic appointments and increases telehealth capabilities to accommodate virtual clinic appointments.
- The state of Michigan’s first COVID-19 death is confirmed.
- U-M ramps down noncritical laboratory research activities.
- U-M moves all summer and spring term classes online and limits the number of people on campus.
- Hospitals across the U.S. report severe shortages of PPE and critical supplies.
- Michigan ranks third nationally for coronavirus-related deaths, behind New York and New Jersey, with a total of 259 deaths.
- U-M limits all laboratory research deemed “noncritical” until further notice.
April

- The Centers for Disease Control and Prevention recommends that “Everyone should wear a cloth face covering when they have to go out in public.”

- The VA Ann Arbor Healthcare System accepts non-veteran patient transfers from overburdened area hospitals for the first time in its 67-year history.

- Deaths from COVID-19 become the leading cause of death in the U.S.

- A 519-bed Michigan Medicine Field Hospital is set up in U-M’s indoor track facility to meet an expected surge in COVID-19 patients.

- Michigan Medicine houses frontline workers in local hotels so they can avoid bringing COVID-19 home to their families.

- The number of COVID-19 patients at Michigan Medicine reaches a high of 229.

- Michigan’s stay-at-home order is extended to May 15, with some restrictions lifted and others added.

- Michigan Medicine accepts more than 800 transfers of all types of patients during the six-week height of the pandemic when other southeast Michigan hospitals are overwhelmed.
**May**
- Michigan’s stay-at-home order extended until June 12 and the state of emergency until June 19.

**June**
- Michigan’s final stay-at-home order expires.

**July**
- U-M researchers are allowed to slowly ramp up research following strict capacity limits and safety protocols.
- U-M medical students are allowed to return to clinical rotations.
- U-M announces it will be offering a hybrid model for fall semester.

**August**
- The state of Michigan surpasses 100,000 confirmed cases of COVID-19.
- As cases begin to increase again, Governor Whitmer extends the state of emergency until September 4.
- The state reports 1,121 new cases, the highest since May 14, and surpasses 90,000 total cases.

**September**
- The state reports 1,313 new cases, the highest single-day total since April 24.
- Governor Whitmer extends the state of emergency until October 27.
NOVEMBER

U-M asks students not to return to campus for the winter 2021 semester. All classes will be virtual.

Michigan sets new records for highest number of new cases in a day seven times. The last during this period was on Nov. 13, when 8,516 new cases were reported.

Several businesses and public services, including high schools and universities, are asked to shut down for three weeks.

The state records 9,779 new cases, a new single-day record.

Six Michigan hospitals reach 100 percent capacity and another 18 are at 90 percent or more. Statewide, almost 4,100 people were hospitalized with COVID-19.

OCTOBER

State Health Department issues COVID-19 emergency order restricting gatherings and requiring face masks.

The state records 3,792 new cases, a new single-day record.

Washtenaw County Health Department and U-M issue a 14-day Stay in Place order for undergraduate students.

November

OCTOBER

The state records 3,792 new cases, a new single-day record.

Six Michigan hospitals reach 100 percent capacity and another 18 are at 90 percent or more. Statewide, almost 4,100 people were hospitalized with COVID-19.

Chief Medical Executive and Chief Deputy Director for Health for the Michigan Department of Health and Human Services Joneigh S. Khaldun, MD (left) and U-M President Mark Schlissel, MD (center), welcome the very first shipment of vaccines at Michigan Medicine.

DECEMBER

Chief Medical Executive and Chief Deputy Director for Health for the Michigan Department of Health and Human Services Joneigh S. Khaldun, MD (left) and U-M President Mark Schlissel, MD (center), welcome the very first shipment of vaccines at Michigan Medicine.

December

Michigan surpasses 10,000 confirmed deaths.

The first shipment of COVID-19 vaccines arrives at Michigan Medicine.

2021

The fight against COVID-19 continues as the global distribution of vaccines brings much needed hope for a better year ahead.
From preparing for the surge of COVID-19 patients, to opening the Regional Infectious Containment Unit and planning a field hospital, our department provided vital support to other hospitals across the state while keeping our team and patients as safe and healthy as possible.
When It All Began

In the early days of the COVID-19 pandemic, Vineet Chopra, MBBS, MD, MSc, associate professor and chief of the Division of Hospital Medicine, received a phone call from Vikas Parekh, MD, professor, Division of Hospital Medicine; associate vice chair for the Department of Internal Medicine; and associate chief clinical officer for Medical, Emergency and Psychiatry Services for adult hospitals, who was calling in his leadership capacity to say, “Listen, have you been hearing or reading about COVID-19? We don’t know what may happen here, but we need a team to be ready and on standby in case we start seeing these patients in our hospital.”

“Ebola was a false alarm, but we had developed a model we knew we could enact if we were ever called upon,” says Chopra. That exchange soon led to the organization of a small team of providers that would be prepared to take care of COVID-19 patients. “There were about four of us at the beginning that essentially were available to cover days and nights for COVID-19 patients who may be hospitalized,” he says. “Several days went by and when no patients arrived we thought, well, maybe this is much ado about nothing.”

Chopra recalls the first patient admitted to University Hospital in early March 2020. “It was a double-lung transplant patient who was admitted to the pulmonary service and then he came to us,” says Chopra. “Keep in mind these were the early days when we didn’t have rapid testing turnaround or diagnostics, so we had no way of knowing whether a patient was positive or negative at the outset. It would take 24, sometimes 48 hours, before we could confirm a patient had COVID-19. We called these patients ‘persons under investigation,’ or PUIs, so we would admit them and care for them as if they had COVID-19, not knowing whether they did or not.”

A second patient was admitted in quick succession. Within a couple of days, that patient also tested positive. “We realized very quickly that we had to develop a scalable COVID-19 team to care for these patients,” he says. “We started to carve out a separate, dedicated group of providers from our original small group, many of whom were researchers and had time to do this, as well as clinicians who, despite being busy, volunteered to step in,” he says. “As you can imagine, there was a lot of fear and anxiety, and a lot of uncertainty around how many patients would come and what we would do. We didn’t have good therapeutics at the time, so our focus was on supportive care and oxygen, and from that morphed our COVID-19 care team which, by the time the initial surge hit, pretty much became all that we in the division were doing.”

Early Planning

As this chaotic period unfolded, what became most important was the need for effective communication channels. “Even though there was only a small number of us at the outset doing COVID-19 care, there were weekly updates for the entire group as to what was happening so that everyone was in the loop,” says Chopra. “When the numbers started to go up we realized we were going to
quickly get overwhelmed, so we changed our entire plan from some of us doing COVID-19 care to basically all of us doing COVID-19 care."

At the time of the initial COVID-19 surge, Parekh held multiple institutional leadership roles at Michigan Medicine. "First, I had my role as associate vice chair for the Department of Internal Medicine. Second, I was associate chief clinical officer for Medical, Emergency and Psychiatry Services for the adult hospitals. And third, I was the system medical director for Capacity Management," he says. He was also part of the leadership team that manned the U-M Hospital Command Center every day, all day, during the early days of the pandemic. "In our health system, we have a defined emergency response plan that activates what we call our hospital command center, a physical space located in University Hospital-South, where everyone can get together. Within that are defined roles to direct the leadership response," says Parekh. "That command center served as the hub of our response in understanding how we were doing, addressing issues that would come up and then coordinating responses. The center remained open for over 100 days."

During this challenging time, Parekh’s most critical function was to prepare for the opening of the Regional Infectious Containment Unit (RICU), a 64-bed negative-pressure isolation unit designed for optimal care of adult COVID-19 patients and optimal safety for health care workers located in C.S. Mott Children’s Hospital (page 42). Together with nursing and administrative partners, Parekh worked to identify physician leadership for the RICU. He quickly tapped Chopra as inaugural medical director of the unit. "I worked closely to support Vineet in terms of developing the coverage model for our critical care faculty to get their physicians into the RICU,” he says. "And with these partners, I supported the large team that worked on operational implementation of the RICU. We were given a very tight timeline of less than seven days with which to open the unit, and we actually hit that mark in six days. It was an intense amount of work during the initial surge."

**Capacity Management**

Parekh also guided the hospital’s work relating to capacity management, and led an operational analytics team working to optimize patient flow throughout the health system. "We needed to understand how to ramp down clinical activity to be able to make space for the RICU, and how to manage our scheduled surgical-related activity in the house to succeed,” says Parekh. "As it turned out, we
didn’t end up needing to do much because a lot of that just naturally happened as patients grew fearful of coming into the hospital. But before we knew that was going to happen, there was a lot of planning around how we could begin to delay surgical procedures, and which patients to move into the RICU. At the time, the RICU was a fully functional pediatric unit, so we needed to figure out how to move those patients and safely care for them elsewhere.

Parekh points to Jenny Pardo, senior IT project manager, and Max Garifullin, senior staff specialist, capacity management, Michigan Medicine, for their exceptional contributions to this effort.

**Predictive Modeling**

Parekh was also part of a team focused on the institutional response for the initial COVID-19 surge related to understanding data and predictive modeling. “We were looking at what we could expect in the future. Our main role was to take whatever information we had about what was going on with COVID-19 in Washtenaw County, and in the state, in terms of cases and trajectory,” he says. “So we were really trying to predict how many people would be in the hospital and what type of care they would need, including how many ICU and non-ICU patients we might have and what trajectory that would take over time. Such complex predictions are based on an epidemiological model of disease and multiple data inputs.”

But trying to model a disease and how it will play out when information is scarce is extremely taxing. “We were evolving our work almost every day, as we received new information about things like how quickly the disease spread, or how many patients ended up being hospitalized who got infected, and how many ended up needing to go to the ICU,” says Parekh. “In the early days, good information about new cases in each county was hard to come by, but with time that improved. We were able to refine this work which was important from a planning perspective and to be ahead of what was at times a very rapid growth in cases. For a period, we were doubling the number of hospitalized COVID-19 patients we had every three days. If we hadn’t had good insight into this growth we would have been at a tough spot.”

**Sharing Insights Statewide**

Parekh and colleagues conducted similar work with the state of Michigan, which helped to inform state response about whether to open field hospitals, where the pressure was being felt in the state from hospitalizations and how the state would respond. “There was also work around safety from a hospital facility perspective in terms of making sure we had the appropriate negative-pressure rooms and training for the staff around personal protective equipment,” he says. “In addition to the modeling work we did for the health system, we also started to watch statewide patterns.”

To expand on this, Keith Dickey, PhD, chief strategy officer, Michigan Medicine, and also part of the team in the command center, connected Parekh and colleagues with leadership from the Michigan Department of Health and Human Services (MDHHS). “MDHHS was struggling to understand what was going on in the state. At the time there was a dearth of information and a lack of clarity around disease modeling. And that led to us being asked to share our modeling and insight with both Michigan Governor Gretchen Whitmer and state legislative leaders,” says Parekh. “So we were informing folks across both sides of the aisle in political parties around what we saw in the state and what we were predicting in terms of the future for COVID-19 around volume and impact.”

Parekh and colleagues were soon providing briefings to the governor twice a week, and then ultimately weekly, which continue to this day. “We get to be part of that process and continue to add information and provide context to the governor and the MDHHS around our state-wide COVID-19 experience. I am very proud of the role we played in the statewide effort,” he explains.
LEADING THROUGH CRISIS

In addition to his close collaboration with Parekh, Chopra adds that there were many leaders throughout the department who constantly adjusted schedules and worked with people to understand their fears early on during the pandemic, such as Sarah Hartley, MD, associate professor, Division of Hospital Medicine, and associate program director of the Department of Internal Medicine. "As a hospitalist, Sarah worked very closely with us in coordinating schedules with the residents, not only making sure we were able to keep them safe, but also to meet their educational needs during COVID-19 care," he says.

He also points to the invaluable work of Scott Flanders, MD, professor, Division of Hospital Medicine; vice chair of external relations for the Department of Internal Medicine; and chief clinical strategy officer for Michigan Medicine. "Scott and I, literally every day, would touch base about how things were unfolding on the floors and what he was seeing across other organizations in Michigan. He was the real czar of inpatient planning," says Chopra. "So while I focused on the RICU and on our division, he was really thinking about the entire department and capacity planning and worked with hospital leadership to secure resources."

Overseeing the enormity of the logistics and management piece was John Carethers, MD, John G. Searle Professor, and chair of the Department of Internal Medicine; Jeffrey Desmond, MD, chief medical officer, Michigan Medicine, and associate professor, Department of Emergency Medicine; and David Miller, MD, MPH, president, Michigan Medicine.
At the onset of the initial surge of COVID-19, Michigan Medicine began planning for the activation of the U-M Regional Infectious Containment Unit (RICU), a negative-pressure isolation unit with 32 private rooms located on the 10th floor of C.S. Mott Children’s Hospital.

“The opening of the RICU was a monumental feat in a number of different ways, first and foremost because of the complicated logistical planning that went into it,” says Vineet Chopra, MBBS, MD, MSc, associate professor and chief of the Division of Hospital Medicine. “The RICU was actually built with the intention that an entire floor of the hospital could become a negative-pressure environment for optimal patient care. COVID-19 patients need care in very specialized rooms with negative pressure, and the facilities with such capacities are typically scattered across the hospital system.”

Also integral to the activation process were Christopher Smith, MD, assistant professor, Division of Hospital Medicine, and medical director of the RICU, and Valerie Vaughn, MD, former assistant professor, Division of Hospital Medicine. “Drs. Smith and Vaughn were the first to volunteer to help with COVID-19 care. They literally put their safety second to that of patient care needs and planning.”

Perhaps most extraordinary is that the RICU was activated just six days after the first two COVID-19 cases in the state of Michigan were confirmed. During an accelerated period of planning, Chopra and hospital colleagues faced enormous logistical and staffing challenges.

“We were looking at everything from how to get food into the unit to how to make sure that the HEPA air filtration systems were working appropriately,” he says. “Mott is a children’s hospital, so, of course, the pharmacy was not stocked with adult medications. And we needed to find a way to get adult medications into the unit. Also, the beds were pediatric beds, so we had to actually swap out beds in all of the rooms for adults. Throughout, we were responsible for informing the U-M Hospital Command Center’s logistics team as to what we would need for care and how care was occurring on a daily basis.”

Chopra still recalls the day he toured the rooms on the 10th floor of Mott Children’s Hospital. “I remember walking through and looking at the bathroom doors and saying, ‘These patients aren’t going to need bathrooms because they’re..."
going to be on ventilators. And boy, if you put two people in this room, that door is not going to open because we need space around the beds. It was very interesting to be an architect, a clinician and a logistics expert at the same time. That is what makes us unique as hospitalists; we understand care delivery in ways that many others don’t,” says Chopra.

Another challenge faced was in relocating the existing patients on the 10th floor. “There were patients there who needed cancer care who had to be moved so that rooms could be readied and made available for COVID-19 patients,” he says. “And so it was this cascade that if we’re going to use that space for COVID-19 care, then we have to move people that are currently on the floor. And they have to go somewhere else, which means that another patient has to be displaced, as we don’t have empty floors lying around in the hospital. But, because patients had stopped coming to the hospital for routine care due to COVID-19 and we slowed down elective care, we were able to create enough capacity to do that.”

Added to the list of challenges was how to staff the RICU. “It is a 32-bed unit but we could double up patients in every room to make it 64 beds, and that’s exactly what we planned for. So, from zero to 30 patients, we agreed that the Division of Hospital Medicine would provide coverage,” says Chopra. Moreover, rather than having all the ICU physicians move to the RICU, which was very difficult to do because the ICUs were also busy at the main hospital, Chopra and colleagues designed a new collaborative care model wherein the hospitalist would be the primary physician for the patient. “The ICU physicians, infectious disease physicians, nephrology teams, palliative care physicians and whoever else needed to be present for the patient, would round together as a multidisciplinary team and everyone would provide input on their area of expertise during rounds,” he explains. “It was our job to execute on that plan. And the advantages of this model were economies of scale and size because we were there, and the ICU physicians and other subspecialists didn’t have to be in the RICU all day.”

Chopra says that the rounds served as the point where everyone came together as a hub, and, when patient volume was manageable, it worked well. “Even though hospitalists aren’t trained as intensivists, and things like ventilator care and managing airways is not typically part of our portfolio, it actually worked to the point where consultants could do what they were good at, and we could help oversee and deliver as generalists,” says Chopra. “So our model was incredibly powerful because it gave us time to be able to get ready and develop a more stable plan as the number of patients began to rise.”

Expanding COVID Care
In April 2020, after the RICU had been open for about a month, Chopra and colleagues began to realize that there were going to be more patients in the ICU than team capacity allowed for. “Our expertise also became necessary in non-ICU areas to provide care to those patients who had survived COVID-19, but needed to still be in the hospital, as well as a growing number of non-critically ill patients,” he says. “We found ourselves stretched to the point where we just couldn’t do both and that’s when we handed the reins of the RICU over to Jakob McSparron, MD, associate professor, Division of Pulmonary & Critical Care Medicine, and Ross Blank, MD, clinical assistant professor, Department of Critical Care Medicine-Anesthesiology. Together, they developed a unique critical care model composed of ER physicians, medical intensivists, surgical intensivists, neurointensivists and anesthesiologists coming together to deliver care in the RICU.”

The RICU provided exceptional care for COVID-19 patients for 84 days between March 16 and June 9, 2020. Contingency plans were developed in case
it needed to reopen due to a second wave of patients.

Addressing the Second Surge

Chopra says that during the initial COVID-19 surge the number of patients coming in for routine appointments, such as for heart care, dropped dramatically. “All of a sudden it was actually quite easy to pivot to COVID-19 care across all of our services. Patients were essentially afraid to come to the hospital, given the questions about this infection and risks therein, so we actually had quite a bit of bandwidth,” says Chopra.

The second surge in the fall of 2020 was a very different story. “In this phase, we made it very clear that we could not stop doing all of the things that Michigan Medicine does. We had learned that a lot of delayed or deferred care had consequences for patients. It was just not right to have people die from heart failure and stroke when we could save them,” he says. “So we changed our messaging to say we will do COVID and non-COVID care as best as we can.”

During this time, Smith and Vaughn helped create Michigan Medicine’s new Moderate Care Clinical Service for COVID-19 patients. “The service provided a new type of moderate-care capacity on medical wards, where patients with high oxygen needs could get heated high-flow oxygen without having to be in the ICU,” Smith explains. “This platform has been the hallmark of the second surge, in that we didn’t need to reopen the RICU to care for these otherwise critically ill patients.”

Pulmonary & Critical Care Medicine

Many faculty from the Division of Pulmonary & Critical Care Medicine were called upon to provide critical care for some of the sickest COVID-19 patients in the RICU. “Our division was obviously impacted in a major way, since COVID-19 can cause lung complications such as pneumonia, and, in the most serious cases, acute respiratory distress syndrome,” says Theodore Standiford, MD, professor and chief of the Division of Pulmonary & Critical Care Medicine.

In addition to caring for these critically ill patients, the division was asked to transform their moderate care unit into a fully functioning intensive care unit. “This was a substantial challenge for us,” he explains. Dennis Mark Lyu, MD, associate professor, Division of Pulmonary & Critical Care Medicine, worked closely with the hospitalists to accomplish this transition. Helena Miriam Schotland, MD, associate professor, Division of Pulmonary & Critical Care Medicine, and clinical service chief, was instrumental in scheduling faculty to attending blocks. “Helena did a masterful job,” says Standiford. “She also provided a daily update to the division regarding the number of COVID-19 patients, and the changes in the service structure to care for these patients.”
By April of 2020, approximately 28 freestanding alternate care sites ranging in size from 50 to 3,000 beds were underway or finished in the U.S., including the Michigan Medicine Field Hospital among them.

This 500-bed alternate care site was planned and built in spring 2020 to meet the anticipated surge in COVID-19 patients, who were expected to overrun hospitals in Michigan and nationwide. Planning began on March 27, 2020, and the site was ready for patients on April 9, 2020.

The Michigan Medicine Field Hospital was planned to be a step-down care facility where the least ill COVID-19 patients could be safely treated. The idea was to increase bed capacity for more acutely ill patients in the remaining Michigan Medicine hospitals. (In any event, the majority of field hospitals constructed for COVID patients in the U.S. weren’t called into service, including the Michigan Medicine facility.)

Planning for the hospital was organized into six units: personnel and labor, security, clinical operations, logistics and supply, planning and training and communications.

The team visited indoor facilities and dormitories near the hospital, ultimately selecting the new 73,000-square-foot indoor track and performance facility, a 12-minute drive from the main hospital. A draft layout was completed in two days for a 519-bed facility, including a 20-bed higher acuity area for patients requiring a transfer back to Michigan Medicine. The goal was to provide the highest level of comprehensive care possible in a temporary setting.

One major advantage of an academic medical center-run facility was physician staffing capacity. Academic physicians are not generally 100 percent clinical, and Michigan Medicine physicians and resident trainees could provide extra clinical capacity. Tapping into staff with prior military and disaster experience was also critical.

While the experience was specific to COVID-19, much of what was learned is generalizable to other instances requiring a field hospital.
The state of Michigan, and in particular southeast Michigan, was hard hit by the initial surge of the COVID-19 pandemic. “It was clear where the trajectory was heading, especially in the city of Detroit and in Oakland County, where hospitals were starting to see a sharp rise in patients,” says Vikas Parekh, MD, professor, Division of Hospital Medicine; associate vice chair for the Department of Internal Medicine; associate chief clinical officer for Medical, Emergency and Psychiatry Services for the adult hospitals; and system medical director for Capacity Management.

At the time, faculty in the U-M Hospital Command Center were talking with the Michigan Department of Health and Human Services (MDHHS) and the state. “In those discussions, it became clear that many Michigan hospitals needed help,” he explains. “So when Michigan Medicine saw that we had capacity, mostly because much of our routine patient care wasn’t happening and patients weren’t showing up in the ER, we began to look at ways we could help. We made a conscious decision to actively reach out and to be open for transfer patients, focusing primarily on ICU patients because we knew that was the most critical constraint in the region.”

Super Admitting Officer of the Day Program

Parekh and his team created the Super Admitting Officer of the Day Program, staffed with experienced physicians taking transfer requests and helping to determine which patients would be admitted. Mark McQuillian, MD, clinical associate professor, Division of Rheumatology, was a key leader in this space. “We’d set goals and targets for how

HELPING OTHER HOSPITALS
At the peak of the initial surge, Michigan Medicine took 25 ICU transfers a day from Detroit

VA Ann Arbor Accepts Non-Veteran Transfer Patients

For the first time in its 67-year history, on April 5, 2020, the VA Ann Arbor Healthcare System (VAAAHS) accepted non-veteran patient transfers from overburdened area hospitals. In this historic move, John D. Dingell VA Medical Center in Detroit and the VAAAHS each activated their response to VA’s “Fourth Mission”: to improve the nation’s preparedness for response to national emergencies and to support local critical needs to non-veterans in times of crisis. Both the Federal Emergency Management Agency and the state requested support from the VA.

VAAAHS opened 35 beds to critical and non-critical COVID-19 patients and ten beds for intensive care and 25 for acute care.

“As a consequence, the number of COVID-19 patients in the intensive care unit at the VA substantially increased,” says Theodore Standiford, MD, professor and chief of the Division of Pulmonary & Critical Care Medicine. “We provided increased care for these patients requiring two different services. Normally, we just have one ICU service, but we had to go to two ICU services and provide day and night coverage.

Jane Deng, MD, associate professor and section chief of pulmonary at the VA Ann Arbor Healthcare System, did a fabulous job of leading this group in the care of these patients.”

Mark McQuillian, MD
“We were able to have a meaningful impact on many of those patients, and I think we saved many lives in the process by decompressing some of those hospitals and emergency rooms.”

— Vikas Parekh, MD

many transfer patients we could take that day and then work with the admitting officer in the transfer center to coordinate that. At peak, we were taking up to 25 ICU transfers a day from Detroit,” says Parekh. “These were patients from emergency rooms who were otherwise going to be sitting there for days because there was no ICU capacity in those hospitals. We would just take the patient straight out of the emergency room and bring them here. We were willing to help any hospital that had a need and reached out to us.”

Stretching Capacity

Parekh notes that Michigan Medicine was one of few, if any, health systems in the state that took patient transfers during the initial COVID-19 surge. “Every other health system was either just trying to handle its own or afraid that they weren’t really capable of helping out,” he explains. “It was an enormous strain on our health system. We stretched our bed capacity from about 100 adult ICU beds to well over 200 ICU beds, primarily to help take transfers from Detroit emergency rooms for ICU care. They would have patients who needed ICU care wedged in hallways or put in places where they really could not provide adequate care. In the end, we took several hundred transfers.”

Looking back, Parekh says that Michigan Medicine served a critical role in ensuring that COVID-19 patients in Detroit got into an ICU and got the care they needed. “We were able to have a meaningful impact on many of those patients, and I think we saved many lives in the process by decompressing some of those hospitals and emergency rooms.”
Laraine Washer, MD, associate professor, Division of Infectious Diseases, and hospital epidemiologist, Michigan Medicine, oversees infection prevention efforts for hospital and ambulatory services for University Hospital, C.S. Mott Children’s Hospital and Von Voigtlander Women’s Hospital, and more than 126 ambulatory clinics and home care operations that handle more than 2.3 million outpatient visits a year.

During the initial surge of COVID-19, Washer quickly pivoted from her routine work geared to prevent health care-associated infections among patients, visitors and staff across the health system. Together with our infection preventionists, data analysts and others on our team, we create policies and procedures and conduct surveillance for infections and then feed back that information. We also lead and participate in quality improvement around health care-associated infections and community-level infections,” says Washer.

“Since the onset of COVID-19, my role has expanded because the ambulatory and inpatient settings have changed dramatically — and by the moment — and the complexity of patients has only increased.”

The IPE has played a critical role since the onset of the pandemic. “The department is staffed by experts in infection prevention, including John Peter Mills, MD, clinical assistant professor, Division of Infectious Diseases and Emily Kate Stoneman, MD, clinical associate professor, Division of Infectious Diseases, both associate hospital epidemiologists and members of the Department of Internal Medicine. Also on the team is Terri Lynn Stillwell, MD, clinical assistant professor, pediatric infectious diseases in the Department of Pediatrics, and associate hospital epidemiologist for Mott Children’s Hospital,” she says.

“Challenges Faced”

Washer says the challenges Michigan Medicine teams have faced during COVID-19 are universal to all health systems. “Our goal is to provide safety for our staff and our patients, while continuing to provide care for both COVID-19 patients and non-COVID-19 patients,” says Washer. “So we had to change the way we do things. To begin with, we had to implement screening processes for everyone who enters one of our hospitals or clinics to determine if they’ve been exposed to COVID-19 or have symptoms, and manage those persons differently.

Washer also serves as medical director for the U-M Department of Infection Prevention & Epidemiology (IPE). “We are responsible for developing and implementing practices to prevent health care-associated infections among patients, visitors and staff across the health system. Together with our infection preventionists, data analysts and others on our team, we create policies and procedures and conduct surveillance for infections and then feedback that information. We also lead and participate in quality improvement around health care-associated infections and community-level infections,” says Washer.

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Most importantly, we needed to follow established guidelines to minimize the spread of COVID-19, as the complexity and volume of our patients increased. 

Added to this has been the challenge of supplying appropriate personal protective equipment (PPE). “We have used a variety of PPE throughout the health system, beginning early in the pandemic with the implementation of universal masking for all of our employees, and, quickly thereafter, with universal masking for our patients,” she explains. “So there have been a lot of opportunities to create best practices around PPE and to provide the best care for our patients,” says Washer. “These multidisciplinary collaborations with people that we don’t always work with, such as our supply chain specialists, environmental services specialists and facilities management specialists, have been invaluable. I’m really proud of the way that we’ve been able to manage through this tough time, and we continue to go forward following the principles of safe patient care.”

In a March 11, 2020, paper titled, “How Should U.S. Hospitals Prepare for Coronavirus Disease 2019 (COVID-19),” published in the Annals of Internal Medicine, Laraine Washer, MD, associate professor, Division of Infectious Diseases, and hospital epidemiologist, Michigan Medicine; and lead author Vineet Chopra, MBBS, MD, MSc, associate professor, Division of Hospital Medicine, provided an overview of the essential components of hospital COVID-19 preparedness, together with colleagues from Johns Hopkins University and Georgetown University. Based on their experience and published research, they recommended: 1) developing a strategy for patient volume and complexity; 2) protecting and supporting health care workers on the front lines; 3) defining a strategy to allocate health care resources; and 4) developing a robust, transparent and open community policy.
When the COVID-19 pandemic hit in March 2020, Scott Flanders, MD, had to pivot quickly. Flanders, a professor in the Division of Hospital Medicine, chief clinical strategy officer at Michigan Medicine and program director of the Michigan Hospital Medicine Safety Consortium, along with faculty from the Department of Internal Medicine transitioned from the work they were doing to build a data collection strategy that led to the creation of the statewide infrastructure known as the Mi-COVID-19 Registry, which collects data online from hospitals across Michigan.

Key departmental participants on the initiative included Elizabeth McLaughlin, MS, RN, program manager of the Michigan Hospital Medicine Safety Consortium; Hallie Prescott, MD, MSC, associate professor, Division of Pulmonary & Critical Care Medicine; Vineet Chopra, MBBS, MD, MSc, associate professor and chief of the Division of Hospital Medicine; Lindsay Petty, MD, clinical assistant professor, Division of Infectious Diseases; and Tejal Nikhil Gandhi, MD, clinical associate professor, Division of Infectious Diseases.

“We quickly recruited over 40 hospitals in Michigan to begin data collection so that we could better understand COVID-19. We wanted to look at how hospitals were delivering care, and to identify best practices in caring for patients with the virus,” says Flanders. “And we looked at variability and improvement opportunities for patients with COVID-19, with the ultimate goal of helping all the hospitals do the best they could to deliver the highest quality of care for hospitalized patients across Michigan.”

Flanders and his team used the Michigan Hospital Medicine Safety Consortium, one of the Blue Cross Blue Shield Collaborative Quality Initiatives (CQIs) he leads. “In March, we pivoted to begin data abstraction around COVID-19,” he says. “Within six weeks, we were able to provide data on more than 1,000 patients in hospitals across Michigan. And over the summer, we generated several reports looking at key aspects of care delivery, and shared those through peer-reviewed publications, webinars and informational sessions.”

**Webinars**

The team continued its data collection when the second COVID-19 surge appeared in late fall. “We also began to ramp up weekly webinars led by Jakob McSparron, MD, associate professor, Division of Pulmonary & Critical Care Medicine, to engage providers across the state in conversations about how best to deliver care, how to build capacity and how to learn from hospitals that had large volumes of patients in the spring,” says Flanders. “There were sessions on everything from evidence-based practices and creating surge capacity to vaccination and delivering care in rural critical-access hospitals. We coordinated this by bringing in experts from health systems across the state who were doing this work to participate in panel discussions.”
“It was just amazing to see the health care community in our state, led in large part by teams at Michigan Medicine, roll up their sleeves in a very fearless, selfless way to support the care of these patients and to be at the front edge of a once-in-a-century pandemic.”

— Scott Flanders, MD

Teamwork
Flanders still reflects on the level of willingness of hospitals and providers around the state to share and do heavy lifting. “We were very inspired by how willing everybody was to lean in. I should also emphasize that there were many other Blue Cross Blue Shield CQIs that didn’t necessarily focus on the hospitalized medical patient, but were quick to help facilitate data collection,” he says. “It was just amazing to see the health care community in our state, led in large part by teams at Michigan Medicine, roll up their sleeves in a very fearless, selfless way to support the care of these patients and to be at the front edge of a once-in-a-century pandemic.”

COVID-19 Colleague Connect
McSparron also led the development of COVID-19 Colleague Connect, a Michigan Medicine hotline staffed 24/7 by pulmonary critical care faculty, ICU nurses and pharmacists to field questions from hospitals across the state about management of patients with COVID-19. The hotline was a key reference point for providers looking for a resource to help them deliver better care. “Jake tells me we’ve had over 30 calls to that hotline in the last month with hospitals reaching out for advice and expert opinion,” says Flanders. “We have continued the Colleague Connect, given the recurrent surges in Michigan, and our volume has actually increased throughout spring 2021. As new evidence emerges, we have been able to share our practices with others outside of this large academic center,” says McSparron. “Many questions focus on vaccination or treatment options, and we frequently discuss best practices for ventilator management or further diagnostic workup. The Colleague Connect has relied on countless team members from various areas across Michigan Medicine. Not only those on the calls, but also colleagues from M-line, the medical library, the Admitting Officer of the Day team and many more. This is just one more example of how we came together during this crisis to try to help in any way possible.”
When the initial surge of the COVID-19 pandemic arrived, there was limited data in the literature on how to treat patients infected by the novel coronavirus. “We had minimal information from China about hyperglycemia and COVID-19. We did know that patients with diabetes were at high risk for worse outcomes with COVID-19 disease,” says Roma Gianchandani, MD, professor, Division of Metabolism, Endocrinology and Diabetes.

In April, Gianchandani’s diabetes management team received a call from providers in the U-M Regional Infectious Containment Unit, a negative pressure area set up specifically for the care of COVID-19 patients with respiratory compromise, reporting COVID-19 patients with very high blood sugars. “They asked for our help, so we started seeing these patients to identify those who needed specialized blood glucose management,” she says. “What we saw was that even patients with mild diabetes had significantly elevated blood sugars in COVID-19, and so did several patients with COVID-19 without diabetes.”

That finding led to a critical new consideration, one they had not commonly experienced. “These patients with extremely high blood sugars, sometimes with 500 milligram per deciliter blood sugars, were severely insulin resistant and difficult to control early in their disease course,” says Gianchandani, whose research focuses on outcomes of inpatient blood glucose management programs and the technological aspects of intravenous insulin delivery and glucose sensing. “Some of the patients were coming in with ketoacidosis, or hyperosmolar states. Although we gave these patients large amounts of insulin, it was very often just not enough.”

Gianchandani’s team typically works in the Cardiovascular Intensive Care Unit (CVICU) for postsurgical patients, but with minimized surgical procedures during the early pandemic, they had the capacity to help in other areas. To start, the diabetes management team modified their protocols to preserve PPE for nurses. “Blood sugar checks are done every hour for patients on an insulin drip. For patients who are not on a drip, it’s every six hours,” she says. “We created a program where the nurses would go in and check the blood sugar and the insulin dose at the same time so they didn’t have to go in and out of the room twice. We also transitioned patients off insulin drips to subcutaneous insulin as soon as safely possible to reduce their glucose checks.”

After seeing patients for a few days, Gianchandani and her team realized they needed to modify their current protocols. “These patients with large insulin requirements were also on tube feeds and steroids, both of which elevate glucose. When patients were proned, tube feeds were held. Additionally, their clinical condition changed very quickly, making glucose management challenging,” says Gianchandani.

The diabetes management team took over all severe hyperglycemia management. “Between the Endocrine Consult Service and the Michigan Medicine Hospital Intensive Insulin Program, we assisted the ICU and ICU patients at University Hospital with their hyperglycemia management,” she says. “I believe it was a very valuable program, as it took the burden of diabetes management off the primary providers who already had so much to do, and...
“Our patient numbers doubled, so we had to increase our team sizes and had to have two attendings from each service come in.”

— Roma Gianchandani, MD

undoubtedly improved patient outcomes.”

Gianchandani explains that hyperglycemia is known to increase complications in hospitalized patients and needs to be addressed immediately upon admission. “We now know that the unique presentation of hyperglycemia in this patient group is caused by the virus’ effect on the beta cell which causes relative insulin deficiency. In addition, some patients develop significant insulin resistance from the cytokine surge caused by the virus. This explains the presentation of many patients with type 2 diabetes with severe hyperglycemia and acidosis usually seen only in type 1 diabetes. Like much else about this virus, we were discovering this while actively treating patients.”

In July 2020, Gianchandani and her team shared their guidelines in a presentation titled “Diabetes, Obesity and COVID-19, The Perfect Storm,” during the Department of Internal Medicine Grand Rounds.

They also published their preliminary observations in a paper titled “Managing Hyperglycemia in the COVID-19 Inflammatory Storm,” in the October 2020 issue of Diabetes, addressing why high blood sugar may trigger worse outcomes in people infected with COVID-19.

Gianchandani says she’s very proud of the collective response from the Division of Metabolism, Endocrinology and Diabetes. “Our patient numbers doubled, so we had to increase our team sizes and had to have two attendings from each service come in. We also learned how to effectively manage patients without face-to-face interaction and our comfort with virtual care increased considerably,” says Gianchandani. “Coordination and communication between the teams was also critical for patient care and to lessen the burden on one set of providers.”

While reflecting on this work, she is pleasantly reminded of one very critical COVID-19 patient her team followed. “This patient was hospitalized for months and was on a ventilator, tube feeds and other support,” she says. “Seeing him back in the clinic late last year, off oxygen and tube feeds, functioning independently and with improved blood glucose was a truly gratifying outcome.”
FINDING SAFER WAYS TO CARE
Expanding virtual and at-home care options

On March 9, Michigan Medicine treated its first COVID-19 patient, one of two in the state, prompting Michigan Governor Gretchen Whitmer to mandate that non-essential workers “Stay Home and Stay Safe.” To Michigan Medicine ambulatory care clinics, this meant deferring all in-person, noncritical appointments and elective surgeries, creating a backlog of appointments that pushed virtual care to the forefront.

In the ensuing weeks, the use of virtual visits exploded. During the month of February 2020, Michigan Medicine conducted 444 video visits. This skyrocketed to 6,800 in March and 26,907 in April 2020.

Video visits have been available to Michigan Medicine patients in a number of ambulatory clinics since 2016, and e-visits have been offered to primary care patients since 2017. But it took several key policy shifts at the federal level in response to the pandemic to enable the recent rapid surge of telehealth.

Up until March 2020, the Medicare program did not allow patients to connect with clinicians using their smartphones from home. But as the pandemic began to unfold and shelter-in-place measures were instituted across the country, Medicare not only allowed patients to connect with clinicians from home, it allowed for the use of non-HIPAA-compliant equipment and the practice of medicine across state lines. Before these moves, providers couldn’t be sure whether a patient would get stuck with a large bill for a telehealth visit. Now, Medicare considers a video visit equivalent to an office visit.

“As a response to this crisis, virtual visits have introduced

Virtual care offerings currently in use at Michigan Medicine include:

- E-visits, where a patient fills out a questionnaire and receives a written treatment plan
- E-consults, where a primary care provider and another provider, typically a specialist, consult regarding a specific patient/condition
- Tele-specialty consults, conducted between Michigan Medicine providers and affiliates/partners to coordinate patient care
- Video visits, involving two-way audiovisual communication between a patient and a Michigan Medicine provider

it took several key policy shifts at the federal level in response to the pandemic to enable the recent rapid surge of telehealth.
“A virtual visit provides more convenience and more responsive care to our patients. It improves patient satisfaction and is also very appropriate for many conditions — but not all.”

— Kevin Chan, MD

Kevin Chan, MD

us to a better way, in certain circumstances, to care for individuals,” explains Kevin Chan, MD, the Department of Internal Medicine’s vice chair of clinical experience and quality. “And it has rapidly shifted providers thinking about this type of care. Our faculty has responded to the call to care for our patients by video visits. We now have whole ‘clinics’ that are virtual. It’s taken some time to develop. In the early stages, we would have face-to-face visits mixed with virtual visits. But now, over the past year, my clinic is now full of patients who are willing to interact with me on a virtual platform.”

Chan believes these advances are positive for most patients. “A virtual visit provides more convenience and more responsive care to our patients. It improves patient satisfaction and is also very appropriate for many conditions — but not all. When you require testing or other procedures, then the virtual visit is not appropriate. But it has really taken off. I think most of the public is embracing it, except for some of our older patients.” Raymond Yung, MD, chief of the Division of Geriatric and Palliative Medicine explains:

“If you look at all the divisions in internal medicine, our number of virtual visits is lower than the others. It’s not because we don’t try, but really the population we look after just doesn’t have the means to do it. The average age of our patients is close to 80 years old. Many don’t own a computer or barely use the camera or video function on their cell phone. They rely a lot on their children and caregivers for help, so that adds another layer of challenges to providing virtual care.”

Addressing the Digital Divide

Julia Chen, MD, a clinical instructor from the Division of General Medicine, who leads the implementation of telehealth for her division, was part of a team that studied access to virtual care. They discovered that older patients and patients with less resources — those with Medicaid insurance and less access to the internet — were less apt to participate in video visits and more likely to complete telephone visits. Patients who are African American or require an interpreter were also less likely to use video-based telehealth.

During the peak of the first wave of infections, telehealth visits accounted for more than 75 percent of patient visits at Michigan Medicine during April and May 2020. Nearly half of those visits were conducted by telephone alone rather than via audio and video communication, as is conventionally required by insurance. All patients were first offered video visits, but were rescheduled to telephone visits if video visits were declined.

While using telephone as an alternative to video visits may seem like an obvious solution, doctors previously were not reimbursed for care delivered by audio connection alone. In order to help all patients maintain access to care during the pandemic, the Centers for Medicare and Medicaid Services made a temporary exception to this rule in March 2020. It allows doctors to be paid the same amount for in-person, video and traditional telephone visits. This change is helping doctors reach patients who might otherwise be left behind in the “digital divide.” Ongoing reimbursement for telephone visits is important, in order to continue providing care to those unable to access video visits.
Monitoring Patients at Home

In addition to virtual care, two new programs were introduced at Michigan Medicine in 2020 that bring together advanced technology and the expertise of care teams to help patients avoid or shorten a hospital stay, while still getting the care they need at home.

A pilot program called Hospital Care at Home (HCAH) began identifying patients who could safely go home from Michigan Medicine’s adult emergency department, instead of being admitted to the hospital. It joined a program available to hospitalized Michigan Medicine patients called Patient Monitoring at Home, which launched recently with funding from a grant from the Federal Communications Commission’s COVID-19 Telehealth Program.

“Both of these programs offer patients more flexibility about where they receive their care, while ensuring that they are connected to a health care team that understands their needs while remaining in familiar surroundings, with uninterrupted sleep,” says Grace Jenq, MD, an associate professor from the Division of Geriatric and Palliative Medicine and associate chief clinical officer for post-acute care at Michigan Medicine. “Especially during a pandemic, we are proud to be able to offer this type of option to our patients.”

Hospital Care at Home

The HCAH program is the first test of the ‘hospital at home’ concept in Michigan, and is patterned after a successful program in another state that was originally funded by Medicare. It focuses on evaluating patients with medical conditions — that are unlikely to require intensive care, procedures or consultation services — while they’re still in the emergency department.

If they qualify for the pilot program, they are transported home. They then receive a range of home-based care — including blood draws, X-rays and medication infusions — through visits from trained staff including a physician, nurses and nurse practitioner, a home health aide and a physical therapist if needed. Each patient is lent a digital tablet and a kit of electronic devices that monitor vital signs and transmit the data to nurses who can coach them and act on changes. A physician and paramedics are on call for urgent needs.

Past research on similar programs, says Jenq, has shown that they reduce readmissions to the hospital and improve patient satisfaction.

Patient Monitoring at Home

Meanwhile, some inpatients at Michigan Medicine are being able to go home earlier with the extra support provided by the new Patient Monitoring at Home program.

Recently discharged patients are supplied with a cellular digital tablet and the suite of devices that connect to it. They monitor their vital signs, connect

Increasing Outreach

According to Scott Flanders, MD, the Department of Internal Medicine’s vice chair of external relations, the massive switch to virtual care this year has also increased Michigan Medicine’s ability to support its affiliates and partners across the state.

“It’s created an increased comfort level within our teams, and our providers’ ability to deliver care virtually. They are now comfortable with how to interact with patients, how to manage the technology and what they can and can’t do well in that format. We now have a whole group of faculty that are now more able and willing to help more patients across the state,” he says.

“For example, Monica Colvin, MD, an associate professor from the Division of Cardiovascular Medicine, transferred her advanced heart failure clinic at MidMichigan in Midland [which had required a commute of two hours each way for Colvin] to a virtual approach. This is allowing her to provide more expertise and care to more patients at this location.

“Another great example is how we were able to help the UP-Health System. They had been having difficulty attracting nephrologists to the community, and this was limiting their ability to provide acute inpatient support for nephrology. Michael Heung, MD, a professor from the Division of Nephrology, is leading a group of U-M nephrologists who volunteer for a week at a time to provide virtual inpatient consultations for patients.”
with nurses remotely and have access to on-call help.

The program aims to improve patients’ experience, reduce their risk of readmission and maintain their quality of care, while allowing Michigan Medicine to make the best use of the inpatient beds it has at any one time. Patients can remain in the program for several weeks, as needed.

Each patient receives a box containing a tablet that connects via wireless Bluetooth technology to a blood pressure cuff, scale, blood sugar monitor, thermometer and blood-oxygen sensor. Before they leave the hospital, or soon after arriving home, they’ll receive training in how to use the devices and how to check in with the team that will monitor their results.

“In just our first months of using this program, we’ve had many ‘saves’ where patients received needed adjustments to their medications, or were scheduled for diagnostic tests,” says Jenq. She notes that patients with a wide range of conditions — from type 1 diabetes and kidney disease to COVID-19 and heart failure — have already used the program successfully.

“When we send someone home from the hospital, they go from constant monitoring to nothing, and they and their families are expected to manage everything,” says Jenq. “The approach we’re taking with both of these programs tries to find a new way, especially for patients with short hospital stays. It also gives the patient’s regular physician a way to see trends in their vital signs before they come in for an office or telehealth visit, and provides recommendations.”

### GENERAL MEDICINE RESPONDS TO COVID-19

While most of the work of our Division of General Medicine is not considered “on the frontlines,” their behind-the-scenes efforts were vital to keeping all of our patients safe and healthy throughout the pandemic. Our general medicine division and its faculty:

- Converted to virtual management of complex patients.
- Consolidated our East Ann Arbor, Saline, Taubman and Brianwood Clinics into the West Ann Arbor location.
- Covered resident clinics and patients when residents were reassigned to inpatient duties.
- Served on inpatient teams during the initial surge in Spring 2020.
- Provided respiratory clinics at West Ann Arbor, Brighton and Canton and supported drive-thru testing sites at those locations.
- Developed a COVID-19 hotline and provided phone triage to allow patients to be cared for at home.
- Provided post-hospitalization followup for COVID-19 and other patients so they could be discharged from the hospital earlier.
“Adding Years to Life and Life to Years,” is somewhat of a motto for the Division of Geriatric and Palliative Medicine. Their work is focused on helping patients feel their best no matter their stage of life. Yet trying to stay true to this mission while caring for a vulnerable population in a pandemic has proven to be extremely challenging, and heartbreaking in many ways.

Older adults are at the greatest risk of requiring hospitalization or dying from COVID-19. The older you are, the higher your risk. The Centers for Disease Control and Prevention reports that 8 out of every 10 COVID-19 deaths in the U.S. have been adults 65 years old and older.

Both the division’s patient care and community programming had to be altered drastically throughout the year — either closed or switched to virtual or reduced-capacity formats — making it harder to connect with a population that needed them more than ever.

“We take care of a lot of older folks who are very frail, and are at particularly high risk for getting COVID-19 and COVID-related complications,” says Raymond Yung, MD, chief of the Division of Geriatric and Palliative Medicine. “Not surprisingly, there has been a great deal of anxiety among our patients as well as the participants of our social work and community programs. It has also been a stressful year for our faculty and staff, as they continue to provide critical support for the community. And as the crisis evolved, there were a lot of unknowns and uncertainty. That really was quite difficult.”

Virtual Care & Clinics

“Our clinic was greatly impacted by the pandemic,” Yung adds. “The average age of our clinic patients is close to 80. Many of them do not have the technology know-how to connect with their doctors via virtual care.”

— Raymond Yung, MD

Given the challenges of virtual care formats, the division needed to provide adequate face-to-face care options. Their clinics had to find ways to provide safe environments while also addressing the older patients’ fear and anxiety. “We have had many patients who just don’t want to come to the clinic even though they need care. So having an excellent doctor-patient relationship and taking patient safety issues very seriously were extremely important during the pandemic. We want them to feel comfortable coming to the clinic when they need to,” says Yung.

In April 2020, the division had to temporarily shut down its Acute Care for Elders program.
at St. Joseph Mercy Hospital in Ann Arbor because the hospital needed those beds during the initial COVID-19 surge. They reopened the unit during the summer but then had to reduce its capacity in the fall by half during the second surge. Now the 26-bed unit is back running at full capacity with both hospitalists and geriatricians again.

One positive thing Yung and his colleagues did discover over the past year was that the virtual care format has worked quite well for the majority of the outpatient palliative care patients. “Because this group is even more frail and near the end of their lives, it’s harder for them to get out, so they would usually miss a lot of their appointments. For those who were able to set up virtual care, we actually found that the no-show rate went down quite a bit from the pre-pandemic level,” he says.

Community Programs
The community programs offered through the Geriatrics Center’s Turner Senior Resource Center had to be paused, modified or drastically reduced to meet COVID-19 safety protocols. “Our team, led by Nina Abney, MSW, director of social work and community programs, worked hard to provide as much programming as possible given the circumstances,” says Yung. “During a year when so many older folks felt very isolated, we knew we had to do everything we could to provide resources, support and social connection whenever possible. Important programs like our Osher Lifelong Learning Institute, which provides lectures, courses and events for more than 1,700 older adults, changed to an all-virtual format. The Silver Club Memory Program, which provides a safe and engaging daycare environment for individuals with memory loss/dementia so their caregivers can recharge, had to close in-person programming between March-August 2020 and November 2020-January 2021. Fortunately, the program was able to partially reopen again using the latest safety guidelines in February 2021.

Yung continues, “When we were able to reopen our community programs to in-person visits after the first wave of the pandemic, we had to turn away some people because of capacity issues to meet distancing guidelines. It is also particularly hard for older folks with memory issues, as they have difficulty understanding why we insist on having them doing certain things, such as wearing a face mask. When they do wear a face mask, they will often take it off after a few minutes because they don’t remember why they have it on in the first place.

The need for programs like the Silver Club has actually grown during the pandemic, as many stressed-out caregivers need to have self-care time away from looking after their loved one 24/7. They look to us as an important support system, and it was heart-wrenching when we had to scale back.”

Taking Patient Preference into Account
Yung is proud of the many contributions his division was able to make to the care and support of older adults during the pandemic, but he struggles with the fact that many of the rules and protocols made an already marginalized population even more so.

“Something that I don’t want to lose sight of: medicine is very much a people discipline. It’s about people. And this pandemic has affected older adults in so many ways, including increased isolation, loneliness and disruption of their daily routine — it’s really palpable when we notice the decline, and
In the Community
While the Division of Geriatric Medicine and Palliative Care had to revamp its clinics and programming, its faculty and their expertise continued contributing to important efforts in the community.

PACE Program
The Program of All-Inclusive Care for the Elderly (PACE) is an innovative care model for Medicare and Medicaid patients who require nursing home care. Division faculty worked with the Huron Valley PACE office run by United Methodist Retirement Communities to help them manage COVID-19-related issues within their facilities, including testing, care and protocols.

Patient Care at Home
One thing that became very clear during the first wave of the pandemic is that people became very sick with COVID-19 and were in the hospital for a very long time. Their functional capacity was significantly reduced and it was difficult to discharge them.

Grace Jenq, MD, associate chief clinical officer for post-acute care at Michigan Medicine, played a critical role in strategizing on how to take care of these patients and allow them to go home earlier than they would under a traditional care model (page 56).

Advising Nursing Homes
Lona Mody, MD, MSc, the associate director for clinical and translational research at the U-M Geriatrics Center, heads the Preventing Resistance and Infection by Integrating Systems in Michigan project, which partnered with skilled nursing facilities, hospitals and public health agencies across the state to provide guidance on COVID-19 and older adults throughout the pandemic (page 106).
While conducting other research, Rodica Busui, MD, PhD, and her clinical research team became aware that many patients who survived COVID-19 and were discharged had started to experience serious lingering effects of the infection (page 96). Busui, the Larry Soderquist Professor of Diabetes; professor, Division of Metabolism, Endocrinology & Diabetes; and vice chair for Clinical and Health Outcomes Research noted long term consequences and complications as unusual pain syndromes, shortness of breath, fatigue, joint and muscle pain, weakness, dizziness, cognitive and memory problems, new onset diabetes and metabolic dysfunction.

Patients hospitalized for COVID-19 are experiencing a broad range of long-term, multi-organ issues involving pulmonary, cardiovascular, kidney, metabolic and neurologic complications. “There is an urgent need to better understand the long-term complications of COVID-19 and provide specialized care for high-risk groups of patients,” says Busui.

To address this broad range of complications, Busui and colleagues from several Department of Internal Medicine divisions — including MEND, Cardiovascular Medicine, Infectious Diseases, Nephrology and Pulmonary, as well as the Departments of Physical Medicine & Rehabilitation and Neurology — created the Michigan Medicine Multidisciplinary Post-COVID-19 clinic and clinical research program to provide targeted personalized care to patients presenting with post-acute sequelae of COVID-19 (or long-term COVID-19). “This clinic is not only going to continue the research and follow-up of these patients for clinical care, but will also try to better understand the long-term consequences of this disease,” she says.

“Although initially focusing on patients with diabetes who were admitted for severe COVID-19, the clinic has expanded and is now providing care to all patients who developed these sequelae regardless of initial disease severity, as most recently it became apparent that even patients who had milder forms of COVID-19 are at high risk of developing symptoms and complications associated with long COVID-19,” says Busui, who serves as director of the clinic.

Busui and her clinical research team have received initial funding from the National Institute of Diabetes and Digestive and Kidney Diseases, and are now integrating the post-COVID-19 research into clinical care via this new multidisciplinary clinic. “This is a very exciting project, and we have a strong collaborative team,” she says. “We are now deeply studying these patients for all potential systems, starting with the nervous system for cognitive assessment and psychological aspects that have been stimulated by this severe infection.”

“There is an urgent need to better understand the long-term complications of COVID-19 and provide specialized care for high-risk groups of patients.”

— Rodica Busui, MD, PhD
Faculty from all areas of the Department of Internal Medicine share their most vivid memories and the strongest lessons they learned by working through a pandemic.

WE’VE NEVER FELT MORE SURE OF EACH OTHER

“Michigan Medicine has an incredible bench capacity. As a leader, I can tell you that my colleagues and I have become stronger during the pandemic. We’ve never felt more sure of each other than we do now. Despite all of the doom and gloom, what has emerged is a more unified division and a more unified department. For that I am grateful.”

Vineet Chopra, MD
Chief, Division of Hospital Medicine
WE DIVIDED AND CONQUERED

“Our teams really rose to the occasion. We benefited from the wide array of leaders who stepped up in the organization, and in the Department of Internal Medicine. As a department, we were very collaborative and nimble. I worked closely with Scott Flanders, MD, professor, Division of Hospital Medicine, and Sarah Hartley, MD, associate professor, Division of Hospital Medicine, to really coordinate our departmental response. And with Jakob McSparron, MD, associate professor, Division of Pulmonary & Critical Care Medicine, and Vineet Chopra, MD, chief and associate professor, Division of Hospital Medicine to ensure we had the right clinical providers in the right place, and that we were all working together as a team. We divided and conquered so that no one was overwhelmed with responsibilities.”

Vikas Parekh, MD
Associate Chief Clinical Officer, Medical, Emergency and Psychiatry Services

GOOD COMMUNICATION BETWEEN THE DIVISIONS AND TEAMS

John Carethers, MD, chair of the Department of Internal Medicine, had the vision to hold division chief meetings on a weekly basis. “Good communication between the divisions and the teams that were formed in the RICU was a perfect example of how well everyone worked together. I want to specifically acknowledge the Division of Hospital Medicine, which, much like our division, carried a significant part of the clinical load. Also, the Division of Nephrology which, again, carried a good part of the clinical load due to the high incidence of acute kidney injury in COVID-19 patients and the need for dialysis. And finally, the members of the Division of Infectious Diseases who were instrumental in protocol development, research initiatives and providing expert patient care.

Theodore Standiford, MD
Chief, Division of Pulmonary & Critical Care Medicine
ONCE-IN-A-LIFETIME EXPERIENCE
“The RICU was perhaps a once-in-a-lifetime experience. We had volunteer providers from all parts of our health care system coming together in an uncertain environment, and needing to adapt and learn as we went along. Working clinical shifts in the RICU was unique for me in that it was a mix of the familiar feeling of wanting to serve and care for my assigned patients, while also sensing a foreign and ever present vigilance to protect myself and other coworkers in our unit.”
Christopher Smith, MD
Medical Director of the RICU

FACED WITH A DISEASE WE DIDN’T KNOW
“We were faced with a disease we didn’t know how to treat. And really, we had oxygen to offer but otherwise the disease really just ran its course. And it was our job to support the patients. We’re used to supporting patients in all sorts of disease processes, but we usually have more therapeutics to offer. Early on in the pandemic, we didn’t know how to help them yet. Dealing with that uncertainty was really hard for all of us.”
Sarah Hartley, MD
Associate Director, Department of Internal Medicine Residency Program
THESE RELATIONSHIPS WILL LAST

“None of us were prepared to manage this many critically ill patients, and yet so many people were willing to step into this uncertain environment and serve on the frontlines. It was incredibly humbling and inspiring to be part of this work. Teams were formed of individuals from multiple areas across our health system and they came together seamlessly. Every team member went above and beyond to provide the best patient care possible. Together with the Critical Care Medicine Unit and other ICUs in our system, the RICU developed a true expertise in managing patients with severe acute respiratory distress syndrome and other aspects of COVID-19. It is hard to find silver linings during a year like this, but this collaborative work was truly remarkable. These relationships will last well beyond the pandemic.”

Jakob McSparron, MD
Associate Professor, Division of Pulmonary & Critical Care Medicine
I WAS WORRIED THAT NOBODY WOULD SIGN UP

“When I asked people to step in to provide COVID-19 care, I asked for volunteers. To be honest, I was worried that nobody would sign up. But it was really heartwarming to see how many people responded and said, ‘Count me in. I’m happy to do it.’ And all those people got trained and got comfortable with COVID-19 care, using personal protective equipment, donning, doffing and all of them literally put their lives on the line in stepping up to this challenge.”

Vineet Chopra, MD
Chief, Division of Hospital Medicine

THE RESPONSE WAS TREMENDOUS

“Our division [Pulmonary & Critical Care Medicine] was asked to play a large role in the RICU. After we had decided on the staffing model, I put out an email call for volunteers. Within seconds to minutes of putting out the email, I already had multiple volunteers. Many more poured in over the next hour. The response was tremendous.”

Helena Schotland, MD
Clinical Service Chief, Division of Pulmonary & Critical Care Medicine
“It was like a ghost town at University Hospital. It sent chills through my spine when I would walk through the wards to check on house staff. It was too quiet. There were halls and halls of rooms with no patients. Having been here for the many years I have, it was an eerie, eerie feeling.”

John Del Valle, MD
Vice Chair for Graduate Medical Education
Program Director, Department of Internal Medicine
Residency Program

A COMBINATION OF DUTY AND SATISFACTION

“Every day there were emails and updates from hospital leaders about the predictions for the surge of patients, including plans for a field hospital in case the hospital was overwhelmed. When they asked if any subspecialists would volunteer to cover the General Medicine services and care for the patients with COVID-19, I felt a combination of duty and satisfaction to know there was a way for me to contribute and help. And I hope my children learned important lessons by seeing me help out, although I think deep down they were scared. Really, we all were.”

Melinda Davis, MD
Assistant Professor, Division of Cardiovascular Medicine
ON FEAR & RESPONSIBILITY

“Early in the pandemic, while working in the incident command center, I recall watching daily reports of the rapidly rising cases and deaths in New York City that preceded our surge in Michigan. I had been preparing for a potential large-scale pandemic my entire career in infectious diseases but I realized one cannot practice for the intense sense of responsibility I and others felt to keep our colleagues, patients and families safe in the face of all of the fears and uncertainties of the pandemic.”

Laraine Washer, MD
Medical Director, U-M Department of Infection Prevention & Epidemiology

INTENSE SENSE OF RESPONSIBILITY

“Early in the pandemic, while working in the incident command center, I recall watching daily reports of the rapidly rising cases and deaths in New York City that preceded our surge in Michigan. I had been preparing for a potential large-scale pandemic my entire career in infectious diseases but I realized one cannot practice for the intense sense of responsibility I and others felt to keep our colleagues, patients and families safe in the face of all of the fears and uncertainties of the pandemic.”

Laraine Washer, MD
Medical Director, U-M Department of Infection Prevention & Epidemiology

ABSOLUTE FEAR IN PEOPLE’S EYES

“I’ll never forget the look in the eyes of our house staff and nursing staff as they were caring for COVID-19 patients. Just the absolute fear in people’s eyes, worrying about what was going to happen and if they would get exposed to the virus. Our goal was not just, of course, to take care of our patients, but also to keep our house staff safe throughout this process. That’s one of the biggest things. To be honest, what kept me up at night [especially early on when we didn’t know what we were dealing with in terms of who was affected or not and what the outcomes were going to be] was taking care of the individuals I was responsible for. I view myself as responsible for every single house officer and member of my team.”

John Del Valle, MD
Vice Chair for Graduate Medical Education
Program Director, Department of Internal Medicine Residency Program
“I was frightened to death the first time I entered the room of a COVID-19 patient. I went through the safety checklist over and over in my head. I washed my hands. I put on the gown. I washed my hands. I put on the gloves. I washed my hands. I put on a mask. I wiped the goggles down. I put the goggles on. I asked one of my colleagues to snap a photo so I could send it to my wife, kids, mother, sister — all in health care and all at risk — so they could be assured I did it right. When I entered the room, my fear fell away. I knew that patient needed us.”

David Pinsky, MD
Chief, Division of Cardiovascular Medicine
“Many of the patients were on ventilators. Many were sedated. The ability to talk to them, to have a conversation to learn about who they are, had been interrupted. You used to be able to get some information from families, but because visitors were prevented from coming to the bedside, that human connection was lost. So whenever anything personal was learned about a patient, many of our residents started noting it below their name on their chart (or somewhere else prominent). This person has a dog, this person works in this field, this person has these family members. They were doing whatever they could to connect to the humanity of the patient in the midst of all the chaos.”

Thomas Sisson, MD
Associate Director, Department of Internal Medicine Residency Program

“As I look back at what we accomplished as a team during this once-in-a-century pandemic, I am reminded that we are ordinary people who perform sacred work.”

Sanjay Saint, MD, MPH
Chief of Medicine, VA Ann Arbor Healthcare System
NOT A DRY EYE IN THE ROOM

“I will never forget one of the first COVID-19 patients in the RICU, who was actually an anesthesiologist who had trained at U-M and had contracted COVID-19 while working at the Detroit Medical Center. Many of our anesthesia colleagues knew him. I still remember so clearly when this patient was being wheeled out of the RICU to go to the surgical ICU, and his family asked to see him. One of our physicians, Julie Elizabeth Barrett, MD, MPH, Facetimed with his family while we were all in the room. The patient’s four-year-old daughter wanted to sing a song to her father, so she sang ‘You Are My Sunshine’ over the phone to him. He was intubated at the time. We all heard the song and I can tell you that there was not a dry eye in the room that day. Her voice still haunts me. The patient recovered and was discharged from the hospital. It was a success story, but I can tell you that, at that time, we all thought he wouldn’t have made it.”

Vineet Chopra, MD
Chief, Division of Hospital Medicine
THE FIRST COVID-19 PATIENT

“This photo was taken during an office visit on March 5, 2020, with my double-lung transplant patient Paul Dewyse. His company had just made a donation to our transplant center that allowed us to purchase these backpacks for our patients.

Two days later I was notified that Mr. Dewyse was in the ER with nausea and vomiting with minimal respiratory symptoms but testing positive for SARS CoV-2. He had become Michigan Medicine’s and the state of Michigan’s very first documented case of COVID-19. I was quite surprised by the finding. I then became incredibly concerned about him and also about the possibility of being infected myself. I contacted infection control immediately and ultimately, never had symptoms and tested negative for the virus. It caused quite a commotion in the clinic since we did not have any suspicion that he had the virus since he did not have significant symptoms at the time. Thankfully, he did not have any respiratory issues during his hospitalization, but since he was our first case and was a transplant recipient, he was observed in the hospital a little longer than required.”

After three different intravenous antibiotics, around-the-clock pain meds and a lot of sleep, DeWyse was discharged to finish recovering at home after 11 days in the hospital. He never needed a ventilator. Dennis Lyu, MD, the attending inpatient physician for lung transplant services, oversaw DeWyse’s care while he was hospitalized.

Kevin Chan, MD
Vice Chair for Clinical Experience & Quality
UNSUNG HEROES

SUPPORTING US BEHIND THE SCENES

“Our frontline has been tremendous. I would also like to highlight the unsung heroes, who have been supporting us behind the scenes. Everything from our department and division administrators on down. One good example is my whole Michigan Hospital Medicine Safety Continuous Quality Improvement team. This is a group who’s basically been working at home since March 2020. And yet they put together an entire data collection strategy, built a data registry and supported our ability to better understand COVID-19 and deliver more effective care across our state. None of us could have done our work as well without these members on our team.”

Scott Flanders, MD
Chief Clinical Strategy Officer for Michigan Medicine
Vice Chair for External Relations
Capturing the Moment

Many of the moving black and white images documenting life on the frontlines featured in this report were taken by Steven Upton, MSW, MS, PA-C, from the Division of Hospital Medicine.
Honoring Our RICU Teams

"While all Department of Internal Medicine faculty and staff contributed to our pandemic efforts in a myriad of ways. Our 2020 Chair’s Award for Impact recognized the key figures who stepped up to activate the Regional Infectious Containment Unit that played a central role in Michigan Medicine’s response to and preparation for COVID-19 as cases were increasing dramatically throughout Southeastern Michigan.”

John Carethers, MD
Chair, Department of Internal Medicine

DEPARTMENT OF INTERNAL MEDICINE

2020 IMPACT AWARDS

The Department of Internal Medicine Impact Award for 2020 recognized the exemplary work of three divisions for their major contributions to providing leadership in addressing the COVID-19 pandemic in Michigan.

DIVISION OF HOSPITAL MEDICINE
Vineet Chopra, MD
Sarah Hartley, MD
Vikas Parekh, MD
Marisa Rodriguez
Richard Schildhouse, MD

DIVISION OF INFECTIOUS DISEASES
Powel Kazanjian, MD
Adam Lauring, MD
Laraine Washer, MD

DIVISION OF PULMONARY & CRITICAL CARE MEDICINE
Jakob McSparron, MD
Ted Standiford, MD
As COVID-19 made us close our labs and put some projects on hold, our department found creative new ways to continue our work by developing new protocols and projects and pivoting the focus of valuable research toward finding solutions that could help COVID-19 patients and fight the pandemic.
As diagnosed cases of the novel coronavirus continued to climb across the country and throughout the state, the University of Michigan limited all laboratory research deemed “noncritical” until further notice. This order came in late March 2020, a little more than a week after the university had placed restrictions on all projects using human subjects. The university and Michigan Medicine also requested that labs with available supplies, including face masks and gowns, donate their materials to the hospital as soon as possible to prepare for an influx of cases in the coming weeks.

Researchers and leadership throughout the Department of Internal Medicine who have dedicated their lives to finding new solutions for challenging problems had to quickly figure out how they could safely follow these orders without losing too much time or valuable data on important projects.

Finding Creative Solutions

The Department of Internal Medicine’s Vice Chair for Basic and Translational Research Vibha Lama, MD, describes what a Herculean task it was. “We have never had to close labs completely and say, ‘go finish all your experiments and shut everything down’ before. For most basic research — the labs had to close except for very essential activities,” she says. “Each lab had to designate one or two people in charge of these tasks. There was a high degree of thoughtfulness which was put into the whole operation. On the clinical side of things, it was even more complicated. They had to create a whole tier system depending upon how much human interaction was needed.”

Rodica Pop-Busui, MD, the Department of Internal Medicine’s vice chair for clinical and health services research explains what was at stake for many. “When you are part of large multi-centered trials, or when you have your own trials in process with 50 to 60 patients that need follow-up, you cannot just put everything on hold. You would be losing very important data collection points,” she says.

Given all of the nuances of different clinical projects, researchers had to decide what could be shut down, what could stay open and what could be modified, that would fit into state and university policies at that time while maintaining safety for patients and staff. “If modification of a study procedure could allow the study to stay open, we would give guidance on how to work with the Institutional Review Board (IRB) to quickly approve those modifications so certain pieces of that research could still move forward,” says Anna Lok, MD, the assistant dean of clinical research for the Medical School.

These discussions spurred a lot of research teams that normally would be conducting the research through face-to-face encounters to be innovative. If they couldn’t bring the patients in, could they still collect data by calling the patients or by connecting with them through video? Could they have the pharmacy mail drugs to the patient’s home?

“Throughout all of this, the IRB was very helpful, and they were really working day and night, seven days a week to look at all the adaptations and give us guidance and approve them so that we didn’t have to pause all our research. This was particularly important for some clinical trials which offer therapies that may be life-saving or slow down disease progression,” says Lok.
Throughout all of this, the IRB was very helpful, and they were really working day and night, seven days a week to look at all the adaptations and give us guidance and approve them so that we didn’t have to pause all our research.”

— Anna Lok, MD

“The majority of our interventional trials were allowed to continue, but every effort had to be made to transform any potential components as virtual. Only the critical components of a clinic visit or a critical laboratory testing were performed. The recruitment of new patients was not allowed for most trials,” says Busui.

Developing New Protocols & Ideas

In addition to modifying research, new safety protocols had to be implemented as well. “We had to create a new infrastructure and make sure that our investigators and research coordinators were trained properly on how to protect participants and themselves. Our department provided protective equipment and disinfectants for all of the clinical research areas where visits had to be done in person and offered tools and training for investigators who needed to convert different aspects of their research into virtual formats,” says Busui.

While COVID-19 caused a lot of research to be put on hold or modified, it also inspired many investigators to pursue new ideas to address it, Lama explains. “For example, I normally do lung transplant research and I thought of an idea for a new drug for COVID-19. Within one month, we were doing a clinical trial of that drug. Our circumstances really pushed forward a lot of translational work during this time. Things which normally would take very long to get approved, ideas which would normally take us years to bring to the patient’s bedside were going full speed ahead. Safely and thoughtfully we were able to cut through some of the red tape and inertia.”

As the year progressed, it became apparent that some of the COVID-19 patients who had recovered and been discharged were experiencing serious lingering effects caused by the infection. This led to new investigations focused on post-COVID care. “We wanted to learn more about why this was happening and what we could do to help current patients and prevent these issues from happening in future patients. We have already been able to actually integrate some of this research into clinical care,” (page 61) says Busui.

Ramping Up, Down and Up

“When we started ramping basic science research back up in June 2020, it was done incrementally from 30 percent to 45 percent to 60 percent capacity. And every time that happened, we had to tell each group how many people could be in their lab, depending on square footage and the amount of space for physical distancing,” explains Lama. “It was really hard because people wanted to get back to work. But we had to tell them that you can only have so many people and will need to shift some work remotely. Following these protocols really did make a difference. There have been no reports of any major COVID-19 outbreaks related to research at U-M.”

In October and November 2020, when a second COVID-19 surge hit, some of the observational studies had to be closed down for safety. As of February 2021, they have been reopened again. Lama adds, “COVID-19 affected every aspect of our lives — not just our research. There were so many people who had to stay at home to help their children with remote school or care for a loved one who was ill. Now we need to look closely at how we can help our investigators gain back some of the time and productivity they lost during the pandemic.”

When reflecting about the experience, Lok is hopeful about its impact on the future. “The most gratifying thing about this year has been our common purpose. People really came together and worked together well. They were willing to put a lot of time and thought into making things work. I hope that this positive energy and creativity will stay with us forever.”
Anna Lok, MD, serves as principal investigator of umbrella protocol to collect COVID-19 patient blood samples.

The initial surge of the COVID-19 pandemic, in the months of March and April 2020, was marked by a rapidly moving landscape of uncertainty, and limited understanding of the intricacies of the virus. “Many of us at Michigan Medicine thought it would be great if we could enroll COVID-19 patients in a study to obtain blood and urine samples, as well as nasal swabs, for greater understanding of the virus, but the majority of us were really looking for blood samples,” says Anna Lok, MD, the Alice Lohrman Andrews Research Professor in the Division of Gastroenterology and Hepatology, who is also director of clinical hepatology and assistant dean for clinical research in the University of Michigan Medical School.

Lok explains that there were many questions to address in accomplishing that mission. “First, we asked ourselves who would consent a patient? Teams were working from home at the time, and PPE was limited. And we didn’t want 10 people wandering around the hospital using up all the PPE just because we wanted to consent a patient for a study to get blood samples. Added to this was the question of who would collect the blood samples? And who would process the samples? Because again, the majority of people were working from home.”

There were equally important concerns relating to the safety and well-being of the COVID-19 patient population. “We did not want seriously ill patients to be approached by three different teams, each wanting two tubes of blood. These patients were sick enough already and didn’t want to be bothered by multiple people who wanted their blood and offered them no benefit,” says Lok. “Very quickly, we realized that everyone wanted samples from these patients, so it was important that we coordinated efforts. Although we wanted to promote and facilitate research, we also needed to be cognizant of the patient perspective, and the safety of everyone.”

Lok took it upon herself to become the principal investigator of an umbrella protocol wherein everyone would come through a common door. “Each investigator would let me know which type of patients they wanted to enroll and what samples they needed, after they had IRB approval,” she says. “We put together a common grid so that we had one team responsible for approaching the patients for consent and that same team would be responsible for collecting the blood, taking it back and processing it and distributing it to those wanting the samples. Whatever was left behind was stored for future research in a central repository that belongs to Michigan Medicine.”

The Michigan Medicine Department of Pathology was very helpful in the collaboration. “Many of the patients in the hospital were getting blood draws every day anyway,” says Lok. “Oftentimes, after the required testing was completed, there were residual blood samples left behind. And typically, after two or three days, those samples were discarded. So we ended up identifying samples ready to be discarded. We’d go and collect them and catalog them. And because they were discarded samples and would have otherwise been thrown away, patient consent was not required. As long as we de-identified the samples, we could appropriately use them for research. So we were able to make use of what would have been discarded to generate important information in addition to the samples we prospectively collected from patients we consented.”
She explains that most of their efforts were focused on the question of why some patients recovered, got discharged and did well, and, conversely, why some patients did not do well and required ventilator support and ICU care, and died. “It’s really about understanding the pathway that drives progression and severity of the disease,” she says.

Lok adds, “Marilia Cascalho, MD, PhD, associate professor, Microbiology & Immunology, and her team found that infection with SARS-CoV-2 evokes high affinity B cell responses, some products of which are broadly neutralizing and others highly strain-specific. They also identified variants that would potentially resist immunity evoked by infection with the Wuhan Hu-1 founder strain or by vaccines developed with products of that strain. Jason Knight, MD, PhD, associate professor, Division of Rheumatology, and his team found prothrombotic autoantibodies in patients with COVID-19, which may explain the high rate of arterial and venous thrombosis which contributes to organ failure and death in some patients.”

All told, over a five- to six-month period, Lok and colleagues collected more than 10,000 samples from about 1,000 patients. “We’ve since stopped collecting these samples because we think we have enough in the repository. There are also outside parties that have requested samples from us, so we have helped not only our own researchers but researchers elsewhere,” says Lok. “Some of the samples were used to validate new diagnostic assays and others to look at immunologic recovery.”

“Although we wanted to promote and facilitate research, we also needed to be cognizant of the patient perspective, and the safety of everyone.”

— Anna Lok, MD
Adam Lauring, MD, PhD, associate professor, Division of Infectious Diseases, and associate professor in the Departments of Microbiology and Immunology and Ecology and Evolutionary Biology, studies how different viruses evolve within people and spread. “We’ve done a lot of work over the years with a number of viruses, particularly with influenza, where we collaborated with other teams to conduct research studies,” says Lauring.

In March 2020, with the onset of the COVID-19 pandemic, Lauring and colleagues turned their research efforts to the investigation of SARS-CoV-2, the novel coronavirus that causes COVID-19. His studies utilize genome sequencing to help determine how the virus’ behavior changes from one person to the next and how it transmits. “We are looking at who is getting infected, where they are getting infected and how the virus spreads within a household, health care settings and the community,” he says.

**SARS-CoV-2 Sequencing Study**

Lauring admits that it was a natural fit, once COVID-19 happened, for his team to pivot to the novel coronavirus. “What we’ve been doing since the beginning of the pandemic, but then more intensively since September 2020, is sequencing a lot of SARS-CoV-2 specimens. We’ve been getting nearly all positive specimens from the Clinical Microbiology Laboratory in the Department of Pathology, which has been fantastic,” says Lauring. “We’re performing whole genome sequencing of SARS-CoV-2 from residual clinical specimens and other specimens collected through observational cohorts. Data gathered will inform the transmission and spread of the virus in health care settings and communities.”

Moreover, Lauring and his lab have entered into a contract with the Centers for Disease Control and Prevention to sequence these specimens and analyze the data to try to understand how SARS-CoV-2 spreads in communities. “We have an interesting community here in Ann Arbor, in that we have a university campus, a surrounding community and a health system that serves a larger community,” he says. “The sequences have allowed us to start understanding how different SARS-CoV-2 variants spread and what they can tell us about where infections are happening and how they’re going from person to person. That has been the engine of our research since the fall of 2020.”

Lauring reports that the sequence data have given the team a chance to answer other questions along the way. “We’ve learned about the degree to which viruses that arrive on campus spill over into the community or not,” says Lauring. “We’ve also been able to conduct investigations to better understand the B.1.1.7 variant outbreak we had in Washtenaw County and at the University of Michigan in January and February 2021, which has been very interesting. Also, to collaborate with the Washtenaw County Public Health Department and the state laboratory in terms of tracking the spread of B.1.1.7.”

**Monoclonal Antibodies**

Now, Lauring and his team are gearing up to use these data to inform decisions in the health system related to monoclonal antibody therapies. “This data can tell us which variants are present. And there’s data on how the therapies work against different variants. So that’s been
kind of a spillover effect of the research,” he says. “And then increasingly we’re shifting our focus to try to understand what variants are out there in terms of vaccines. So understanding variants and whether they are seen more commonly in people who are vaccinated or not vaccinated, and trying to understand how the changes in the virus affect how well COVID-19 vaccines work. That’s going to be the major focus for us moving forward.”

Expanding Reach
Along the way, Lauring and his team have used the sequence data for other smaller projects. “We’ve been able to work with Ji Hoon Baang, MD, clinical assistant professor, Division of Infectious Diseases, and others in the department to try to understand how the virus evolves in people who have prolonged infections,” says Lauring. “We teamed up with Dan Kaul, MD, clinical professor, Division of Infectious Diseases, and director of the Michigan Medicine Transplant Infectious Disease Service, to examine a case where an individual got COVID-19 from a lung transplant. That was an important case to really understand what kind of protocols needed to be changed in order to prevent something like that happening in the future. We set out to sequence to try to understand one problem, but we’ve now found that we can use the data and our approach to address other important issues with COVID-19.”

Lauring reports that the data the team is generating has definitely informed how the virus transmits from one person to another—and on a larger scale, how the virus is spreading in the community, where it’s spreading and how to use that information to control it. “Knowing where a virus spreads and how is important for whatever kind of measures we have. I’m confident moving forward that it’s going to be very important information for understanding the degree to which variants present a problem for vaccines,” he says. “We don’t know if they do, but the way to know is to understand what viruses vaccinated people get, and what viruses unvaccinated people get, and analyze those data to really see if there’s a difference based on variants and vaccination.”

Collaboration
Lauring explains that, since the early days of the pandemic, teamwork has been key. “We’ve had a great partnership with the Department of Pathology that runs the clinical labs in terms of helping us get these samples,” he says. “Also, we’ve collaborated with the Department of Medicine and the Division of Infectious Diseases. I think a bright spot in this whole pandemic has been in working with so many different people toward a common goal.”

“The sequences have allowed us to start understanding how different SARS-CoV-2 variants spread and what they can tell us about where infections are happening and how they’re going from person to person.”

— Adam Lauring, MD, PhD
EXPLORING NEUTROPHIL EXTRACELLULAR TRAPS

Researchers are taking what they have learned about blood clotting in antiphospholipid syndrome and applying that knowledge to COVID-19

Jason Knight, MD, PhD, associate professor, Division of Rheumatology, and research collaborators across Michigan Medicine have spent the better part of the past 10 years focused on the study of antiphospholipid syndrome (APS), an unpredictable, chronic autoimmune disease that can cause dangerous clots to form in the body’s blood vessels.

“These clots can lead to serious and sometimes life-threatening complications, including stroke, heart attack and late-term pregnancy losses, which are all very devastating,” says Knight. “We are working to advance the understanding of the disease process and identify new, sophisticated approaches to the treatment of APS that are both personalized and proactive.”

In addition to his primary role as a scientist, Knight is also a practicing rheumatologist. “In this role, I round in University Hospital once a year, typically during the first two weeks in March. In 2020, this happened to coincide with the onset of the first surge of COVID-19,” he says. “Things were still pretty normal during that first week. But, in the second week, everything changed with all the COVID-19 admissions to the hospital.”

The second positive COVID-19 test at Michigan Medicine was a lupus patient that Knight and colleagues evaluated on their consult service. “We were called on to determine whether this patient was having a lupus flare,” says Knight. “Our thought was that it actually looked like something else, and we feared it could be the COVID-19 we’d been hearing about.”

When Knight finished rounding, he started a deeper dive into the COVID-19 literature. “At the time, it was mainly just papers coming out of China. Some of the papers were preprints and not yet peer-reviewed, and some had been rapidly peer-reviewed,” he explains. “One of the things we noticed, and this is not so common for most viral infections, was that patients with COVID-19 that were having a severe disease course tended to have very high levels of neutrophils in their blood.”

Neutrophil Extracellular Traps

Knight explains that one of his lab’s first discoveries in APS centered around structures called neutrophil extracellular traps, or NETs. “It’s not that we discovered NETs, but we did discover their relevance in APS,” he says. “NETs come from a type of white blood cell called the neutrophil. They are the cells designed to be the first line of defense, and they come pre-armed with all of the tools they need to turn back an invader like a bacteria or a virus. But when the brakes don’t work well, or they’re overstimulated, neutrophils can cause a host of problems because they have all of this potentially toxic stuff inside of them.”

He notes that one of the ways in which neutrophils combat bacteria is to shoot out spiderweb-like NETs that are built out of DNA. “These NETs become much larger than the original neutrophil itself by taking all this condensed DNA from the nucleus and spilling it out into a web. What we found is that, when this happens in the bloodstream, it is a significant cause of blood clotting.”

Early on in the pandemic, research was rarely focused on the connection between COVID-19 and blood clotting. “That changed pretty quickly as March went into April, and as more reports started to surface that when people get very sick...
from COVID-19, blood clotting is a big part of that,” says Knight. “It’s not only blood clotting in the big vessels, but also in the microscopic vessels, including in the lungs. In the very first COVID-19 autopsy series that was released, the lung damage looked more like it was coming from blood clotting, versus what we’re used to seeing in patients in the ICU with pneumonia. And actually, in some ways, it looked like the type of pathology we would see in APS. So we thought maybe it would be worth looking for NETs in COVID-19 patients.”

Collaboration

In the meantime, Knight had initiated a collaboration with Ray Zuo, MD, clinical assistant professor, Division of Rheumatology, who was working on APS in Knight’s lab, and Yogendra Kanthi, MD, assistant professor, Division of Cardiovascular Medicine, and a Lasker Investigator at the National Institutes of Health’s National Heart, Lung, and Blood Institute. “The three of us together thought we would do a study, and we initially tried to write a protocol where we would consent patients in the hospital to give us a blood sample,” he explains. “All we really needed was a sample to do the early studies, but this was a chaotic time and PPE was in short supply. There were no protocols for whether researchers would be allowed to approach COVID-19 patients for research purposes.”

After spinning their wheels for the better part of a week, Knight, Zuo and Kanthi moved to a different train of thought. “We would work with the clinical labs that, once they had done the regular testing ordered by the clinician, had leftover blood samples that got thrown away,” says Knight. “We submitted an application to the U-M Institutional Review Board (IRB) to address the issue of whether patients needed to consent for us to take samples. The IRB agreed that, given the urgency of the situation, the difficulties with consenting in COVID-19, and the fact that these samples were going to be thrown away anyway, we were approved to study the samples without signed consent.”

Soon thereafter, Zuo traveled all over the hospital and managed to get his hands on several COVID-19 blood samples. “Initially, we had 50 patient samples from COVID-19 patients,” he says. “Eventually the blood sample collection process was nicely organized by Dr. Anna Lok’s team and the U-M COVID-19 Biorepository. They ultimately started doing this in a larger-scale fashion than what we had done initially. And now they have a lot of these discarded samples in their freezer that researchers can use.”

Labs Closing

Also happening universitywide in the early days of the pandemic was that laboratories were being shut down, including Knight’s research lab. “Although we had figured out a way to get blood samples, we did not have an open lab with which to continue the process,” says Knight. “So we wrote to Steven Kunkel, PhD, Peter A. Ward Distinguished University Professor; executive vice dean for research, Medical School; chief scientific officer, Michigan Medicine; and endowed professor of Pathology Research, to appeal that our lab be reopened.”

NETs in Covid-19

Knight and colleagues started the pilot on April 1, 2020, and, in fact, found exactly what they had predicted: that there were high levels of NETs in the blood of COVID-19 patients. “The important thing we could tell, even only testing 50 patients, is that higher levels predicted more severe disease. People on the ventilator had much higher levels than people who were less sick and who were still breathing.

“One of the things we noticed, and this is not so common for most viral infections, was that patients with COVID-19 that were having a severe disease course tended to have very high levels of neutrophils in their blood.”

— Jason Knight, MD, PhD
normally, or weren’t needing oxygen support,” says Knight.

To highlight the advances of their work, Knight and the team wrote a paper titled, “Neutrophil extracellular traps in COVID-19,” published in JCI Insight on April 24, 2020. To date, the article has been cited more than 500 times, which is considered a sizable accomplishment for basic science research in just a year’s period.

“I think it has so many citations because a lot of people have now done something similar and are citing back to our original work. It would be fair to say the work has been replicated on every continent. Well, except Antarctica,” he says.

Expanding Concepts

Knight reports that their work has informed a number of clinical trial concepts for the treatment of COVID-19, including a randomized clinical trial on a drug called Dipyridamole, an FDA-approved anti-clotting agent. Written by Kanthi, the trials launched in May. “Recruitment was very slow in the summer, as this was an inpatient trial and hospitalizations for COVID-19 were quite low then. But eventually the second surge happened, and we recruited 100 people by January 2021,” says Knight. “Right now we’re analyzing those data to see if this drug made a difference or not in COVID-19 patients when they were admitted to the hospital.”

Antiphospholipid Autoantibodies

Around the time Knight and colleagues were discovering NETs in COVID-19, a Chinese research group published a paper in the New England Journal of Medicine, reporting three patients who had COVID-19 and blood clots, and in whom antiphospholipid antibodies were detected. “These are the autoantibodies that occur in APS that we studied pre-COVID-19. And these autoantibodies can sometimes be associated with infections,” he explains. “When the body is under stress, it can be a trigger for these autoantibodies. Although this was known, no one had ever really dug in deeply to understand if they might be causing problems.”

Knight and colleagues wanted to know whether these autoantibodies, if detected transiently during an infection, could signal trouble. “We used the same types of samples that we had used for the NETs study, and we measured a whole panel of these autoantibodies. We eventually had 172 subjects,” says Knight. “And we found that a little more than half of the subjects had at least some level of these autoantibodies in the blood. These were all people in the hospital with COVID-19. And so we thought that was pretty interesting, but this still didn’t prove that they were causing any trouble.”

So Knight and colleagues purified the autoantibodies, which is something they were well versed in, given their prior research in APS. “We got approval from the animal regulatory body, which involved a lot of email exchanges, to inject these autoantibodies into mice. This is something we had done pre-pandemic with APS research to see if they caused blood clotting or not,” he says. “And that is what we found. So if we take these autoantibodies from COVID-19 patients and transfer them into mice, the mice show higher levels of NETs, and they also develop really large blood clots.”

What followed was a paper co-authored by Knight, titled “Prothrombotic autoantibodies in...”
MOVING FORWARD

Jason Knight, MD, PhD, associate professor, Division of Rheumatology, says that he and his colleagues plan to go deeper, and have submitted grants to look more generally at autoantibodies in serious infections. “It isn’t that no one has ever thought about infection-induced autoimmunity. But we wonder if that is perhaps more prevalent than we realized,” says Knight. “It is interesting that while we were discovering these autoantibodies in COVID-19 causing blood clots, other types of potentially problematic autoantibodies were being described by others. One example is autoantibodies that turn down the volume on antiviral cytokines.”

Knight says it’s possible that this whole new field of functional autoantibodies might have its origins in evolution. “There was surely an era in human history when bleeding to death on the cave floor was a much more important concern than getting a blood clot in your leg when you’re on an airplane,” he reflects. “So perhaps some of these autoantibodies were designed as kind of an emergency last gasp response. I tend to think that all of us have this autoimmune potential living inside us. And COVID-19 seems to be really good at bringing it out.”

Applying Knowledge

Knight’s lab remains one of the major research centers in the United States studying APS. “As a disease, APS is relatively understudied compared with the impact it actually has,” he says. “To say that we have been toiling in obscurity would be a tad histrionic, but I think it is fair to say that our work with APS was not getting too much attention. But it seems our prior work put us in a good position to make some discoveries related to COVID-19. This is a reminder about the importance of researching relatively rare diseases, because you may not know at the beginning of that research where it could take you. Before 2020, there was no such thing as COVID-19. But now there is. So we are taking what we have learned about blood clotting in APS and applying that knowledge to the study of COVID-19. We really hope it makes a difference.”

serum from patients hospitalized with COVID-19,” published in Science Translational Medicine in November 2020. “The paper somehow broke through to the popular press and Francis Collins, MD, PhD, director of the National Institutes of Health, noticed it and wrote about it on his blog,” says Knight.

Applying Knowledge

Knight’s lab remains one of the major research centers in the United States studying APS. “As a disease, APS is relatively understudied compared with the impact it actually has,” he says. “To say that we have been toiling in obscurity would be a tad histrionic, but I think it is fair to say that our work with APS was not getting too much attention. But it seems our prior work put us in a good position to make some discoveries related to COVID-19. This is a reminder about the importance of researching relatively rare diseases, because you may not know at the beginning of that research where it could take you. Before 2020, there was no such thing as COVID-19. But now there is. So we are taking what we have learned about blood clotting in APS and applying that knowledge to the study of COVID-19. We really hope it makes a difference.”

A blood clot triggered by an autoimmune antibody that’s circulating in the blood.

A blood clot triggered by an autoimmune antibody that’s circulating in the blood.

MOVING FORWARD

Jason Knight, MD, PhD, associate professor, Division of Rheumatology, says that he and his colleagues plan to go deeper, and have submitted grants to look more generally at autoantibodies in serious infections. “It isn’t that no one has ever thought about infection-induced autoimmunity. But we wonder if that is perhaps more prevalent than we realized,” says Knight. “It is interesting that while we were discovering these autoantibodies in COVID-19 causing blood clots, other types of potentially problematic autoantibodies were being described by others. One example is autoantibodies that turn down the volume on antiviral cytokines.”

Knight says it’s possible that this whole new field of functional autoantibodies might have its origins in evolution. “There was surely an era in human history when bleeding to death on the cave floor was a much more important concern than getting a blood clot in your leg when you’re on an airplane,” he reflects. “So perhaps some of these autoantibodies were designed as kind of an emergency last gasp response. I tend to think that all of us have this autoimmune potential living inside us. And COVID-19 seems to be really good at bringing it out.”

Applying Knowledge

Knight’s lab remains one of the major research centers in the United States studying APS. “As a disease, APS is relatively understudied compared with the impact it actually has,” he says. “To say that we have been toiling in obscurity would be a tad histrionic, but I think it is fair to say that our work with APS was not getting too much attention. But it seems our prior work put us in a good position to make some discoveries related to COVID-19. This is a reminder about the importance of researching relatively rare diseases, because you may not know at the beginning of that research where it could take you. Before 2020, there was no such thing as COVID-19. But now there is. So we are taking what we have learned about blood clotting in APS and applying that knowledge to the study of COVID-19. We really hope it makes a difference.”

A blood clot triggered by an autoimmune antibody that’s circulating in the blood.

A blood clot triggered by an autoimmune antibody that’s circulating in the blood.
Thirteen years ago, David Markovitz, MD, professor, Division of Infectious Diseases, was introduced to the field of lectins by the late U-M professor emeritus Irwin Goldstein, PhD, Department of Biological Chemistry, a pioneer in sugar code work, or glycobiology. “Irwin had this protein isolated from the fruit of bananas, which was a lectin called BanLec,” says Markovitz. “And BanLec, he thought, might be effective against human immunodeficiency virus (HIV) that attacks the body’s immune system.”

Lectins, which are proteins found in plants and animals, have evolved over millions of years to be highly selective in their ability to recognize complex sugars. “On the surface of a number of important viruses is something called ‘high mannose,’” he explains. “And that type of carbohydrate is rarely found on normal healthy human cells. For that reason, investigators have held they might be able to target those complex sugars with lectins to treat viral infections. In other words, the lectin would bind to the high mannose on the surface of the virus, and because the virus is tied up it could no longer get into a human cell and cause disease.”

**Focus on HIV**

At the time, Markovitz had a doctoral student in his laboratory named Michael Swanson, who was interested in pursuing this line of research. “Mike was able to show that, indeed, the banana lectin could inhibit HIV replication by blocking its entry into cells,” says Markovitz, who also holds appointments in the programs in cellular and molecular biology, cancer biology and immunology. In March 2010, Swanson and Markovitz co-authored a paper titled, “A Lectin Isolated from Bananas Is a Potent Inhibitor of HIV Replication,” in the Journal of Biological Chemistry, and expected that no one would pay much attention to it or its potential use as a vaginal anti-HIV microbicide. “It turned out that our paper got international press galore because of the combination of sex, HIV and bananas,” he says. “We were quoted and misquoted many times. It was all a lot of fun, but a bit sobering, and I was interviewed on the BBC about misconceptions of our work put forward by the popular press.”

All fun aside, it wasn’t long before Markovitz and his laboratory found that there was a challenge with the way the lectin came out of the bananas. “That’s because it carried with it a potential side effect, called mitogenicity,” says Markovitz. “At that point Goldstein and his colleague Harry Winter would actually go to the Kroger grocery store and buy the bananas, mash them up and then extract the protein. But what the protein that comes directly from bananas does is cause an unwanted immune activation, and not the sort of immune activation that would kill viruses, but that would instead harm the person getting it.”

**Targeted Molecular Engineering**

Next, Swanson set out, through targeted molecular engineering, to create a BanLec that was not mitogenic, but still antiviral. “It would be made in a recombinant fashion from bacteria,” Markovitz says. The good news was that the structure of the molecule was known already because of the prior work of Jeanne Stuckey, PhD, research associate professor of biological chemistry and biophysics and research associate professor, U-M Life Sciences Institute.
To make a long story short, Swanson was able to introduce a mutation that could then lead to a molecule that was no longer mitogenic, yet still potently antiviral, and he was able to show the mechanism of action.

In 2015, Markovitz published a paper titled, “Engineering a Therapeutic Lectin by Uncoupling Mitogenicity from Antiviral Activity,” in Cell, with 26 authors from five different countries, showing how this molecule had changed at the structural level, and that it was effective against all flu, HIV and hepatitis C viruses tested in the labs. It would also block vaginal transmission of HIV in an animal model.

**Focus on Influenza**

Soon, Markovitz and his laboratory shifted their focus to the study of influenza. In 2020, he co-authored a paper titled, “A molecularly engineered antiviral banana lectin inhibits fusion and is efficacious against influenza virus infection in-vivo,” in the Proceedings of the National Academy of Sciences of the United States of America, with Evelyn Covés-Datson, a sixth-year medical scientist training program and fourth-year microbiology and immunology PhD student. “Evie showed that the modified banana lectin, called H84T BanLec, was highly effective against influenza when given intranasally, and even showed that the new molecule was tolerated well when given systemically,” he explains. “We administered the compound intraperitoneally, which is generally equivalent in the mouse to IV. Further, Evie demonstrated the mechanism of action by which BanLec kills influenza.”

**Focus on Coronaviruses**

Such earlier investigations have led Markovitz and his laboratory to exploratory research to develop an antiviral therapeutic used to treat coronaviruses. “We had actually started to look at the coronavirus as many as four years ago because coronaviruses also have this

“In 2008, I knew nothing about lectins other than you used them to stimulate T-cells so you could grow HIV. And I vaguely knew that they bound sugars. Now, thirteen years later, it’s become a huge part of my research life. It’s really amazing.”

— David Markovitz, MD
high mannose on the surface,” says Markovitz. “The common theme is that viruses with high mannose on their surface are typically susceptible to treatment with H84T BanLec. Therefore, we began to test these coronaviruses to see whether they were susceptible to our modified banana lectin. It went very well because, as it turned out, all of them were.”

Markovitz and colleagues also tested the banana lectin against the versions of coronavirus that cause the common cold and in immunocompromised individuals with bone marrow transplants that can cause pneumonia. “And those viruses were sensitive to H84T BanLec,” he says. “We also found that the original severe acute respiratory syndrome (SARS) virus was also susceptible. When we were starting the work, our biggest fear was the middle-eastern respiratory coronavirus (MERS), which has a 35 percent mortality rate. So we tested it and MERS was also sensitive.”

The Animal Model
Markovitz explains that all investigations relating to the coronaviruses had, thus far, been conducted in the laboratory, but now the research team wanted to test H84T BanLec against MERS in the animal model. “It took two years to develop the type of mouse that you could actually test, because normal mice don’t get infected with MERS,” says Markovitz. “You have to make something called a transgenic mouse to do that. Our collaborators in Hong Kong, led by Drs. Jasper Chan and K.Y. Yuen, were able to do this, and showed that H84T BanLec had much less virus in their nose and lungs and were much less sick than those not treated. It was very effective, whether given systemically or whether it was given in the nose, and whether treatment was initiated before or after viral challenge.”

Structural Biology
The research team then shifted to structural biology to illustrate how lectins interact with H84T BanLec, and with the spike protein of COVID-19. “This was done with a group in Austria led by Professor Peter Hinterdorfer, and we’re now trying to look at it with cryo-EM here at Michigan Medicine,” says Markovitz. “We’re very excited because the beauty of H84T BanLec is that it’s highly effective against all strains of flu tested and all strains of coronaviruses. So we can imagine it being used perhaps as nasal drops or a nasal spray, and to have it ready for future pandemics of coronaviruses.

Looking Forward
Markovitz will tell you that the development of the Moderna and Pfizer COVID-19 vaccines within a year of the onset of a pandemic is nothing short of astounding. “This is a huge, huge win. But, of course, now we face the issue of a public health infrastructure that is not really set up for rapid action. And this really should change. We probably need much more federal coordination. This is not an area where states’ rights should be dominant,” he says. “For many years, people in public health positions, funding positions and politics, obviously, have ignored the potential for viral pandemics to wreak havoc upon us. And this particular one was not the first, of course, and it won’t be the last. So, it’s very important that, as a society, we address the potential for pandemic viruses, and start at the top politically.”

To this day, Markovitz maintains that, in the realm of research, if you keep an open mind you never know where you’re going to end up. “Most of my projects have gone in ways I never would have predicted. In 2008, I knew nothing about lectins other than you used them to stimulate T-cells so you could grow HIV. And I vaguely knew that they bound sugars. Now, thirteen years later, it’s become a huge part of my research life. It’s really amazing.”
Since late March 2020, investigators at Michigan Medicine’s clinical trials enterprise have participated in more than 20 COVID-19 treatment trials. “Early on, we realized that we were seeing all these seriously ill patients with COVID-19 being admitted to the hospital, and we knew we wanted to try to make a difference,” says Anna Lok, MD, the Alice Lohrman Andrews Research Professor in the Division of Gastroenterology and Hepatology, who is also director of clinical hepatology and assistant dean for clinical research at the University of Michigan Medical School. “When we were approached by industry sponsors [for industry-funded trials] and colleagues with ideas for exploring treatments in COVID-19 treatment trials, we were eager to jump in. When you see people dying in front of your eyes, and so quickly, everything is worth a try.”

Lok and colleagues have initiated and participated in a wide array of COVID-19 treatment trials, including a trial for remdesivir, an antiviral medication. “We participated in treatment trials focused on monoclonal antibodies as well as convalescent plasma. And we participated in the hydroxychloroquine treatment trial, which turned out to be not beneficial,” she says. “Added to these were trials that looked at blocking the inflammatory response, such as IL6 inhibitors and JAK inhibitors; and different strategies to prevent clotting. We also looked at the body positioning of COVID-19 patients on ventilators; specifically whether they should lie on their back or their stomach. We learned that sometimes lying on your stomach, or rotating a patient, actually helps to open up the lungs and could be beneficial.”

Challenges Faced
The enrollment of patients into treatment trials has not been without complications. “There were times when University Hospital had 100 COVID-19 patients, so we had many patients to enroll,” says Lok. “And when you have multiple trials all wanting to enroll these patients, you’re essentially competing against one another, which is not optimal.”

To address such challenges, Lok and colleagues developed a series of steps to coordinate efforts. “Every time someone said, ‘I want to launch a trial looking at a COVID-19 treatment,’ we looked at our ongoing trials and asked ourselves whether that new trial might compete with an existing trial. If there was a conflict, we looked at whether that new trial had a greater chance of helping patients than an existing trial,” she explains. “We also looked at what was really feasible, since there’s no point in going through all the steps in launching a trial if, ultimately, you won’t be able to enroll a large number of patients.”

Another key challenge was getting a patient’s consent for a treatment trial. “The COVID-19 patients were so sick and they were in the ICU, and their families weren’t allowed to visit,” says Lok. “We needed to find a way to explain the trial to the patient and gain consent.”

To address this, Lok and colleagues participated in a number of discussions to determine the best approach. “Every time someone said, ‘I want to launch a trial looking at a COVID-19 treatment,’ we looked at our ongoing trials and asked ourselves whether that new trial might compete with an existing trial. If there was a conflict, we looked at whether that new trial had a greater chance of helping patients than an existing trial,” she explains. “We also looked at what was really feasible, since there’s no point in going through all the steps in launching a trial if, ultimately, you won’t be able to enroll a large number of patients.”

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Looking back, Lok reports that some of the treatment trials have gone on to be published, and some have led to a treatment being given FDA emergency use authorization. “For most of these treatments, the benefit is small. But sometimes even a tiny benefit is better than no benefit,” she says.
During the initial surge of the COVID-19 pandemic, Michigan Medicine was admitting a large number of patients sickened by the virus to University Hospital. “At the time, there was all sorts of poorly understood information circulating about treatments that might work for COVID-19, whether it was repurposed drugs that were already approved, or investigational drugs,” says Daniel Richard Kaul, MD, clinical professor, Division of Infectious Diseases, and director of the Michigan Medicine Transplant Infectious Disease Service. “The general feeling for those of us caring for patients with COVID-19 was that we should participate in clinical trials, both for repurposed and for not previously licensed agents, to determine what therapies might work best.”

Remdesivir
In April, Kaul led a trial to evaluate the potential of remdesivir to act as an antiviral therapy for COVID-19 patients. “One hope was that remdesivir might target viral replication and help patients recover more quickly,” he says. “Remdesivir (Veklury), which is now an FDA-approved treatment for hospitalized patients with COVID-19, was one of the first drugs tested.”

As principal investigator, Kaul led a Phase 3 randomized study to evaluate the safety and antiviral activity of remdesivir, which consisted of two sets of studies: one for hospitalized patients with severe disease, and the other for hospitalized patients with moderate disease. “The aim was to assess whether the therapy improved clinical outcomes and reduced mortality, and to assess the safety of the treatment,” explains Kaul. He enrolled 37 patients in the severe category and seven patients in the moderate category. “From the literature, in general, it’s been demonstrated that, for hospitalized patients who do not require critical care levels of support, remdesivir speeds recovery time by a matter of days so that patients can be discharged from the hospital earlier,” he says. “The remdesivir trials, in total, determined the proper dose, proper duration and in what circumstances the drugs were effective.”

Sarilumab
In a similar investigation, Kevin Gregg, MD, associate professor, Division of Infectious Diseases, conducted a trial to determine whether sarilumab (Kevzara), an Interleukin-6 inhibitor licensed for treating rheumatoid arthritis, was efficacious in reducing inflammation in hospitalized COVID-19 patients. “In COVID-19, many patients progressed to an inflammatory phase where the immune system’s response to the virus seemed to be the problem,” says Kaul. “There were anecdotal reports from Asia and previous studies on SARS-CoV-1 that drugs which blocked Interleukin-6 might be effective for patients in the inflammatory phase. This clinical study investigated whether sarilumab could reduce an overactive immune response, or ‘cytokine storm,’ that has been thought to result in a dramatic clinical deterioration in some patients suffering serious cases of infection with SARS CoV-2.”

Along the way, Kaul and his team partnered with Anna Lok, MD, the Alice Lohman Andrews Research Professor in
“The general feeling for those of us caring for patients with COVID-19 was that we should participate in clinical trials, both for repurposed and for not previously licensed agents, to determine what therapies might work best.”
— Daniel Richard Kaul, MD

the Division of Gastroenterology and Hepatology, and many individuals in the U-M Clinical Trials Support Office. “Dr. Lok’s leadership and flexibility were phenomenal,” he says.

All told, the study found that sarilumab did not improve mortality or other important outcomes. “Other studies since on this drug and similar drugs have shown that it’s likely beneficial when given at the exact right time in the course of COVID-19, when someone is deteriorating and heading toward the intensive care unit. Drugs such as this do seem to have some benefit in that circumstance,” says Kaul.

**Teamwork**

Kaul reflects on the tremendous team effort he witnessed during the past year. “There are a lot of people who do essential work at Michigan Medicine on the contracting side and on the regulatory side, such as Judy Birk, JD, director of the Medical School Institutional Review Board,” he says. “Everybody pulled together to show that, as an organization, we could get these things going very quickly, and still meet all the regulatory and safety requirements that are essential for a clinical trial.”

**Challenges**

Kaul points to Barbara Sullins, assistant director of acute clinical research, U-M Office of Research, who made significant contributions toward orchestrating these trials. “There were some unprecedented challenges in getting these trials organized and approved. We wanted to get these potentially effective treatments to our patients as quickly as possible, and to be part of the effort to figure out what worked and what didn’t work. We got these trials, which normally would take four to six months at a minimum, approved in a matter of weeks,” says Kaul. “Barb figured out how to do things in a different way, since many of the study coordinators who were integral to the process were not able to be physically present. There were also challenges in terms of obtaining informed consent and how to even transfer paperwork out of the room in a way that was safe.”

As Kaul looks back on the early days of the pandemic, he remains amazed at the flexibility and creative approach that so many people in the research enterprise at Michigan Medicine demonstrated under incredibly demanding circumstances. “As we have moved on to vaccine trials, I continue to observe the same spirit of service to the community to do what we can to learn how to best address the pandemic while always putting the safety of research participants first,” he says.

Kevin Gregg, MD
In severe cases of COVID-19, patients can develop acute respiratory distress syndrome (ARDS), a condition marked by inflammation and fluid accumulation in the lungs that results in breathing failure and low oxygen levels in the blood. “COVID-19 is a state where there is a strong inflammatory response mediated by excessive monocyte-macrophage activation, and lung infiltration with these cells which triggers the production of cytokines, a broad category of small proteins important in cell signaling,” says Lenar Yessayan, MD, associate professor, Division of Nephrology. “Emerging evidence suggests the pervasive role of monocytes and macrophages in the pathogenesis of this viral infection and in the release of inflammatory cytokines which triggers and recruit more white blood cells in a positive feedback loop and in the development of ARDS in COVID-19.”

In the United States, many novel blood purifying filters became available in 2020, subject to an “emergency use authorization” from the FDA to treat COVID-19 associated critical illness. “The available filters either lower viral load or bind cytokines. The levels of plasma viral load and cytokines have been reported to correlate with the degree of disease severity. There are a few observational studies with such filters suggesting reduction in plasma viral load and cytokines to correlate with the degree of disease severity. There are a few observational studies with such filters suggesting reduction in ICU expected mortality,” he says. “Clinical trials are underway to further assess the efficacy of these filters. While these filters show promise, I believe it is more crucial to address the excessive monocyte-macrophage inflammatory state, since it plays a key role in the development of COVID-19 ARDS.”

**Selective Cytopheretic Device Therapy**

With an eye toward improved therapies, Yessayan and colleagues have turned their focus to selective cytopheretic device (SCD) therapy, an immunomodulatory approach to treat excessive inflammation in COVID-19. “The device employs immunomodulating technology to selectively target pro-inflammatory neutrophils and monocytes during continuous renal replacement therapy (CRRT),” says Yessayan. “In turn, it increases the reparative subtypes of monocytes and may diminish local production of cytokines that cause inflammation, organ failure and possible death in these critically ill patients.”

Yessayan explains that the device is a membrane that is integrated into a typical hemodialysis system, or CRRT blood circuit. “As blood flows along the membranes within the device, the most activated white blood cells bind to the membrane and in the presence of a low ionized calcium environment the cells are altered to a less inflammatory phenotype. The white blood cells engage less in attacking the organs, which tempers the cytokine storm and subsequent tissue damage,” he says. “A low ionized calcium environment is necessary for the SCD therapy to work appropriately.”

He maintains that this could only be accomplished safely using a CRRT system with regional citrate anticoagulation. “Citrate is infused into the CRRT circuit. It binds calcium and lowers the...”
**Investigative Trial with Emergency Expanded Use Permission**

At the beginning of the pandemic, under the guidance of the Michigan Institute for Clinical and Health Research (MICHR) Emergency Expanded Access Support Unit, the filter was used in select patients with severe ARDS. “Our group worked with the U-M Institutional Review Board (IRB) and the FDA to deploy this filter under ‘emergency expanded use’ in critically ill COVID-19 patients with severe ARDS,” says Yessayan.

He notes that the results were encouraging in the first two patients treated. “Both patients were also on extracorporeal membrane oxygenation (ECMO), a technique that provides prolonged cardiac and respiratory support to persons whose heart and lungs are unable to provide an adequate amount of gas exchange or perfusion to sustain life,” he explains. “The two patients we treated with SCD therapy were successfully weaned off ECMO after 17 and 16 days of SCD therapy, respectively. The results were encouraging, prompting the desire for further investigations and formal assessment within the context of a clinical trial.”

Yessayan says it is critical that SCD therapy be initiated early in the disease course. “A lot of the COVID-19 patients we’ve seen are transfers from other hospitals who have been elsewhere for a time,” he says. “The key is to intervene quickly, and not to wait until the disease has taken its course and irreversible lung damage has already ensued.”

In December 2020, the research team published their initial experience with the two patients in a paper titled “Treatment of Cytokine Storm in COVID-19 Patients with Immunomodulatory Therapy,” in the American Society for Artificial Internal Organs Journal. The paper describes the clinical course of the two patients along with changes in the levels of inflammatory markers during the course of the treatment. “I can’t comment on the device in terms of data, but for the patients we’ve treated overall, we’re seeing good results,” says Yessayan. “We are waiting for results from the other centers as well. In the end, the sponsor will evaluate the data that are coming from all centers.”

Moreover, the device could potentially be helpful in acute and chronic inflammatory states. There are ongoing trials in preparation to study this device in disease states beyond COVID-19, including septic shock, hepatorenal syndrome and cardiorenal syndrome.

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**Multicenter Clinical Trial**

A multicenter clinical trial, initiated by SeaStar Medical, the company that produces the selective cytopheretic device (SCD), is now underway with an FDA-approved “investigational device exemption” to evaluate the potential of SCD therapy to effectively treat COVID-19 ICU patients. “Michigan Medicine is one of the centers that is enrolling patients in this trial, given our expertise in using the device in many different disease states,” says Lenar Yessayan, MD, associate professor, Division of Nephrology. “All centers are required to use the citrate protocol we have developed, since it ensures the circuit ionized calcium is lowered to the level needed for SCD activity. We are working with other centers to make sure they are using this solution in the correct way.”

The selective cytopheretic device (SCD) therapy technology was invented and further developed by H. David Humes, MD, professor, Division of Nephrology, and his laboratory. The U-M technology has been licensed to SeaStar Medical, to commercialize FDA-approved products for treatment of a variety of inflammatory disorders.
Since the onset of the COVID-19 pandemic, more than 1500 adult patients have been hospitalized with a severe course of the novel coronavirus at Michigan Medicine, with more than two-thirds having diabetes. “The pandemic of 2020 has wreaked havoc on patients with diabetes, and even on patients who had not necessarily known they have diabetes, such as prediabetes. This is due to the enormous impact of the inflammatory storm of severe coronavirus which directly affects blood glucose levels and our ability to treat them,” says Rodica Busui, MD, PhD, Larry Soderquist Professor of Diabetes; professor, Division of Metabolism, Endocrinology & Diabetes; and vice chair for Clinical and Health Outcomes Research.

Focus on Hyperglycemia
In April 2020, the U-M Regional Infectious Containment Unit, a negative pressure area set up specifically for the care of COVID-19 patients, found that many patients with mild diabetes had significantly elevated blood sugars, as did several without diabetes. The unit called in the Michigan Medicine Hospital Intensive Insulin Program for help in managing severe hyperglycemia in these patients (page 52).

Busui and her clinical research team are working to develop new ways to treat the very severe blood sugar surges during the initial waves of COVID-19. “We have collected samples from all patients admitted with severe COVID-19 at University Hospital since the pandemic began,” she says. “We are trying to understand how to apply a differentiated treatment approach for patients at the time of admission.”

The research team highlighted their findings in a paper titled “COVID-19 and Diabetes: A Collision and Collusion of Two Diseases,” published in Diabetes in December 2020.

“The COVID-19 pandemic has collided with the diabetes pandemic to create especially susceptible diabetes COVID-19 patient populations,” says Busui. “Among diabetes patients who contract COVID-19, well-controlled blood glucose has emerged as an important predictor of more favorable patient outcomes and survival.”

COVID-19 can also induce high blood sugar in nondiabetic patients, secondary to infection, which increases the risk of critical disease. “Prediabetes, characterized by elevated fasting blood sugar or impaired insulin sensitivity, has been mostly overlooked in COVID-19 studies, but could potentially pose a threat to clinical outcomes,” she says.

Focus on Kidney Injury
Working together with Salim Hayek, MD, assistant professor, Division of Cardiovascular Medicine, and principal investigator on the Michigan Medicine COVID-19 Cohort (M2C2), Busui and other members of the Michigan clinical research team found that patients admitted specifically for severe COVID-19 have high levels of soluble urokinase receptor (suPAR), an immune-derived pathogenic protein that is strongly predictive of kidney injury.

Hayek and a national team of collaborators have been studying suPAR’s role in kidney disease for close to a decade. In breakthrough experimental studies published in The New England Journal of Medicine and other high-impact journals, the team found that high suPAR levels actually causes kidney injury, and targeting suPAR...
“The pandemic of 2020 has wreaked havoc on patients with diabetes, and even on patients who had not necessarily known they have diabetes, such as prediabetes. This is due to the enormous impact of the inflammatory storm of severe coronavirus which directly affects blood glucose levels and our ability to treat them.”
— Rodica Busui, MD, PhD

through various methods prevents it. SuPAR levels are high in patients with diabetes, cardiovascular disease and other inflammatory diseases strongly linked to kidney disease. “I believe we’ve discovered in suPAR the link between the immune response and kidney disease,” says Hayek.

The team tested the suPAR levels of 352 study participants when they were admitted to the hospital for COVID-19 infection. A quarter of the study participants developed acute kidney injury while hospitalized, and their median suPAR levels were more than 60 percent higher than those of the rest of the participants. The risk of needing dialysis was increased 20-fold in patients with the highest suPAR levels. Overall, median suPAR levels for these study participants hospitalized with severe COVID-19 were almost three times higher than levels of healthy people. None of the patients with normal suPAR levels had severe kidney injury or needed dialysis.

“We don’t know exactly why patients with severe COVID-19 have a high rate of kidney injury,” says Hayek, senior author of the observational study. “It is, however, becoming clearer that a hyperactive immune system plays a major role in the morbidity of COVID-19, including kidney-related complications, and that suPAR could be its direct mediator.”


Hayek is now conducting the first clinical trial targeting suPAR in patients with COVID-19 as a strategy to reduce the risk of kidney injury. “This will be the first time ever we target suPAR in patients, with implications extending to millions of people at risk of kidney injury from a hyperactive immune system.”

Algorithm for Glucose Monitoring

In a study led by Rodica Busui, MD, PhD, Larry Soderquist Professor of Diabetes; professor, Division of Metabolism, Endocrinology & Diabetes (MEND); and vice chair for Clinical and Health Outcomes Research, and Roma Gianchandani, MBBS, MD, clinical professor, MEND; director of the Michigan Medicine Hospital Intensive Insulin Program; and associate vice chair for Quality and Innovation, preliminary observations in the first 200 COVID-19 patients admitted at Michigan Medicine with severe hyperglycemia led to the development of a successful algorithm for glucose management in these patients with serious complications from the virus.

Other Department of Internal Medicine faculty involved were Lynn Ang, MBBS, assistant professor; Palak Upendra Choksi, MBBS, clinical associate professor; Jennifer Jill Iyengar, MD, clinical assistant professor; and Nazanene Helen Esfandiari, MD, clinical professor; all among the Division of Metabolism, Endocrinology & Diabetes. This protocol has been implemented across Michigan Medicine and shared with many other hospitals. It is also linked more recently with the follow-up as part of the new Multidisciplinary Post COVID-19 Clinic, which provides post discharge care to patients with long-term post-COVID-19 symptoms and complications (page 61).

The team published its findings about why high blood sugar may trigger worse outcomes in people infected with the virus in a paper titled “Managing Hyperglycemia in the COVID-19 Inflammatory Storm,” in Diabetes, October 2020.
In the fall of 2020, Michigan Medicine partnered with pharmaceutical industry sponsors AstraZeneca and Janssen Pharmaceutical Companies of Johnson & Johnson (Janssen), on multi-site, international efforts researching investigational vaccines for the prevention of COVID-19, the disease caused by the novel coronavirus SARS-CoV-2.

“AstraZeneca and Janssen reached out to us in August 2020, and we obviously jumped with joy to be able to participate in these trials and contribute to the knowledge and data, as well as to be able to give individuals at risk a chance to receive the vaccine prior to it being approved,” says Anna Lok, MD, the Alice Lohrman Andrews Research Professor in the Division of Gastroenterology and Hepatology, who is also director of clinical hepatology and assistant dean for clinical research in the University of Michigan Medical School. “The two Phase III COVID-19 vaccine trials began enrolling patients in early November 2020, with a total of 250 subjects enrolled in the AstraZeneca trial and 150 subjects enrolled in the Janssen trial.”

**AstraZeneca**

The AstraZeneca Phase III COVID-19 vaccine trial — known officially as AZD1222 — is a randomized, double-blind, placebo-controlled clinical trial that looks at how well the investigational, two-dose vaccine works and how safe it is. “In this study, participants were randomly assigned to receive two injections (the first on day one and the second on day 28) of either the investigational vaccine or placebo in a period four weeks apart. And we are eagerly awaiting these results,” she says. “We will need to wait at least one month after the second dose is administered, and then there are two more months of follow-up for safety analysis. We’re hopeful that the results from the analysis will soon be available. Once the analysis is completed, AstraZeneca will likely go on to submit to the U.S. Federal Drug Administration (FDA) for emergency use authorization (EUA) of the vaccine.”

Preliminary analysis of the US AZD1222 Phase III trial confirmed safety and efficacy, with 76 percent vaccine efficacy against symptomatic COVID-19. No date has been set for FDA review.

Trials in the United Kingdom and South Africa were ahead of those in the United States, and the AstraZeneca vaccine has received EUA in many countries, including the UK, European Union, Canada and Australia, among others.

**Janssen Pharmaceutical Companies of Johnson & Johnson**

The Janssen COVID-19 vaccine clinical trial, also known as the Phase III ENSEMBLE study, is a randomized, double-blind, placebo-controlled clinical trial in individuals 18 years of age and older. The study was designed to evaluate the safety and efficacy of the Janssen vaccine in protecting against both moderate and severe COVID-19 disease. It is the first single-dose COVID-19 vaccine. In February 2021, the FDA issued an EUA for the Janssen vaccine. “In this case, the vaccine was 66 percent efficacious [72 percent in the U.S., higher than in Brazil and South Africa where variants were more prevalent at the time the trial was conducted], and demonstrated 85 percent effectiveness in preventing severe disease,” says Lok. “More than 8 million doses have been administered in the United States. Although there was a concern about blood clotting, the CDC, Advisory Committee on Immunization Practices and FDA determined that the benefits outweigh the risks of this very rare adverse effect, and administration of the Janssen vaccine has resumed.”

**Vector Approach**

It is important to note that both the Janssen and AstraZeneca COVID-19 vaccine clinical trials employed a different approach to preparing the vaccines. “It’s what we call the vector approach: essentially we use a common cold virus, or adenovirus, that is modified so that it cannot replicate within the vaccine recipient and cause a cold infection,” she says. “We used that virus as a vector to bring a piece of the COVID-19 virus DNA into the human body. So it’s really like a Trojan Horse. You’re bringing a piece of the COVID-19 virus DNA, but not the whole COVID-19 virus, so it doesn’t cause the COVID-19 virus infection. The common cold virus that’s been modified to carry a piece of the COVID-19 DNA makes the spike protein that then stimulates an immune response, so that if an individual is exposed to COVID-19 in the future, they’re protected against it.”
Loks says the AstraZeneca vaccine trial used an adenovirus from a monkey, so humans should not have been exposed to that virus and are less likely to reject the vaccine. The Janssen vaccine trial used the adenovirus type 26, which is a less common cold virus, so there’s a lower chance that human bodies have been exposed to that virus and will reject that vaccine.

Overall, efficacy of the AstraZeneca and Janssen vaccines is slightly lower than the currently administered Pfizer and Moderna vaccines, which used another platform known as messenger RNA. “The results are a little different but this may be due to the emergence of the new variants which were not present earlier on when the Pfizer and Moderna vaccine trials were conducted. Some variants, notably the variants that originated from Brazil and South Africa, can affect the efficacy of the vaccines,” says Lok. “I think we have to look carefully at the details of all the results to arrive at conclusions, but so far the vaccines have a very good safety profile. People have the usual side effects at the injection site: you get some pain, swelling, itchiness and redness and some patients might have systemic side effects with fever, headache and feeling tired for a day or two. In general, symptoms are very mild.”

Njira Lugogo, MD, MS, associate professor, Division of Pulmonary & Critical Care Medicine, and medical director of the Michigan Clinical Research Unit, says it was essential for Michigan Medicine to play a role in the COVID-19 vaccine trials and to be part of the solution. “The trials required a very rapid start up and aggressive enrollment timelines, but we were able to meet these challenges because of an unprecedented level of teamwork and commitment across multiple departments within the institution and support from the highest level of leadership,” she says. “We were humbled by the number of volunteers that were willing to participate, sharing heartwarming stories about why they had decided to sign up for the study. Many of those participants are still enrolled in the study to help us understand the long-term effectiveness and safety of these vaccines. The bonds that were forged during the COVID-19 vaccines trials will last for years.”

“AstraZeneca and Janssen reached out to us in August 2020, and we obviously jumped with joy to be able to participate in these trials and contribute to the knowledge and data, as well as to be able to give individuals at risk a chance to receive the vaccine prior to it being approved.”

— Anna Lok, MD
At the start of the pandemic, there was an enormous need to understand what treatments or interventions were or were not working in COVID-19 patients. “When it became apparent that the state of Michigan — and particularly the Detroit area — was among the first regions in the United States to experience a COVID-19 surge, we recognized the need to collect and analyze as much real world data as possible,” says Emily Somers, PhD, ScM, associate professor, Division of Rheumatology; associate professor, Environmental Health Sciences; and associate professor, Obstetrics & Gynecology. “And we were well positioned to conduct this type of work.”

The COVID-19 Rapid Response Registry was launched in March 2020 to take on the vital role of providing researchers and clinicians with a centralized and comprehensive resource for COVID-19 patient data to help advance science and inform clinical decisions based on rapidly evolving evidence.

Developed by a University of Michigan team, and led by Somers, the registry operates with support from the U-M Michigan Institute for Clinical and Health Research (MICHR); it is also a partner site of the International Severe Acute Respiratory and Emerging Infection Consortium (ISARIC), a network of 488 organizations in 37 countries that pools resources internationally to find the best treatments for COVID-19 as quickly as possible.

The registry gathers data from patients hospitalized with COVID-19, including demographics, comorbidities, onset and admission details, pathogen testing, daily assessment, medications, labs, imaging and echocardiography and complications and outcomes.

Somers and her team, made up of biostatisticians, pharmacists and clinicians in specialties ranging from infectious diseases to ER medicine, created a platform to run the registry in record time — just two weeks after the first COVID-19 patient admission to University Hospital on March 10, 2020. “We were able to get our data use agreements in place by working with administrative support teams,” she explains. “I can’t tell you how wonderful it was to see the teamwork behind the scenes pulling together to prioritize the project and to set it up. Once we had the regulatory approvals in place, we were able to actually start data collection and analysis.”

Somers notes that registries such as this serve as fundamental epidemiologic tools, and are essential to understanding and treating new diseases. “Every day counts in a public health crisis, and the responsibility of an epidemiologist is to quickly aggregate and analyze data to provide as much insight as possible. With a brand-new health threat, such as this novel coronavirus (SARS-CoV-2), we did not have clinical trial evidence to support therapeutics for prevention or treatment of the disease,” says Somers. “The starting point for answering questions about a new disease is high-quality, descriptive data. Our registry, combined with data collected from other ISARIC sites across the globe, has played a critical role in providing the best available data to help inform clinical decision-making, in as close to real time as possible.”

She says it was critical to assemble a solid interdisciplinary team. “An amazing and gratifying thing as a scientist is to see that when everyone is working together toward a common goal, and it’s all about collaboration and not competition, there is potential...
“Surveillance and registries may not seem innovative, but are essential for understanding disease and facilitating research.”

— Emily Somers, PhD, ScM

to achieve so much. The tools of science are very powerful when you work together,” she says.

International Severe Acute Respiratory and Emerging Infection Consortium

Michigan Medicine was one of the first sites in the United States to join the ISARIC. “This is a group that had formed in the UK several years ago, and they were poised to rapidly respond to emerging infections and epidemics,” says Somers. “They had a dormant protocol where they had gone through a lot of advance consensus work with clinicians and public health experts to come up with a common set of data tools that would be important to use in an outbreak of respiratory disease, or other emerging infections. And they went through regulatory approvals, and so forth, so that this protocol could be reactivated in a time of need, such as what we were experiencing with COVID-19. Having that boilerplate was really essential for us.”

The Starting Point

Somers explains that the team’s initial focus was in evaluating the effectiveness of drugs repurposed to treat patients with COVID-19. “Such drugs are FDA-approved for other purposes, and are thus accessible as treatment options, despite the uncertainty about whether they would benefit patients with COVID-19,” she says. “Early in the pandemic, the most immediately actionable evidence that we could provide was from the analysis of observational, ‘real-world’ data — allowing us to support frontline clinicians’ treatment decisions in the absence of data from randomized controlled trials.”

Tocilizumab

Somers and her team set their sights on an immunosuppressive drug called tocilizumab, an interleukin (IL)-6 inhibitor originally approved by the FDA for rheumatoid arthritis. “We had theoretical reason to believe it would work in COVID-19 patients. But again, we had no data for these patients to back that up because it was a new disease,” says Somers. “I work in the field of rheumatology, and this is a biologic therapy that our clinicians and pharmacists had experience with in other diseases, and we thought it potentially would be beneficial for the COVID-19 population.”

Within a month of the registry’s launch, over 150 patients with COVID-19 had been treated with tocilizumab. “We call this off-label treatment, because the drug had been approved for a different disease, and not for COVID-19,” she says. “We were able to design an epidemiologic study to be able to statistically analyze the data from the patients with COVID-19 who received the treatment, and from those who did not receive the treatment, so we had a comparison group. We had to be very careful to try to make sure the groups were similar in other characteristics, because we didn’t want to bias the findings.”

Through sophisticated epidemiologic analyses of the registry’s observational data, Somers and her team published the single-center study titled “Tocilizumab for Treatment of Mechanically Ventilated Patients with COVID-19,” in Clinical Infectious Diseases. “Our findings revealed that a single dose of tocilizumab was associated with a 45 percent lower risk of death among critically ill, mechanically ventilated patients with COVID-19. Patients were also shown to be more likely to be out of the hospital or off a ventilator one month after treatment than those who did not receive the drug.”

The group was the first to publish a rigorous, controlled study of IL-6 blockade with tocilizumab in severe COVID-19. “This study provided the basis for other groups around the world to have, first of all, clinicians using this treatment off label with more confidence, and then other studies that started around the world, including several clinical trials,” she explains. By February 2021, the major clinical trials demonstrated that this treatment is effective in COVID-19 patients, leading to changes in clinical guidance around the globe.”

Expanding Knowledge

Somers explains that the team was not only able to show the clinical benefit with tocilizumab, but was also able to characterize other factors about COVID-19 patients that had not been carefully reviewed to date, including the secondary superinfections COVID-19 patients developed in the hospital. “As part of our study, we identified a previously undescribed association with staphylococcal pneumonia and severe COVID-19 illness,” says Somers. Looking back, after a very consuming and challenging year, Somers says the registry has been an invaluable resource. “Clinical and public health decisions have to get made based on the best available information, but a lot can happen in just a few days and decisions are rarely perfect in a rapidly evolving crisis,” she says. “Traditionally, in the hierarchy of medical evidence, people have been trained to think that clinical trials are the highest level of evidence. But, in the absence of clinical trials data, the best tool for making decisions is high-quality observational and epidemiologic data.”
At the onset of the first surge of the COVID-19 pandemic, Cristen Willer, PhD, Frank N. Wilson Professor of Cardiovascular Medicine; associate professor, Department of Human Genetics; and associate professor, Department of Computational Medicine and Bioinformatics; and colleagues developed the Michigan Medicine Precision Health COVID-19 Survey.

“The purpose of the survey was to evaluate SARS-CoV-2 exposure, COVID-19 symptoms and risk factors and the impact of the ‘Stay Home Stay Safe’ executive order on people in Michigan. ‘We were first faced with this completely unknown pandemic and we pushed boundaries at the university level to be able to send an electronic survey to over 50,000 people, over 9,000 of whom responded.”

Willer’s research team is grateful for all the people who have signed up as study participants to help their communities. “And we are grateful for the Michigan researchers who have previously worked so hard to ethically recruit patients to these research studies—thoughtful, ethical recruitment to research studies is an often unrecognized yet critically important first step of research,” she says.

The biorepository participants consented to either the Michigan Genomics Initiative (MGI), the Cardiovascular Health Improvement Project (CHIP) or the Michigan Study of Racial Equality and Community Health (MREACH), which allowed the researchers to recontact them.

With this survey, the team set out to answer three main questions: 1) Which risk factors are associated with contracting COVID-19, and are they different from risk factors associated with a severe COVID-19 course? 2) Why are African Americans at higher risk of contracting COVID-19?; and 3) What is the potential impact of the ‘Stay Home Stay Safe’ executive order in Michigan on health behaviors that might increase or decrease rates of cardiovascular disease? Are people gaining weight? Drinking more? Smoking more? More stressed?

Among the risk factors studied were demographic variables, socioeconomic indicators, environmental factors, health behaviors, workplace information, community exposure, precautions practiced and comorbidities.

Generating Data

Willer and colleagues adopted existing Michigan Medicine technology using Qualtrics to send an email to over 50,000 people with an individual link to a survey. “We had to keep track of all the data in a confidential way, but we could still link each individual to their medical record,” says Willer. “It was really quite a technological advance, due to the hard work of the team while all personally struggling with the pandemic and childcare issues, et cetera, but we managed to make this happen in a very quick time period. It was because we were all very motivated to do what we could to assist in greater understanding of, and hopefully mitigating, the COVID-19 pandemic.”

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All told, the research team analyzed survey results from 8,041 participants who had completed the survey before a data freeze in late June. “The University of Michigan Data Office for Clinical and Translational Research (DOCTR) office maintained personal health information and created coded identifiers for researchers to access survey data. The protocol and study procedures were approved by the U-M Institutional Review Board,” she says.

Study Findings

To highlight the findings of this survey, Willer and colleagues published a paper titled “Exposure and risk factors for COVID-19 and the impact of staying home on Michigan residents,” in PLoS ONE in February 2021.

“We found that during the ‘Stay Home Stay Safe’ order in Michigan, some people — African Americans, women and the lowest income group — reported worse health behaviors and higher overall concern for the potential detrimental effects of the pandemic,” says Willer. “The higher risk of contracting COVID-19 observed among African Americans may be due to the increased rates of working as essential employees, lower socioeconomic status and exposure to known positive cases.”

The survey asked participants about their behaviors related to wearing masks and other personal protective behaviors. “We asked about the impact on mental health, physical activity and pain, with three questions in mind,” she says. “First, how prevalent was COVID-19 in the community at that time when very little testing was available? Second, did we see any differences in who was more or less likely to wear masks or use other preventive equipment? And third, did we see any differences in which individuals were essentially suffering more because of the COVID-19 ‘Stay Home Stay Safe’ guidelines?”

One of the things the team noticed very early on in analyzing the survey was that, unfortunately, the people who were already at risk in these communities were likely to become even more at
risk of unhealthy behaviors as the social isolation continued. “People from the lowest socioeconomic status, especially women, and racial minority groups were more likely to suffer from poor nutrition and other less-healthy lifestyle changes and that was really concerning to us,” says Willer.

One of the team’s most striking findings was that people who self-reported having had COVID-19 (by June 2020) were three times more likely to report higher BMI, lower income, higher rates of living in rental housing and more social exposure to COVID-19-positive individuals, which would be family members,” says Willer.

“Unfortunately, with the data we had, it really could have been any one of those things. We just couldn’t disentangle it with the data we had at that time,” she says. “It would take much larger sample sizes, and intentionally more carefully designed observational experiments, to be able to disentangle all those different factors related to socioeconomic differences and race/racism in America.”

**Collaboration**

Throughout, Willer and colleagues collaborated with the International Common Disease Alliance. “We benefited from shared survey information from other geographical regions that were also experiencing a surge in COVID-19 diagnoses. There was a group in Italy and in China with early COVID-19 experience that shared with us,” says Willer. “Researchers shared survey templates to start to facilitate the research moving forward as quickly as possible, because, if you remember at that time, testing was generally not available. It was very effective to collaborate with this international group to ensure that we were covering the same topics and asking questions in a similar way.”

Together with other U-M biostatistics faculty, including Sebastian Zöllner, PhD, professor, Biostatistics Department, Computational Medicine and Bioinformatics, we also collaborated on genetic risk factors for COVID-19, which will be published shortly in Nature.

**Challenges Ahead**

Willer maintains that there is an understandable mistrust of research at medical institutions from individuals in certain communities that have been historically mistreated. “I feel it’s really important to ensure our research is ethical, responsible and meets the needs of all members of our society, openly tackling existing inequities in health,” she says. “And with time, hopefully that will build trust with all Americans, which will likely result in higher participation rates in research, and better research that will benefit understudied groups. This would help us in trying to disentangle some of the risk factors so that we can do a better job of improving lifestyle behaviors in all individuals to reduce risk of not just COVID-19, but also cardiometabolic disease.”

Gaining insights from the past year, Willer says it’s critical to take a step back from the research to really assess whether an investigation is important, and whether it will help all communities. “It’s important to keep pushing against roadblocks or limitations in how we do our science. And to keep pushing on technological and sometimes institutional frontiers to do the most helpful science that we can for all people,” says Willer. “Continued efforts should focus on prevention and mitigation strategies for COVID-19 and other major diseases, as well as to address systemic inequalities in our society that result in higher risks for both short-term and long-term health outcomes in some groups.”
Income level, employment, housing location, medical insurance, education, tobacco and alcohol use, diet and obesity and access to medical care. These are some of the factors that cause worse cancer outcomes in people who are Black. These same factors are also causing worse outcomes from COVID-19 in this population. Blacks are 2.1 times more likely than whites to die from the virus. In fact, if Blacks had the same death rate as whites from COVID-19, roughly 25,000 fewer Black people would have died in 2020.

“In cancer we are seeing in slow motion what has been observed rapidly with COVID — that the same conditions in our society put specific groups at risk for both,” says John Carethers, MD, John G. Searle Professor and chair of the Department of Internal Medicine. “If we can fundamentally change socioeconomic inequality, we theoretically could reduce disparities in both diseases.”

Carethers collaborated with Lisa A. Newman, MD, MPH, from Weill Cornell Medicine and Robert A. Winn, MD, from Virginia Commonwealth University on a paper published in Clinical Cancer Research that outlines the similar disparities occurring in cancer and COVID-19 and recommends potential policy changes and strategies to help improve outcomes.

Racial disparities in cancer outcomes are well-documented, with lower five-year survival rates for Blacks than whites within most cancer types. With COVID-19, about 20 percent of cases in the U.S. have occurred in people who are Black, even though that population represents only 13 percent of the population. Similarly, Latinos comprise 32 percent of COVID-19 infections but are only 17 percent of the population.

On the surface these seem like very different diseases — cancer is often caused by genetic defects and COVID-19 is an infectious disease. But, the researchers point out, issues including socioeconomic disadvantages, education, lifestyle factors, other medical conditions and limited access to medical care are fueling risk for both cancer and COVID-19 — and contributing to worse outcomes.

The major battles for health disparities are insurance coverage and use of preventive health services that could help eliminate comorbidities such as obesity and diabetes, Carethers notes. The paper presents several suggestions that would impact both cancer and COVID-19 outcomes:

• Ensure diversity in clinical trial participants.
• Support public hospitals to meet the health care needs of those who are medically underserved.
• Improve access to technology so all populations can access telehealth services.

“In cancer we are seeing in slow motion what has been observed rapidly with COVID — that the same conditions in our society put specific groups at risk for both.”

— John Carethers, MD
work,” Carethers says. “There is much to do at all levels.”

Promoting Vaccinations
Carethers is also hopeful that concentrated vaccination efforts can be used as a tool to directly address COVID-19 health disparities. “Prevention through immunization with recent government-authorized COVID-19 vaccines will be critical for protection from infection. Convincing communities of color to fully participate in vaccination programs will take effort from national and local leaders to demonstrate the safety of the vaccination and the needed protection from the virus. This is a tremendous opportunity to help these communities hard hit by COVID-19. Each community should be targeted and encouraged to reach herd immunity at the same rates as other communities with vaccine availability.”

How COVID-19 Could Impact Future Cancer Outcomes
In addition to disproportionately affecting minority communities, the COVID-19 pandemic has also curtailed preventive services, including cancer screening to preserve personal protective equipment and prevent spread of infection. While access to cancer screenings has been coming back nationally, Carethers is concerned that the return may not be even across all populations, with minority population screening that was already behind becoming further behind as a result of the community ravages from COVID-19. “Fear of COVID-19, limited access to clinics, and personal factors such as financial, employment and transportation issues are concerns that are intensified in medically underserved communities. Having prolonged delays in cancer screening will increase cancer in the overall population from pre-COVID-19 trajectories, and elevate the cancer disparity in minority populations,” he says.

In order to slow further growth of this disparity, Carethers recommends raising awareness of the overall benefit of cancer screening versus the risk of acquiring COVID-19 and utilizing at-home cancer screening tests to help keep the COVID-19-induced delay in screenings to a minimum in these communities.
Nearly one-third of U.S. coronavirus deaths are linked to nursing homes. While 4 percent of the country's cases have occurred in long-term care facilities, deaths related to COVID-19 in these facilities account for about 32 percent of the country's pandemic fatalities. Thankfully, however, this number has declined since the vaccination rollout began.

Nursing home populations are at a high risk of being infected by — and dying from — the coronavirus, according to the Centers for Disease Control and Prevention (CDC). COVID-19, the disease caused by the coronavirus, is known to be particularly lethal to adults in their 60s and older who have underlying health conditions. And it can spread more easily where many people live in a confined environment and workers move from room to room.

“Our nursing homes house some of the most vulnerable in our society. This virus unfortunately is very contagious, the disease it causes has incredibly poor outcomes in older adults with comorbidities and nursing homes are communal settings with shared spaces and resource limitations. This creates a perfect storm of sorts,” explains Lona Mody, MD, MSc, a professor from the Division of Geriatric and Palliative Medicine, the associate director for clinical and translational research at the U-M Geriatrics Center, and director of the Infection Prevention in Aging research group, who has dedicated her career to researching and raising awareness about infection prevention in nursing homes.

Mody also leads the PRIISM (Preventing Resistance and Infection by Integrating Systems in Michigan) project, which partners with skilled nursing facilities, hospitals and public health agencies across the state to create and test education and training materials for nursing home staff. The program’s website has many free materials available for use by nursing homes everywhere.

Pandemic Preparedness

When the COVID-19 pandemic hit the state of Michigan in March 2020, Mody surveyed 130 nursing homes and found that they were far better prepared for this pandemic than they were for the last one. Nearly all had at least one staff member in charge of pandemic preparedness. That’s compared with just over half of the 280 nursing homes that answered the same survey in 2007. Nearly all said they had at least one staff member in charge of pandemic preparedness.

The previous survey was taken in 2007 after the H5N1 “bird flu” pandemic of 2005 raised national awareness of the importance of pandemic preparedness. Mody and colleagues published pandemic preparedness guidance for nursing homes at that time. It appears that their guidance was helpful: 85 percent of nursing homes that responded said they had stockpiled supplies before COVID-19 hit, compared with 57 percent after 2007.

“This pandemic has brought nursing homes front and center and accelerated progress and planning in this area.”

— Lona Mody, MD, MSc
the H5N1 pandemic. Those that had stockpiled supplies had focused on surgical masks, gloves and hand sanitizer. Still, 42 percent of the nursing homes that answered a question about COVID-19-specific concerns said they were worried about running short of personal protective gear.

“Although the size and severity of COVID-19 outbreaks in some nursing homes have taken everyone by surprise, just as so much about this pandemic has, in general nursing homes knew exactly what their challenges were going to be in a pandemic — PPE shortages, staff shortages and worries that they did not have the capacity to care for COVID patients after their hospital stay,” she says.

Nearly all now say they had trained staff on how their facility would respond in a pandemic, up from 42 percent in 2007. Mody notes that nursing homes have a much higher rate of staff turnover than hospitals — meaning that training on infection prevention and pandemic response has to be offered whenever a new person joins the organization. Michigan’s nursing homes appear to have gotten better connected to the broader health care system in the past decade, with significantly more respondents saying they regularly communicate with local hospitals and public health departments. Many also said they were drawing COVID-19 guidance not just from the CDC, but also from these partners.

In addition to stockpiling PPE and cleaning supplies, they recommend that nursing homes should use “burn calculators” to predict how quickly they’ll use those supplies based on their patient population. Another gap in preparedness that the COVID-19 pandemic is revealing, Mody says, is a gap in communication with patients and their families. Keeping families informed, and enabling them to connect virtually with their loved ones when they can’t visit in person, is crucial, she says.

Proactive Partnerships

Another study led by Division of Geriatric and Palliative Care Medicine faculty including Mody, Ana Montoya, MD, MPH, the medical director for sub-acute care at Michigan Medicine and Grace Jenq, MD, the associate chief clinical officer for post-acute care at...
Michigan Medicine, details how three Michigan nursing homes were able to limit the spread of the coronavirus within their facilities. The findings, published in the Journal of the American Geriatrics Society, could help inform ongoing efforts to protect nursing home residents regionally and nationwide.

All three nursing homes went into the pandemic with a proactive, partnership-based approach to general infection prevention and had response plans in place to effectively contain COVID-19 by having embedded U-M geriatric physicians and nurse practitioners, regular meetings among clinical and administrative team members from the institutions and a long history of involvement in U-M research. Throughout the pandemic, the nursing homes also connected proactively with the county health department.

**Rapid Action and Testing**

Having these plans and connections already in place meant that when coronavirus cases started appearing in Michigan, the three facilities could immediately spring into action. Proactive testing of both symptomatic and asymptomatic residents — timely test results — played a crucial role in containing the outbreak of COVID-19 in these facilities. Michigan Medicine’s in-house diagnostic laboratory prioritized samples from the nursing homes, so the results came much faster than they had with the commercial laboratories that had been used at first. A testing “blitz” was carried out in a single day at each facility in early April — a time when testing people without symptoms was very unusual. It allowed the nursing homes to move infected but asymptomatic residents away from others in designated COVID-19 sections of the facility. More than 600 staff were also tested; 3.8 percent tested positive and were told to stay home until their risk of transmitting the virus was gone.

**Implementing Existing Plans**

As soon as symptoms were diagnosed or a COVID test came back positive, the nursing homes would move COVID-19-positive residents into a dedicated wing staffed by teams that only cared for COVID-positive residents. Clinical teams worked together to lower risks by reducing interactions between staff and patients infected with the virus. This included changing the frequency of medication dosing, procedures that could aerosolize the virus and a temporary reduction in routine blood draws and other testing. The nursing homes implemented alternative bathing options if the patient’s temporary room had no shower, and arranged to bring services to them instead of having them leave their room for therapy or meals. Staff who worked at more than one nursing home, including those not in the Michigan Medicine-linked facilities, were asked to pick one and work there exclusively, to avoid carrying the virus between facilities.

The facility’s leadership communicated about testing and results with residents, health care professionals and families, and embarked on intensive cleaning as well as reeducation efforts for staff about personal protective equipment use. The companies that own the nursing

**15,000 NURSING HOMES IN THE U.S.**
COVID-19 Recommendations for Nursing Homes

Mody and her colleagues John P. Mills, MD, and Keith Kaye, MD, from the U-M Division of Infectious Diseases published recommendations regarding COVID-19 and older adults in the Journal of Clinical Investigation Insight. They recommended that nursing homes in communities where COVID-19 is spreading widely should:

- Place patients with known or suspected disease in the same area of the facility, away from others.
- Perform rapid COVID-19 tests on all patients, both short-stay and long-stay.
- Screen health care workers and other staff for symptoms including checking temperatures.
- Limit visitors and group activities.
- Require everyone to wear a surgical mask.
- Require additional protective gear for clinical staff.

homes also made special efforts to obtain enough PPE for staff when there were shortages. “There are 15,000 nursing homes in the U.S. and not everyone is aligned or affiliated with an academic medical center. But this outbreak really brought nursing homes and hospitals together because they knew that one cannot operate well without the other. During the first wave, field hospitals were created to handle the expected surge of COVID-19 patients. By the second wave in the fall, all of the nursing homes had learned how to create their own units. This reduced the burden on hospitals significantly. There was no need for field hospitals. I think this was better for everyone involved — including the patients,” says Mody.

In addition to the increase in partnerships, Mody is hopeful that the increased attention on nursing home safety will have lasting, positive results. “This pandemic has brought nursing homes front and center and accelerated progress and planning in this area. There are now more resources, policies and projects focused on it. We hope our work will be used to inform actions at the state and national levels that will help protect more nursing home residents.”
Preeti Malani, MD, MS, MSJ, professor, Division of Infectious Diseases, and chief health officer for the University of Michigan, is the director of the National Poll on Healthy Aging (NPHA), an initiative that collects and shares findings about a wide range of health-related topics relevant to older adults, their families, health care providers and policymakers based at the Institute for Healthcare Policy and Innovation.

In June 2020, NPHA asked a national sample of U.S. adults age 50-80 about lack of companionship and isolation (loneliness), social interactions and health behaviors as a follow-up to a similar NPHA survey conducted in October 2018 among a different national sample. The findings revealed a substantial increase in loneliness among older adults from before the COVID-19 pandemic to the period of March–June 2020.

Loss of Social Connection
The results of this poll suggest that the COVID-19 pandemic has had a substantial impact on feelings of loneliness and lack of social connections among older adults. A greater proportion of adults age 50-80 felt a lack of companionship, felt socially isolated and had infrequent contact with others outside their homes during the early months of the pandemic than in 2018 when those numbers were already worrisomely high.

“During the summer of 2020, I fielded dozens of calls from friends and colleagues to try to figure out how they could visit safely with their older relatives because they had put it off for so long to reduce the risk of COVID-19. But I would tell them there’s also a risk to not visiting,” explains Malani. “We’re isolating people to the point where other aspects of their health, including their well-being, are suffering.”

This poll found that loneliness and limited social contact during the pandemic were strongly associated with depressive symptoms and overall mental health among older adults. In addition, the results revealed that those who engaged in healthy behaviors like regular exercise and getting enough sleep were less likely to experience loneliness.

Finding Alternatives
The increases in loneliness and infrequent social contact are partially explained by the important public health strategies used to reduce the spread of COVID-19 (e.g., stay-at-home orders). These results also suggest that the use of video chat and social media, while helpful for some, may not buffer feelings of loneliness for many older adults.

On the other hand, those who interacted with others in their neighborhood and/or with nature experienced less loneliness. While personal interactions and social activities may look different during the COVID-19 pandemic (physically distanced, outdoors or online), providing safe opportunities for regular and meaningful interaction with others and with nature is important to reduce loneliness and maintain social connections.

“This has been a conversation I’ve had a lot with people. I say, ‘If you do everything you can to decrease risk by wearing masks, physically distancing and being outdoors, go and enjoy time with your parents. I want you to go. If you don’t get together this year, they might not be able to do it next year,’” says Malani.

Taking Loneliness Into Account
Malani believes it is critical for policymakers, clinicians and family members to address feelings of
“We’re isolating people to the point where other aspects of their health, including their well-being, are suffering.”

— Preeti Malani, MD, MS, MSJ

loneliness among older adults to mitigate their effects on mental and physical health.

“This pandemic has affected every aspect of people’s lives. Obviously, there’s the increased risk of death and severe disease and hospitalization, but not allowing people to visit their family at all, particularly in the nursing homes and assisted living, that really took its toll. Those places locked their doors. Friends and colleagues would tell me, ‘I can only see my mom through the window, I can’t visit with her, and I can see she’s not eating, she’s not moving.’ That’s the difficult thing with this: the public health response only required that COVID-19 be kept in mind — not anything else. Now that we have vaccinations, I am sure they will loosen the rules and let people visit with their loved ones. But to think that you missed a whole year of life, a whole year of celebrations. You know, Zoom isn’t everything.”

In addition to her many roles at U-M, Malani was also appointed by Governor Gretchen Whitmer to the Michigan Nursing Homes COVID-19 Preparedness Task Force, an advisory body in the Department of Health and Human Services, to adequately inform the state’s response to a potential second wave of COVID-19. The Task Force is charged with coordinating across state government and with industry stakeholders to ensure a broad range of input from relevant entities, analyzing relevant data on the threat of COVID-19 in nursing homes and making recommendations to the governor on improving data quality, reporting on best practices and providing appropriate and timely technical assistance.
When the pandemic pulled medical students out of clinical settings, they found new ways to contribute to efforts at Michigan Medicine and in the community, our residents and fellows completely revamped their schedules and programs to meet pressing needs on the frontline, our faculty provided leadership to U-M’s pandemic response while our partners in China shared valuable knowledge and supplies with us.
Former Chief Medical Resident Raymond Yeow, MD, recalls the early days of COVID-19. “At the time the news started coming out of Wuhan, China, in December 2019, we really didn’t know how the novel coronavirus would impact us here in the United States. We thought, ‘Okay, well, it’s pretty localized in China, and, hopefully, it stays that way.’”

As we all know too well now, it did not. When the novel coronavirus reached Michigan in March 2020, it brought many unexpected waves of transformation to the Department of Internal Medicine Residency Program.

Yeow’s Co-Chief Marcus Geer, MD, recalls sitting in a conference room at University Hospital with Yeow, the Program Director John Del Valle, MD; Associate Program Director Sarah Hartley, MD; and the other chief medical residents: Molly Tokaz, MD, and Alexandria Miller, MD, trying to formulate a plan. “Leadership essentially told us to ‘Tear it all down and build something that will allow us to cope with COVID-19 as best we can.’ I don’t know that we completely realized the gravity of this message in that moment,” says Geer. “Suddenly, we were faced with something that was entirely new and different. But what stood out was the success of the University of Michigan as an institution, and of the residency program, which was built upon years and years of adapting and modifying and tweaking and building upon prior years, so I knew we were prepared.”

Hartley says there was a need to quickly modify the entire structure, such as the way clinical rotations were established, the services covered and the make up of teams. Initially, the four chief medical residents needed to come up with an optimal staffing model to address rescheduling needs for more than 214 residents. “The challenge was just the sheer number of resident schedules that we had to rearrange,” says Yeow.

“We had to rethink how residents were deployed across the hospital as a whole.”

Del Valle adds, “We had to blow up everything to accommodate COVID-19, and it was not easy because of the size of our residency program. We care for a lot of patients within the institution, and we couldn’t have done the things we did if not for key collaborations and partnerships across the institution (page 120). We also had to depend on fellows throughout the department because, in some instances, part of closing down certain services meant that our residents could no longer cover those patients. These were fellows who had finished their residency training years ago, and we were asking them to take on roles as primary providers on our services, such as gastroenterology, cardiology, hematology and oncology, and...
“Residents found themselves in a world where their mentors were equally busy trying to contend with a disease they didn’t fully understand.”

— Sarah Hartley, MD

they did an extraordinary job doing so.”

The chiefs were also faced with reorganizing teams, such that they would be able to care for the largest number of patients, while at the same time not sacrificing the safety of the support structure for residents during the acute phase of COVID-19. “We did a completely different schedule than we’ve done before by splitting the entire residency into two parts: 1) the residents in the field, and 2) the residents on the bench waiting to go in. It was a very different arrangement than our residents had known before,” Tokaz notes.

Guiding the Residency Program

Added to the chaotic nature of the pandemic was that the residents, as trainees, were also trying to advance their medical education. “How do you balance the emotional toll of a pandemic, and all the distractions at play, with the idea that you still want to conduct research projects and focus on your career goals?” says Hartley. “As if this weren’t enough, residents found themselves in a world where their mentors were equally busy trying to contend with a disease they didn’t fully understand.”

In the weeks ahead, the department’s program and service structure underwent numerous reconfigurations to best address the initial surge. With pressure mounting, Yeow and his co-chiefs set out to manage the situation as best they could, and to continue to foster the education and development of the residents, all the while sharpening their focus on the well-being and safety of the trainees.

Geer admits that he and his co-chiefs experienced genuine angst, knowing how much they were asking of the trainees. And throughout, the chiefs never lost sight of the fact that they were overseeing a group of residents who were training in the unique space and time of COVID-19. “It was their one shot before they went into practice. The residency runs for three years, and we are now going on a full year of the pandemic,” says Geer. “The concern we kept coming back to was that COVID-19 might possibly define our residents’ experience. And we didn’t want to scar that experience. So we just kept asking ourselves how we could meet this unprecedented challenge without completely disrupting the track our residents were on.”

Residents were heavily relied upon as essential frontline caregivers, many assuming roles that were not typically part of residency training. “At times, our residents were deployed to clinical areas...
that were unfamiliar to them. So it was important that they received appropriate training and supervision,” says Miller. “There was training in PPE, both at University Hospital and at the VA Ann Arbor Healthcare System, for anyone who was starting on a new service. This training was also provided at some of our conferences in case residents weren’t able to make it to the university-run sessions. As an added measure, the co-chiefs posted updates on the Internal Medicine Residency Program website about such things as parking lot changes, door entrance changes, PPE updates with videos and clinical management protocols.”

Tokaz credits Hartley for her exceptional responsiveness throughout the epidemic. “Sarah conducted most of these training sessions and sent daily emails to the residency program with updates on the newest recommendations for safety practices, often twice a week,” she says. “Things were changing very rapidly at the time. There were challenges that came up on a daily basis that we really hadn’t faced before, and we had to get input moment by moment from those on the frontlines. It allowed us to pull the resources that we needed to support the residents in those moments so their leadership skills could continue to be honed, despite all the chaos around them.”

**Bolstering Support Systems**

There’s no doubt that the pandemic has wreaked havoc on the lives of health care providers who are constantly on the frontlines and worried about their own health, and about the health of their support structure outside the hospital, whether that’s a partner, a family member or children.

Early on, when the numbers began to take a steep climb up, the residency program participated in online discussions with institutions across the country to learn how other programs were handling COVID-19. “One of the first things that became clear was the need for a focus on resident wellness, such as the necessity for emotional space to decompress, and to step away from medicine, so that they could return the next day with energy,” Hartley says. “And that’s what really drove us, once we had the Accreditation Council for Graduate Medical Education (ACGME) waiver to change our schedules, to set up teams where the residents did seven days of direct inpatient care and then spent the alternate week covering emergency room shifts, allowing time for some independent study.”

Adjustments continued to be implemented, given the wide variety of patient presentations in hospitalized COVID-19 patients. “Normally, in internal medicine, our residents take care of a wide breadth of patients in disciplines such as cardiology, nephrology and pulmonology, for example,” says Tokaz. “But as the number of non-COVID patients being admitted to the hospital dropped dramatically during the initial surge, we needed to adapt our model to provide care for the patients that needed us most.”

She explains that in the early days of COVID-19, residents were doing the lion’s share of patient care in the intensive care units. “The pandemic imposed extraordinary challenges on the role of the resident physician. We needed to figure out how best to support our teams. Most importantly, we wanted to prevent burnout from the stress and fatigue due to the sheer number of hours they were working, and to give them the rest they needed on the other side. We also wanted to make sure residents were supported in a psychological sense, and in going through their own adjustment with all the uncertainty associated with the novel coronavirus.”

Miller adds, “Many had significant others and young children at home who may or may not have had...
health-related concerns. Or who were pregnant at the time. We just didn’t know how COVID-19 was presenting at the time, and residents, more than ever, were uncertain about health risks and exposure, and even about whether they should come to work or not. So we were trying to help them navigate that."

Thomas Sisson, MD, an associate program director for the residency program, says that as a group of administrators, leadership focused on ways to help the residents manage all the unknowns. “We tried to find ways that residents could socialize safely so they could start to forge those bonds, and to figure out ways trainees could get rapidly tested so they might feel comfortable visiting loved ones.”

Among the initiatives introduced by the co-chiefs was “Resilience Rounds,” which were essentially regular check-ins to see how residents were doing. “It was a safe space for residents to voice their concerns about how they were feeling. Ultimately, we wanted them to be able to talk about the toll this pandemic has taken on them,” Yeow says.

Going Virtual
There is little doubt that the pandemic has imposed harsh accommodations on the mission of the residency program. “Early on, our institution switched to a virtual space using the Zoom platform. The inability to congregate in a conference room, and to have that face-to-face interaction has required the program, and, I’m sure many other graduate medical education programs, to really pivot to a different realm of learning,” says Sisson. “Of course, there are some advantages. I don’t want to say it’s necessarily all negative, because it certainly saves applicants a lot of money not having to travel all over the country. Yet a lot is lost in terms of getting to know people, and allowing them to see what the culture is like here. I’m a little worried that people are going to be nervous about selecting a place they’ve never seen.”

Loss of Patient Contact
Sisson notes that one of the most dramatic shifts in the residency program this past year can be seen in patient care. “Patients used to come to the clinic in person, but even now a good chunk of outpatient care remains virtual,” he says. “A lot of what I do is in the ICU where the patients are the sickest. That’s where lives are typically lost. Many of the patients are on ventilators, and are sedated. And the residents really feel it there, so we’ve tried to make changes to the service structure in the ICU so it is a little more tolerable for them.”

The novel coronavirus has also made authentic connection in patient care all the more challenging. “It’s hard now to really talk to patients, or to have a conversation to learn what

“At times, our residents were deployed to clinical areas that were unfamiliar to them. So it was important that they received appropriate training and supervision.”
— Alexandria Miller, MD
they’re all about. This has been interrupted by the virus. Many times, you get that information from families when they visit. But because families have been prevented from coming to the bedside, we have lost that human connection,” says Sisson. “I’ve heard of teams, particularly some residents, really trying to learn something personal about each patient, and then putting that information on the patient’s chart just below their name. It is important to remember that a patient had a life outside of the hospital before this terrible virus landed them in the intensive care unit.”

**Lasting Impressions**

**Caring with compassion**

Most would agree that the novel coronavirus has presented many invaluable lessons along the way. As for Yeow, he admits that the pandemic has caused him to reevaluate the relationship between physician and patient. “I think it is important as we move ahead to try to bring more grace and understanding to patient care,” he says. “We have seen the psychological toll that COVID-19 has taken on patients and families, as we have cared for some of the sickest patients who contracted the virus. Obviously, you feel for these patients when you see the anxiety, fear and uncertainty in their eyes. Some patients would test positive for COVID-19 and look fine one day, but in 24 hours they would be in the hospital on high levels of oxygen. And to a provider, that can be very frustrating and scary.”

**Mobilizing quickly**

The pandemic has also helped many realize how much can be accomplished when faced with adversity. In the middle of upending just about everything, Geer and his co-chiefs started taking notes about what was working and what was not. “We kept saying that we needed to remember this or that when the pandemic is over, especially noting when we had found something that worked,” he says. “There were many things that literally changed overnight that would otherwise have taken a very long period of deliberation before implementing. It was just the necessity of the moment that required it.”

Del Valle agrees that this is progress worth noting. “People were flexible, and pivoted when pivoting needed to happen with a speed and velocity I had felt was not humanly possible. Some of the structural changes in our program took literally decades to develop and we broke them down within hours.”

Sisson hopes that these lessons will be carried forward, especially in terms of how quickly teams mobilized and learned something new. “The vaccine is an example...”

**2019-2020 Chief Medical Residents**

**Where are they now?**

**Marcus Geer, MD**
Hematology and Oncology Fellow
University of Michigan

**Alexandria Miller, MD**
Cardiology Fellow
The Ohio State University

**Molly Tokaz, MD**
Hematology and Oncology Fellow
University of Washington – Seattle

**Raymond Yeow, MD**
Cardiology Fellow
University of Michigan
of that. It is remarkable how quickly a vaccine can be developed when you desperately need something to give people hope,” he says. “I was very impressed, not only at the resident level, but as a medical community, by how many research studies got launched in the past year, despite COVID-19. And, how many new medications were tested. The residents certainly contributed to this by participating in trials.”

Reevaluating Traditional Methods
Hartley believes that the pandemic has forced residency program leadership to take a step back and ask whether what they have been doing is really the best path forward. “It has given us the opportunity to adapt swiftly to change, and to be very learner-centered. Also, to understand that the lives of physicians do not stop as they leave the hospital,” says Hartley. “So it is incumbent upon us to try to look at the bigger picture in a more intense way than we have before.”

She contends that the pandemic has presented a unique moment in time for leadership and collaboration. “It’s very clear that this experience required everybody to step up and lean in to the team in order to get the mission accomplished.”

Recognizing the Role of Residents
Geer has found the positive momentum toward health care providers, especially residents who transitioned to the frontlines, and the recognition of the work being accomplished, to be one of the silver linings of an otherwise chaotic period. “This is work that was being done every day before COVID-19, and with the same effort and intensity. Now, the pandemic has moved health care providers to the spotlight,” he explains. “I hope this continues as time goes on. While COVID-19 is unique for our moment, it is really just an exacerbation of all the things our residents deal with on a daily basis, and it is important to keep that in mind as we come out on the other side.”

Sisson suggests it may take years for us all to fully appreciate the impact of this year. “I think the fact that residents were able to contribute to an unprecedented crisis [that really is a world crisis], and that they were on the frontlines and made a difference in people’s lives is going to be something they’ll talk to their children and their grandchildren about,” he says. “This is not going to be a time that is forgotten. That might be hard to see that right now, because it’s been such a long grind, and there’s a tendency to just see this as part of our job. But the fact that so many people stepped up and contributed in a unique way is going to be something that everybody will be proud of when they can finally see this in the rearview mirror.”

Passing the Torch
The chief medical residents had to change the way they did many things, especially the end-of-year tasks involving helping residents move on to the next chapter. “For us, the months of March through May are a time of transition where we’re providing more assistance to the rising chiefs and trying to create a smooth transition for our residents, and we were certainly much busier during that period with COVID-19,” says Miller. “It was a very trying time. And I would like to recognize all of our residents, as well as my co-chiefs, and the leadership in the Department of Internal Medicine, who helped everybody through.”

Del Valle concludes, “Our residents have had an experience that, hopefully, they’ll never have to live again. But certainly, they will be able to draw on this experience for the rest of their lives as they think about how tenuous things can be and how life can really throw all sorts of interesting opportunities at you. Throughout, they always responded, ‘We’re here. We got this. We will do whatever we can do.’ It was extraordinary.”

Stepping up to fulfill the role of Chief Medical Residents for 2020-2021 are Paul Christine, MD; Victoria Scicluna, MD; Ginny Sheffield, MD and Govind Warrier, MD (page 23).
THE POWER OF PARTNERSHIPS

John Del Valle, MD, vice chair for graduate medical education and program director for the Department of Internal Medicine Residency Program describes how the power of partnerships allowed their residents to provide the best care possible to COVID-19 patients:

“People throughout U-M stepped up with extraordinary esprit de corps and commitment, and were champions throughout this whole process,” he says. “Beyond the Department of Internal Medicine, we clearly could not care for all the COVID-19 patients, and it required us to partner with our office of Graduate Medical Education at the Medical School, putting forth an emergency mandate that we could redefine what residents were responsible for doing. We also partnered with the Departments of Ophthalmology, Neurology and Psychiatry, and had their trainees do things that perhaps they hadn’t done since medical school. But, they were ready and willing to do so. ”

Del Valle worked very closely with David Miller, MD, MPH, president, University of Michigan Health System, and Michael Mulholland, MD, PhD, the senior associate dean of clinical affairs in the Medical School, who were able to put forth resources to pay for incremental faculty such as hospitalist extenders. This was critically important, and would not have happened if not for partnerships spanning disciplines and departments across the institution.

“In addition, we also had a great partnership with the VA Ann Arbor Healthcare System, which had the mandate to care for patients with COVID-19. We were engaged there with our teams, and that also required a lot of collaboration and cross-talk,” he explains.

Del Valle says the team learned they could be flexible when called upon and innovative in a way that is collaborative and collegial. “The teamwork was incredible, and I am convinced that anything is possible after this past year.”
PULMONARY & CRITICAL CARE FELLOWS
STEP UP AND SERVE
Fellowship program plays vital role in serving COVID-19 patients

The Division of Pulmonary & Critical Care Medicine has faced massive challenges since the initial surge of COVID-19 in the spring of 2020. “This pandemic has had a dramatic impact on the department’s educational mission, particularly our Pulmonary and Critical Care Fellowship Program,” says Theodore Standiford, MD, Henry Sewall Professor of Medicine, and chief of the Division of Pulmonary & Critical Care Medicine. “Throughout, we have tried to uphold that mission as much as possible.”

Standiford credits much of the success to Jakob McSparron, MD, associate professor, Division of Pulmonary & Critical Care Medicine, who serves as program director for the Pulmonary and Critical Care Fellowship Program. “Not only has Jake done a great job in keeping the morale high within the fellowship program, he has also been nimble enough to change schedules to promote availability of our fellows in caring for COVID-19 patients,” he explains. “Although this is not unique to our program, it was a challenge that added to the complexity of providing COVID-19 care in the fellowship rotations. Major kudos to Jake for being attentive to the well-being of the fellows, and for closely adhering to the guidelines of the Accreditation Council for Graduate Medical Education.”

McSparron says it has been humbling to lead the fellowship training program throughout the pandemic. “Our fellows literally lined up to care for these patients from day one. Despite the uncertainty and risk in the early days, these individuals showed up and asked where they were needed. I received multiple emails from fellows scheduled to be on vacation or elective rotations asking if they could work day or night in the intensive care unit,” he explains.

Jakob McSparron, MD, (right) program director of the Pulmonary & Critical Care Fellowship Program.
“What has been very heartening is to see how everybody, from faculty to fellows to staff, has been willing to step up. There was a group of fellows that immediately volunteered to care for patients in the RICU.”
— Theodore Standiford, MD

“They took care of patients and they took care of each other, frequently telling their peers to take a few days off when an individual needed to decompress or be with family. Honestly, they also took care of us as faculty. I received countless messages from fellows simply checking on me and making sure I was holding up okay. I am proud to be involved in training this incredible group of selfless physicians. These are the future leaders of our field, and they are the people I want caring for the sickest patients in the hospital.”

**Shifting to Virtual Platforms**

At the onset of the pandemic, the fellowship program transitioned to all virtual conferences. And that continues today. “We really haven’t lost a beat with regard to our capacity to provide our educational forums. While it’s certainly different than being on-site and interacting with the presenter, we’ve done the best that we can to stay true to our vision,” says Standiford.

**Coping with Disruption**

The pandemic has led to significant changes in clinical rotations for the fellows. “We put a hold on outpatient clinical activities and diverted fellows to where they were most needed,” he says. “This was supported by the Accreditation Council for Graduate Medical Education, since the pandemic was deemed a medical emergency that required alteration of typical rotations. We shifted our fellows from both the outpatient setting and certain rotations where they weren’t needed, such as the Medical Procedures Unit. Since we had shut down all elective procedures, the fellows were shifted to mostly ICU-based rotations. That was both at University Hospital and the VA Ann Arbor Healthcare System. All of this was obviously driven out of necessity. We tried to provide as much support to the fellows as we could. In fact, University Hospital actually provided some meals for the fellows, which was much appreciated.”

**Fellows Staff ICU**

In the early days of the pandemic, there was also a need for fellow support in the U-M Regional Infectious Containment Unit (RICU) in C.S. Mott Children’s Hospital, a 64-bed negative-pressure isolation unit designed for optimal care of adult COVID-19 patients and optimal safety for health care workers. The unit was launched just six days after the first two COVID-19 cases in the state of Michigan were confirmed. “Frankly, the level of care the fellows provided in the RICU was astounding. And this was in addition to their regular critical care rotations. We had more patients, and these patients were much sicker. The fellows were just called upon to do more,” says Standiford. “What has been very heartening is to see how everybody, from faculty to fellows to staff, has been willing to step up. There was a group of fellows that immediately volunteered to care for patients in the RICU. We probably would have been in a position to have to assign people, but they just simply stepped up and said, ‘When do I start?’”

**Expanding Overnight Coverage**

Fellows were also called upon to do more nighttime coverage, while adhering to the Accreditation Council for Graduate Medical Education guidelines. “It was not so much that they were working more hours, but the type of work that
they were doing. Working night shifts can be very taxing. We continued this arrangement from the onset of the pandemic in mid-March through mid-June,” he says. “And then, by July, the fellows returned to the outpatient setting again in the Medical Procedures Unit at University Hospital.”

**Showing Support**

During the initial surge, the Fellowship Program developed additional educational opportunities centered around COVID-19. “We created a weekly COVID-19 Journal Club that met every Monday afternoon, where we would discuss topics relevant to COVID-19 pathogenesis and clinical care. This was open to all faculty and all fellows,” says Standiford. “Actually, it was fairly popular. It was headed by Robert Pickett Dickson, MD, associate professor, Division of Pulmonary & Critical Care Medicine. Participation was not limited to faculty, with fellows also presenting on specific topics and opening it up for discussion which was actually very helpful.”

The division also raised money from faculty to provide gift certificates for the fellows to try to recognize them for the work they were doing, and the intensity and stress they experienced in caring for COVID-19 patients, as well as for putting themselves at risk.
In April 2020, in response to the initial surge of COVID-19, the Department of Internal Medicine initiated a drastic expansion in medical services to meet growing patient care needs. Laura Mariani, MD, assistant professor, Division of Nephrology, was called upon to staff the inpatient service of the Division of General Medicine, which had essentially, like many other services, become a COVID-19 service.

“As a sub-specialist in the Division of Nephrology, my usual role is to take care of patients with rare kidney disease in the outpatient setting,” says Mariani. “As soon as I made the transition, at least 90 percent of the patients I was taking care of had COVID-19.”

Medical Students Fill Gaps

Mariani is also a dedicated medical educator. “Our medical students were being pulled from their clinical rotations due to the onset of the pandemic. I thought it was really sad not to have our students as part of the team,” she says. “Obviously, it was the right decision, because there was a lot of uncertainty about how infectious COVID-19 was, and the risks it posed to faculty, staff and patients. There were also concerns about supplies of PPE.”

M-Response Corps

Nevertheless, Mariani knew that the medical students still wanted to participate and to be helpful. So she joined forces with third-year medical student Sam Schuiteman to identify ways that students could participate in COVID-19 patient care during her new assignment in General Medicine. Together, they submitted a proposal to M-Response Corps, a student-led volunteer group formed by third-year medical student Ali Hammoud at the onset of the pandemic, with the goal of placing medical students in pandemic-related roles to benefit patient care.

Their proposal suggested that medical student volunteers be assigned to one of the General Medicine inpatient teams, not in a direct patient-facing role, but to actually follow up with the patients via phone who had been discharged back home. “In April, we were sending people home who, clinically, we thought were doing better and maybe still needed a little bit of oxygen. Or they were going home to a situation where they had lots of family members around,” says Mariani. “But it just felt a little scary to send people out into the community and not have any touchpoint with them.”

This type of follow-up had become increasingly important because Michigan Medicine was taking transfer patients from other area hospitals who were not...
necessarily local to Ann Arbor. “These patients were going back to other communities and didn’t necessarily have primary care physicians in our health system. I was just really worried about the unknown after they left the hospital,” she says.

**Tremendous Support**

Mariani recalls the tremendous support received for their proposal, not only from the Department of Internal Medicine, but from the Medical School, as well as residents, interns and faculty in these services. “Everyone wanted the students, and was happy to have them be part of their team to learn about this rapidly changing pandemic,” says Mariani. “I was impressed that the Medical School leadership was not only open to it, but encouraged finding opportunities where our students could volunteer and participate, not only to be helpful, but to learn. With so many competing priorities, it would have been really easy to say, ‘Well, we’re going to set medical student education and experience aside.’ But they didn’t do that.”

**Medical Students Sign Up**

Soon, an email went out to invite students to sign up. About 30 students responded and joined the team. “There were 10 General Medicine services that got activated from April through June, and we put one student with each team, and then had them alternate every week,” she says. “Sam and I assigned the medical students to the inpatient teams. We also communicated with the inpatient attendings and residents to tell them, ‘Hey, this is the program, and here’s the student that is assigned to your team for the week.’”

**Training**

The medical students received training early on. “We had a video that was developed by one of the department’s residents about how to have an effective phone call with a patient. We also had a script with questions that should be asked,” says Mariani. “We wanted the students to ask discharged patients a series of questions, such as if they had enough food and medicine, and if they had ways to stay socially distanced from their family members. We also wanted to know if their symptoms were improving.”

**Patient Appreciation**

Mariani will tell you that early spring was a very uncertain time for Michigan Medicine health care professionals. “We knew nowhere near as much as we know now, especially about what happens in the transition from the hospital to home. And patients were very nervous about going home, and about their family members,” she says. “They appreciated having someone from Michigan Medicine call to make sure they were doing okay, and to answer questions once they returned home. It also gave the General Medicine inpatient teams a level of comfort to know that patients were doing well. I think there was a lot of clinical value. And, the educational value to the students was really high.”

Mariani reports that the medical students remained safe throughout. “There was no direct exposure to patients with COVID-19, so the overall risk was really low,” says Mariani. “In 2020, the students returned to their usual clinical education roles.”

**An Invaluable Experience**

“Having medical students as part of our care team was invaluable. It’s the essence of who we are at Michigan Medicine. To be able to include students in something as enormous and even overwhelming as a pandemic was really important,” she says. “I’m hoping that this was a once-in-a-lifetime opportunity for our students to learn about a brand-new disease. Also, to see the medical community adapt swiftly, and to learn in real time about how to save lives. It was really an important experience, and I did not want our students to miss it.”

— Laura Mariani, MD
When the pandemic forced medical schools across the country to pull students from clinical settings in March 2020, student leaders at the University of Michigan Medical School jumped into action to find new ways they could serve the community. In addition to helping our department follow up with patients, many volunteered and took part in outreach projects.

**M-Response Corps**

From sorting donated personal protective equipment (PPE) at the North Campus Research Complex to delivering groceries to vulnerable populations to rescheduling patient appointments, U-M medical students in the quickly formed M-Response Corps worked tirelessly to meet an endless stream of pandemic-related needs.

Some volunteers provided child care for their fellow students, checked on geriatric patients by phone and rescheduled numerous patient appointments. Others helped obstetricians with virtual visits to pre- and postnatal patients, trained hospital staff on PPE protocol and answered COVID-19-related phone calls.

**Wolverine Street Medicine**

Wolverine Street Medicine, a program in which Michigan Medicine students help care for southwest Michigan’s vulnerable homeless population through supervised clinic services in local shelters and sometimes on the street, turned into a distribution network for donated hygiene and health supplies for the region’s homeless. Student volunteers signed up to receive kits and made bottles of sanitizer at home. In addition to the sanitizer, they collected and distributed disinfectant wipes, surgical gloves, masks, and hygiene and meal kits for the region’s homeless community throughout the pandemic. The group’s efforts were recognized by the American Medical Association’s annual Students and Residents Impact Challenge competition. Internal Medicine faculty member Brent Williams, MD, MPH, is the faculty advisor for this group.
Assembling the kits

One thousand bottles of sanitizer donated

Delivering groceries

Sorting PPE

One of the sanitizer kits
Preeti Malani, MD, MS, MSJ, professor, Division of Infectious Diseases, and chief health officer for the University of Michigan, recalls the initial email she sent to U-M President Mark Schlissel, MD, PhD, on January 20, 2020, to provide updates relating to the novel coronavirus. “Things were getting bad in Wuhan, China, and we were starting to hear about COVID-19 in bits and pieces,” says Malani. “I remember saying something like, ‘There’s this cluster of infections and it looks like a coronavirus. It’s not as contagious as SARS, but there is a lot we don’t know right now. Here’s our plan. We’re going to look to the Centers for Disease Control and the World Health Organization, and we’ll go over our preparedness on campus because we might have students who have traveled to Wuhan recently. More to come. Stay tuned.’ There wasn’t a lot more beyond that. It just seemed very far away at the time.”

In her role as chief health officer, Malani serves as an advisor to President Schlissel on matters of health and wellness in the university community, including disease management, public health preparedness and promotion of healthy practices and climate on all three campuses. “I am one of many people advising and helping to make decisions,” she explains. “But because I’m an infectious disease physician, and in this role as a key advisor to President Schlissel [who is also a Department of Internal Medicine faculty member and immunologist], it has put me at the center.”

Since the onset of the pandemic, Malani has served on Schlissel’s COVID-19 Campus Health Response Committee. Its members design and implement public health and safety measures and policies, analyze data and serve as a resource to schools, colleges and units on the three U-M campuses. Leading the committee is Chair Robert Ernst, MD, formerly a Department of Internal Medicine chief medical resident and faculty member, who is now the associate vice president for Student Life and executive director of the U-M University Health Service. “Rob has been at the forefront of U-M’s response to COVID-19. He has taken the logistics and implementation piece, which has proven to be very complicated, and he’s done this tirelessly throughout, especially in the fall 2020 and winter 2021 semesters,” says Malani.

**House of Cards**

It wasn’t until February 2020 that things really started to heat up on the Ann Arbor campus. “We saw what was happening in Italy and in Spain with COVID-19. It was a process where, within just a few days, we went from asking ourselves whether we should cancel the Michigan Ross class trip to Milan, Italy, to the larger concern for how we would get our students, faculty and staff home safely,” she says. “There was something new coming in all the time. Every morning we would learn one thing, and then every afternoon we would learn another. Things were changing by the minute.”
Malani remembers the pivotal meeting that took place in early March with Schlissel and other key U-M advisors in the Fleming Administration Building. “This was when staff members were still meeting in person. I was getting texts that Indiana University, The Ohio State University and the University of Illinois were all suspending in-person classes,” says Malani. “Michigan State University followed suit, suspending face-to-face instruction in classroom settings and moved to virtual instruction. It was just this kind of movement.”

Almost immediately, everything changed on the U-M campus. “It was like a house of cards,” she says. “Initially, it was easy because we made the difficult decision to pivot to remote learning and that happened over the course of really a couple of days.”

U-M made the announcement that, effective Thursday, March 12, all classes were canceled and would resume on Monday, March 16, delivered remotely in alternative formats — and not meeting in person — through April 21, the last day of winter semester classes for the Ann Arbor, Dearborn and Flint campuses.

Uncertainty prevailed in the days and weeks ahead. “First, we learned about the asymptomatic aspect of COVID-19, which made things even more complicated. And then we learned that face masks were effective in minimizing transmission of the virus,” says Malani. “What followed was the U-M spring/summer semester, which is the vacation term from May through August.”

Planning for Fall Semester 2020

The University of Michigan is fortunate in that it has significant public health and medical expertise not commonly found at other institutions. This includes a highly ranked academic medical center, medical school and School of Public Health, whose faculty experts provide advice to state of Michigan leaders on their COVID-19 pandemic response. From the very beginning, U-M also partnered with the Washtenaw County Health Department. “The department’s medical director and the epidemiologists have been so helpful to us. I think that's actually been part of why we’ve been able to be successful. We have this great respect for one another,” she says.

During the summer months numerous committees of U-M experts from public health, medicine, innovative teaching, engaged learning and physical space use met regularly to respond to the COVID-19 pandemic and to plan for the fall semester, 2020.

One such committee was led by F. Dubois Bowman, PhD, dean of the U-M School of Public Health, and a number of people from the Department of Internal Medicine, including Emily Stoneman, MD, associate professor, Division of Infectious Diseases, who connected on a near-daily basis about logistics, high-level policy and implementation. Their planning included how to protect vulnerable populations, monitor the spread of the virus, implement measures to contain the virus, care for the sick, strengthen the public health infrastructure to protect the U-M community and enact ongoing mitigation strategies as conditions changed.

On June 22, U-M announced it would be offering a public health-informed fall semester based on the hybrid model, with courses offered in formats that included in-person, remote and mixed instruction that relied on research-based public health strategies. The focus would be on density in classrooms, social distancing, minimizing out-of-area travel, wearing face coverings and washing hands frequently. Added to this was coronavirus and antibody testing, symptom screening, clinical testing, contact tracing and quarantine that added up to a highly effective way to limit spread of the illness, while students pursued their education.

“The students were delighted to be back. What I saw were students holding each other accountable and trying to find ways to move forward because this was a year of their life,” says Malani. “And they may spend four years here as students. This is our typical undergraduate. I’m very proud of our students.”

Yet, the fall semester did not continue without disruption. In October, as COVID-19 cases...
increased among students both on and off campus, the Washtenaw County Health Department, in collaboration with U-M, issued a 14-day Stay in Place order for undergraduate students effective through November 3. Under the order, undergrads living in on-campus, near-campus or off-campus housing in Ann Arbor were required to stay in place and remain in their current designated residence. Efforts were also made to move more undergraduate courses to fully remote instruction. “We learned a lot in the fall semester, and we learned because we had to, since we were driving without a map,” she says.

On November 6, U-M urged students not to return to campus for the winter 2021 semester, which it announced would be primarily virtual. The university had introduced the U-M COVID-19 Community Sampling and Tracking Program, a free, asymptomatic testing program for those on the Ann Arbor campus in the fall. “We have ramped this up really since the fall to do testing of individuals without symptoms. Anyone in the community, even if you’re not a student, faculty or staff member, can get tested,” she says. “This is an example of how U-M is trying to do more for the community.”

Just a week into winter term, the Washtenaw County Health Department issued a Stay in Place recommendation for all U-M Ann Arbor undergraduate, graduate and professional students living in Washtenaw County to help prevent the spread of the emerging COVID-19 B.1.1.7 variant which had recently reached the area. The order urged all students, including those in on-campus housing, to remain in their residence or household through February 7, 2021.

Human Cost

Through it all, Malani has remained mindful about the toll that COVID-19 has taken on students. “One of the things I wish people understood better is how much vulnerability there is among our students. There might be a tendency to think that all the students are well supported. But there’s a lot of vulnerability among our student body. And our internal numbers suggest that about 30 percent of our students have food insecurity. And many students do not have a suitable home in which to continue their studies,” says Malani. “Not everyone can learn remotely. Not everyone has broadband where they live.”

She is also quick to remind that this pandemic has countered just about everything that college
This past year, Malani has appeared on CNN’s Cuomo Prime Time and Good Morning America to talk about everything from the new coronavirus variants to vaccines to mental health issues related to COVID-19. She has also participated in several regional and national coronavirus task forces. Malani is a member of The Big Ten Conference Task Force for Emerging Infectious Diseases. She is also a contributor to The New York Times, with her most recent article, “Managing Pandemic Health Risks on College Campuses.”
Established in 2010, the Joint Institute (JI) for Translational and Clinical Research is a partnership between Michigan Medicine and Peking University Health Science Center (PKUHSC), in Beijing, China, to support meaningful health research collaboration on projects of mutual interest. To date, the JI has funded about 50 individual projects that span numerous disciplines.

In recognition of this esteemed partnership, active JI researcher Jie Qiao, PI, executive vice president of PKUHSC, and president of Peking University Third Hospital, reached out to Michigan Medicine leaders in March 2020 to arrange a personal protective equipment (PPE) donation through her hospital’s suppliers.

Less than one month later, a generous shipment of PPE arrived in Ann Arbor from several Beijing hospitals affiliated with PKUHSC.

Joseph Kolars, MD, co-director for the JI, and U-M Medical School senior associate dean for education and global initiatives; and Amy Huang, MD, director for Asia Programs, U-M Global REACH, received the donation at the U-M North Campus Research Complex.

“The Chinese market can be difficult to navigate. Our colleagues at PKUHSC are familiar with the PPE suppliers and know which ones offer top quality. The items we received are from the same suppliers PKUHSC uses in their hospitals,” says Huang. “The delivery included 10,000 equivalent N95 masks, 60,000 surgical masks, 200 coveralls and 50 3M goggles.”

Although PPE is now much more accessible it is important to remember that, during the initial surge of COVID-19, the entire country was in urgent need of these supplies. “Everyone was looking to China to supply the needed gear,” says Kolars. “There are a lot of incredible complexities and barriers surrounding PPE sourcing. There were questions about whether the PPE would be of sufficient quality. And, even if it was of sufficient quality, would we be able to get it through customs?”

Kolars points to the longstanding relationship that Michigan Medicine has with partner hospitals in China. “We very much trusted that what they were offering was of the best quality,” he says. “A lot of interactions with the Joint Institute can be very transactional, such as we do this, and you do that, but this time it was about genuine care. We felt a real outpouring of support and friendship. Our partners were giving us supplies because they wanted us to be better and they weren’t going to charge us for it. We are extremely grateful to them for helping our health care teams stay safe.”

The donation has made a significant impact on Michigan Medicine hospital operations. “On two occasions, our doctors called me to say they were wearing one of the masks from the shipment,” says Kolars. “People started to recognize that the masks they were wearing from China to care for patients were also helping to protect them.”

As with all of the PPE Michigan Medicine has collected through donations, supply chain team members continue to check that the items donated are comparable to those products regularly used at the hospital and are appropriate for use.

Sharing Perspectives

As COVID-19 infections ramped up across the United States, PKUHSC leaders and faculty associated with the JI reached out to Michigan Medicine to share perspectives on treating COVID-19 patients in both Beijing and Wuhan.

“Our Chinese partners were sharing information and lived experiences that weren’t necessarily subject to a big trial or worthy of a big paper,” says Kolars. “It felt more like friends helping friends, rather than institutions mechanically trading things back and forth. And these were people who were on the front lines. Suddenly, we could have conversations with colleagues on the other side of the world who were further down the road with the virus. And this is what they were doing as standard practice.”

The exchange of information led to greater understanding about the workings of the novel coronavirus. “We learned about some of the clotting problems associated with...”

PROVIDING PROTECTION AND PERSPECTIVES FROM CHINA

Joint Institute collaboration provides much needed PPE and valuable medical insights

Joseph Kolars, MD, and Amy Huang, MD, accepting the PPE donation at the North Campus Research Complex.
10th Anniversary Symposium

In September 2020, Michigan Medicine hosted a virtual symposium for the Joint Institute for Translational and Clinical Research with leadership from the National Institutes of Health (NIH), National Academy of Medicine (NAM) and U-M President Mark Schlissel, MD, PhD, in a roundtable discussion. Leaders and faculty from Michigan Medicine and PKUHSC gathered to reflect on a decade of innovation, friendship and collaboration, and to lay out a vision for the next phase of the institutional partnership.

“There’s been more political scrutiny over shared intellectual property with China and conflicts of interest,” says Kolars. “We’ve avoided that with the Joint Institute, which shows that you can do good collaborative research and advance a win-win agenda. It was also good to feel appreciated by some of the national organizations like the NIH and NAM that supported this as a very positive model.”

COVID-19, and that these patients have a greater tendency to clot, so there is a need for anticoagulation therapies,” he explains. “This is, of course, obvious to us now, and subsequent papers came out in 2020 in March. China was ahead of us in terms of their thinking and their implementation. They could talk about their standards of practice and what they were doing. And we started to alert our frontline doctors about what we had learned about clotting.”

Kolars says Michigan Medicine teams also learned that China was more aggressive than the United States with steroid treatments early on. “Now it’s mainstay therapy,” says Kolars. “So it was their faith and experience with steroids at a time when we were uncertain about them that was something we clearly learned from China.”

Moreover, Michigan Medicine teams learned about the power of aggressive control measures from their Chinese partners. “This is where people really had to lock down,” he says. “I see that they were able to shut down in a very aggressive way. Being locked down really paid off for China, and is another enviable approach.”

It is also important to remember that overall protection rates in China were extremely high early on. “China’s ability to keep their health care workers safe with PPE and their precautions were extremely impressive,” says Kolars. “This was at a time when people were still questioning whether masks were really that helpful. We started off not thinking that we needed masks, but to see the incredible control rates that were practiced in China, and understanding that PPE contributed to that, and to have the same access to that level of equipment was really good.”

Kolars reports that Michigan Medicine was able to share observations that were new to their Chinese partners as well. “One of the things we discovered early on was the loss of taste or smell in patients with COVID-19,” he explains. “When we shared this with our partners in China, they admitted that they were not aware of this. Our partners said that maybe this was something they had overlooked as an early sign.”

Roundtable Discussion

On March 26, 2020, Michigan Medicine participated in a teleconference with more than 40 doctors and nurses from PKUHSC to share expertise in terms of how to diagnose and treat COVID-19 patients. “It was organized by the Michigan Medicine-PKUHSC Joint Institute and U-M Global REACH,” says Huang. “The 90-minute call focused on the clinical aspects of COVID-19 and gave Michigan Medicine participants the opportunity to ask questions of their Chinese counterparts.”

Attending from the Department of Internal Medicine were Executive Vice Dean for Research and Chief Scientific Officer Steve Kunkel, PhD; Chair of Internal Medicine John Carethers, MD; and Chief of Pulmonary & Critical Care Medicine Theodore Standiford, MD.”

While COVID-19 has disrupted face-to-face interactions between JI partners, it has also provided opportunities for research and ongoing collaborations. Ning Zhang, PhD, vice president of PKUHSC and associate director of the JI, noted that “crisis” is represented in Mandarin by writing two characters side by side. “One word is ‘danger’ but the other is ‘opportunity.’ The COVID-19 outbreak has been a test of this partnership,” says Zhang. “The opportunity we see is that our collaboration endures in the ongoing crisis. We think this challenge provides an opportunity for the next phase of our collaboration.”

“It felt more like friends helping friends, rather than institutions mechanically trading things back and forth. And these were people who were on the frontlines. Suddenly, we could have conversations with colleagues on the other side of the world who were further down the road with the virus.”

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